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A-7 ATTACK AIRCRAFT PROGRAM

by

RICHARD GLENN HEAD, Major, U.S.A.F.

B.S., United States Air Force Academy, 1960
M.P.A., Syracuse University, 1969

DISSERTATION

Submitted in partial fulfillment of the requirements for the degree of Doctor of Public Administration in the Graduate School of Syracuse University, [redacted] January 1971

Approved Edwin A Bock

Date 18 December 1970

The views expressed herein are those of the author and do not necessarily reflect the views of the Air University, the United States Air Force, or the Department of Defense.

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ABSTRACT

This study was conducted to reconnoiter the decision-making process surrounding a defense research and development program. The specific subject was the A-7 attack aircraft, although the research incorporates data on a wide range of defense policies during the period 1960-1970.

The theoretical base for the study was provided by Graham T. Allison's three models of policy analysis developed in "Conceptual Models and the Cuban Missile Crisis," American Political Science Review, September, 1969. Allison's models were examined and applied to these decisions in the A-7 program.

1. The 1963 Navy decision to modernize the carrier attack force with the initiation of an A-7 program.

2. The interest in the A-7 by the Systems Analysis staff and the 1965 decision to develop the Navy A-7 for the Air Force.

3. The initial 1966 decision on a Pratt and Whitney engine and a modest navigation/weapon delivery system.

4. The 1966 Air Force decision to change from the Pratt and Whitney engine to a British Spey engine.

5. The 1967 Air Force/Navy decision to make a major imporvement in the navigation/weapon delivery system.

6. The 1966 Congressional decision to terminate, and

then reinstate the Air Force A-7 program.

The research consisted of library materials, readings, documentary search in Department of Defense, Air Force, and Navy files, and interviews with over one hundred twenty participants in the program. The research is presented in a narrative form, tracing the many elements of defense policy that affected the decisions and the A-7 program. Where possible, the participants are quoted to provide first-person accounts of their views and intentions.

The results of the research indicate that the A-7 was viewed much differently by each organization--the Navy, the Air Force, and the Office of the Secretary of Defense. These differences were found to extend generally the differing professional perspectives and historical backgrounds of the organizations involved.

The conclusions of the study include an analysis of Allison's three models. In this analysis the Organizational Process Model is indicated to have great utility in the prediction of policy outcome, and a wider range of application is anticipated. In an attempt to account for some of the distinctive organizational differences in this case study, the Organizational Process Model was broadened to include aspects of professionalism. The resulting Professional Organization Model is then used to explain the A-7 decisions in more depth.

PREFACE

The process by which American defense policy is decided has long been a fertile field for scholarly research. The decade of the 1950's, in particular, witnessed the publication of scores of studies in the areas of unification, national strategy and deterrence theory. Even in this abundance of literature, however, there were relatively few works which specifically addressed a major area of importance--the decision among weapons system alternatives in an organizational context and a political environment. The key variables affecting these decisions are three: technological capabilities, organizational perspectives, and factors external to Defense.

This study is an attempt to relate these three variables in the narration and examination of a sequence of decisions involving the administration of national security policy. The work is organized around six major decisions on the A-7 aircraft research and development program. The decisions were chosen because they represented discrete points for analysis and yet contribute to an understanding of a larger political process.

The first decision-process will show how the program was conceived by the Navy to meet certain military requirements and received the strong backing of civilian officials working in the Office of the Secretary of Defense. The second decision was the Air Force adoption of the aircraft to meet its responsibilities in support of yet another Service--the Army. The third, fourth and fifth decisions relate directly to the Air Force modification of the aircraft and the sixth was the Congressional decision to terminate the program. The process by which this program unfolds is approached from the perspective of organization theory and views the decision-makers as members of organizations in the American political system.

The completion of this study would have been impossible without the assistance, advice and cooperation of countless individuals in the Department of Defense, Ling-Temco-Vought, Inc., the Institute for Defense Analysis, and the RAND Corporation. I owe a special debt of gratitude to two former Air Force officials: the Chief of Staff, General John P. McConnell, and the Secretary of the Air Force, Dr. Harold Brown. The decisions I discuss are largely their decisions, made not in the cool detachment of academic reflection, but in the daily fire of political controversy. Their assistance and encouragement is most sincerely appreciated.

Acknowledgements are also due to General Gabriel P. Disosway, Lt. Gen. Gordon M. Graham, Maj. Gen. Robert E. Hails, Maj. Gen. Kenneth C. Dempster, Colonel Howard M. Fish, Colonel Harold W. Stoneberger, Colonel James R. Hildreth and Colonel Edward A. Chavarrie for their valuable knowledge of the program and for their invaluable time. Insight into the professional world of the Navy was largely gained through the contributions of Vice Admiral Thomas F. Connolly and Captains Carl M. Cruse and Robert F. Doss. Two DDR&E officials who deserve special mention are Mr. Charles A. Fowler and Vice Admiral Vincent P. de Poix. Dr. Alain C. Enthoven, Mr. Russell Murray, II, and many other members of Systems Analysis contributed generously.

Many thanks are due to the dozens of civilian officials in the Department of Defense and the Department of the Air Force who consented to interviews or aided in the research preparation. A special word of thanks is due to Mrs. Bessie Moore and Benita Gregory for their efforts to retrieve bits of seemingly unconnected data. In addition, Colonel Richard C. Bowman, Colonel Thomas C. Pinckney, and Lt. Col. Don Clelland provided guidance and professional counsel throughout the research process. For their suggestions and support, I would like to thank my colleagues in the Department of Political Science at the United States Air Force Academy.

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INTRODUCTION

The subject of this study is decision-making, organizational decision-making in the complex environment of the defense sector of American national government. The research was conducted in an attempt to discover how decisions are made, who formulates the alternatives, and by what means organizations and individuals affect the outcomes of the decisions. The study is thus a reconnaissance into the field of defense policy conducted from the perspective of decision-making and organization theory.

What is the relevance of current theories of decision-making to the particular field of defense policy? Graham T. Allison has noted,

> Organization theory has only recently begun to study organizations as decision-makers and has not yet produced behavioral studies of national security organizations from a decision-making perspective.[1]

The decisions in this study revolve around a single, defense research and development program. The program is the joint Navy and Air Force development of the A-7 attack aircraft. The A-7 Corsair II is a single-seat, single-engine jet aircraft developed originally to increase the range of the Navy carrier strike forces in the performance

[1]Graham T. Allison, "Conceptual Models and the Cuban Missile Crisis," American Political Science Review, Vol. 63, No. 3 (September, 1969), p. 699n.

of long distance bombing missions and for shorter missions in direct support of ground forces. The Air Force interest in the aircraft was primarily because of its performance in carrying heavy bomb loads for the latter mission--the close air support of Army ground forces.

Within the general perspective of decision-making there are really two special areas this study will address: the nature of decision-making on a national defense research and development program; and the development of weapons in the field of tactical aviation. The examination of both areas is considered necessary because of the close relationship between what is being done--research and development--and the why or reason for the program. Both areas will be shown to condition the decision-making process on the A-7.

The A-7 program, it will be argued, is a significant public policy issue for many reasons. The aircraft was developed by the Navy at a time when the overall national defense strategy was changing from Massive Retaliation to Flexible Response and increases were being made in the capability of the tactical forces. The A-7 program served as an issue in the "management revolution" of former Defense Secretary Robert S. McNamara and was significantly influenced by one of McNamara's primary policy-making agencies--the office of Systems Analysis. The technique of using cost/effectiveness studies, to both evaluate the selection of the A-7 and to determine the total number desired, was used extensively, and a description of the process should provide insight into the use of this technique.

The Air Force decision to adopt the Navy aircraft for its own use adds significance to the program because it shows the evaluation of the A-7 against a different background of traditions, service doctrines and organizational pressures. The jointness of the A-7 program is important because it is one of the relatively few cases of two services managing a joint program and carrying it successfully into production.

The A-7 is additionally significant because it shows the interaction of technology and public policy and exemplifies some of the resultant pressures on the decision process. The magnitude of this interaction has often presented bewildering complexity to the management of government programs. Technology affected the A-7 program because the aircraft was designed around a new concept in the development of engines--the turbofan jet--which represented a technological innovation. The development of the turbofan offered the opportunity to significantly reduce the fuel requirements of large jet engines. The result of the innovation would be to reduce the fuel flow in the engine--and thus greatly increase the aircraft's range--without decreasing the power or thrust. The general thesis this innovation suggests is that technology is a potent factor in promoting the development of new weapons.

There is every indication that technology will continue to be a strong force in public policy--one that administrators need to know more about. The case has been set forward in one of the nation's leading technical management journals,

> The galloping pace of aerospace technology for the past 20 years has both astonished and perplexed the military and civilian managers who have had to cope with it. The pressure from the pace of new technical advances across an ever-broadening spectrum has forced the development of new managerial and financing techniques by both industry and government, culminating in the incredible Apollo lunar landing program.[2]

One of the really important questions is what does technology do to the decision process; what forces does it inflict on organizational patterns and national policy. *Aviation Week* continues,

> Again the managers of industry and government would like to imagine they have reached another comfortable technical plateau where the pace can be safely slowed....
>
> But these hopes are doomed by the *inexorable competitive pressure of revolutionary new technology*.....In the military field, competition is also outmoding not only current weapons but also the strategic and tactical doctrines by which the global powers have maneuvered for two decades.[3]

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[2]*Aviation Week and Space Technology*, June 22, 1970, p. 21.

[3]*Ibid*. (Emphasis added).

It is difficult to deny the existance of the "pressure of revolutionary new technology" and the concurrent argument that technical advances often impel decisions on new weapons. Either way, the responsibilities of the government administrator include those of understanding technical/administrative decision-making.

The A-7 is a significant issue of public policy for other reasons, not the least of which is that the Navy and Air Force programs have been programmed to spend nearly five billion dollars of public funds. Through the budgetary process which places the Congress in a position of near-final authority on appropriations, the A-7 received unusual congressional attention. The program is significant in this sense as an issue of public accountability and control, with the Congress interacting with an executive department to produce one of the final decisions on the A-7.

The Six Major Decisions on the A-7 Program

The six major decisions which will be described and analyzed are:

1. The 1963 Navy decision to modernize the carrier attack force with the initiation of an A-7 program.

2. The 1965 Air Force decision to develop the Navy A-7 for the Air Force.

3. The initial 1966 decision on a Pratt and Whitney engine and a modest navigation/weapon delivery system.

4. The 1966 Air Force decision to change from the Pratt and Whitney engine to a British engine.

5. The 1967 Air Force/Navy decision to make a major avionics improvement in both the Air Force and the Navy A-7's.

6. The 1969 Congressional decision to terminate, and then reinstate, the Air Force A-7 program.

Objectives of the Study

The general purposes of this study are to investigate the decisions on a major military aircraft development program to learn more about the technological and organizational factors that affect weapons and national strategy. Several more specific objectives include those to:

1. Discover the nature of the decision-making process on a defense research and development program.

2. Describe the most significant aspects of the process affecting the decisions.

3. Analyze several decision-making models derived from organization theory.

4. Compare the models with the decisions on the program to see if they can be servicable without drastic modification.

5. Contribute to the construction on a more refined model which will take into account the special environment of national defense, research and development, and tactical aviation.

6. Compile a history of the major decisions on the A-7 to determine to what extent the decisions finalized policy and how each of them affected the program.

7. Investigate the degree to which the A-7 program was influenced by and influenced the overall national defense strategy process.

8. Reconnoiter certain presumably important but still inadequately understood areas of government--especially, the relationships among the military departments, the Office of the Secretary of Defense, the Congress, and other agencies which significantly influence national defense.

9. Inquire into the significance of the division of responsibilities among the military services in roles and missions agreements.

10. Examine the extent to which technology and the analysis of technical capabilities affected the decisions.

11. Investigate the impact of external factors on a defense weapons program.

12. By implication, to add to the predictive capability of social science.

The Origin and Scope of the Present Study

The interest in this study began with the author's academic program in science and public policy in the larger field of public administration. First, a moderate length work was prepared in an attempt to develop an undergraduate course on science and public policy. The result of that effort was a heightened interest in the subfield of research and development management, which led to several shorter papers on the management of large-scale technology programs, the specific technique of systems or project management, and organizational factors affecting technological innovation.

The background of the research for this study included readings on the nature of the scientific method, scientists in the governmental process, organizational arrangements for the promotion of research and development, contracting policy, and a comparative study of governmental organization for science and technology in Europe. This more specific study was coordinated with the writer's continued interest and research into the functional area of defense policy, and both fields--technology and defense--were approached from the perspective of public administration.

The idea that research and development programs in general--and the A-7 in particular--provided a unique opportunity for social science research was developed during visits to the RAND Corporation. The decision-making approach was concurrently selected as an appropriate perspective for the research study. Decision-making was chosen primarily because it offered an opportunity to show the interdisciplinary nature of technology and public administration.

The result was to research a single research and development program from its conception to the present, and to place that program in the perspective of several decision-making models. The issues thus raised include not only those specific problems of the A-7 aircraft, but the broader purposes of the organizations involved in the decision-making process. Paul Y. Hammond has noted.

> [One] method in the literature of public administration is a less theoretical and more detailed analysis of political relationships. Such attention to political detail is warranted by the importance of the subject. But the case studies that result often concentrate on the shape and flow of political transactions without dealing explicitly and systematically with the raison d'être of the agency under consideration. Even the more formally structured studies of administrative organizations that use the methods of social psychology commonly do not examine the agency's overall purpose.[4]

One purpose of this study, already stated, is to examine both the theoretical aspects of decision-making and the practical decisions which result. The purposes and premises of the participating organizations are an integral part of any such effort. Accordingly, research was conducted

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[4]Paul Y. Hammond, "A Functional Analysis of Defense Department Decision-Making in the McNamara Administration," American Political Science Review, Vol. 62, No. 1 (March, 1968), p. 57.

into the premises surrounding the major decisions on the A-7 program.

The range of the reserch was centered on Headquarters, USAF, and branched out to include other organizations in the Department of Defense. They were primarily the Department of the Navy and the Office of the Secretary of Defense (OSD). Within OSD two agencies were the attention of considerable research, the office of the Director of Defense Research and Engineering (DDR&E) and Systems Analysis. Outside of the headquarters the primary organizations where research was conducted were the A-7 Project Management Office and the contractor, Ling-Temco-Vought, Inc.

Throughout the research process an effort was made to consciously examine those elements of broader policy that affected the A-7 program. This facet of the study was begun by library research into the nature of decision-making models, the evolution of national defense strategy, the background of the tactical air forces of the Air Force and Navy, and the management techniques that were employed in the Department of Defense.

The accumulation of evidence on the various decisions was begun by an extensive and thorough search for documents in agency files. This was a necessary step in the determination of what actually happened, or what the officials reported. The difficulty of research on decision-making through documents has been noted by Barnard,

> Not the least of the difficulties of appraising the executive functions or the relative merits of executives lies in the fact that there is little direct opportunity to observe the essential operations of decision. It is a perplexing fact that most executive decisions produce no direct evidence of themselves and that knowledge of them can only be derived from the cumulation of indirect evidence. They must largely be inferred from general results in which they are merely one factor, and from symptomatic indications of roundabout character.
>
> Those decisions which are most directly known result in the emission of authoritative communications, that is, orders.[5]

The documentary search provided the skelton upon which to build the more intensive personal interviews. Using the documents as a guide and verifying the significance of various individuals with others in the decision process, a list of the most direct participants was compiled.

Interviews were requested and obtained with the majority of these participants. Only in one organizational area were interviews refused to the writer, that being the Army General Staff. Fortunately, sufficient documentary materials, including one detailed Army research study, were available to describe the Army position in the decision process. In all, over one hundred twenty interviews were obtained with key decision-makers and participants in various aspects of the program.

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[5]Chester I. Barnard, The Functions of the Executive (Cambridge: Harvard University Press, 1938), pp. 192-193.

Public Administration and Decision-Making

The study of decision-making as a vital part of the study of organizations was recommended by Barnard. He noted that decisions were "the essential process of adaptation in organizations,"[6] and that

> ...acts of decision are characteristic of organization behavior as contrasted with individual behavior, and that the description of the processes of decision are relatively more important to the understanding of organization behavior than in the case of individuals. Moreover, whereas these processes in individuals are as yet matters of speculation rather than of science in the various psychologies, they are in organizations much more open to empirical observation.[7]

The relationship between organizational decision-making and administrative theory has been described by Professor Herbert Simon,

> Although any practical activity involves both "deciding" and "doing," it has not commonly been recognized that a theory of administration should be concerned with the processes of decision as well as with the processes of action.[8]

Simon emphasized that administrative processes were decisional processes, and that

> The task of "deciding pervades the entire administrative organization quite as much as does the task of "doing"--indeed, it is integrally tied up with the latter. A general theory of administration must include principles

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[6]*Ibid.*, p. 286.

[7]*Ibid.*, pp. 186-187.

[8]Herbert A. Simon, *Administrative Behavior*, 2d ed. (New York: The Free Press, 1947), p. 1.

> of organization that will insure correct decision-making, just as it must include principles that will insure effective action.[9]

This criticism of administrative theory is over twenty years old, and Simon's seminal work did much to prepare the way for other studies on decision-making. Many of those studies were tailored to fill the gap Simon had spotlighted with his criticism--the breach between decision-making practice and theory. As a result there is now a range of administrative theories which touch on or include decision-making concepts.

The question remains, however, as to how much use the administrator can derive from such studies. How relevant are the theories to the executive faced with deadlines, a small staff, and operating in a specialized area? What special conditions exist in the field of defense decision-making which require existing theories to be extended or modified?

The combination of the processes of decision with those of action are very evident in the works of Barnard and Simon, but neither of these writers directed their theories specifically toward the field of _public_ administration. Their works touch public administration generally as organization theory influences public administration. The current state of administrative theory incorporates a great

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[9] _Ibid._

deal of organization theory for its own use, but the two are not identical.

Waldo notes the study of decision-making in public administration has been related to the rise in the incidence of policy studies, which has been in turn, partially related to the influence of the case method. Waldo described the case method's portrayal of the interrelationships between policy and administration and noted,

> As this implies, there was also a new emphasis upon policy. This interest in turn had two aspects, substantive and procedural: the substantive development of policies in areas such as natural resources and defense, and at all times the decision-making processes by which policy alternatives are developed and selected.[10]

The procedural aspects of the decision-making process have attracted other political scientists to the study of decisions. Norton Long has noted,

> The study of organizations as political systems should provide the student of political science with enough cases to make the testing of certain kinds of generalizations possible. Indeed, if we are really to come to grips with organizational behavior we must investigate the political process by which organizational decisions are made. Such study is called for not only because we need it to understand the larger political process of which it is a part.[11]

This emphasis on the procedural aspects of decision-making is reflected in Simon's discussion of decisions as having two elements--fact and value. He stated,

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[10]Dwight Waldo, "Public Administration," Journal of Politics, May, 1968, p. 468.

[11]Norton Long, "The Administrative Organization as a Political System," in Concepts and Issues in Administrative Behavior, ed. by Sidney Mailick and Edward H. Van Ness (Englewood Cliffs, New Jersey: Prentice-Hall, 1962), p. 121.

> Factual propositions are statements about the observable world and the way in which it operates. In principle, factual propositions may be treated to determine whether they are _true_ or _false_--whether what they say about the world actually occurs, or whether it does not.
>
> Decisions are something more than factual propositions. To be sure, they are descriptive of a future state of affairs, and this description can be true or false in a strictly empirical sense; but they possess, in addition, an imperative quality--they select one future state of affairs in preference to another and direct behavior toward the chosen alternative. In short, they have an _ethical_ as well as a factual content.
>
> *
>
> We see that in a strict sense, the administrator's decisions cannot be evaluated by scientific means.[12]

Although Simon carefully qualifies the extent to which the differences between factual and ethical qualities of decisions can be separated, he does indicate that the two sets exist. Further, he identifies the fact/value separation with a traditional public administration concept--the policy/administration dichotomy. He states, based on the distinction between the factual and ethical elements, that democratic responsibility can be increased by a more effective separation of the factual and ethical premises in decisions. Further, he indicates the legislature should have control of those decisions involving high value content while it is possible, in the maintenance of democratic

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[12]Simon, _op. cit._, pp. 45-47.

responsibility, to allow administrative agencies to control those questions with high factual content.

Simon has been criticized for this suggestion that it was even possible to separate the fact and value elements of a decision. A modern political science text described Simon's approach as one of eliminating values in a search for rational choice. It noted,

> Decision-making is commonly rooted in the differential levels of aspiration of relevant actors and--although the point does not receive great emphasis--this ties decision-making firmly into consideration of values.[13]

This criticism of Simon's theory is well taken, but it may also be viewed as the expression of the difficulty that Simon expressed in separating the two concepts--fact and value--in the first place. There is no attempt here to settle whatever theoretical controversy may exist between the followers of Simon or his critics. The point is that values are a significant element of decisions, and what is even more important--differing value premises will be shown to be the primary components of disagreements over the advisability of specific decisions.

Definition of a Decision

Before going further, I wish to clarify some of the terms in extensive use during this study. The most basic term in the lexicon of decision-making is simply "decision."

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[13]Robert T. Golembiewski, William A. Welsh and William J. Crotty, A Methodological Primer for Political Scientists (Chicago: Rand McNally, 1969), p. 210.

"Decision" has been defined as the act of deciding, a selection among alternatives, a choice, the determination of a course of action, a resolution of issues, and an act putting an end to controversy. In almost all cases the implication is one of finality, of ending a process, of the termination of a phase. Gross defines a conscious decision as a choice among alternatives, and goes further to define the "great decision, the strategic choice, the decisive turning point" as containing three possibilities:

> First, it may be a symbolic act which ratifies decision sequences already completed or promotes commitment to future sequences. Second, if truly a single act, such as an executive's final approval of an important policy, it is a choice which has genuine significance only insofar as it represents a commitment of future sequences of action and may limit or determine the nature of future alternatives. The long-range decision is something that always takes place in the present. Third, if truly a major decision, it is a shorthand way of talking about a sequence of choice among sequences of ever-shifting alternatives.[14]

The essence of Gross' three definitions or cases is that a decision may be a symbolic act, represent a commitment, or be part of a sequence of choice. He implicitly rejects the concept that decisions end controversy or terminate discussion or in any way represent the solution to a problem.

[14]Bertram M. Gross, Organizations and Their Managing (New York: The Free Press, 1968), p. 562.

Simon and March identify the term decision with the sequence of "problem", "alternatives," "consequences", and "choice," and further simplify the term as synonimous with "choice problem."[15] The implication in their theory is of an action which corresponds closely with the conceptual model of rational policy that will be discussed later. Basically, the Rational Policy Model envisions action as rational choice with the sequence of events running from goals and objectives, to options, to consequences, to choice. The implication is that decisions do "solve" problems in the classical sense and that it is useful to think of decisions in this manner.

Another use of the term decision has been to identify it with "process."

> An administrative decision would be the process involved whereby one person came to make a choice which affects the behavior of others in the organization in their contribution to the achievement of the organization's goals.[16]

Although this relation of a discrete decision to the process of implementation could have utility for certain studies, its use in this study is specifically rejected. If such a meaning is desired, the broader term decision-making process or simply decision-making will be used.

"Decision," as used in this study, will be intended to mean a discrete administrative action, identifiable in

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[15]Herbert A. Simon and James G. March, Organizations (New York: John Wiley and Sons, 1958), p. 256.

[16]Craig C. Lundberg, "Administrative Decisions: A Scheme for Analysis," in The Making of Decisions, ed. by William J. Gore and J. W. Dyson (New York: The Free Press of Glencoe, 1964), p. 20.

time and location to a fairly specific date (within one or two days) and place within the organization (not necessarily to an individual, but certainly to an office). The decision is intended to mean the selection of a course of action (even if the only alternative is to do nothing) including symbolic acts and motivational pronouncements. The implication that the decision will in any way be a final determination of action or the total resolution of conflict is specifically rejected. However, it is recognized that the idea of a decision as the termination of a phase or the partial resolution of certain issues has great conceptual utility; these aspects of a decision are specifically included.

A Definition of Decision-Making

The relationship between decisions and decisioning or decision-making is generally unclear in most studies of public policy. One of the best descriptions has been rendered by Gore,

> Decisions weave individual choices into a web of relationships that constitutes a basis for action. If we view decisions in this way, decision making may then be seen as a response mechanism. More precisely, decision making is a social strategy for mounting a collective response to a problematic situation.[17]

The important idea in this statement is the combination of decisions into a larger scheme, implying now the concept

[17] Gore and Dyson, op. cit., p. 1.

of process. Gore goes on with his combination of individual actions and process-orientation.

> We find, as a rule, that individuals develop predictable reactions to policy proposals, and seek out the same sources of information and/or are sought out by the same individuals over time. To the extent that this procedure is followed in each of the power centers concerned with a decision, effective responses may be mounted. Thus, decision making takes shape through the patterned interaction of individuals.[18]

While the concept of a decision as being localized into a fairly identifiable time and place may have some utility for this study, there is no similar, overpowering reason to limit the definition of decision-making. The general conception of the term will be used to mean the processes by which decisions are made with some of the actions of the participants being patterned and some being hueristic. In the broader sense of process-oriented usage, decision-making will be used to mean the process of making decisions.

This broad definition of decision-making conforms to its extremely wide usage and does not exclude it from current criticisms that attack the generality of the term. Some of those criticisms extend from Gore's cryptic remark,

> Research indicates that decision-making is an ubiquitous concept, referring variously to change, to a choice, to a climate of opinion, to a condition of agreement, to communication, or to a vaguely-felt state of affairs which--

[18] *Ibid.*, p. 14.

> like ice--melts in the hands of anyone who stops to examine it.[19]

Gore proceeds to identify the emphasis on decision-making with public administration's preoccupation with impartiality and efficiency, a note which is echoed by Waldo.[20] But Gore goes beyond his own critics of decision-making as a method and advocates its use as a research focus.

> ...our concern should be not with decision-making as a technique but with decision-making as a potential focus for an administrative theory that offers us a more reliable representation of the administrator's dilemma.[21]

The intention of this study is to take Gore's advice and use decision-making as an approach, a focus that will allow us to view the extremely complex interactions of a government organizational process, with an eye toward the development of an administrative theory.

Decision-Making Versus Policy-Making

Without going into great detail it is possible to state that decision-making is intimately related to the popular term "policy-making." Bauer, in a work called *The Study of Policy Formation*, defines policy as a "course setting involving decisions of the widest ramifications and

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[19]William J. Gore, "Decision-Making Research: Some Prospects and Limitations," in Mailick and Van Ness, *op. cit.*, p. 50.

[20]*Ibid.*, p. 51 and Waldo, "Public Administration," *op. cit.*, p. 464.

[21]Gore, *Ibid.*, p. 52.

longest time perspective in the life of an organization."[22] It is significant that Bauer defines policy in terms of decisions, because in his introductory essay to the volume he states flatly that decision making is inappropriate for characterizing policy formulation.

The criticism that decision-making is not a universal technique, transferable to any one of several diverse specific contexts, is well-founded. Few of its adherents claim any such universality. Similarly, the criticism is made that the goal of the decision-making focus is to "solve" problems. If problems cannot be fully "solved" in a permanent sense, the argument goes, then decision-making is irrelevant. A view that seems more precisely to the point is that if problems are not "solved" but only modified or subject to proximate solutions, then decision-making becomes process-oriented.

This blend of elements of decision-making and policy-making, while the bane of definitional purists, is reflected in the literature. A recent review on the subject of "Decision Making Versus Policy Making" noted,

> Policy making, one would have thought, is a way of reintroducing the structural elements; it looks as though it implies the older notions, merely in a new language more compatible with the contemporary requirements of science....It implies the coming together again of policy and administration, just as it implies a recombination of government with politics. But further scrutiny reveals

[22]Raymond A. Bauer, "Descriptive Decision Theory," in Bauer and Kenneth J. Gergen, ed., The Study of Policy Formation (New York: The Free Press, 1968), p. 2.

> that the change in vocabulary has not been that significant....
> *
> To Lindblom a policy is an outcome of any process....for most of the authors in the Bauer volume, policy becomes indistinguishable from decision as they proceed simply to apply decision-making theories to policy-making problems.[23]

On a scale from narrower conceptions to broader ones, it may be useful to relate "decisions" to the narrow end and policy-making toward the other. In the sense that decisions imply the termination of certain parts of the process, that may be especially true. Lindblom's emphasis has shifted from decision-making to policy-making. In The Policy-Making Process he uses the widest possible definition of policy-making,

> We are going to look at policy making as an extremely complex analytical and political process to which there is no beginning or end, and the boundaries of which are most uncertain.[24]

The generality of Lindblom's definition of policy-making stands in clear contrast to the narrower concepts implied by the term decisions. However, both terms will be used in this study. As stated previously, the concept of a discrete decision will be used to examine several choices in this research and development program, and the concept of

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[23]Theodore Lowi, "Decision Making Vs. Policy Making: Toward an Antidote for Technocracy," Public Administration Review, Vol. 30, No. 3 (May/June, 1970), pp. 315, 318.

[24]Charles E. Lindblom, The Policy-Making Process (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1968) p. 4.

policy making will be used with decision-making to mean the broader and longer-range aspects of process orientation.

Types of Decision-Making

One of the problems with the broad definition of decision-making is that it refers to many completely different types of choice situations. It has been difficult for theorists to construct a scheme capable of adequately covering the wide range of disparate decisions. It may be helpful to divide the larger problem into units which (perhaps) will be more manageable in terms of applying theory to the complications of reality. The process of subdividing the concept of decision-making may suggest the application of certain methods of analysis in one section and not in another. The question arises as to what are the types of policy analysis and how can decision-making processes be differentiated.

Lindblom and Braybrooke divide decision-making into four types depending on the size of the change involved and the degree of understanding of the consequences. (See Figure 1.)

Figure 1. Types of Decision-Making

High
Understanding

Incremental Change ←	→ Large Change
Quadrant 2 Some Administrative and "Technical" Decision-Making Analytical Method: Synoptic	Quadrant 1 Revolutionary and Utopian Decision-Making Analytical Method: None
Quadrant 3 Incremental Politics Analytical Method: Disjointed Incrementalism (Among others)	Quadrant 4 Wars, Revolutions, Crises, and Grand Opportunities Analytical Method: Not Formalized or well Understood

Low
Understanding

Source: Charles E. Lindblom and David Braybrooke, _A Strategy of Decision_ (New York: The Free Press, 1963), p. 78.

Lindblom and Braybrooke indicate that the number of decisions that are characterized by large change and a high degree of understanding (Quadrant 1) is exceedingly rare, and they do not consider this class of decisions further. Quadrant 2 decisions with a fairly high degree of understanding and only effecting small changes are generally labeled "technical decisions." The authors perceptively note the role of specialists and professionals in this class of decision.

> Where a decision effecting an incremental change does indeed seem to fall within a recognizable competence--rather than to depend largely on imponderables or preferences--the decision is often delegated to a specialized group: engineers, economists, physicians, accountants--or one or another subgroup of that very large and internally differentiated group of experts on small policy decisions, the public administrators. We can say, therefore, that for decisions of the second quadrant, the decision-maker is typically not at the highest levels of the government bureaucracy and may be a professional specialist of some sort.[25]

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[25]Charles E. Lindblom and David Braybrooke, A Strategy of Decision (New York: The Free Press, 1963), p. 70. The authors are quite obviously not public administration oriented in their denigration of the scope of the field. Waldo has noted, "The lower things with which Public Administration is nowadays deeply engaged are such matters as the common defense, education, safety and health, economic development and the elimination of poverty, problems of freedom and equality, law enforcement and the administration of justice, the preservation and development of resources, social and physical mobility, population planning, recreation and the amenities, the development of science and the use of technology; and with the relations and interactions of all such matters with governmental theories, institutions and processes, at all levels of government at home and in all countries in the world." Waldo, "Public Administration," *op. cit.*, p. 445 (footnote).

These decisions will be of primary interest in this study, because the only difference between the technical decisions and political decisions in the Lindblom/Braybrooke typology is the degree of understanding of the consequences. On first glance, the selection of one aircraft over another would seem to be a case where the consequences would be well-known. In that case weapons selection would naturally fall into the class of "technical" decisions. The reader should note whether the consequences of the A-7 decisions were well-known and to what degree there was agreement on the technical aspects of the A-7's performance.

The method for evaluating technical decisions is listed as "synoptic analysis" which specifies, "The ideal way to make policy is to choose among alternatives after careful and complete study of all possible courses of action and all their possible consequences and after an evaluation of those consequences in the light of one's values."[26] The authors note further that, "....under this conception of problem solving, ideal policy-making, rational decision-making, policy analysis, and rational problem solving are synonymous."[27] Thus, "synoptic analysis" as Lindblom and Braybrooke define the term is almost identical with what we will later identify as the Rational Policy Model.

Lindblom and Braybrooke make another point which the writer wishes to emphasize in this study, that many

[26] Ibid., p. 40.

[27] Ibid.

supposedly technical decisions may not rest ultimately on their factual elements, but that disagreement over the values implicit in the technical decision may often provoke controversy. The authors state the limitation of the technical class of decisions,

> If a decision is a second quadrant decision, it is probably an administrative or professional decision, but many administrative and professional decisions are too complex to fall into the second quadrant.[28]

They proceed to a discussion of the third category of decisions,

> We are thus brought to the third quadrant: decisions effecting small or incremental change and not guided by a high level of understanding. These decisions, we now see, are the decisions typical of ordinary political life--even if they rarely solve problems but merely stave them off or nibble at them, often making headway but sometimes retrogressing. Decisions like these are made day by day in ordinary political circumstances by congressmen, executives, administrators, and party leaders.[29]

These decisions are characterized by small, incremental moves rather than large, comprehensive changes and, the authors state, call for a radically different form of policy analysis. The appropriate strategy is labeled "disjointed incrementalism" which the authors posit as a direct alternative to the failures of the synoptic ideal. Disjointed incrementalism will not be described at length here except to note that it is a strategy proposed to be appropriate when policy analysis is "incremental, exploratory,

[28]*Ibid.*, p. 71

[29]*Ibid.*

serial, remedial, fragmented, and marked by adjustment of ends to means."[30]

The fourth quadrant of decisions involving crises, wars, revolutions and grand opportunities Lindblom and Braybrooke back away from, saying that strategies of decision-making (including disjointed incrementalism) are not sufficiently developed to handle them.

The four quadrants of the Lindblom/Braybrooke typology are certainly not exhaustive of the types of decision-making one could conjure up. They have suggested some of the aspects and characteristics of decisions under different conditions and viewed through different analytical "glasses." The intent was to present a spectrum of decision-making approaches to show the range and scope of the term's use.

The Role of Project Histories

The study of research and development and its relationship to the larger processes of government is of growing importance to the nation. One indication of this is the increasing number of university courses in science and public policy, which focus directly on these (and other) questions. The study of the research and development process has been one of the primary interests of the RAND Corporation since its formation after World War II. A RAND

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[30] *Ibid.*, p. 102ff.

researcher, T. A. Marschak, in The Role of Project Histories in the Study of R & D, notes,

> The student of research and development today finds himself, though no longer alone, still very much in an uncharted territory. The importance of knowledge about the process that generates knowledge no longer needs to be argued. The national research and development effort, as a necessary condition of technical change and therefore of economic growth, is taking its place among the government's major economic policy opportunities. Efficient management of government financed R & D is a growing challenge. But sound, accepted knowledge about the R & D process is still extremely scarce.[31]

Marschak proceeds to state three major approaches to the development process: the empirical study of aggregates; the development of a normative theory; and "the intensive historical study of completed development projects."[32]

The project histories provide valuable general knowledge about the development process while contributing to two specific subtopics: a better understanding of alternative strategies for the conduct of development in a given area of technology, and knowledge about the consequences of alternative modes of project team organization.

The limitations of the project or case method have often been noted. They include the strong subjective element that may accompany any interpretation of history, the possibility that the research generated will have no relation to other cases or projects, and the disadvantages of generating more hypotheses than can be answered by the present

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[31] T. A. Marschak, The Role of Project Histories in the Study of R & D, P-2850 (The RAND Corporation, 1964), p. 1.

[32] Ibid., pp. 1-2.

body of literature.[33] These criticisms or limitations of project histories and cases exist not only in the field of R & D but in the general fields of public administration and political science.

One of the central criticisms of the case method has been the difficulty of fitting the reams of new data into existing theories. In a recent essay Edwin A. Bock refutes this criticism and provides a perspective that is both humorous and penetrating,

> Has an eager welcome been extended by political scientists to such case data brought back for them from the otherwise inaccessible lands of consequential political affairs and the uncharted islands of potentially momentous new policy areas and new forces of social change? Not always. Our rigorous Spanish Grandees are often disinterested in these bizarre stories of our Columbuses, impatient with all the disjointed details about savages, potatoes, and the world being round, and above all critical because the explorers have brought back no gold ducats that....will fit into the home town parking meters.[34]

Another criticism of the case method is that the subjects studied and the results reached are often specialized to individual instances or programs--the problem of uniqueness. The critics question the scientific value of studies

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[33] See James E. Jernberg, "On Taking the Next Step in Case Studies," Public Administration Review, Vol. 29, No. 4 (July/August, 1969), p. 410. The Jernberg article is a review of Frederick C. Mosher (ed.), Governmental Reorganizations: Cases and Commentary (Indianapolis: Bobbs-Merrill Company, 1967).

[34] Edwin A. Bock, "Improving the Usefullness of the Case Study in Political Science," in An Introduction to the Science of Politics, ed. by Donald Freemen (New York: The Free Press, 1970), mimeo, p. 23.

that are unique and, by their very nature, non-representative.[35] These critics have a valid point in questioning the nature of any science of politics, and they rightly indicate the difficulty in developing theories which must account for irregular, infrequent, and non-representative situations.

The question is whether the study of political science is to be held up while adequate theories are generated. Hopefully, the data examined in the special, non-representative cases will add to rather than inhibit, the development of new theories. It would seem that if political science is to progress as a discipline, it will have to encourage the spawning of theories that incorporate, predict or at least accomodate the unusual relationship, the special program, and the international crisis. Difficult though these instances are to predict, they are a major portion of the political affairs that govern the rise and fall of nations.

In the specific case of the A-7, the program was indeed unique, and there will never be another development program exactly like it. However, the organizations and agencies that influenced the A-7 still exist, and they will go on to influence other weapons development programs in a manner that (we hope) can be better understood in the light of a study of the A-7.

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[35]This question is explicitly raised and examined by James W. Fesler in a classic critique, "The Case Method in Political Science," in Essays on the Case Method, ed. by Edwin A. Bock, James W. Fesler, Harold Stein, and Dwight Waldo (Brussels, Belgium: International Institute of Administrative Sciences, 1962).

There is one specific warning, however, which must be issued to the reader about to begin this project history. The mere selection of a single aircraft program as the subject necessitated the rejection of many other approaches. Implicit in this original rejection was the rejection of much existing data which bore obliquely on the A-7 but led off into other, tangential fields. Specifically, the reader should bear in mind that the decision makers discussed in this study devoted only a small portion of their time to the A-7; they were constantly beseiged by other matters which cannot be fully appreciated by the casual observer. The effect this may have on the study is to impose a more coherent picture of the events in retrospect than was experienced by the participants in the original decision process.[36]

The present study was undertaken with the knowledge of the limitations of the case method and the project history, but also with a view toward their strengths. The advantages include teaching, research, and operational capabilities present in an unusual degree in a case study. The usefullness of cases in teaching about political science is an acknowledged fact.[37] Both Bock and Fesler also emphasize the value of the case method to the researcher who has to gather the data, integrate documentary material with interviews, and then produce a scholarly piece of creative writing.

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[36]The writer is indebted to former Secretary of the Air Force, Dr. Harold Brown, who, after reading an early draft copy of this study, suggested this caveat.

[37]See Fesler, _op. cit._, p. 14.

The case method also has a distinctive advantage in the reconnaissance of areas of public policy that are relatively unknown or are changing rapidly. Bock notes,

> ....it has been shown conclusively that the case study has especially good capabilities for exploring, discovering, and communicating significant aspects of the real world of politics and public policy that probably could not or would not be delivered by any other scholarly style of research.[38]

The case study approach to the A-7 was selected because it presented: the opportunity to examine several decisions as close to their real-life complexity as was possible; the exploration of the flow of premises that went into the decisions; the research into some of the national and international issues that conditioned the decisions; and to explore the nature of organizational and individual behavior in a sequence of decision situations.

The overall emphasis on decisions and decision-making in this study bears a strong resemblance to the case method as pioneered by the Inter-University Case Program and explained by Harold Stein. In the introduction to Public Administration and Policy Development he wrote,

> The cases in this volume are centered on the making of decisions....The making of decisions, whether in public or private life, whether in or out of an administrative context, always involves some of the same psychological processes. Most notably, perhaps, is the fact that decision itself is fundamentally a process rather than an act without temporal dimensions....the understanding of a decision requires understanding of what

[38]Bock, "Improving the Usefullness of the Case Study in Political Science," op. cit., p. 21.

> came before as well as of the circumstances of the moment,...many of the decisions of today are in effect the consequences of yesterday's decisions.[39]

Stein tied the study of decisions securely to the field of public administration. "Thorough understanding of public administration is possible only for those who are willing to undergo at least vicariously the pangs of decision."[40]

The act of decision is the center of this study, with the sequence of decisions making up the primary elements of a process of decision-making in the field of defense research and development. The resultant product will have some resemblance to a project history and to a case study; hopefully, it will also provide the basis for further scientific research. One of the theoretical concerns of this effort is to investigate the extent to which contemporary decision models explain the special world of defense decision-making in the program under study.

Conceptual Decision Models--Model I: The Rational Policy Model

The use of various decision models in both the making of decisions and the analysis of the decision-making process is widespread, although the selection of a particular model is seldom made explicit. The case is stated by Professor Allison,

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[39]Harold Stein, ed., Public Administration and Policy Development (New York: Harcourt, Brace and Company, 1948), p. xiii.

[40]Ibid., p. xiv.

> Analysts think about problems of foreign and military policy in terms of largely implicit conceptual models that have significant consequences for the content of their thought.[41]

Allison proceeds to state,

> Most analysts explain (and predict) the behavior of national governments in terms of various forms of one basic conceptual model, here entitled the Rational Policy Model (Model I).[42]

What are the characteristics of Model I? Allison states his version of the Rational Policy Model includes the classical approach to the scientific method of problem-solving--search, evaluation, choice--and that specific organizing concepts are used. The first of these is that "policy" is the result of national choice with alternatives selected to maximize strategic goals and objectives. His description of the decision-making actor is classic:

> A. National Actor. The nation or government, conceived as a rational, unitary decision-maker, is the agent. This actor has one set of specified goals (the equivalent of a consistent, utility function), one set of perceived options, and a single estimate of the consequences that follow from each alternative.
>
> B. The Problem. Action is chosen in response to the strategic problem which the nation faces. Threats and opportunities arising in the "international strategic market place" move the nation to act.

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[41] Graham T. Allison, "Conceptual Models and the Cuban Missile Crisis," American Political Science Review, Vol. 63, No. 3 (September, 1969), p. 689. This article has been expanded at the RAND Corporation, where Allison collaborated with Andrew W. Marshall in the publication of Organizational Process Model for Predicting Government Action, RM-5897 (S), May, 1969.

[42] Ibid., p. 690. Allison notes that the selection of names for his models has aroused heated arguments. He suggests it may be better to simply refer to this model as Model I.

* *

C. Static Selection....
D. Action as Rational Choice....
1. Goals and Objectives....
2. Options....
3. Consequences....
4. Choice. Rational choice is value-maximizing. The rational agent selects the alternative whose consequences rank highest in terms of his goals and objectives.[43]

In addition to these organizing concepts, Allison specifies two general propositions, which he developed as an analogue of the theory of the rational entrepreneur in economics. The two propositions specify the "substitution effect" that will be shown later to have a significant impact on the way analysts in the Department of Defense approached policy choices as they considered substituting one weapons system for another.

> (1) An increase in the cost of an alternative, i.e., a reduction in the value of the set of consequences which will follow from that action, or a reduction in the value of the probability of attaining fixed consequences, reduces the likelihood of that alternative being chosen.
> (2) A decrease in the costs of an alternative, i.e., an increase in the value of the set of consequences which will follow from that alternative, or an increase in the probability of attaining fixed consequences, increases the likelihood of that action being chosen.[44]

That this conception of policy as rational choice exists and has played a strong role in organization theory is attested to by Waldo and Etzioni, among others. Waldo went to great lengths to demonstrate in his classic work, The Administrative State, that American public administration

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[43] Ibid., p. 694.

[44] Ibid.

has always been basically rationalist.[45] Waldo and Etzioni trace the rise of the Scientific Management movement that exerted great influence on both public administration and business management in the first third of this century (and still carries on with reduced influence). Etzioni, in Modern Organizations, states that Scientific Management was the counterpart of the perfect competition model (the rational state) that maximizes both organizational and individual welfare at the same time.[46]

The competition model and the concept of maximization of utility were combined in the concept of "economic man." Simon and March have given a lengthy but comprehensive summary of the economic man's rational decision model.

> The rational man of economics and statistical decision theory makes "optimal" choices in a highly specified and clearly defined environment:
>
> 1. When we first encounter him in the decision-making situation, he already has laid out before him the whole set of alternatives from which he will choose his action. This set of alternatives is simply "given"; the theory does not tell how it is obtained.
> 2. To each alternative is attached a set of consequences--the events that will ensue if that particular alternative is chosen....
> 3. At the outset, the decision maker has a "utility function" or a "preference-ordering" that ranks all sets of consequences from the most preferred to the least preferred.
> 4. The decision maker selects the alternative leading to the preferred set of consequences.[47]

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[45] Dwight Waldo, The Administrative State (New York: Ronald Press, 1948), p. 25ff.

[46] Amitai Etzioni, Modern Organizations (Englewood Cliffs, New Jersey: Prentice-Hall, 1964), p. 17ff.

[47] Simon and March, op. cit., p. 137.

The concept of economic man acting in a rigorously rational manner is the basis for much of classical economic theory. However, it has been argued that the theory was much more than just an abstraction, that it formed the basis for a utopian construct of reality.

> Thus, classical economic theory did not represent an abstract theory. In point of fact, it presented an idealized picture of events in the commodity market under conditions of exchange, free competition, and narrowly defined rational conduct.[48]

Why is this connection of the Rational Policy Model with economics important to a study of decision-making on the selection of a weapons system? The answer has at least three parts. First, even though the Rational Policy Model is recognized as an ideal-type and a caricature, many analysts (including Allison) have argued that versions of this scheme are in wide use as decision-making models. Second, some knowledge of the tradition of economic theory will be important later in the work when the relationship of economics to the Systems Analysis organization is discussed. Third, the Rational Policy Model suggests certain specific propositions about the decisions on the A-7 program under study.

Model II: The Organizational Process Model

The limitations of the rigorously rational model have led analysts and policy-makers to search for a more

[48] Robert Boguslaw, The New Utopians: A Study of System Design and Social Change (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1965), p. 60.

accurate approximation of reality as an assist in the difficult choice problems of policy. Lindblom notes,

> Only in relatively restricted areas does economic theory achieve sufficient precision to go far in resolving policy questions; its helpfulness in policy-making is always so limited that it requires supplementation through comparative analysis.[49]

Simon and March are more systematic in their criticism of the model,

> A....difficulty with existing models of rational man is that it makes three exceedingly important demands upon the choice-making mechanism. It assumes (1) that all the alternatives of choice are "given;" (2) that all the consequences attached to each alternative are known....; (3) that the rational man has a complete utility-ordering (or cardinal function) for all possible sets of consequences.[50]

One of the clearest statements of the differences between the Model I and the Organizational Process Model (Model II) has been stated by the model's originator, Professor Allison,

> For some purposes, governmental behavior can be usefully summarized as action chosen by a unitary, rational decision maker; centrally controlled, completely informed, and value maximizing. But this simplification must not be allowed to conceal the fact that a "government" consists of a conglomerate of semi-feudal, loosely allied organizations, each with a substantial life of its own. Government leaders do sit formally, and to some extent in fact, on top of this conglomerate. But governments perceive problems through organizational sensors. Governments define alternatives and estimate consequences as organizations process information. Governments act as these organizations enact routines. Government behavior can therefore be

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[49] Charles E. Lindblom, "The Science of 'Muddling Through'," Public Administration Review, Vol. 19 (1959), and in Gore and Dyson, op. cit., p. 168.

[50] Simon and March, op. cit., p. 138.

> understood according to a second conceptual model, less as deliberate choices of leaders and more as outputs of large organizations functioning according to standard patterns of behavior.[51]

The components of Allison's Organizational Process Model are: organizational actors; the factoring of problems into special areas of responsibility and the consequent division of power; and the establishment of organizational priorities, perceptions and issues. There are seven concepts which are combined in the Organizational Process Model:

1. Concept of Acceptable Goals. This was stated originally by Simon and March as a realistic refutation of the concept of maximization.

> Most human decision-making, whether individual or organizational, is concerned with the discovery and selection of satisfactory alternatives; only in exceptional cases is it concerned with the discovery and selection of optimal alternatives. To optimize requires processes several orders of magnitude more complex than those required to satisfice.[52]

The concept of satisficing--searching only for satisfactory solutions--was formulated by March and Simon and included by Allison in his Organizational Process Model.

2. Sequential Attention to Goals. This concept is similar to the one of "problem-directed search" below. It refers, Allison notes, to the assignment of problems to specialized sub-units, which attempt to deal with them in terms of their own conception of the organization's goals.

[51]Allison, op. cit., p. 698.

[52]Simon and March, op. cit., pp. 140-141.

3. Standard Operating Procedures. The requirements of coordination within the organization require standardization of procedures. While the intention is to assure reliable performance and an "administrative due process" for the combined effort of the organization, the effect on any one program may appear to compel compliance with an unduely formalized, and possibly unresponsive system.

4. Programs and Repertoirs. Programs are instituted to facilitate the rapid implementation of directions. One of the best examples in the military services is the emphasis on the planning function and the production of elaborate contingency plans.

5. Uncertainty Avoidance. Uncertainty is the enemy of planned activity. Therefore, organizations attempt to negotiate treaties with agencies in their environment in an attempt to regularize inputs to the decision process. The best example of this for our purposes is the history of Army/Air Force discussions over the issue of who (and how and with what equipment) would supply air support for ground forces. (This specific example of a negotiated environment has been labeled the issue of service "roles and missions" and will be discussed at length in the next chapter.)

6. Problem-Directed Search. When a problem occurs the organization engages in a search for alternatives, but the search is not random or exhaustive. It searches to

solve that particular problem. As Simon notes,

> In most global models of rational choice, all alternatives are evaluated before a choice is made. In actual human decision-making, alternatives are often examined sequentially.[53]

Thus there is a tendency to stop the search mode with the first alternative that meets the criteria.

7. Organizational Learning and Change. The organizational elements of structure, external constraints, standard operating procedures, plans, and uncertainty avoidance combine against large or sweeping changes in policy. Decisions today are likely to be only incrementally different from decisions yesterday. One of the most consistent advocates of incrementalism has been Charles E. Lindblom, who compared the method of "successive limited comparisons" with "muddling through" and identified it with the politically possible.

> Usually--though not always--what is feasible politically is policy only incrementally, or marginally, different from existing policies. Drastically different policies fall beyond the pale.[54]

Allison states that the Organizational Process Model supports several general propositions about action and

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[53]Herbert A. Simon, "A Behavioral Model of Rational Choice," Quarterly Journal of Economics, Vol. 69, No. 1 (February, 1955). Also in Gore and Dyson, op. cit., p. 121.

[54]Lindblom, The Policy Making Process, op. cit., pp. 26-27. Although he would certainly not want to limit his approach to incrementalism, Professor Waldo used the concept before the Lindblom works were published. "'Managers' and 'administrators' have overrun the realm of policy--as the British conquered India--not by intent and plan, but by a continuous process of 'tidying up the border.'" The Administrative State, op. cit., p. 57.

policy. First, policy is not immediately responsive to the leaders' directions, but is conditioned by organizational routines, previously prepared plans, and standard scenarios. Second, organizations demonstrate only limited flexibility, and change, when it occurs, is incremental. Third, one of the chief criteria for judging the acceptability of proposed policies is that of administrative feasibility.[55]

Model III: The Individual Influence Model

Allison's third model is one considerably less elegant and structurally refined than his other two.[56] The model is not built around an ideal construct, but is almost solely explained in terms of individuals in the policy process.

> The actor is neither a unitary nation, nor a conglomerate of organizations, but rather a number of individual players. Groups of these players constitute the agent for particular government decisions and actions. Players are men in jobs.
>
> Individuals become players in the national security policy game by occupying a critical position in an administration....

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[55] Allison, op. cit., pp. 702-703.

[56] Allison calls his third model the "Bureaucratic Politics Model," but this term does not indicate the degree to which he emphasizes the actions of individuals as opposed to organizations (which were at the center of his Model II). In addition, there is a great amount of confusion associated with the term "bureaucratic"; there are many definitions and uses of the word but many of them are pejorative. For this reason his Model III will be referred to as the "Individual Influence Model" because that term seems to transmit the essence of Allison's intent. Allison notes his Model III relies on the ideas of a small, but growing group of analysts including Warner Schilling, Roger Hilsman, and Richard E. Neustadt. The model is represented concisely in Neustadt's phrase, "Presidential power is the power to persuade."

* *

> For players are also people. Men's metabolisms differ. The core of the bureaucratic politics mix is personality. How each man manages to stand the heat in his kitchen, each player's basic operating style, and the complementarity or contradiction among personalities and styles in the inner circles are irreducible pieces of the policy blend. Moreover, each person comes to his position with baggage in tow, including sensitivities to certain issues, commitments to various programs, and personal standing and debts with groups in the society.[57]

In this bargaining model policy is seen as a stream of political outcomes; decisions are made in a political environment, with the pace of the game being set by the flurry of hundreds of issues. The pace of the game and the political environment dictate a focus for the decision-maker that is not solely toward the broad, strategic problem in the sense of Model I, but directly on the decision which he must make at the time.

Allison stresses that administrative and decision-making theories have not adequately accounted for policy with the complexity of Model III.

> The concept of national security policy as political outcome contradicts both public imagery and academic orthodoxy. Issues vital to national security, it is said, are too important to be settled by political games. They must be "above" politics. To accuse someone of "playing politics with national security" is a most serious charge. What public conviction demands, the academic penchant for intellectual elegance reinforces....Occasional memoirs, anecdotes in historical accounts, and several detailed case studies to the contrary, most of the literature of

[57]Allison, <u>op. cit</u>., pp. 708-709.

> foreign policy avoids bureaucratic politics. The gap between academic literature and the experience of participants in government is nowhere wider than at this point.[58]

Allison's three models were designed to assist in the analysis of policy-making at very high levels in the government. The models are of sufficiently recent publication that few researchers have had an opportunity to apply them in the analysis of actual decision-making situations. The research in this study is a specific attempt to apply Allison's models in the same general environment--high level policy--that he intended. The result should aid in the evaluation of his models and lead to the development of a more specific model.

Concepts of Rationality in Models I, II and III

Allison does not dwell on the concepts of rationality his three models imply for specific decision-making situations. Another political scientist, Paul Y. Hammond, specifically discussed defense decision-making and posited three types of rationality that come temptingly close to Allison's three models. There is no evidence in their writings that either Hammond or Allison knew of the other's work, but since both researchers were at the RAND Corporation, there is room for speculation.

Hammond states that three standards of rationality perform the rationalizing function for bureaucracies.

[58] *Ibid.*

There is a close correspondence to Models I, II, and III, respectively,

> Radical rationality attacks the cognitive obstacles directly, postulating criteria and applying them to the substance of policies. It persuades and legitimizes on the basis of shared values. In any given context, however, the radically rational position begs the question about how to establish criteria scientifically. Radical empiricism is a variant of radical rationality. It postulates the validity of empirical (not necessarily organizational) methods by which to acquire and analyze data. One might refer to it as scientific due process.
>
> Procedural rationality appeals to some self-evident or widely accepted standards of organizational or administrative due process, such as deliberation and clearance, information gathering and processing, authority, subordination, and responsibility. Administrative due process can rely upon agreement about more tangible things having to do with how things ought to be done.
>
> The third form, liberal or transactional rationality, is a special case of the second; due process for extreme skeptics in a pluralistic and liberal culture. Skeptical of prevailing standards of administrative due process, it falls back upon the generic political processes of the classical liberal market place. It is more individualistic than administrative due process. Of the three forms of rationality, it may beg the fewest questions although it assumes rationality in individual behavior.[59]

What do Hammond's standards of rationality and Allison's three models tell us about decision-making? They perform the very important function of setting up a spectrum of policy making models with various implications for individual and organizational behavior.

The following discussion will attempt to show that certain groups of decision-makers applied Hammond's standard

[59] Hammond, op. cit., p. 58. (Emphasis added.)

of "scientific due process" to the decisions in the A-7 program, while others used the standard of "administrative due process." Why was this important? It was important because the application of two different and conceptually distinct standards of rationality may have led decision-makers in different organizations to arrive at different conclusions on the acceptability and desirability of initiating and proceeding with the A-7 program.

The Organizations Involved in the A-7 Decision Process

The organizations in the Department of Defense that had a major impact on the A-7 program were the three services--Army, Navy and Air Force--and the Office of the Secretary of Defense. (See Appendix I.) Within the Office of the Secretary of Defense (OSD) two organizations played very important parts in the A-7 program--the offices of the Director of Defense Research and Engineering and Systems Analysis.

The functions and professional perspectives of these organizations will be explained in detail later in the study. Basically, the office of the Director of Defense Research and Engineering (DDR&E) was established in its present form in 1958 and had the responsibility to be the primary advisor to the Secretary of Defense on matters of a scientific or technical nature. This specifically included the research and development of new combat aircraft for the military services.

Systems Analysis was first organized in the office of the Comptroller in 1961 and then moved into a separate organizational position at the Assistant Secretary level in 1965. The responsibilities of Systems Analysis included not only the monitoring of research and development but analysis of many other functional areas as well. On the A-7 program the office was involved in the decisions on the development of the aircraft and in the determination of how many aircraft were to be purchased.

The three military services were involved in the decisions on the A-7 program. The Navy was the original service to begin the program, and it took the initiative to get the A-7 approved by OSD. The Army was interested in the Air Force obtaining the A-7 because it represented a type of aircraft the Army believed could deliver large payloads of bombs in the support of ground forces. The Air Force decided to develop the Navy A-7 for its own use in 1965, partially to fulfill its responsibilities in supporting the Army.

These, then, are the major organizations involved in the A-7 decision process. The decisions can, and will, be discussed in terms of Allison's three policy models, but they are not sufficient to fully explain the complexity of process. When this study was begun, it was recognized that the organizations involved in the A-7 decisions were professional organizations. Many of the individuals in the organizations were professionals and brought professional values to their organizational work. For this reason the research was conducted with an eye toward the professions involved. If Allison's models need modification to assist our understanding of the A-7 decision process, the direction of that modification may well be to incorporate some aspects of professionalism in the models.

The Importance of Professionalism in Defense Decision-Making

The most significant aspect of professionalism in the modern industrial (or post-industrial) society is its rapid growth, which has, in most cases, overrun our ability to conceptualize its nature. The growth of professionalism is related to the explosion of specialized knowledge, which is, in turn, largely the result of rapidly expanding science and technology.

Don K. Price, in his classic work, The Scientific Estate, identified four powerful groups in our society: scientists, professionals, administrators and politicians. Price's central thesis was that the scientific revolution "...seems certain to have a more radical effect on our political institutions than did the industrial revolution..."

From this he stated three primary assertions:

> (1) The scientific revolution is moving the public and private sectors closer together [because of the decline of the market economy].
> (2) The scientific revolution is bringing a new order of complexity into the administration of public affairs [because of the rise of professionalism].
> (3) The scientific revolution is upsetting our system of checks and balances.[60]

Price noted further that the United States was undergoing a fusion of economic and political power through the research and development process, and that increased specialization was causing a diffusion of sovereignty. All three assertions and these two extra points relate directly to professionalism.

Frederick C. Mosher noted the importance of Price's work, but placed even more emphasis on professionalism.

> But the characteristic of the public service--and indeed of a great part of the rest of society--which seems to me most significant today is professionalism....
> ....the importance of the professions, among which I would include the applied scientists in virtually all disciplines, is increasing rapidly and will continue to do so. Viewed broadly, the professions are social mechanisms whereby knowledge, including particularly new knowledge, is translated into action and service. They provide the means whereby intellectual achievement becomes operational.[61]

If professions are important groups for the formation of public policy, what are their distinguishing characteristics? Samuel P. Huntington, in the Soldier and the State, set down one of the most enduring definitions of the

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[60] Don K. Price, The Scientific Estate (Cambridge: Belknap Press of Harvard University Press, 1965), pp. 15-16.

[61] Frederick C. Mosher, Democracy and the Public Service (New York: Oxford University Press, 1968), pp. 101-102.

characteristics of a profession:

> 1. Expertise--The professional man is an expert with specialized knowledge and skill in a significant field of human endeavor. His expertise is acquired only by prolonged education and experience. It is the basis of objective standards of professional competence for separating the profession from laymen and measuring the relative competence of members of the profession....Professional knowledge has a history, and some knowledge of that history is essential to professional competence.
> 2. Responsibility--The professional man is a practicing expert, working in a social context, and performing a service, ...which is essential to the functioning of society. The essential and general character of his service and his monopoly of his skill impose upon the professional man the responsibility to perform the service when required by society....The responsibility to serve and devotion to his skill furnish the professional motive. Financial remuneration cannot be the primary aid of the professional man _qua_ professional man....
> 3. Corporateness--The members of a profession share a sense of organic unity and consciousness of themselves as a group apart from laymen.[62]

Four Important Professions in Defense Decision-Making

The Huntington description of a profession lays the foundation for an examination of how organizations _inside_ the Department of Defense can be differentiated. We have previously noted that the important decision-making organizations included: OSD Systems Analysis, OSD Director of Defense Research and Engineering, and the military services. How did these organizations differ in their professional perspectives?

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[62]Samuel P. Huntington, _The Soldier and the State_ (Cambridge: Harvard Univeristy Press, 1957), pp. 8-10.

This section will inquire whether the organizations in Defense were clustered around four professions:

1) Applied Economics

2) Engineering

3) Military Operations

4) Military Systems Management

The identification of four professions in the A-7 decision process does not mean that any one organization can be neatly categorized into one or another of these professions. Neither does it mean that other professions were not represented in these organizations. What is intended is to show how some of the differences among the organizations involved can be explained by professional perspectives.

The basic organization/profession relationship appears to be:

1) OSD Systems Analysis--Applied Economics

2) OSD DDR&E--Engineering

3) Military Services--Military Operations

--Military Systems Management

Systems Analysis and Applied Economics

Why is Systems Analysis identified with the economics profession? McNamara's Assistant Secretary of Defense for Systems Analysis, Dr. Alain C. Enthoven, was asked the question, "What is systems analysis?" He answered,

> It is, in part, an outgrowth of military operations research which really had its start, as a systematic discipline, in World War II. It was not until after that war that economic analysis began to be applied to the program of choice of weapons systems. And it is only in very recent years that it has been taken seriously by top-level decision-makers.[63]

Enthoven continued to describe the relationship of economics to systems analysis.

> Next, choosing strategies and weapons systems is <u>fundamentally an economic problem</u>, using the term in its precise sense. That is, it is a problem in choosing how best to use our limited dollars and limited resources valued in dollars, such as man hours, materials, plant and equipment, etc. To do this properly, one must think through the purposes of the weapons systems, formulate good criteria of effectiveness, and then consider alternative systems or mixes of systems in terms of their effectiveness and their cost.
>
> Much of the innovation of which I am speaking has been the introduction of techniques of rational economic analysis and planning.[64]

Enthoven's use of the term "rational economic analysis" is interesting, because it is very similar to the concept of "economic man" and implies the application of Allison's Rational Rolicy Model. This relationship of the Rational Policy Model to the operation of the Systems Analysis staff will not be pursued further here except to note the similarity of language. As the A-7 program is described

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[63]Dr. Alain C. Enthoven, "Choosing Strategies and Selecting Weapon Systems," Address before the Naval War College, Newport, R. I., June 6, 1963, reprinted in <u>A Modern Design for Defense Decision: A McNamara-Hitch-Enthoven Anthology</u>, ed. by Samuel A. Tucker (Washington, D.C.: Industrial College of the Armed Forces, 1966), pp. 137-138.

[64]<u>Ibid</u>., pp. 141-142. (Emphasis added.)

the reader should note whether Systems Analysis appears to apply the Rational Policy Model and/or Hammond's concept of "scientific due process" to the various decisions.

If the office of Systems Analysis is related to the profession of economics, we would expect to find the office staffed with a significant number of economists and the use of ecomonic terms to be commonplace. That was not exactly the case. There were, from 1961 to 1970, many professionals in Systems Analysis who were not economists. A 1967 study showed the following statistics for the 126 professional staff members of Systems Analysis (70 civilians, 56 military officers):

	Civilian	Military
Economics (or economics combined with allied fields)	32%	16%
Physical sciences	17%	28%
Mathematics	13%	12%
Miscellaneous (political science, law, administration, other)	38%	44%

Source: Brig. Gen. Arnold W. Braswell, The Role of the Systems Analysis Staff in Defense Decision Making (unpublished Master's thesis, George Washington University, 1967), p. 22. Data based on a January, 1967, survey.

The 32% of the civilian staff with economics (or economics related) degrees is significantly high, but it does not indicate a complete dominance of the organization. However, the organization began under the leadership of

Dr. Enthoven, and he held a Ph.D. from Massachusetts Institute of Technology in Economics. Enthoven has contributed many articles on economic journals, was a member of the American Economic Association and the Econometric Society, and had an overwhelming influence on the organization.

Thus, even though the majority of the staff of Systems Analysis did not have economics educational backgrounds, the influence of Enthoven could have a great bearing on the establishment of an economic perspective. If such a perspective were established in Systems Analysis, it could be identified in an emphasis on the economic concept of marginal utility analysis and the extensive use of quantitative measures of comparison. As previously stated one of the purposes of the study was to investigate the extent to which these techniques were used in actual defense decision-making on the A-7 program.

This study was begun with the hypothesis that the operation of Systems Analysis was closely related to the values and principles of the economics profession. If that is shown to be true, it would have significant implications for the relationships between Systems Analysis and the other organizations in the decision process. Two areas where the values of the four different professions would be likely to diverge are emphasis on the cost aspects of weapons and the role of experience.

Enthoven has been quoted as saying the selection of a weapon for the military services is "fundamentally an economic problem." An engineer or a military professional might say that the cost aspects of weapons selection and development have to be considered, but neither would be likely to say it was <u>fundamentally</u> an economic problem.

The differences between the economics profession and the military operations profession include a divergence of opinion on the value of experience. While neither profession denies the importance of either concept in correct proportions the literature abounds with examples of differences over what the correct balance is to be. Enthoven expressed the Systems Analysis view to officers at the Naval War College,

> Another implication of the rapid pace of technological change is that today's weapons differ more and more from the weapons many of you used in World War II and in Korea. Although it is difficult to know exactly how and to what extent, this does mean that some aspects of earlier experience in combat are probably out of date. And peacetime experience with military operations, however valuable, does not completely make up for this....
>
> To deal with it, the Office of the Secretary of Defense is trying to encourage, stimulate, and contribute to the development of a new analytical approach to discipline for synthesizing many of the factors that go into defense planning. It is clear that both the Secretary of Defense and our senior military

> leaders are being forced by present circumstances to place increasing reliance on such analysis rather than placing exclusive reliance on their experience and judgement.[65]

Enthoven went on to state that the emerging discipline of systems analysis did not deprecate the role of experience, intuition and personal reputation in the field of military operational command.[66] At the same time he stated that systems analysis would provide a viable alternative to experience and intuition in the selection of strategies and weapons systems.

Systems Analysis is also important because the office was perceived to be especially close to Secretary of Defense McNamara and held a respected position in his personal method of decision-making. Hammond noted the relationship among McNamara, Systems Analysis, and DDR&E and wrote in 1968:

> Systems Analysis has held the initiative in defense management for six years. In the research and development sector, the Directorate of Defense Research and Engineering had become a powerful agency by 1961. Since then it has lost its predominance to the Office of the Assistant Secretary of Defense for Systems Analysis, the primary agent in OSD for exploiting these techniques [cost-effectiveness analysis and program budgeting]. The "opportunity approach" to research and development used normally in DDR&E may be more flexible, but it is less thorough in the exploration of trade-offs in a technological environment of rapidly increasing possibilities than are the decision analysis techniques which are exploited by OSD(SA). It is a fair estimate that the latter persuades the Secretary of

[65]*Ibid.*, pp. 136-137.

[66]*Ibid.*, pp. 139-140.

Defense more often than does DDR&E on major research and development questions.[67]

DDR&E--Stronghold of the Engineering Profession

The Director of Defense Research and Engineering (DDR&E) is by law the principal advisor to the Secretary of Defense on matters of a scientific and technical nature. Established formally in 1958, this places that OSD office near the top of the decision-making apparatus for the national research and development community. In 1969 the federal government allocated $17.3 billion dollars to the research and development effort, of which the largest portion (47%) went to the Department of Defense.[68]

Research and Development (R&D) is a broad-gauge term referring to a spectrum of activities including basic research, applied research, and engineering development. Of the $7.698 billion appropriated for R&D in the Department of Defense in Fiscal 1969, the allocations among these three activities were as follows: basic research, 3%; applied research, 15% development, 81%.[69] From this it is easy to see that the development activity is the chief concern of DDR&E although the agency supervises many important programs in the areas of basic and applied research.

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[67]Hammond, op. cit., pp. 61-62.

[68]National Science Foundation, Federal Funds for Research, Development and Other Scientific Activities, Fiscal Years, 1967, 1968, 1969, NSF-68-27. (Washington, D.C.: National Science Foundation, 1968), p. vii. In 1958 DOD accounted for over 74% of the nation's R & D budget.

[69]Ibid., p. 39.

The manning of the office of DDR&E indicates its scientific and engineering functions. The staff of the Director included 558 people (381 civilian; 177 military) in 1967.[70] A survey of its top echelon of management personnel indicated the following breakdown of educational specialties:

Physical Science or Engineering Degree	Other Degree	No Degree
86%	4%	10%

Source: DDR&E, Office of the Assistant Director for Laboratory Management, Personnel Files on all DDR&E Public Law 313 and Supergrade positions, 1966. Fifty-five officials comprised the survey.

Starting in 1958 when the position of Director was authorized by Congress, the first three Directors of DDR&E have been physicists--first Dr. Herbert York, then Dr. Harold Brown, and then Dr. John S. Foster, Jr. We have noted that DDR&E is manned by officials generally having an engineering or scientific degree. There is another characteristic of DDR&E that is distinctive when compared to the office of OSD Systems Analysis or the military services. That is that most of the officials in DDR&E have worked in some phase of private industry. Of the 55 officials surveyed in 1970 over half (30) had worked in industry. On the other hand, Systems Analysis had very few people with industrial experience; most analysts in the office came from

[70] Carl W. Borklund, The Department of Defense (New York: Praeger, 1968), p. 83.

either university or non-profit corporations (like the RAND Corporation). By comparison the overwhelming majority of officers in the military profession have not served outside of that profession.

If most of DDR&E's activity is in the area of engineering development, and most of its officials are engineers, what does that mean? What is engineering development? A part of the activity of DDR&E is indicated by the appropriations category it is budgeted under--Research, Development, Test and Evaluation (R.D.T.&E.). If most of the "research" is conducted and managed by scientists, then engineers tend to perform development, test and evaluation.

Peck and Scherer in The Weapons Acquisition Process define two of the engineering activities this way:

> (1) advanced engineering and development--the identification, modification, and combination of feasible or existing concepts, components, and devices to provide a distinctly new application practical in terms of performance, reliability, and cost.
> (2) product engineering--Relatively minor modification of existing components, devices and systems to improve the performance, increase reliability, reduce cost and simplify application.[71]

It is important to note that DDR&E does not actually perform many of the actual scientific or engineering activities. It supervises military and civilian agencies that perform research and development. For this reason, Mr. Charles A. Fowler, DDR&E Deputy Director for Tactical

[71]Merton J. Peck and Frederic M. Scherer, The Weapons Acquisition Process: An Economic Analysis (Boston: Harvard University, 1962), p. 28.

Warfare Programs, has noted that the personnel of DDR&E tend to be older engineers and scientists who have drifted away from <u>conducting</u> R & D to administering or managing.[72]

Fowler also noted that DDR&E generally has less technical expertise than the Military Services, but relatively more than the Service headquarters staffs in the Pentagon. This is because DDR&E does not have the technical base (research laboratories, testing facilities, etc.) to match the Services. (However, he added that the technical expertise in private industry surpasses both that of DDR&E and the Services.) What, then, is the relationship among DDR&E and the Services on weapons proposals?

Fowler explained that DDR&E is able to maintain a degree of control over Service R & D projects because they work in an organizational structure where DDR&E controls many of the ground rules and has a great deal of authority. That is, DDR&E is able to exert its influence by posing questions, requiring additional study, and generally in making the Services come to DDR&E for a decision or a concurrence in a recommendation for the Secretary of Defense. (He added that DDR&E officials have reported that it is relatively easier to control research and development management by sitting back and asking pointed questions, rather than attempting to maintain a high level of technical expertise in the many areas of DDR&E responsibility.)

[72] Interview with Mr. Fowler, August 18, 1970.

The position of DDR&E is made all the more powerful because it has primary authority for managing the distribution of funds for military research and development projects. In addition, it has a certain allotment of contingency funds yearly which may be granted solely at the discretion of DDR&E. The Services know this and quite often attempt to get the DDR&E funds for their own projects.[73]

DDR&E consults with the Joint Chiefs of Staff and agencies in the intelligence community to keep abreast of possible technological threats to national security. This responsibility of DDR&E and the role of the engineering profession in the defense environment has been described by the Director, Dr. John S. Foster, Jr.:

> ....research and development provide a <u>qualitative advantage</u> required to compensate for any numerical inferiority which the United States has or might suffer in troops or equipment and for any temporary disadvantage we might suffer should a numerically superior force take the initiative. If we maintain our technical leadership, we can achieve our goals... without necessarily competing with the Soviet Union in total numbers of missiles or bombers or troops. Thus, the <u>quality</u> of our deterrent may be more critical than the quantity of our deterrent--and without R & D you cannot have this quality.[74]

This emphasis on the quality of weapons is a characteristic of the engineering profession that this study will attempt to demonstrate acts on the development process with great force. It tends to emphasize the utility of

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[73] <u>Ibid</u>.

[74] Statement by Dr. John S. Foster, Jr., DDR&E, on the FY 1971 Defense RDT&E Program before the Joint Committee on Armed Services and Defense Subcommittee of the Appropriations Committee, U.S. Senate, 91st Cong., 2d sess., February 26, 1970, p. 26. (Emphasis added.)

using advanced technology even if that means increasing the cost of the aircraft involved. The clearest statement of this pressure, which is shared to a great extent by the military services, is in a British volume in the History of World War II series, The Design and Development of Weapons.

> The doctrine of quality, i.e., the view that the power of the R.A.F. depends largely if not wholly, on the perfection of its equipment, was one which the Air Ministry handed down to the Ministry of Aircraft production and which the Air Staff consistently pressed. It was equally accepted that the sacrifice in the numbers of output and establishment was necessary in order to maintain quality; and it was well understood, both on the Air Staff and in the Supply branches, that perfection of aircraft has to be paid for in terms of output.[75]

The "Doctrine of Quality" is distinctly an engineering value. It places primary emphasis on technology and relegates cost to a secondary consideration. There is no mention of marginal utility analysis. The concept of the doctrine of quality is similar to the American approach to many problems, as Don K. Price has noted, "Americans are notoriously more interested in inventing gadgets than in studying the basic laws of nature."[76]

The Deputy Director of DDR&E for Administration, Evaluation, and Management, Vice Admiral Vincent P. de Poix, in an interview noted that DDR&E people tend inherently to

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[75]M. M. Postan, D. Hay, and J. D. Scott, Design and Development of Weapons: Studies in Government and Industrial Organization (London: Her Majesty's Stationery Office, 1964), p. 1.

[76]Price, The Scientific Estate, op. cit., p. 208.

be proponents of new weapons.[77] Compared with the proponent position assumed by the Services and DDR&E, he noted that Systems Analysis was often viewed as negative. This may be because of its professional perspective based on economics and/or because Systems Analysis received more proposals for new weapons than there were funds for.

The difference, however slight, between the engineering profession and the economics/systems analysis profession on the question of quality, is significant. Note, for instance, the difference in tone between the British statement of the Doctrine of Quality and the remarks of Dr. Charles J. Hitch, McNamara's Comptroller,

> It should always be our policy to spend whatever is necessary for defense, but to spend whatever is spent in such a way as to achieve the greatest possible military capability-- not to buy quality when the same amount spent on quantity will purchase greater effectiveness, and *vice versa*. Sometimes a weapon system with less than the maximum unit cost and effectiveness does win out as in the case of the new Navy attack aircraft, the A-7, which is far slower than many other aircraft now in the forces--and also much cheaper. The A-7 program promises to be not only satisfactory for the missions it is intended to perform, but superior in those missions to alternatives which cost more per aircraft.[78]

There is nothing intended in this statement of organizational and professional values that either quality or cost/effectiveness is a superior concept. What *is* significant is that these two concepts may have been applied

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[77] Interview with Vice Admiral de Poix, February 20, 1970.

[78] Charles J. Hitch, *Decision Making for Defense* (Berkeley: University of California Press, 1965). Reprinted in Tucker, *op. cit.*, pp. 124-125. (Emphasis added.)

differentially in the development of the A-7 program by the offices of DDR&E and Systems Analysis.

The Military Profession--Combat Leaders and Project Managers

If the organization of OSD Systems Analysis can be identified with the profession of applied economics, and DDR&E with that of engineering, can the military Services be characterized as unified in the pursuit of the military profession? There is little doubt that military organizations fulfill Huntington's three requirements for a profession: expertise, responsibility, and corporateness.

A statement of the perspective of the core of the military profession has been made by Morris Janowitz in his classic work, The Professional Soldier.

> ....the military professional is unique because he is an expert in war-making and in the organized use of violence. This primary goal of the military establishment creates its special environment and influences its decision-making process. Social background, military authority, and career experiences condition the perspectives of its leaders. The style of life of the military community and a sense of military honor serve to perpetuate professional distinctiveness.[79]

It is significant that Janowitz mentioned the importance of experience, which is a central characteristic of the military profession. We have previously indicated that this value placed on experience was not shared by Enthoven to the same degree it was honored in the military profession.

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[79]Morris Janowitz, The Professional Soldier (New York: The Free Press, 1960), p. 15.

The impact of technology upon the profession of arms has strongly affected the previously sacrosanct value of experience by raising a new value--specialized knowledge. Technology has had the effect of "civilianizing" the military profession--or part of it--and increasing the value of education and technical knowledge. In short, technology may have split the military profession into at least two sub-professions: "military operations" and "military systems management." Janowitz has set some of the differing values of these two groups in contrast by using the terms "heroic leaders" and "military managers."

> The history of the modern military establishment can be described as a struggle between heroic leaders, who embody traditionalism and glory, and military "managers," who are concerned with the scientific and rational conduct of war. This distinction is fundamental. The military manager reflects scientific and pragmatic dimensions of war-making; he is the professional with effective links to civilian society. The heroic leader is a perpetuation of the warrior type, the mounted officer who embodies the martial spirit and the theme of personal valor.[80]

The portrait Janowitz paints is too stark by half, but it is generally representative of the two sub-professions emerging in the military. His "heroic leader" exists in modified form--better educated and more civilianized--in the military operations sub-profession, which is that part of the military that actually participates in combat and is assigned to combat-ready units. This sub-profession.

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[80] *Ibid.*, p. 21.

generally places a higher value on experience and a lower value on education than does the systems management sub-profession.

The military profession in the United States places a very high value on an idealized career pattern. This is an important factor in the manning of headquarters staffs, where the decision-process is centralized. The military operations sub-profession includes officers who are stationed in the combat commands and, when they are assigned to staff duty in the Pentagon, generally aspire to positions in the operations and planning sections. (The organization of Headquarters USAF will be described in detail later, but for now it is sufficient to note that the combat orientation is most significant in the office of the Deputy Chief of Staff for Plans and Operations.)

Military systems management, on the other hand, is that part of the military profession which is most closely related to the research and development community. Broadly construed, this view of military systems management sees the sub-profession place a high value of the advancement of technology, the development of new weapons and the expansion of the national base for science and technology.

The military systems management sub-profession does not comprise all the officers outside of the operations sub-profession, but it is a significant group in the decision-making process. The systems management sub-profession is not primarily associated with the combat commands, although many of its officers have served tours of duty in the operations specialty. This sub-profession in the Air Force is most closely identified with the Headquarters office of the Deputy Chief of Staff for Research and Development, the field offices of Air Force Systems Command, and--most directly--with the project management office in charge of the A-7 development.[81]

The emphasis on systems or project management is a relative recent trend. It is generally understood to have begun with the Manhattan District project to develop the atomic bomb (1941-1945) and was accelerated by the Air Force development of the intercontinental ballistic missile--ICBM--(1954-1959).[82] The technique of project management was used extensively on the most spectacular technological achievement of the 1960's--the Apollo moon landing program.

What impact did project management and the military systems management sub-profession have on the A-7 program? This research was conducted to test the hypothesis that the

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[81] The concepts, theory and development of the project management have been extensively analyzed in David I. Cleland and William R. King, Systems Analysis and Project Management (New York: McGraw-Hill, 1968).

[82] For a description of the management techniques and organizational innovations in the Air Force on the ICBM program, see Kenneth F. Gantz, ed., The United States Air Force Report on the Ballistic Missile (Garden City New York: Doubleday & Co., 1958) and Claude J. Johns Jr., The United States Air Force Intercontinental Ballistic Missile Program, 1954-1959: Technological Change and Organization Innovation (Colorado: United States Air Force Academy, 1965).

existance of a systems management sub-profession would tend to influence the program toward the use of developing technology. The result--if confirmed--would be to demonstrate a community of interest between the project management office and DDR&E on the issue of the Doctrine of Quality. We would also expect to find a lesser degree of cooperation--and perhaps conflict--between the project management office and the office of OSD Systems Analysis.

While the impact of technology was important to the establishment of the systems management sub-profession, the military professionals were divided into other groups also. Mosher has described this process of specialization,

> Professional elites in larger agencies tend to specialize into subdivisions under the general professional canopy. These may be reflections of well-recognized divisions of the profession, determined outside the agency and extending back into educational specialization, as in medicine and engineering. They may be grounded in specializations of work in the agency itself, sometimes highly formalized as in various arms and services of the Army [or in the Air Force between the advocates of strategic bombers and tactical fighters]....Among such sub-groups there is normally a pecking order of prestige and influence. The most elite of the sub-groups is likely to be the one which historically was most closely identified with the end purpose, the basic content of the agency--the officers of the line in the Navy, the pilots in the Air Force....[83]

The next chapter will describe how the pilots of the Air Force were sub-divided into the specialties of bomber

[83]Mosher, _op. cit._, p. 114.

pilots and fighter pilots. The Navy did not have strategic bomber pilots, but it divided the tactical air missions into two basic categories. Thus, the Navy developed the specialties of attack pilots and fighter pilots. (The missions performed by the Navy attack and fighter pilots were generally performed in the Air Force by tactical fighter and tactical bomber pilots between World War II and 1961.)

This description of the specializations and sub-professions in the Air Force and Navy completes our discussions of the organizational/professional characteristics of the major groups involved in the A-7 decision-making process. There is nowhere a clear delineation of the boundaries between the professions; they tend to spill over into various organizations. There were some engineers in the Office of Systems Analysis; DDR&E includes scientists as well as engineers (although no economists were found in DDR&E). The military services present many characteristics of a unified profession, but the impact of technology and work specialization has modified the concept of a monolithic group. The military sub-profession has been characterized as that portion that has modified its beliefs the least, while the sub-profession of military systems management was virtually created by the pressures of advancing technology.

How do these combinations of professions and organizations fit into our models of the decision-making process? First of all, they challenge the scope of the present models and indicate that the Organizational Process Model specifically might be broadened to include aspects of professionalism. Second, the existance of the professions in the Defense organizations conditioned the type and nature of the debate on the A-7 program. Mosher has described how professions affect intra-organizational conflict.

> The key zones of potential tension and conflict in agencies of this kind [DOD] lie not between management and workers, though these are not absent; nor between management and professionals, because most of the management is professional....Rather it is delineated by the...tensions between:
> (1) politically appointed officials and the elite profession (or its elite segment), especially if the political leaders are not members of the profession (or segment);
> (2) different and competing segments of the elite profession;
> (3) the elite profession (or elite segment thereof) and other professions in the agency, including especially those in line and administrative professions.
>
> My unproven observation is that the most explosive situations in professionalized public agencies arise between those in different professions (or segments) and in different personnel systems who are approximately equal in level of responsibility and pay, but where one is "more elite" than the other.[84]

We have already noted how the professional perspectives of the organizations involved in the decision process differed. What remains is to see how these differences fit

[84] Mosher, *op. cit.*, pp. 121, 122.

into the highly structured decision-making process under Secretary McNamara. The relationship of the professions to the political role of the Secretary of Defense has been the subject of many inquiries, but it is most clearly stated by Price,

> The first protection of the politician is his ability to define the issues and the assumptions....Second, the politician is protected against encroachment by the experts by his ability to detect, and take advantage of, differences of opinion among scientists and professional advisers. Third, the politician has (or should have) the authority to sort out the elements of a policy problem, and to decide which must be determined by his administrative subordinates or by himself. In considering the development of a weapons system, for example, the Secretary of Defense can assert his authority by observing how professional advice from the several services cancels itself out, and how the science of the economist helps to criticize the plans of the engineer. This right to make the jurisdictional decisions among the several estates, so to speak, is the essence of political power, and usually of executive authority.[85]

Price has noted and it is the contention of this study that decisions in the Department of Defense were influenced by the organizations involved and by the professional perspectives of the organizational actors. However, only a small number of the many defense decisions were examined in this research. The decisions on the A-7 aircraft were strongly influenced by the character of the research and development process itself.

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[85]Price, The Scientific Estate, op. cit., pp. 200-201.

The Research and Development Process

The decisions on the A-7 program were research and development decisions. They were decisions for the Navy to develop the aircraft, the Air Force to develop the aircraft, and decisions of what kind of aircraft it was going to be and how many would be purchased. Most of these decisions were considered concurrently, and many of them had to be changed several times during the evolution of the program. Since decisions on a research and development program follow a general pattern--with individual exceptions--that pattern will be discussed.

The "life cycle" of a weapons system (or project) can be visualized as four basic phases: Concept Formulation, Contract Definition, System Acquisition, and System Operation.[86]

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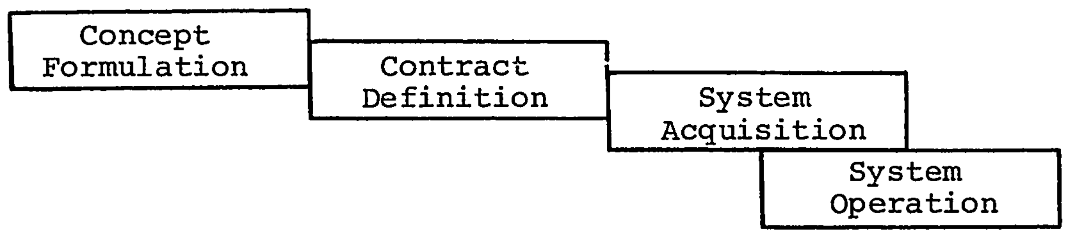
[86]For a more complete discussion of the extremely complex and dynamic research and development process, see Peck and Scherer, The Weapons Acquisition Process, op. cit., Clarence H. Danhof, Government Contracting and Technological Change (Washington, D.C.: The Brookings Institution, 1968); and Charles J. Hitch and Roland N. McKean, The Economics of Defense in the Nuclear Age (New York: Atheneum, 1960). The following discussion was developed using the above and the Information Brochure, DCS/Research and Development, (Headquarters USAF, Spring 1968) and USAF Air University, Introduction to System or Project Management (Gunter Air Force Base, Alabama: Extension Course Institute, undated.)

These four phases usually follow one on another from the time when the idea for the weapon is conceived until the weapon has been developed and placed into operation in the combat units.



1) The <u>Concept Formulation</u> phase is usually begun by the military service stating an operational need (a requirement) for a new capability or a new weapon.

2) The <u>Contract Definition</u>[87] phase is usually begun with OSD approval for the service to proceed with the selection of contractor(s) to prepare technical proposals. The Contract Definition ends with the selection of a contractor and the decision on the technical design (configuration) of the system, which is then formalized in the preparation of a contract between the service and the industrial contractor.

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[87] The Contract Definition phase was an innovation in the defense development process installed by Secretary McNamara in 1963. Its purpose was to further define the proposed design before large amounts of funds were commited to the production phase. The DOD policies surrounding Contract Definition are spelled out in, DOD Directive 3200.9, "Initiation of Engineering and Operational Systems Development," July 1, 1965. The selection of a contractor to produce the weapons system is the subject of Air Force Regulation 70-15, "Proposal Evaluation and Source Selection Procedures," May 17, 1968.

3) The System Acquisition phase usually begins with the OSD approval of a decision to begin production. Until this decision is made by OSD the Service cannot sign a production contract. After it is signed, the contractor begins the production phase, which includes engineering development, design and mock-up, fabrication and the start of testing. One of the primary goals of the System Acquisition phase is the production of enough weapons (i.e., aircraft systems) to form a combat-ready organization.

4) The Systems Operation phase begins when sufficient weapons have been produced and the crews trained to form an initial operational capability (IOC). From this point on production continues until the required numbers of weapons have been accepted by the service. Then the operational units use the weapons until the decision is made to replace the weapon with a new one or to simply phase it out of service. However, during this phase there is a strong likelihood that the weapon will either undergo a major modification to prolong its life and/or improve its performance or that changes to the design of the weapon will require a new version to be produced.

The decisions on research and development projects are characterized by several important factors which condition the decision process. The first is a future-orientation caused by the long lead-time of the process.

"Lead-time" as used here is the time between the decision to begin development and the initial operational capability of the system. Peck and Scherer, in their study of 12 research and development projects, found the average development cycle--lead time--was eight years.[88] Thus, the decision-makers had to forecast a state of nature and external threat eight years in the future.

The lead time on a development project is only one source of uncertainty. Other sources of uncertainty are: the technical feasibility of the project, the development time and cost, the production and operational costs, and the nature of the strategic threat that the weapon is designed to meet. These uncertainties are naturally reduced as the system progresses through the various phases and more knowledge is obtained. Peck and Scherer combine these factors in what they call time-expenditure-uncertainty relationships.

> The net effect of the time-expenditure-uncertainty relationships just described is to encourage sequential decision making and, indeed to make it inevitable. Thus, the program decision is not a single commitment to full-scale development, as we have assumed in our simplified theoretical analysis. Instead, program decisions are made repeatedly as various bench marks in the development-production-operation progression are reached and as budgets come up for their periodic reviews. Only the first few decisions must be taken under the full play of uncertainty, and these decisions only commit the government to expenditures which are small relative

[88]Peck and Scherer, op. cit., p. 54.

> to total weapons cycle outlays (even though large in an absolute sense). Each successive decision becomes more costly, but is based upon more and more reliable development possibility and military value information.[89]

Peck and Scherer continue to point out that the governmental decision process is not only considering how the program should proceed, but that the alternative of its cancellation is always present. While "sunk costs" provide strong psychological and political motivation to continue the program, the program's incremental cost is continually being evaluated against its expected military value amid competing programs. A primary force on the program is the annual budgetary process, which forces a yearly decision--even if it is only implicit--on each project. For a weapons system with the relatively low priority of the A-7 aircraft, the continual prospect of cancellation and the yearly crisis over the budget combined to force unusual pressure on the program.

The factors discussed thus far are those that inhere in any research and development project. The uncertainties that govern the fundamental nature of development must now be placed in the complex administrative network of the Department of Defense. The result will be to examine a sequence of decisions under conditions of substantive uncertainty with significant professional differences existing among the decision-making organizations.

[89] _Ibid._, p. 316.

Issues in Defense Decision-Making on the A-7 Program

The decade of the 1960's witnessed a massive change in the decision-making system of the Department of Defense. The A-7 was affected--some say created--by the results of that change. The purpose of this study is to explore some of the direct effects and implications of the decision-making process as they affected the A-7. In doing this several other issues will become apparent.

First, Systems Analysis will be studied to see how its role in the McNamara management system influenced the A-7. We have noted that Dr. Enthoven, the head of the Systems Analysis organization, placed great weight on the use of marginal utility analysis and cost/effectiveness studies as decision tools in the selection of new weapons systems. One of the primary interests of this research is to see how these studies were run and what effect they had on the decision.

Second, the issue of interservice rivalry and competing military doctrines will be discussed. The competition of the military services has, in the past, been a vitally important aspect of defense decision-making. The Air Force/Navy debate over the B-36, and the Army/Air Force dispute over the intermediate range ballistic missile (IRBM) are two classic examples.[90] Some well-known policy analysts have argued that these debates over the roles and missions

[90]The case of the IRBM debate is set out in Michael H. Armacost, The Politics of Weapons Innovation: The Thor-Jupiter Controversy (New York: Columbia University Press, 1969).

of the services were relegated to history when McNamara centralized defense decision-making.

Harold Stein was of this persuasion,

> ....the great debates of the past over roles and missions, the inconclusive compacts at Key West and Newport, are obsolescent. Military forces on land, on the sea, in the air are all prepared to use missiles, and to use atomic bombs and shells. The attempt to establish roles and missions in terms of particular weapons has been largely abandoned. And the efforts to persuade military officers to settle budgetary matters by discussion have been dropped. The Secretary of Defense now has the powers and the accompanying responsibilities....[to settle service disputes].[91]

The A-7 aircraft was developed by the Navy and adopted for Air Force use in the support of Army ground forces. Another of the stated purposes of this study is to discover what effect the other Services had in the decisions to develop and fund the A-7 for the Air Force.

The A-7 did not spring full-grown into the Navy air forces, and it was not accepted by the Air Force in exactly the configuration the Navy had developed. Why and how did the A-7 originate? Under what conditions did it represent a technological or organizational innovation in either the Navy or Air Force. How was the program formulated, the aircraft designed and any resistance overcome? These questions will be answered as the A-7 program is described.

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[91]Harold Stein, "Editorial Comments," on Super Carriers and B-36 Bombers: Appropriations, Strategy, and Politics, by Paul Y. Hammond, Inter-University Case No. 97 (New York: Bobbs-Merrill, 1963), p. 101. (Emphasis added.)

The decisions on the A-7 will also be shown to reflect the influence of service requirements processes. That is, the attitudes of the Navy and Air Force toward the A-7 program were inevitably conditioned by their view of how the aircraft fit into the overall strategic pattern of forces and capabilities. The requirements process provides a vital input to the military's formal decision-making theory which includes the functions of: threat perception, requirements generation, hardware development, and operational capability.

The relationship between a proposal for a new weapon and the establishment of a valid military requirement for that weapon is vitally important. As will be shown in the A-7 program, the mere existance of a technological innovation is not sufficient to generate a need for its use.[92] Many obstacles, including service doctrine, budgetary limitations, and national defense strategy, may loom in the path of a proposal.

The description of the decision-making process on the A-7 program will attempt to show that even when the national defense strategy could be used to justify an aircraft of the A-7 type, and the program had OSD backing, the

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[92]The relationship between technological change and the military requirements process is discussed by Robert L. Perry, Innovation and Military Requirements: A Comparative Study, RM-5182PR (Santa Monica: The RAND Corporation, August, 1967). Perry describes innovation as a three-step sequential process: (1) invention or conception, (2) demonstration of feasibility, and (3) acceptance, adoption or limitation.

subsonic attack aircraft program was not uniformly accepted because it was not consistent with professional views of what the next war would require in the way of weapons. In the end, the A-7 provided not only a new technological capability, it would provide a doctrinal innovation in the Air Force.

PART ONE

AIR FORCE AND NAVY DOCTRINE AND THE SELECTION OF THE A-7

CHAPTER I

AIR FORCE AND NAVY TACTICAL AIR FORCES BEFORE 1961

This study is built around the central theme that the strategy and the administration of national defense are interrelated and that an understanding of the decision process by which both are conditioned is important. Defense strategy in this context is understood to be the overall national plan, the broad, general objectives which determine the general direction of the defense effort. These goals are formalized primarily by the President, the National Security Council, the Joint Chiefs of Staff and the Congress, but many other public and private agencies participate in their articulation.

Strategy is inherent in such documents as the Joint Strategic Objectives Plan, but it also resides in more informal concepts like Massive Retaliation or Flexible Response when they are translated into national policy.

The Secretary of Defense, other civilian officials, and the military officers in the Department of Defense also participate in the articulation of goals and objectives because of their official positions and substantive knowledge in the field. The administration of defense is their specialty, and for many it forms the basis of their career in a professional organization. Although these officials participate in the process of goal determination they have a special capacity in the implementation of defense policy--the means of accomplishment. The significance of the relationship between strategy and implementation has been described by Robert Osgood,

> An effective strategy requires more than the mere formulation of objectives; it requires a balance between objectives and means, such that the objectives are within range of the means and the means are commensurate with the objectives. Otherwise, we shall have to intrust our security to bluff, improvisation, and sheer luck.[1]

What are the means of defense? How can the strategy be transformed into policy and the objectives into capability? The means of defense consist of resources which can be separated into two primary categories--personnel and weapons. In ancient times the strength of an army was roughly proportional to its size. As time progressed the influence of technology grew until one man with a superior weapon could best many times his number.

The men and weapons are organized into forces, and the combination of their units is called <u>force structure</u>. "Force structure," then, is a generic term meaning the

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[1]Robert E. Osgood, <u>Limited War: The Challenge to American Strategy</u> (Chicago: University of Chicago Press, 1957), p. 241.

organizations of men and weapons that are capable of responding to direction. Because force structure is a quantitative measure of the size of the military force it is often used as a surrogate for capability which is a more nebulous concept. Changes in the force structure are especially important because they often signal shifts in the national strategy.

These changes in the force structure can be either variations in the level of forces or in their hardware. Both are important, and the processes by which the changes occur are often interrelated. The decision-makers at the highest levels of the Defense Department must integrate the differential aspects of the processes and consider the impact of their decisions on their organization, its budget, its capabilities, and the national strategy.

The study of defense policy often concentrates on an analysis of alternative national strategies. If the determination of strategy and the implementation of strategy are interrelated, a broader view of the decision process is indicated. For this view to be comprehensive it should include:

1) an explanation of how weapons decisions affected and are affected by the national strategy.
2) an examination of the relationship of the decisions to

service doctrine and concepts.

3) a description of the impact of the decisions on weapons development.

In each of these three areas the decisions of the 1960's were conditioned by previous strategy.

Massive Retaliation 1953-1961

It has been argued that the determination of a national strategy--strategic doctrine--is vital to a defense posture and should precede the selection of weapons systems. Henry Kissinger has noted,

> Strategic doctrine translates power into policy. . . . In the absence of concepts that define the nature of power, its purpose and its relation to policy, the possession of it may serve merely to paralyze the will. All the difficult choices of the nuclear period--the nature of its weapons systems, the risks diplomacy can run, the issues for which to contend--presuppose a doctrinal answer before they can find a technical one. . . . History demonstrates that superiority in strategic doctrine has at least as often been the cause of victory as has superiority in resources. . . . An adequate strategic doctrine is therefore the basic requirement of American strategy.[2]

The strategy of the United States in the field of national defense in the period 1953-1961 was generally that

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[2]Henry A. Kissinger, "Strategy and Organization," Foreign Affairs, April, 1957, reprinted in Defense Policy Vol. II, ed. by Department of Political Science, U. S. Air Force Academy, Colorado, 1959, p. 14.1. Kissinger here uses the term "strategic doctrine" in the same sense that we will use "strategy." We will reserve the term "doctrine" to indicate service doctrine although there are various levels of doctrine, and all are guides to action.

of Massive Retaliation.[3]

Massive Retaliation held as its central tenet the idea that future wars would most likely be nuclear, intercontinental, and total. That is, the strategy was primarily designed to deter nuclear war if possible, and to insure the survival of the United States in case war did occur. The implementation of the strategy was based on the theory of the decisiveness of strategic bombardment, and units of the strategic forces were given budgetary and organizational priority.[4]

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[3]Although the policy of Massive Retaliation is commonly identified with Secretary of State John Foster Dulles, it was actually the product of the "New Look" strategy which was developed by the Eisenhower Administration in 1953. Note, for instance, the statement of General Maxwell D. Taylor, "However, I would say massive retaliation became a formalized doctrine with the advent of the "New Look" in 1953. Early documents of the "New Look" put into cold print definite statements that we intended to use these big weapons--where, as, and under the circumstances which we would choose. Mr. Dulles gave his name to that doctrine." U. S. Senate, Committee on Government Operations, Organizing for National Security, Inquiry of the Subcommittee on National Policy Machinery, Vol. 1, June 14, 1960, p. 797. For an indepth analysis of this national strategy see, "The 'New Look' of 1953," by Glenn H. Snyder, in Strategy, Politics, and Defense Budgets (New York: Columbia University Press, 1962).

[4]One of the few formal statements of the Massive Retaliation strategy is found in Secretary of State Dulles' speech, January 12, 1954, reported in the New York Times, January 13, 1954. Although the speech was interpreted widely to mean the United States would respond to provocation with nuclear weapons or nothing at all, there is evidence that this absolute philosophy was never intended. See, for example, Dulles' article, "Policy for Security and Peace," Foreign Affairs, Vol. 32, No. 3 (April, 1954), pp. 353-364. In this article which was based on his speech, the Secretary presents a policy which is much less unified and more circumspect than was generally assumed from the speech. The range of the nation's options was not to be limited. He wrote, for instance, "But the free world must have the means to respond effectively on a selective basis when it chooses.

The strategy of Massive Retaliation and nuclear deterrence did not deny that crises would occur in the middle-to-low end of the conflict spectrum. The Korean War, the Suez crisis of 1956 and several other international situations in the 1950's indicated that less-than-nuclear conflicts would continue to erupt as foreign policy problems. For this reason the United States continued to train, maintain, and develop forces for tactical operations. However, the priority of these forces was less than that for the strategic forces.

Secretary Dulles' speech of January 12, 1954, summed up the administration policy and presented it to public view. The concept of a unilateral response to local aggression and its formalization into national strategy was not, however, universally accepted.

> Dulles' formal statement of what, in reality, had long been the policy of the Administration provoked a storm of criticism, not only from leading Democrats, but also from a number of students of national security policy. These critics, who included Chester Bowles and Dean Acheson, as well as such academics as William Kaufman and Henry Kissinger, argued that the doctrine of massive retaliation would not be effective in deterring local, more ambigious Communist moves.[5]

It must not put itself in the position where the only response open to it is general war." (p. 358) However, the statement that the United States should have a less-than-nuclear capability did not draw the attention or the headlines to this policy. For one of the most logical and influential statements of the nation's nuclear policy and capabilities, see Bernard Brodie's, Strategy in the Missile Age (Princeton: Princeton University Press, 1959).

[5]Morton H. Halperin, Contemporary Military Strategy (Boston: Little, Brown and Company, 1967), p. 48.

The basis of this criticism was not only that the concept of a single, massive response would be ineffective, but that the corresponding emphasis on strategic striking forces would over-balance the force structure. Henry Kissinger struck this point with force,

> The biggest gap in our defense establishment is the lack of units capable of fighting local actions and specifically designed for this purpose. At present the Air Force is preoccupied with a doctrine of all-out war and of complete air superiority. The Army is small, relatively immobile, and its organization cumbersome. Only the Navy possesses a force capable to some extent of discriminating offensive operations.[6]

Kissinger went deeper into the implications of the nuclear strategy and its effect on the tactical air forces:

> The preoccupation with all-out war determines not only the doctrine of the tactical air forces but also their priorities for equipment and personnel and for mobility in case of conflict. Under present procedures many of the planes which have become obsolescent for strategic missions are assigned to Tactical Air Command.[7]

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[6]Henry A. Kissinger, Nuclear Weapons and Foreign Policy (Garden City, New York: Doubleday, 1957), p. 131.

[7]*Ibid.*, p. 132. The aircraft Kissinger was referring to were the B-29 and B-50 bombers which were turned over to Tactical Air Command (TAC) in the 1950's from Strategic Air Command (SAC). SAC replaced the older bombers with newer all-jet B-47's and B-52's.

Morton Halperin argues that the whole strategy of Massive Retaliation was wrapped up in the idea of American technology and its relationship to airpower. He notes, "The belief that airpower could be the backbone of the American military establishment stemmed from a notion that technology could somehow substitute for manpower. The United States, being short on manpower but highly advanced technologically, could be expected--it was argued--to find a solution to its military problems by relying on its strengths and deemphasizing its weaknesses. In addition, the emphasis on airpower reflected the search for a single solution to a complex problem, which characterizes the American approach to many situations." *Op. cit.*, p. 46.

Massive Retaliation also had a great effect on the development of new fighters for TAC. The F-105 was started in 1952, had its first flight in 1955, and was designed specifically for the tactical air forces. One of the chief requirements which Headquarters USAF said the aircraft must have was an internal bomb bay to carry a tactical nuclear weapon. This aircraft was designed to be the mainstay of the tactical air forces during the 1960's, and it represented the first attempt to build a fighter aircraft to carry bombs internally. This emphasis on the design of fighters to carry tactical nuclear weapons exemplified the trend of the Air Force in the 1950's, to have Tactical Air Command participate in the strategy of Massive Retaliation.

The strategy of Massive Retaliation was debated among the military services and their leaders on the Joint Chiefs of Staff. The Army, in particular, was opposed to not only the concept of Massive Retaliation, but to the budgetary implications of the strategy. Once the Korean War ended the Army proportion of the DOD budget declined steadily during the 1950's.

Table 1. Military Service Budgets 1950-1957*
($billion)

Fiscal Year	Army	Navy	Air Force
1950	$ 4.2	$ 4.1	$ 4.7
1951	19.4	12.5	15.9
1952	21.6	16.1	22.3
1953	13.6	12.5	20.3
1954	13.0	9.4	11.4
1955	7.1	9.7	11.6
1956	7.1	9.6	15.7
1957	7.8	10.4	17.7

*Total Obligational Authority

Source: USAF Air University, History of the USAF, p. 10-4.

General Taylor, the Army Chief of Staff 1955-1959, was particularly vocal in pointing out the debate in the Joint Chiefs of Staff councils,

> Next there is a real philosophical division among us or was with regard to massive retaliation and its effectiveness as a national military strategy.[8]

General Taylor retired in 1959 and published a book the following year entitled The Uncertain Trumpet, which was an eloquent statement of his views and summarized many of the criticisms of Massive Retaliation. He advocated a new strategy for the nation's defense policy:

> The National Military Program of Flexible Response should contain at the outset an unqualified renunciation of reliance on the strategy of Massive Retaliation. It should be made clear that the United States will prepare itself to respond anywhere, anytime, with weapons and forces appropriate to the situation.[9]

[8] Testimony before Congress in Organizing for National Security, Hearings, op. cit., p. 780.

[9] Maxwell D. Taylor, The Uncertain Trumpet (New York: Harper and Row, 1960), p. 130.

This statement, in itself, does not sound too different from Dulles', "by means and at places of our own choosing," but General Taylor followed up his conceptual change with suggestions for a modification of priorities.

> In my judgment, the first priority of our Military Program is a double-barreled extension of our "quick fixes"--to modernize and protect the atomic deterrent force and to build up our limited-war, counterattrition forces to offset the present preponderent Soviet forces on the ground.[10]

Taylor's book and the general Army discontent with the strategy of Massive Retaliation coincided with political views of some leading Democrats. Senator John F. Kennedy had been critical of the Administration's reduction in Army force structure since 1954.[11] When Taylor's book was published, Kennedy was much impressed with it; in 1961 he was to appoint General Taylor as his personal advisor on military affairs and later to the position of Chairman of the Joint Chiefs of Staff.

Kennedy made a campaign issue of defense and stressed the "missile gap" and the need to increase the country's conventional forces. In a speech to the Senate on June 14, 1960, he said,

> We must regain the ability to intervene effectively and swiftly in any limited war anywhere in the world--augmenting, modernizing and providing increased mobility and versatility for the conventional forces and weapons of the Army and Marine Corps.[12]

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[10] Ibid., p.131.

[11] Kennedy's speech to the Senate cited by Arthur M. Schlesinger, Jr., A Thousand Days (New York: Fawcett Crest, 1965), p. 290.

[12] Speech to the floor of the Senate, June 14, 1960, reprinted in The Strategy of Peace: The Speeches of John F. Kennedy, ed. by Allan Nevins (New York: Harper and Row, 1960), p. 5. See also, Schlesinger, op. cit., p. 282.

One of the results of Kennedy's victory in the presidential election of 1960 was to change the national defense strategy from Massive Retaliation to one of Flexible Response. When President Kennedy took office in January 1961 he set about to implement the new strategy by changing the formal statements, the force structure, and the selection of weapons development programs. The A-7 attack aircraft program could be viewed as one of the means by which the strategy of Flexible Response was implemented.

The A-7 may have been a means to a strategic end, but the decision process on the program was far too complicated to be explained in ends-means terminology. The aircraft was developed by the Navy largely because it was consistent with Navy tactical doctrine and professional concepts. The Air Force, on the other hand, had long considered strategic warfare the most critical threat to the nation's security, a belief that had been reinforced by the explicit national strategy of Massive Retaliation. The reader may surmise that, in view of this difference, it would not be surprising if the A-7 and other tactical aircraft were resisted as unnecessary diversions of resources. In addition, the A-7 was a <u>specialized</u> aircraft--it was specialized for ground attack missions. On this point the Air Force and Navy doctrine diverged. To understand these professional differences and their influence on the decision process requires some background on Air Force and Navy tactical doctrine.

Air Force Tactical Air Doctrine Before 1961

A "doctrine" as the term is used among professionals in national security affairs and military history, is a group of shared concepts that give direction and purpose to organizational activity. But it is more than just a set of related ideas; it is a set of unified concepts which are taught and form the basis for plans and action. The Air Force has defined doctrine this way: "Doctrine is a body of concepts which have official acceptance and which are taught or disseminated as a guide to action."[13] However, this definition does not state, and the writer does not want to imply, that doctrine is unchanging, rigid, or permanent. Doctrine does not _determine_ or _decide_

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[13] Department of the Air Force, _Organizations and Functions Chartbook_, Headquarters Pamphlet HP 21-1, December 31, 1969, p. 15. The official Air Force Dictionary defines doctrine as, "a rule, proposition or teaching that has official sanction and authority, especially a rule, proposition or teaching that arises from a concept; collectively a body of such rules or teachings." The terms "concepts" and "doctrine" tend to blend into one meaning. The essential difference between the two is that concepts are ideas; doctrines are taught. When a concept enters the teaching process, that which is taught is doctrine. For a more extensive derivation and examination of the differences and their impact on Air Force policy, see Major Richard L. Kuiper's extensive work, _Close Air Support Concepts and Doctrine, 1954-1968_ (unpublished Master's thesis: Auburn University, 1969). The following section on the evolution of Air Force close air support doctrine draws heavily on his research.

policy issues; it only influences. Doctrine is really nothing more than general guidance on purposes and methods which the leaders have directed for the large organization to follow.[14]

Doctrine has organizational status in that there is in Headquarters USAF a "Director of Doctrine, Concepts and Objectives" with the rank of Major General. The significance of the organization and its relation to future activities is indicated by the fact that the directorate publishes a document known as USAF Planning Concepts which has been referred to as "The Plan." This document attempts to relate Air Force objectives to the national strategy for as long as 15 years into the future. The directorate is also responsible for developing the Air Force position on the roles and missions of the services.[15]

Doctrine is important in military organizations because of the emphasis on public responsibility and "duty." Samuel Huntington notes,

> Every bureaucratic agency, military or civilian, tends to develop a "bureau philosophy" or "ideology." The Armed services differ from most civilian groups, however, in the extent to which the bureau philosophy becomes formal, self-conscious and explicit. The philosophies of civilian agencies may be just as real as those of the military, but they are seldom codified into written statements of "doctrine." The importance of doctrine stems from the extent to

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[14]I am indebted for this point to an official in the Office of the Secretary of the Air Force who, after reading an initial draft, suggested this modification.

[15]Chartbook, op. cit., pp. 123-124.

> which the military groups are perceived to be and perceive themselves to be simply instruments of a higher national policy.[16]

Huntington's comment about perceived loyalty and the concept of the military being an instrument of national policy relate directly to the public administration debate over policy and administration. Although the artificial distinction between policy and administration that pervaded the government service in the first half of this century has been attacked by scholars, it has not been demolished as an operational concept.[17] Huntington's note is indicative of the continued strength of the philosophy.

Huntington also discusses the relationship of doctrine to the military's role perception. This will become more significant when the two concepts of role and mission are discussed later in this chapter under the subject of service "roles and missions" disputes and agreements.

The doctrine of a military organization is a directive mechanism that determines in some significant measure the relationship of the profession to science and technology. Doctrine that is developed to institute change can be a

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[16] Samuel P. Huntington, "Interservice Competition and the Political Roles of the Armed Services," in Problems of National Strategy, ed. by Henry A. Kissinger (New York: Praeger, 1965), p. 468. For a further exposition of the characteristics of bureau ideologies, see Anthony Downs, Inside Bureaucracy (Boston: Little, Brown and Co., 1966), pp. 237-246.

[17] Many scholars have attacked the "policy/administration dichotomy" which was supposed to mean that politicians made policy and administrators only carried out the orders of their political superiors. For Simon's attack, see Administrative Behavior, op. cit.

powerful force in the generation of new technology, as in the development of the four-engined bomber to implement the Air Corps doctrine of strategic bombardment in the 1930's. Conversely, doctrine that is uninformed or insensitive to changes in technology can be a force to resist innovation. This debate between the forces that favor change and the loyalty to established patterns of behavior is as prevalent in the military as in civilian organizations. Doctrine, then--like almost every other concept of prescriptive behavior--has elements of advantage and disadvantage. Carried to excess, the unifying aspects of doctrine can lead to intransigence and resistence to change. On the other hand, as Kissinger has so accurately noted, doctrine provides important guidance to the selection among diverse technological possibilities. And superiority in doctrine and theory has often meant the difference between victory and defeat.

The Missions of Tactical Air Forces

Tactical fighter forces have traditionally been given three essential responsibilities--a trinity of missions. They are: Counter Air, Air Interdiction, and Close Air Support. Their definitions are important for the understanding of the A-7's role.

Counter Air--"gaining and maintaining control of the air to deny the enemy use of the skies over the combat zone."[18]

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[18] U.S. Air Force Fact Sheet, Tactical Air Command, Secretary of the Air Force of Information, 68-22-5A (1968), p. 1.

Air Interdiction--"action taken to deny the enemy's deployed combat forces the supplies, mobility, and reinforcements needed to carry out sustained operations."[19]

Close Air Support--"air action against hostile targets in close proximity to friendly forces and requires detailed integration of each air mission with the fire and movement of those forces."[20]

The "attack" mission in the Navy and the Air Force generally combines both the air interdiction and close air support missions defined here.

These three missions affect all the services, but for purposes of this roles and missions discussion we will concentrate on those aspects which bear on Air Force/Army relationships. The Army is vitally interested in how the Air Force performs the tactical air functions. One of the purposes of counter air is to prevent the enemy from attacking our ground forces; interdiction is aimed at the enemy's supply lines to reduce the effectiveness of his army; and close air support is conducted primarily at the Army's request as a tactical weapon in ground combat. This means there must be a dialogue between the Army and Air Force on what the appropriate missions for tactical air are to be and how they are best accomplished. The exact limits of this

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[19] Ibid.

[20] Air Force Manual 2-1, Aerospace Operational Doctrine, Tactical Air Operations--Counter Air, Close Air Support, and Air Interdiction, Headquarters USAF, May 2, 1969, p. 6-1. These missions of tactical fighter forces comprise only three of the five combat air functions. The other two are Tactical Airlift and Tactical Air Reconnaissance and are described in AF Manuals 2-4 and 2-6.

dialogue are flexible and changing, but as with any such vitally important effort requiring cooperation at the Department level, there are bound to be disagreements. Such disputes often come under the heading of "roles and missions." They involve both the objective responsibility for performing some function--"mission"--and the subjective aspects of "role" performance.

The two concepts of role and mission may be explained as different views of responsibility. "Mission" is closely akin to the definition of "objective responsibility" as enunciated by Frederick C. Mosher in Democracy and the Public Service.[21] As such, "mission" is the assignment of objective responsibility "for" some aspect of national security. It is similar to accountability. "Role," on the other hand, is better defined as subjective responsibility, as the perceived position of the profession with regard to its historical tradition. This concept of role is more psychological and informal than the concept of mission. Mosher notes that it is more responsibility that is internalized than is delineated formally. It is intimately associated with behavior. Because most individuals do not probe into the fine characteristics of these separate concepts, they are often referred to as the "mission" when discussing the objectives of one military service and "roles and missions" when they involve disputes between

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[21]Frederick C. Mosher, Democracy and the Public Serivce (New York: Oxford University Press, 1968), pp. 7-10.

services.

An analogy that may be closer to the reader's experience than military roles and missions is to be found in the disputes between fire departments and police departments over their respective roles. They both serve the function of public safety, yet they perceive their roles and responsibilities quite differently.[22]

Most of the Air Force/Army discussions over roles and missions of the tactical air forces have centered around the close air support mission and involve four primary issues:

1) Should the control over air forces be vested in the ground forces or in an independent service?

2) Should the control over air forces be centralized into one command or should it be delegated to subordinate units?

3) Should the aircraft designed to perform the close air support mission be multipurpose or specialized? That is, should they be capable of performing all three tactical air missions or designed solely for close air support?

4) Does aviation have a mission independent of supporting ground forces?

The history of this particular set of roles and missions discussions dates back almost to the time the Army bought its first airplane in 1909. From the very beginning the ground officers scoffed at the pilots as being "acrobats" and

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[22]For an example of this conflict between fire and police departments, see The Guardians of LaLoma, Inter-University Case No. 102, by Margaret G. Oslund (New York: Bobbs-Merrill, 1967).

"prima donnas," while the pilots often thought the ground officers lacking in vision and aggressiveness.

The attitude of the pilots was expressed by General Carl Spaatz, later to become the first U. S. Air Force Chief of Staff:

> I guess we considered ourselves a different breed of cat, right in the beginning. We flew through the air and the other people walked on the ground; it was as simple as that![23]

While the technological innovation of the airplane was proven by combat experience in World War I, there were only a few men who could envision an integrated theory for the employment of airpower. One of the few who did was Brigadier General William Mitchell who had commanded all the Army aviation at the front as Chief of the Air Service.

The example of the independent British Royal Air Force, and the theories of strategic bombardment formulated by its commander, Major General Sir Hugh M. Trenchard, had impressed Mitchell. After the war Mitchell became an outspoken crusader for an independent air arm and ended a martyr.

Huntington related the activities of Mitchell and the other airpower advocates to doctrine,

> Lacking secure organizational existence, or general acceptance during the 1920's and 1930's, the supporters of airpower, like any new, crusading group, were tremendously concerned with the development of an intellectual rationale.[24]

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[23]Cited in Contrails, 1960-61, ed. by R. Head (Colorado: U.S. Air Force Academy, 1960), p. 209. This quotation is in the section on "Fourth Class Knowledge" and was required to be memorized by all freshmen at the Academy.

[24]Samuel P. Huntington, "Interservice Competition and the Political Roles of the Armed Services," in Kissinger, *op. cit.*, p. 468.

Huntington assumes in this quote that the Air Corps advocates wanted, first of all, organizational independence from the Army, and searched for an intellectual rationale to support that position. This is an assumption, and it is one not supported by overwhelming evidence. There is, in fact, much historical material to suggest that the advocates of airpower only became advocates after their experiences in World War I, in which they were absolutely convinced, as Mitchell was, of the decisiveness of strategic bombardment. This theory was applied in World War II by the daylight precision bombing of Germany and the strategic bombing of Japan (of which the two atomic bombs were a part). Although the bombing campaigns did not end the war by themselves, strategic bombardment was an important factor in the allied victory. The fact that the United States chose to base its post-war defense policy largely on airpower is evidence that its leaders believed in the continued effectiveness of this force.[25]

One of the central questions to emerge from World War II was the proper placement of the air forces within an overall defense establishment. The Airpower advocates were strongly of the opinion that the control of air forces should be centralized under one commander and not parceled out to subordinate Army or Air Force units. This belief was established as early as 1918 and became so strong as to

[25]For an account of the relationship between the strategic bombing doctrine and the establishment of the Air Force as an independent service, see Perry M. Smith, The Air Force Plans for Peace 1943-1945 (New York: Columbia University Press, 1970).

become doctrine within the Air Corps. The doctrine was apparently confirmed by the U. S. experience in World War II, especially in North Africa, where the doctrine of centralized control was violated.

In the mid-1950's the Air Force was called on to defend this doctrine to Congress. Part of that official statement read,

> World War II was the beginning of what might be termed the first scientific application of tactical air operations, and the basic doctrine for tactical air operations, as they are known today, had its inception in the lessons and hard-won experience of that conflict. For example in the North African campaign we initially followed the practice of parceling our airpower to corps commanders to use as they saw fit. It was not until we realized that we were taking a beating from a numberically inferior German Air Force that we changed our practice. Once our air forces had been centrally organized under an air commander, their total effectiveness was fully exploited to turn the tide of battle. Thus, the tenet of having airpower controlled at the highest level that it can be effectively utilized was developed and is reflected today in the organization of each theater command.[26]

After World War II, when the question of the proper organization of the defense establishment came before Congress, many military leaders testified with their views. One of the most influential figures was also an ardent

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[26] Report submitted by the Department of the Air Force on the Air Force Concept of Close Air Support, reprinted in House of Representatives, Committee on Armed Services, Hearing on H. R. 3377 (NACA Bill) and Miscellaneous Real Estate Projects, March 19, 1957, p. 539. For a more extensive historical account, see The Development of Air Doctrine in the Army Air Arm, 1917-1941, USAF Air University (Gunter Air Force Base, Alabama: Extension Course Institute, 1957), pp. 5-13; and The Army Air Forces in World War II, ed. by W. F. Craven and J. L. Cate (Chicago: University of Chicago Press, 1948).

advocate of centralized control of air forces--General of the Army Dwight D. Eisenhower. General Eisenhower told Congress in 1947 why the Air Force should have centralized control,

> Listen, we have given up in the Army all the Air Force, even to include the reconnaissance squadrons. We have given up everything. The reason being that when the supreme commander in war, when he needs the air, he needs it all. He does not want to have to go down and fight the Third Army or the Twelfth Army or the Sixth Army. He wants every single one.[27]

World War II experience also established the Air Force doctrine of multipurpose aircraft as opposed to specialized aircraft.

> The foremost threat to any force is enemy air. . . . The counter air battle could be accomplished by specialized aircraft in sufficient numbers to accomplish efficiently this task. We could have specialized interdiction, close air support, reconnaissance, and airlift aircraft in sufficient numbers so that one task would not detract from another. From the standpoint of national economy alone this can never be the case. . . . Thus, the theater air effort requires multipurpose aircraft employed under centralized control to accomplish the task which at particular times, poses the greatest threat to the theater mission.[28]

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[27]House of Representatives, Committee on Expenditure in the Executive Department, Hearings on H.R. 2319, 219, 687, 80th Cong., 1st sess., (1947), p. 299.

[28]Report submitted by the Department of the Air Force, ibid., pp. 540, 541. Even though the statements themselves are dated 1957, they reflect essentially no doctrinal change since before World War II. In 1942 Field Manual 100-15 stated, "successful modern military operations demand air superiority" and "the initial objective must include the attainment of air superiority." U.S. Army FM 100-15, June 29, 1942, cited in U.S. Army, Combat Developments Command, Institute of Special Studies, A Short History of Close Air Support Issues (Fort Belvoir, Virginia: July, 1968), p. 17. It could also be noted here that the U. S. Army Air Corps was not the only organization to develop the doctrine of multipurpose aircraft during World War II. The British Royal Air Force developed the same concept, and the statement of it will show the professional nature of

The Air Corps doctrine that all _fighter_ aircraft had to be multipurpose was essentially that they be capable of performing the three roles of counter air, interdiction, and close air support. Since the counter air mission required the highest speed to outperform enemy aircraft, it was common practice to design the fighter aircraft _first_ to achieve high speed and then to accept whatever bomb-carrying capability was available as a fall-out. The evolution of fighter aircraft designs with continually increasing speeds to the present is witness to this doctrine.

The professional Air Force doctrine had not always specified the use of multipurpose aircraft. A short review of the evolution of this doctrine will place in perspective the position of the Air Force when McNamara became Secretary of Defense in 1961.

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†this doctrine. Specifically, the British developed during the second year of the war the doctrine of a "flexible force well supplied with general purpose weapons." One of the first official statements of this policy concerning the design and development of new weapons was in a letter from the Chief of the Air Staff (Royal Air Force) to Colonel Moore-Brabazon, the Minister of Aircraft Production, "We have not, and probably we never shall have, an Air Force adequate to the needs of the Empire. Time and time again we are forced to use aircraft intended primarily for one theatre in some other theatre, or for some duty for which they were not originally intended. Specialisation is therefore undesirable, and unless we keep this firmly in mind we lose flexibility and find ourselves saddled with types of very limited usefulness. I agree that some specialisation is unavoidable e.g. the flying boat, the pressurised bomber, the pressurised fighter and a few others, but it is only for some inescapable physical reason that we should accept specialisation." Cited in M. M. Postan, D. Hay, and J. D. Scott, _Design and Development of Weapons: Studies in Government and Industrial Organisation_, British History of the Second World War Series (London: Her Majesty's Stationery Office, 1964), p. 17.

A Short History of Attack Aviation in the Air Force

The pilots in the Air Service of the U. S. Army developed distinctive professional perspectives based largely on experiences in World War I. The air operations of that war were roughly divided into four types: observation, pursuit, bombardment and attack. The Air Service had used specialized aircraft for observation, pursuit and bombardment, but not for attack. The concept of attack operations evolved only in the closing months of combat in 1918, and the Air Service preferred to conduct ground attack missions with pursuit, bombardment, and (rarely) observation aircraft.[29]

The professional air doctrine that emerged from World War I included the belief that the most important targets were the enemy's airfields and supply points far behind the lines. This doctrine conceded that attacks on front-line positions were morale-boosting for friendly ground forces, but these attacks were considered wasteful and inefficient. In addition ground support missions had proven exceedingly dangerous to attacking airplanes (because intense enemy small arms fire had caused a high loss rate).[30]

The techniques favored in World War I were low-altitude, level attacks on front-line forces and high-altitude, level bombing of targets behind the lines. The technique of dive-bombing was attempted by some pursuit pilots, but it

[29] USAF Air University, The Development of Air Doctrine in the Army Air Arm, 1917-1941 (Gunter Air Force Base, Alabama: Extension Course Institute, 1961), p. 12. Hereafter referred to as The Development of Air Doctrine.

[30] Ibid., p. 39.

was considered a distinctly inferior tactic. This, in itself, indicates a difference in professional perspective between Air Force and Navy pilots, because the Navy in the 1920's adopted dive-bombing as one of its primary methods of attacking enemy ships and ground forces.

After World War I the primary institution for the evolution and transmission of Air Corps doctrine was the Air Corps Tactical School, first at Langley Field, Virginia, and after 1931 at Maxwell Field, Alabama (the present headquarters of the Air University). The lessons on tactical air doctrine as they were taught in that school stressed the identification of the close air support mission with attack aircraft. The principal influence on attack doctrine and tactics at the Tactical School was Captain (later General) George C. Kenney; when he left in 1926, attack aviation entered a long period of decline.

The development of appropriate attack aircraft was correspondingly slow. Several models (including the Curtis XA-7, A-8, A-12, and A-17) were developed between 1930 and 1936, with each of these aircraft being heavier and slower than the pursuit planes of the era. The employment doctrine for attack aircraft envisioned strikes against ground targets with machine guns and bombs.

While the development of the attack and pursuit aircraft was slow and laborious between 1930 and 1935, there was a noticably rapid advance in the technology affecting bombardment aviation. In 1931 the Nordon bombsight had been demonstrated to the Army Air Corps, and it promised to provide extremely accurate (at that time) bomb delivery from high altitudes in level flight. This technical breakthrough, coupled with the development of the long-range, high altitude bomber, (which was proven with the testing of the B-17 in 1935) provided the weapons to implement the theory of strategic bombardment.[31] When compared to the attack aircraft of the era, the B-17 promised to deliver large loads of bombs with unrivaled accuracy, from altitudes where losses from enemy anti-aircraft fire would be minimal. Much of the difference in effectiveness between the high-altitude bomber and the attack aircraft depended on the degree of accuracy of their respective delivery systems.

In 1936 a series of tactical exercises were held in the Hawaiin Islands to evaluate the progress of attack aviation. The results of these tests were communicated to the Air Corps Tactical School by Major Clayton Bissel, a former instructor at the School. He wrote that the Curtis A-12 Shrike's used in the exercise carried no precision bombsights, were capable of hitting only very large area targets with bombs, and were inaccurate with machine gun fire against precision targets.[32]

This episode demonstrates the importance attached to

[31] Craven and Cate, The Army Air Forces in World War II, Vol. I, pp. 598-599.

[32] The Development of Air Doctrine, p. 87.

the performance of a weapon system. The performance criterion, in this case, was accuracy and had to be measured against the expected attrition (loss) rate to be expected in wartime. The Air Corps planners knew they must expect high losses on low-altitude attack missions because of the experience in World War I. If the attack aircraft could not compensate for this high loss rate with a correspondingly high degree of accuracy, their whole reason for existence was seriously in question. (The degree of accuracy required in an attack aircraft was to become an issue in the A-7 decision-making process thirty years later.)

The influence of the advocates of strategic bombardment and the disenchantment with the low altitude technique among attack instructors led to interest in the development of a twin-engined attack bomber. Lt. Col. Carl Spaatz, in a reply to a request from the Chief of theAir Corps, General H. H. "Hap" Arnold, in 1939, ventured the opinion that the attack aircraft had not been proven tactically or experimentally, and that experience might well show that the mission could be better performed by bombers.[33]

This opinion by Spaatz was reinforced by a formal report of the Air Corps Board in September 1939 as it recommended the elimination of both the attack and attack-bomber in Air Corps requirements. In their place, the Board recommended the development of a light bomber to support

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[33] *Ibid.*, p. 88.

ground forces. An Air Force manual on doctrine stated,

> This move was based upon the conclusion of the board that bombs were the most valuable weapons against the usual targets of support aviation and that the proper type of plane would therefore be one built especially for bomb-carrying. The machine gun was regarded as of limited effectiveness as a ground attack weapon because of the ready dispersion of targets suitable to destruction by that weapon, the ineffectiveness of fire at high aircraft speeds, and the proved vulnerability of aviation in low-altitude attacks. The board believed that light bombers, supported by the necessary pursuit, reconnaissance, and transport aircraft, would best fulfill the mission of ground support.[34]

The Air Corps doctrine of the light bomber replaced the concept of the attack aircraft and was formalized in the publication of Field Manual 1-5.[35] Twin-engined light bombers were developed and employed in World War II as part of the tactical air forces. These consisted primarily of the Douglas A-26 Invader and the Douglas A-20 Havoc. The latter was first ordered by the Air Corps in July 1939 and

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[34] Ibid., p. 122, Air Board Report, September 15, 1939, tab D, pp. 1-2.

[35] The Development of Air Doctrine, op. cit., p. 122, Report of the Air Corps Board, Study No. 3A, p. 33. This Air Corps doctrine was to remain relatively stable in the face of several attempts to change it. In June 1941 Robert A. Lovett, Assistant Secretary of War for Air (and later Secretary of Defense 1951-1953), advised General Arnold that in his judgment the Air Corps had devoted insufficient attention to ground support. Lovett recommended the Air Corps reconsider its stand on procuring light bombers and purchase instead more attack dive-bombers. Arnold reported that he would assign the matter to a conference of interested War Department agencies. Lovett's attempt was representative of other War Department efforts to increase the Air Corps priority for the attack aircraft in the performance of the close air support mission, but they made little headway against the doctrine and advocates of bombardment. Ibid.

was the most numerous of all the Army Air Forces attack aircraft in World War II with 7385 being built.[36] In almost all cases their techniques involved level bombing from medium altitudes, and only seldom did they use low altitude, dive-bombing tactics.

One exception to the emerging light bomber doctrine was the development of the single-engined A-36. The A-36 was the ground attack version of the North American P-51 Mustang, which most Air Force pilots considered the best air superiority plane of World War II. The A-36 had been originally ordered by the British in April 1940, and it entered wartime service with Royal Air Force squadrons in July 1942. Meanwhile, the Army Air Forces had stated a need for a high-speed dive bomber to be used in ground support missions in the forthcoming North Africa campaign. The AAF contracted for 500 A-36's in April 1942, and the aircraft entered combat in May 1943.[37]

When the need for a long-range escort fighter became apparent due to high losses among the B-17's raiding Germany, the A-36 was modified into an air superiority fighter, the P-51. Another major Air Force fighter, the Republic P-47 Thunderbolt, proved to be capable of providing both air

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[36] F. G. Swanborough, United States Military Aircraft Since 1919 (New York: Putnam, 1963), p. 235.

[37] Robert W. Gruenhagen, Mustang: The Story of the P-51 Fighter (New York: Arco, 1969), pp. 54-61.

superiority and ground support.[38]

Thus, the concept of the "fighter-bomber" was born out of necessity, and the modification of fighters to perform both missions was largely conducted in the field and under hastily improvised conditions. As the battle for air superiority over Europe was gradually won in the winter of 1944, and the June date for the invasion of Normandy approached, the fighter forces were increasingly pressed into use attacking ground targets. Once again, the Air Force learned that the losses to enemy ground fire were several orders of magnitude higher in these ground attack missions than they were in the high-altitude escort missions.

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[38] One of the most active advocates of using fighters in the ground support role was Major General Elwood R. Quesada, Commander of the 9th Tactical Air Command attached to General Bradley's First Army, 1944, (and later the first commander of the Tactical Air Command). Bradley described Quesada's efforts to use fighters as fighter bombers, "Although Quesada could have passed for a prototype of the hot pilot with his shiny green trousers, broad easy smile, and crumpled but jaunty hat, he was a brilliant, hard, and daring air-support commander on the ground. He had come into the war as a young and imaginative man unencumbered by the prejudices and theories of so many of his seniors on the employment of tactical air. To Quesada the fighter was a little-known weapon with vast unexplored potentialities in support of ground troops. He conceived it his duty to learn what they were. In England, Quesada first experimented when heavier bombloads for his fighters by hanging their wings and bellies with more and heavier bombs. He even converted a squadron of fast, sleek Spits into fighter bombers. When the British protested this heretical misuses of the fighter in which they took such pride, the imperturable Quesada retorted, "But they're not your planes any ~~more--they're mine. And I'll do anything I want to with~~ them." This search for more and heavier bombloads reached its climax in England when Quesada hung a pair of 1,000-pound bombs on his P-47 fighters. General Omar N. Bradley, A Soldier's Story (New York: Henry Holt, 1951), p. 337.

This dual role which emerged for the P-51 and the P-47 and their excellence in performing both missions--air superiority and ground support--was a vital factor in the development of the doctrine of multipurpose fighters in the Air Force. The lesson the Air Force learned from this experience was that, if technology would permit the fusion, the effectiveness of the fighter forces would be greatly improved by having multipurpose rather than specialized aircraft.

With the development of the light bomber and the attack capabilities of the "fighter-bombers" there seemed little reason to continue the development of a specialized "attack" airplane. Accordingly, in 1948 the attack designation was formally dropped by the Air Force, and the A-26 Invader was redesignated the B-26.[39] There was no major Air Force program to develop another attack aircraft until the A-7 decision in 1965.

During the Korean War the Air Force used many types of aircraft to perform the mission of interdiction and close air support--fighter-bombers, light bombers and medium bombers. As in World War II the missions of low altitude, ground attack suffered high losses, with the losses being higher among slower aircraft than among the faster jets. The B-26, developed originally during World War II for the attack mission, was even taken off daytime missions because

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[39] Swanborough, op. cit., p. 239.

of the prohibitively high loss rates caused by enemy anti-aircraft fire. As a night intruder, the B-26 performed exceptionally well, and the loss rate decreased measurably. This experience confirmed in the minds of the Air Force professionals the need for high speed in ground attack aircraft because speed was now considered as essential for survival in ground attack missions as it had previously been in air-to-air fighting.

The Air Force also introduced a new category of aircraft--the "day fighter"--which was represented by the F-86 Sabrejet. The mission of the specialized day fighter was to gain air superiority in air-to-air combat with enemy fighters; it was not designed to attack ground targets in either the interdiction or close air support missions. (The aircraft had machine guns and did have a limited ground support capability however.)

The follow-on aircraft to the F-86 day fighter was begun in 1951 during the Korean War. The aircraft was called the F-100 Supersabre and was initially designed as another day fighter--to perform the counter-air mission. The F-100 exceeded the speed of sound on its first flight in 1953, and in 1954 the first squadron received its new supersonic fighter. The F-100A was designed almost solely for the counter-air mission, but the influence of the Massive Retaliation strategy was reflected in the evolution of the

F-100C and D as fighter-bombers. With the demise of the F-100A the category of the day fighter was virtually eliminated from the tactical fighter forces.

The tactical air forces in the late 1950's consisted of fighter-bombers and tactical bombers. The fighter-bombers were capable of all three tactical air missions--counter-air, interdiction, and close air support. They represented the fulfillment of the Air Force doctrine of multipurpose fighter aircraft. With the passing of the day fighter designation, the fighter-bombers in the Air Force were redesignated "tactical fighters" to indicate their multipurpose capability. Similarly, the light and medium bombers in the Air Force were redesigned "tactical bombers," but their numbers were constantly being reduced in the face of the increasing range and load-carrying abilities of the tactical fighters.

When the Kennedy Administration came into office in 1961, the Air Force had 16 wings of tactical fighters (mostly F-100's) and 2 wings of tactical bombers.[40] The Air Force planned to replace the F-100 with the F-105 which was in the development process. The influence of the Massive Retaliation strategy on the design of the F-105 has already been related. It is sufficient to add here that the F-105 was developed with a tactical nuclear capability, but it too was a multipurpose aircraft capable of performing counter

[40]Schlesinger, op. cit., p. 295. Each tactical fighter wing had 72 aircraft, and each tactical bomber wing had 48 aircraft, according to The Air Force Blue Book, Vol. I, ed. by Tom Compere (New York: Military Publishing Company, 1959), p. 331.

air, interdiction and close air support missions.

The Army developed an increasing skepticism over the ability of supersonic aircraft to perform the close air support mission, as they defined that mission (i.e very accurate delivery of weapons by aircraft responsive to Army requests). The continuing debate with the Army over "roles and missions" largely centered on a difference of professional opinions over the priority of these three missions and the related question of the characteristics required in a close air support aircraft. One of the manifestations of the debate was a series of discussions at the highest levels in Defense. One of the central issues was which service--Army or Air Force--should have primary responsibility for the close air support mission.

Air Force/Army Roles and Missions Discussions

The National Security Act of 1947 established the Air Force as a separate service and basically divided the roles and missions of the services according to the mediums of sea, land, and air.[41] According to this perspective, the

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[41]The National Security Act of 1947 specified, "In general, the Air Force includes aviation forces both combat and service not otherwise assigned. It shall be organized, trained, and equipped primarily for prompt and sustained offensive and defensive air operations. It is responsible for the preparation of the air forces necessary for the effective prosecution of war except as otherwise assigned and, in accordance with integrated joint mobilization plans, for the expansion of the peacetime components of the Air Force to meet the needs of war." This general statement was not followed by any more specific guidance regarding close air support. U.S. Senate, Committee on Armed Forces, National Security Act of 1947, P. L. 253 (61 Stat. 495) 80th Cong., July 26, 1947, with amendments through December 31, 1958. Committee print, Committee on Armed Services, 85th Cong., 2d sess., 1959, p. 24.

close air support mission was allotted to the Air Force. The issue involved in roles and missions continued to evolve however. Secretary of Defense James Forrestal held roles and missions conferences with the Joint Chiefs of Staff at Key West on March 12-14 and at Newport on August 20-22, 1948.[42]

The main points resolved were the assignment of the strategic bombing mission to the Air Force and the control of the seas mission to the Navy. It was also resolved that each Service would seek the assistance of the other services in carrying out its missions. The close air support mission was discussed, but no specific conclusions were reached on its exact outline or on the development responsibility for vehicles to perform the task.[43]

The 1948 agreements did, however, set the stage for a 1952 memorandum of understanding between the Secretary of the Army and the Secretary of the Air Force. The Pace-Finletter agreement of November 4, 1952, established a 5000 pound weight limit on Army fixed-wing aircraft, but did not mention any restrictions on Army helicopters.[44] Since the weight of any aircraft capable of carrying a large ordnance load would have been considerably greater than 5000 pounds, this restriction essentially prevented the Army from developing aircraft to perform the close air support mission.

The Korean War did little to ease the tension between

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[42]See Walter Millis, ed., The Forrestal Diaries (New York: Viking Press, 1951), p. 169, passim.

[43]A Short History of Close Air Support Issues, op. cit., p. 44.

[44]Ibid.

the two Services; the Air Force was vitally concerned about maintaining air superiority and yet devoted over 75% of its effort to interdiction and close air support. The Army was not satisfied with the level of support its forces received, although in specific instances the ground commanders credited Air Force close air support with turning the tide of battle.[45]

General Mathew Ridgeway stated part of the Army's argument,

> Our efforts to speed up and improve the use of Air Force planes in close air support met with a less cooperative attitude because of policy decisions made in Washington. Though I strongly advocated that some small part of the combat aviation be assigned to the Headquarters Field Army and its Corps, so that air strikes could be called with a minimum of delay, Air Force adamantly opposed this plan. Requests for air strikes continued to follow the old merry-go-round, up through channels to Army, then to Air Force, and down again. As a result of this time consuming procedure, when the planes got there the enemy had gone.[46]

General Ridgeway's reasoning was that the Army ground combat units needed air support that was timely and responsive to Army requests. As most Army arguments on this issue, the assumption was made that if the Army could control the air forces it would delegate them to subordinate units in order to achieve this responsiveness. Ridgeway was also concerned with the lack of interest in the Air Force in a close air support aircraft and gave a warning for the consequences of continued Air Force intransigence on this issue.

[45]See Air Force Magazine, "The Air-Ground Operation in Korea," March, 1961, pp. 19-44.

[46]General Mathew B. Ridgeway, Soldier (New York: Harper and Brothers, 1956), p. 135. Also cited by Kuiper, op. cit., Chapter 3, p. 1.

> The Army must have the support of combat aircraft that can in any kind of weather, under all conditions incident to enemy interference, both in the air and from the ground and deliver its bombload, or its rockets with the accuracy of a field gun. If the Air Force should develop these planes we would be deeply pleased. If they continue to ignore our needs in this respect, we eventually will have to develop them ourselves.[47]

The roles and missions arguments continued while technology advanced and brought the concept of the armed, battlefield helicopter closer to reality. Charles Wilson, Secretary of Defense, 1953-1957, attempted to resolve part of the question. In a modification to the Key West agreement he issued a memorandum which was published as a DOD Directive in March 1957. The directive was issued for the purpose of:

> 1. Defining the scope of the U.S. Army aviation and establishment.
> 2. Insuring that the U.S. Army may employ aircraft necessary for its internal requirements in the conduct of operations on land, without duplicating the functions assigned to the U.S. Air Force.[48]

The exact difference between interdiction and close air support had never been clear. Close air support was

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[47]Ibid., p. 314. There were even articles advocating taking the close air support mission away from the Air Force and giving it to the Navy. See Col. George C. Reinhardt, "Put TACAIR in Navy Blue," Army Combat Forces Journal, September, 1954, pp. 21-25, cited in The Politics of Weapons Innovation, by Michael H. Armacost (New York: Columbia University Press, 1969), p. 43.

[48]DOD Directive No. 5160,22, March 18, 1957, p. 1. It began in the form of a memorandum, Secretary of Defense to the Armed Forces Policy Council, November 26, 1956, Subject: "Clarification of Roles and Missions to Improve the Effectiveness of Operations in the Department of Defense."

supposed to take place in the immediate area around the front lines, but attempts to define how deep this combat zone went into enemy territory had proven frustrating. Wilson decided the issue somewhat by limiting the "combat zone" for the Army to 100 miles to the front and rear of the battle line. In addition, Army aviation was to be subject to the following limitations:

> 1. Fixed wing aircraft, convertiplanes, and vertical/short take-off and landing aircraft will have an empty weight not to exceed 5,000 pounds. Rotary wing aircraft will have an empty weight not to exceed 20,000 pounds. . . .
>
> 4. The U.S. Army Aviation Program will not provide for aircraft to perform the following functions:
>
> a. Strategic and tactical airlift, . . .
> b. Tactical reconnaissance.
> c. Interdiction of the battlefield.
> d. Close combat air support.[49]

The issue about the capabilities of tactical fighters remained in dispute, with the Army being convinced the Air Force really did not want to design and buy aircraft with the characteristics that would make them good close air support planes. One of the performance features that the Army had always wanted to see in a ground support aircraft

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[49] *Ibid.*, pp. 4-5 (Emphasis added). The limitation on fixed wing aircraft was the same as the 1952 Pace-Finletter agreement, but the limit on helicopters was new. These limitations on weight have since been outdated by actual Army purchases of aircraft in both categories. Implicitly the Directive has been disregarded since OSD has approved the Army purchases over the limits established in this document. See "Close Air Support: Sixty Years of Unresolved Problems," *Armed Forces Journal*, April 25, 1970, p. 21 for specific examples.

was endurance--the ability to loiter over the battlefield for long periods of time. The Army did not consider the 1-2 hour endurance of the tactical fighters of the 1950's sufficient for the close air support mission. A 1957 statement of Air Force preferences on aircraft characteristics only frustrated the Army even more. The Joint Air-Ground Operations Manual of that year stated that tactical fighter/fighter-bomber aircraft were to be capable of:

1. Air to air combat
2. Air to ground gunnery
3. Rocketry
4. Bombing
5. Reconnaissance
6. Chemical Spray[50]

Their characteristics were to include:

1. The ability to live in the air in the battle area.
2. The ability to operate under varied weather conditions.
3. Adequate endurance to accomplish the mission.[51]

The Army found it difficult to believe that the Air Force wanted its close air support aircraft to be, first of all, capable of "air-to-air combat." Not only was the Army unhappy about the lack of a specific close support aircraft, it was concerned about getting the Air Force to give priority to the close air support mission amid the competing issues. The 1957 Air Force Tactical Bombardment Manual gives insight into the realization of Army fears.

> Close support targets are normally requested by the ground force commander in the area and are

[50] Joint Air-Ground Operations Manual, Continental Army Command TT110-100-1 and Tactical Air Command Manual 55-3, September 1, 1957, p. 21. (Emphasis added.)

[51] Ibid., p. 68. (Emphasis added.)

> dictated by the exigencies of the battle. They usually consist of strong points, armor, gun batteries, troop concentrations, etc. The missions are flown after considering the validity of the ground force commander's request for the mission, and the availability of aircraft.[52]

> And

> Close air support is an important function of the tactical bomber and intruder forces and especially so when large tonnages of bombs are necessary to gain the desired results, or in cases where the fighter-bomber aircraft cannot meet their commitments.[53]

The position of the Air Force as the 1950's drew to a close was that it was capable of providing the best possible close air support by the use of tactical fighter and tactical bomber aircraft employed under a system of centralized air control. The final roles and missions agreement of the 1950's in the field of close air support was published by the Joint Chiefs of Staff in 1959. The document was named *Unified Action Armed Forces*, and it once again identified the Air Force as having the specific responsibility for providing forces and developing doctrines, equipment, tactics and techniques for the close air support of ground forces.[54]

Under the overall national strategy of Massive Retaliation the Air Force in the 1950's had given the highest priority to the strategic mission in general and to Strategic Air Command (SAC) in particular. SAC combat wings grew in number from 19 in 1950-51 to 51 in 1957, while the percentage

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[52] *The Tactical Bombardment Manual*, TACM 51-1, 1957, p. 17.

[53] *Ibid.*, p. 68. (Emphasis added.)

[54] Joint Chiefs of Staff, *Unified Action Armed Forces*, JCS Publication 2, November, 1959, p. 28.

of USAF personnel assigned to SAC grew from 17% in 1950-51 to 26% in 1959.[55] The force structure of the tactical forces rose during and after the Korean War from 19 wings to a high of 34 wings in 1957 (after the transfer of six strategic fighter escort wings from SAC to TAC). After 1957 the tactical force structure began a rapid decline: from 34 to 26 wings in 1958, to 18 wings in 1959. In 1960 there were 18 wings of tactical aircraft (two tactical bomber wings and sixteen tactical fighter wings). When the Kennedy administration came to Washington in 1961, Air Force plans called for these 18 tactical wings to be reduced to 15.[56]

This description of the relationships among the national strategy, doctrine, and force structure provides a background for the understanding of the later decisions on the A-7. After 1961, when Systems Analysis was delegated a great amount of authority in the determination of military force structures, the relationship of the analysts to Air Force and Navy doctrine was to become very significant. In particular, the Air Force position on the requirement for fighters to be multipurpose aircraft was to come under Systems Analysis attack. At least part of the Systems Analysis view was apparently the existence of a countervailing doctrine in the Navy. It is to the Navy doctrine and the tradition of specialized aircraft that we now turn.

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[55] The Air Force Blue Book, op. cit., pp. 300-301.

[56] Headquarters USAF, Tactical Force Historical Data 1952--Present, Directorate of Aerospace Programs, PRTB, 1969.

Brief History of Naval Air Attack Forces

A summary of the Navy traditions and doctrine in the development of specialized fighter and ground support aircraft is essential to the understanding of the place of the A-7. It is important not only because the Navy originally developed the A-7 for its own use, but because the Systems Analysis staff viewed the Navy doctrine as being clearly competitive with that of the Air Force. The Systems Analysis pressure on the Air Force to accept the A-7 as a specialized ground support aircraft was a direct result of a belief in the superiority of the Navy doctrine.

The basic types of naval aircraft were established shortly after World War I. In 1919 the chief of Naval Operations described four categories of aircraft needed by the Navy: (1) fighting planes; (2) spotting and short distance reconnaissance planes; (3) torpedo and bombing planes; and (4) large flying boats.[57]

In the 1920's an attempt was made to build tri-purpose aircraft to fulfill the missions of scouting, horizontal bombing, and torpedo bombing, and several aircraft models were introduced.[58] Later the tactic of dive bombing was developed

[57]Letter, U.S. Naval Department, Office of Naval Operations, Washington, "Future Policy Governing Development of Air Service for the United States Navy," to "the Solicitor," August 28, 1919. National Archives, R.G.-80, Secretary of the Navy General Files, 1897-1925, file 11158-71.

[58]The ensuing account draws primarily from interviews with Navy and Marine pilots and Captain C.O. Holmquist's excellent portrayal, "Developments and Problems in Carrier-Based Attack Aircraft," Naval Review: 1969, ed. by Frank Uhlig, Jr. (Annapolis, Maryland: U.S. Naval Institute, 1969), pp. 195-215.

and generally replaced the old concept of horizontal bombing in the Navy.

The exact reason for this is unclear. The most likely supposition is that the type of target and the aircraft available had a great deal to do with the tactics. That is, the Navy was primarily concerned with the delivery of weapons against ships of an opposing navy. Ships are small, fairly maneuverable objects (when compared to factories), and a high degree of accuracy is required to hit them. The Navy could not use large four-engined aircraft on carriers, so the tactics were built around small, single-engined planes. The steep angle of the dive bombing attack brings the aircraft into close range with the target, and the resultant accuracy gives a maximum probability of damage. The Navy position may well have been that the exposure of the aircraft to intense anti-aircraft fire was less important than the increase in accuracy afforded by the dive-bombing attack.

The Air Corps pilots of the same period had been impressed with the extremely large number of pilots and aircraft lost to enemy ground fire in low altitude attack missions in World War I. Thus, the dive bombing tactic never did become favored in the Air Corps, and the development of high altitude, precision bombing continued.[59]

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[59] The Army Air Forces in World War II, Vol. I, p. 598. The Air Corps of the 1930's was also interested in developing tactics and weapons to attack surface ships. In fact, the Norden bombsight was originally designed to aid in the delivery of bombs from high altitude, level bombing attacks against ships. This concern with a potential threat from the seas was partially the result of the limited range of bombers of the 1930's and the association of the long range bomber with the

The use of the term "bombing" in the Navy seldom had the connotation of "strategic bombing." The Air Force developed the heavy bomber to perform the mission of strategic bombardment. The Navy was technologically restricted on the size and weight of its aircraft because of the limited capacity of the aircraft carrier. Therefore, the "bombers" and "attack" aircraft of the Navy were developed primarily to perform the missions of what the Air Force would call interdiction and close air support. Navy "fighter" aircraft were smaller and lighter than the bombing and attack aircraft of the same era, and were designed to perform what in the Air Force would be known as the "air superiority" mission.

The Navy used dive bombers, torpedo bombers and fighters extensively in World War II. One of the best of the Navy fighters was the Corsair built by Chance-Vought, the forerunner of the LTV-Vought Aeronautics Division, builder of the A-7 Corsair II.[60]

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coastal defense mission of the Army. For a more detailed examination of the relationship of the bombardment mission with the coastal defense mission, see Richard C. Bowman, "Organizational Fanaticism," The Airpower Historian, April, 1963, pp. 50-53.

[60]The distinction between Ling-Temco-Vought (LTV) and Vought Aeronautics is strictly one of perspective. Starting from the bottom of the conglomerate LTV organization, Vought Aeronautics Division is a subsidiary of LTV Aerospace, which is a subsidiary of LTV, Incorporated. From the inside it is quite apparent that the employees work for and devote their loyalties to Vought Aeronautics, which bears the proud heritage of the Corsair I. However, in the interests of the general reader, the builder of the A-7 will be referred to as LTV in most cases, with the full understanding that Vought Aeronautics is actually doing the engineering and production work with management responsibilities being shared with the parent corporation. Occasionally, the term Chance-Vought will be used by the actors in the narrative since that was a former name of the company.

The merger of the dive bombing and torpedo bombing designations into the single mission of "attack" came after World War II. The Douglas Skyraider became the Navy's specialized ground attack aircraft. The Skyraider, or A-1 as it was later designated, was one of the most successful aircraft designs in the world. It could carry a heavier bomb load than the B-17 and had an endurance of up to twelve hours in the air. Conceptualized in 1944, the pro-pellor driven A-1 went through seven versions, 28 sub-versions, and countless modifications. A total of 3180 aircraft rolled out in twelve years of production. Although the U.S. Navy decommissioned its last Skyraider squadron in 1968 after 21 years of operational service, the Navy gave its few remaining aircraft to the Air Force, and the same A-1 aircraft were still in service in 1970.[61]

During the Korean War another Douglas aircraft, the jet A-4 Skyhawk had its beginning with the same design philosophy as the A-1: simplicity, reliability, maintain-ability, light weight, small size and low cost. The A-4 was also a most successful design, and by 1965 1845 of these aircraft had been produced by Douglas. (The A-4M and N versions are still being built by the McDonnell-Douglas company. Israel has bought substantial numbers of the A-4 for her ground attack forces. The A-4 is still in use by

[61]For the most complete Navy history of the Skyraider, see B.R. Jackson, Douglas Skyraider (Fallbrook, California: Aero Publishers, 1969). For its position in the history of naval aviation see Norman Polmar's excellent and comprehensive Aircraft Carriers: A Graphic History of Carrier Aviation and Its Influence on World Events (Garden City, New York: Double-day and Co., 1969).

the U.S. Navy and Marine Corps.)

Although Navy fighters have been used to carry bombs they were primarily designed for their air superiority role. Their bomb-carrying abilities were considered secondary to the ability to fight other airplanes in air-to-air combat. The difference between the two is stated by Captain Holmquist,

> The basic design criteria for a fighter aircraft are entirely different from those of an attack aircraft. Navy fighters are optimized for two important roles: the interceptor role of destroying attacking aircraft which may endanger the Fleet, and the fighter role of escort and fighter-to-fighter combat in the air. . . . Carrier-based attack aircraft are designed for the missions of close air support and interdiction and are optimized for the task of carrying heavy loads of ordnance long distances.[62]

The single most distinctive performance difference between attack aircraft and fighters is their top speed and load-carrying ability. Because most of the subsequent argument in the Air Force A-7 decisions are based on the speed difference, the following figure will set out the basic two groups.

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[62]Holmquist, _op. cit._, pp. 211, 196.

Table 2. Speeds of Attack and Fighter Aircraft

Service	Type Attack Aircraft	Top Speed in Level Flight
Air Force	A-36	Subsonic
Navy/Air Force	A-1	Subsonic
Navy	A-4	Subsonic
Navy/Air Force	A-7	Subsonic
	Fighter Aircraft	
Navy/Air Force	F-4	Supersonic
Navy	F-8	Supersonic
Air Force	F-100	Supersonic
Air Force	F-105	Supersonic
Air Force	F-111	Supersonic

The most immediate point the reader may note is that all the Navy fighters were supersonic while none of its attack aircraft possessed that capability. When asked why this difference exists several Navy pilots suggested:

1) Both supersonic and subsonic aircraft deliver bombs at subsonic speeds.

2) Supersonic flight does not appreciably reduce the probability of damage from enemy ground fire.

3) The Navy prefers to escort slower aircraft rather than buy all supersonic aircraft.

4) When carrying external bombs aircraft pay a very

heavy penalty in fuel burned for supersonic flight.[63]

The Deputy Chief of Naval Operations (Air), Vice Admiral Thomas F. Connolly, elaborated further on the Navy position,

> By the time you load them up with bombs you are not going to go supersonic, not until after you let the bombs go. We have an appreciation for the advantages of being able to withdraw from a heavily defended target area swiftly and if possible, supersonically. We appreciate speed, but we've been concerned about the price one must pay to go fast at low altitude. We have felt that high subsonic is a good compromise of all things--cost and effectiveness and safety. . . . Of course, the limit seems to be about Mach 1.2 on the deck, and if you can withdraw at Mach 0.9, you're talking about 180 knots [difference] which is fine, but it <u>is</u> only about 25-30% slower. And of course the cost in fuel is very high [to go supersonic].[64]

The fact that the Navy had developed a different doctrine on the use of specialized attack aircraft was not the only contrast with the Air Force in 1961. The Navy had also specialized its pilots into two basic categories--attack pilots and fighter pilots. The Air Force, on the other hand, had maintained the position that any tactical fighter pilot should be capable of performing all three of the tactical air missions--especially so since he flew a multipurpose aircraft capable of those missions.

As the research into the factors influencing the A-7 decisions progressed, it became apparent that this division of Navy pilots into two groups based on the missions of

[63] Interviews, Comdr. Charles Ernest, Capt. Thomas Gallagher and others.

[64] Interview with Admiral Connolly, March 13, 1970.

their aircraft might be a factor related to professionalism. That is, the two groups of Navy pilots might demonstrate characteristics of a sub-profession within the Navy, just as tactical fighter pilots and strategic bomber pilots represented sub-professions within the Air Force. Further interviews indicated that Navy pilots initially assigned to attack squadrons seldom cross-trained into the fighter specialty. This lack of assignment rotation from attack aircraft to fighters or vice versa was not a rigid policy, but crosstraining is expensive and time-consuming. Most of the Navy pilots interviewed indicated that while switching specialties was possible and not unlikely, it was the exception rather than the rule. Admiral Connolly was asked,

> Does the fact that the Navy has tended to develop two parallel groups of officers--attack pilots and fighter pilots--affect the philosophy of a subsonic attack aircraft?
>
> The Admiral answered:
>
> I think that is a fair question; I think the answer is that anytime you create one group that is a little different from another they tend to address their own system and their own way of doing things and perhaps to prefer them, to argue for improvement in that way of doing things. However, we do exchange fighter pilots and attack pilots, and there are more attack pilots than there are fighter pilots. We have, roughly speaking, three squadrons of attack to every two squadrons of fighters. This is not an inflexible rule.[65]

This brief history of naval air attack forces has set the stage for an appreciation of the developments and

[65] Interview, March 13, 1970.

decisions that arose in the 1960's. The basic elements are three: (1) the tradition of naval attack aviation with a separate and distinct mission was grounded in experience in World War II. It was reinforced by the development of several generations of attack aircraft, specialized for that mission. (2) There was no general belief or strong doctrinal force that required these attack aircraft be either multipurpose or supersonic. (3) The attack pilots of the Navy, although not sealed off from cross-training, tended to perpetuate their beliefs, to some degree, by remaining an identifiable group--a sub-profession.

The implications of these elements are not easily identified. However, three strong tendencies are discernible in the influence of naval attack aviation on the decisions of the McNamara administration.

(1) The influence of Navy attack pilots and Naval attack experience tended to argue for the development of another Navy attack aircraft program after the A-4 was terminated.

(2) The same attack heritage had an influence on the characteristics required in the new aircraft (A-7). The direction of this pressure was indicated by an attack professional,

> Our experience tells us that simplicity, reliability, maintainability, light weight, small size, and low cost are the guidelines we should follow in the future. Our ever-expanding

> technology is a strong force to drive us away from most of these objectives. Let us hope we can make the right decisions.[66]

(3) If the Systems Analysis representatives were inclined to look for a weapons system with the characteristics of low cost, light weight, simplicity, maintainability and reliability, they would have found ready advocates among Navy attack pilots.

The contrast between the Navy and Air Force professionals on many of these points is clear. The Air Force was not opposed to a simple, low cost aircraft as such. The Air Force did, however, develop and maintain the doctrine of multipurpose aircraft for the tactical missions. The professional Air Force position in the 1950's was that a specialized close air support aircraft was undesirable, regardless of its cost. In addition, there was no significantly large group of attack pilots in the Air Force to influence the development of a specialized aircraft for the close air support mission.

Thus, when Systems Analysis was looking to formulate alternatives to the national strategy of Massive Retaliation, the Navy and the Air Force appeared as contrasting examples of professional organizations. Each organization had a tactical doctrine, and Systems Analysis, to a large degree, was free to select between them.

In order to understand the significance of the changes wrought by McNamara and Systems Analysis in the area of

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[66] Holmquist, op.cit., p. 215.

weapons system selection and development, the relationship of the Military Departments to the development process needs to be established.

The Military Departments and the Requirements Process

The research and development process is usually begun with the statement of a military requirement for the new weapons system. During and after World War II the military services retained most of the responsibility for the generation of these military requirements.

Hammond has noted that the traditional military requirements determination process bolstered the central authority of the Services. Even more to the point of this research, Hammond maintains that the Services applied a concept of rationality he calls "administrative due process" and adjusted their decision-making processes to conform to this set of rationality norms.

> . . . since the wartime roles of the military chiefs dictated that at all times they be at or near the center of the military organization, giving them the main voice in determining military requirements had the effect of centralizing authority in the military service departments. . . .
>
> It should be noted that the criterion of rationality here amounts to what we might call administrative due process: the distribution of authority so as to give sufficient weight to the views of the people who are most closely identified with the pay-off function. One does not attempt to test the wisdom or validity of their collective findings by scrutinizing the deductive and inductive methods by which they have arrived at their conclusions. Avoiding that task may be only for

> economic reasons. It can also be in order to accommodate an essentially romantic view about judgment that intuition can come closer to the truth than can formal--and hence explicit, articulate, and communicable--analytical procedures.
>
> The traditional military requirements notion may be regarded as the supporting doctrine for an authoritative due process arrangement.[67]

There are two essential points to be made about Hammond's analysis of the pre-1958 requirements process. The first is that although the military services were the recipients of the authority to determine their own requirements, it does not necessarily mean that the authority would stay centralized in the service. For instance, if the Air Force Chief of Staff has the authority in Hammond's description, he may further delegate an important role in the decision-making process to the commander of the organization even more closely identified with the "pay-off function" (i.e., the commander of TAC in the case of a fighter requirement). This is not only conceivable, it is highly likely given the stated criterion of administrative due process. This is a very important point. It closely adheres to the concept of administrative feasibility, which is a daily consideration of decision-makers in large organizations.

The second point about Hammond's observation is that it identifies experience (intuition) as an important part of administrative due process. This may not be true in all organizations, but it seems to be unusually appropriate to identify experience as a powerful force in the military

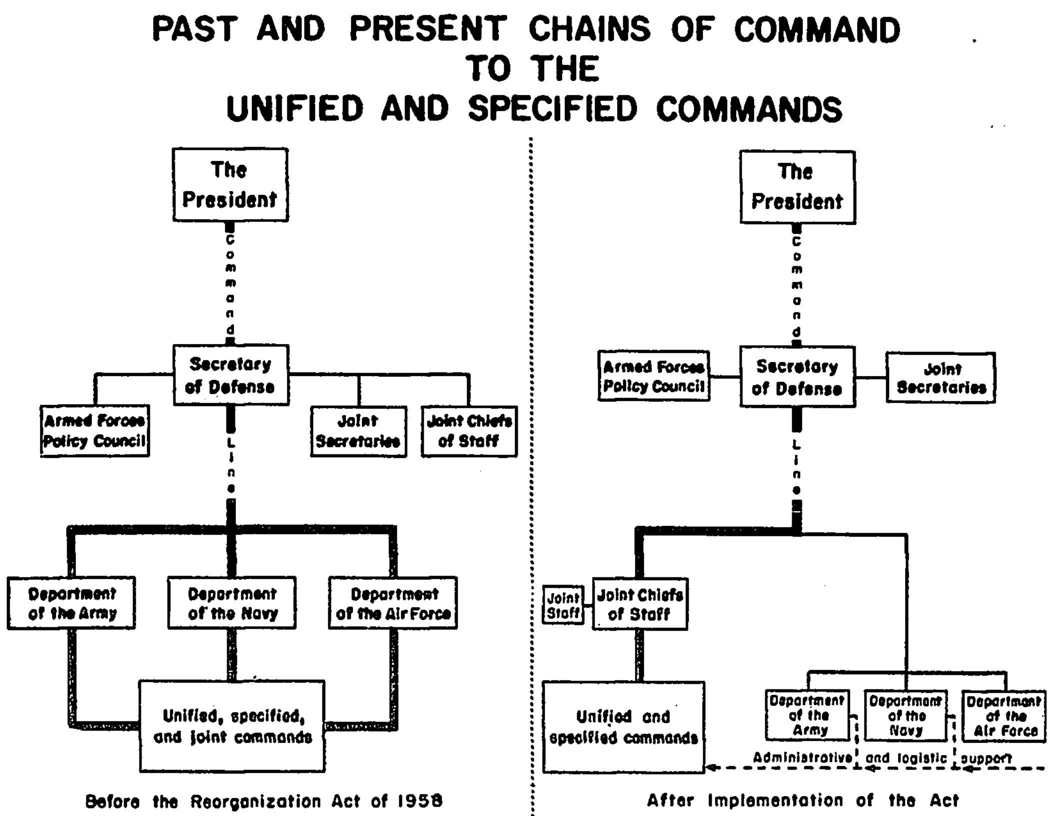
[67] Hammond, *op. cit.*, pp. 58-59.

organization/profession. The importance of experience in the military profession (especially in the military operations sub-profession) has already been stated through Janowitz and other observers. The significant point here is that Hammond seems to approach the relationship of experience to the military from another direction. The result is to demonstrate the military use of administrative due process as a part of the broader organizational decision-making process. Subsequent discussion of the changes after 1958 and the A-7 program decisions after the McNamara revolution in 1961 will attempt to show that the administrative due process portion of the military decision-making process was not altered significantly.

Before 1958 the military departments had been the principal authority on the generation of military requirements for new weapons. The Department of Defense Reorganization Act of 1958 created a second channel for the generation of military requirements. Under this Act the nation's primary combat forces were organized into unified and specified commands which reported directly to the Joint Chiefs of Staff.[68] (See Figure 2.) The results of this reorganization were to remove the Service Departments from the operational chain of command and to strengthen the role of the Joint Chiefs of Staff (JCS) and the Secretary of

[68]The unified commands incorporate units from more than one service. In 1970 they included the Alaskan Command, Atlantic Command, European Command, Pacific Command, Southern Command and Strike Command. The only specified command was the Strategic Air Command which had only Air Force elements in it.

Figure 2. Past and Present Chains of Command to the Unified and Specified Commands



Defense.[69]

With the 1958 reorganization the generation of military requirements for new weapons could go either through the JCS or through the Service Secretary. Hammond notes, however, that the requirements seldom reached the JCS unless they involved weapons for joint use.[70] The result was to leave a significant amount of authority for requirements generation to the individual Service Departments. Indeed, one of the purposes of the 1958 reorganization had been to specialize the Departments as agencies of support, which included the functions of requirements and weapons development.

After 1958 the Departments of the Army, Navy and Air Force with their respective Secretaries were responsible to:

> Prepare forces and establish reserves of equipment. . . .
> Organize, train and equip forces for assignment to unified or specified commands.
> Prepare and submit to the Secretary of Defense budgets. . . .
> Conduct research, develop tactics, techniques, and organization, and *develop and procure weapons*, equipment, and supplies essential to the fulfillment of the functions hereinafter assigned.[71]

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[69]For an opinion of the consequences of this realignment, see John C. Ries, *The Management of Defense* (Baltimore: Johns Hopkins Press, 1964). Paul Y. Hammond, writing in 1961 before he joined the RAND Corporation, gave a sinister overtone to the reorganization, "Gradually, and with a finesse which demands respect, the services are being dismembered and disembowelled, so that the question of their utility is decided continually in decrements. So long as the Defense Department is proceeding in a series of adaptations to accommodate itself to changing circumstances, the important questions by which to appraise these adaptations bear directly upon the primary objectives to be achieved. The preservation of the service departments is not one of those objectives." *Organizing For Defense* (Princeton: Princeton University Press, 1961), pp. 374-375.

[70]Hammond, "Defense Department Decision-Making in the McNamara Administration," *op. cit.*, p. 59.

[71]Department of Defense Directive 5100.1, December 31, 1958, with changes through June 17, 1969. (Emphasis added.)

The responsibility of the headquarters staffs in the military Departments to generate requirements and initiate proposals for weapons development was described by the Deputy Chief of Naval Operations for Air, Admiral Connolly,

> We are the requirements people; we represent the fleet. The fleet commanders made their input here. We convert that into operational requirements and send those requirements to our research and development organization . . . our engineering people.[72]

Once the requirements were generated, the Military Departments were responsible to "develop and procure weapons" in order to implement the national strategy and to provide the force structure with the means to maintain adequate capabilities. In fact, the development process can be viewed as the essential link between strategy and capabilities. Development is the process by which requirements are turned into future equipment and hardware. However, the relationship between strategy and hardware is one of two-way interaction because of the lead time necessary for development.

Hardware and weapons systems not only provide the means to implement national strategy; the determination of a national strategy is often limited by past hardware decisions. Thus, the decision to buy one aircraft over another or to go ahead from basic research and applied research to a development program has immediate budgetary implications and long-range impact on the capabilities of the operational

[72] Interview, March 13, 1970.

forces.

The significance of the decisions on a weapons development program has been described by Dr. Harold Brown, former Director of Defense Research and Engineering and Secretary of the Air Force,

> The decision to proceed with full-scale development of a major new weapons system is an important event; almost without exception it indicates a large commitment of resources, and it defines, limits or expands the conditions under which future combat forces will be able to fight effectively. Normally the decision is made by the President or at the highest level in the Defense Department with Presidential concurrence. . . . Here again the directing and restraining influences of strategy deserve emphasis. If anything, strategy and the criterion of utility in support of national objectives merit increasing influence on development decisions. The development community argues too often for going ahead "because you can do it."[73]

During 1958 there was an increased recognition of the importance of weapons development decisions to the security of the nation. In addition, the Soviet Union's success in placing the first man-made satellite (Sputnik I) in orbit the previous year had demonstrated the potential of rapidly advancing science and technology. The result was that President Eisenhower and the Congress shared the view that the authority of the Secretary of Defense should be increased in the area of research and development.[74]

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[73] Harold Brown, "Planning Our Military Forces," Foreign Affairs, January, 1966, pp. 283-285.

[74] Harry B. Yoshpe and Theodore W. Bauer, Defense Organization and Management (Washington, D. C.: Industrial College of the Armed Forces, 1967), p. 46.

This increased authority was represented in the Defense Reorganization Act of 1958 by the replacement of the Assistant Secretary of Defense for Research and Engineering with the post of Director of Defense Research and Engineering (DDR&E). The New Director was to take precedence immediately after the three Service Secretaries, and he was to be the principal advisor to the Secretary of Defense on matters of a scientific and technical nature. The intention of the Act was clearly to strengthen the centralized control of OSD as the Director was to "supervise all research and engineering activities in the Department of Defense" and "Direct and control . . . activities that the Secretary of Defense deems to require centralized management."[75]

The 1958 Act also clarified the role of the Service Departments as they related to OSD. Previously, Congress had used the terminology that the Departments would be "separately administered." This term had apparently led to some confusion about the degree of administrative autonomy the Departments were to have, so the Reorganization Act specified the Departments were only to be "separately organized." In addition, they were to "cooperate fully" with OSD to implement the direction and authority of the Secretary of Defense. A significant change occurred when the Act specified that Assistant Secretaries of Defense could give orders to the Service Departments through their Secretaries.[76]

[75] *Ibid.*, pp. 46, 47.

[76] *Ibid.*

Although the Reorganization Act had significantly strengthened the role of the Secretary of Defense--especially in the area of research and development decision-making--criticisms of defense policy continued. The national strategy remained firmly under the concept of Massive Retaliation. The Army and General Taylor were proposing a more balanced strategy and more emphasis on conventional weapons and weapons systems. The Services were criticized for the continuation of roles and missions disputes and for a lack of coordination. There were proposals for a new budgeting system and a further centralization of authority.

The relationship of this continued debate to the selection of weapons and the development of force structure was described in a RAND research study,

> Most persons, including voters and congressmen, agreed that force-structure and systems-development choices needed better coordination than Service bargaining provided. Perhaps there were other ways to make the bargaining process work better, but to most people steps toward more affirmative OSD control over these decisions seemed to be the best, or possibly only, way to proceed.[77]

The Kennedy Administration Comes Into Office--1961

At the same time the Kennedy administration was moving to Washington Soviet Party Chairman Nikita Khrushchev was addressing the annual conference of the Communist Party, January 6, 1961. He listed four types of wars in his speech--world wars, wars of national liberation and popular uprisings. He

[77]James R. Schlesinger, Defense Planning and Budgeting: The Issue of Centralized Control, P-3813 (Santa Monica: The RAND Corporation, 1968), p. 9.

stressed that the Soviet Union did not believe in either world-wide or local wars, but would fully support wars of national liberation.[78]

President Kennedy took office on January 21, 1961, with a desire to change the basic course of the country toward the "New Frontier" and to change the national defense strategy as well. He had campaigned on the defense issues of a "missile gap" and the need to build up the nation's conventional forces. He chose as his Secretary of Defense, Robert S. McNamara, and gave him an extremely broad mandate:

(1) "Reappraise our entire defense strategy."[79]

(2) "Develop the force structure necessary to our military requirements without regard to arbitrary or predetermined budget ceilings."

(3) "Having determined that force structure, procure it at the lowest possible cost."[80]

With the strong backing of the President and instructions to install Flexible Response as the national strategy, McNamara confronted the Department of Defense. The manner in which McNamara was to operate has been described by Schlesinger,

> McNamara had been fascinated by the intellectual problem of administering large organizations since his days as a student and teacher of statistical control in the Harvard Business School and his experience as a junior officer in the Pentagon during the war . . . the quest for control required in his

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[78]Arthur M. Schlesinger, A Thousand Days, op. cit., pp. 282-285.

[79]John f. Kennedy, State of the Union Address, January 30, 1961.

[80]Robert S. McNamara's statement before the House Committee on Armed Services, Hearings on Military Posture, House of Representatives, 1962, p. 3162.

> judgment two things: the use of analysis to force alternative programs to the surface and the definition of the "options" in quantitative terms in order to facilitate choice. . . . The computer was his ally in making options precise.[81]

The relationship between management tools and his approach to the job of Secretary of Defense was later described by McNamara in his own words,

> It seemed to me, when I took office in January 1961, that the principal problem standing in the way of efficient management of the Department's resources was not the lack of management authority--the National Security Act [and especially the 1958 Reorganization] provides the Secretary of Defense a full measure of power--but rather the absence of the essential management tools needed to make sound decisions on the really crucial issues of national security.[82]

The management tools which McNamara instituted to accomplish his goals were essentially two: the Planning-Programming-Budgeting-System and the increased manning and authority of the Office of the Secretary of Defense (OSD).[83] McNamara elevated the <u>Deputy</u> Director of DDR&E to the level of Assistant Secretary and increased the number of <u>Deputy</u> Assistant Secretaries from 7 to 27. The Planning-Programming-Budgeting-System was introduced under the supervision of the Comptroller, Charles Hitch, whom McNamara had

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[81]Schlesinger, <u>A Thousand Days</u>, <u>op. cit</u>., pp. 293-294.

[82]Statement of Secretary McNamara on Fiscal Year 1969-1973 Defense Program and Fiscal Year 1969 Defense Budget, January 22, 1968.

[83]The acronym OSD will be used throughout this study to mean not only the immediate office of the Secretary of ~~Defense and the Deputy Secretary, but to include (as it does~~ by law) the office of all seven Assistant Secretaries, DDR&E, the General Counsel and two Assistants to the Secretary. (See Appendix 1.) In 1968, OSD had about 2700 people of which 1800 were professionals.

hired from the RAND Corporation. Hitch had been the chairman of the Economics Department at RAND and had written, with Roland McKean, The Economics of Defense in the Nuclear Age, which had expressed many innovative ideas about the uses of the concepts of "substitution effect," marginal utility, and the tools of game theory and analysis.[84] Hitch brought with him many research people from RAND and invited Alain Enthoven to be a Deputy Assistant Secretary of Defense (Systems Analysis) in the Comptroller's office. Enthoven had formerly worked for RAND, had written the mathematical appendix to the Hitch and McKean volume, and had been working in DDR&E for several months.

With the aid of his energetic staff McNamara compiled a document on what he found in the Department of Defense and sent it to the President within a week after the inauguration. McNamara reported he had found:

> (1) A strategy of massive retaliation . . . and serious weaknesses in our conventional forces.
>
> (2) A financial ceiling on national security.
>
> (3) A strategic nuclear force vulnerable to surprise missile attack.
>
> (4) Too few Pentagon-wide plans for each kind of contingency.[85]

On March 1, 1961, McNamara sustained his initiative on the Department by issuing a set of questions which immediately drew the name the "Ninety-six trombones." He followed these

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[84] Charles J. Hitch and Roland N. McKean, The Economics of Defense in the Nuclear Age (Cambridge: Harvard University Press, 1960).

[85] Theodore C. Sorensen, Kennedy (New York: Harper & Row, 1965), p. 603.

up with 104 Study Projects and four Task Forces on the subjects of limited war, nuclear war, installations, and research and development. The majority of these projects were given to his civilian aides, with Charles Hitch being assigned the study on nuclear war. (Hitch and Enthoven had specialized in the study of nuclear war during their time at RAND.) The immediate result of all these studies was a March 28 budget request for an additional $650 million to build up the strategic retaliatory, limited war and guerilla war force structures.

The Planning-Programming-Budgeting-System

The relationships between the Services and OSD is significantly affected by both the structure and content of decision-making. The structure of the decision-making process under McNamara was largely shaped around the form of the Planning-Programming-Budgeting-System (PPBS). The five major elements of the new structure were:

> 1) A program structure in terms of missions, forces, and weapon and support systems.
>
> 2) The analytical comparisons of alternatives.
>
> 3) A continually updated five-year force structure and finalcial program.
>
> 4) Related year-round decision making on new programs and changes.
>
> 5) Progress reporting to test the validity and administration of the plan.[86]

[86] David Novick, "The Department of Defense," in Program Budgeting, ed. by David Novick (Washington, D. C.: U. S. Government Printing Office, 1964), p. 57.

Charles Hitch has described how he and Secretary McNamara felt about the relationship of weapons decisions to the new system.

> We were both convinced that the financial management system must also provide the data needed by top defense management to make the really crucial decisions, particularly on the major forces and weapons systems needed to carry out the principal missions of the defense establishment. And we were well aware that the financial management system, as it had evolved over the years, could not directly produce the required data in the form desired. It was clear that a new function, which we call programming, would have to be incorporated in the financial management system.[87]

The role of programming was to provide a bridge between the planning phase and the budgeting phase. It required the reorganization of the inputs of defense policy (personnel, procurement, construction, maintenance, operations, etc.) to provide a measure of the outputs (missions, weapons systems, force structure). The result was the formation of activities into nearly 1000 "program elements" and the combination of the program elements into nine, mission-oriented programs. The programs were:

1. Strategic Retaliatory Forces
2. Continental Defense Forces
3. General Purpose Forces
4. Airlift and Sealift
5. Reserve and Guard
6. Research and Development

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[87] Charles J. Hitch, Decision-Making for Defense (Los Angeles: University of California Press, 1965). Reprinted in American Defense Policy, 2d ed., ed by Mark E. Smith, III, and Claude J. Johns, Jr. (Baltimore: Johns Hopkins Press, 1968), p. 445.

7. General Support

8. Retired Pay

9. Military Assistance[88]

Another essential feature of the PPBS was the formalization of a five-year planning and programming horizon and the establishment of a financial baseline from which to work. The combination became a formal document called the Five-Year Force Plan and Financial Program; it has since been shortened to Five-Year Defense Program or FYDP. It is significant that this document was meant to be the central repository of the Secretary's approved defense program. Changes to the Five-Year Defense Program could be made in two ways. One, the services could submit Program Change Proposals (PCP's) at any time they desired. The proposals had to include detailed schedules and complete manpower and financial data to revise the Five-Year Defense Program and update the associated data bank.[89] Secondly, when the Secretary of Defense chose to announce a tentative decision on a major force issue, he did it through a series of documents known as Draft Memorandums for the President (DPM's). Most of the DPM's were prepared in the office of Systems Analysis.[90]

The characteristics of this system were selected as the primary management tools by which Secretary McNamara was to direct the Department of Defense. A Department

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[88] Ibid., p. 450. The Continental Defense Forces Program has since been incorporated with the Strategic Retaliatory Forces Program.

[89] Braswell, The Role of the Systems Analysis Staff in Defense Decision Making, op. cit., p. 17.

[90] Ibid., p. 16.

spokesman identified the significant features of the formalized plan and change procedures:

1. There is only one channel for major decision making.

2. Proposed changes receive a rapid but complete review by all parties concerned.

3. Program decisions are made on the basis of the best information available, including a validation of their long-range cost implications.

4. All major changes are made only after approval of the Secretary of Defense.

5. There is always available an approved, up-to-date five-year program for U.S. defense activities.[91]

The Role of the Systems Analysis Staff

When PPBS was installed in the Department of Defense in 1961 it had as an essential feature the analytical measurement and comparison of alternative programs. Charles Hitch had selected Alain Enthoven to perform this function, and established his small staff in the programming section of the Comptroller's office.

When asked what systems analysis consisted of, Enthoven has answered,

> Some have described it as "quantative common sense." Alternatively, it is the application of methods of quantitative economic analysis and scientific method, in the broadest sense, to the problems of choice of weapons system and strategy. It is a systematic attempt to provide decision-makers with a full, accurate, and meaningful

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[91]"U.S. Department of Defense, Planning-Programming-Budgeting System" (text of oral presentation), cited in Braswell, ibid., p. 17. For a more complete examination of the program change system see, Carl A. Johnson and James R. Tolbert, A Comparison of DOD Program Change Procedures, (Wright-Patterson Air Force Base, Ohio: School of Systems and Logistics, Air Force Institute of Technology, August, 1969), SLSR-2-69.

> summary of the information relevant to clearly defined issues and alternatives.[92]

A question even more to the point is what did Secretary McNamara hope to achieve with systems analysis. He has stated,

> In the selection of weapon systems, in the design of forces, and in determination of the level of the defense effort . . . , we are making greater use of the technique called systems analysis. Perhaps it is best described as "quantitative common sense."
>
> Systems analysis takes a complex problem and sorts out the tangle of factors. It aims to assist the decision-maker by furnishing him with quantitative courses which he could choose. Confronting a multiplicity of options we have turned to analytical techniques to assist us in our choice.[93]

Enthoven has described part of the operation of Systems Analysis,

> The introduction of any major innovation requires not only a recognition of the need for change but also the availability of the tools for an effective solution. Both were present by 1961. The economic theory of price and allocation . . . had been reduced to mathematical terms and made into a usable instrument for quantitative analysis of problems of choice. In the later 1940's the Air Force established Project RAND and Mr. Charles J. Hitch began to assemble the Economic Division of the RAND Corporation. During the 1950's, this group began applying economic analysis to the choice of weapon systems and strategies, as a research tool, to the point that, by 1961, it was

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[92] Dr. Alain C. Enthoven, "Systems Analysis and the Navy," Naval Review, 1965, reprinted in Samuel Tucker, ed. A Modern Design for Defense Decision, A McNamara-Hitch-Enthoven Anthology (Washington: Industrial College of the Armed Forces, 1966), p. 161.

[93] Robert S. McNamara, "Managing the Department of Defense," Civil Service Journal, Vol. 4 (April-June, 1964), p. 3. Also cited in Braswell, op. cit., p. 4.

> ready for use as a working management technique in the Defense Department. . . . The 1940's and 1950's also saw the rapid development of many other tools of analysis that might be grouped under the general title of "Decision Theory." The list includes statistical decision theory, theory of games, linear programming and its extensions, etc. Operations research, a new discipline in World War II, was expanding beyond the solution of tactical problems and analysis of single weapons to constantly broader fields, particularly under the influence of economists, who contributed their deceptively simple technique of isolating a problem, "arraying alternatives, estimating the utilities and cost of each, and choosing the alternative that yields the greatest excess of utilities over costs." The digital computer, a classified project in World War II, had achieved capabilities to store and display vast amounts of information and to do computations of a scale undreamed of only a few years earlier.
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> * * * * * * * * * * * * *
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> The arrival of Mr. McNamara as Secretary of Defense in January 1961 resulted in a concerted and intensive effort to focus these new developments on the vital and complicated issues of U.S. national security in the 1960's. As the first Secretary of Defense educated in the modern tools of management analysis, he made it clear to the Department that he wanted all its problems approached in a logical, analytical way.[94]

It has been established that Secretary McNamara installed a new decision-making system centered on the methods and techniques of PPBS and that systems analysis was to play a large part in its implementation. But what were the types of decisions that needed to be made and how was the Systems Analysis staff to relate to each of those decisions? The answer to these questions will set the stage for the relationship of Systems Analysis to the Services which was to develop during the 1960's.

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[94] Alain C. Enthoven, "Introduction," in Tucker, op. cit., pp. 5, 6.

Students of defense policy have noted that there are four broad categories of defense decisions: those on national strategy, force structure, weapons systems, and operations (or commanding forces in the field).[95] The first of these sets of decisions--the selection of a basic national strategy--was largely accomplished outside of the Department of Defense. The decision was the product of the criticism of Massive Retaliation, the statement of alternative strategies as in The Uncertain Trumpet, the political campaign of 1960, and the stated intention of President Kennedy to change the direction of the country's defense policy. Systems Analysis had very little to do with the selection of the strategy of Flexible Response, but the staff was dedicated to the role of making the Department of Defense responsive to the direction of the White House.[96]

The second and third categories--force structure and weapons systems--involved decisions in which the Systems Analysis staff was to play a very large role. Indeed, McNamara said he wanted Systems Analysis to provide alternatives "in the selection of weapon systems" and "in the level of the defense effort." Of the four categories of decisions, Systems Analysis was to have the least responsibility for decisions on combat operations. However, even here the office had a growing influence on the resource requirements submitted by operational commanders.[97]

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[95] Braswell, op. cit., p. 9.

[96] Hammond, op. cit., p. 64.

[97] Braswell, op. cit., p. 61.

The formal authority of Systems Analysis on these four sets of decisions was further spelled out when Enthoven was elevated to the position of Assistant Secretary of Defense (Systems Analysis) in 1965. The responsibilities of the office included those:

> 1. To review, for the Secretary of Defense, quantitative requirements including forces, weapons systems, equipment, personnel, and nuclear weapons.
>
> 2. To assist the Secretary in the initiation, monitoring, guiding, and reviewing of requirements studies and cost-effectiveness studies.
>
> 3. To encourage the use of the best analytical methods throughout the Department of Defense.
>
> 4. To conduct or participate in special studies as directed by the Secretary of Defense.[98]

In carrying out these responsibilities the Office was to perform various functions, several of which pertain to our study,

> 1. Develop measures of cost and effectiveness in order to make quickly and accurately analyses of a variety of alternative programs of force structure, weapons systems, and other military capabilities projected over a period of years.
>
> 2. Analyze and review quantitative requirements in the following functional fields:
>
> a. Force Structures.
>
> b. Weapons Systems. . . .
>
> 3. Assist the Secretary of Defense in initiating, monitoring, guiding, reviewing and summarizing requirements studies. . . .[99]

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[98] Department of Defense Directive, No. 5141.1, September 17, 1965, p. 1.

[99] Ibid., p. 2.

In addition, the head of the Systems Analysis office was authorized and delegated authority to:

> Issue instructions and one-time directive-type memoranda, in writing, appropriate to carrying out policies approved by the Secretary of Defense.
>
> Communicate directly with heads of DOD components including the Secretaries of the military departments, the Joint Chiefs of Staff and the Directors of the Defense Agencies.[100]

In summary, then, the office of Systems Analysis under Alain Enthoven was established to review requirements for forces and weapons and to conduct studies of costs and effectiveness to determine the relative merits of alternative programs. In carrying out these tasks they were authorized to communicate directly with the military services and in some instances to issue orders.

We have already noted that the military Departments had responsibilities to "organize, train, and equip forces" and to "conduct research" and "develop and procure weapons" for their services. As the special projects and task forces were being conducted in the spring of 1961 it was becoming apparent to officials in the Pentagon that with Systems Analysis making studies and recommendations on force structure and weapons systems, there was going to emerge a new type of dialogue between OSD and the Services.

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[100] *Ibid.*, p. 4.

CHAPTER II

SYSTEMS ANALYSIS AND THE 1963 NAVY DECISION TO BUY THE A-7

Enthoven began with only a few people working for him, preparing initial recommendations on the force structure to implement the President's strategy of Flexible Response. One of these systems analysts describes how he came to work for Enthoven and provides insight into their initial concept of the operation of this controversial office.

In the words of Dr. Victor Heyman,

> I was finishing up two years of teaching political science at Marshall University in West Virginia, and had served a couple of years in Air Force intelligence. I felt that I had served my apprenticeship in the hinterlands and was looking for someplace to go. I sent out some résumés . . . [and] got a call one day from Enthoven in which he described what he was trying to do for McNamara. He described it essentially in the same terms as Dick Neustadt's Presidential Power, creation of alternatives, broadening the horizons of the decision-maker, costs as well as benefits, unlocking the decision-maker from the single set of recommendations that normally comes up from below. He sounded interesting; the job sounded

> interesting, so I interviewed with Enthoven and was subsequently the first civilian hired by Enthoven on June 1, 1961. . . . I started as a GS-13 and would up an 18 in eight years. . . . Enthoven is a magnetic figure, and I enjoyed working for him and for McNamara, so I stayed.[1]

Enthoven, Heyman, Merton J. Peck (author with Frederic M. Scherer of The Weapons Acquisition Process)[2] and several others began working on the documents which would affect the translation of the force structure into the PPBS. As the Systems Analysis staff began to look at the capability of the tactical forces in 1961, they came to believe that the U.S. had neither enough tactical airpower nor the right type of aircraft to fight limited war.

Systems Analysis Influences the Air Force to Buy the Navy F-4 in 1961

The Air Force had 16 wings of F-100 tactical fighters and 2 wings of tactical bombers in its tactical force structure.[3] In the Air Force plans of 1961, the F-105 was being introduced to replace the older F-100.

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[1] Interview with Dr. Victor K. Heyman, March 12, 1970. For a general comparison a GS-13 is roughly equivalent to an Air Force major while a GS-18 is equivalent to a General officer. He was to remain with Systems Analysis until April 4, 1969.

[2] Merton J. Peck and Frederic M. Scherer, The Weapons Acquisition Process: An Economic Analysis (Boston: Harvard University Press, 1962).

[3] Schlesinger, op. cit., p. 295.

Heyman described the initial attempt by Systems Analysis to replace the expensive F-105 with a much lower cost Navy attack plane.

> The feeling that existed when I came on board was one of flexible response, the need to be able to fight conventional warfare as well as nuclear warfare. In DDR&E the assumption was that the Air Force needed a lower cost and better attack airplane than the F-105. In June/July 1961 the Air Force submitted [to OSD] a set of alternative budgets with the F-105 in all of them, and when they had purchased as many as production lines would allow they put in the F-4. But all were within our 18 wing force, so the question was exclusively one of modernization as far as the Air Force was concerned. Joe Peck in Systems Analysis, who was pulling this material together for what became the 22 September Secretary of Defense guidelines, which led to the first Five Year Force Structure and Financial Plan, put five wings of Navy A-4's into the Air Force structure for tactical fighters.[4]

The substitution of the subsonic A-4 for the supersonic F-105 was viewed with considerable alarm in the Air Force. Not only was it a Navy airplane but it was considered much too slow for the Air Force mission of counter-air-fighting other airplanes. The Air Force had taken many years to develop the doctrine of multipurpose aircraft for the tactical mission; the introduction of the F-105 was regarded by the Air Force professionals as being the most capable and versatile fighter ever developed. The pilots in the military profession considered it the

[4]Interview, March 12, 1970. The Republic F-105 Thunderchief cost was over $3 million per aircraft whereas the Douglas A-4 Skyhawk cost less than $1 million. The real difference in performance was that the top speed on the A-4 was only 600 miles an hour while the F-105 could fly over 1200 miles an hour.

latest product of continually advancing technology with the best performance available. The aircraft was recognized as being expensive, but the aircraft seemed well worth the high cost. One of the reasons the tactical pilots believed the supersonic F-105 was worth its cost was that the highest speed was expected to reduce losses to enemy action in case of war. Within the Air Force, the operations people specifically rejected the Navy philosophy on the survivability of the subsonic attack aircraft.

The Air Force doctrine on supersonic tactical fighters was expressed strongly by the officers in the Plans and Operations section of the Air Staff. One of the most respected of the operations professionals, Colonel (later Lt. Gen.) Gordon M. Graham, later expressed the general feeling of the pilots.

> We hadn't bought an attack airplane since World War II. The general doctrine and philosophy in the tactical area is that those [A-4 and later the A-7 attack] aircraft are not the kinds of machines that would survive in a sophisticated environment, and that is the kind of war that we have to be prepared to fight. So we don't want to encumber ourselves and fill our force structure up with them.[5]

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[5]Interview with Lieutenant General Gordon M. Graham, Vice Commander, Tactical Air Command, February 11, 1970. General Graham had spent nearly his entire career in the operations profession. During World War II he had flown P-51 Mustangs and was a triple ace with 16-1/2 enemy planes to his credit. During the discussion on the F-105/A-4 he was serving in the Directorate of Operations, first as the Chief of the Tactical Division and later as the Deputy Director for Operational Forces.

There was even a division of opinion on the utility of the A-4 within Systems Analysis. One of those analysts who was skeptical of the performance of the A-4 was a German physicist named Dr. Dieter Schwebs.[6] Heyman described how he and Schwebs conducted a cost/effectiveness study in November 1961 to compare the capabilities of the A-4 against the F-105, the Navy F-4 fighter, the Air Force F-100 and another Navy attack plane, the A-6 Intruder.[7]

> Dieter Schwebs, who had been on loan to Enthoven from the Institute for Defense Analysis, and a real key figure in these early years, objected on the basis of intuition more than anything else that the

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[6]Dr. Dieter Schwebs was a primary figure in the Systems Analysis organization during its early years. He had flown in the German Luftwaffe and participated in the Battle of Malta flying in Stuka dive-bombers. He was considered one of the real experts on tactical warfare by the Systems Analysis staff. He related in an interview that he was primarily convinced the Air Force needed a better airplane for close air support and that more emphasis should be given that portion of the tactical air mission. He was a strong believer in the desirability of the Air Force purchasing more non-nuclear ordnance and was one of the principle individuals behind the concept of developing the air-to-ground guided missile to be fired from fighter aircraft. Interview, May 1, 1970.

[7]The F-4 Phantom II aircraft will appear throughout this study. The weapon system was begun by McDonnell in 1954 as a single-seat Navy F4H-1, was changed to an attack designation AH-1 and then back to the fighter F4H when its armament was designed around four Sparrow missiles and its internal gun deleted. The aircraft reached operational service with the Navy in 1960 and has a top speed over 1300 miles an hour--Mach 2. The F-4 was used by Air Force, Navy and Marine fighter squadrons, and over 3000 aircraft have been purchased. See J. S. Butz, Jr., "F-4 Phantom II: Versatile and Long-Lived," Air Force and Space Digest, August, 1966, pp. 30-36.

> A-4 was a terrible attack airplane and that no cost/effective analysis had gone into that Secretary of Defense decision. He and I and another fellow on loan from the Institute of Defense Analysis put together a cost/effectiveness analysis that used the criterion of tons delivered per million dollars expended assuming that you simply bought a wing of each of these airplanes, had peacetime costs for five years, the war started and you paid for attrition. Candidates included the F-105, F-4, A-4, F-100 and A-6. The A-4 did not look good at all in this comparison. The A-6 didn't look good because of cost, and this study assumed that all the airplanes had the same accuracy in weapons delivery on target.
>
> The (Navy) F-4 beat out the F-105; it did so for the wrong reasons. We had big wing tanks on there which the Air Force never ended up buying. It was able to beat out the F-105 at the longer distances. It was therefore cheapest on a tons delivered basis, and we were able to point out that it had an intercept capability which was non-existant in the Air Force. The Air Force didn't like the idea of stopping the F-105 production cold, but they were in a tight corner. They were caught between the A-4 and no more F-105's.[8]

The decision among the A-4, F-4 and F-105 aircraft for the Air Force was a complex process with varied organizational and professional inputs. The cost/effectiveness study,which formed a part of that process, included three characteristics. First, the analysis was relatively unsophisticated in that the computer model was relatively simple.[9] Second, the economic concept of examining "full-

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[8]Interview with Heyman, March 12, 1970.

[9]*Ibid.* The best example of this is that the study assumed the same rate of attrition (loss) for each aircraft, regardless of speed. This lack of sophistication should not be shocking to the observer; Hitch was quite straightforward in admitting, "In fact, the techniques we use in the Office of the Secretary of Defense are usually rather simple and old fashioned." Tucker, *op. cit.*, p. 128.

costing was represented by calculating the total of research and development costs--if any--investment costs, and operating costs for a certain period--5 or 10 years).[10] Third, the study used the decision criterion of "cost-per-ton-mile" which was to become a commonplace term in OSD decision-making. Thus, the performance characteristic of the aircraft which was magnified was the ability to carry a heavy load of bombs or other ordnance a long distance. Accuracy and survivability in a combat environment were assumed equal for all aircraft.

The Systems Anslysis study was an important part of the process, but there were many other factors. On one occasion, an operations analyst from Tactical Air Command visited the Pentagon and argued very persuasively that the A-4 had a low degree of survivability in any heavily defended environment because of its slow attack speed. This analyst talked with Schwebs and Heyman shortly before the decision and represented at least a confirming view that the F-4 was better than the A-4, even though it cost much more.[11]

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[10]James Schlesinger noted that one of the primary purposes of OSD under McNamara was to encourage the use of the full-costing technique by the Services in considering weapons system decisions. Full-costing was one of the concepts implicit in the adoption of the Five Year Force Structure and Financial Plan. RAND P-3813, op. cit., p. 10.

[11]Interview with George W. Stickle, Deputy Chief of Operations Analysis, Tactical Air Command, February 13, 1970. Mr. Stickle earned a B.S. in aeronautical engineering from Purdue and worked at Langley Field from 1929 to 1970. He started with the National Advisory Committee

The decision that was being considered in November 1961 by Systems Analysis was a potentially significant turning point. The production line on the F-100 had been stopped for several years. The F-105 was designed as the follow-on tactical fighter to carry nuclear or non-nuclear ordnance. It also had an internal gun and a small radar set for air-to-air combat or air-to-ground delivery. The Navy F-4 was an exceptionally fast aircraft with a powerful radar set for seeking out enemy fighters, but it carried no provisions for a gun. The Navy A-4 was subsonic, cheap and could carry a large load of ordnance. The decision among the A-4, F-4 and F-105 was significant because it was one of the first major tactical air decisions by OSD under the McNamara administration and because it would have an impact on the tactical fighter force structure for many years.

DDR&E was also interested in the F-4 for the Air Force. During 1961 the staff of DDR&E asked the Air Force to evaluate the capability of the F-4 in competition with the new air defense interceptor, the F-106. In

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for Aeronautics and switched to the headquarters of Tactical Air Command in 1951. His view of the role of systems analysis and tactical aircraft studies is particularly valuable because it represents the position of a person who shares many of the professional qualifications of the analysts, but has a different organizational background. Stickle's version of the conversation with Schwebs and Heyman was related to the author, but it also is found in an unclassified version of a document, Operations Analysis Internal Memorandum 69-8 (OA IM 69-8), The Wisdom and Economy of a High Priority for Tactical Air, prepared by George W. Stickle, George Svadeba and Bobby G. Batten (Langley Air Force Base, Virginia, Headquarters Tactical Air Command, July 1969).

"Project Highspeed" the F-4 was found to have 25% greater radar acquisition and tracking range, and be capable of carrying a heavier load a longer distance.[12]

The decision was discussed in DDR&E and the Services, but Systems Analysis played a very important role. Within Systems Analysis Enthoven and Schwebs worked closely together. Enthoven related his view of the decision process:

> In 1961, one of the things Systems Analysis was involved in doing was getting the Air Force to switch from the F-105 to the F-4, and that's pretty worthwhile background for the later A-7 decision in the Air Force. Dieter Schwebs played a very big role in that decision, and he deserves a lot of credit for it. He is a very innovative guy. I remember Harold Brown in DDR&E used to call Dieter, "Dr. F-4." There was a certain amount of criticism in the Air Force of the F-4, and for a time they fought very hard to keep the F-105. Although a number of Air Force officers told us privately that they really believed we were on the right track in going for the F-4, that it was just a lot better plane. So we did press that to, from our point of view, a successful conclusion in stopping the F-105 and buying the F-4, which turned out to be a very good decision.[13]

Secretary McNamara made the decision on the F-4 for the Air Force in late 1961 after receiving the cost/effectiveness study and the recommendations of his staff in OSD. Heyman later wondered if the cost/effectiveness study had been valid, and he discussed it with the Secretary:

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[12]William Green, The World's Fighting Planes (Garden City, New York: Doubleday, 1963), p. 193.

[13]Interview with Dr. Enthoven, April 8, 1970.

> McNamara, when I pointed out several years later that we had bought the F-4 for the wrong reasons (you know, those fuel tanks the Air Force ended up not buying), he said, "No, we didn't . I bought the F-4 because it was as good as the F-105 and gave us much more flexibility.[14]

Heyman went on to describe some of the aspects of the F-4 decision

> So the Air Force took the F-4, sort of reluctantly. We had a major battle trying to get them to buy F-4's faster. If you go back in the records of the day you'll find the Air Force wanted to start with a very slow procurement program. We [OSD Systems Analysis] were trying to get them into it fast. In part this was the old strategic versus tactical fight that, the less money spent for TAC the better, and particularly if TAC was not going to be a nuclear force. Because the F-105 was built as a nuclear delivery airplane.[15]

Once the decision to buy the F-4 for the Air Force had been made, the question arose of exactly how the Navy aircraft would be modified for Air Force use. General Graham described the process,

> We had to modify the F-4 to meet USAF tactical requirements. General LeMay, Air Force Chief of Staff, directed the modifications would be made--and also the Department of Defense, the DDR&E and Systems Analysis people were very insistent that we take the airplane with a minimum amount of expense in modifications. We really made essentially only about five changes. We put bigger wheels on it and belled out the wells in the wings to take larger wheels. We reconfigured the rear cockpit so that you could fly it from the rear. We added an inertial navigation system, the first in any USAF

[14]Interview, March 12, 1970.

[15]*Ibid*.

> fighter, and we put our own life support equipment [oxygen system, ejection seats] in it, but essentially it remained pretty much the same airplane.[16]

The emphasis of OSD on a minimum number of modifications to keep the cost down is a significant factor. The five changes that were made on the F-4 in 1962 compare with the some 19-42 changes on the A-7 in 1966 (depending on how the changes are counted). It is significant that the Air Force put an inertial navigation system in the F-4, because the A-7 was to be modified with an inertial system also.

Plans for the Air Force to accept the F-4 into the force were soon blooming, and by 1964 it was reported that 16 of the tactical fighter wings would be equipped with F-4's.[17]

The Air Force Tactical Air Forces Increase to 24 Wings

The level of tactical air forces in the Air Force had been level at 18 wings since the late 1950's.[18] One of the first things McNamara had his staff in OSD examine was the possibility of increasing the number of tactical fighter wings in accordance with the new national defense

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[16] Interview, February 11, 1970. The "inertial navigation system" referred to is an automatic system using gyroscope devices to absorb and interpret data on the aircraft's speed and direction in order to provide the crew with a precise indication of its position.

[17] Green, *op. cit.*, p. 191.

[18] Heyman interview.

strategy of Flexible Response. However, before any decision could be made, an international crisis developed over Berlin.

Tension over the divided city had been rising in diplomatic circles for several months after the Soviet Union notified the world of its intention to recognize East Germany and thus legalize and perpetuate the divided status of the two Germany's. Suddenly, on August 13, 1961, East German police and army troops occupied all crossing-points between East and West Berlin. The flow of traffic and refugees was increasingly restricted and, on August 17, the East Germans began the construction of what became known as the ominous "Berlin Wall." President Kennedy formed a Berlin Task Force and pondered what response the United States should make.[19]

The U. S. forces in Europe were placed on full alert, but Kennedy and Secretary McNamara were especially worried that there might not be enough forces in Europe. Accordingly, McNamara and the Joint Chiefs of Staff called up substantial forces from the National Guard and deployed many of them to Europe. Among these forces were three wings of F-84 tactical fighter aircraft. The Berlin crisis maintained its pressure for several months, until Premier Khrushchev on October 17, announced the Soviet Union would not insist on the signing of a peace treaty

[19] Schlesinger, A Thousand Days, op. cit., Chapter 15, pp. 352-376.

with East Germany in 1961. The international crisis was apparently ended, but the three Air National Guard wings remained on active duty.

The three F-84 wings brought the total number of tactical air wings in the force structure to twenty-one. These twenty-one wings included units in the Pacific, Europe and the United States. In addition to what was then known as the Air Force "tactical force structure" there were several squadrons of F-102 air defense radar interceptors defending the overseas bases. These aircraft carried air-to-air missiles, but they were not capable of carrying bombs or guns, so they were never considered part of the "tactical fighter force." When they too were replaced by F-4's, the tactical force structure jumped from 21 to 24 wings.[20]

Heyman described the overall increase in the Air Force tactical force structure from 18 wings to 24 wings.

> The Air Force, when we [the Kennedy Administration] came in, had 16 wings of tactical fighters and 2 wings of tactical bombers, so they had 18 wings of tactical aircraft. It was McNamara and the President that decided that that wasn't enough tac air. Dieter and I worked on the call-up of the F-84's from the Air National Guard. The question was, "What is the maximum number of wings that can be retained?" You don't want to call them up and peek at something like 24 wings, and then find that your production facilities couldn't keep up with the attrition [loss through accidents, etc.] of the airplanes and then

[20]U. S. Congress, Senate, Committee on Armed Services, Authorization for Military Procurement, Research and Development, Fiscal Year 1968, and Reserve Strength, Hearings before the Committee on Armed Services, 90th Cong., 2d Sess., February, 1968, p. 766.

> fall back. We originally programmed something like 22 or 23 wings, and then it fell back to 21 wings. McNamara said level it at 21.
>
> That was 21 tactical fighter wings plus 10 squadrons of air defense interceptors. It was my brainchild that led to the 24. We went through the "gold flow" studies in 1963-64, and saw we were going to be pulling out tactical interceptors from Spain, Japan and other places. I didn't feel we had enough tac air, and I suggested to the Air Force, "Look, why don't we convert these F-102 squadrons of interceptors into tactical fighters? We can go from 21 to 24 wings. You get a multipurpose aircraft (and with the advent of the F-4, we were now in a position to get multipurpose aircraft), and you can have multiple missions--non-nuclear ground attack and tactical intercept.
>
> McNamara bought the concept and the Air Force bought the concept. So that's how you went to 24 wings of tactical fighters in the Air Force. To go from 21 to 24 wings was more of a definitional change more than a force structure increase.[21]

Thus, during the period 1961-1968 when McNamara was Secretary of Defense, there was only one significant increase in the forces considered under the label "Air Force tactical force structure." That increase was directly in line with the national strategy of Flexible Response and was accomplished by the calling to active duty of the Air National Guard in 1961. Once the National Guard wings and the overseas air defense interceptors brought the tactical force structure to 24 wings, that level was maintained in the Five Year Force Structure and Financial Plan until 1967. The only significant

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[21]Interview, March 12, 1970. The F-84 was a Korean War vintage "fighter-bomber" that had been retired from the active duty Air Force during the mid-1950's.

change to the 24 wing force structure after 1961 would be in August 1967 when it was affected by the A-7 program.

OSD Directs Joint Development of the Air Force/Navy TFX

The decision on the number of wings was intertwined with a set of McNamara decisions on another aircraft--the controversial TFX. The TFX aircraft program was to have a continued influence on both the F-4 and A-7 throughout the 1960's. The TFX was begun in 1959 as a Tactical Air Command request for a new multipurpose fighter to follow the F-105 and perform the three missions of counter-air, interdiction and close air support.

The aircraft was conceived arount two technological innovations--the variable-sweep wing and the turbofan engine.[22] The swing-wing had been under experimental research for many years, and by 1959 the research teams at the Langley Field facility of the National Aeronautics and Space Administration thought the concept was ready for a full-scale aircraft development. The purpose of the swing-wing development would be to allow an aircraft to operate at both high (Mach 2) and low (subsonic) speeds with a maximum wing efficiency to save fuel.

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[22]For an excellent treatment of the development of the swing-wing concept and its relationship to the military requirements process, see Perry, Innovation and Military Requirements: A Comparative Study, op. cit. The whole TFX decision process has been treated in Robert J. Art, The TFX Decision: McNamara and the Military (Boston: Little, Brown and Co., 1968).

The turbofan was also a recent breakthrough which promised to develop an engine with adequate thrust, but with a significantly reduced fuel flow. The combination of these two innovations was expected to contribute to greatly increased range and endurance of the aircraft.

Headquarters USAF took TAC's request and in 1960 developed a Specific Operational Requirement for the new aircraft to be designated the TFX (later the F-111).[23] The Air Force requirement was approved by DDR&E, and by October 1960 the Air Force was ready to go out to industry with a request for design proposals.

At the same time in 1960 the Navy was in the concept formulation phase of developing a new fighter called the F-6 Missileer. The Missileer was built around the concept of a large subsonic aircraft powered by the same turbofan engines as the TFX, and carrying a high-performance missile called Eagle. Faced with the significance of the decisions to develop the Missileer for the Navy and the TFX for the Air Force, Secretary of Defense Thomas S. Gates, in November 1960, directed both programs to wait until the new administration could evaluate them.

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[23]The TAC request was dated January 14, 1960, and was developed into Specific Operational Requirement (SOR) 183 by July, 1960. Testimony of Colonel John L. Gregory, Jr., April 2, 1963. U.S. Congress, Senate, Committee on Government Operations, TFX Contract Investigation, Hearing before the Permanent Subcommittee on Investigations of the Committee on Government Operations, 88th Cong., 1st sess., Part 3, p. 718. (Hereafter referred to as the TFX Hearings).

One of the first decisions McNamara made as Secretary of Defense was to have the services combine their efforts and develop a single fighter aircraft. The cost savings on such a joint program were expected by McNamara and OSD to be substantial. McNamara's decision was communicated to the services through a memorandum from the Director of Defense Research and Engineering, Dr. Herbert F. York, dated February 14, 1961.[24]

The response of the Navy was strong in tone and quick in forming. In a memorandum to DDR&E on March 9, 1961, the Assistant Secretary of the Navy for Research and Development, Dr. James H. Wakelin, Jr., spoke for the Navy position. His letter not only marked the Navy's opposition to the TFX, it identified <u>some</u> of that opposition with the inability of the TFX to perform the close air support mission. He firmly stated the Navy's need to develop a new light-weight attack plane (that eventually became the A-7).

> . . .the Navy considers that the TFX is not suitable for Navy use since it has little or no application to Navy or Marine missions. Further, the Army has indicated that the TFX will not meet the close-air support requirements. The Navy has better aircraft for our purposes in being and in development.
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> The Navy is interested in R.D.T.&E. [Research, Development, Test and Evaluation] programs for light attack/close-air-support aircraft which would incorporate variable sweep wing design and turbofan engines.

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[24] Prepared statement of Secretary of the Navy, Fred Korth, <u>Ibid</u>., Pt. 6, p. 1385.

> With regard to your referenced memorandum, I agree that the TFX program should be re-oriented in order to provide a good light attack aircraft to meet the close-air-support requirements of the Army and Marines. We also have in mind interdiction, and reconnaissances--in other words a versatile aircraft with emphasis on limited warfare missions. In this respect, I commend to you the extensive experience of the Navy in developing light attack/strike/close-air-support aircraft (F-J4, A-4D, A-2F) and suggest that the Navy should be the program manager for the R.D.T.&E. program, in the event that such a program were established.
>
> . . .I recommend. . . . (a) Drop the TFX altogether. (b) Procure A-4D-5's now to meet the requirements of all services for early close air support under visual flight conditions. . . . (c) Procure A-2F's [later known as the A-6 Intruder] now to meet the requirements of all services for all-weather close air support and interdiction. (d) Procure F-4H's [Phantoms] now to meet the requirements of all services for air superiority aircraft, to be followed by Eagle-Missileer, when available. . . . (f) Expand the scope of the planned Navy-Marine R.D.T.&E. program, to develop a follow on light attack aircraft for the A-4D-5, to include Army and/or Air Force participation. . . .
>
> I am concerned about what appears to be overemphasis on a single aircraft configuration to meet these vital operational national defense requirements.[25]

The new light attack aircraft that Wakelin referred to was in the preliminary stages of concept formulation in 1961. It was called the VAX (for "aircraft, attack, experimental"), and was conceived as a much lighter, smaller and less costly aircraft than the TFX. The Navy was considering, as Wakelin noted, the use of a swing-wing

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[25] *Ibid.*, p. 1462.

and the incorporation of turbofan engines to give it the capability for long endurance.

The Navy in 1961 was also considering the alternative of improving the A-4 Skyhawk. There had been many proposals for improving the A-4--mainly by incorporating the turbofan engine--for years. The OSD pressure to have the Navy participate in the TFX program brought this alternative to the surface once again. The internal dynamics of one of these proposals involved a Navy officer who was to play a major role in the later development of the A-7. Commander Robert F. Doss later described how the TFX affected the Navy's plans for the VAX and the proposal for the improved A-4:

> I was the junior member of a TFX-VAX strategy team hurriedly formed in the Chief of Naval Operations Office to deal with the TFX issue (Spring, 1961). My primary interest was attack--hence VAX. In examining the preliminary VAX requirement--small (under 30,000 pounds), twin-engined, high performance--it was obvious we were a long way away from getting it. There were no engines of the appropriate size in development. I didn't think we could wait. The A-4 as configured would not meet the demands of Flexible Response and conventional warfare. It was primarily a miniature nuclear bomber. It had three bomb racks, but two were always used for external fuel. It was underpowered for multiple carriage of conventional ordnance. But there was no other airframe as good. I proposed a gap-filler, a big A-4, using the TF-30 engine which was planned for the Missileer. With encouragement from the team I called Leo Devlin of Douglas. In one week we threw together a rather respectable airplane proposal

> with a great thrust-to-weight ratio, enough internal fuel, space for avionics, and five bomb racks. Leo estimated the cost to develop it to be under $25 million. This idea was set aside temporarily because it would have interferred with the prospect of getting the all-new VAX.[26]

The TFX was extensively studied in DOD in an attempt to reconcile the differing requirements of the services. Many of these studies were conducted by DDR&E, and Dr. York formed a Committee on Tactical Air to achieve consensus on the issue. (In May, 1961 Dr. York left the Department of Defense and Dr. Harold Brown became the new Director of DDR&E). The role of DDR&E, as the principal technical agency responsive to McNamara, was especially significant on the TFX because of the technological complexity of the new aircraft. The position of DDR&E, as stated by one of Brown's top aides, A. W. Blackburn, related the TFX to the Air Force acquisition of the F-4.

> Neither service wished for the program to proceed as a joint development because it would deny them the privilege of autonomously developing their own weapon systems. Moreover, there was a feeling that it would be unwise to have the entire high performance spectrum for the next generation of tactical aircraft covered by a single development effort. Finally, there is a strong feeling held by many of the "old pros" in the weapons system development business that competition between the Air Force and the Navy tends to generate better, more effective weapons. Throughout the exercise these points were never formally voiced by the services but

[26]Letter, Captain Doss to the author, October 25, 1970.

> rather they chose to argue against the bi-service development program on the grounds of technical infeasibility. This was at a time when the Air Force was making a decision to buy into the Navy F-4H program and indeed to supplant much of the F-105 scheduled production with the Navy-developed F-4H. Thus, the outstanding Navy-developed aircraft will be the backbone of both Air Force and Navy tactical airpower until introduction of the TFX. The question of technical infeasibility is indeed difficult to substantiate under these circumstances particularly when one contemplates the very much greater flexibility of operations offered by the incorporation of such TFX innovations as the variable sweep wing and the afterburning turbofan engine.[27]

The discussion among DDR&E, the Air Force and the Navy on the TFX issue continued throughout the spring and summer of 1961. The Committee on Tactical Air, chaired by DDR&E, rendered its report on May 19 and recommended the joint development of the TFX and a new light attack aircraft. In the meantime, all funds for the Navy Missileer program had been canceled by OSD, and the Navy was faced with the possibility of having no new air defense fighter, unless it was to be the TFX.[28]

The Air Force and the Navy agreed on the concept of having a joint fighter, but no agreement could be reached on what the technical details and specifications should

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[27]Memorandum for the Record, March 1, 1963, prepared by Mr. Blackburn to summarize the TFX decision process after he heard of the Senate investigation of the contract award. Blackburn was the head of the Tactical Weapons Office in DDR&E and had been intimately associated with the TFX since its inception in 1959. Memorandum reprinted in TFX Hearings, Pt. 5, p. 1203.

[28]The Missileer was canceled during the period March-May 1961, according to Dr. Wakelin, TFX Hearings, Pt. 6, p. 1476.

be for the aircraft. On August 22 the two services reported to Secretary McNamara that it was not considered technically feasible to build a single TFX that would meet both the mission requirements of the Air Force for a long-range interdiction fighter and the Navy for an air defense fighter.

McNamara did not let the service arguments prevail. He sent a memorandum, which had been prepared in DDR&E by Blackburn, to the Secretaries of the Air Force and Navy on September 1, 1961:

> My office has reviewed the most recent positions of the Air Force and the Navy with regard to joint development of a tactical fighter for both services. I believe that the development of a single aircraft of genuine tactical utility to both services in the projected time frame is technically feasible.
>
> A single aircraft for both the Air Force tactical mission and the Navy fleet air defense mission will be undertaken. The Air Force shall proceed with the development of such an aircraft.
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> *
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> Changes to the Air Force tactical version of the basic aircraft to achieve the Navy mission shall be held to a minimum. . . .
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> *
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> If the expeditious resolution of differences in specifications cannot be achieved, these differences shall be delineated and presented to the Director of Defense Research and Engineering for solution.[29]

The McNamara memorandum of September 1 marked the beginning of the joint Air Force/Navy development of the TFX. The planning in October 1961 was that 876 TFX's

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[29] Exhibit 42 in <u>TFX Hearings</u>, Pt. 6, pp. 1513-1514.

would be developed, approximately two-thirds of which would go to the Air Force and one-third to the Navy.[30] The development and procurement costs were expected to be high, perhaps as high as seven billion dollars. The cost of the TFX program was to be a major factor in defense decisions for the entire decade of the 1960's. The cost of the TFX was expected to be high because it was attempting technological advances in two areas: variable sweep wing and turbofan engines. Later in the development of the program a third major technical advance was to be attempted --a completely integrated electronic navigation and bombing system. The uncertainties inherent with these advances made the decision-makers consider the interactions among development programs. If the TFX development took longer than planned, the fighter forces would need more aircraft on an interim basis until the TFX was available. If it cost more than expected, there would possibly be less money to spend on other programs. Of course, these are only two possibilities; there were countless considerations that had to be made, and the alternatives were not simple or easy to forecast.

The McNamara administration had entered OSD in 1961 with high hopes of making the decision process more centralized. As Systems Analysis, DDR&E and the rest of OSD was settling in to the task of implementing Flexible

[30] U.S. Congress, Senate, Committee on Appropriations, DOD Appropriations FY1970, 91st Cong., 1st sess., July 29, 1969, Part 4, p. 34.

Response, they were also searching for personnel, developing methodologies for approaching their work, and getting adjusted to their decisional environment. Of course, not everyone in OSD was new or brought in by McNamara or his aides. There were many officials who provided continuity between the Eisenhower and Kennedy administrations, and many of them remained in Defense after McNamara left in 1968. But there were also many new individuals who, while they were still learning the complexity of the organizational process and the differential perspectives of the professionals in Defense, were called on to participate in a series of unusually significant decisions.

The decisions in the field of tactical aviation involved the selection of weapons systems and a change in the level of tactical air force structure. The TFX began the most expensive development program of the 1960's. It was to influence every other major program in the Air Force and Navy plans for tactical air. It directed the Navy and Air Force into a joint program and came after the complete cancelation of the Navy's Missileer program. The Navy was allowed to continue with the concept formulation of a new attack aircraft, but the future of that program was most uncertain in 1961. The OSD decisions on Air Force tactical fighters had created a great amount of turbulence in the Air Staff. First, the F-105 was canceled and the subsonic A-4 put in its place in the force structure. Then OSD was convinced of the merits of the supersonic F-4 Phantom for the Air Force, and it replaced the plans for the A-4.

As 1961 ended the whole picture of the tactical air forces looked vastly different than it did a year earlier. The Navy was committed to a joint program it had not anticipated; the Air Force was planning to buy large numbers of a Navy fighter. The entire decade of the 1960's in the field of tactical airpower would largely be measured by the three programs started in 1961 by McNamara and OSD--the TFX, the F-4, and the new, unknown attack airplane.

<u>The Competition for the TFX Contract--1962</u>

As McNamara ended his first year as Secretary of Defense, the Air Force had submitted the request for proposals on the TFX to industry. Six bids were returned with proposals to develop the aircraft. The competition for the contract and the evaluation of the Boeing and General Dynamics proposals through four source selection evaluations will be only briefly described here.[31]

The selection process was conducted from October 1961 to November 1962. After the fourth evaluation the combined Air Force/Navy Source Selection Board voted

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[31]The award of the TFX contract was extensively covered in the <u>TFX Hearings</u> and developed in narrative form in Art, <u>op. cit</u>.

unanimously to recommend the Boeing Company as the winner. On November 21, 1962, OSD formally announced that the General Dynamics - Grumman team had been awarded the contract to develop the TFX with $439 million as the initial fee. As The TFX Decision described it,

> McNamara had thus overruled the unanimous recommendation of one colonel, four major generals, six lieutenant generals, five generals, five rear admirals, and one admiral.[32]

The McNamara decision on the TFX is not the subject of this study, but it is impossible to omit for two reasons. First, the decision prompted a Congressional investigation by Senator John L. McClellan that was to dominate the defense decision environment during the hearings (February-November 1963) and to a lesser degree through 1970. Second, many of the participants in OSD and the military on the TFX decision were to be the actors in later decisions on the A-7 program. The TFX (later known as the F-111) then, becomes an important part of the environment for the A-7, which in 1962 was wrapped up in the Navy proposal for a new attack aircraft.

The Swing-Wing VAX Proposal for a New Navy Attack Aircraft

The proposed attack aircraft was called the VAX and was planned by the Navy around the concept of a swing-wing, supersonic aircraft about one-half the size, weight and

[32]Robert J. Art, The TFX Decision, op. cit., p. 78.

cost of the TFX. (It is significant in establishing the Navy's priorities to note that it was willing to let the Air Force have the primary responsibility for management of the TFX program, if it could get approval for and have control over, the attack aircraft VAX program.[33] As the concept was defined by the Navy in 1961-1962 the VAX proposal envisioned an aircraft capable of Mach 2 supersonic flight at high altitude, but only a high subsonic (Mach .9) speed at sea level. The development costs for 24 aircraft were estimated at $500 million with the production bill running about $3.5 billion for 1700 aircraft.[34] The VAX had many features similar to those of the TFX/F-111; in fact, the Boeing VAX design proposal looked so much like the losing Boeing F-111 design, Pentagon staffers immediately named it the F-55.5. From the view of DDR&E and Systems Analysis there was one major problem with the VAX: the Navy was proposing a supersonic aircraft to perform a mission (i.e., ground attack) for which supersonic flight had never been a requirement.[35] This disparity between the requirement and the proposal, coupled with the aircraft's high development cost led Systems Analysis to recommend against the VAX. Secretary

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[33] Interview with Mr. George A. Spangenberg, Director of the Evaluation Division, Naval Air Systems Command, March 2, 1970.

[34] Aviation Week and Space Technology, July 8, 1963, p. 17.

[35] Interview with Mr. Frank Horton, DDR&E, October 15, 1969.

McNamara subsequently postponed the VAX program, and in late 1962, asked the Navy to reevaluate its requirement for a follow-on attack aircraft and to conduct a study of the Naval Air Force's needs for force structure in the time period 1965-1972.

The incentive for the Navy to reevaluate its need and redefine the qualities it wanted in a new attack airplane was provided by Systems Analysis. Just as Systems Analysis had participated in the reduction in the F-105 program and the cancellation of the Missileer in 1961, Systems Analysis played a central role in the evaluation of the Navy attack force. Dr. Heyman, who was in 1963 in the Air Force Tactical Air section of Systems Analysis, noted that his organization was responsible for <u>terminating</u> the procurement of the Navy A-4, "which put the Navy in a bind, so they <u>had</u> to come up with a new airplane." Heyman described the influence of Dieter Schwebs in what he called "the killing of the A-4."

> Dieter, I guess from the original studies of the A-4D-5, felt that it was a bad airplane and put, in the Five Year Force Structure and Financial Plan, a complete halt to the procurement of any Navy attack airplane. . . .That just left a gap; you kill the A-4D-5 and you don't buy anything else. This forced the Navy to really get in and do a study. They had been talking about the A-4D-6 for some time, but without really getting into what it was and why it would be a significant improvement.

> Dieter couldn't understand why they couldn't use the F-4 for both missions [fighter and attack] giving them much greater flexibility in deck loading and that sort of thing. The Navy kept coming back, saying "You put an F-4 on a catapult, and you can't load it up like you can on land." But Dieter had no "salt water in his veins."
>
> So that led to the Sea-Based Air Strike Forces Study and the design competition for the A-7.[36]

The Navy Sea-Based Air Strike Forces Study-1963

The Sea-Based Air Strike Forces Study was a Navy study developed in response to OSD request and was run from February to May 1963. The exercise was under the supervision of Vice Admiral William A. Schoech, the Deputy Chief of Naval Operations for Air. A steering committee was established composed of Dr. Wakelin, Admiral Schoech, Vice Admiral Ulysses S. G. Sharp, Jr., Rear Admiral John B. Colwell and Major General Edward W. Snedeker, USMC. Rear Admiral Turner E. Caldwell and Dr. Alain Enthoven were ex-officio members.[37]

This technique of forming a study group composed mostly of military officers with Systems Analysis representation was to be followed in other studies during the McNamara period. One of the economic principles that Enthoven was interested in emphasizing to the services was that of "full system cost"--considering the multi-year operating costs as well as the investment costs on

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[36] Interview, March 12, 1970

[37] Aviation Week and Space Technology, April 15, 1963, p. 37.

any new airplane. Enthoven described how he approached the Sea-Based Air Strike Forces Study and its relationship to developing a Navy requirement for a new attack aircraft.

> I had felt my office played an important role in that original decision, and the role was in reviewing the Navy's program we made the point to them that they should think about total system cost to do the job and not just procurement cost of the airplane. If you thought about total system cost you would see that, with the new engines technology would make available, that it ought to be possible to build a plane that would be a lot more capable than the A-4 for a very small increase in cost, so that in terms of effectiveness relative to cost you would get a big increase. We criticized the A-4 as being not effective enough in relation to cost and encouraged the Navy to come in with a new plane with substantially more payload, although I remember the idea was in part to figure some comparatively cheap way to develop it.[38]

Enthoven did not attend all the meetings, so Mr. Russell Murray and Dr. Dieter Schwebs were the Systems Analysis representatives for most of the exercise.[39] The Navy members of the Study group were all hand-picked, and the result was the first of the large, Navy studies in the 1960's directed specifically at Systems Analysis. It was composed of two parts: first, an analysis of attack

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[38]Interview, April 8, 1970.

[39]Mr. Russell Murray, 2d was an aeronautical engineer with a B.S. and an M.S. from M.I.T., 1950. He had worked in the Missile Flight Test Analysis Division of Grumman Aircraft Engineering Corp. and spent eight years as the Assistant Chief of the company's Operations Analysis Group. At the time the study started he was a consultant in Systems Analysis, but in April 1963 he joined Enthoven's staff full-time.

carrier force levels; second, an analysis of the composition of a carrier air wing (type of aircraft). The second phase of the study was run by Captain (later Vice Admiral) E. P. Aurand, the Director of Air Weapon System Analysis staff of the DCNO (Air). The only option open to the phase two study group was to change the attack aircraft of the carrier air wing. The panel investigated 27 future and existing aircraft designs in the categories of light, medium and heavy attack. In addition, fighter aircraft and five versions of the VAX were priced and evaluated with 144 different combinations of avionics (aviation electronics), ordnance and airframe programs. The general decision rule of the panel was to program a minimum number of fighters, reconnaissance, all-weather attack, electronic counter measures and anti-submarine planes and then to maximize the number of attack aircraft without endangering the safety of the fleet.[40]

The portion of the study concerned with the attack mission evaluated, among others, the Douglas A-4, the North American FJ Fury, a modified Grumman A-6, and a Vought Aeronautics proposal. (The preliminary proposal from Vought was numbered the V-461 and was a subsonic

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[40] Aviation Week and Space Technology, June 15, 1964, p. 110. Interview with Mr. George Haering, Office of the Chief of Naval Operations, April 29, 1970. Haering at the time (1963) was employed by the Operations Evaluation Group which evolved into the present Center for Naval Analysis (CNA), a major non-profit corporation. He was the Air Attack Task Leader and wrote the Gross Offensive Cost Effectiveness, Tab A, on the final report. In addition, he briefed Secretary of the Navy Fred Korth, Dr. Enthoven, and Secretary McNamara on the study.

version of their successful F-8 Crusader; the V-461 later turned into the present A-7). Due to a late submittal, the Vought proposal was not analyzed in as much detail as the others. The mechanics of the study were relatively simple, one of the most critical parameters being a substantial increase in the desired range over the version of the A-4 that was already serving in the fleet. At the long range selected (600-700 miles) it was determined the aircraft could stay beyond the range of about ninety percent of the potential enemy's aircraft and yet cover close to one hundred percent of the world's potential limited war areas.[41] (Supersonic flight was still not a requirement.)

The cost/effectiveness analysis done by George Haering pointed out that the preferred aircraft design available in 1965 would best be obtained by matching a modification of an existing operational airframe with the Pratt and Whitney TF-30 turbofan engine which had been planned for the Missileer and was going on the TFX/F-111. Of the aircraft in the fleet, the analysis showed the F-4 and the A-4 lacked the long range required to meet this requirement. The follow-on A-4 design submitted by Douglas (similar to the design proposed by Captain Doss and Douglas' Leo Devlin in 1961) met the range specified, as did the North American FJ Fury design.

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[41] Flight International, June 18, 1964, reported the range requirement of the study was to be 600-700 miles. (P. 1025). Aviation Week and Space Technology, June 15, 1964, p. 112, quoted the combat radius as 621 nautical miles and gave the "close to 100%" figure.

These two aircraft were indistinguishable in cost/effectiveness, and both designs promised cost/effectiveness factors greater than any of the other proposals. The Grumman A-6 was recognizably higher in cost. The Vought V-461, although in preliminary form, promised an aircraft of comparable effectiveness with only a slightly higher cost. The VAX was not favored because of the expected 4-5 years to develop this wholly-new aircraft.

The Sea-Based Air Strike Forces Study was also significant in that it stated the feelings of the Navy staff toward the supersonic/subsonic argument in general and the F-111 in particular. The VAX and the already-approved F-111 were proposals for supersonic, heavy attack aircraft (in addition to the air defense mission of the F-111). The costs of the VAX were estimated to be so high relative to the A-4 that three light attack aircraft could be purchased for the price of one VAX. If the supersonic aircraft did not promise a commensurate increase in effectiveness, the study group did not feel justified in recommending the VAX.

The summary and conclusions section of the Study stated, "Supersonic performance does not appear to promise an order of magnitude decrease in vulnerability although there is conflicting opinion on this point. In any event, an enormous increase in A-4D-6/FJ-5 attrition would be required to make the F-111 superior in cost/effectiveness to the A-4D-5/FJ-5."[42] Haering ran a sensitivity test to determine the value of supersonic speed for the attack mission. He found the increased effectiveness would not be worth the added cost and so briefed it to Secretary McNamara. McNamara agreed.[43]

The result was that the Douglas modified A-4 design and the North American FJ design tended to dominate the study, but their dominance was not overwhelming. The study group did not consider the small differential in cost/effectiveness (less than 10%) to be sufficient to warrant a decision to develop a new aircraft. This led the members of the group to include such factors as compatability with the present equipment in the fleet, maintenance, experience, and flight simulators. When viewed in this light, there seemed little reason to recommend anything but another version of the light weight, low cost A-4, changed primarily to accomodate the TF-30 turbofan engine. Accordingly, the study recommended purchasing the modified Douglas A-4 with the TF-30.[43] The new light attack aircraft was given the designation VAL. The VAX proposal was delayed further and finally canceled altogether. However, since the procurement of

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[42] Chief of Naval Operations, Sea-Based Air Strike Forces Study for the Secretary of Defense (U) May 17, 1963, Part II, p. A-7. Unclassified extract cited by Mr. Haering, interview, August 13, 1970. The cost relationship of three light attack aircraft to one VAX was cited in Aviation Week and Space Technology, June 15, 1964, p. 12.

[43] Haering interview.

all current models of the A-4 had been halted by Systems Analysis, the Navy decided it needed the new VAL as soon as possible. Efforts were taken to speed the new proposal through the decision process in minimum time.

The Study was signed by Admiral Anderson, the Chief of Naval Operations, dated May 17, 1963, and sent to Secretary McNamara.[44] Aviation Week reported that the Strike Panel Report had "smooth sailing" with OSD largely because of the early and continuous consultation with OSD representatives (Enthoven, Schwebs and Murray).[45]

What did Systems Analysis think of the VAL and what effect had the coming of Murray had on Systems Analysis? Although Murray's education had been as an aeronautical engineer, his experience with the operations research group at Grumman had convinced him of the importance of asking broader and more searching questions than those engineers usually asked. He was particularly interested in the operation of the new Systems Analysis staff in Defense and was in general agreement with the application of economic principles to weapon systems selection as enunciated by Enthoven. Murray was becoming less influenced by his engineering training than by the emerging discipline of systems analysis. Insight into his influence on the development of the A-7 can be seen from Alain Enthoven's description of him,

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[44]Chief of Naval Operations, Sea-Based Air Strike Forces Study for the Secretary of Defense (U) May 17, 1963. Aviation Week and Space Technology, June 10, 1963, p. 25.

[45]Aviation Week and Space Technology, April 15, 1963, p. 37.

> Russ Murray was really "Mr. Tactical Air" for the Systems Analysis office; that is, Russ and I tended to divide up the work based largely on background and prior interest. My own background had been in the strategic nuclear business, doing strategic studies at RAND, and I also knew something about and was very interested in NATO. So I tended to do the nuclear and NATO business. Russ had a background in tactical air, so he was the leading person on tactical air questions in Systems Analysis and worked also on various other "general purpose forces" questions (Army equipment, Navy ships, etc.).[46]

Since Murray had worked at Grumman, and Grumman had built many Navy attack and fighter aircraft, he was later asked if his studies there had influenced his thinking about the subsonic/supersonic argument for attack airplanes. He answered,

> Yes, without a doubt. When you work for a company that's pushing a subsonic product (the Grumman A-6 Intruder) there is a natural bias to favor a subsonic machine, and I don't know how much of that I suffered from. But it seemed to me that the arguments were pretty clear. We did some cost work which is hard to do in the industry because your empirical base is so small. You can get data on your own airplanes (and even some of that is hard to get since some of the contract people do not want to tell the engineers what the costs are). We did some work that indicated the supersonic airplane on a pound per pound basis was running something like twice the cost of a subsonic airplane, not counting the avionics. We also tried to do some work on survivability, and it seemed to us the difference between penetration at .9 Mach and 1.2 Mach was small and might even be negative. . . .At any rate I had an

[46] Interview April 8, 1970.

> opinion that the subsonic would be the better buy, that twice as many subsonic aircraft would be a better buy than half as many supersonics.[47]

Since Murray had been in almost continuous consultation with the Navy Study Panel on the VAL, he was familiar with the Navy proposal and recommended approval to Enthoven. Enthoven carried the Systems Analysis recommendation to McNamara.

McNamara approved the development proposal for the VAL aircraft, and the Navy was cleared to formalize a written requirement and a request for proposals. The requirement was dated the same day as the Study was submitted, May 17, 1963, indicating prior staff work. The speed and efficiency with which the requirement was drafted and implemented was largely due to the decision to hand-pick the study group members. In particular, the group included Captain John Fair, the Assistant Head of the Aviation Requirements Branch of the DCNO (Air), the office responsible for writing the requirement. The document was entitled the Specific Operational Requirement (Follow-on Light Attack Aircraft) and went from the Office of the Chief of Naval Operations to the Chief, Bureau of Naval Weapons (the organization which became the present Naval Air Systems Command.)[48]

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[47] Interview with Mr. Murray, April 28, 1970.

[48] Specific Operational Requirement No. W 11-26 (Follow-on Light Attack Aircraft) (U), May 17, 1963.

The requirement stated the need for a single-seat, single-engine attack aircraft using the Pratt and Whitney TF-30 turbofan. It stated the importance of maintainability, simplicity of operation and stressed the criticality of funding. The principle was reaffirmed that the cost had to be held to a minimum so large numbers could be bought within a limited budget. The avionics (aviation electronics) were to be simple; existing equipment was to be used until such time as the Integrated Light Attack Avionics System (ILAAS), which was under development, was proven ready to be installed in an aircraft. A requirement was included for a two-seat version to serve as a trainer.[49]

Captain Henry Suerstedt, who had worked on the Sea-Based Air Strike Forces Study, was appointed the VAL Project Manager in the Bureau of Naval Weapons, Captain Suerstedt's charter included the directive, "This program is of the highest priority and greatest importance; . . . he is hereby delegated full authority to direct and control (not simply to coordinate) Bureau actions."[50]

Since Captain Suerstedt had worked for many weeks on the Study, he knew intimately what the Navy staff wanted in the VAL aircraft. He coordinated the Bureau activities, and preparations were quickly made to issue a formal request for proposals from industry. Within a week after

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[49]Aviation Week and Space Technology, August 12, 1963, p. 26.

[50]Memorandum from Chief, Bureau of Naval Weapons, to all Assistant Chiefs, May 15, 1963. Project Master Plan, Vol. 1, June 30, 1968, pp. 1-5-1.

the requirement had been received (May 15) the Bureau issued a synopsis of the request to industry (May 24, 1963).

The decision to open the competition (and not just award a contract to Douglas for a modification of the A-4) was made at the highest levels in the Department of the Navy. There were at least two good reasons for opening the competition. First, the estimated performance of the modified Douglas A-4 had not dominated the Sea-Based Air Strike Forces Study or any of the other Navy analyses. North American had done a great deal of work on their modification of the FJ, to the point where it was competitive with the Douglas design. Vought was considered a possibility in the competition, but at this point it was far behind North American and Douglas.

The contractors were, of course, trying to convince Admiral Schoech (DCNO Air) and other DOD officials that the TF-30 engine would require a major structural change in the small A-4 fuselage, so an entirely new aircraft would result.[51]

The second reason for opening the competition was the political climate in Washington over weapon system contracts. The TFX had just gone through extensive source selection procedures, and the Air Force, OSD, and the Navy were in the midst of congressional hearings before the McClellan committee. The VAL contract looked like it was

[51]Interview with Mr. J. W. Lankford, Vought Aeronautics Director of Marketing, April 1, 1970.

leading to the most important development in attack aviation for several years, and the whole decision-making process was working under the shadow of the TFX.

In this political atmosphere and with the hope that opening the competition would provide the Navy with a better attack aircraft, the decision was made. The exact location of the decision is uncertain, but several participants indicated Admiral Schoech as the Deputy Chief of Naval Operations for air was a central figure. He was heard to remark that it would be politically infeasible to develop the VAL as a modification of the A-4.[52] There was widespread belief in the industry and in DOD that Douglas was the odds-on favorite to win the competition.

The synopsis of the request for proposal went out to industry on May 24, 1963, and the formal request was dated June 29. Captain Suerstedt coordinated the Request and carefully outlined a series of penalties the contractor would incur if he failed to meet certain guarantees of weight, speed, maintainability and delivery dates.

Ling-Temco-Vought Bids on the VAL

The VAL contract competition in the summer of 1963 took place amid the Congressional controversy over the award of the TFX contract to General Dynamics of Fort Worth, Texas. LTV's Vought Aeronautics Division was also

[52] Haering interview, August 13, 1970, and Murray interview, April 28, 1970.

a Texas company, located at the Dallas Naval Air Station in a leased Navy facility. LTV had been awaiting the opportunity to bid on another Navy aircraft. By 1963 the Navy F-8 Crusader program was cutting back and was scheduled to terminate in 1965, when the VAL program would be at its peak. The lean times and the lack of alternatives combined to induce LTV to make an all-out effort to win the VAL contract.

The position of LTV in the competition from the view of the Bureau of Naval Weapons was later related by George Spangenberg. He pointed out the strong factor of company desire to win the competition and the contract:

> At that time Vought was running well behing because they hadn't faced up to the problem of doing an honest-to-goodness modification of the F-8. Their studies were built around the J-57 [engine in the F-8] and it just did not have the range to do a good attack job. I think the Vought effort was the biggest surprise to the industry as a whole. We were aware of the amount of effort they were putting into it, and they needed the business badly.
>
> One thing that normally happens in this business is the guy that needs the business the worst ends up doing the best job. Sometimes the company that needs it the most gets the award, and then you read in the trade journals that they were awarded the contract <u>because</u> they needed the business. It is really <u>desire</u> and the amount of effort the contractor puts into the job.[53]

The tradition of building Navy aircraft at Vought extend as far back as 1917 when the company designed a biplane known as the VE-7. In the 1920's and 30's the

[53]Interview with George Spangenberg, August 17, 1970.

company produced five different attack aircraft and the O2U-1, the very first Corsair, in 1927. Various dive bombers and torpedo bombers were produced before and during World War II, but the most famous and successful Vought creation was the F4U Corsair. Corsair pilots established an overall kill ratio of 12 to 1, and between 1943 and 1953 over 12,000 of the aircraft were produced.

The Navy tradition at Vought is more than a public relations theme; there is a widespread feeling of "belonging" to the Navy family which is reinforced by the usually high percentage of ex-Navy officers and pilots in the company's management. The president of Vought Aeronautics was Paul Thayer, World War II Navy ace and formerly an experimental test pilot with the company.[54]

The nominal decision to incur the substantial expense of preparing a bid on the VAL competition was made by Paul Thayer, but was agreed to by James Ling, the Chairman of the board of LTV, Inc. Conrad Lau in concert with Sol Love, the head of the Engineering Department, set about to organize the company's effort. While LTV's engineering people were designing the VAL proposal to be submitted to the Strike Force study group, the marketing division set about to convince the Navy decision-

[54] LTV advertisements often carry the boast, "Thayer's organization has a higher ratio of ex-fighter pilots in management and engineering than any other company." Until 1968 when the company became deeply concerned with its image in the Air Force, it was almost completely Navy-oriented. Between 1968 and 1970 many Air Force pilots were hired by the company, including General Gabriel Disosway, former commander of the Tactical Air Command.

makers to open the competition to the industry--or at least to those companies with aircraft in service which could be modified to the VAL mission. J. W. Lankford, a Navy Commander and Dauntless dive-bomber pilot in World War II, worked directly for Conrad Lau at this time and handled much of the marketing activity, along with John Allyn, the Vice President of LTV's Washington office. Lankford spent about four days a week in Washington and made a major effort to convince Admiral Schoech that Douglas would have to extensively modify their aircraft to accept the larger TF-30 engine.[55] The direction of the argument was that the opening of the competition would benefit the Navy as well as LTV, in providing a better aircraft.

With the opening of the competition LTV formed a Blue Team and a Purple Team. The Blue Team worked on the LTV design, and the Purple Team forecast what the competitors would do. Sol Love was the Program Team Director and had been associated for the preceding few years with attempts to adapt the F-8 Crusader to carry air-to-ground ordnance in addition to its air-superiority mission. He described the competition:

> In my judgment, the Navy did an excellent job in projecting what their requirements were with respect to carrier-based attack forces and justifying it to DOD. . . . We took a look at it and decided there was one way to win the competition, and that was to optimize

[55]Interview with Mr. Lankford, April 1, 1970, at Vought where he is now the Director of Marketing.

> the airplane for the attack role. There were no supersonic requirements, the radius, payload, cost, maintainability and reliability were important. So we set out to come up with an airplane that used as many common parts of the F-8 as we could. . . .We proposed to the Navy that we'd be willing to take pre-negotiated penalties for failure to meet the performance guarantees.[56]

The magnitude of the LTV effort can be gauged from the internal publication Light Attack Airplane VA(L) Primer, which was written to summarize the LTV proposal and plan for winning the award. Under a section called the "Name of the Game" it outlined the philosophy of development, the Navy requirements, the company risk, and the "Size of the Pot," which was estimated to be worth about $500 million to LTV for 600 aircraft.[57]

One section is illuminating on the interaction of marketing with design:

> The V-463 design philosophy was established recognizing the existence of several basic facts:
> 1) In order to be competitive, CV's [Chance Vought's] entry had to be a member of the F-8 family.
> 2) The F-8 maintainability history has not been competitive with that of the strongest VAL competitor, the A4D.
> 3) The A-4D was the favored airplane for the VAL, was almost procured without a competition, and was the basis for a large part of the final VAL type specification.
> 4) A cost effectiveness evaluation was to be made and the results of it utilized in the selection of a VAL winner.[58]

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[56] Interview, April 2, 1970. His reference to the validity of the Navy requirements will take on more meaning when it is contrasted with the LTV view of the AF requirements process later in the study.

[57] LTV, V-463 Light Attack Airplane, VA(L) Primer, (U) undated.

[58] Ibid., p. 2.2.2.

The implications of this were:

1) To preserve F-8 family resemblance the V-463 must include at least: single, chin duct inlet; high wing with a planform of the F-8; low horizontal tail.
2) It is not possible to compete in weight.
3) Maintenance and turnaround characteristics must be greatly improved.
4) Dollar cost and spotting factor (size) are to be minimized.[59]

The Primer stressed the "experienced, old-line Navy Team," and outlined the decision-makers in DOD. As an insight into who LTV thought were the important decision-maker, the listing is significant.

Secretary of Defense	Davis, Gilpatric
Comptroller	Murray,* Schwebs,* Hitch
DDR&E	Brown,* Muse,* Perry
Mainstream	Spangenberg,* Morton, Suerstedt, Hines, Masterson, Aurand, Bringle, Haering,* Connor, Thach, McDonald Wakelin, McLucas Enthoven,* Schoech, Korth, McNamara.[60]

The Primer went on to discuss the backlog of each company with the intent of showing how LTV's was the lowest of the four competitors. They even went into the total military RDT&E and Prime awards from 1958 to 1962 by state, and showed how Texas had only 6.1% in 1958 versus 23.6% for California. In 1962 the balance had shifted further against Texas (3.5%) and for California

[59] Ibid. The "planform" of an aircraft is the top view.

[60] Those interviewed for this study are indicated by *. Robert McNamara declined an interview.

(25%). The differences showed California had increased 41.9% in the four years while Texas had declined 29.9%.[61]

An LTV cost/effectiveness study influenced these aspects of the LTV VAL 463 design:

1. eight external bomb and rocket racks instead of six.

2. 10,000 pounds of internal fuel instead of 6500.

> "Analysis indicated superior cost/effectiveness would obtain from exceeding specified performance rather than by attempting to cut cost. The physical characteristics of the F-8E precluded extensive cost reduction."

The V-463 analysis showed it superior in close air support and with multiple missions. The problem of commonality with the F-8 proved to be a weighty subject. When the pieces were laid out, counted and put on the scale, the tally showed:

Airframe structure	13% by weight
Airplane systems	58% by weight (component quantity)
Special support eq.	76% including government furnished
Special support eq.	72% excluding government furnished
Spares	13%
Major tooling	7.6%

By aircraft section the count looked even worse:

Section	#Parts	% Identical	%Similar to F-8
Wing	6543	0	96
Nose and midsect.	7663	.1%	98
Aft sect & tails	4326	27.7	67.4

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[61] *Primer*, p. 5.1.2.

> Although most V-463 airframe parts will be new, their similarity to previously designed and produced F-8 parts affords a kind of commonality not measurable in pounds or numbers of parts.[62]

This problem of commonality between the V-463 proposal and the F-8, of which it was supposed to be only a modification, was never really resolved. The general subject of commonality was an issue that was to come up again over the 1969 Air Force/Navy versions. LTV and the industry apparently did not know it, but the decision-makers in the Bureau and the Navy headquarters had already acknowledged that the proposals would have very little production commonality with previous aircraft. The changes in the fuselage to accomodate the TF-30 engine would lead to changes in the wings to carry the heavier load, which would reflect in changes in the landing gear, etc., in an iterative process familiar to all aeronautical engineers.

The issue is significant, however, because the lack of commonality was a factor in the A-7 congressional appropriation in January 1964, and formed the basis for later Systems Analysis reservations about the aircraft in comparison with the A-4. Specific individuals in Systems Analysis later disputed the validity of the A-7/LTV competition because of this commonality issue, and

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[62] Ibid., p. 6.6.2.

the philosophy of a low cost-per-ton-mile criterion being the basis for the competition.

One of these individuals was Mr. Pierre M. Sprey who joined Systems Analysis in 1965. Sprey was of the opinion that it might have been better to let Douglas build another version of the A-4 than to open up the competition. Sprey discussed the relationship of Systems Analysis to the decision to proceed with the VAL/A-7 and the criterion for the decision.

> Looking back on what we knew at that time it is not clear that we should have built any airplane at all. Looking back to the alternative of improving the A-4 versus building a new airplane it is not clear there was any justification whatsoever to build a new airplane rather than keep on building better A-4's. The Douglas entry was not a modified A-4, but was a totally new airplane. The Navy convinced Russ Murray that we needed a new airplane, and that the appropriate criterion was to build the cheapest possible airplane to deliver a large amount of ton-miles. This is a dreadful criterion for building airplanes. I might add, and it's evident it's a dreadful criterion by the way the airplane has turned out. I think that is the most important institutional factor, because Russ Murray was directly responsible for convincing Alain Enthoven, who, in turn, was directly responsible for convincing McNamara to go ahead with the whole thing. And, of course, the way they got Enthoven and McNamara to go ahead with this whole idea that they were going to have a cheap airplane. That the whole competition was just going to be cost to deliver ton-miles. . . . One of the chief reasons LTV did win the competition was their sales department made a basic decision at the beginning of the whole program that they were going to make the airplane look like the F-8, and that was done

> specifically and intentionally to buy-in to the program. The fact of the matter is the A-7 is a totally new airplane, requires completely new tooling, and cannot be built on an F-8 production line.[63]

The Evaluation Process

The contractors had until August 12, 1963, to respond to the Navy's request for proposal with engineering data and until September 3 with cost figures. Because of the short time period the contractors were able to convince the Navy to postpone the request for a two-seater version of the aircraft. Four contractors submitted designs. The Douglas A-4F design showed an aircraft outwardly looking like the A-4 Skyhawk, but with increased wingspan, wing area, and a larger fuselage to hold the TF-30 engine. It had a somewhat shorter range than the competitors on internal fuel, but planned to make up the difference with external tanks. The North American Aviation NA-295 entry was a modification of the FJ Fury but with a completely redesigned structure.

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[63]It should be understood that Pierre Sprey is an acknowledged iconoclast and was one of OSD's resident critics. At the time of the competition in 1963 he was not in Systems Analysis, but was working for Grumman as a research scientist. He had a B.E. in Mechanical Engineering, an M.S. in Statistics and had a Ph.D. but for dissertation. His view was not that Grumman should have won the competition, but that Douglas should have. His views are important because they represent a continuing Systems Analysis position of a hard look at military requirements and a preference for low cost, simple aircraft which has persisted through 1970 and can be distinguised as pressures on the AX and F-15 programs. Interviews, October 16, 1969, and March, 1970.

The Grumman G-12 entry was designed around the A-6 Intruder all-weather attack aircraft, but Grumman proposed to strip it of all the expensive avionics equipment and just manufacture the basic airframe. Even with this effort the G-12 cost was about $2 million per aircraft. However, it used two J-52 engines instead of the suggested TF-30 powerplant. In addition, the Grumman position was weakened by its recent award of part of the TFX contract as half of the General Dynamics/Grumman team.[64]

The proposals were submitted to the Bureau of Naval Weapons which was located in Washington just across the river from the Pentagon. There they went to many offices, one of which was the Evaluation Division, headed by a civilian aeronautical engineer with one of the most extraordinary reputations in the Navy Department: George Spangenberg. Spangenberg went to work for the naval aircraft factory in 1935, transferred to the Bureau of Naval Weapons in 1939, and had been involved in design work and aircraft competitions ever since. As Director of the Evaluation Division he supervised the VAL competition.[65]

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[64]Interview with Pierre Sprey. Grumman was to perform essentially the Navy portion of the development program.

[65]His level of supervision is indicated by Public Law 313 which places him roughly equivalent to general officers although there is no specific rank. He is the holder of the Distinguished Civilian Service Medal. He graduated from Michigan in 1935 with a B.S. and an M.S. in aeronautical engineering.

The evaluation was conducted in a dual effort: the first runs were to pick the best aircraft design, and the second to test whether the winning proposal would be cost/effective enough to warrant a new development program. In the first round, the designs were subjected to intensive analysis on their ability to perform three types of attack missions: ability to defend against an enemy attacker in air-to-air engagements; close air support of ground forces; and isolation of the battlefield (interdiction). Instead of the normal ten mission/radius problems, the aircraft designs were evaluated on eighty-five different range/payload combinations, ostensibly to demonstrate to OSD thoroughness of the Navy's evaluation methods.

George Spangenberg described the results of the design competition:

> The way the competition ended up was that technically the North Anerican and Vought designs were very close, from a capabilities standpoint. The capability of the North American and Vought designs were virtually the same, with the Douglas design being less capable. Then the cost of the Douglas design and the Vought design were the lowest. Vought had a substantial edge over North American in price.
>
> So the choice really became even; you took the greatest capability at the least cost. You didn't really have to do much analysis to see the way the thing was going to come out. I think those experienced in the art can really make the determination of what is the

> most cost/effective without going through all the elaborate process, when you have that clear a case.[66]

Once the best aircraft design was selected the evaluation continued to determine the cost/effectiveness of the new system compared with the A-4E which was in the fleet. At this time the costs of the LTV V-463 proposal were about one million dollars per aircraft with the Douglas proposal and the A-4E about $800,000.[67]

According to *Aviation Week*,

> The final evaluation showed that the L-T-V proposal was comparable in effectiveness to two A-4E's at short combat radii or four A-4E's at long radii, this prime factor representing the quantum jump in attack capability that the Office of the Secretary of Defense had laid down as a requirement for approving procurement of a new light attack aircraft.[68]

The cost/effectiveness study showed the LTV design to be "clearly superior" to the A-4E. This having been decided, the evaluation was signed by Chief of the Bureau of Naval Weapons in November 1963 and sent to the Chief of Naval Operations Office where it was distributed to the Navy staff. The Secretary of the Navy, Fred Korth, approved it on November 13, shortly

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[66] Interview with Spangenberg, August 17, 1970.

[67] *Aviation Week and Space Technology*, March 30, 1964, p. 17.

[68] *Aviation Week and Space Technology*, June 15, 1964, p. 112. The Bureau of Naval Weapons Report is "VAL Competition, Analysis and Recommendation (U)," November 4, 1963. The Weapons System Analysis Office report is "VAL Cost-Effectiveness Evaluation (U)," November 1963, NAIR Report No. R-5-63-64.

before he resigned. The new Secretary was to be Paul H. Nitze who had been McNamara's Assistant Secretary of Defense for International Security Affairs. The VAL decision was in the meantime sent to OSD where it was examined by Systems Analysis and DDR&E.

Russell Murray was the primary OSD Systems Analysis representative assigned to monitor the evaluation, and his view of the process is enlightening. When asked how Systems Analysis viewed the Bureau of Naval Weapons procedure, he said,

> George Spangenberg did his usual, first-rate, excellent job on the competition.[69]

When asked if he respected Spangenberg's office, he responded philosophically,

> It's the only one like it I've ever even heard of. He's just in a class by himself. He is extremely knowledgeable and absolutely the soul of integrity. Unfortunately he got on McNamara's list for what he said about the F-111, but I've known George for a long time and I have the highest respect for him. He is first rate from a technical sense and with a sense of integrity. He's done great service for the country. As far as evaluating the competition, Systems Analysis was there really to sort of monitor what the evaluation was. Nobody in our shop was competent and nobody in DDR&E was competent to second guess George on what the airplane was going to do and how much the contractors' estimates should be changed. From my point of view having known George for a long time, I figured that anything he said was the most knowledgeable, authoritative source on performance. I took that face value. Then we ran some relatively simple tests of the airplane to see if it

[69]Interview, April 28, 1970.

> lived up to what the Sea-Based Air Strike Forces Study had claimed such an airplane would. We presented that to McNamara and he agreed. He said "OK, let's go ahead with it," and that was that.[70]

Alain Enthoven commented about the significance of his position on this decision.

> That illustrated a point that I thought was important about the kinds of things the Systems Analysis office did, and that is, we were not always just looking for a cheaper airplane per copy; we were looking for something that could do the overall job cheaper, which might mean a more capable plane. . . . We thought the A-7 was a good idea, and the approvals went through pretty quickly. It was clearly a step in the direction we thought we wanted to go.[71]

DDR&E was not intimately involved with the selection of the prime contractor for the VAL (now designated the A-7). The Director of DDR&E, Dr. Harold Brown, was consulted on the selection of LTV and approved, but reported that since high technology was not involved, DDR&E really had no large role.[72] DDR&E did, however, speed up the A-7 decision process by waiving the requirement for a Contract Definition phase.

The speed with which the A-7 proposal went through the OSD decision process is indicative of the priority and merit attached to it by the Navy and OSD. There is no set time for each of the four phases of the "system acquisition cycle," but Concept Formulation can nominally take 12-18 months or more and Contract Definition often

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[70] Ibid., For George Spangenberg's position on the F-111B see TFX Hearings, Pt. 2, pp. 324-325.

[71] Interview, April 8, 1970.

[72] Interview with Dr. Harold Brown, April 8, 1970.

required 12-13 months to complete. Although there was no formal Contract Definition Phase in DOD in 1962, the TFX took 14 months (October 1961-November 1962) to complete the nominal activities of Contract Definition.

By way of contrast, the A-7 decision process took only 6 months from the establishment of the Navy requirement until the contractor was selected. Although DDR&E had just announced in 1963 the requirement for all future weapon systems to include a Contract Definition phase, Contract Definition on the A-7 was waived by OSD. The reasoning given was that the intent of Contract Definition had been met by the Navy's evaluation and selection process.

This establishment of the process by which the original A-7 requirement was developed by the Navy, approved by Systems Analysis, designed and marketed by LTV, evaluated by the Bureau of Naval Weapons and agreed to by OSD and the Navy, is important to the understanding of the rest of the study. Even though Systems Analysis played a continuing role in many aspects of the process, in retrospect, the decision-making criteria on the 1963 Navy decision were little changed from those used by the Navy for years.[73]

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[73]The evidence for this categorization is based on many views of the decision process, but was stated clearly by Russ Murray in an interview April 28, 1970. "The Navy 1963 decision would have gone that way even if Systems Analysis had not been there." Similarly, Victor Heyman supported this view in interview, March 12, 1970. "The decision to buy the A-7 as against any other VAL was a Navy decision. It was not at all an OSD decision. . . ."

However, once the Navy decision to buy the A-7 was made, the question of how many were to be purchased arose. This led Systems Analysis almost immediately to ask, "Why shouldn't the Air Force be in this?"[74] Before this question could be answered the Congress would have to give its approval for funding the A-7 program. With the backing of DDR&E and Systems Analysis, Secretary McNamara signed the Navy request to approve the procurement of the A-7 on November 23, 1963, and sent it to Congress.

Congress Approves the Program

When the A-7 program came before Congress in November, 1963, it was in the form of a Department of Defense Request to reprogram $34,400,000 of Fiscal Year 1964 funds.[75] Until the reprogramming was approved the A-7 program was limited to using unobligated funds from the Research, Development, Test and Evaluation account and had already used some $15 million from the Department of Defense emergency funds.[76] The way the

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[74]Confirmed by the person who asked the question, Victor Heyman, interview, March 12, 1970.

[75]Reprogramming is covered by DOD Directive No. 7250.5, March 4, 1963, and DOD Instruction 7250.10, March 5, 1963. The latter documents reads, "Reprogramming actions are defined as changes in the application of financial resources from the purposes originally contemplated and budgeted for, testified to, and described in the justifications submitted to the Congressional Committees is support of fund authorization and budget requests. . . ."

[76]U.S. Congress, House, Committee on Armed Services, Department of Defense Reprogramming of Appropriated Funds: A Case Study. Report of the Subcommittee for Special Investigations of the Committee on Armed Services, 89th Congress, 1st sess., July 8, 1965, p. 12. (Hereafter called the Reprogramming Report).

law was written, the two Armed Services Committees and the two Appropriations Committees had fifteen days to object to the reprogramming action. If they did not notify the Secretary of Defense to the contrary in that time period, it could be assumed they approved, and the program could go ahead. If the A-7/VAL request had been the only reprogramming action to come before the Congress that year, that is probably what would have happened. However, in the preceeding two years over $7.4 billion dollars had been reprogrammed in the DOD accounts for aircraft, missiles, ships and RDT&E alone.[77] Congress, fearing the loss of control over its appropriations function, held up the A-7 request until hearings could be held on the request in January 1964.[78]

Insight into the issue can be obtained from a House Report in 1965 after another Navy reprogramming request was received, this time on the Douglas TA-4E two-seat trainer. (The decision had been made in the Navy to defer the design of a two-seat TA-7 trainer and to proceed with the A-4 version). The House Report noted:

> The reprogramming of the VAL and the TA-4E followed a similar pattern. Both programs were presented to the committee as modifications of existing aircraft in the Navy inventory. Both provided for an initial procurement of a few planes but these relatively small buys opened the door to follow-on procurement of substantially greater quantities of aircraft.

[77] *Ibid.*, p. 32.

[78] *Aviation Week and Space Technology*, December 23, 1963.

> The VAL was more than an ordinary reprogramming action in that it initiated development of a major weapons system involving future requirements of airplanes. The VAL procurement was limited to those design/manufacturers who had single engined aircraft in the Navy inventory capable of incorporating a TF-30 turbo fan jet engine. Despite these limitations, the Navy insists that this was competitive procurement. . . .The Navy presented the VAL as the modification of an aircraft already in the Navy inventory. However, Navy witnesses agreed that the modifications involved a new engine and changes in the fuselage, wing and avionics.[79]

The intent of Congress, especially the House Committee on Armed Services which issued this report, is set forth in the recommendations,

> The Secretary of Defense should issue appropriate instructions. . .to insure that:
> 1. Each reprogramming proposal contains all information necessary for its complete and objective evaluation by congressional committees concerned.
> 2. The reprogramming procedure will not be used as a vehicle to obscure or excuse confusion and delay in decisionmaking, or result in avoidance of the safeguards of competitive bidding.
> 3. The military departments will not be allowed to begin a major weapons development program through the reprogramming process.[80]

Although the Reprogramming Report was not written until 1965, these same arguments were heard over the VAL request. Nevertheless, the House Armed Services Committee approved the reprogramming request on January 15, 1964. Representative Otis G. Pike (Dem., N.Y.) was not in favor of the program and was quoted as saying, the

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[79] Reprogramming Report, pp. 13, 14.

[80] Ibid., pp. 3-4.

"Navy played games with Congress on this procurement. . . . The VAL program is designed to keep some production lines, which were to close down this summer, in operation."[81] He said the VAL was not common with any F-8 version, but would be a 90% new aircraft and called it a "brand new $2-billion program illegitimately conceived and dedicated to the proposition that members of Congress will vote for any military program because they would rather be called soft in the head than soft on Communism."[82] He then proposed an amendment to delete the Navy's A-7 appropriation of $171.5 million in the Fiscal 1965 DOD budget. His amendment was defeated by the House of Representatives on February 20, 1964.

LTV was announced the winner of the A-7 competition on February 11, and a Fixed Price contract of $24,119,698 was negotiated for the initial research and development of the first three prototypes. At that time the Navy was apparently thinking about buying nearly 1000 A-7's at an average unit cost per weapons system (including support and personnel costs) of $1.7 million.[83] Discounting the cost of government-furnished equipment (like the TF-30 engines) the value of the contract to LTV was estimated to come close to one billion dollars. The Marines had expressed an interest in buying the A-7 for their forces, but only the boldest optimist

[81] _Aviation Week and Space Technology_, March 30, 1964, p. 17.

[82] _Ibid_.

[83] _Ibid_., p. 16.

could have predicted the Air Force would be getting the A-7. Meanwhile, the Air Force interest in the A-7 was strongly influenced by developments in the Army and their possible effect on the allocation of roles and missions.

CHAPTER III

THE 1965 AIR FORCE DECISION TO BUY THE A-7

Air Force Close Air Support Doctrine 1961-1964

1961 opened with Chairman Khrushchev's challenge on the "wars of national liberation" and was shortly followed by a crisis in Laos in March and the crisis over Berlin in August. President Kennedy spoke on the danger to American interests in Laos during March when it looked like the new administration might commit troops to the inland kingdom.

In this increasingly tense environment the Army made a move to capture from the Air Force the mission of providing close air support for U.S. ground forces. In June the Secretary of the Army, Elvis J. Stahr, Jr., let it be known that he was not satisfied with the present roles and missions arrangement and desired to extend Army Aviation into the performance of the close air support mission.[1] Rumors began flying that the Army could be getting as many as eleven squadrons of A-4 attack aircraft.[2]

Secretary McNamara's decision in October, 1961, to buy the F-4 rather than more F-105's for the Air Force was strongly influenced by his desire to build up tactical forces

[1] "Roles and Missions Get New Review," Army-Navy-Air Force Journal, June 3, 1961, pp. 1-6.

[2] Army Times, November 11, 1961.

and to provide a better capability for close air support. In later testimony before the House Armed Services Committee, McNamara said,

> I don't disagree a bit as to the implication that in the past, the Air Force has not directed sufficient attention to Close Air Support for the Army. I think this is absolutely correct. Quite frankly, that is why I ordered the Air Force to procure the F-4, and replace the F-105 with the F-4. It is a better airplane [for close air support].[3]

The decision on the F-4 coincided with a memorandum which McNamara sent to the Secretaries of the Army and Air Force, directing the Air Force to study tactical airpower needs and composition of forces. In this memo he referred to another letter in which he had expressed a tentative decision that the Air Force should have a large force of tactical aircraft, and that it should include a specialized close air support aircraft.[4]

Secretary of the Air Force Eugene Zuckert promptly answered with a request for an increase in the number of tactical fighter wings and recommended the future purchase of a new multipurpose aircraft.[5] Within three days Secretary of the Army Stahr forwarded his comments on

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[3]Reported in Army Times, June 15, 1966.

[4]Memorandum, Secretary of Defense to Secretaries of the Air Force and Army, October 9, 1961. Secretary of the Air Force File on Close Air Support, Research and Analysis Library, Headquarters USAF. The other letter referred to by McNamara was unavailable for research.

[5]Memorandum, Secretary of the Air Force to the Secretary of Defense, November 1, 1961, Close Air Support File, Secretary of the Air Force Research and Analysis Library, Headquarters USAF.

Zuckert's memo and stated the Army position against multi-purpose aircraft. He noted the Army needed "Close Air Support aircraft of a proper type" which would be "under a system of operational control which makes them responsive to Army needs."[6] In addition, Secretary Stahr attached a list of desirable characteristics for close air support aircraft. Generally these included: 1) rapid response; 2) extensive loiter time; 3) operations at night and in bad weather; and 4) accurate delivery of mixed ordnance. (Among these characteristics the qualities of "extensive loiter time" and "accurate delivery" of ordnance were to play a major role in the decisions to modify the Air Force A-7.)

In addition to the activity in the Pentagon, the doctrine of the Army was again pointed out by a 1961 study on close air support done by the Army Command and General Staff College, Fort Leavenworth, at the request of the Continental Army Command. The Study concluded,

> 1) Joint Air Force/Army planning should be decentralized to field army-tactical air force level or to the independent corps.
> 2) Enough Close Air Support sorties should be allocated to meet requirements.
> 3) Air craft and units allocated to Close Air Support should be under command of the Army commander
> 4) Air units designated to support Close Air Support tasks must be equipped with aircraft designed for ground attack as a primary mission.[7]

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[6] U.S. Army Close Air Support Requirements Board, Close Air Support (Fort Meade, Maryland, 1963) Annex A, pp. 62, 64.

[7] Cited in A Short History of Close Air Support Issues, U.S. Army Combat Development Command (Fort Belvoir, Va., July, 1968), p. 56.

Secretary McNamara was interested in how these doctrinal percepts would translate into requirements and hardware development. In a memorandum to Secretary of the Army Stahr in April, 1962, he was critical of the Army's conservative approach to developing quantitative and qualitative requirements for new aircraft and helicopters:

> I do not believe the Army has fully explored the opportunities offered by aeronautical technology for making a revolutionary break with traditional surface mobility means.[8]

He called for an innovative approach "conducted in an atmosphere divorced from traditional viewpoints and past policies."[9]

The implications were clear: that McNamara did not consider the present Army weapons and transport capability adequate, and that he was challenging the Army to investigate the technological advantages of helicopter and fixed-wing aircraft mobility. At the same time McNamara sent another memorandum to Secretary Zuckert in which he threatened to remove the close air support mission from the Air Force unless it developed a better capability for Army support.[10]

The Secretary of the Army in April 1962 orally gave the job of developing"an innovative approach" to Army

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[8]Secretary of Defense Memorandum to the Secretary of the Army, April 19, 1962. See *Aviation Week and Space Technology*, June 25, 1962, p. 26.

[9]*Ibid.*

[10]*Aviation Week and Space Technology*, January 14, 1963, p. 27.

requirements to the Commanding General of the Continental Army Command, General Herbert B. Powell. Powell directed the formation of the U.S. Army Tactical Mobility Requirements Board with Lt. Gen. Hamilton H. Howze as the chairman. Howze had been the first Director of Army Aviation and promptly selected 17 Army generals, other officers and civilians, to participate in seven working groups.[11] It is significant that many of those selected had identified themselves with Army mobility in the past.

An indication of the unique status of the Howze Board can be obtained from the implicit charter given by the Secretary of Defense. Aviation Week reported that McNamara's instructions were so sweeping that top officials were advised the Howze Board's recommendations were not to be reviewed by Army conservatives for possible dilution or veto.[12]

The Howze Board met in the period May--July 1962 and submitted its final report to the Secretary of Defense in August. The Board's recommendations were centered on a broad expansion of Army aviation designed around a new type of army unit--the "air assault" division. The Board recommended the formation of six air assault divisions out of a total Army force level of sixteen divisions. The extent of this break with tradition can be measured by reference to Table 3.

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[11]Membership on the Howze Board's many panels was listed in Aviation Week and Space Technology, June 25, 1962, pp. 26-27.

[12]Ibid.

Table 3. Army Aircraft Per Division

1945	10	
1957	50	
1962	101	
Howze Board	459	(Air Assault Division only)

Source: Armed Forces Journal, April 25, 1970, p. 19.

The 459 aircraft (fixed-wing and helicopters) in these divisions would perform the missions of observation, reconnaissance, air transport and attack. The attack helicopters would be armed with anti-tank and anti-personnel weapons such as rockets and machine guns. In addition, the Board specifically recommended Army development of a close air support fixed-wing aircraft.

The Howze Board recommended a massive increase in the total number of Army aircraft from the approved level of 4,887 to 10,992 (for Fiscal 1967). The cost of the current level was $1.662 billion while the Howze recommendations would cost $3.784 billion.[13]

With the formation of any official board with the scope and mandate given to the Howze Board, it was apparent that a major attack on or a significant modification of the Roles and Missions agreements could be expected. The Air Force took two actions to respond to the McNamara challenge. First, in April 1962, the same month that McNamara had written to the Army, the Air Force organized the Special

[13] Aviation Week and Space Technology, May 27, 1963, p. 30.

Air Warfare Center to provide an increased tactical air capability in counterinsurgency situations. The new Center was authorized 1000 men and 2 squadrons of converted T-28 trainers and converted World War II B-26 medium bombers for use as close air support aircraft. The twin-engined B-26 Invader was redesignated the A-26 to indicate its new attack mission.

In January 1963, as the Army pressure increased with the publication of the Howze Board's recommendations, the Air Force increased the manning of the Special Air Warfare Center from 1000 to 3000 and the aircraft from two to six squadrons. (Some of these squadrons were to be among the first Air Force units deployed to South Vietnam as advisors.) One of the most significant aspects of these six squadrons was that they were established outside of what came to be known as the "24-wing tactical fighter force structure." Thus, increases in Special Air Warfare aircraft did not have to come at the expense of F-4 or F-111 wings in the OSD-approved Five-year plans.

The second action the Air Force took in 1962 on this subject was the organization of a board to review the findings and recommendations of the Howze Board. The Air Force board was named after its chairman, Lt. Gen. Gabriel P. Disosway, the Deputy Chief of Staff for Programs and Requirements in the Air Staff. (General Disosway was later to become the commander of the Tactical Air Command.) The Disosway Board was critical of the approach taken by the Howze Board in neglecting to examine the Air Force capabilities to meet Army requirements.

> We think that the Howze Board has some very good ideas in it. Certainly we are not opposed to the Army being more mobile.... We think that the Howze Board did not take into consideration the full capabilities of the Air Force. Certainly in the close-support role, the reconnaissance role, the assault-landing phase, and the research-and-development phase, we think it needs more looking into.[14]

The Disosway report devoted considerable space to a comparison of relatively fast jet aircraft (like the F-4) and slower vehicles (like the proposed Army fixed-wing aircraft and helicopters) in the performance of the close air support mission. The F-4, the Report noted, was 2.5 times faster than the Army aircraft and could carry six times the firepower.[15]

The Disosway Board proceeded to recommend an increase in the Air Force force structure from 21 to 25 tactical fighter wings and to equip more of those wings with F-4 Phantoms. In describing the process later, General Disosway said, "The fundamental thing about the Howze Board was that they established for themselves the mission of close air support."[16]

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[14] Conclusion of the Disosway Board cited in <u>A Short History of Close Air Support Issues</u>, <u>op. cit</u>., p. 61.

[15] <u>Aviation Week and Space Technology</u>, May 27, 1963, p. 30.

[16] Disosway Interview, April 3, 1970.

Neither Board's report won the whole-hearted approval of Secretary McNamara. He did agree with the Air Force that the Howze Board

> "....did not take full account of the extent to which the Air Force could supply and perform some of the functions which the Howze board recommended the Army provide... two functions in particular: one, mobility, near-battlefield mobility, movement of supplies into the battlefield, etc., and....close support. I suspect that on both of these counts....we will find that the Air Force can give far more support to the Army than the Army assumed or that the Howze board assumed."[17]

One thing which both boards had recommended was an increase in the amount of testing in the field of tactical warfare weapons, concepts and organizations. Accordingly, the Army tentatively formed the 11th Air Assault Division and in 1963 began a series of air mobility tests. In 1964 the unified Army/Air Force Strike Command began a series of joint exercises. The exercises were elaborate attempts to measure the costs and effectiveness of the Army's new 11th Air Assault Division against the units of the Tactical Air Command by the collection of vast amounts of computerized data. However, there was no immediate agreement on the conclusions of the exercises, and the 11th Air Assault Division was allowed to remain intact.

The Cuban missile crisis occured in the fall of 1962, just after the Howze and Disosway boards had presented

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[17]McNamara quoted in Aviation Week and Space Technology, May 27, 1963, p. 30.

their recommendations. The results of this real-life exercise of the tactical forces showed to both military and civilian leaders in the Pentagon the need to further define and refine the conditions under which and the procedures by which the Air Force was to participate in ground operations. McNamara again linked the Roles and Missions arguments to the change in national policy. In a memorandum to the Secretaries of the Air Force and Army in February 1963, he requested a series of close air support studies and noted,

> Much of the impetus for the Army desire to provide its own close air support, reconnaissance, and airlift stems from the low national priority which these missions have enjoyed in recent years. It seems appropriate that this situation will change.[18]

Before the Close Air Support Boards could meet, however, another change in conceptual direction occurred. The Army Chief of Staff had forwarded a recommendation to the Secretary of the Army for the development of a weapons helicopter. The Army Secretary (now Cyrus R. Vance) denied the request, but in doing so he set in motion a program that was to have consequences far outside the bounds of the Army. Vance's memo of March 1963, read,

> After most careful review and consideration, I have concluded that the marginal military advantages represented in the attached proposal to initiate a weapons helicopter development program do not warrant the expenditure involved.

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[18] Report of the Close Air Support Board, 1963, Vol. 1., Headquarters USAF, AFXDOD.

> Accordingly, the proposal as it now stands is disapproved.
>
> At the same time I want to emphasize that this disapproval is, in essence, a signal to lift the Army's sights in its efforts to provide aircraft for the helicopter escort role. We must now press forward with speed and imagination to develop a more advanced weapons system which will nearly approximate the optimum.
>
> In view of the foregoing, please have the Staff prepare recommendations aimed at reaching this objective.[19]
>
> /s/
> Cyrus R. Vance
> Secretary of the Army

The direct result of that memo was the initiation of the Cheyenne (AH-56) program to build a 220-knot, attack helicopter to compete for the close support role.

Within six months another change occurred which affected the outlines and form of the close air support mission rivalry. The Army conducted a study called The Army and Aviation (TARA), which was a comprehensive and complete view of the subject. Some of its revolutionary concepts were published in a letter from the Army Chief of Staff, General Earle G. Wheeler, to all Army commanders, October 14, 1963:

> 1) Air vehicles should fall into two categories--"direct support" and "general support."
> 2) The Army believes a new terminology should be applied to distinguish service functions.
> 3) The Army does not want to form another air arm.

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[19]Memorandum from the Secretary of the Army to Chief of Staff, March 27, 1963. The entirety of the memorandum is reprinted in the Armed Forces Journal, December 14, 1968, p. 7. Vance had succeeded Elvis J. Stahr, Jr. as Secretary of the Army on May 21, 1962.

> 4) The Army changes will not involve roles and missions or duplicate equipment.[20]
>
> Specifically, "Units of other Services will conduct close air support with aircraft that can deliver large volumes of ordnance on call of the ground commander. Aerial vehicles of the Army will conduct aerial fire support with aerial vehicles capable of discriminating firepower in close proximity to ground combat elements."[21]

On command and control of these forces it read,

> (1) The Army considers that the doctrine of centralized control does not fit the modern or future land battle. When applied to all types of aviation activities, centralized control would limit the effectiveness of aircraft in support of the land battle. The Army does not disagree with the concept of centralization where it actually results in greater effectiveness and efficiency. However, centralization should not apply to organic air vehicles of Army forces;
>
> (2) The Army does not believe that the ground commander needs command over general support aircraft provided by other Services. The ground commander does require a voice in time over target and timing of all types of delivery of units and supplies.[22]

The Army Tries to Interest the Air Force in the A-7

Before we leave this series of studies it is essential to see another source of pressure exerted on the Air Force by the Army's demand for a specialized aircraft for close air support. That pressure was exerted in the Boards which McNamara requested in his February 1963 memorandum. There were two boards--an Army Close Air Support Board and an Air Force one. The purpose of

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[20] The Army and Aviation Study, August, 1963, cited in A Short History of Close Air Support Issues, op. cit., pp. 66-67.

[21] Ibid. (Emphasis added.)

[22] Ibid.

the boards was to: "determine the Army's quantative requirements for close air support in the FY1965-70 time period" and "to determine improvements that can be made in close air support effectiveness during this time period."[23]

The Army Close Air Support Board formally stated that the Air Force was best qualified to determine what type of aircraft was suited for close support. However, it stated there were qualities which the Army would like to see in any new weapon system. These features included the ability to carry 4,000 pounds of ordnance, take-off from very short fields (1000 feet in length), loiter for long periods of time, incorporate an "all-weather navigation capability." However, the Army only requested a "simple, visual target acquisition means." Specifically, the Army Report called for the Air Force to buy an aircraft like the Navy VAL (A-7).

The Air Force Board concluded that improvements were needed in three basic areas: improved survivability, improved target acquisition by the strike pilot (aided visual means), and development of low-level delivered munitions for use against hard, small targets. (The Air Force was later to come under fire from Representative

[23]USAF-US Army, Final Report, CAS Boards, August, 1963, Vol. V. Annex H, p. 1.

Pike because there conclusions did not include any mention of improving the response time to Army requests.[24]

The fall of 1963, when the Close Air Support Boards were submitting their reports, was also the time of the Navy VAL competition. By March, 1964, the contract to build the VAL/A-7 had been awarded to LTV, and General LeMay, the Air Force Chief of Staff, was under fire from OSD to look at the A-7 as the answer to the Army's desires. General LeMay replied tersely to the A-7 proposition before Congress, "I am very unenthusiastic" about the A-7. "Preliminary investigations that we have made so far indicate, cost-analysis-wise, it is not much good."[25]

At this point General Maxwell D. Taylor, Chairman of the Joint Chiefs of Staff, wrote a memorandum to the Secretary of Defense. In it he acknowledged the impasse of the Army and Air Force on the limits of Army aviation. He recommended the limits be based on design and functional characteristics of the aircraft and be enforced by budgetary

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[24]USAF-US Army, Final Report, CAS Boards. Conclusions of the Close Air Support Boards published in U. S. Congress, House of Representatives, Committee on Armed Services, Close Air Support, Report of the Special Subcommittee on Tactical Air Support of the Committee on Armed Services, 89th Cong., 2d Sess., February 1, 1966, p. 4867. (No. 44, 4122.) The Army and Air Force conclusions and Representative Pike's comments also appeared in the Armed Forces Journal February 12, 1966, p. 15. The Air Force desire for improved methods of target acquisition for the pilot will become ~~more significant below when we describe the 1967 decision~~ to improve the avionics/bombing system in the A-7.

[25]Reported in Aviation Week and Space Technology, March 23, 1954, p. 15, under the title, "USAF snubs VAL."

decisions on individual vehicles. Some of the distinguishing characteristics of Army aviation vehicles which he saw were:

> 1) Comparatively short range, low performance, independent of prepared airfields.
> 2) Not designed or equipped to penetrate hostile airspace in the face of enemy resistance.
> 3) Carry weapons for self-defense or to conduct their primary mission.[26]

The memo was apparently well received by the Army Chief of Staff and, with minor changes, by the Chief of Naval Operations. The USAF Chief of Staff, General LeMay wrote a stong rebuttal:

> Essentially, the fundamental issues reflected in CM-1356-64 evolve from differing Service philosophies on the proper use of aviation. The intrinsic question which these issues pose is whether a single Service requires, in the context of the Unified Command concept, all of the resources necessary to wage war in both the land and air media. The Army position reflects the philosophy that possession of all organic means, including air resources, is necessary for prompt and sustained combat on the ground....In contrast, the Air Force position is based on the premise that no one Service can realistically obtain all the resources needed to fight a war and should not attempt to do so by substantially extending its primary combat functions into other operational media. Each Service contributed the particular forces for which it is expert, and collectively these forces form a unified, mutually supporting combat team. Specifically, the Chairman's memorandum delineates Army and Air Force responsibilities regarding the use of aerial vehicles in a manner which would provide the basis for development and employment

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[26] Memorandum, JCS Chairman to the Secretary of Defense, May 13, 1964, CM-1356-64. Reprinted in A Short History of Close Air Support Issues, op. cit., pp. 71-72.

> of two separate but parallel tactical air capabilities for support of land combat.... the functional alignments prescribed by CM-1356-64 constitute an unnecessarily arbitrary assignment of responsibilities for aviation which ignores the essential considerations of operational and cost effectiveness....I envision an arrangement which consists of three interdependent elements:
>
> a. The Air Force would provide, equip, and operate all aerial vehicles required by the Army....
>
> b. The Army would revise its organizational plans and arrangements as required to transfer to the Air Force all of its aerial vehicles and associated facilities and personnel....[27]

DDR&E Expresses an Interest in the A-7 for the Air Force

Not only were the Joint Chiefs of Staff unable to agree on the limits of Army Aviation, the civilian appointees in OSD were equally at a loss to decide the issue. The Director of Defense Research and Engineering, Dr. Harold Brown, wrote to McNamara on June 1, 1964, following LeMay's memorandum. He noted that the Army and Air Force Close Air Support boards were in fundamental disagreement, and it appeared to him that they could not be made compatible by quantitative analysis. Brown indicated that his thoughts were basically that the multi-purpose aircraft had advantages, but that there were limits on its utility, and that, at some point, a lower cost aircraft might improve the quality of the mixed force. He said that this ratio where a lower cost aircraft

[27]Memorandum to JCS from Chief of Staff, USAF, May 12, 1964, "Army and Air Force Responsibilities Regarding the Use of Aerial Vehicles," reprinted in A Short History of Close Air Support Issues, op. cit., pp. 72-73.

might be valuable could be around a 3:1 figure compared to the F-111A.[28] Due to the fact that Dr. Brown was to become the Secretary of the Air Force in 1965, this memorandum seems unusually significant.

Brown was very perceptive of the nature of the differences between the Army and the Air Force over the full range of issues under the general rubric of close air support. Being a physicist by education and training, he developed a feeling for the importance of professionalism in the organization. In a later interview he discussed the significance of professional doctrine in the debate over centralized versus decentralized control of close air support aircraft. He began by expanding on his memo predicting that the differences of the Army and Air Force on this issue were not going to be reconcilable by quantitative analysis.

> I never really changed my mind about that. It was really an argument between two doctrines. One was that the Army commander had to have control of whatever impacts on him just as he does on his artillery. The Air Force argument is that air is a unity. I'm afraid that neither of these is terribly convincing by itself. The argument, which from the Air Force point of view I always found most convincing, was that the command ought to be determined on the basis of range, and that the range of the aircraft was 600 miles. And it shouldn't be at the disposal of anybody who didn't control that much of the front. If you give it to the Army, by that time it is already up to such a high level in the Army

[28] Memorandum, DDR&E to Secretary of Defense, June 1, 1964.

> that it is no good to the guy who's calling in the close air support. To put it at Field Army level is really no better to the battalion commander than to give it to the Air Force. He doesn't really know the difference. The Army headquarters may know the difference, but he doesn't know the difference. That's why in the end we always argued, "Give it to the theater commander; he's the man who really is best able to balance demands between elements 600 miles apart. There's nobody in the Army who can, or in the Air Force either."[29]

Although there had been efforts by the Army and Systems Analysis to get the Air Force to look closely at subsonic aircraft for the close air support role, Dr. Brown's memo seems to signify a change in the organizational climate of decision-making. Until then, DDR&E had not been particularly involved in the close air support aircraft issue. After this memo the environment became increasingly receptive to change on this issue.[30] The A-7 was repeatedly nominated as a condidate for purchase by the Air Force. In the end, it would result in the Air Force buying a new aircraft, and the A-7 would be the

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[29] Interview with Dr. Brown, April 8, 1970.

[30] It should be noted that this change was really nothing more than a slight shift in position. Many individuals in the decision process did not change at all, and Air Force doctrine remained where it had consistently been since the late 1930's--opposed to a specialized aircraft for close air support. Even after the decision to buy the A-7 there remained professional differences of opinion in the Air Staff and TAC over the utility and limitations of a subsonic aircraft. One of the differences between Brown's memo and previous statements on the subject may have been that instead of adopting or rejecting the subsonic attack aircraft on principle and doctrinal grounds, Brown substituted a decision rule: that some lower cost aircraft might be acceptable if the cost were in a ratio of one to three.

instrument representing an innovation in Air Force doctrine. Before that decision can be described, however, we need to know something about the environment of the Secretary of the Air Force and Headquarters USAF.

Air Force Headquarters Organization

Decision-making in the Air Force is conditioned by three decisional units:

The Office of the Secretary of Defense

The Office of the Secretary of the Air Force

The Air Staff.

A note on their respective sizes is in order.

Table 4. Respective Sizes of OSD and the Air Staff

	Military	Civilian	Total
OSD	1000	2000	3000
Office of the Secretary of the Air Force	165	335	500
Air Staff	2500	2500	5000

Source: Under Secretary of the Air Force John L. McLucas' speech to the Air War College, Maxwell AFB, Alabama, September 18, 1969.

The Office of the Secretary of the Air Force is functionally divided into four principal areas with an Assistant Secretary in charge of each: Research and Development (R&D); Installations and Logistics (I&L); Manpower and Reserve Affairs, and Financial Management.[31] The principal offices involved in the A-7 decisions were R&D and I&L.

The Air Staff is a complex array of people and offices which back up and provide information for the Secretary of the Air Force and the Chief of Staff. The Chief of Staff is the highest ranking officer in the Air Force, usually a four-star general. It is significant that the Chief of Staff not only presides over the Air Staff, but serves as a member of the Joint Chiefs of Staff (JCS) and spends roughly 70-75 percent of his time on JCS matters.[32] In his JCS capacity he is a military advisor to the President and the National Security Council as well as to the Secretary of Defense. He is also the principal military advisor and executive to the Secretary

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[31]See Appendix II for the organization chart. For a full description of each office's responsibilities see Department of the Air Force, Organization and Functions (Chartbook), December 31, 1969.

[32]General Curtis E. LeMay, Mission with LeMay (Garden City, New York: Doubleday & Co., 1965), p. 507. For an exceptionally lucid and penetrating piece of research on the JCS decision-making process by a member of the Joint Staff, see Lawrence B. Tatum, "The Joint Chiefs of Staff and Defense Policy Formulation," in American Defense Policy, 2d ed. Ed. by Mark E. Smith, III, and Claude J. Johns, Jr. (Baltimore: Johns Hopkins Press, 1968), pp. 377-392.

of the Air Force, and, with the Secretary, presents and defends the Air Force budget to Congress annually.

The second-in-command after the Chief of Staff is the Vice Chief, also a four-star general. Usually the Vice Chief has been selected for that position because he has the qualities which will make him a Chief of Staff. (General McConnell was Vice Chief under General LeMay before he became Chief of Staff in February 1965.) He serves as the chairman of the Air Force Council which will be described below. The Vice Chief out-ranks all the three-star generals who serve as the Deputy Chiefs of Staff on the Air Staff. He is usually the <u>same</u> rank as the most senior of the commanding generals of the Major Air Commands. (In 1969, seven of the fifteen Major Air Commands were commanded by four-star generals.)

The Vice Chief of Staff in 1970 was General John C. Meyer, who described the purpose and organization of the Air Staff in this manner,

> The mission of the Air Staff is planning, programming, policy-formulating, and budgeting....It is essentially a planning staff, since its functions relate to determining the use to which present and future resources will be put.[33]

General Meyer described the Air Staff as functionally organized but responsive to the principles of simplicity, flexibility and decentralization. The Air Staff contains

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[33]General John C. Meyer, "The Air Staff," <u>Air University Quarterly</u>, January-February, 1970, p. 4.

special advisory agencies, of which three normally play a large role in development programs: the USAF Scientific Advisory Board, the Office of Operations Analysis, and the Office of the Assistant Chief of Staff for Studies and Analysis. The principal functions of the Air Staff in 1964 were divided into six agencies (deputates), each headed by a Deputy Chief of Staff (DCS): the Comptroller, DCS/Personnel, DCS/Programs and Requirements, DCS/Plans and Operations, DCS/Research and Development, and DCS/Systems and Logistics. The last four organizations were the agencies primarily involved in the A-7 development decisions.[34]

The Air Staff is an extremely complex organization of individuals with widely differing educational and professional qualifications. It is exceptionally difficult to generalize with a group this large and diverse. Still, some basic generalizations may help the reader to understand the orientation of certain organizations within the Air Staff. Most of the military officers on the Air Staff would undoubtedly classify themselves as military professionals--incorporating the qualities of expertise, responsibility and corporateness. There is a unity of the military professionals which is generated by their common experiences, related training, and shared values and goals. The military profession is distinguished from

[34]See Appendix III for organization chart of the Air Staff. Note that by 1968 DCS/Programs and Requirements had become DCS/Programs and Resources. This occurred when DCS/Programs and Requirements lost the Directorate of Operational Requirements to DCS/R&D.

other governmental groups because, among other things, rank inheres in the man rather than in the position he holds. When a colonel is transferred to a new job, he goes as a colonel. But he may also have qualities which distinguish him among military professionals.

Two groups which can be distinguished within the military are the operations sub-profession (with a combat orientation) and the systems management sub-profession (with a research and development orientation). The two are not antithetical; they are certainly not mutually exclusive. However, most officers tend to specialize to some degree in their career progression and educational patterns. Thus, the operations specialist will tend to spend many years in strategic or tactical operations, although he may serve in many other positions also. One agency on the Air Staff is particularly well-suited to specialists in operations--the Deputy Chief of Staff for Plans and Operations. The Plans and Operations positions tend to be filled by officers with orientations and career expectations based on the agencies most directly concerned with the pay-off function--the combat forces. They include (for instance in the tactical area) fighter pilots, many of whom have extensive experience in fighter squadrons and operations.

Although there is no strict line between the operations professionals and the system management professionals (because both groups serve combat tours of duty in wartime) the officers who participate in the research and development activity tend to have slightly different backgrounds. They have relatively less experience in flying (or missile) operations; they have (slightly) more education as represented by Master's degrees, and they have a keen interest in participation in research and development of new weapon systems. In the Air Staff the agency most closely associated with their interests is the office of the Deputy Chief of Staff for Research and Development. Since many of these officers have degrees in engineering or related subjects they have a natural professional identity with the research and development community which, in Defense, includes DDR&E.

The Air Staff is divided horizontally into several levels which compose its hierarchy. From top-to-bottom the levels include: Deputates; Directorates; and Divisions. The Deputates are headed by a three-star general (Deputy Chief of Staff); the Directorates are headed by a two-star general (Director); and the Divisions are headed by a colonel (Division Chief). The lower staff levels are manned by "actions officers" (mostly Majors and Lt. Col.'s) who provide more expertise, analysis, advice and coordination.

General Meyer, in his discussion of the Air Staff, notes there have been many advantages to the organization as it is now, but that it has two potential disadvantages. These he lists as:

> (1) The potential for inundating the Office of the Chief of Staff. Since authority to act for the Chief of Staff has been delegated to subordinate staff elements, the Chief's immediate staff of people with substantive decision-making authority is limited to the Vice Chief and Assistant Vice Chief. There is no reviewing agency between the Chief's office and the staff comparable to that of a general staff secretariat. . . .
> (2) The difficulty of integrating and coordinating a large number of decision-making offices. . . . Action officers at the lower staff levels are authorized direct coordination on a horizontal plane with other interested offices.[35]

The Chief of Staff and the Secretary of the Air Force are assisted in their decision-making roles by the Air Force Board Structure.[36] This Board Structure is, in effect, a group of standing committees composed primarily of members from the Air Staff and the Secretary's office. The only major air command with permanent representation in the Board Structure is Air Force Systems Command (AFSC), which is the principal research and development organization in the Air Force. The Board Structure has, in addition, a secretariat of its own.

The Air Force Board Structure is composed of the Designated Systems Management Group, the Air Force Council, the Air Staff Board, specialist Panels and many committees.

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[35] Meyer, *op. cit.*, p. 6. (Emphasis added.)

[36] See Appendix IV for chart.

The Designated Systems Management Group is chaired by the Secretary of the Air Force and contains the Under Secretary, the Chief of Staff, the Vice Chief, the Commander of AFSC, the Assistant Secretaries, the Deputy Chiefs of Staff and others.[37]

The Air Force Council is chaired by the Vice Chief of Staff and is primarily composed of the Deputy Chiefs of Staff. The Air Staff Board is chaired by a two-star general, the Director of Aerospace Programs, which makes his directorate especially important in the decision-making process. (The Director of Aerospace Programs responsibilities include: overall control in formulating and directing programs resulting from OSD and Air Force decisions; primary control over all Program Change Requests to the PPBS; and principal witness supporting the Director of the Budget in presenting the Air Force budget to Congress.) The members of the Air Staff Board are the Directors of: the Budget, Operational Requirements and Development Plans, Personnel Planning, Plans, and others.

Although it is not designed to substitute for the normal chain of command, the Board Structure plays a large role in weapon systems decisions. Two major issues which come before these committees are the annual Air Force

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[37]The Designated Systems Management Group has since been changed to the Secretary of the Air Force Program Reviews, but since the older term was in use during virtually the entire period the A-7 subject was appearing before the committee, that term will be used. For a complete listing of the authorized attendance, see the *Chartbook, op. cit.*

budget submissions and the Air Force force structure. Since the principal members of the Board Structure are the Assistant Secretaries, Deputy Chiefs of Staff and Directors of the Air Staff, there is a high degree of correspondence between the Air Staff functions and the Board Structure.

With this discussion of the basic organization of the Air Staff and Headquarters USAF the stage is set for a more detailed look at the decision process on the A-7. That process was influenced by the accelerated development in the 1960's of computer technology and analytical techniques. Indeed, the determination of force structure plans and weapon system selection was increasingly dependent on studies and analyses, partially because Systems Analysis was promoting their use.

Internal Computer Studies and External Pressures--The Bohn Study

During the early 1960's the Air Force expertise with the use of computers and computerized analytical studies was small, but growing. Early attempts at using computers had been made in the late 1950's under the Director of Targets, Assistant Chief of Staff for Intelligence. The primary objectives of this effort were in the field of strategic operations, as they attempted (among other things) to put the Single Integrated Operations Plan on computers.

When McNamara and Enthoven began stressing the use of quantitative analysis after 1961, the Air Force already had considerable competence in strategic analysis but neither the Air Force nor Systems Analysis had much expertise in tactical air analysis.

In 1962 the Air Force formed an Air Battle Analysis staff under the Director of Plans, and one of the primary objectives of this agency were to conduct quantitative analyses that would be useful in selecting future weapons. At most this organization was composed of about 30 people, but they greatly increased the Air Force capability in the development of cost/effectiveness studies.[38] Later, a special Air Staff organization--the office of the Assistant Chief of Staff for Studies and Analysis--was formed to further increase this capability, but the Directorate of Plans retained its small staff for studies directly relating to force structure. This office, now called the Special Assistant for Analysis and Force Plans, was to run two computer studies in 1964-1965 that would be of special significance to the A-7 program.

As has been previously noted, the Air Force doctrine of tactical air included the concept that new aircraft should be multipurpose, and that supersonic, high-performance tactical fighters were superior to subsonic, specialized close air support aircraft. Air Staff studies and analyses

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[38]Interview with Colonel E. A. Chavarrie, DCS/Plans and Operations, August 18, 1970.

had confirmed these concepts for the Air Force professionals.[39] As the events of the 1960's unfolded, this position was increasingly difficult to maintain.

The pressures on the Air Force to reexamine its requirement for close air support were accumulating from the Howze Board's recommendations, the formation of the 11th Air Assault Division, the Army initiation of an attack helicopter program, and Dr. Brown's memo of June 1, 1964, on the utility of a lower cost aircraft. In addition, Systems Analysis was encouraging the Air Force to look at the A-7 and specifically requested a study of alternative mixes of tactical aircraft during the summer of 1964.

By direction of the Chief of Staff, General LeMay, the Directorate of Plans ran a study from August to December 1964 called Force Options For Tactical Air. It was begun with the formation of a formal Headquarters USAF Study Group on August 17. With Lt. Col. John W. Bohn as the Study Group Project Officer, the study became known as the "Bohn Study." It was to have its report completed by October 31, 1964.

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[39] For instance, General Ferguson when he was DCS/R & D testified to the general thrust of the Air Force studies, "These studies conclusively showed that a versatile, high-performance tactical fighter such as the F-105D or the F-110A [F-4] is superior by a factor of more than 2 to 1 in the tactical support role when compared on a cost effectiveness basis, with a specialized close-support airplane." U.S. Congress, House of Representatives, DOD Appropriations for 1963, Hearings before a subcommittee of the Committee on Appropriations, 87th Congress, 2d. sess., Part 4, p. 321. Testimony on March 6, 1962.

The basic approach of the study group was to review different tactical force alternatives with various numbers of F-111's, F-4's and F-105's and to include an evaluation of a mix of lower cost airplanes. The aircraft nominated for the roles of lower cost designs were hypothetical versions of the Northrop F-5 Freedom Fighter and the LTV A-7. At that time the costs on the F-5 were estimated by to about $700,000 a copy and the A-7 was slightly over one million.[40]

It is significant to note that LTV representatives had been trying to interest the Air Force in the A-7 for some time. They made their first contact with officers in the Air Staff only three weeks after the March 1964 award of the Navy contract. They continued to supply the Air Force information during the Bohn Study as to the A-7's capabilities and performance characteristics. They received some sympathy but very little encouragement from lower ranking Air Force staff officers.[41]

The guidance to the Study Group from the Chief of Staff was that the number of each aircraft could be varied, but the total Air Force fighter force structure was to be under a certain budget ceiling. The objective was to maximize the effectiveness of the total Air Force fighter force.[42]

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[40] Aviation Week and Space Technology, September 21, 1964, p. 21.

[41] Interview with Mr. J. W. Lankford, LTV Marketing Director, April 1, 1970.

[42] Interview.

Many previous studies had used as their primary analytical tool a linear function of aircraft payload/range characteristics. The Bohn Study was the first one to use a newly conceptualized scheme for describing the extremely complex relationships and situations that happen in fighter air-to-air engagements.[43] This theory--"energy maneuverability"--was conceptualized by Lt. Col. John Boyd, a tactical fighter pilot and an instructor at the USAF Fighter Weapons School, Nellis Air Force Base, Nevada. The methodology as it was adapted for the Bohn Study was done primarily by Colonel John J. Burns, then Director of Operational Requirements at Tactical Air Command (and later a Brigadier General). One of the purposes of the Bohn Study was to refine this new conceptual scheme and the methodology for applying it to a comparison of aircraft in a simulated combat environment.

Since the directions to the Study Group did not include specifically choosing one low cost aircraft, hypothetical and not production aircraft served the purpose. An optimized attack aircraft design (which would have required extensive development) was even included. Versions

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[43]Interview with Colonel James R. Hildreth, February 9, 1970. The difficulty of modeling air-to-air combat has been described by Herbert Rosenzweig, former member of Systems Analysis, "Our ability to simulate air combat situations is not nearly so good as our ability to simulate, say, free flight in a wind tunnel. In addition, we get so little feedback from actual experience that we cannot check our models as we can in predicting aircraft speed and range." "Technological Considerations," in Systems Analysis and Policy Planning: Applications in Defense, ed. by E. S. Quade and W. I. Boucher (New York: Elsevier, 1968), p. 117.

of the F-5 and the A-7 were examined because they were representative of the types of aircraft which could be obtained for relatively little additional develcpment cost. However, since the A-7 had already been nominated by some members of Systems Analysis for possible Air Force purchase, there was at least the implicit assumption that the A-7 was more than a hypothetical input. Enthoven expressed Systems Analysis' intentions at this time,

> We asked the Air Force to do studies of alternative force mixes, and we in Systems Analysis were <u>definitely</u> trying to encourage the Air Force ~~to buy the~~ A-7. Why were we trying to do that? Because first of all we believed that for the kind of wars the tactical air forces were likely to fight that the A-7 would simply be substantially better. It would have longer range and better payload and the payload could be translated into all sorts of things. . . .It would be a lot more effective in relation to cost, and in fact, there was even good reason to believe that it was just more effective, that a subsonic design would be positively advantageous because it would be more maneuverable; you could have a better [steeper] dive angle for bombing which would mean more accuracy and less vulnerability.[44]

It should be noted that OSD Systems Analysis did not officially participate in either the modeling or the war game of the Bohn Study, even though it had expressed the opinion that the study should be conducted. Representatives of Systems Analysis did, however, maintain contact with the study group personnel and were aware of the Study's progress.

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[44] Enthoven interview, April 8, 1970.

Without disclosing any of the classified aspects of the Study, it is safe to say the performance of the A-7 and F-5 was consistent with their well known differences. The turbofan engine and the large fuel capacity of the A-7 gave it advantages in range and loiter time. With six wing pylons and two fuselage pylons, it could carry a varied, 15,000-pound load of ordnance. The F-5 was generally limited to about 3,000 pounds of ordnance. Thus, if the decision criterion was low cost-per-ton-mile, the A-7 showed a comparative advantage. On the other hand, the twin engines of the F-5 and that aircraft's overall small size gave it a high degree of survivability against enemy ground fire. Its supersonic speed gave it definite advantages in air-to-air combat with enemy fighters.[45]

The conclusions of the Bohn Study were generally that the addition of a lower cost aircraft (i.e., cheaper than the F-111) would improve the overall effectiveness of the force. Although this study did not specifically choose the F-5 as the winner of the competition, the general consensus was that the study could be used to justify a recommendation for F-5's.[46]

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[45]The F-5 has been the subject of many aviation articles. For a discussion of its performance characteristics and evolution see, "The Northrop F-5-21: Study of a Fighter in Evolution," Interavia, No. 7 (August, 1969). For an excellent summary of how a study can compare aircraft see "Cost-effectiveness Analysis of a Ground Attack Mission," Interavia, No. 8 (August, 1968).

[46]Interviews with officers who worked on the Study, February 9 and 25, 1970.

The Bohn Study was verbally presented (the military term is "briefed") to many officials within the Air Force, up to and including Secretary Zuckert.[47] The Study was "briefed" to Heyman, Murray, Enthoven, and others in Systems Analysis. Murray's evaluation of the Bohn Study's conclusions are significant, because he was the Systems Analysis Director for Tactical Air Programs. He later said,

> In the first one [the Bohn Study] the Air Force's predilection for supersonic airplanes just came through everything. One of the airplanes that they wanted was the F-5 for an attack airplane. I think it was just generally the feeling of the Air Staff that we should have a supersonic aircraft, and the idea was to look for a little less expensive airplane. They didn't want something big like the F-111 because they already had that.[48]

Systems Analysis--as represented by the views of Murray, Heyman, and Enthoven--was very critical of the conclusion of the Bohn Study that showed the F-5 as relatively superior to the A-7. Murray and Heyman later noted they were critical of the manner in which the study had been run and the inputs placed in the computer model.[49]

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[47]Verbal presentations are an important mode of communication in the military services as they are in other large organizations. In the military they are called "briefings" because they are meant to be concise representations of complex subjects. Studies like the Bohn Study were presented in both oral briefings and written form.

[48]Interview, April 28, 1970.

[49]Interviews with Murray and Heyman.

However, Systems Analysis was limited in the degree of criticism it could bring to bear, because the office had not participated in the Bohn Study Group. Systems Analysis was still interested in getting the Air Force to adopt the A-7, and Enthoven and Murray recommended that the Air Force run another study, this time with Systems Analysis participation.

The result of Enthoven's recommendation was a memorandum from Secretary McNamara to Secretary Zuckert in January, 1965, requesting the Air Force conduct another study of tactical aircraft capabilities for close air support.[50] McNamara discussed the need to replace the A-1 Skyraider in use with the Special Air Warfare Center and in Vietnam. (The Air Force had received several squadrons of Skyraiders from the Navy to augment the T-28's and A-26's.) He noted the supply of Skyraiders was extremely limited and that a new attack aircraft was badly needed for the Air Force, with an Initial Operational Capability by 1967. This criterion, he added, indicated his interest in "existing production aircraft." McNamara requested the Air Force study an aircraft "optimized for close air support," but he noted additionally that it had to be "acceptable" for the [24-wing] tactical fighter forces. He stated the use of the new attack aircraft should be considered assuming air superiority or air cover

[50] Memorandum, Secretary of Defense to the Secretary of the Air Force, January 7, 1965.

"in all cases." He specifically suggested the consideration of the A-7, the A-6 Intruder, the F-5 or similar types.[51]

The Army Starts to Develop a Close Support Helicopter

The McNamara memorandum was written while the Army was increasing its efforts in the close air support area. The Army, on August 1, 1964, had issued an open request to the aerospace industry for proposals to build a two-place, compound helicopter with a top speed of over 220 miles an hour. The program was called the Advanced Aerial Fire Support System (AAFSS/Cheyenne) and was viewed by the Air Force planners in the Pentagon as a direct threat to Air Force supremacy in the close air support mission.[52]

General McConnell Becomes USAF Chief of Staff

While the Air Force was preparing its response to the McNamara memorandum, and the Army was beginning the Cheyenne development, the Air Force had a change of command. General J. P. McConnell succeeded General LeMay as the Air Force Chief of Staff on February 1, 1965. McConnell had been following the selection of a new tactical aircraft

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[51] Ibid.

[52] Aviation Week and Space Technology, November 9, 1964, p. 92. From this time forward the AAFSS (AH-56) or Cheyenne as it was later called, would be viewed by the Air Force as a competing weapon system for the close air support mission. The implicit assumption was that if the Air Force did not design or buy a specialized close air support aircraft, OSD could justify a redistribution of budgetary allocations to favor the Army.

very closely. In one of General McConnell's first appearances before the House Armed Services Committee as Chief of Staff, he was pressed on the close air support aircraft issue by Representative Pike, who said:

> But I have a very bad feeling that the Air Force wants to buy the glamour planes. There is a great push for advancing manned strategic aircraft, and there is a great push for an improved manned interceptor and I have a very bad feeling that these are the glamour aircraft. They are designed to fight the air battles which we may be called upon to fight at some future date, but there hasn't been any push whatsoever for the type of aircraft we need today. . . .[53]

During the period when General McConnell was assuming responsibility as Chief of Staff, Systems Analysis was approaching Tactical Air Command with proposals for the A-7. Maj. Gen. Gordon M. Graham was the Assistant Deputy Chief of Staff for Operations at TAC. (He was soon to become the Deputy for Operations.) General Graham described how he first heard of the A-7.

> In December of 1964, Vic Heyman, who was the exponent of the A-7 in Systems Analysis, told me personally that we were going to be given that airplane, and I laughed at him. In fact, I didn't really know what it was. That spring of 1965, we got the first specific piece of paper that said, "We are considering giving you the A-7."[54]

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[53]U.S. Congress, House of Representatives, Hearings on Military Posture, 89th Cong., 1st sess., 1966, p. 1373. Representative Pike was rapidly becoming a consistent critic of the Air Force's close air support policy. He was especially interested in getting the Air Force to develop a specialized close air support aircraft for Vietnam-type operations. He subsequent hearings he constantly brought forward the Marine use of specialized attack airplanes and the Marine system of decentralized control of air forces for close air support. During World War II, Representative Pike had been a Marine dive bomber pilot.

[54]Graham Interview.

Victor Heyman and some other members of OSD took a trip to Tactical Air Command during February, 1965, to talk to the commanders and men. The entire discussion centered around the A-7 and a stripped-down F-4, which would have a lower cost than the F-4 which TAC was then getting. The TAC commanders and pilots made their desires known that the stripped F-4 more closely approximated their needs and requirements and provided the flexibility TAC needed with growth potential. Heyman asked them if the A-7 would be acceptable if more of them were available on a three to two ratio. The TAC staff emphatically said, "No!"[55]

Heyman recalled his conversations with General Graham and the TAC staff.

> I was taking the devil's advocate point of view there and pushing the A-7 to see what the reaction was, and why, and how strongly the view was held. They really considered the A-7 a dog. There is something about being supersonic that the pilots love; I don't know what it is.[56]

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[55]Trip Report of Dr. Heyman, Mr. Carr and Party, March 17, 1965, written by Major Allen, TAC Headquarters. General Graham was the TAC host for the Heyman trip.

[56]Heyman Interview, March 12, 1970. This confrontation of OSD Systems Analysis with what they considered to be the Air Force enchantment with supersonic aircraft was a recurring theme. It was echoed by Dr. Enthoven, "But even more to the point was the very strong feeling that a supersonic was just a better plane to have, that air superiority was the important thing. Going back deep into the traditions of the Air Force wanting to become a separate service, wanting to have its own mission that was not just supporting somebody else, but doing their own thing like winning the air battle while somebody else was winning the ground battle. They were much more interested in that than in being a support for the Army. All those psychological elements went into it, I think, certainly the feeling that a supersonic airplane was just bound to be better. Somehow it's the difference between something modern and exciting and something old fashioned." Enthoven interview, April 8, 1970.

As the representatives of the men who would have to fly the new attack airplane, the staff of Tactical Air Command was becoming increasingly concerned lest DOD buy an aircraft that was not suited--in TAC's opinion--for world-wide use. TAC had created the Special Air Warfare Center and equipped it with A-1 Skyraiders for close air support, but the TAC commanders did not want to accept, for the 24-wing tactical fighter force, an aircraft that did not have a supersonic, air superiority capability. They wanted aircraft that were capable of fighting against the best any potential opponent could develop, in addition to flying in Vietnam.

During the Heyman visit to TAC the Air Staff concluded its deliberations on the Bohn Study. On the advice of the Air Force Board Structure and General McConnell, Secretary Zuckert sent a memorandum to Secretary McNamara on March 16, 1965, requesting the Air Force be given permission to buy two wings (144 aircraft plus spares)[57] of F-5 supersonic fighters.[58]

The handling of this potentially important memorandum was complex, but it is also descriptive of the elusive decision process. When the memorandum was routed to Systems Analysis it was not approved, neither was it disapproved; it was held in abeyance. In this case the written communications fail to describe the ensuing events.

[57] This is based on the assumption that each wing would have 72 aircraft as listed in The Air Force Blue Book, op. cit., p. 331.

[58] Memorandum, Secretary of the Air Force to Secretary of Defense, March 18, 1965, entitled, "Headquarters USAF Study on 'Force Options for Tactical Air.'"

Systems Analysis at this point had the initiative in that it was the agency in OSD with the authority to act on the request. Systems Analysis was not inclined to let the Air Force buy the F-5 for two reasons: first, the analysts did not believe in the F-5 as an attack aircraft; and second, they did not have faith in the Bohn Study from which the F-5 request had sprung.

Heyman later noted that he considered the F-5 to be no better than the F-100, with its limitations of only a few bomb racks and a limited endurance. On this basis, Systems Analysis viewed the Air Force F-5 request as one of modernization, and Systems Analysis did not want to modernize just for modernization's sake.[59] This was despite the fact that the F-5 was even cheaper than the A-7.

Beyond the issue of the aircraft lay the conduct of the study itself. While the Bohn Study was being briefed to OSD, Heyman and Murray indicated their disagreement with various of the Study's assumptions, methods and procedures. As a counter to the Air Force study, Heyman prepared a Systems Analysis critique. When the critique was presented to the Air Force, it became itself the subject of much discussion and controversy. Since the whole issue was growing in size and complexity the Air Force decided to prepare a counter-critique. By this time Bohn and many of the others who had run the study were giving briefings to

[59]Heyman Interview, March 12, 1970.

the European and Pacific Air Force commanders, so they were unavailable for the needed staff work. Within the Directorate of Plans, General Agan decided that the Air Force counter would be prepared by a most forceful and dynamic officer--Colonel Howard M. Fish.

Colonel Fish, of the office of Analysis and Force Plans, prepared comments for the Air Force counter to the Heyman critique. The positions were then presented in a high-level meeting of Air Force and OSD officials, including Dr. Enthoven and Dr. Brown. The results of that meeting were not conclusive regarding the Bohn Study, but general agreement was obtained that a follow-on study would be conducted. The Air Force request for F-5's was continued in abeyance until the impending study was complete. Shortly after that, in June 1965, Heyman moved out of the Air Force Tactical Air shop of Systems Analysis and became Enthoven's assistant for special projects.

The Secretary of Defense and OSD were still not convinced that the Air Force was making a full effort to develop a true close air support capability as envisioned in the strategy of Flexible Response.[60] They were, on the other hand, becoming more impressed with recent Army developments. Having followed the Howze Board's recommendations with the subsequent formation of the 11th Air Assault Division, McNamara was increasingly receptive to

[60]Letter, Dr. Brown to the author, September 9, 1970.

the Army's requests for more helicopters and aviation units. Accordingly, he approved the redesignation of the 11th Air Assault Division as the 1st Cavalry Division (Airmobile).[61] The growing U.S. involvement in Vietnam during the spring and summer of 1965 was undoubtedly a factor. In February 1965 there were only 23,000 Americans in South Vietnam; by June there were 51,000; July saw 70,000; and by the end of 1965 the total reached 181,000.[62] The new 1st Cavalry Division was one of the first, division-size American units to be sent to Vietnam during that summer.

With the implicit OSD disapproval of the request for F-5's and the growing Army pressure, the Air Force was having its alternatives limited. In May, General McConnell sent a formal request to Secretary Zuckert recommending the development of a new attack aircraft. He cited the Bohn study and its conclusion that within a fixed budget a mix of lower-cost aircraft with F-4's and F-111's would be more cost/effective than the presently-approved five-year force structure. He recognized the attractive features of the A-7 as stated in the study (low cost, high payload) but wondered about its slow speed in a hostile air environment.

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[61] Prior to July 1965 the 1st Cavalry Division was on duty in the 8th Army in Korea. A change of colors traded the titles of the 2d Infantry Division at Fort Benning with the 1st Cavalry in Korea. The 11th Air Assault absorbed eight of the maneuver battalions of the 2d Infantry and became the 1st Cavalry, while the ex-1st Cavalry in Korea became the 2d Infantry.

[62] Aviation Week and Space Technology, June 14, 1965, p. 73, and January 3, 1966, p. 16.

Accordingly, he recommended a research and development program for a close air support-optimized aircraft with the source selection by December 1966.[63] No action was taken, but Zuckert forwarded the memo to Secretary McNamara.

While General McConnell was appearing before Congress and the Bohn Study was being discussed in the Spring of 1965, Tactical Air Command was running its own cost effectiveness study. Started at the request of Dr. Heyman during his second visit in April, 1965 the study was conducted by the Operations Analysis office at TAC Headquarters.

The study was done in April and May and entitled "Cost Effectiveness of Close Air Support." It compared the F-5, F-4 and A-7 in a series of missions against selected fixed, ground targets. It showed the A-7 with a very high loss rate to enemy fighters and ground fire because of its slow speed. Nevertheless, it edged out the F-5 on a cost-per-target-destroyed basis. However, both the A-7 and F-5 were shown to be significantly inferior to the F-4. A briefing on the study was given to the TAC staff and commander which concluded,

> The briefing demonstrates that the basic F-4 aircraft gives:
> a. The highest low level penetration speed.
> b. The best air-to-air capability.
> c. The lowest attrition per target destroyed.

[63]Memorandum, "Close Support and Special Air Warfare Aircraft," Chief of Staff to Secretary of the Air Force, May 10, 1965. The Secretary of the Air Force forwarded the memo on June 14, 1965.

> It is therefore shown to be the best close support aircraft of the three candidate aircraft.[64]

This study was presented at Tactical Air Command and in the Air Staff. Its conclusions were consistent with Air Force doctrine on close air support, and were accepted by the majority of Air Force professionals. The study itself, however, had very little impact outside the Air Force, and was specifically not accepted by Systems Analysis, which continued to press for the A-7.[65]

The Secretary of Defense was still dissatisfied with the studies on the close air support aircraft issue; his displeasure was hinted at by the OSD Comptroller, Charles Hitch, "I just don't feel anybody has thought this problem through and come up with the answer for the airplane or mix of airplanes for the whole range of missions which must be performed." He said, "It's a hard problem" because of the variety of missions, and "until recently" there has been little combat experience with aircraft in a counter-insurgency situation.[66]

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[64]Quote is from an unclassified letter from the Chief, Operations Analysis, to the TAC Council, entitled, "Briefing on Cost Effectiveness of F-4, A-7, F-5 in Close Air Support," June 4, 1965. The study was entitled, Cost Effectiveness of Close Air Support, Operations Analysis Working Paper No. 119 (TAC OA WP-119), April 1965. The study was conducted by Mr. George Stickle who, in 1961, had helped persuade Systems Analysis of the wisdom of selecting the F-4 over the A-4 for the Air Force.

[65]Interview with Mr. Stickle, February 13, 1970.

[66]Quoted in Aviation Week and Space Technology, July 19, 1965, p. 15.

In the Systems Analysis section of the Comptroller's office, there was a slight shift of personnel after the Bohn Study. An analyst named Patrick J. Parker moved from the office of Navy Tactical Air within Systems Analysis to head the all-service Tactical Air office. Parker (GS-16, roughly equivalent to a one-star general) then worked directly for Russell Murray (GS-18, roughly equivalent to a three-star general) who headed the Systems Analysis office for General Purpose Programs. Heyman later noted that, "Pat Parker came from the Center for Naval Analysis to Systems Analysis, so he had 'salt water in his veins' and kept the Air Force's nose to the attack business.[67]

<u>The Joint OSD/Air Force Computer Effort--The Fish Study</u>

One of the things the Air Force and OSD were interested in doing was having the Air Force, in conjunction with Systems Analysis and DDR&E, reexamine the questions addressed in the Bohn Study. The objective was to agree on the inputs and methodology so that there would be no disagreement on the results. Their request for continued studies and McNamara's backing produced a new, and larger, analytical effort. The study was conducted amid increasing tension over Vietnam, the deployment of the 1st Cavalry Division, and the Congressional pressure represented by the Pike hearings.

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[67]Heyman Interview, March 12, 1970.

The study was called the Joint Air Force/OSD FX Effort, but was widely known as the "Fish Study" because Colonel Fish was selected to head the Study Group's Air Force Secretariat. An elaborate hierarchy was established for the supervision of the Fish Study.[68]

Policy Group	Organization
Dr. Harold Brown	DDR&E
Dr. Alain C. Enthoven	Systems Analysis
Lt. Gen. K. K. Compton	DCS/Plans and Operations
Lt. Gen. James Ferguson	DCS/Research and Development

Steering Group	Organization
Maj. Gen. Arthur C. Agan	Director of Plans
Maj. Gen. Jack J. Catton	Director of Operational Requirements
Maj. Gen. Gordon M. Graham	Director of Operations, TAC
Dr. Thomas P. Cheatham	DDR&E
Mr. Russell Murray	Systems Analysis

In addition to the Policy and Steering Groups there was a Coordinating and Control Group with four Air Force colonels and three civilian officials. Colonel Fish's Secretariat consisted primarily of Air Force officers with some RAND assistance. The study was begun with a meeting attended by Brown, Enthoven, Compton and Ferguson on June 4 and ran during the summer and into the late fall of 1965. From

[68] Joint Air Force/OSD FX Effort, Vol. III, December 1, 1965. The memo from the Secretary of Defense formally asking for the study was "USAF Tactical Fighter Force" dated July 1, 1965, to the Secretary of the Air Force.

the start, the requirement for a lower cost aircraft had been established; the purpose of this study was: "to define the characteristics and select a lower cost aircraft for the tactical fighter force."[69]

The candidates for the study included the A-7, F-5, A-6, CL-901, and a stripped F-4. The CL-901 was a version of the Lockheed F-104. The stripped F-4 was a McDonnell proposal for a cheap version of the F-4 Phantom without avionics. In addition, the study eventually addressed the requirement for a better air-to-air fighter capability to compensate for a lack of such capability in the lower cost attack aircraft. This additional air-to-air capability was represented in proposals to build another version of the F-4 with an internal 20mm gun. This version of the F-4 was called the TSF for Tactical Strike Fighter.

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[69] *Ibid.*, Vol. 1, p. 1

It later became known as the F-4E and was an almost constant influence on the development of the A-7.[70] In addition to the near term capability represented by the F-4 TSF, the Study also examined the requirement for a completely new air superiority fighter to meet the expected threat some ten years hence. This requirement was known as the FX and eventually became the F-15 program.

The model used in the Fish Study was a theater-wide war game with essentially the same methodology as the Bohn Study--an evaluation of air-to-air engagements using Energy

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[70] It is significant to note this distinction between the F-4 which was flying in the Navy and Air Force in 1965 with no internal cannon and the TSF/F-4E which was an attempt to get an internal cannon into the aircraft in addition to the airplane's missile armament. The philosophy in the 1950's when the original F-4 was designed was that advances in radar and heat-seeking missile technology had rendered the air-to-air cannon obsolete. When this missile technology did not prove capable of solving all the complex problems of close-in air-to-air battles, a major portion of the Air Staff's effort in 1965-66 was spent in establishing a requirement for putting an internal gun in the F-4. Systems Analysis resisted any change in the armament on the F-4 until it was firmly established that the gun would not disturb the radar set in nose of the aircraft, and that the radar could be satisfactorily modified. The placement of the gun in the lower part of the nose section was going to require extensive miniaturization of the radar set. (The radar was valuable in finding enemy aircraft well beyond visual range and was also used in certain modes of ground attack.) This miniaturization had not been proven technically feasible, and Dr. Enthoven, in a later interview, stated that he was skeptical of the TSF for that reason. Many officers in the Air Staff and in Tactical Air Command, however, were willing to take the TSF F-4 with no radar set in the nose if they could get a gun in the aircraft. A clear statement of the position of the operations profession was later given by a Fighter Weapons School publication: "Despite arguments to the contrary, supported by volumes of cost analysis data, the need for an internal gun in fighter aircraft has long been the consensus among fighter pilots." Major Thomas G. McInerney, "F-4E Cat [Category] III," USAF Fighter Weapons Newsletter, March, 1969, p. 30.

Maneuverability to compare aircraft. Then, simulated close air support and interdiction missions were run with various bomb loads and at various ranges. Throughout the simulation the inputs had to be approved by the ad hoc committees before they could be put in the computer. There was also an attempt to specify the hardness or softness of the data by classifying it according to four categories in an Input Data Matrix: 1. Test data. 2. Analysis. 3. Rationale--"reasonable, logical processes which try to reflect operational, real-life factors, and for which no test nor analytically derived data is available." 4. Hard data.[71]

The capability of each aircraft versus each target was figured by using the average number of sorties required to "nominally" destroy each target and the probability of each raid being successful. The costs of each airplane were obtained and the cost/effectiveness of each one determined relatively.

It is very significant that the characteristics of the A-7 placed into the computer included the basic Navy A-7A but added a low-cost afterburner to the engine to

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[71] Joint Air Force/OSD FX Effort, Vol. 1, pp. 1, 2.

increase its thrust and improve the total performance of the airplane.[72] (This became even more significant when the Air Force later was deciding on a new engine for the aircraft.) The CL-901 was exceptionally fast, but lacked both the excellent radar of the F-4 and the long range and heavy payload of the A-7. The study boiled down to another evaluation of the stripped F-4 versus the A-7 and F-5, although the F-4 was recognized as being more expensive, even in a stripped-down version.

The supervision of the study was a critical factor since the elaborate hierarchy had been established to approve the inputs. The Policy Group (Brown, Enthoven, Compton, Ferguson) met only twice and generally deferred to their respective subordinates in the Steering Group.[73] The Steering Group (Agan, Catton, Graham, Cheatham, Murray) was intimately involved in the Study. The significance of this group and the method of operation were later described by Colonel Fish.

> Really and truly the Steering Group made the policy, and the Secretariat did the work. We [the Secretariat] prepared briefings and went to the Steering Group, and the Steering

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[72] An "afterburner" is an auxiliary combustion chamber attached to the tailpipe of a jet engine to increase its power or thrust. It involves a process of spraying jet fuel into the hot unused oxygen and exhaust gases of the engine to burn and thus increase the temperature and density of the exhaust gases as they leave the tailpipe. The afterburner consumes great amounts of fuel so it is normally used only on take-off and during short periods (2-3 minutes) of flight when additional acceleration is needed. The afterburner usually increases the thrust of the engine about 50%.

[73] Interview with Colonel Fish, August 15, 1970.

> Group sat in session as long as eight and nine hours--and these are pretty high level guys--eight and nine hours at a session, taking briefings and giving me instructions then to go ahead and make another excursion of this or that sort.[74]

There is an important point lodged in this description of the computer study. This study was, by the accounts of every individual interviewed, extremely complex--so complex in fact that it taxed the abilities of the entire Study Group to comprehend it. It should be remembered that this was one of the first attempts to model the air-to-air battle and to incorporate it with the air-to-ground situation. The Study was a tremendous education for the personnel involved, especially the Steering Group.[75] The difficulty of the Steering Group's job was primarily due to two factors: first, the stakes were very high. The decision they were participating in would affect the Air Force force structure for many years. Second, the level of technical expertise required to understand the computer model was very sophisticated. It was extremely difficult to determine the effect of a decision on an input factor.

The magnitude of the problem for the Steering Group was indicated by the Systems Analysis representative, Russell Murray,

> The activity that I can remember best is sitting in Harold Brown's conference room, day after day having these meetings with Generals and DDR&E. We would have these great discussions.

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[74]Fish interview.

[75]This point was specifically made in a letter from Colonel Fish to the author, September 10, 1970.

> Then the Air Force computer was just going like mad; it was grinding out pages and pages of data. They built this gigantic model which simulated a whole air war. Then the Energy Maneuverability guys were in there attempting to show how a given difference in energy maneuverability would translate into a difference in kill probability.. . .
>
> There was a lot of this [discussion] going on, and I didn't feel we were getting to any particular conclusion. Naturally Systems Analysis was pushing for an A-7 or an airplane like that. By pushing I mean we were there to see that it at least got a fair shake. The calculations were not done by us: they were done by the Air Force. But the Air Force model was [complex].. . .I spent some time running through these pages and pages of data, and I can still recall a couple of things that came out of this war. We had a situation where the F-4 was just shooting down everything in sight. It was wonderful what the F-4 could do.. . .
>
> It was so complicated that nobody could figure out really what was going on in the model, that was the problem. It was a gigantic set-up that put forth reams and reams of data, and there wasn't anybody that could analyze the thing and understand it.[76]

Thus, the Steering Group had been appointed because of the importance of having inter-organizational approval of the inputs. Yet the complexity of the model challenged the supervisors' abilities to understand the details of this new decision-making instrument. (General Graham also indicated the model was complex.)[77] This highlights a classic management problem: the supervision of highly complex, technical work being done by specialists from a level which,must by its very nature be generalist-oriented.

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[76]Murray interview, April 28, 1970.

[77]Graham interview, February 11, 1970.

Another of the factors that this identifies is the critical role played by the head of the Secretariat, Colonel Fish.

As the leader of the group caring for and feeding the computer, Colonel Fish had to reconcile many conflicting opinions and viewpoints. His was a potentially controversial job, but he was aided by a chance association. The Systems Analysis official working directly for Murray on the Study was Patrick Parker. Parker's former association with Navy tactical air could have been a disruptive factor, had it not been for his objectivity and the fact that Parker and Fish had gone to the University of Chicago together. While attending the graduate School of Business Administration there they had become acquainted, and this feeling of respect carried over to the Study Group.[78]

Thus Colonel Fish held the central position of monitoring the computer runs and at the same time preparing the many briefings for higher officials. As the study continued into September and then October, a feeling of urgency pervaded the atmosphere. "Budget season" in Washington was approaching, and the importance of finishing the Study before the annual DOD submission was being considered. As the complexity of the Study became apparent the deadline for its accomplishment was moved back. Still, the study dragged on with the computer running while the organizations attempted to get a consensus on the inputs.

[78]Fish interview.

Systems Analysis is Promoted by McNamara

Before the Study could be completed, two significant organizational changes occurred. Charles J. Hitch, OSD Comptroller, returned to private life, and Systems Analysis, which had been in the Comptroller's office, was moved out. Dr. Alain Enthoven was appointed by McNamara to the separate organizational position of Assistant Secretary of Defense (Systems Analysis). This move into one of the seven assistant secretaries positions prepared the way for an enlargement of the office from about 25 professionals in 1965 to 126 in 1967.[79]

Dr. Harold Brown Becomes Secretary of the Air Force

Three weeks after Dr. Enthoven became an Assistant Secretary of Defense, the Secretary of the Air Force, Eugene M. Zuckert, retired. McNamara appointed his head of DDR&E, Dr. Harold Brown, to be the new Secretary of the Air Force. Dr. Brown was a nuclear physicist, and at 38, was the youngest Air Force secretary ever to be appointed. He turned his DDR&E position over to Dr. John S. Foster, and assumed his new post on October 1, 1965.[80]

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[79] Braswell, *op. cit.*, p. 21. Enthoven was confirmed by the Senate July 16, 1965, and sworn in by Secretary McNamara on September 10, 1965. The official establishment of the new office was in DOD Directive 5141.1, September 17, 1965. McNamara did not *create* the additional Assistant Secretary position; the *Deputy* Director of DDR&E had just left DOD, so McNamara took this opportunity to demote that position to the *Deputy* Assistant Secretary level and upgrade Enthoven's.

[80] "McNamara Team Extending Sphere Into Top Operation Service Posts," *Aviation Week and Space Technology*, July 19, 1965, p. 24.

As Secretary of the Air Force one of Harold Brown's first actions was to send a memorandum to the Secretary of Defense on the progress of the Fish Study. In a memo on October 5 he stated the initial computer runs were being reviewed, that additional sensitivity tests were being run, and that the results should assist in choosing among the various aircraft. He stated, however, that the study would not say whether the tactical force should be increased. That decision, he noted, must rest on a comparison of the effectiveness of an expanded force with the presently approved 24 wings of tactical fighters.[81]

An attachment to Brown's memo was written by the Policy Group of the Fish Study. (Dr. Foster, Dr. Enthoven, General Ferguson and General Compton.) They stated the "entire methodology, programming, costing, and input data for the model were thoroughly reviewed" by the Air Staff, DDR&E and Systems Analysis. They cautioned, it was "not possible to obtain unqualified agreement on each input but in all cases, the matter at issue was resolved to a degree that all parties accepted the resultant position as a reasonable basis on which to proceed. . . . It is evident from the early results that a powerful tool has been developed for assisting in the determination of optimum tactical aircraft force mixes." They stated that the A-6

[81]Memorandum, Secretary of the Air Force to Secretary of Defense, "USAF Tactical Fighter Forces," October 15, 1965.

had been dropped because of its high cost and that additional analysis was needed to refine the result.[82]

As the study continued it narrowed the field of candidate aircraft down to the A-7, F-5, and F-4. Their costs and effectiveness were exhaustively compared among the various missions, and the Study Group prepared to draft the conclusions. Just as in the Bohn Study the F-5 and A-7 each demonstrated an area of specialization. The F-5 appeared to be the better air-to-air fighter, while the A-7 was capable of greater range.

This capability of the A-7 for long range, which could be converted into long loiter time for close air support missions, was primarily due to its use of a technological innovation--the turbofan engine. Another subtle, but very important feature of the A-7 was its combination of a heavy-load-carrying capability with a large, relatively spacious fuselage (when compared with the tiny F-5). This combination presented to the engineering-minded, research and development community, an opportunity to incorporate in future models, a variety of avionics equipment to achieve greater accuracy in navigation and dive bombing. (This quality is generally referred to as "growth potential.")

The many and varied qualities of the different aircraft were finally brought together by the Study Group,

[82] *Ibid.*, Attachment.

and the factors were arrayed for a decision. However, some of the features of the study were especially prominent. General Graham commented on how the study was concluded, and the salience of the A-7 cost:

> Although that study never came out and said, "Buy the A-7," of course, it was used that way. I'll give you another very concrete and specific on why it came out the way it did. The single most important item in that Fish study was the cost quote on the A-7. . . . [LTV and Systems Analysis] validated the cost, the unit fly-away cost, at 1.4 million dollars a copy. This made the A-7 come out shining because of the price. We had an exact price of the F-4 because of the history of production, but the A-7 was mushy enough that you could call it whatever you wanted and get away with it. . . . [LTV] people in furnishing the cost came up with this, and the Systems Analysis guys popped on that and insisted that be used, although we in the panel objected to it because we knew what it involved.[83]

The price of the A-7 referred to by General Graham was requested from LTV early in the study. In discussing the price, LTV personnel said they were asked for the cost of the original A-7 after they had built 1000 aircraft

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[83]Graham interview, February 11, 1970. There is some confusion about where the actual price quote on the A-7 came from. Normally Air Force Systems Command would get the cost from the contractor and then check it for accuracy. General Graham indicated that this probably happened. However, Colonel Robert E. Hails had occasion to research this after he was appointed the Air Force A-7 project manager. He indicated this particular cost quote did not go through the normal channel but was supplied directly from LTV to OSD Systems Analysis.

for the Navy. The price LTV sent to OSD which was subsequently placed in the model was $1.2-1.3 million per aircraft.[84]

With the A-7's performance and its relatively low cost quote, it appeared to be a real contender. The case for the F-5, however, was strengthened by some aspects of the war game, and many officers (including several Generals) thought the F-5 was the better aircraft. While the conclusions and recommendations of the study were being drafted and briefed through the Air Force Board Structure, in October/November 1965, four external events were affecting the environment of the decision.

The first was the increasing intensity of the Vietnam War. The number of American servicemen and aircraft in South Vietnam had multiplied, and U.S. units were coming into larger and larger battles with the Viet Cong. One of the most significant battles began in late October 1965 at the Special Forces Camp of Plei Me. During the six days that the camp was beseiged by overwhelming enemy forces, 516 close air support strike sorties were flown

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[84]Interview with Mr. Whitney McCormack, LTV A-7 Program Manager, April 1, 1970. McCormack sent the quote of $1.2-1.3 to OSD in the fall of 1965. This figure represented the cost of the A-7A after the Navy had paid for all the development work, with the production facilities and tooling being already in place. The only addition the Air Force planners made to the LTV cost quote was to add an afterburner to the jet engine and raise the cost about $50,000. The total cost was based on the Navy buying 1000 A-7A's and the Air Force buying 864 A-7A's. The FY 66 unit cost from LTV was $1.421 million for the Navy aircraft, but this cost would decrease with volume purchase so that the average would be $1.249 million per A-7.

by various aircraft for its defenders. The commander of the camp, Army Captain Harold M. Moore, said later, "In my opinion, the Air Force has saved this camp. . .air strikes outstanding."[85] The effect of this combat information would have been to place a higher value on the close air support mission among the various missions evaluated.

The second set of events was concerned with the deployment of the first test squadron of F-5's to Vietnam. They arrived from the U.S. on October 23, during the Plei Me battle, and began flying close air support missions in the area around Saigon. This real-life experience with the aircraft immediately began to filter into Headquarters USAF, and several limitations of the F-5 became apparent. They were primarily its lack of range and load-carrying ability.

Aviation Week reported the range of the F-5 was limited to 120 miles, while the ordnance load was limited to four 750-pound bombs (3000-pound total).[86] This compared with the A-7's range which was reported as 600 miles, and its load-carrying capability of 15,000 pounds.[87]

The A-7 Flies for the First Time

The third event was the first flight of the A-7 at the Dallas plant of Ling-Temco-Vought. The chief test pilot

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[85]Cited in Supplement to the Air Force Policy Letter for Commanders, December, 1965, p. 24. The author participated in day and night attack missions over Plei Me.

[86]"F-5 Combat Trials Pinpoint Advantages, Limitations." Aviation Week and Space Technology, January 17, 1966, pp. 28-30.

[87]Aviation Week and Space Technology, June 15, 1964, p. 112.

of LTV flew the A-7 for 10 minutes and again for one hour on September 27, 1965. The event was significant because it showed LTV was one month ahead of schedule in producing the aircraft for the Navy, and it demonstrated the aircraft's technical feasibility.[88]

The fourth event in the political process outside the Pentagon was a set of Congressional hearings on Close Air Support by the Special Subcommittee on Tactical Air Support of the House Armed Services Committee under the chairmanship of Representative Pike. These hearings were begun in September and ended on October 14, 1965, during the conclusive phase of the Fish Study. Representative Pike was critical of the Air Force performance in Vietnam, and he specifically charged the Air Force with neglecting to develop a specialized aircraft for close air support. He requested testimony from a series of relatively junior officers and non-commissioned officers who had just returned from Vietnam.

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[88] Aviation Week and Space Technology, October 4, 1965, p. 29. The first flight of any new aircraft is a significant achievement. The degree of its importance is attested to by Robert L. Perry of the RAND Corporation, "A convincing feasibility demonstration would appreciably enhance confidence in the predicted worth of whatever was being evaluated. Indeed, it is difficult to conceive of any single event that could so markedly change the value of the entire equation, particularly if doubt about the technical feasibility of the innovation had been prevalent earlier." Innovation and Military Requirements: A Comparative Study (Santa Monica: RAND, 1967), RM-5182PR, p. 9. It is, of course, recognized that the A-7 represented far less than a revolutionary technique or vehicle. There was very little debate about its technical feasibility. Still, the very fact that it had successfully flown was a mark in its favor, and it certainly represented a reduction in the uncertainty surrounding the new airplane. This uncertainty regarding the Navy spawned A-7 was recognizably high in the Air Force.

One of these officers was an Air Force captain named Alan L. Rennick. Rennick personified the Vietnam-version of the young, Air Force fighter pilot of the operations profession. He had flown over 300 missions in Vietnam, most of them in the A-1 Skyraider. Representative Pike and the members of the committee were particularly interested in getting Captain Rennick's opinion on the need for a new attack aircraft. Rennick's testimony is important, because officers in the Air Staff were also interested in what the pilots performing close air support needed in a new aircraft. Rennick stated he liked the advantages of the speed of the F-100 (which he had flown before he went to Vietnam) but that the A-1 had advantages:

> Mr. Ichord. You have a pretty high opinion of the A-1E, even though it is a 20-year-old airplane, as Mr. Wilson put it.
>
> Captain Rennick. Yes, sir. I think that in the given set of circumstances, that we have discussed, that it is doing a real fine job. And I don't--it is as good an airplane as we have in the inventory right now for a given set of circumstances.
>
> Mr. Pike. I can understand why it would drop more bombs [it had 15 bomb racks]. Why is it more accurate?
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> Captain Rennick. Slower release speed, sir. You can release your ordnance at a lower altitude and effect the recovery in much less distance. Therefore, you can release closer to the target.[89]

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[89]U.S. Congress, House of Representatives, Committee on Armed Services, Close Air Support, Hearings before the Special Subcommittee on Tactical Air Support of the Committee on Armed Services, 89th Cong., 1st sess., September 23, 1965, p. 4689. (Emphasis added.)

This point about the accuracy of the A-1 versus any other airplane because of its slow speed was a controversial issue, because the committee and the press then openly questioned the Air Force position on using supersonic tactical fighters for close air support. The committee asked Rennick what specific qualities a new attack plane should have.

> Captain Rennick. Well, I think that any new airplane that we develop specifically for close air support should have a good capacity to carry--a large capacity to carry ordnance. It should have a long loiter time, and be able to respond rapidly. I would think that these three things would be of the most importance.[90]

Captain Rennick's testimony came close to specifying the decision criteria for the Fish Study, in addition to the fact that the hearings were an external factor in the decision process.

The Air Force Decision on the A-7

These factors began to come together in late October 1965 as the Air Force, in conjunction with OSD, prepared to make a decision on the results of the Fish Study. Before describing the decision point it may be helpful to review some of the positions of the organizations involved.

The Systems Analysis representatives were of the opinion that the A-7 suited the needs of the Air Force better than any of the other contenders. DDR&E does not

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[90] *Ibid.*, p. 4695.

seem to have established a strong view, one way or the other, in choosing between the A-7 and F-5, although some DDR&E people were vocal advocates for putting a gun in the F-4.

The Air Staff was split. In an attempt to discern why this was so, Colonel Fish was asked if there were differences in professional perspective within the Air Staff. He answered:

> Oh, yes. I think the best way to point that out was the fact that . . .DCS/R&D, including Requirements, was absolutely convinced that we [the Air Force] had to continue to press for a multipurpose,supersonic airplane that was the F-5.
>
> The Operations people were heavily and strongly for continuing in the supersonic business. Our Requirements people were that way, and TAC people were that way. But when we finished all of our simulations I would say the Requirements people. . . had come around very strongly to the fact that it made sense to have some small part of the force able to carry large loads of bombs, like the A-7 showed up in the studies. You couldn't have a <u>whole lot</u> of the force doing that, but you would always have some portion of it doing that, close air support.
>
> The Plans position was that we wanted an airplane that--we wanted a <u>decision</u>. Here's an interesting thing. The Plans position was that we wanted an airplane that we could put into that force structure and get on with the problem. My immediate boss in those days was [Brig.] General [R.D.] Reinbold, although I worked for General Agan on this problem. General Reinbold said to me, "I don't care which airplane you all come up with, but your principal job--and you haven't done anything if you don't do it--we need a decision for this next budget cycle which starts really in December. If we're going to do something we

> have to have a decision in November." So the Plans position was whichever airplane comes out best, that's the one we want, but we want a decision.[91]

Finally, the results of the Study came into form. The Secretariat initially pointed out that it thought a stripped-down version of the F-4 would be the best vehicle, but this was not considered feasible because of production schedules and other (unexplained) reasons. Then Colonel Fish wrote a paper, circulated to Generals Agan, Catton and Graham, in which he said, "Let's buy the A-7, and put bigger engines and a gun in the F-4 to fill in for an air-to-air fighting capability in the near term to compensate us for the fact that the A-7 would not have an air-to-air fighting capability, and start a crash development program for the FX, the F-15--a superior air-to-air fighting aircraft that would be able to withstand the enemy threat in 1975 plus 20%."[92] This paper was not meant to be a recommendation, but only for use as a discussion subject. It did not meet with universal approval, but it formed the basis for what was to follow.

Colonel Fish described the events leading up to the critical decision point on November 5, 1965.

> I thought it would be better if we didn't come up with "Buy the A-7" or "Buy the F-5." One night about two in the morning I said the way we should present this thing is to list all the characteristics in two columns and say, "Buy the A-7 if you believe in these things,"

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[91]Fish interview. The placement of "Requirements" in both the R&D and operations groups will be discussed more below when the Air Force drafts a requirement for the A-7.

[92]Fish interview.

and "Buy the F-5 if you believe these things." Because even within my own group there was a division of opinion as to what we should do; there was no consensus.

We briefed it to the Steering Group, and General Agan said, "Let's take this to the Chief of Staff." So they arranged a meeting for the Chief of Staff, and he said he'd take the briefing with the Secretary. This thing got on a real fast train. I've spent six years on the Air Staff, and I don't think in all the days I've been here that I remember anything like this going quite as fast as this. Zap! We took it on in to the Chief of Staff and the Secretary at about six o'clock at night.

Without there having been any formal announcement that this briefing was to be given to the Chief of Staff and the Secretary, every three-star general in the building showed up in the room, plus some extras. The word was out. This had been a gut issue, and there had been lots of meetings on it.

I gave the briefing, and I ended up with these two slides: "Buy the F-5 if you believe these things," and "Buy the A-7 if you believe these things." [One of the Air Staff officers] said, "There are a lot of things wrong with that list on the left" (meaning the A-7). General McConnell said, "There are a lot of things wrong with that list on the right" (meaning the F-5). And I knew right then where we were. Up to that minute we really didn't know which way the Chief of Staff was coming down.

The Chief of Staff said, "I think we ought to buy the A-7" to the Secretary. The Secretary said, "I certainly agree. Let's prepare an appropriate piece of paper for Mr. McNamara." I prepared that letter, and I prepared it immediately the next day.

> It was not coordinated throughout the Air Staff. I prepared it with direct guidance from General McConnell and Secretary Brown.[93]

The memorandum was dated the same day as the briefing, November 5, 1965. What were General McConnell's thoughts as he listened to the briefing and balanced it off against the other factors that he had to consider? General McConnell later related his decision to the long history of Roles and Missions disputes between the Air Force and the Army:

> Ever since World War II the Air Force began dedicating all of its funds gradually towards the build-up of a strategic offensive capability and continental defense capability, and therefore didn't have enough money to go into a tactical air capability the way they should have. But that was the philosophy of the government at that time--Massive Retaliation, at places of our own selection with weapons of our own choosing. So we got behind the eight-ball in tactical aviation. And naturally the Army attempted to move into the tactical aviation area with organizational aircraft. . . .
>
> The thing that was pushing [in 1965] was that we had to get something to give the Army close air support. First, it was our job. Second, if we didn't do it, somebody else was going to do it for us. Every once in awhile that would come up on the Hill, especially with Representative Pike. Pike wanted to turn the Army into another Marine Corps since

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[93]Fish interview. For his part in the Study, Colonel Fish received an unusual tribute from OSD. In a letter dated December 13, 1965, and addressed to General McConnell and General Agan, Murray and Cheatham formally commended Colonel Fish for his finesse and competence in the exceptionally difficult job of coordinating the Study. They pointed out that Colonel Fish had been the "most important single member of the Joint OSD/AF F-X Study Group" and had been the inspiration behind the excellent efforts of the Air Force Secretariat.

> he was an old Marine. Senator Symington kept showing charts all the time that he was the last guy to lay down a fighter aircraft when he was Secretary of the Air Force. . . .
>
> The thrust of the whole thing was that if the Air Force was going to meet its responsibilities, it had to go to a tactical weapons system that would drop iron bombs in close support and specialize it for close support. That is what drove it. . . .
>
> We didn't pay too much attention to the briefings and the computer study; we knew we had to have an airplane, and this one we thought we were going to get for $1.4 million.[94]

General McConnell and Secretary Brown consulted extensively over the decision. Brown later reflected on his perspective,

> It was perfectly clear by late 1965 and early 1966 that the Air Force was going to be put to the test both by the existence of the Vietnam War and its nature--however representative or unrepresentative they would be of a war somewhere else--and by Congressional interest and by OSD interest in the question of how could the Close Support role--however defined--as part of the area intrinsic to the ground battlefield.
>
> The Air Force was going to be put to the test by all these things, and therefore it had to look at the question of close support specifically, and not just say as had been part of doctrine of organizations within the Air Force for many years, that whatever can fight the air battle can then go ahead and do the Close Support role. I think there was coming to be an awareness in the Air Force that, as a result of contraints inherent in limited war, you might not be able to fight the air battle. You might be forced to a close support situation where you hadn't won the air battle; you might have complete air superiority, but there might be other contraints as well.[95]

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[94]Interview with General John P. McConnell, USAF, retired, May 6, 1970. General McConnell retired on July 31, 1969.

[95]Interview with Dr. Harold Brown, April 8, 1970.

Secretary Brown then discussed the Fish study and the location of the decision to buy A-7's. He stressed the importance of the TAC commander, General Disosway, in the decision-making process:

> It became clear that--depending on how you defined the tasks--it did help to have some specialized close support aircraft. Providing you had a big enough total force you could devote some to this activity. . . .This, I think, was reinforced by the political view that lacking some close support aircraft the Army would inevitably have a better argument for developing its armed helicopters to do the close support role. . . .
>
> It really narrowed down to the F-5 and the A-7. By then enough information had come in from Vietnam on how important it was to have a big payload--both because of the bombs you could carry and because it gave you room to put in all kinds of targeting equipment which would allow you to get accuracy. People didn't yet realize the importance of this, at headquarters at least, but were beginning to. So a decision was made to go with the A-7. It was really made at the Chief's level and mine, but it was recommended by the Air Staff Board and the Air Council, and it was supported, in the end, by TAC. I think that was very important, because it would have been very difficult to overrule General Disosway had he come to a different conclusion.[96]

When asked if the computer study had any effect on his decision, Secretary Brown answered,

> The computer study was, I think, quite important. What it did was that it showed what I think computers are good for; it showed what's important, then you go back and you look at those and make the judgment on how that's likely to be. In other words, it tells you what characteristics and what premises govern the outcome of the study. Then you make the judgment on which of these

[96] *Ibid.*

> premises is most likely to be right, and that tells you which is the right answer. It saves you from having to make a judgment of whether the A-7 is better or the F-5 based just on their characteristics, and allows you to make a judgment that the distance you will want to go is so and so far or that the increased accuracy which will require fairly heavy aiming devices is going to be important. You decide that, and then it tells you what your choice should be.[97]

Secretary Brown's identification of the opportunity presented to improve the A-7's avionics/targeting equipment by the incorporation of extensive aiming devices was especially prescient considering the evolution of the avionics which was to occur. Brown also indicated the significance of having General Disosway concur in any decision to buy a new tactical aircraft.

General McConnell was later asked <u>why</u> it was so important that General Disosway, as the TAC commander, have a voice in the decision process:

> Because Tactical Air Command was going to employ the aircraft, and he was the commander of Tactical Air Command. If he was going to use it he was supposed to be knowing what he would be required to do with it, and therefore we needed a concurrence out of him before you go up on the Hill and he says, "No, I don't agree with it and never did agree with it." They'll always ask him.[98]

General Disosway's position in 1965 was the commander of all the stateside tactical air forces in the Air Force. He had over 80,000 men in his command which included some sixteen air force bases. In his tactical fighter force he

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[97] <u>Ibid.</u>

[98] Interview, May 6, 1970.

had all supersonic aircraft consisting of F-100's, F-105's and F-4's. General Disosway described the general sentiments of the operations profession before the A-7 decision.

> As soon as you get a better machine you can take on all those low performing aircraft [and shoot them all down.] You've got historic examples of that that are just as applicable today as when they happened. Look at the German Stuka; it was a great airplane [for attacks on ground forces] as long as it didn't run into anything that could shoot it down. As soon as they started using it in the air where British Spitfires and P-40's were available to fight it, it disappeared off the battlefield. The Me-109 and FW-190 were a similar example because they set their production on those two aircraft prior to the time we set the production on ours, and ours were superior aircraft. And we beat them. Now if they had come out with the Me-262 [jet fighter] sooner, they would have beaten us. I don't think there is any question about it, in the air-to-air business you've got to have a superior aircraft.[99]

General Disosway related how General McConnell called him before the final decision, and asked for his position as the TAC commander:

> Really, the Air Force didn't want the A-7, but they wanted the F-5 less. McNamara, according to my understanding, gave the Air Force a choice to buy a cheaper aircraft than the F-4 which we were buying, and then if we would buy the cheaper airplane, we could have the F-4E with the gun on it, which was going to cost some extra money. So the choice was between the A-7 and the F-5. There wasn't any question in my mind as to which aircraft we should have, because the F-5 wasn't as good....

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[99]Interview, April 3, 1970. The relation of the A-7 to the German Stuka is one continually made by fighter people. See Colonel William F. Scott, "The Rise and Fall of the Stuka Dive Bomber," Air University Review, May-June,1966, pp. 46-63. This article was written only weeks after the A-7 decision.

> McConnell called me and asked which aircraft I'd pick. I said I'd take the A-7. We really didn't know a lot about the airplane, but once the decision had been made we got the people together to see what changes needed to be made. TAC's big job was to get any airplane.[100]

It is significant that Tactical Air Command wanted two outcomes from the Fish Study--more tactical aircraft and the TSF F-4. TAC recommended that if A-7's were to be purchased, the request should also contain TSF F-4's to protect them. The request for A-7's and F-4's was related to TAC's attempt to increase the 24-wing force structure for tactical fighters. General Graham was later asked if there was any hope for a force structure increase with the A-7/F-4 request:

> Well, there was always and still is [in 1970] hope for it, but there were a lot higher hopes then. It looked as though tactical forces would continue to enjoy ascendancy and reach as high as 29 wings.[101]

With General Disosway's verbal concurrance, General McConnell and Secretary Brown proceeded to have Colonel Fish draft a memorandum to request both TSF F-4's and A-7's. The paper was not coordinated through the Air Staff, and it went forward swiftly to OSD. When General McConnell was asked if he agreed with the Secretary's request he answered,

> Yes, we wrote it together; we finished it off together. Secretary Brown and I practically lived together on these things; he and I were very close. We never came up with a split decision between us; we'd work it out. Not

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[100]Disosway interview, April 3, 1970.

[101]Graham interview, February 11, 1970.

> one time did we ever go downstairs with a split. Through Secretarial channels he always went the same that I went through JCS channels.[102]

The Air Force decision on the A-7 went to the Secretary of Defense in the form of Secretary Brown's memorandum of November 5, 1965:[103]

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[102]McConnell interview, May 6, 1970.

[103](Emphasis added.) The assumptions of the decision had apparently been: (1) The F-4 was needed in the gun version for air superiority; (2) The A-7 was the most cost/effective of the candidates; (3) Only minimum changes in the Navy A-7 would be needed to meet Air Force needs; (4) It would be possible to divert part of the early Navy production to the Air Force; (5) The A-7 would be available to participate in the Vietnam War; and (6) The cost of the A-7 would be about $1.4 million per aircraft. These assumptions are the results of research conducted by Lt. Col. Don Clelland, USAF, in the Office of the Secretary of the Air Force.

E X T R A C T

DEPARTMENT OF THE AIR FORCE
WASHINGTON

Office of The Secretary

November 5, 1965

MEMORANDUM FOR THE SECRETARY OF DEFENSE

SUBJECT: Interim Buy Tactical Fighters (U)

My memorandum of October 15, 1965 deferred recommendations on an interim medium cost aircraft for the tactical fighter force until additional analysis could be accomplished. The computer simulation being used in the joint Air Force/OSD selection effort has been subjected to numerous sensitivity tests. The data thus developed supports some general and some specific conclusions.

. . . .

The study considered the performance of a variety of alternative equal cost forces added to the approved basic tactical fighter force.

. . . .

The cost/effectiveness of the A-7 and F-5 was very close. Review of the results of the analysis, including the numerous sensitivity tests and excursions, shows that under certain conditions the F-5 would be the most cost effective aircraft; whereas given other conditions, the A-7 would be the better choice. For a given acquisition and ten-year operation cost, the equal cost forces represent a larger number of F-5's than of A-7's, and they are of near equal effectiveness in the environment considered in the study. This makes important such factors as MAP compatibility or disposability (favoring the F-5), compatibility with the Navy (favoring the A-7), and providing an increased hot production line (favoring the F-5, which now is planned for a lower rate in MAP than the A-7 is for the Navy).

. . . .

However, the overriding requirement was to determine what weapons system, at comparably low cost, would be most capable of carrying out the missions of close air support in a permissive environment. . . Under such assumptions. . .the A-7 (on the basis of ten-year investment and operating costs) has a probable cost effectiveness superiority. The added flexibility provided by the payload/range/mission time advantage appears to make the A-7 a better choice providing air superiority is established by the recommended F-4 force (including the TSF version). Put another way, when added to the F-111/F-4 mixture now approved, the combination of the F-4 (TSF) and A-7 appears to cover the widest range of low and medium intensity air-to-air, air-ground situations. The Chief of Staff and I, on the basis of the above factors, recommend such a mixture as an addition to the force.

/s/

Harold Brown

The A-7 issue also had foreign policy implications as it lay on McNamara's desk. The situation was aptly described by Aviation Week in its "Washington Roundup" column,

> Defense Secretary Robert S. McNamara is leaning toward buying the Navy/Ling-Temco-Vought A-7A for the Air Force rather than the Northrop F-5--a move which had the Canadian Defense Ministry up in arms.
>
> Before placing their order for 125 F-5's last summer Canadian defense officials felt they had assurances the Pentagon would buy some F-5's for the USAF. They were counting on the US to follow through to neutralize criticism at home that the Canadian Defense Ministry was buying a 'second-class' aircraft not good enough for the USAF.

> Pentagon insiders say the latest plan--always subject to change in last minute budget conferences--is to buy the A-7A for entry into the USAF inventory in 1968. Canada also had considered buying the A-7A before deciding on the F-5.[104]

Secretary Brown later reflected on his view of the memorandum as it went to McNamara and then to Systems Analysis:

> We then sent down this recommendation to the office of the Secretary of Defense, which was well received at the time partly because some of the people in Systems Analysis considered this was their airplane. I'm sure they had some reservations about the question of future growth. They were trying to keep the price down, again because it was their airplane; if you kept the price down it would look better.[105]

Systems Analysis did receive the request favorably, as had been expected. Enthoven and Murray had been trying to interest the Air Force in the A-7 for over two and one-half years. When asked several years later Dr. Enthoven did not remember the memorandum as such, but he noted, "I would have had the action on that recommendation. If that was the first time the Air Force recommended the A-7, then we would

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[104] Aviation Week and Space Technology, December 6, 1965, p. 25. The press lagged the decision process by some weeks, but when they did catch up, they over-simplified the reasons for the decision to the change in service Secretaries. "Air Force Retreat on Supersonic Aircraft Traced to New Secretary," Aviation Daily, December 13, 1965. This was certainly an important factor and points out the significance of having politically appointed officials at the highest levels of executive agencies. Harry Howe Ransom has traced the history of many organizational innovations in air forces to this critical variable. See, "The Politics of Airpower: A Comparative Analysis," Public Policy, Vol. 8 (1958), pp. 87-119.

[105] Brown interview, April 8, 1970. (Emphasis added.)

have concurred in that and recommended approval."[106] In fact, Systems Analysis recommended the Air Force be given more A-7's than Brown and McConnell had requested.

Secretary Brown and General McConnell had asked for approval to buy 96 F-4 TSF's[107] and 387 A-7's.[108] Secretary McNamara consulted with Systems Analysis, and quickly on November 19, 1965, sent his answer. He approved the procurement of 561 A-7's for the Air Force.[109] The development of an afterburner on the Air Force version of the A-7 was approved. He denied approval of the F-4 TSF with an internal gun because of the development cost and the delayed schedule that would result.[110] (The F-4 TSF was not approved until eight months later.) OSD at this time anticipated the Air Force A-7 would be a virtual copy of the Navy model (plus afterburner) and that initial deliveries of the aircraft would be in January 1967.

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[106] Enthoven interview, April 8, 1970.

[107] Graham interview, February 11, 1970.

[108] U.S. Congress, Senate, Committee on Appropriations, Department of Defense Appropriations Fiscal Year 1970, Hearings before the subcommittee of the Committee on Appropriations, 91st Cong., 1st sess., July 29, 1969, Part 4, p. 34. Testimony of Secretary of the Air Force Seamans. (See Appendix.)

[109] DOD Appropriations, FY 1970, Senate, *op. cit.*, p. 34.

[110] Memorandum, Secretary of Defense to the Secretary of the Air Force, November 19, 1965, "FY 1966 and 1967 USAF Tactical Air Procurement and Utilization Rates (U)". The Secretary of Defense did not approve production of the F-4 TSF (now the F-4E) with a gun and a microminiaturized radar until July 22, 1966. History of the Tactical Division, Directorate of Operational Requirements and Development Plans, DCS/R&D, July 1-December 31, 1966, p. 6.

PART TWO

DEVELOPMENT DECISIONS ON THE A-7

With the Air Force decision to buy the A-7 and the OSD approval, the A-7 program entered a new phase of decision-making. Heretofore, the questions had largely been centered on whether the Air Force should buy a specialized close air support aircraft and which of several candidates should be selected. The debate over the supersonic F-5 versus the subsonic A-7 had reflected organizational positions and professional perspectives developed over years of experience. In addition, the Air Force had been denied the opportunity to develop a new aircraft that would have been designed specifically for close air support.

The decision had been made that the specialized close air support aircraft for the Air Force would be a modification of the Navy A-7 which was in the early stage of production. After this point the issues in the decision process were centered around the differences between the capabilities of the Navy version and those the Air Force desired. The decisions in this part are "development" decisions; they were molded and constrained by the deadlines and uncertainties of the research and development process.

The two major decisions that will be discussed were those to incorporate a more powerful engine in the A-7 and to develop an improved navigation/weapons delivery (avionics) system. These were not technical issues in isolation from the main body of defense decision-making. The proposals had technical characteristics, but the decisions on the engine and the avionics system impacted directly on the cost of the program and the schedule it was expected to meet. These determinations of cost, schedule, and performance shaped the issues internal to the program. At the same time, the program itself became an issue in the larger framework of Air Force/Army/Navy discussions, OSD/Air Force interaction, and DOD/Congressional relationships.

The participants in the development decisions were many of the same individuals and organizations that had shaped the debate over the selection of the A-7. The Air Force was the developing agency, and the Air Force Secretary and Chief of Staff continued to be the focal points for issues and proposals. The Army, Navy, Air Staff, Tactical Air Command, OSD, Congress, and the press continued to influence the decision process, but there was one major new actor.

The development program was the unique responsibility of the Project Management Office which was created especially to plan, coordinate, schedule--in short, to nurture--the Air Force A-7 from concept to operational service. The process whereby the project management office was established will be described, and an attempt will be made to show how the project manager made a contribution to the shaping of the decision alternatives.

The project management office was to be a new participant in the total process we are describing. The other organizational participants, which had influenced the decision to buy the A-7, continued for the most part to influence its development. The decisions on the engine and the avionics, plus the annual appropriations request, provided ample opportunity for many organizations to make inputs to the process. This part will describe how the A-7 related to the purposes of these various organizations and how, in turn, the A-7 program became the resultant of differing organizational influences.

CHAPTER IV

THE INITIAL AIR FORCE DECISION ON CHANGES TO THE A-7

Once the decision had been made to develop the Navy A-7 for the Air Force, the problem became primarily one of "management"--integrating all the necessary resources for the accomplishment of a specific purpose. In this case the general "purpose" was to deliver the A-7 aircraft in sufficient numbers with adequate performance and on a timely basis to the operating forces. But who determined "sufficient numbers", what performance was "adequate", and what would be a "timely basis?"

The purpose of this chapter is to show how these questions were answered by describing how the program was initiated between the OSD November 1965 decision to let the Air Force develop the A-7 and the April 1966 decision on the changes from the Navy version.

Research and Development Project Management

The development and acquisition of complex weapon systems in the military services has become a specialized field with many characteristics of a sub-profession. The management technique by which weapons systems are developed and produced is called "project management." A brief outline of the general characteristics of project management may provide insight into the operation of the Air Force project manager as his activities are described.[1]

Project Management is essentially a technique of centralized control over a process of creative innovation. It is a method of identifying the uniqueness of an individual project and provides a basis for maintaining continuity during the research and development process. The official Department of Defense definition uses the terms "system management" and "project management" as interchangeable.

> System/Project Management: A concept for the technical and business management of particular systems/projects based on the use of a designated, centralized management authority who is responsible for planning, directing, and controlling the definition, development, and production of a system/project; and for assuring that planning is accomplished by the organizations responsible for the complementary functions of logistic and maintenance support, personnel training, operational testing, activation, or deployment. The centralized management authority is supported by functional organizations, which are responsible to the

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[1]This description of project management draws from many sources. For a more complete discussion of the background,theory and application of the technique, see David I. Cleland and William R. King, Systems Analysis and Project Management (New York: McGraw-Hill, 1968); John S. Baumgartner, Project Management (Homewood, Illinois: Richard D. Irwin, Inc., 1963); Peck and Scherer, op. cit.; Alexander O. Stanley and K. K. White, Organizing the R & D Function (American Management Association, 1965); NASA-Apollo Program Management (Washington, D.C.: NASA, 1967); USAF Air University, Introduction to System or Project Management (Gunter Air Force Base, Alabama: Extension Course Institute, undated); and George A. Steiner and William G. Ryan, Industrial Project Management (New York: Macmillan, 1968).

> centralized management authority for the execution of specifically assigned system/project tasks.[2]

The central management authority referred to is the project management office which is established when the project is sufficiently defined to warrant continuous supervision. The establishment of a project management office is, in itself, an indication that a project has a high priority, requiring high-level visibility and backing. When the project declines in its relative priority or when the development progresses to a point where a more traditional organization structure can be used, the project office is usually abolished and the project management team dispursed and/or assigned to other activities.

Project management is normally viewed as an alternative to the traditional form of organization. The "traditional" form, as it is described in the project management literature, is almost universally hierarchical, characterized by a "chain of command" from the top-level executives to the functional specialists. The advocates of project management argue that this strong identification with vertical relationships is unrealistic and inefficient when complex projects require creative integration and are measured against deadlines. Cleland and King in Systems Analysis and Project Management present the basic argument,

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[2]DOD Directive 5010.14, "System/Project Management," May 4, 1965, p. 2.

> The management of project activities such as exist in a research and development organization, however, requires horizontal and diagonal relationships. In such an organization, managers and technicians deal horizontally with peers and associates at different levels in the same organization and with outside organizations. To follow the "chain of command" would be unwieldy, time consuming, and costly and would disrupt and delay the work. Horizontal and vertical contacts grow out of the necessity to get the job done; they are seldom charted, and yet they are necessary to a smooth flow of work in the organization.[3]

The alternative presented by project management is to organize a project team outside the functional areas of the organization and make this team responsible directly to top management. The project team then manages across functional lines on all activities that are necessary for the successful completion of the project. In addition, the project team must manage across organizational boundaries to influence those activities that affect the project but are the primary responsibility of other organizations. How does the project team achieve any of its goals if it has to manage activities over which it has little or no direct control? This is one of the central questions of projectment management theory.

The success of a project is intimately associated with the selection of the project manager and the amount of authority he is able to exert on the project. Traditional organization theory has assumed that authority is the "legal

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[3] Cleland and King, *op. cit.*, p. 151.

or rightful power to command or act," yet the project manager directly commands very few people. Recent research tends to confirm what project management theorists have been saying for years--that formal, designated authority is only a portion of the project manager's total authority. David L. Wilemon and John P. Cicero of the Syracuse/NASA Project Management Research Group focus on this broader aspect of project authority in one of their conclusions:

> The traditional superior and subordinate relationship must be modified to include a variety of interfaces among individuals and groups not associated one to the other by bonds of authority designated through relative positions in the organizational hierarchy. The interrelationships tend to be a function of the project work flow. . . .Authority is not a function of power and position, but becomes coupled with leadership and influence generated through knowledge and respect; earned authority is the key to the project authority structure.[4]

This broader conception of authority includes the legal and personal influence of the project manager. Cleland identifies it as _de jure_ and _de facto_ authority.[5] _De jure_ authority emanates from the formal, specific authority delegated to the project manager from this superiors and is described in formal policy and procedure statements such as the project manager's charter. _De facto_

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[4] David L. Wilemon and John P. Cicero, "A Concept of Project Authority in the NASA/Apollo Programmatic Environment," Working Paper No. 7, June 16, 1969.

[5] David I. Cleland, "Project Management--An Innovation in Managerial Thought and Theory," _Air University Review_, Vol. 16, No. 2 (January-February, 1965), p. 17. See also Cleland and King, _op. cit._, Chapter 10.

authority includes the project manager's professional reputation, his persuasive ability, his rapport with outside organizations, and his status in the informal organization. It is implicit authority reflected in the project manager's rank, position in the organizational structure, and special technical or managerial knowledge.[6]

The authority of the project manager is limited authority; it is constrained by the priority of the project and the ability of the project manager to negotiate alliances with the functional managers of his own and outside organizations. It is ultimately limited to the degree the project manager can project himself or his influence into the decision-making process.

This brief discussion of some of the salient features of project management theory is intended to outline some of the constraints and possibilities of the project managers on the A-7 program. The project managers were set in a position with a job to do--to define and manage the various resources necessary to the development of the A-7. But these were broad and indefinite bounds. The project managers were further constrained by their specific organizational environment. What were the organizations the A-7 project managers had to deal with, and how did the Navy program affect Air Force project management?

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[6] The authority of the project manager has been suggested as being a power spectrum with five sources of influence: formal authority; reward power, punishment power, expert power and referent power. See Gary Gemmill and David L. Wilemon, "The Power Spectrum in Project Management," forthcoming article in <u>Industrial Management Review</u>, 1970.

Project Management on the A-7

The project management process on the A-7 began essentially when Captain Henry Suerstedt was assigned in May 1963 to be the Navy project manager in the Bureau of Naval Weapons.[7] Suerstedt remained with the project for one year, until June 1964, at which time the Navy A-7A was still in the early design and development phase. (He left very soon after the initial contract was signed with LTV in March 1964.) Suerstedt was replaced by Navy Captain Carl M. Cruse in June 1964. Both Suerstedt and Cruse were professional Navy attack pilots with experience in development work. At the time the Air Force joined the program in November 1965, the A-7A had flown, and the Navy had just exercised its option to have LTV produce 199 A-7A's.

The Navy Project Management Office was established in the Bureau of Naval Weapons in Washington where it was one of many project offices.[8] The A-7 Project Manager reported directly to the Chief of Naval Weapons, who reported to the Secretary of the Navy. After a major reorganization the Bureau of Naval Weapons was replaced by Naval Air Systems Command, which reported to the Chief of

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[7]Air Force and Navy terminology differ. The project management office in the Air Force is called the Systems Program Office (SPO), and the project manager is called the Systems Program Director (SPD). The Navy uses the terms, Project Management Office and Project Manager. Because the Air Force A-7 project management office was established in the Navy A-7 Project Management Office, the Navy terms will be used throughout.

[8]For instance, in 1970 there were 27 research and development projects that reported directly to the commander of Naval Air Systems Command.

Naval Material. (See Appendix V.) In contrast, the Air Force organizational structure for acquiring weapon systems was less centralized.

Aircraft development in the Air Force was the responsibility of the Aeronautical Systems Division (ASD) of the Air Force Systems Command (AFSC). (See Appendixes VI and VII.) ASD was located at Wright-Patterson Air Force Base, Ohio, while the Headquarters of Air Force Systems Command was at Andrews Air Force Base, Maryland. If the A-7 had been an Air Force development program like the F-105, the A-7 project management office would have been called the Systems Program Office (SPO) and located at ASD, Wright-Patterson. The A-7 project manager would have reported to the commander of ASD, who reported to the commander of AFSC, who reported to the Chief of Staff.

Joint service programs were regarded by the Air Staff and Air Force Systems Command as unusually complex, presenting difficult management problems. One of the reasons given was the differences in the services' research and development procedures and organizations. In an effort to minimize the management difficulties and achieve the benefits of joint management (cost savings through commonality of equipment, contracts, etc.) the F-111 had been established as a joint program with the Air Force as DOD executive agent. Most of the Navy and Air Force management personnel on the program were assigned to the joint F-111 Systems Program Office at Wright-Patterson.

The Air Force anticipated that the Navy would be assigned the role of executive manager on the A-7. This would mean that the Air Force project manager would be assigned to the Navy A-7 Project Management Office in the Bureau of Naval Weapons. The Navy Project Manager (Capt. Cruse) would continue as the joint service project manager, and the Air Force project manager would become an A-7 Deputy Project Manager. However, the Air Force project manager would still have to report to Aeronautical Systems Division and Air Force Systems Command before reporting to the Air Staff.

As the Air Force project manager he would have the formal authority with respect to the A-7 program to:

> (1) Manage (plan,organize, coordinate, control, and direct) the collective actions of participating organizations in planning and executing the system program.
> (2) Propose and/or prepare modification of or changes to the system program within the limits of guidance received from participating organizations or higher authority.
> (3) Make changes to the system program consistent with his authority, as required to maintain internal balance of the system program.[9]

In addition, the project manager was expected to be the

> . . . field manager with authority to speak for the Air Force, within the confines of the

[9]Air Force Regulation 375-3, "System Program Director," November 25, 1963 and March 6, 1970, p. 1.

> approved system program. Participating field organizations will look to the [project manager] as the one person responsible for determining how the actions of all organizations should fit together. When consistent with the approved system program, his decisions are directive and may be changed only by HQ USAF.[10]

This Air Force regulation fundamentally governed the general characteristics of the project manager's responsibility, but what was he specifically supposed to do? An Air Force Systems Command manual was more specific with respect to his functions:

> (1) Establish firm and realistic system and equipment specifications.
> (2) Define interfaces and responsibilities [of his staff].
> (3) Identify High Risk areas.
> (4) Explore trade-offs and alternatives.
> (5) Select the best technical approaches.
> (6) Establish firm and realistic schedules and cost estimates.
> (7) Formulate realistic logistics support and operational concepts.
> (8) Lay the ground-work for fixed price or incentive contracting for the major part of the program.[11]

The project manager was to be assigned the central responsibility to see his particular weapons system meets all the established goals of performance, schedule and cost.

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[10] Ibid.

[11] Air Force Systems Command Manual 375-3, June 18, 1964, p. 5. The Navy charter for the Project Manager specified, "The Project Manager's mission is to provide the A-7 Weapon System to the Operating Forces of the Navy/Marine Corps and Air Force to satisfy approved operation requirements of both services and to be delivered in time to meet training, operational and deployment schedules." Naval Air Systems Command Instruction 5400.6, December 10, 1966, p. 4. Reprinted in A-7D Project Master Plan, p. 5-1-2.

He was to be placed in a central position with communications and authority links to the Air Staff, OSD, AFSC, the Navy and the contractor. (See Figure 3.) But he would not have unlimited authority. He was to manage "within the limits of guidance", "consistent with his authority," and "within the confines of the approved program."

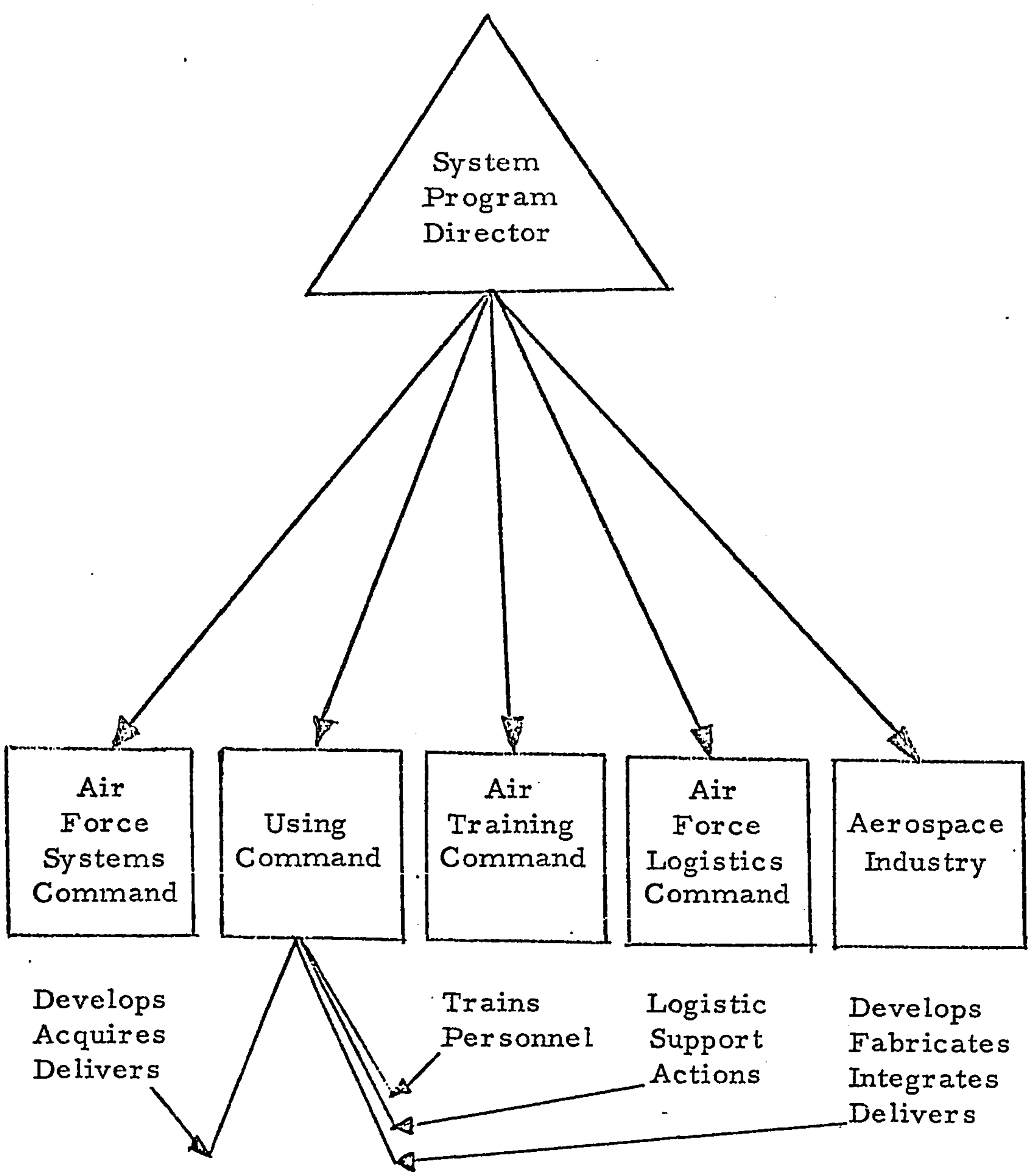
In addition, the Air Force A-7 project manager's authority would be constrained because of the unusually complex organizational environment. He would, first of all, not be a Project Manager, but would only be a Deputy Manager in the Navy Project Management Office. He would not only have the commanders and staffs at ASD and AFSC to consider, he would have the Bureau of Naval Weapons as an influence. Additionally, the Air Force and Navy A-7 programs would undoubtedly affect one another, with the result that the project manager would be indirectly influenced by the Office of the Chief of Naval Operations (OPNAV). Finally, there would arise a vital question of how the Air Force project manager's influence would be perceived by LTV.

Thus, a whole series of inter-service questions was placed on top of the normally complex and relatively sophisticated project management issues. We have reviewed some of the issues and theory of project management and described some of the organizational factors involved on

Figure 3

SYSTEM PROGRAM MANAGEMENT BY THE
SYSTEM PROGRAM DIRECTOR (SPD)

Manages collective actions of participating organizations in planning and executing the system program



Source: AIR FORCE SYSTEMS COMMAND MANUAL 375-3, 15 June 1964 the A-7. Now we will examine how the project managers worked within the established system to define the program and manage its evolution. This portion of the decision process begins with the selection of the Air Force project manager.

The Air Force Selects a Project Manager for the A-7

By 1965 the Air Force had developed extensive experience in the specialized field of research and development management. The Air Force had pioneered in many of the developments and applications of the project management technique during the 1950's, especially in the massive program to develop the Intercontinental Ballistic Missile. One of the results of this experience was the identification of a group of officers with managerial and technical skills who tended to specialize in systems/project management. They rotated among organizations in the research and development community (AFSC Headquarters, ASD, DCS/R&D on the Air Staff, etc.) and occasionally were assigned to flight operations or another specialty.

When Secretary Brown and General McConnell received word on November 19, 1965, that Secretary McNamara had approved the initiation of an Air Force A-7 program, they began to look around for an officer with the requisite professional skills. They needed an officer with extensive weapon system management experience and a feeling for the complexity and sensitivity of an interservice, joint development program. Within the Secretary's office, upon the recommendation of AFSC, it was decided that man would be Colonel Robert E. Hails.

Colonel Hails had an aeronautical engineering degree (B.S., 1947) from Auburn and a master of science degree in industrial management from Columbia (1950). He had flown B-24 bombers in the Pacific during World War II, but his assignments since then had generally been in the field of research and development/systems management. He had served as the project manager for the U.S.-sponsored development of the Mystere IV aircraft program in France. He had also served for many years in Headquarters USAF (DCS/R&D) as the Air Staff project officer for the F-104 and F-105 aircraft. He was presently working for Assistant Secretary Robert H. Charles (Installations and Logistics) on the joint F-4 and F-111 programs.

Colonel Hails recalled how he was notified he was to be the Air Force Project Manager on the A-7.

> When I was first called into the program General Schriever was then commander, Air Force Systems Command, and General Austin Davis was vice commander. I had previously worked for Davis. They were looking for somebody who had Systems Program Office experience, technical background, and yet understood the diffidulties involved in a joint service program, which I had by benefit of three and one half years in the Secretary's office, working on the F-111 and F-4. I was

> the military assistant for Weapons System Management in the office of the Assistant Secretary for Installations and Logistics (I&L) at the time I went to the A-7 program. I had been at Harvard at the Advanced Management program and got back on the 15th of December. . . .
>
> Davis called me, and I might say that I was dumbfounded when I found out the Air Force was going to buy the A-7, because it contradicted everything we had been talking about and doing. We were going to have two motors and two pilots in any future fighter, and it would jolly well be supersonic. So the A-7, in my personal judgment as an Air Force aviator with some knowledge of requirements, was absolutely the wrong airplane at the wrong time for the wrong mission. And I told this to General Davis when he asked me if I'd go over to the Navy to run the program. He said, "Look, that's none of your business; you didn't make the decision to buy it. Your job is to go make it the best airplane that we can get." And that was essentially my entire charge.[12]

Colonel Hails was selected because of his personal qualities as a professional Air Force officer with an acknowledged expertise in systems/project management. He was respected by the Secretary of the Air Force and the Chief of Staff, and he had a close working and personal relationship with Assistant Secretary Charles.[13] The selection of Colonel Hails was, in itself, an indication of the priority of the A-7 project within the Secretary's office.

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[12]Interview, March 30, 1970. Colonel Hails was promoted to Brigadier General after he left the A-7 program in August 1968. When interviewed he was the Assistant Deputy Chief of Staff for Maintenance Engineering at Headquarters, Air Force Logistics Command. He has subsequently been promoted to Major General.

[13]Interviews.

Colonel Hails reported to the Navy A-7 Project Management Office where he became the Air Force Deputy Project Manager under Captain Cruse. Cruse was working with a small staff because the functional staffs of the Bureau of Naval Weapons provided most of the technical expertise for the A-7 (engineering, logistics, contracting, etc.). Hails was virtually alone in the Air Force section of the office for several months.

The Air Force Interest in a New Engine for the A-7

There were two issues of primary concern to Colonel Hails and the Air Force decision-makers during this early period--the A-7 engine and avionics (aviation electronics) system. In addition, the project managers would have to examine the Navy A-7 closely to see which of its many components would have to be changed to be compatible with Air Force equipment. These were the reasons the Air Force decision was essentially one to develop the A-7 rather than just "buy" the Navy A-7 off-the-shelf.

The engine in the Navy A-7A was the Pratt and Whitney TF-30-P-6, a turbofan derivative of the TF-30-P-1 on the F-111. The P-6 engine delivered 11,350 pounds of thrust.[14] This was considered insufficient for Air Force use because of the extremely long take-off roll the aircraft would require to get airborne with a load of bombs. The engine

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[14] LTV, A-7D Tactical Fighter Report, p. 4.

had been selected for the Navy aircraft because the aircraft carrier supplied a catapult system to get the plane into the air. However, there were Navy officers who wanted to see more power in the aircraft if it were available.

The Navy Project Management Office had already been looking at the problem of increasing the thrust of the TF-30 engine. As early as October 6, 1965, a discussion took place among LTV, Pratt and Whitney, and the Bureau of Naval Weapons on the possibility of putting a low augmented afterburner on the TF-30-P-8 engine.[15] The afterburner would have increased the thrust for takeoff from 11,350 to about 15,000 pounds. After this discussion Pratt and Whitney had done some figuring and responded to the Program Management Office with, on November 2, costs and schedules to add an afterburner.[16] These discussions had continued while the Fish Study was being conducted in the Pentagon. (The A-7 in the computer model was given an afterburner which was priced at $50,000, and could be used in the air as well as on takeoff. The simulated performance represented marked improvement in load-carrying and maneuvering ability.) Once the Air Force entered the program there was renewed

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[15] LTV, A-7D Project Master Plan, "Engine History A-7D Program."

[16] Ibid. LTV representatives noted that Pratt and Whitney's response to the request for an afterburner proposal was "less than enthusiastic." The reasons may have been that they were saturated with engine business since they were making hundreds of engines for Boeing 707's and F-111's. Interview with Mr. J. W. Lankford, LTV, April 1, 1970. LTV at this time was already feeling pressure from the Navy pilots who wanted more power in the aircraft.

effort to find a new or a modified engine for the aircraft. One of the questions asked was how much would a new engine cost.

The price of the A-7 was to be a continuing issue for the duration of the program. The figure of $1.2-1.3 million unit flyaway cost per aircraft had been put into the computer study based on certain assumptions about the Navy buying 1000 aircraft and the Air Force following with 864. This figure had been attacked by General Graham and other Air Force members of the Study Group as not being realistic,[17] but it was remembered as the base price, especially in Systems Analysis.[18]

As Colonel Hails gathered more data about the program during December 1965, he learned that the Navy A-7 (and therefore any Air Force version) was going to cost more than $1.2-1.3 million. According to Colonel Hails,

> When I came to the program, first, I had to disabuse them that this [$1.2 million] ever existed. That's fantasy. The Navy would have had to buy airplanes out to 1972. . . . Who was going to buy these 1000 airplanes? Somebody had to buy that learning curve down. [The "learning curve" is the reduction in unit cost with increased production.] The facts are that the Navy airplane--when they got through putting all the fixes on it--that $1.8 airplane never existed. The average after they bought 199 A-7A's and 200 A-7B's was more like $2.6 or $2.4 million. If they had continued building that A-7A airplane they might have come down to some lower number, $1.8 [unit program cost]. . .
>
> So the first bad news that I brought over there [to the Pentagon in December 1965] was

[17]Interview with General Graham.

[18]Confirmed by Enthoven and Murray interviews.

> that the airplane was not going to come as cheap as you people have been led to believe. We made an analysis of what the airplane was capable of as opposed to what had been advertised, and we said, "Here's this information. Do you still want the airplane? . . ." The decision was, "Yes, we do."[19]

Organizational Inputs to Change the A-7

One of the Air Staff organizations that was to play an especially important part in the development decisions on the A-7 was the Directorate of Operational Requirements and Development Plans under DCS/R&D. Requirements is an unusual function because it combines expertise from many areas; it is not strictly operational, nor is it strictly R&D. The Deputy Director of the organization in 1965-66 was Brig. Gen. (later Maj. Gen.) Kenneth C. Dempster. He described some of the orientation and function of Requirements.

> The operational command always established the "requirement." The Directorate of Operational Requirements, we really always treated that as an operational group of people. We predominately were operations people in there; we had some [R & D people] but the majority were operational people. We looked for the smartest man we could lay our hands on, but if you look back on it, most of them had an operational background, too [in addition to advanced degrees].
>
> This has been confirmed by the fact that if you ever look through the staff structure and watch the changes of it, you would notice that in about ten years Operational Requirements had served under the Deputy Chief of Staff/ Operations, it had served under the DCS/Programs and it served under DCS/R&D, and previous to that three-step jump it had been under DCS/R&D. So it

[19]Hails interview, March 30, 1970.

> is a <u>function</u> that I think can serve anywhere on the Air Staff. It is not pure R&D, and it is not purely operational; it is really an interface. They take the operational requirement as specified by the operational command, they translate that into a RAD [Requirements Action Directive], and then it is handed to the R&D people.[20]

Major James Hildreth of the Directorate of Operational Requirements and Development Plans had anticipated accelerated action on the A-7. He had participated in the Fish Study and began coordinating Air Staff activities on the A-7. One of the first concerns of the Air Staff and Colonel Hails was over the configuration of the aircraft. (The "configuration" as the term is used in the Air Force means the equipment and subsystems that comprise the hardware of the weapon system.)[21]

Major Hildreth completed the necessary coordination and called a preliminary configuration conference for December 20, 1965. The conference was called the Air Force A-7A Tactical Aircraft Working Group. Colonel Hails attended, as did representatives from various Air Staff offices, Air Force Systems Command, Logistics Command, Tactical Air Command, Chief of Naval Operations office and the Bureau of Naval Weapons. The conference was called by

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[20] Interview with Maj. Gen. Kenneth C. Dempster, Deputy Director for General Purpose and Airlift Forces, Directorate of Operational Requirements and Development Plans, DCS/R&D. Interview August 17, 1970.

[21] The official Air Force definition of "configuration" is: "The relative disposition and makeup of component parts; the internal and external contours that result from this disposition; the shape of a thing at any given time."

the Directorate of Operational Requirements because it had the primary responsibility to draft a formal Air Force requirement for the aircraft. The "requirement" would largely be determined by the Air Staff, in conjunction with this configuration conference, and would be presented to the Chief of Staff for approval.

The requirement would be formalized in a document known as a Specific Operational Requirement (later known as a Requirements Action Directive or RAD).[22] The status of the Specific Operational Requirement was significant, because the document formed the major policy guidance for the project manager; once it was written and approved, it would be difficult to change.

At the configuration conference Air Force Systems Command proposed a draft of a Specific Operational Requirement, and TAC presented its views on a desired configuration. The extremely tight schedule that had been envisioned by OSD was discussed. The OSD schedule called for the Air Force to receive its first A-7A in January 1967 (slightly over one year away at that point), have 7 aircraft by June 1967 and 17 aircraft by September 1967.

When this schedule was presented to the Navy representatives, they exhibited skepticism that such a schedule

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[22]The definition of the Requirements Action Directive (RAD) is: "An authoritative, numbered document HQ USAF issues to direct and guide Air Force operations necessary to translate a required operational capability into an approved and funded program or project leading to the procurement of a new or improved system or equipment." Air Force Regulation 375-1, March 6, 1970, p. 3.

could be maintained. The differences in schedule were worked out by the Working Group, and the new schedule estimated the Air Force could receive its first A-7A in September 1967--8 months later than OSD had envisioned during the McNamara decision. It was recognized that a major difficulty in projecting any schedule at this point was due to the uncertainty caused by the Air Force attempts to deviate from the Navy A-7A configuration. The conference closed with instructions for Systems Command, Logistics Command and LTV to conduct feasibility, cost, and schedule studies on TAC's proposed changes. TAC was to provide detailed justification for each item by January 17.[23]

The central figure in the A-7 activity at TAC was General Graham who had been the TAC representative on the Fish study. On December 29 he wrote a letter to General Catton, Director of Requirements, stating that the cost of the A-7 was rising above the earlier estimate of $1.47 million. He noted the cost of the afterburner and other "minimum essential changes" would run the cost to $1.75-1.8 million, which, he said, cast serious doubt over the assumptions of the computer study. He noted the afterburner would cut the range of the aircraft considerably (because of added weight and fuel consumption) and that an afterburner limited to use only on takeoff had not been envisioned in the study. He stated there was doubt the A-7 could be ready

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[23]Directorate of Operational Requirements and Development Plans, History of the Tactical Division, July 1--December 31, 1965, December 20, 1965, written by Major Hildreth.

in 24 months, (the development period envisioned by McNamara) and wondered if the aircraft would be compatible with the overseas deployment capabilities of the aircraft already in the force. In closing, he stated the purpose of the letter was to bring up some things which might affect the A-7 program, were probably already apparent to the Air Staff, but which he thought should be evaluated in depth.[24]

During this period the Navy had been moving toward a decision on a new engine. Essentially, the Navy staff decided on modifying the TF-30-P-6 engine to a P-8 version and adding an afterburner for use on take-off only. The Secretary of the Navy on January 6, 1966, sent a memorandum to the Secretary of Defense requesting approval for the development of the afterburner engine. At this point Colonel Hails was having the engine specialists at the Aeronautical Systems Division evaluate the feasibility of the afterburning Pratt and Whitney engine. The evaluation did not take long, and on January 12, ASD engineers recommended against using an afterburner on the TF-30 engine if another method could be found to augment the engine's thrust.[25]

Colonel Hails immediately began searching for alternatives to the Pratt and Whitney engine. His reconnaissances led him into discussions with LTV, TAC, the Air Staff,

[24]Letter, Major General Gordon M. Graham to Major General Jack J. Catton, Director of Operational Requirements and Development Plans, DCS/R&D, December 29, 1965.

[25]LTV, A-7D Project Master Plan, "Engine History A-7D Program."

DDR&E, the Navy, and several contractors where the subject of the British Spey engine arose.[26] For the next three months (February--April) Hails was quietly seeking information on the Spey, but he was unable to provide any alternative to the Pratt and Whitney engine by the time of the April Chief of Staff/Secretary of the Air Force decision on the A-7 configuration.

Colonel Hails was also engaged in an effort to examine the avionics/weapons delivery capability of the Navy A-7A. In doing this he worked with the Navy Project Manager, Captain Cruse, and with the avionics specialists in the Bureau of Naval Weapons. Captain Cruse later described the situation in January-February 1966 when Hails was seeking to establish the alternatives for Air Force avionics equipment. His concept of what the A-7A was designed to do gives a base to the avionics changes that were to come.

> The A-7A was laid out pretty clearly in the Study [Sea-Based Air Strike Forces, 1963] which was made by the Chief of Naval Operations. It was to be a simple, not-sophisticated avionics suit, daylight, visual aircraft with long range and large bomb-carrying capability. So there was never any real question about

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[26]The Rolls-Royce "Spey" was a family of engines developed in the United Kingdom during the early 1960's for use primarily in civil airliners. The British were considering using a Spey engine in the Royal Air Force version of the F-4 Phantom. General McConnell later related that he had personally encouraged an arrangement whereby the Allison Division of General Motors had negotiated for the rights to build the Rolls-Royce Spey engine in the United States before the 1965 Air Force decision to develop the A-7. Rolls-Royce/Allison did not have at this time an engine of sufficient thrust for the A-7. Mr. Sol Love, Vice President/A-7 Program Director (and in 1970, the President) of Vought Aeronautics, specifically remembered suggesting to Colonel Hails and TAC in early 1966 that a derivative of the Spey be developed for the A-7.

> what the A-7A was supposed to be. Then all this started to change.[27]

Part of the change referred to by Captain Cruse was influenced by another Navy program--the Integrated Light Attack Avionics System. A short history of the purposes and plans for this program will indicate its relationship to the A-7.

A Short History of the Integrated Light Attack Avionics System

When the Navy officers first conceived the VAL program they planned the A-7A as an unsophisticated, simple attack weapon system. But the A-7B was planned to incorporate another Navy development--the Integrated Light Attack Avionics System (ILAAS). The concept of ILAAS grew partially out of Navy experience with avionics in the late 1950's. Most avionics developments at that time were individual "black boxes" which, when placed in an aircraft, caused numerous interface and integration problems.

ILAAS was one of the first attempts to approach avionics on a "system" basis and design a total package of components which would be designed and tested as a unit and could, theoretically, be installed in any one of several different aircraft. ILAAS was based on advances in digital computer techniques that would provide, for the first time, a "continuous" solution to the navigation and bombing problems

[27] Cruse interview.

of the pilot. ILAAS was to include four digital computers, sensors, several types of radar and a heads-up-display for the pilot.[28]

In comparison, the avionics system on the A-7A was built around an analog computer (called the CP-741) and a fixed sight. The analog computer provided assistance to the pilot for one type of weapon delivery--a dive maneuver with a standard pull-up and a toss-bombing solution. There were provisions for deviations in dive angle, slant range, and airspeed, but there was no wind correction. Because of the limitations in the analog solution, if the pilot deviated greatly from any of the optimum release conditions the result would be an inaccurate impact. There was no connection between the computer and the gunsight (with the sole exception of an emergency command of when to begin the pull-up). By contrast, the ILAAS and the subsequent avionics developed around a digital computer integrated the information coming from the radar, air data system, and inertial sensors and continuously computed a bombing solution. The results were displayed in the form of commands to the pilot on his windscreen, within easy view. (This meant the pilot did not have to refer to the many flight instruments

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[28]Interview with Mr. Donald R. Spencer, Chief, Avionics and Guidance Division, DDR&E, April 29, 1970. He is a naval reserve officer with experience in Naval Air Systems Command and a registered professional engineer. He reported he worked to get ILAAS identified as the avionics system on the A-7 and followed the program closely. Also see Aviation Week and Space Technology, June 15, 1964, pp. 109-110.

for information on airspeed, dive angle, etc.) The digital computer received information on the wind drift of the aircraft, and fully compensated for this error, which in normal dive bombing is quite significant. The difference in capability between the two systems is primarily that the digital computer offered to lighten the burden on the pilot, allow him a great deal more flexibility in his selection of delivery maneuvers, and provide greatly improved accuracy.

DDR&E had issued a program go-ahead for ILAAS in April, 1963, during the Sea-Based Air Strike Forces Study. The original plan had been to incorporate ILAAS in the A-7 program, beginning with the 200th airplane.[29] About 200 A-7A's were planned without ILAAS, and another 800-1000 A-7B's were planned for production with ILAAS. The program continued to receive strong backing from DDR&E and the Navy, and in June 1966, a contract for $17.9 million was awarded to Sperry to build two prototypes of the ILAAS system.[30] The chief problem with ILAAS was that it was

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[29] Aviation Week and Space Technology, February 22, 1965, p. 62, and October 26, 1964, p. 23. The ILAAS system is similar to the Air Force Mark II avionics, which was being developed for the F-111D at this time.

[30] Journal of the Armed Forces, July 9, 1966, p. 18. At this time in 1966 the ILAAS was reported to still be planned for incorporation in the A-7. DDR&E even approached several Air Force officers to see if they might be interested in participating in the ILAAS program. The interest in ILAAS on the part of DDR&E was reported to be with the backing of the deputy director, Dr. Fubini. Interviews with Lt. Col. Richard Haggren, Directorate of Operational Requirements, and Mr. Frank Horton, DDR&E.

expected to cost from $800,000 to $1.4 million per system, in addition to the $1.2-$1.6 million cost of the airframe.[31]

The ILAAS effort between 1963 and 1966 was conducted by the Bureau of Naval Weapons where it was assigned to a project officer (a Navy Captain) in the Avionics division. Captain Cruse had permission to put ILAAS in the A-7, but he had no direct authority over ILAAS. Captain Cruse explained his view,

> The Navy avionics people felt they had a good case with DDR&E, and they pushed ILAAS very hard. In fact they pushed it on me in a way that made it extremely difficult for me to get it into the A-7. It had to be done in a very intimate way; the A-7 was a <u>going</u> program, moving very fast. There wasn't anybody who could have coped with the management problems of trying to put a new avionics suit in the airplane except the A-7 Project Manager. But as far as I was concerned, the Navy made the mistake of establishing a project manager for the avionics system, ILAAS. He had the same authority for that system as I had for the A-7 system, and this gave me real heartburn, because I couldn't make him understand that it was impossible for him to jam that system into the A-7. He would have to work with me and help me get it in there, because it would be a monumental task to catch an outgoing program that was mvoing very fast and put a whole new avionics suit in it. . . . But the concept was that he was managing that system, and the A-7 would just have to move over and take this system aboard. . . He and I became good friends, but we never did work things out to get ILAAS in the A-7.[32]

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[31] <u>Aviation Week and Space Technology</u>, February 22, 1965, p. 63.

[32] Interview with Captain Cruse. The ILAAS project was primarily contracted to Sperry Gyroscope, but LTV had a small portion of the contract. LTV engineers reported that even there the ILAAS project was a separate organization, not integrated into the A-7 program. Several individuals at LTV said they recognized the limitations of the CP-741 analog system in the A-7A, but they were afraid of the extremely high cost of the ILAAS.

Establishing the Alternatives for the Air Force Avionics Decision

When Colonel Hails entered the Project Management Office in December 1965, he was confronted with many of the same problems with ILAAS that Captain Cruse had experienced. But to Hails, the ILAAS was only one of many possibilities in a rapidly changing situation.

With the Air Force starting a program for a potentially new aircraft, various contractors saw an opportunity to sell their products. On January 10 the Air Staff received an unsolicited proposal from North American Autonetics on an improved avionics system. The study was passed around the Air Staff and was forwarded by General Catton to Mr. Harry Davis, Deputy Assistant Secretary of the Air Force (R&D) for Special Programs. General Catton noted the proposal did not contain any new optical sensor or display elements to improve the pilot's ability to find and destroy visual targets. If close air support was to be improved, he added, new means would be needed to visually acquire the target.[33]

Avionics was also a central issue at Tactical Air Command where Colonel John J. Burns was gathering the data to put into TAC's request for the A-7. The packet of 33 changes contained several of significance to this study. TAC requested: a two-place aircraft in addition to the

[33]Letter, M/G Catton to Harry Davis, SAF-RD, Subject: "Technical Proposal Summary for USAF A-7 Avionics (U)," February 21, 1966. North American Autonetics proposal was dated January 10, 1966. General Catton's thoughts on the type of avionics desired are significant, since he was to become the chairman of the Air Staff Board which would recommend the final avionics decision.

single-seat model; deletion of the 11,350-pound thrust engine and development of a 15,600-pound thrust afterburner version; replacement of the Navy guns with an Air Force gun; and replacement of the Navy's analog weapons release computer by an "aided-visual" analog system.[34]

For an understanding of the avionics debate over the next two years, it is important to know something of the equipment being discussed. The purpose of an avionics system is primarily to achieve accuracy--accuracy in navigating <u>to</u> the target and accuracy in delivering weapons <u>on</u> the target. The accuracy achieved is largely dependent on the individual pilot's ability if the system is simple and austere; as the equipment gets more complex, the accuracy becomes more dependent on the reliability and performance of the "black boxes." The arguments over the level of capability desired generally took the form of advocacy of one of three mutually exclusive categories of equipment. They ranged from simple aids for the pilot to complex computers for elaborate computations. The following table sets out the basic differences:

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[34]Letter, "Justification of A-7A Configuration Changes," from Director of Operational Requirements, TAC, to Headquarters USAF, Director of Operational Requirements and Development Plans, January 15, 1966.

Table 5. Avionics Alternatives--1966

	System I (Basic A-7A)	System II ("Improved")	System III ("Complex")
Computer	Analog	Improved Analog	Digital
Sight[1]	Fixed[2]	Servoed[3] (Stabilized)	Heads-Up-Display[4]
Accuracy	20-40 mils[5]	15-20 mils	10 mils

Source: LTV, A-7D Tactical Fighter, 1969, p. 4.

[1]The Sight is the aiming device the pilot uses to line up on the target.

[2]A Fixed Sight is a simple aiming point requiring the pilot to do all the weapon delivery computations.

[3]A Servoed Sight does a few but not all of the computations for the pilot. It makes no corrections for wind.

[4]A Heads-Up-Display provides the pilot with computerized, continuous attack solutions displayed within easy view on the windscreen.

[5]A "mil" is a unit of angular measurement; short for milliradian. The accuracy of any weapon in feet is usually classified, but the mil accuracy is not. However, one mil equals one foot at a distance of 1000 feet. If, for instance, the aircraft is 10,000 feet from the target when it releases a bomb, the various systems would give these accuracies: 20 mil--200 feet; 15 mil--150 feet; 10 mil--100 feet.

Tactical Air Command, at this point, was requesting a capability represented by System II, with an improved analog computer and a servoed sight. TAC stated in the letter of January 15, 1966, that it recognized the alternatives included the basic Navy System(I) as it stood, an aided visual system (System II), or a new system such as that represented by the Navy's Integrated Light Attack Avionics System (ILAAS) with four digital computers.[35]

Tactical Air Command was interested in improving the avionics capability of the Air Force A-7, and this interest was reinforced by interest from Air Force Systems Command Headquarters. Major General Cody, the Deputy Chief of Staff of AFSC for Systems, wrote to his commander, General Bernard Schriever, on February 9, 1966, and stated that AFSC was very interested in improving the avionics on the A-7.[36] The TAC and AFSC interests were communicated to Colonel Hails in the Project Management Office. Colonel Hails was then gathering as much information as possible from the Navy, the avionics engineers who had worked on ILAAS, and Air Force organizations in order to determine the best technical approach for the Air Force A-7 avionics.

Accordingly, in January 1966, he requested that LTV do a study to see what would be available as alternatives and what accuracy could be obtained with each option. LTV conducted the study in January and February 1966,

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[35] Ibid.

[36] Letter, AFSC DSC/Systems to Commander, AFSC, February 9, 1966.

and reported that with the selection of the latest computer technology using many of the concepts of ILAAS, it would be possible to develop an avionics system with an accuracy of 7 mils.[37]

In the Air Staff, the officers in Operational Requirements were busy in the same period with drafting an initial Requirements Action Directive (RAD). The draft RAD was circulated to offices in the Air Staff, AFSC, TAC and the Project Management Office, but no firm requirements could be specified until the Chief of Staff made a decision on the configuration.[38]

Congressional Pressure Increases with the Pike Report on Close Air Support

The month of February saw the publication of the formal report of the Special Subcommittee on Tactical Air Support of the House of Representatives. The report was entitled Close Air Support and included the conclusions of Representative Pike's hearings during the previous September and October. The Pike Report charged the Air Force with neglect of the close air support mission, failing to provide proper air-to-ground communications, failing to develop a sufficient target acquisition and marking system, slow response times to Army requests for support, and the failure to develop a special close air support

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[37] Interviews with Colonel Hails and LTV avionics personnel.

[38] While the RAD was in draft form, Aviation Week and Space Technology, published a list of 24 changes which it said the Air Force was considering, February 21, 1966, p. 25.

aircraft. The Report attacked the roles and missions agreements of the Services as standing in the way of the Army developing its own capability for close air support:

> Under current doctrine of roles and missions assigned to each Service, the Army can have armed helicopters, which may direct "suppressive fires" at the enemy, but may not have fixed-wing aircraft to provide "close air support" for its troops.[39]

The Report singled out the issue of a specialized close air support aircraft:

> It is the official position of the U.S. Army, expounded by the Chief of Staff, that "The Air Force is best qualified to determine what types of aircraft is best suited to support." The Air Force has done exactly that with the results noted above. They have never built an aircraft designed primarily for close air support. They are not actively engaged in developing one at the present time.
>
> . . . .
>
> Our criticism is directed at the upper echelons, both in and out of the Air Force, where policy is made, for not preparing well enough to fight guerilla war.
>
> . . . .
>
> When funds are limited, first things must come first. Unfortunately, Close Air Support did not have the urgency of air lift, or interception roles, or strategic bombing in the Air Force planning. Time has been wasted, but there is still time to correct our deficiencies in Army-Air Force Close Air Support operations. We hope this report will serve as a useful prod, and not as a criticism that must be defended or explained.[40]

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[39] U.S. Congress, House of Representatives, Committee on Armed Services. Close Air Support, Report of the Special Subcommittee on Tactical Air Support of the Committee on Armed Services, 89th Cong., 2d sess., February 1, 1966, p. 4861. (No. 44, 4122.)

[40] Ibid., pp. 4867, 4870, 4873. The Pike Report is discussed in A Short History of Close Air Support Issues, op. cit., and Aviation Week and Space Technology, February 7, 1966, p. 21. The Washington Post picked up the February 1 Pike Report and printed a column on February 3, 1966, entitled, "Pentagon Charged with Delays in Developing Ground Support Plane."

Despite the admonition against a defense, the Air Force issued a response to Representative Pike's allegations. The Air Staff paper reaffirmed "that unified strategic direction and unified command of combatant forces is the best way of integrating land, naval and air forces into an efficient team."[41] It went on to note that historically, the development of tactical fighter aircraft in the United States had emphasized high performance and multipurpose aircraft. While it added that this was still the policy of the Air Force, it was in the process of jointly selecting a close air support aircraft with OSD officials.

The situation between the Air Staff and Congress was not eased when the Pike Report showed that young Air Force pilots and Army personnel returning from Vietnam had testified to the need for more propellor-driven aircraft. Both in testimony before the Pike Committee and in press conferences some returning officers had been saying the Air Force was delivering excellent close air support, but that it was partially due to the slow speed and endurance of the older planes, not to the supersonic jets.

Alternatives Are Considered by the Air Force Board Structure

Meanwhile, the A-7 briefing was being prepared to go before the Air Staff Board. The initial presentation was made during February 1966 by officers in the Directorate of

[41] _Armed Forces Journal_, February 19, 1966, p. 15.

Requirements who were of the persuasion that a simple fixed sight would be the most cost/effective option. When this briefing was given to the Air Staff Board, the chairman, Maj. Gen. Lavelle, expressed the opinion that the slides showed that for a little more money they could get a more accurate system, and perhaps the problem should be restudied. He directed the formation of an Ad Hoc Group on A-7 Requirements.[42]

The problem was restudied with the result that the briefing was modified several times in the Tactical Panel, Air Staff Board, the Requirements directorate and the Project Management Office. Most of the briefings from this point forward were conducted by Colonel Hails. His briefings showed that the 42 proposed changes would result in an increase of 1600 pounds in weight. The addition of an afterburner would decrease the takeoff roll by 1400 feet, but it would also decrease the range 100 miles in radius and would decrease the loiter time by 25 minutes. The changes would increase the cost from $1.4 million to approximately $1.7 million for each aircraft.

The Air Force Council meeting on February 26 was chaired by the Vice Chief of Staff, General Blanchard. Before Colonel Hails gave his briefing, General Blanchard observed to all present that the Chief of Staff (General McConnell) had stated to him, "there had better not be

[42]Interview with Lt. Col. Richard Haggren, who at the time was assigned to the Tactical Division of Requirements. The Air Staff Board briefing was given by Colonel William Ritchie.

a lot of costly changes or he would throw out both the changes and the present council."[43]

Colonel Hails recalled the briefing,

> We went to the Air Council, and the airplane was extremely emotional. Some people didn't want it because it was subsonic; others didn't want it because it was a Navy airplane; others didn't want it because they felt OSD had some covert objective in mind.[44]

However, the briefing by Colonel Hails and Captain Cruse met with a "well done" from General Blanchard. General Catton noted, "It's getting to be a pretty expensive investment we're looking at," when he saw the $1.7 million per plane price tag. However, no firm decision was made.

The deliberations of the Air Force Council and the whole decision process on the A-7 were the subject of continued interest at Tactical Air Command. At TAC there existed a high degree of uncertainty about the A-7. General Disosway and General Graham, in particular, were worried that the A-7 might hinder TAC's chances to get more F-4's. In addition, TAC had very little information on the real capabilities of the existing Navy A-7A. The first A-7 flight had just been conducted six months earlier, and no one in the Air Force had flown the few test models in existence.

In an effort to learn more about the A-7, General Graham (now the Deputy Commander of TAC for Operations) went to Dallas to fly the aircraft on March 2. He later described

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[43] A-7 Program Report, February 26, 1966, written by Colonel Hails.

[44] Interview with General Hails.

the experience and his view of the changes needed for any Air Force version.

> With that, I went out and flew the airplane to see what kind of merchandise we were going to be equipped with . . . I chose to fly three strike missions. . . . I loaded it up with three sets of stores, complete combat profile . . . then I came back and wrote a report that established 47 modifications on the aircraft to make it even safe enough to fly. It needed a bigger engine, etc. Well, we got a good number of those modifications. . . . my feelings were let's fix it, but don't make it so expensive that it becomes a monster and we don't get very many. If we are going to get some, we have to have at least [360 aircraft.][45]

When General Graham was asked what the TAC position was on changing the avionics system, and possibly including ILAAS, he answered:

> I felt we shouldn't disturb the avionics on the airplane. . . .but I felt we desperately needed a digital computer. We got more than we asked for. . . .That ILAAS was an extremely sophisticated and expensive system. We didn't want any part of that.[46]

As the debate over the final configuration and avionics equipment went on, Air Force Secretary Brown received a memorandum from Secretary of the Navy Nitze. The memo, dated March 9, noted that Secretary McNamara had appeared before Congress on February 11, 1966, and had said the Air Force would be getting its first A-7 in January 1967 (less than a year away), but that this schedule was considered infeasible by the Navy. He stated the lead-time required for government-furnished equipment (radar, radios,

[45]Interview with General Graham. His flights at Dallas Naval Air Station, the home of LTV's Vought Aeronautics Division, took place March 2-5, 1966.

[46]*Ibid*.

etc.) and support equipment would require more time. Nitze noted that the lack of a firm Air Force configuration prevented any promise of a realistic schedule. While the original schedule worked out by the two services in the December 1965 configuration conference had called for a first delivery in September 1967, Secretary Nitze how estimated that this first delivery would take place in April 1968.[47]

On March 14, the Air Staff Board with Maj. Gen. Lavelle as chairman, met again with the task of recommending a configuration of the A-7. The briefing was done by a Colonel from Requirements while Colonel Hails assisted. The briefing officer reported on the progress of the Ad Hoc Group in the Requirements Directorate and presented four options of avionics equipment with varying levels of accuracy. He recommended and supported a version with maximum capabilities. The Air Staff Board did not agree. It recommended eliminating the bombing computer, radar, radar beacon, doppler equipment, navigation computer and the navigation roller map. It recommended an engine without the afterburner and recommended deleting most of the basic Navy A-7A avionics.[48] The briefing was to go forward to the Air Force Council on March 29.

The Air Staff Board recommendation of an "austere" weapons delivery system did not correspond with the desires

[47]Memorandum, Secretary of the Navy to Secretary of the Air Force, March 9, 1966, Subject: "Delivery Schedule of Air Force A-7 Aircraft (U)."

[48]Program Management Office, Weekly Management Summary, March 14, 1966, written by Colonel Hails.

at Tactical Air Command. The next day General Disosway wrote a letter to the Chief of Staff, stating his need for a weapons system with integrated avionics to perform the night and all-weather close air support mission. He noted this would require a totally new system rather than an incremental change to the Navy A-7A. He stated that TAC needed the A-7, especially amid Congressional and DOD pressures on the possible neglect of the close air support mission. TAC therefore needed the new A-7 to incorporate these additional features to achieve increased weapons delivery accuracy (with capabilities approximated by System III).[49] He proposed buying less than the 561 aircraft programmed if that was necessary to stay within the cost consideration. He strongly stated that such a reduction would have to be accompanied by permission to buy the TSF F-4 with an internal gun.[50] In short, the "austere" avionics configuration was unacceptable to TAC.

When the Air Force Council met on March 31, it had the Air Staff Board recommendation for an "austere" avionics system to consider as well as General Disosway's forceful letter to the Chief of Staff. The Council debated the issues and equipment, and decided on a version close to System II with an improved analog computer and a servoed gunsight. Other proposals were recommended to make the aircraft compatible with Air Force ground support equipment,

[49] Letter, Commander, TAC, to Chief of Staff, March 15, 1966, "A-7 Configuration."

[50] Unclassified Talking Paper on A-7 Configuration and Status, Directorate of Requirements (AFRDQ), March 23, 1966, p. 2.

but all options that would increase the cost without making significant improvements in the weapons delivery accuracy were rejected. On the subject of the engine, the Council recommended buying the TF-30 without an afterburner until the performance of the afterburner could be demonstrated.[51]

The pressure on the Air Force to come to an agreement on the aircraft equipment and configuration was increasing. In mid-March OSD had impounded all Fiscal 1966 funds($56.3 million) for the A-7 program until such time as a firm configuration was reached. During March the Air Force Assistant Vice Chief of Staff sent word to the Project Management Office, that: (1) the Navy would continue as the Executive Manager, and (2) that a joint management agreement was being negotiated. Colonel Hails, however, could do very little until he had a configuration to present to LTV. (During this time, the first A-7A crashed near China Lake Naval Ordnance Test Station, California, during the third of a series of runs simulating complete hydraulic control system failure during landing approach.)[52]

The pressures from OSD and the Army were not lessening, either. In early March Secretary McNamara approved the formation of the Army's second Air Cavalry Division with 434 aircraft and approved 25 more helicopter companies.

[51] AFRDQ Briefing Notes, op. cit.

[52] Aviation Week and Space Technology, April 4, 1966, p. 33. The crash occurred on March 24.

This would bring the Army to a total of 186 helicopter companies and raise the Army aviation program to 9282 aircraft. (The entire Navy had only 8315 aircraft in 1966.)[53]

The 1966 Army-Air Force Agreement on Roles and Missions

The combination of advances in technology, the revision of service doctrines and pressures of the Vietnam War had made the existing Roles and Missions pact between the Army and the Air Force obsolete. Since the last agreement had been ratified in 1956 two major shifts had occurred. First, the Army had been buying and operating the Caribou and Buffalo cargo/airlift aircraft in Vietnam. Both aircraft were fixed-wing and heavier than the 5000-pound limit of the 1956 Agreement. Second, the arming of hundreds of helicopters and the continued development of the Cheyenne (Advanced Aerial Fire Support System) threatened to usurp from the Air Force a large portion of the close air support mission.

Accordingly, the Army Chief of Staff, General Harold K. Johnson and Air Force Chief of Staff, General John P. McConnell, met on April 6 after a series of conferences and signed a new agreement on the roles and missions

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[53] Aviation Week and Space Technology, March 21, 1966. Six months later for publically unexplained reasons, Secretary McNamara withdrew the approval to form the second Air Cavalry Division, and it has remained shelved ever since. However, the Journal of the Armed Forces of May 14, 1966, quoted McNamara saying, "I am sure we will want to add another Air Cavalry Division to the forces of the U.S. Army." p. 21.

of the respective services. Each service gained what appeared to be organizational victories. The Agreement stated the Army, "agrees to relinquish all claims for CV-2B [Caribou] and CV-7 [Buffalo] aircraft, and for future fixed-wing aircraft designed for tactical airlift."[54] The 140 Caribou and 4 Buffalo aircraft in the Army inventory were to be transferred to the Air Force. In addition, the Army was to disarm all of its reconnaissance aircraft in Vietnam lest they infringe on the close air support mission of the Air Force.

The Air Force, in exchange for the right to develop all future airlift aircraft, agreed "to relinquish all claims for helicopters and follow-on rotary wing aircraft which are designed and operated for intra-theater movement, fire support, supply and resupply of Army forces and those Air Force control elements assigned. . . ."[55] This was seen by Army leaders as a victory and promised them a clear field to develop transport helicopters and advanced armed helicopters like the Cheyenne.[56] The Army also gained the right to command certain Air Force units in cases of combat urgency. The significance of this doctrinal innovation was not lost

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[54] Cited in Aviation Week and Space Technology, April 25, 1966, p. 26.

[55] Ibid.

[56] New York Times, April 16, 1966, p. 2., and Journal of the Armed Forces, April 23, 1966. The feeling was reported in the press that the Air Force was losing the fight to prevent the development of the armed helicopter anyway, and this, therefore, was a minor concession.

on the Army. One Army general said, "The Air Force has never [before] agreed to be under an Army commander. This is quite a significant step."[57]

The Air Force Decision on a Configuration for the A-7

In this environment and with the continued development of the armed helicopter, it seemed doubly important to decide on a firm A-7 configuration and get the program moving. The briefings and recommendations of the Air Staff Board and the Air Force Council were presented to the Designated Systems Management Group, which included the Chief of Staff and the Secretary of the Air Force. On April 7, 1966, General McConnell and Secretary Brown made a formal decision on the A-7 configuration. The decision was expressed and transmitted in two different documents, directed toward internal (Air Force) and external (OSD) audiences.

The document directed primarily toward the Air Staff and other Air Force organizations was entitled, "Chief of Staff Decision" to indicate its significance. It was published on April 8 and was signed by the Assistant Vice Chief of Staff for General McConnell.[58] The decision document stated

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[57]The wording of this unusual provision was, "In cases of operational need, the CV-2, CV-7 and C-123 type aircraft performing supply, resupply or trooplift functions in the field army area, may be attached to the subordinate tactical echelons of the field army (corps, division or subordinate commander), as determined by the appropriate joint/unified commander." Cited in Aviation Week and Space Technology, April 25, 1966, p. 26.

[58]Memorandum, "Chief of Staff Decision" on the subject of "A-7 Configuration" from Assistant Vice Chief of Staff, April 8, 1966.

that the Chief of Staff had approved the USAF configuration for the A-7, and that he directed immediate action to procure the aircraft, "which incorporates only minimum changes from the Navy version essential to insure compatibility with Air Force equipment, mission requirements, and safety features necessary for the environment in which it will be operating."[59]

The document presented a range of seven avionics options and indicated the Chief of Staff's decision had been for the center column. That column contained a listing of avionics items that were a moderate improvement on the existing Navy A-7A system but specifically included a servoed sight and an improved analog computer. (Essentially System II.) In addition, the decision specified that the Pratt and Whitney TF-30-P-8 engine and afterburner would be developed and produced for the Air Force A-7.

At the same time, Secretary Brown initiated action on a memorandum to the Secretary of Defense and OSD. The memorandum was written by Air Staff officers in the Directorate of Operational Requirements to "inform OSD" of the Air Force decision on April 7. The document reaffirmed the concept of a "low cost, close air support aircraft" but noted that nineteen changes were in line with that concept. The changes were expected to increase the cost of the aircraft 10-12% and fell into three categories: standardization with Air Force equipment (Air Force gun, etc.); equipping for

[59] Ibid.

land-based operation (afterburner); and improvement of the avionics systems to achieve better accuracy. It stated, however, that the avionics were recognized as being undefined at this point. Secretary Brown's memorandum discussed the need for an afterburner on the TF-30-P-8, but it noted the installation of the afterburner would only be after its performance was demonstrated.[60]

The Brown memorandum requested $36.2 million of the impounded funds on "OSD Hold" be released for seven A-7 aircraft and initial spares. The remainder of the FY 1966 money was requested for diversion to revised Southeast Asia requirements. $10.0 million of RDT&E funds were requested for immediate development of the afterburner engine.

A special attachment to the memorandum listed the ground rules for either a "maximum" or a "normal" effort. Both sets of rules specified a May 1, 1966, go-ahead and a request for only 367 aircraft. The difference between the "maximum" and a "normal" effort was in the development of the new engine. The maximum effort required the transfer of 10 engines from the Navy program and a special arrangement with Pratt and Whitney giving military orders priority over civilian orders for the following 26 months. (This problem with the backlog of engine orders at Pratt and Whitney was to prove even more significant in the following few months.) The memorandum and attachments were circulated throughout

[60] Memorandum, Secretary of the Air Force to the Secretary of Defense, April 9, 1966, "Air Force A-7 Configuration".

the Air Staff and the Secretary's office and sent to Secretary McNamara.

Secretary Brown followed this memorandum with a letter to Secretary of the Navy Nitze in which he stated the Air Force decision on a firm configuration. He said the Air Force was moving rapidly to implement the decision and had an urgent need to obtain the A-7. He submitted a proposed schedule which he "strongly desired" with the first aircraft in November of 1967, six months earlier than Nitze's memo envisioned.[61]

With the decision on a moderate improvement on avionics and an afterburner version of the engine, the Air Force had at last achieved a sufficient internal consensus to go forward with the development program. One of the primary actions that had to be taken was to have the Directorate of Operational Requirements write a Requirements Action Directive to implement the Chief of Staff's decision on the A-7 configuration. The RAD was written, circulated and rewritten between April and August, 1966 and will be discussed in the following chapters.

The formal Chief of Staff/Secretary of the Air Force decision of April 7 on the A-7 configuration was expected to be the last word on the subject. The decision had been to incorporate a moderately improved avionics system and an afterburning engine. However, as the development process

[61]Memorandum, Secretary of the Air Force to Secretary of the Navy, April 22, 1966, Subject: "Procurement of Air Force A-7 Aircraft."

continued and new information became available, both the engine and the avionics were to undergo significant change. The following chapter will describe how the engine on the A-7 was changed from what General McConnell and Secretary Brown envisioned when they made the April configuration decision. The changes on the avionics system will be described in Chapters VI and VII.

CHAPTER V

THE 1966 AIR FORCE DECISION ON THE SPEY ENGINE

When Secretary Brown and General McConnell made their April 7, 1966, decision to use the Pratt and Whitney TF-30 engine on the Air Force A-7, one of the stipulations was that the afterburner would have to be proven technically feasible. It was recognized by Brown, McConnell and the Air Staff that the afterburner development contained a high degree of uncertainty and risk. The decision was a difficult one because the uncertainty of the afterburner had to be weighed against the uncertainty necessarily associated with the development of any new engine.

The basic problem in April for the Air Force was that no other engine seemed to be a viable alternative. (Colonel Hails was still gathering data on the Spey engine, but he felt he did not have sufficient information to bring it to the attention of top officials.)[1]

[1] Interview with General Hails, March 30, 1970.

The development costs associated with new engines were high ($30-40 million), and the Pratt and Whitney TF-30 engine was already in production for the Navy A-7. This chapter will describe the flow of events that led first to an OSD decision to disapprove the afterburner version of the TF-30 and then to the Air Force proposal for a new engine for the A-7.

DDR&E Advice on the Afterburner Engine

The Office of the Defense Director of Research and Engineering had been interested in the development of the Air Force and Navy engines for the A-7 program for some time. The staff office most directly involved was that of Mr. T. C. Muse, the Assistant Director for Tactical Aircraft Systems. Muse and his principal assistant on aircraft engines, Mr. Raymond M. Standahar, had never been enthusiastic about afterburners that were limited to use on take-off only.[2] Such devices had been proposed at various times in the past, but none had been installed in production aircraft.

The basic disadvantage was that the afterburner was a heavy piece of equipment to put on the aft end of a jet engine. Their thinking was generally that this weight penalty was not sufficiently offset by the limited advantages of being able to have more thrust for take-off.

[2]Muse and Standahar were representative of the engineering profession in DDR&E. They both had engineering degrees and had worked in the aerospece industry before joining DDR&E. Muse was a Public Law 313 official while Standahar was a GS-16.

With the normal afterburner engine, the afterburner could be used anytime--on take-off or in flight--and provided nearly 50% additional thrust whenever the pilot needed it most. Although Pratt and Whitney engineers reportedly said the "take-off-only" afterburner could be used in flight, DDR&E analyses showed the added thrust decreased rapidly at altitudes above sea level and would be insignificant compared to the fuel consumed.[3] In addition, the take-off-only afterburner engine was estimated to use more fuel during flight--even with the afterburner shut off--than did the comparable non-afterburner engine. Thus, from an engineering point of view, the take-off-only afterburner would largely negate the advantage of the turbofan engine.

Accordingly, DDR&E had advised against the Navy contracting for a take-off-only afterburner on its new TF-30-P-8 engine. (OSD did approve the Navy change from the TF-30-P-6 to a P-8 without afterburner in response to Nitze's letter of January 6, 1966. The TF-30-P-8 subsequently was planned for all Navy A-7B's, but with only 12,200 pounds thrust it was still much less than the Air Force wanted.)

After Muse and Standahar had just expressed their disapproval of the afterburner engine to the Navy, they saw Air Force interest growing for the same engine. Secretary Brown's memorandum of April 9, requesting permission to

[3] Interview with Muse and Standahar, May 5, 1970.

develop the P-8 with afterburner was routed to OSD/DDR&E and did not meet with approval.

From DDR&E's point of view there were only two alternatives to the afterburner engine: (1) use the P-8 engine without afterburner; (2) let Pratt and Whitney develop a new higher thrust engine without an afterburner. DDR&E and officials in the Office of the Assistant Secretary of the Air Force (R&D) had previously considered a third alternative--that of using a Rolls-Royce engine--but this had not been seriously considered because of the low thrust of the early Rolls-Royce turbofans. The Rolls-Royce idea had been dropped quite early in the year.[4]

The problem with DDR&E's first alternative was that Colonel Hails and pilots in the Air Staff and TAC wanted the A-7 to have more thrust. Nearly everyone else in the decision process, including Systems Analysis, agreed that additional power would be nice if it would be obtained without too much extra cost. The problem with the second alternative was that Pratt and Whitney was not then building a non-afterburning turbofan engine of the thrust required. The only viable alternative from DDR&E's point of view seemed to be to contract with Pratt and Whitney to develop a non-afterburning version of the P-8 with increased power. Muse had been informed by Pratt and Whitney representatives that their company could develop an engine with 13,000-15,000 pounds thrust in 33-36 months.

[4] Ibid.

When DDR&E received Secretary Brown's memorandum requesting funds for the afterburner development, Muse drafted the reply. The Muse memorandum noted that the afterburner development might not be the best solution to the Air Force's problem. He recommended instead the development of a non-afterburning engine which would provide enough thrust (13,000-15,000 pounds) for take-off and yet would not increase the fuel consumption prohibitively for normal flight.[5]

The Secretary of Defense responded to Secretary Brown's request the same day the DDR&E memorandum was sent out. McNamara wrote to both the Secretaries, Army and Navy, and approved the plan to proceed with the Air Force A-7. He noted that since the changes from the Navy A-7 were minor, a formal Contract Definition procedure, with other contractors invited to bid, was not required. However, he disapproved the take-off-only afterburner in favor of a non-afterburning engine (TF-30-P-8A) with 13,000 pounds of thrust which was under development, he said, by Pratt and Whitney. He stated his reason was that the non-afterburner engine would not provide better take-off or acceleration capability, but it would be better in all other aspects of performance (such as range and loiter time). He then released the $10 million in the Air Force RDT&E account for development of the new engine.[6]

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[5] Memorandum, DDR&E (Mr. Muse) to Secretary of the Air Force, April 29, 1966. In addition to DDR&E's formal authority over the allocation of funds for engine development, Muse had worked for Brown when the latter was the Director of DDR&E the year before.

[6] Memorandum, Secretary of Defense to Secretaries of the Navy and Air Force, April 29, 1966.

The development of this new engine was not looked on with anticipation by the Air Force or OSD because of the expected 33-36 month development time. (McNamara's decision to allow the Air Force to develop the A-7 was based on a January 1967 delivery of the first airplane, a date only nine months away at this point.) In addition, during April, Pratt and Whitney began asking the Air Force to build a production plant for the new engine, since the company's facilities were operating at maximum capacity already.[7]

Pratt and Whitney apparently ran into technical difficulties in modifying the TF-30-P-6 engine into the P-8 version for the Navy. The exact reason was not disclosed, but the attempt to develop a non-afterburner version of the P-8 was discontinued. Pratt and Whitney proposed instead a P-14 with afterburner and 15,000 pounds of thrust. From April to August 1966 the P-14 was the version of the TF-30 that was being considered for the A-7, and it did have an afterburner.

There was, during April and May, 1966, a general dissatisfaction with the prospects of waiting for the new engine and yet, the alternatives did not offer

[7] Interview with Muse and Standahar.

any better solution.

The Air Force Finds a New Engine

The twin problems of avionics and engine had been the primary issues confronting Colonel Hails when he took over the management of the Air Force A-7 program. During this first six months he worked almost single-handedly in the office with the Navy, LTV, Pratt and Whitney and the Air Staff, attempting to reach a decision on the configuration of the aircraft. He described his early approach in February, to the engine problem when the Air Staff had been considering the afterburner as the best solution to the underpowered airplane.

> They told me to put an afterburner on it to get the aircraft off the ground, because the thrust was [only] 10,500 pounds. We used to have a joke that the take-off distance of the A-7 was equal to the radius of action of the F-5. So Pratt and Whitney came down, and they wanted to put an afterburner on the TF-30-P-6. It would have given a simple 50% increase in thrust for take-off. Well, in my experience with the F-111 program, most of our early problems were from putting an afterburner back of a by-pass [turbo] fan. This is because when you light the afterburner you get a transient back-pressure that comes up through the side ducts and stalls [disturbs the air flow through] the fan. This is a very sophisticated development, and it has many problems. . . .
>
> So I looked around to see if I couldn't sound out some other way, and I had heard that the [Rolls-Royce] TF-41 [Spey] engine would fit into the airplane. I discussed it with the contractor, LTV, and they said they hadn't done any studies on it but

they had looked at the TF-41 engine when they were trying to sell the airplane to Canada, and it would fit.

This is a humorous story. I thought that GE was the company that was going to build it [under license from Rolls-Royce], so I talked to GE and asked them for some information. They came down here and talked like they knew about the TF-41. They were interested in it, for the business. Two weeks went by, and three weeks went by, and they didn't come back. I had told them when they were here that if they were interested they had better get their boss to buy them a ticket to England and talk to Rolls-Royce and come back. They never did come back, and the Washington representative of GE went to see [Assistant] Secretary Charles (I&L) to get him to direct GE to look at it. It turned out that GM Allison had a working relationship with Rolls, and they [GE] couldn't disturb it. That whole month [of March] they cost me was while they were trying to find some way around the relationship.

When I found out that Allison had something to do with Rolls, I called their Washington office and asked their representative if he knew anything about the Spey engine. He said no, we don't know anything about that. So I called the British embassy and got the commercial attache. I told him who I was and that I wanted to find out if that Rolls-Royce engine would go in my airplane. So he got in touch with the North American representative in Canada, and he called me. We had about three or four meetings, and they asked if they could bring a representative from Allison. I said they could bring their mother, because I was stalled out. This Allison man sat in the corner and said he didn't know if GM was interested in the program. The next morning Roger Keyes, the executive vice president of General Motors, walked in my office and said, "I understand you were wondering whether General Motors was interested in this, and I thought if I flew out here from Detroit, you'd get

> the message." So they made a corporate commitment. Then I had my engineers look at it. Then I started the long row to hoe to sell that [to the Air Force Board Structure].[8]

When asked how his looking around for a new engine fit into the A-7 development Colonel Hails answered,

> I did a lot of that on my own, because I was afraid I'd get cut off if somebody found I was doing it. I did it--not covertly --but I wanted to find out if it would solve the problem before I made a personal commitment to it. Once I found I had something that would work and was saleable, then I started up.[9]

Allison representatives told Colonel Hails in May 1966 that they did not presently have an engine in the Spey family with sufficient thrust to power the A-7, but that they could develop a derivative of the Spey. They proposed to produce a 14,000 pound thrust, non-afterburning engine in less than 18 months.[10] The new engine would be designated the TF-41,

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[8]Interview with General Hails, March 30, 1970. It should be noted that this is the reported view from the Project Management Office. Many other events had taken place and were taking place that Hails may not have been aware of. In the first place, General McConnell reported in an interview with the author, May 6, 1970, that he had made contact with people at Rolls-Royce and with the President of Allison to bring the Rolls-Royce engines to the United States in a licensing agreement. This agreement would allow Allison to build the engines and would establish a third jet engine manufacturer in the U.S. General McConnell said this was done before the November 1965 decision, "We didn't know what kind of an airplane we were going to put it in; what we wanted to do was to get the rights to build it over here. . . ." He noted General Motors/Allison had built a couple of prototypes of early Spey models, and that the knowledge the Spey would fit into the A-7 existed before Colonel Hails made his contact with the Company. However, Colonel Hails was not aware of the McConnell/Allison/Rolls-Royce agreement.

[9]Hails interview.

[10]*Ibid*.

but it would still be referred to by the general family name--Spey. Colonel Hails immediately requested the engineers in the Aerospace Propulsion Laboratory at Wright-Patterson to evaluate the Allison proposal.

The 18-month development time promised by Rolls-Royce/ Allison was compared with 33-36 months estimated by Pratt and Whitney, and the 14,000 pounds thrust was compared with the 15,000 pounds thrust promised in the TF-30-P-14. However, the Pratt and Whitney P-14 engine was being developed with an afterburner, and when the afterburner was not operating the engine was only promised to have 10,950 pounds of thrust. This made the Spey TF-41 appear even better to the engine specialists, because the many technical problems associated with the afterburner/turbofan combination had still not been resolved by Pratt and Whitney. Allison engineers promised the Spey engine would have a lower fuel consumption and give the aircraft more range, more loiter time, and a higher top speed. Allison also promised it would cost less than the P-14.

Pratt and Whitney immediately felt the effect of the competition. When the Allison proposal of an 18 month development time became known, Pratt and Whitney promised to have the new P-14 engine ready in 18 months also.[11] The P-14 did have advantages in that it was estimated to be much lighter than the Spey engine, and it was already under development.

[11] LTV interview.

One of the major problems Colonel Hails had to contend with in May was to compare the uncertainties of Pratt and Whitney's continued development against the uncertainties of the proposed Allison/Rolls-Royce development. In an effort to reduce these uncertainties and to further specify the TF-41 requirements, Rolls-Royce and Allison representatives entered into a concerted effort with Colonel Hails and his small staff in the Project Management Office during the entire month of May. Pratt and Whitney management reportedly did not indicate the same degree of interest in the A-7 project.[12] In addition, Pratt and Whitney still wanted the Air Force to build the company a production facility for the P-14 engine.

With the obvious interest of the Rolls-Royce/Allison team, Colonel Hails began to approach the various organizations that would be affected by any change. First came the Navy in the joint project management office. Colonel Hails recalled the position of the Navy,

> The Navy really didn't oppose it, but they had a low regard for Allison, because they had had previous trouble with them on some engine.[13]

The basic situation as the Navy Project Manager, Captain Cruse, saw it was that the Navy did not face as critical a problem on the engine as did the Air Force. When asked if the Navy was slower to go to the Spey engine, Captain Cruse answered,

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[12]Interviews.

[13]*Ibid*.

> To come around to the idea of wanting to go to the Spey, I would say definitely yes. First, remember the catapult reduced the seriousness of the thrust problem as far as the Navy was concerned. Secondly, the Navy had already committed itself to the [TF-30] P-8 program for the A-7B before the Air Force came in, so we had one improvement out there that we hadn't really seen any benefits from, but we knew we were going to get sometime. I believe the first efforts for the Navy to switch over were based on the desire to have a common airplane. . . . But in general the Navy was reluctant to go this route because the whole [Navy] logistics system had been geared for the TF-30.[14]

Colonel Hails could not convince the Navy to switch engines at this time, so the Air Force would have to bear the full weight of any Rolls-Royce/Allison development costs. He was also concerned with how the airframe contractor, Ling-Temco-Vought, would respond to the change in engines.

LTV is Divided in its Opinion of the New Engine

As it turned out LTV was torn between not wanting to disturb an ongoing program with the Navy and seeing the advantages of increased thrust. Even though the Air Force program was not yet in production, LTV was afraid of the development risk involved with a British engine that had never been tested.[15] LTV had been hearing about the lack

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[14] Interview with Captain Carl A. Cruse.

[15] Interview with LTV Executive Vice President, Sol ~~Love, April 6, 1970. He noted the company knew the A-7A~~ was underthrusted, but they were constrained by the tight production schedule. They were looking around for more thrust in a different engine, and had asked Pratt and Whitney to develop one as early as December 1965. One manager of the A-7 program related he saw a certain resistance to change at LTV, but he said the engineers wanted to

of thrust from Navy pilots with whom LTV maintained close ties.[16]

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go with the new engine. Their reasons included the additional thrust and an interest in developing a new competitive engine source in Allison. He also noted the Air Force seemed to think LTV had ties to Pratt and Whitney from the days when both companies (Vought Aeronautics and P&W) had been a part of United Aircraft. (This relationship in United Aircraft ended in 1956.)

[16]This citation begins a series of references to an organizational and sociological phenomenon concerning the relationship between certain contractors and the Navy which can only be partially measured by scientific techniques and is more "felt" than seen. It is a "special" relationship which is partially conveyed by the rubric, "Navy family." The history of Vought Aeronautics is intertwined with the rise of Naval aviation since World War I. Many of the top management of LTV/Vought are ex-Navy pilots or non-rated officers. Many of the top officers in the Navy echelons flew the Vought Corsair in World War II and got to know the company in that manner. The small size of naval aviation lent itself to personalized relationships, even in an era of growing business complexity. Interviewing dozens of engineers and management officials at LTV it became apparent that they knew by name and reputation almost every Navy pilot who had flown their aircraft, from the Corsair to the A-7 Corsair II. LTV/Vought publishes a monthly newsletter entitled the "Corsair II Attack Report" in the Navy and "A-7D Tactical Fighter Report" in the Air Force. (The difference in title is because the term "Corsair" is emotionally charged in Air Force circles. Similarly, LTV is trying to sell the A-7D as a "tactical fighter" in the Air Force because of the connotation of "slow" with the term "attack" aircraft.) Each squadron commander occasionally is the subject of publicity in the Vought periodical. Through this medium LTV keeps up with the activities of each Navy squadron flying Vought products. This is only one example of how the Navy/LTV relationship is on a broad social as well as an official base. LTV also maintains at least one technical representative on each Navy aircraft carrier which has LTV planes assigned.

cont.

One of the reasons for LTV's reluctance to support immediately the change to the Spey engine is most significant and points out a current underlying the entire LTV/Air Force relationship. LTV knew a lot about the Navy, about Navy requirements, and about Navy officers. LTV managers did not know very much at all, they readily admitted, about the tactical Air Force, about the Air Force requirements process or about Air Force project management.

LTV knew it did not have a very firm grasp on what the Air Force needed, because of the lack of a specialized attack branch in the Air Force after World War II. LTV engineers and executives reported they saw extensive Air Force resistance to the concept of the subsonic A-7 when Systems Analysis was attempting to interest the Air Staff and TAC in the aircraft in 1964-1965. From LTV's point of view, the Air Force (and especially TAC) resistance had not measureably diminished after the 1965 decision to develop the A-7 for the Air Force. LTV management was reportedly continually afraid the Air Force would cancel the program and use the cost of change of engines (or later the change in avionics) as

The result of at least some of this communication is that when the Navy pilots register a complaint, it is heard at Vought almost immediately. This was the case with the thrust of the TF-30 engine. For additional depth and analysis of the special Navy/contractor relationship, see the doctoral dissertation at Syracuse University by Randy Kucera on Grumman Aircraft Corporation, 1970.

an excuse.[17] Using LTV's logic, this line of reasoning was rational and straightforward, and it indicated a policy of minimum risk was appropriate; it almost necessitated a no-risk attitude to avoid further jeopardizing the entire program.

The decision to enter into a technological development program is inherently fraught with unknowns, and therefore risk. From LTV's point of view, it may have appeared that they had everything to lose and nothing to gain by switching from Pratt and Whitney to Rolls-Royce/Allison. But the surface logic line of reasoning does not reveal the inner distress of the Air Force development problem. The Air Force had not decided in any formal or informal manner that it liked the Pratt and Whitney TF-30 above all others. In fact, the low thrust of the TF-30 was one of the primary reasons the Air Staff and TAC did not like the A-7 when it was proposed for the Air Force in 1964. The decision to put the afterburner characteristics into the Fish Study and the later confirmation of a requirement for an afterburner version were indications of Air Force unease with the engine. Certainly nothing it had learned about

[17]Interviews at LTV.

the take-off-only afterburner from DDR&E had settled the Air Force's worries about this form of expediency. McNamara's decision to develop a more powerful TF-30 held three more years of uncertainty and risk for the Air Force.

LTV was not assisted, in its attempt to relate to the high degree of complexity in the Air Force decision process, by its continued close relationship with the Navy. LTV managers and engineers related many incidents where the company's approach to the Colonel Hails, the project management personnel, the Air Staff, and TAC had been unwelcome, ineffective, or unresponsive.[18] A large part of this was due, it was reported, to the LTV failure to perceive that the approach it had developed over years of working with the Navy would not be appropriate when applied to the Air Force. Some of the LTV/Air Force differences revolved around a debate over the need for a more powerful engine in the A-7. LTV personnel reported that there were a few people in the company who could see beyond the development risk of a new engine to a new attitude the Spey would bring to the Air Force.[19] These individuals

[18] Interviews.

[19] Interviews at LTV.

increased in number as Colonel Hails came closer to getting the Air Force decision for the Spey engine. Colonel Hails later noted,

> Once I got the thing committed the company became quite elated over it. Once I sold the engine it was going to resolve a great deal of the antagonism of the airplane, because here with this thrust it gave it tremendous performance. It was a dog before and [Now it would go] right up to .9 Mach. . . . And this overcame a great deal of the problem.[20]

After sounding out the company on the feasibility and desirability of putting in the Spey engine, Colonel Hails took the proposal to the Air Staff. One of the first things he did was to have Allison representatives brief the Headquarters staff. On May 25, General Motors presented a briefing to the Air Staff on the possible use of the Spey engine in the A-7. Allison requested permission to submit a formal proposal by June 8.[21]

General McConnell directed a detailed study of the Spey engine versus the Pratt and Whitney proposed TF-30-P-14. The two engines were under study in four places during June: the Air Staff, the Project Management Office, the Aeronautical Systems Division of Air Force Systems Command, and DDR&E.

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[20] Interview.

[21] LTV, A-7D Project Master Plan, "Engine History A-7D Program."

At this point another obstacle loomed in the path of finding a solution to the engine problem. General Motors Allison Division was indeed interested in developing the Spey engine for the Air Force. By doing so it would increase the major jet engine manufacturers in the United States from two (General Electric and Pratt and Whitney) to three and increase future competition. However, Allison also needed additional production facilities which it proposed to buy from the government. Since General Motors was the largest corporation in the country, the Justice Department viewed the General Motors request as a violation of antitrust legislation. The Justice action threatened to block the Air Force attempt to get the Spey engine. Colonel Hails was intimately involved and related the complication this action presented.

> When we got Allison to commit to the price of the contract one of the conditions precedent to their commitment was that they could buy their old government-owned [Allison-leased] plant in Indianapolis. (You know, the government set up a lot of plants during World War II and gradually we've sold them off to private industry.) Allison had previously [to Hails' contact with them] made an offer to the General Services Administration to buy this plant, because that would provide them with the additional capacity they needed to take on the additional work to build this engine. At the time they made the proposal to buy the plant from the government it was not related to the Spey engine because the Spey engine was not in the picture at that time.
> But when their proposal was made to the General Services Administration, which is the agency of the government that disposes of excess

> plants, they rendered favorably on the offer. After approval of the General Motors offer the Antitrust agency of the Justice Department intervened and stopped the sale. They said, "This is making the big bigger, and we don't want to sell the plant to General Motors because it makes General Motors bigger."
>
> Months later when we came into the picture to get Allison to build our engine, the then-Vice President and General Manager of Allison came in to see me and said one of the conditions of the price on the engine was their successful acquisition of this plant. So I went over to see [Assistant]Secretary Charles and we got this Vice President to see him. The facts were to the contrary; although General Motors was a big plant, what we were trying to do was to make Allison an engine competitor with the two big giants in the engine field. So in this case it was a dichotomy in the sense that the largest corporation in the country was really going to generate competition.
>
> So Secretary Charles and I and two other people worked on it. Charles called the Assistant Attorney General, and we went over to the Justice Department and successfully intervened to get the Justice Department to withdraw their objections to letting General Motors buy that plant. And they did buy it, and that was part of the contract.[22]

Allison submitted its formal, written proposal on June 6, 1966, and on June 14 the deficiencies of the proposal were explained to Allison by the engine contracting professionals at the Aeronautical Systems Division. The deficiencies included: (1) insufficient technical data; (2) costs not well defined; (3) no performance guarantees; (4) no schedule penalties provided.[23] Two days

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[22]This aspect of the decision process was specifically recalled and related to the author by General Hails after he had read an earlier version of this study. Interview August 31, 1970.

[23]Attachment to Memorandum, Secretary of the Air Force to the Secretary of Defense, "Engine for the Air Force A-7 Aircraft," July 22, 1966.

later, the Systems Engineering Group and the officials from the Aerospace Propulsion Laboratory, Aeronautical Systems Division, held a technical review of the Spey at the Allison plant in Indianapolis. Within a week, the combined agencies of Aeronautical Systems Division rendered a favorable report on the technical aspects of the Rolls-Royce/Allison Spey engine to the Project Management Office. Muse in DDR&E did a brief analysis comparing the TF-30-P-14 with the TF-41 Spey, and he, too, confirmed that from an engineering point of view, the Spey was the best solution.

It was quite apparent that once the General Motors/ Allison management learned of the real possibility of putting the Rolls-Royce engine in the A-7, they produced a coordinated and effective effort. At the same time, although Pratt and Whitney may have been worried about the new competition, indications were that they did not mount the same sort of campaign.[24] This was partially confirmed on July 5, when contracting officials from Aeronautical Systems Division briefed the Air Staff and noted that if the Air Force did plan to continue with the

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[24] This is confirmed by Mr. J. E. Martin, Vice President of Vought Aeronautics for Engineering and Logistics. He said in an interview April 6, 1970, that P&W did not do the marketing management they might have done under different circumstances. They were, after all, still in a very favorable corporate position with large backorders for their engines. Martin and many others give a lot of credit to Colonel Hails for his aggressive management of the engine program.

TF-30 engine, the Pratt and Whitney production rate for Air Force engines would be very slow.[25]

Colonel Hails continued to press the Spey engine through the decision process. On July 11 and 12 he briefed Secretary Brown. At this point several political factors entered into the decision. Secretary McNamara had been particularly interested in getting some other countries interested in buying F-111's from the United States. (The costs of the F-111 had been growing for some time, and if other nations added their orders to the U.S. program quantities, the cost of the aircraft would be reduced for everyone.) The U.S. had approached the United Kingdom with the proposal to buy F-111's,and Prime Minister Harold Wilson had been considering the offer. In addition, the U.K. was considering contracting with U.S. companies to procure the F-4 Phantom and some Lockheed transports for the Royal Air Force and the Royal Navy. If the U.K. were to buy all of these products from the United States, the British government thought it only fair that the U.S. seek to offset some of the balance of payments by purchases in Britain. Officials in the two governments were talking in terms of $325 million between 1966 and 1977.[25]

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[25]Engine Contracting Office, Aeronautical Systems Division, briefing to Air Staff, July 5, 1966. A-7 Project Master Plan.

[26]Aviation Week and Space Technology, July 18, 1966, p. 26 and March 6, 1967, p. 107. The July 18, 1966 Aviation Week article indicates the press was following the decision process fairly closely, though wrong in certain details.

Secretary McNamara Approves the F-4E With an Internal Gun

While the new engine for the Air Force A-7 was being considered, the Secretary of Defense decided in favor of letting the Air Force go ahead with plans to put the cannon in the nose of the F-4 Phantom as requested by Secretary Brown in the original A-7 decision memorandum and again on May 25.[27] This was a landmark decision as far as the Air Staff was concerned because of the amount of effort that had gone into the F-4 gun program. The approval was very significant to the A-7 program, because it was this gun-version of the F-4 that was increasingly thought of inside the Air Force as the competitor for funds and force structure with the A-7.

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[27]Secretary of the Air Force Brown had sent a memorandum to the Secretary of Defense on May 25, 1966, with the following statement: "You will recall that our earlier studies of cost/effectiveness of the F-4 in air-ground operations indicated the improved cost/effectiveness which would result with an internally mounted gun. Recent air actions in North Vietnam have also clearly indicated the desirability of an internally mounted gun for air-to-air combat. . . ." "Finally, you will recall that when I recommended inclusion of the A-7 in the force (reference my memorandum to you dated November 5, 1965, Subject: Interim Buy Tactical Fighters), I indicated that the studies which supported this recommendation showed the need for a very high quality air superiority aircraft in such a mixed force. Making future F-4 buys in the TSF configuration, in addition to being cost/effective itself with respect both to air-to-air and air/ground missions, will support the planned mixture of lower cost tactical aircraft in the USAF inventory."

"I request your approval to substitute procurement of the TSF version of the F-4 for the previously approved FY1966 procurement of the 99 F-4E's without internal guns. Simultaneously the TSF should be redesignated the F-4E." This request was approved on July 22, 1966, as noted in History of the Tactical Division, Operational Requirements and Development Plans, DCS/R&D, July 1-December 31, 1966. p. 6.

Secretary Brown's rationale relating the F-4E with the A-7 was stated before Congress on March 30, 1966.

> Both the Chief of Staff and I see an immediate need for an aircraft which can provide effective close air support in a relatively permissive environment, made so either by absence of enemy interceptor capability or by our own over-all counter-air (including air-to-air) operations. After careful study we have agreed that the impressive payload and range of the A-7 make it the best existing aircraft. Our selection of the A-7 will improve the versatility of the total fighter force. The A-7 complements the deep interdiction capabilities of the F-111 and the air-to-air and air-to-surface capabilities of the F-4. Since the combat attrition rate of the A-7 will depend on the degree of air superiority we are able to maintain, the Air Force has recommended improvements in the air-to-air combat capabilities of the F-4 force. We have requested development of an improved F-4 Tactical Strike Fighter (TSF) for this purpose.[28]

The Air Force Decision on the Spey Engine

With the combination of performance factors, contract guarantees and foreign policy considerations, Secretary Brown and General McConnell decided to recommend purchase of the TF-41 Spey engine to the Secretary of Defense. On July 22, 1966, the decision memorandum went to Secretary McNamara stating both the background and rationale for the recommendation. The background stated the Navy was not joining in the program because of the TF-30 commonality with Navy equipment, but that the

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[28] U.S. Congress, Senate, Military Procurement Authorization for Fiscal Year 1967, Hearings before the Committee on Armed Services and the Subcommittee on Department of Defense of the Committee on Appropriations, U.S. Senate, 89th Cong., 2d sess., p. 858.

Canadian version of the A-7 could use the Spey engine. It stated the delay in Pratt and Whitney production availability had been the determining factor in renewed Air Force interest in another source, and that Allison had joined Rolls-Royce in a concerted effort to design an acceptable engine.

The conclusions were that the Spey engine offered:

1. Better overall performance--more range, more loiter time.
2. Lower costs--$315,000 per engine versus $458,000.
3. Higher production rates--20 per month versus 25.
4. Earlier operational capability.
5. More meaningful guarantees.
6. New competitive engine source.
7. F-111/United Kingdom gold flow offset.[29]

The Secretary of Defense approved the Spey engine decision on August 3, 1966.[30] (He noted, however, that the Air Force was to be restrained from putting the Air Force cannon in the A-7 until a joint Air Force/Navy program could be developed for its use.) McNamara later gave these reasons for changing his earlier decision on the engine for the A-7,

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[29] Memorandum, Secretary of the Air Force to the Secretary of Defense, July 22, 1966, Subject: "Engine for the Air Force A-7 Aircraft (U)." The August 8 issue of Aviation Week and Space Technology confirmed the backlog problem of Pratt and Whitney, and said they could only have made delivery of the initial engine after 37 months. The gold flow offset was estimated at $100 million. A lengthy description of the decision followed, p. 33.

[30] LTV, A-7D Project Master Plan, "Engine History A-7D Program."

> Two considerations caused us first to delay and then to change this decision. First, it appeared desirable, if possible, to find a new engine production source rather than add to the already crowded schedule of one of our principal engine manufacturers. Second, if a different, more powerful engine could be used, the load carrying capacity of the A-7 would not have to be penalized by several hundred pounds of dead weight which the afterburner would involve. Such an engine, the Rolls-Royce's "Spey" proved to be obtainable from Allison, who will produce it in the United States under license from the British firm.[31]

During August President Johnson discussed the use of the Rolls-Royce engine with Prime Minister Wilson, while discussing the proposed British purchase of F-111's.[32]

Organizational Positions on the Spey Engine

The Spey engine was in some ways a technical decision, but it also contained the thrust of organizational pressures and showed professional values to some degree. Within the Air Force the operations people wanted a new engine with more thrust to carry more ordnance and provide a faster aircraft for a combat environment. The Air Staff was originally divided on the issue of afterburner/no after-burner, but as soon as they saw the possibility of a

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[31] U.S. Congress, House, Committee on Armed Services, Hearings on Military Posture, FY1968, 90th Cong., 1st sess., March 22, 1967, p. 926.

[32] A-7D Project Master Plan, op. cit., Flight International, August 4, 1966, p. 168, noted the Spey buy was imminent and quoted Sir Deming Pearson, deputy chairman and chief executive of Rolls-Royce saying confirmation was "expected shortly" and, "I regard it as the biggest break-through Rolls-Royce has ever had."

non-afterburning engine with the same thrust, the issue ceased to be critical. The Spey became an obvious choice. Secretary Brown did not remember the Spey issue as dividing the Air Staff in any significant way.[33] The Chief of Staff had always been in favor of a higher performance engine, especially if it would not increase the cost of the program. He had arranged for Allison and Rolls-Royce to get together and produce the Spey engine as a future competitive engine source in the United States, before the Air Force A-7 program had been initiated.

The Air Force Project Manager wanted the Spey for essentially two reasons: to give added performance to the aircraft; and to lessen many of the hostile views he perceived were directed at the program from agencies within the Air Force. He carried out a certain degree of initiative which was later recognized as being successfully innovative.

DDR&E maintained a position favoring the incorporation of a non-afterburning engine for professional reasons. Its engineers confirmed the Spey was the best choice.

Systems Analysis did not really involve itself deeply in the decision once the analysts found out it would not increase the cost. Murray noted,

[33] Interview.

> The Spey was a good idea; it was cheaper than the TF-30 to begin with. We appreciated the fact that it [the A-7] could use more power. It was a pretty sluggish machine and who can be against having more power? The thing we were a little bit scared about though was the cost of the TF-30, so when the Spey came up, that looked very promising. So we said, "Great, let's go ahead and get the Spey."[34]

However, before the data on the lower cost of the Spey engine was available, Systems Analysis had expressed the view that changes to the engine were undesirable. Systems Analysis, as reported by Murray, was against the addition of an afterburner to the TF-30, primarily because it was expected to increase the cost of the program.[35] Even with the lower costs of the Spey, Systems Analysis was a little wary of the uncertainties of its development. Again Murray noted a degree of lingering doubt,

> So that [the engine change] was almost the start of "hard times," but not quite, but that was one of the first little chinks in the system.[36]

It was becoming more apparent to the A-7 project managers and to the Air Staff officers that Systems Analysis was beginning to strongly resist any proposed changes to the A-7 if those changes included increased costs or significant development risk. The stiffening resistance to changes within Systems Analysis would be

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[34] Murray interview.

[35] _Ibid_.

[36] _Ibid_.

even more apparent when the proposals were made for an improved avionics system described in the next chapter.

The Navy was not ready to disturb the production lines on its A-7B, and it already had commitments for the TF-30 into the future. In addition, the Navy logistics system was established around the TF-30 engine. On top of these two factors, the catapult system of the carrier reduced the intensity of the Navy technical problem.

LTV was initially divided over the prospects of losing the program completely and satisfying the customer. The Spey change held potential for both, as it appeared to LTV. As the Allison proposal matured, they saw the technical risk being reduced and at the same time there developed the concept that a new competitive engine source in the country could only help LTV, since they had to either buy their A-7 engines from Pratt and Whitney or have the government buy them. Either way, a competitive market would help LTV's program.

The result was that the Spey decision went through the government's decision process with exceptional speed, from May 25 to August 3, and with little dissent. As one Staff officer noted, "It emerged so fast; it was just such a timely thing. I had never seen anything win approval so fast as did the Spey engine over the Pratt and Whitney."[37]

The Air Force contract with Rolls-Royce/Allison was written on August 31, 1966, and finalized into a Fixed-Price Incentive Fee agreement on December 30, 1966. The contract called for the development and production of 500 Spey engines with options for 1500 more. The cost of the research and development portion was $28 million, and the production contract was for $227,283,619, with an average unit cost of $342,904.[38] In June 1968, two years later, the first test run of the prototype TF-41 engine was completed only one week behind schedule and produced almost 15,000 pounds of thrust. The Navy immediately became very interested in the TF-41 engine for its new version of the A-7, the A-7E.

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[37] Interview with Colonel James R. Hildreth, February 9, 1970.

[38] Aviation Week and Space Technology, January 16, 1967, p. 30.

CHAPTER VI

PROPOSALS AND STUDIES FOR AN IMPROVED AVIONICS SYSTEM

The Secretary of the Air Force/Chief of Staff decision of April 7, 1966, selected an engine, an avionics system, and other configuration changes to the Navy A-7. The events leading to the Air Force change from the Pratt and Whitney TF-30 to the Spey engine between April and August 1966 have been described. This chapter will describe the organizational and individual inputs that led to an evolution of the avionics system over a period of eight months (April 1966--December 1966). During this time action was taken to implement the April 7 decision on avionics, the Air Force requirement was formalized, and the Project Management Office began a series of avionics studies to investigate the best way to provide the required capability.

Review of the April Decision on Avionics

The avionics alternatives as the Air Staff debated them prior to the formal Secretary of the Air Force/Chief of Staff decision of April 7, 1966, ranged among essentially four options:

1) An "austere" system with less equipment than the Navy A-7A.
2) The same equipment as in the A-7A: analog computer; fixed sight; 20-40 mil accuracy (System I).[1]
3) An "improved" system with individual components upgraded from the Navy equipment: improved analog computer; servoed sight; 15-20 mils accuracy (System II).
4) A system of integrated components: digital computer; heads-up display; 10 mil accuracy (System III).[1]

The decision of General McConnell and Secretary Brown, on April 7, had been for the equivalent of System II--a moderate improvement on the Navy system.

The decision document specified several of the individual avionics components that were to be installed in the Air Force A-7D.[2] They included a servoed sight, an analog bombing computer, and a separate computer for navigation computations.[3] The option including a central

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[1]See Table 5 for a breakdown of Systems I, II and III.

[2]The A-7A and the A-7B were exclusively Navy airplanes. The Air Force version came to be called the A-7D. The subsequent Navy version that incorporated many of the Air Force changes like the TF-41 Spey engine, the M-61 gun and the new avionics system would be called the A-7E. The A-7C designation was never used for a production airplane because it was reserved for a two-seat trainer model that was not developed. Discussion about the trainer proposal used the designation TA-7C, with the "T" added to indicate the aircraft's primary mission of training.

[3]Attachment 1 to Memorandum, "Chief of Staff Decision," "A-7 Configuration," April 8, 1966.

digital computer to replace both of the individual computers had been rejected by General McConnell and Secretary Brown.

Translating the Decision into a Written Requirement for the Project Manager.

The mechanism by which this decision was to be implemented by the Air Staff was in the form of a Requirements Action Directive (RAD). The RAD was an authoritative document written in the Directorate of Operational Requirements; its purpose was to "direct and guide" Air Force activities in the procurement of the approved weapon system. The RAD was the primary instrument by which the formal decision was to be communicated to Air Force Systems Command and the Project Management Office.

Action officers in the Directorate of Requirements had been working for several months on various draft versions of the RAD. They had started during the configuration conference of December 1965 and had continued up until the April 7, 1966 decision. During this entire period the Air Staff officers had been in communication with Colonel Hails and officers in the Directorate of of Requirements at TAC Headquarters.

After the April 7 decision, the Brown/McConnell memoranda formed the basis for a new series of drafts on the RAD. The Air Staff officers in the Requirements Directorate wrote the first draft of the new RAD shortly after April 7 and circulated it to TAC and the Project Management Office for comment. The RAD draft made extensive reference to specific items of avionics equipment that were to be used in the Air Force A-7.

Colonel Hails was of the opinion that this early specification (by type and manufacturer) of pieces of avionics equipment might be detrimental to the development of a weapons delivery "system." He discussed the matter with General Schriever, commander of Air Force Systems Command, who agreed. Colonel Hails then wrote a letter for General Schriever's signature that went to General McConnell. The letter requested that the RAD specify the capabilities desired in the A-7 (in terms of navigation and bombing accuracy, range, etc.) but that the selection of individual pieces of avionics equipment be left up to the discretion of Air Force Systems Command and the Project Management Office.[4]

[4] Interview with Colonel Hails.

The effect of this letter is unknown, but subsequent drafts of the RAD were written with specifications of capabilities, and less mention was made of specific items of avionics equipment.

The initial RAD draft also went to TAC early in April. The position of TAC, as expressed earlier by General Disosway's letter of March 15 to General McConnell, was that TAC wanted the A-7 to have an integrated avionics system capable of very accurate weapon delivery under all-weather as well as visual bombing conditions. During the process of drafting and reviewing the RAD, TAC Requirements reportedly continued to stress the importance of having a sophisticated avionics system with a very high degree of accuracy.[5]

The RAD was drafted, circulated, reviewed, rewritten, and recirculated several times between the April 7 decision and the date of its official publication, August 11, 1966. In the interval several other events were influencing the A-7.

On April 18, 1966, barely more than a week after the A-7 configuration decision, General McConnell received a letter from General Hunter Harris, Commander of the

[5] Interviews, October 16, 1969, February 9, 1970, and March 7, 1970.

Pacific Air Forces. Harris stated he was concerned over the avionics equipment on the A-7 and wrote, "Our Southeast Asia experience points out with unmistakable clarity that there is a valid and increasing requirement for round-the-clock, all-weather close support and interdiction capabilities in present tactical air forces. . . . These capabilities dictate a considerable complement of avionics equipment."[6] He stated further that increased weapon delivery accuracy was desirable even if a reduction in the total numbers of new aircraft purchased were the result. In closing he "strongly supported" General Disosway's recommendation that the avionics on the A-7 be improved to the maximum extent possible.[7]

During May 1966, the Navy Department underwent a large reorganization of its support bureaus, and the Bureau of Navy Weapons was redesignated the Naval Air Systems Command.[8] The A-7 Project Management Office now reported to the commander, Naval Air Systems Command.

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[6]Letter, Commander, Pacific Air Forces to Headquarters USAF, Chief of Staff, April 18, 1966.

[7]*Ibid*.

[8]The four Bureaus of Ships, Docks, Supplies and Accounts, and Naval Weapons were broken up and their responsibilities distributed among six new "Systems Commands"--Facilities Engineering, Supply, Electronics, Ship, Ordnance, and Air. *Journal of the Armed Forces*, March 12, 1966, p. 12.

The Air Force need for increased numbers of tactical fighter and attack aircraft was restated in Senate hearings in May. The Preparedness Investigating Subcommittee of the Senate Armed Services Committee held hearings on May 9, 10, 1966, to examine Air Force tactical air operations and readiness. Under the chairmanship of Senator Stennis (D., Miss.) the subcommittee was particularly interested in the air losses over Vietnam. General McConnell testified that the USAF had lost 340 combat-type aircraft to enemy action as of May 5, 1966, and that many of these were due to Soviet-built Surface-to-Air Missiles (SAM's).[9] The SAM's had first appeared during the summer of 1965, and their initial toll of U.S. aircraft over North Vietnam had caused the Air Force and Navy planning staffs to increase their expected rate of aircraft losses.

During July, Colonel Hails' Air Force Project Management Office increased in the numbers of personnel assigned. On July 1 he had only 2 people assigned (one military officer and one civilian), although he was authorized fifteen.[10] By December 1966 he had nine people

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[9] U.S. Congress, Senate, Committee on Armed Services, U.S. Air Force Tactical Air Operations and Readiness, Hearings before the Preparedness Investigating Subcommittee of the Committee on Armed Services, 89th Cong., 2d sess., May 9, 1966, p. 35.

[10] Project Management Office, Semi-Annual Historical Report, July 1, 1966-December 31, 1966. The build-up in personnel of the office was to continue, and in March, 1970, it had 41 people assigned.

assigned to the A-7.

Finally, after many drafts and revisions, the A-7 Requirements Action Directive was received in the Project Management Office. The RAD was published August 11, 1966, and included the following specifications:

> "Direction/Proposal: (U) This RAD validates the requirement for a tactical attack aircraft to be operational during the 1969-1977 time period. It is based on the A-7A, a U.S. Navy attack aircraft in production. The scope of this RAD is limited to a description of those changes made necessary by Air Force operations and maintenance concepts, and the effects of these changes on the performance/capability of the aircraft."
>
> "Operational Mission: (U) The Aircraft will be used to deliver air-to-surface non-nuclear weapons in visual weather in support of tactical air operations."[11]

The RAD required 42 changes to the basic A-7A including:

1. Delete Fixed Optical Sight
2. Provide Stabilized /servoed/ sight
3. Delete CP-741 Weapons Release Computer
4. Provide Analog Bombing Computer
5. Delete MK-12 Guns (Navy)
6. Provide M-61 guns (Air Force)[12]

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[11] USAF, Requirements Action Directive, RAD-7-11-(1) A-7D, August 11, 1966. Unclassified portions only.

[12] LTV, A-7D Project Master Plan, June 30, 1969, pp. 1-1-3, 1-1-4.

The accuracy requirement for the A-7 was stated in feet,not in mils, and was expressed as a Circular Error Probable (CEP).[13]

The exact accuracy of the A-7 is classified, but an unclassified description of the RAD included the phrases, "aided visual weapon delivery," and "no canned delivery."[14] It was regarded by Colonel Hails as requiring very accurate weapon delivery, essentially 10 mils.

When the RAD was received by Colonel Hails in the Project Management Office, it was his responsibility to provide the capability specified. The essential job on the avionics was to determine if and how the required degree of accuracy could be achieved with the equipment specified (analog bombing computer and servoed sight). Before Colonel Hails had gotten very far in his efforts to implement the RAD, he was to be aided by a newcomer to the Project Management Office.

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[13] Circular Error Probable (CEP) is an indicator of the accuracy of a weapon; it is used also as a factor in determining the probable damage to a target. It is the radius of a circle within which half of the projectiles are expected to a fall.

[14] Unclassified page 16 of Briefing in "Talking Papers," file 17-3-1-1, Tactical Division, Directorate of Operational Requirements and Development Plans, DCS/R&D.

The Navy Gets A New Deputy Project Manager

The head of the Project Management Office was still Captain Cruse, who was thinking about an improved avionics system with Colonel Hails. Both officers were wondering if very accurate weapon delivery could ever be achieved on a regular basis with the limitations of the analog computer, even in an improved version. Later, Captain Cruse was asked if the move to an improved avionics system was partially due to reports coming back from Vietnam showing the need for increased bombing accuracy. Captain Cruse said,

> Yes, it was that plus we were learning more about the CP-741 [analog] bombing computer; we could see that while we were going to get improvements, we were not going to get quantum jumps in improvements [in an analog computer], and our accuracy would still be something much to be sought. It was about at this point that Bob Doss came on the scene and relieved me of the Navy part of the program and became the Navy Deputy. Bob was something of an expert in this area having been out at China Lake [Naval Ordnance Test Center] and worked closely with efforts out there to improve bombing accuracy. So he had a large influence on what happened after that. . . . That's about the only way I know how to express it, that Bob had a large influence on how the A-7E turned out to be configured.[15]

Robert F. Doss, Commander, USN (already selected for promotion to Captain) was assigned to the A-7 program as the Navy Deputy Project Manager in July 1966. Previously,

[15] Interview with Captain Cruse.

he had served in Captain Cruse's Carrier Air Wing and in various positions related to attack aviation and the development of avionics equipment. He had just come from a Vietnam tour as the operations officer of the aircraft carrier Ranger, and his assignment had reportedly been at the request of Captain Cruse.[16]

Captain Doss described the situation as he saw it when he was assigned to the Program Management Office,

> Bob Hails was there six months ahead of me. . .and I reported July 1, 1966. He'd gone through all the rat race of not getting any help out of Pratt and Whitney for an engine and not getting much in the way of studies, getting no money and no people. When I got there, there was just him. In fact, there were just about he and I and a few attached people and Carl [Cruse] and Bob Little, who was a GS-13 and the assistant deputy for the Navy, my assistant. Hails had a few people but not many. . ., but we started to grow. . . .
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> Then in the early fall we got together on the configuration; we started that effort in earnest. I don't know exactly why, but the Navy had the A-7A and B which was put together in a hurry with off-the-shelf

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[16]Interview with Captain Doss, October 25, 1970. Captain Doss was regarded as an exceptionally innovative and dynamic officer. He had been one of the youngest Navy pilots to fly the Banshee jet aircraft in the Korean War and had accumulated a wealth of attack experience since that time. He had been an A-4 squadron commander and had spent several tours of duty in the research and development side of attack aviation in the Navy. He had been selected for promotion to Captain well ahead of his contemporaries and was regarded as having an excellent chance of making Rear Admiral. His professional qualifications included a B.S. in Aeronautical Engineering from Georgia Tech and a graduate "professional degree" in Aeronautical Engineering from California Institute of Technology. (The professional degree represented a doctoral-level program in engineering with a Master's thesis.) Doss had, in addition, completed the Naval Post Graduate School and the Naval War College.

> avionics of the 1950's--totally inadequate, a tremendous burden on the pilot because of a lack of integration. I mean we had everything; we had a computer and we had a gunsight, we had a two-gyro platform. . . [etc.] We had an analog navigation computer, but the computer read out digitally and you don't fly that way. There were no suitable displays; there was no integration of information--the pilot was the integrator and the pilot couldn't perform. It was a tremendous workload. If you're going to pay for all this stuff, you need to integrate it and make it produce as assistance to the pilot--or else you've got to provide a second crewman. Our concept, being a single-place airplane, was to see what we could do with a few hundred pounds of avionics to lessen the workload on the pilot.
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> The A-7A did about as well as you could with dive angle, which is a critical error, true airspeed, and slant range (or altitude) in terms of integrating them in a very simple, cheap, $16,000 analog computer. We pay twice that for one Sparrow missile [carried on some air-to-air fighters]; it seems to me that when you're building an airplane to go for 200 to 300 combat sorties, . . you ought to be able to afford something better than a one-way missile.[17]

Before Captain Doss entered the A-7 program he had been warned that the Air Force perspective of the attack aircraft--being different from the Navy--might work to the detriment of the Navy program. Doss therefore entered the program with a certain watchfulness of his unknown Air Force counterpart. Despite this initial uncertainty the two deputy project managers developed a high degree of respect for one another, and they became close friends. They even discovered that they had been fraternity brothers

[17] Interview with Captain Doss, March 13, 1970.

of Sigma Alpha Epsilon--Doss at Georgia Tech and Hails at Auburn. They developed a style of operating as a team that was widely commented on in industry and DOD; the teamwork was based on Hails' extensive management experience and Doss' technical background and operational expertise. Colonel Hails later commented on their relationship.

> I don't think we could have made the progress we did in the airplane if it hadn't been for Bob's objectivity and outstanding technical background.
> I drove Bob with the threat that I'd have a better airplane than the Navy would have, and he didn't want that to come to pass, so he was driving hard to get everything that I put in the Air Force airplane into the Navy's airplane.[18]

Captain Doss describes his appraisal of the situation and relates the approach he saw in respect to ILAAS and Colonel Hails' requirement,

> He had his RAD, which was a system that wouldn't work, and he recognized it (System II). His requirement when it came from the Air Staff [had some incompatabilities]. Basically, you couldn't get the kind of CEP (Circular Error Probable) [they wanted with the equipment specified]. . . .It had a servoed sight but you don't need a servoed sight without inertial velocity inputs--why servo it? The system was very badly conceived; it was one of those kinds of

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[18]Interview with General Hails, March 30, 1970. Another view of Captain Doss was offered by one of his colleagues in the Navy, "I think that Bob Doss has always visualized something [like an integrated avionics capability]; he's been great in the air-to-ground business. He was in VX-5 at China Lake, which is the attack development squadron for the Navy, and he had his own A-4 squadron; he was always insisting on the avionics equipment in his aircraft being updated and working all the time. In doing so he was able to improve on the weapons systems that were given to us. To us, I mean to the people who were flying the aircraft. . . .

> things that the contractors generally go in and sell to the Air Staff. Well, it wasn't going to produce.
>
> The way I looked at the situation was this; the Air Force were going to come in and make a major change to the airplane. They were going to put the M-61 gun in it, a different engine, and probably about a 33-50% fuselage change. They were going to change the avionics rather extensively. I looked at his RAD, and it sized up to me to be a loser. It wasn't going to produce; we were going to spend all the money, but we weren't going to get the capability the RAD called out, nor the capability that we wanted.
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> We had 230 A-7B's (which is the same as the A-7A except for a little more thrust) in the Fiscal 67 budget, which now in July 1966 that's the thing you're aiming toward. It had 240 B's in the Fiscal 1968 budget. It appeared to me that we were going to lose a number of those airplanes. When you sit down and look at the force structure--the number of Air Wings and carriers we've got--and you see that the attrition is nothing like they had projected, you know damn well somebody's going to cut way back on the numbers of airplanes.
>
> The Air Force was going to make this big change, and there wasn't a chance in hell of us ever doing the ILAAS in the A-7 or some portion of the ILAAS in the A-7 after the Air Force made their changes. It was too much to ask the taxpayer to go through that twice. The important thing to do was to get the Air Force to buy the basic objectives of ILAAS which was an integrated digital system.[19]

Colonel Hails was equally interested in getting the Navy and Captain Doss to go along with his avionics improvements. He noted,

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I think this avionics suit belongs to Bob Doss primarily, ~~because he was the one who insisted and pounded day and~~ night that this is what we had to have in order to get the accuracy out of the weapons that we wanted to. . . .I think you're going to have to blame Bob Doss for the avionics on the A-7. It's his fault." Interview, February, 1970.

[19]Interview.

> I was desperately interested in the Navy coming in because we already had an agreement that we would share the non-recurring development costs on a 50-50 basis. Up to that point I was carrying the whole bag on the Air Force program, and I was dedicated to get the improved performance in the airplane.[20]

When Colonel Hails and Captain Doss were looking at what was available in the way of avionics concepts, performance and equipment, the Navy experience with ILAAS was one consideration. Colonel Hails later reported that he was opposed to the ILAAS approach with four digital computers, but that some of the concepts were sound. The big disadvantage to ILAAS that he could see was its high cost,

> That system /ILAAS/ was going to cost about half a million dollars apiece _if_ it ever got it into production. And the Navy from the very outset had planned to upgrade their airplanes by putting in that system. . . . They unfortunately had laid it down-technology-wise--in 1963 and technology moved so rapidly in that time period. When I came along in 1966 we could buy the same capability but much cheaper, because we were going to go at it in a different approach.[21]

What did Captain Doss think of ILAAS? He said,

> ILAAS had been the first integrated avionics program, and the Navy had $36 million invested in it in R & D. It was

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[20]Interview

[21]Interview

> totally unsuitable for the A-7, in my opinion. It's display approach was unsound and the system was more than we needed, far too much to buy, but extractions of ILAAS offered some tremendous opportunity. . . .It was going to be hard for him [Colonel Hails] to get the Air Staff to swallow ILAAS, because it was a Navy avionics program.[22]

At the same time that Captain Doss was getting deeply involved in the A-7 avionics issue, another change in personnel occurred in Systems Analysis that was to affect the OSD attitude toward the A-7 program.

A Shift in Personnel in Systems Analysis

In August 1966 the principal responsibility for the determination of force structure within OSD was still in Systems Analysis. The force structure of the A-7 was primarily determined by the Tactical Air Programs Division of the General Purpose Programs section of Systems Analysis. Russell Murray was still the Deputy Assistant Secretary of Defense for General Programs, but the head of the

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[22]Interview. In addition, several individuals at LTV and in the two services reported their opinion that ILAAS was viewed as a direct threat to the A-7 program. That is, they explained, if Hails and Doss had done nothing at all, they were afraid that the original ILAAS with its high cost and high degree of uncertainty might be put in the aircraft with the result that the Air Force program could be cancelled and the Navy program seriously curtailed. This opinion was continually reported, by others, that Doss and Hails perceived the ILAAS as a definite threat to their program, and felt constrained to develop a system using some of the ILAAS concepts, but avoiding its high cost.

Tactical Air Programs Division had just changed. Mr. Patrick Parker left Systems Analysis and Mr. Herbert Rosenzweig had taken over the tactical air post. Whereas Murray and Parker had held the A-7, and Navy attack aircraft in general, in high esteem, the attitude in the office now was likely to be different. Rosenzweig had just come from the RAND Corporation where he had written, with G. H. Fisher and S. Wildhorn, a paper entitled, A Comparison of Alternative Mixes of Land-Based and Sea-Based Tactical Aircraft (RM-4444, February, 1965). Mr. Rosenzweig's views were widely known within DOD to be in favor of land-based as opposed to sea-based tactical aircraft in general and in favor of the F-4 versus the A-7 in particular. It was the opinion of various individuals in the A-7 program that the numbers of A-7's in future budgets would be scrutinized and, if possible, reduced by Systems Analysis.

The effect of the personnel shift in Systems Analysis was reinforced by the change in attitude toward tactical air of the Assistant Secretary of Defense (Systems Analysis), Alain Enthoven, who said,

> We were spending about $16 billion a year on tactical air forces and really didn't know why. There was just no good analytical, logical basis for why we should be spending so much. We had just kind of started down that road of spending more on tactical air because we all believed in it, and we had never figured out when and where to cut it off.[23]

Not only was Systems Analysis developing a general attitude that the level of spending for tactical air programs was too high, the organization was developing a specific attitude toward avionics improvements. The attitude was expressed by Murray when he was asked why he thought proposals were made for improvements in avionics. He answered:

> Gadgeteers. Gadgeteers. I think it is gadgeteers; it is what happens to every airplane. . . . Pretty soon your nice, simple little airplane has everyone's favorite gadget on it, and the cost is doubled; how did that happen? Well, it's all this junk that keeps getting put on there.
>
> Now it's not all junk, but the difficulty is that people have high hopes for their latest invention. So instead of taking it out and testing it and demonstrating that it really will work under realistic conditions and then putting it in, they say, "No, that'd take too long; we'd miss half of the production. We better put it in at the beginning." And that's what happens.[24]

The statement of the need for more testing before the incorporation of technological changes in production weapons was a recurrent theme in Systems Analysis during the 1960's. This attitude was often interpreted by the

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[23]Interview, Dr. Enthoven. Parker left Systems Analysis on August 31, 1966.

[24]Interview.

services to be an organizational position hostile to technology in general. In the field of avionics, Murray related an example of how a systems analyst became widely known as being hostile to proposals for expensive, complex avionics systems.

> We had an iconoclast in Systems Analysis named Pierre Sprey, and he was given to making a lot of extraordinary statements. At any rate, one of the things he did was to run an analysis on how various bombing systems had worked. The general conclusion was that, by and large, it's better to leave them off, that the aircraft is more accurate bombing with them off than it is to have them on. Now, I don't know if that's actually right, and I think that philosophically there's something wrong with that. You've got to get _some_ accuracy out of a system, or else why do you put a sight on a gun? So, I think that is a little extreme. But nevertheless, the point is there that these claims of bringing a 30 mil error down to 10 mils or 5 mils by using an inertial platform, perhaps a range measuring radar and a computer, were wild. That [accuracy improvement] had just never happened.[25]

The change in attitude within Systems Analysis and the entry of Rosenzweig was immediately noticed by the A-7 project management officers. The Systems Analysis attitude was another factor Hails and Doss had to consider, but it was an exceptionally important one because it was directly linked to the total numbers of aircraft to be purchased.

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[25] _Ibid._

Captain Doss later described how he viewed the possibility of a reduction in the numbers of A-7B's from the Navy plans for about 1000.

> The time the Air Force was going to do the avionics was the time the Navy needed to do the avionics, and furthermore we had these 230 A-7B's in 1967 and 240 in 1968 that I was damn sure we really couldn't buy, because of force structure [lower losses than expected]. Rosenzweig [was] running loose, and I thought it was important to get ahead of him. . .to convert the dollars in the budget to attack capability.
>
> Basically, what I decided we had to do, and my OPNAV [Office of the Chief of Naval Operations] coordinator [staff officer for the A-7] supported it, . . .was to upgrade the airplane so that the end of the war we would be left with some quantity of A-7E's and be in production in that upgraded airplane which would be suitable for the 1970's, rather than be left with a huge block of A-7B's,with the only thing we could hope to do maybe, was to get some of the Air Force versions.[26]

Being convinced that an improvement in the Navy and Air Force avionics systems could be jointly worked out, Captain Doss described how he and Colonel Hails approached the contractors,

> Bob and I started around the country going to all the well-known contractors--Sperry, North American, Hughes, IBM, and LTV. We were having trouble with LTV [resisting any change in the avionics], and we started right out to tell the primes [contractors] that we talked to--the avionics primes--that we were seriously considering an associate contractor to do the avionics and to provide the avionics GFE [Government-Furnished Equipment] to LTV to incorporate in the airplane.

[26] Interview, March 13, 1970.

> We told [LTV] that they were going to have to compete, that we were not going to take what [LTV] said in this single-source arrangement. We were going to keep competitive pressure on them and if they were going to do it, they were going to have to show us that they had a winner. Well, we had to back down off of that later, but not altogether, and we got LTV's attention which is a very important part of program management when you are in a single-source selection.[27]

The activities of the project management office in the fall of 1966 were largely to be directed toward this investigation and definition of technical alternatives to the avionics problem. In the meantime, the environment of the decision process outside the project management office continued to influence the program.

Other Events Outside the Project Management Office

Representative Pike continued to publicize issues that had an effect on the A-7. His special Armed Services subcommittee on tactical air capabilities was holding hearings in September 1966 with the stated intention to focus more attention on the need for accelerated production of tactical aircraft, and particularly counter-insurgency aircraft. Pike was quoted as saying, "greater efforts should be visible to make up the ground we lost when we favored strategic aircraft almost to the exclusion of anything else. . . . I haven't seen any evidence of it.

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[27]Ibid. Government-Furnished-Equipment is purchased by the government directly from an individual contractor (like IBM) and then sent to the contractor with the primary contract for the aircraft--the prime (in this case LTV). Prime contractors are almost always opposed to GFE because it represents money and management supervision they usually like to have for their corporation.

With the present lead time, we ought to be pushing like mad and we're not."[28]

Pike also took issue with those USAF officials who opposed the large buy of the A-7 on the grounds the subsonic aircraft would not be able to fight a conventional war where Soviet Mach 2 and 3 fighters would be the opposition. Pike said, I'm willing to argue with any Air Force officer who says we are going to fight a major conventional war."[29]

The Army was continuing to move into a position to claim part of the close air support mission, and it was being followed closely by the Air Staff. On September 8, 1966, General McConnell sent out a formal Chief of Staff decision letter entitled "Analysis of Close Air Support Operations."

The Chief of Staff directed that:

> a. (U) The Air Force study and incrementally take steps to reflect in official USAF doctrine, tactics and procedures, publications, methods

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[28] Aviation Week and Space Technology, September 26, 1966, p. 28.

[29] Ibid. In an interview with Aviation Week and Space Technology, Representative Pike said the Air Force had gone "hog wild" on the subjects of speed and sophisticated avionics. The magazine quoted him as saying, "I don't care how much electronics we crank into a plane or how many things we can do with it. It can only be in one place at one time. I think that in a conventional and especially guerilla-type war, we would be better off with a greater number of planes with less capability." Whether Representative Pike knew of the avionics debate on the A-7 is not known. Representative L. Mendel Rivers, chairman of the parent House Armed Services Committee had been informed of the configuration changes on the Air Force A-7.

> for accomplishing missions for which the armed helicopter is being provided, and which the Air Force considers part of the Close Air Support function.[30]

This directive, in the middle of the A-7 development process was another indication that the close air support issue was of primary concern to General McConnell, among his many other responsibilities.

McNamara Directs a Common Gun for the Air Force and Navy A-7's

During September, 1966, the Secretary of Defense was again involved in deciding what should go into the Air Force configuration for the A-7. The Navy A-7A had been approved and produced with two cannons installed. Secretary Brown in his April memorandum (described in Chapter IV) had requested permission to replace the two Navy guns with one Air Force M-61 cannon. McNamara's answer to the gun request, in July and again when he approved the Spey engine change on August 3, had been negative until a program for the gun's joint use could be devised. Accordingly, he requested the Secretaries of the Navy and Air Force to develop a plan to standardize the use of the Air Force M-61 gun in both versions of the A-7.[31] The Air Force Force and Navy staffs had

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[30]Letter, Chief of Staff Decision (U) September 8, 1966, "Analysis of Close Air Support Operations (U)," signed by Lt. Gen. Hewitt T. Wheless, Assistant Vice Chief of Staff.

[31]Memorandum, Secretary of Defense to Secretaries of the Air Force and Navy, July 13, 1966.

subsequently come to an impasse on resolving the issue.[32]

When the issue was again brought to the attention of Secretary McNamara in September 1966, he issued a directive, stating that the gun decision would needlessly produce more non-standard aircraft. He ordered, "You are to proceed with the incorporation of the M-61 gun into both Air Force and Navy versions of the A-7. . . ."[33]

Since the issue of the M-61 gun had risen to the OSD level, Systems Analysis had a prime opportunity to make its views known on the subject. Systems Analysis was in favor of letting the Air Force use the M-61 gun, but the organization continued to be staunchly against the efforts to incorporate a more complex avionics system. One of the views of Systems Analysis was expressed by Russell Murray:

> You can't hardly argue that the Air Force has to use the Navy gun [because of the different logistic systems]. The M-61 clearly had to go in. We agreed with that. There were a few little changes here and a few little changes there. As a matter of fact, the Air Force put in some things we thought the Navy should have [like FM radios] to talk to ground troops. We wondered why the Navy didn't have that; it seemed to make pretty good sense.

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[32]Memorandum, From Hugh E. Witt, Deputy for Supply and Maintenance, Secretary of the Air Force, to his boss, Mr. Robert H. Charles, Assistant Secretary of the Air Force, Installations and Logistics, August 8, 1966, Subject: "20mm Gun for the A-7 Aircraft."

[33]Memorandum, Secretary of Defense to Secretaries of the Air Force, Army, and Navy, September 21, 1966.

> Well, we were deeply involved in it; we were a little distressed to see the price going up as much as it was. The big problem came with the fancy avionics. . . . The Navy [and the Air Force] wanted to . . . take our nice, simple, inexpensive, easily-maintained A-7 and put one of these dreadfully complicated systems in it that we doubted would work.[34]

Thus, Systems Analysis approved the change to the M-61 gun, but at the same time, the organization let it be known that they were not favorably disposed toward further changes. Ironically, the McNamara directive to the Navy to change all its new A-7's to incorporate the Air Force M-61 gun was viewed by the Navy project managers as an influence to make further changes in the Navy A-7.

Until this time there had been no major changes to the basic configuration of the Navy A-7A or A-7B. The engine change between the A and B version was only a minor change and did not require any significant alternations of the fuselage structure. Although the plan had been to put ILAAS into the B model, there had been no actual decision at the project management level to tell the contractor when, where and how to put it in. The ILAAS program was slipping in increments as the A-7A production continued and ILAAS remained essentially undefined. The direct order from McNamara to put the

[34]Interview.

Air Force M-61 gun in all future A-7's would require the first major fuselage change in the Navy aircraft.

Captain Doss had participated in the gun debate with characteristic vigor, and he described the implications of the gun decision:

> We ended up putting the M-61 gun in it, and it is a great gun, and it was a good thing to do. . . We had a better course of action in the Navy, but it was not better from a joint standpoint. We could have doubled our firepower with the Mark IV gun for a 50-pound weight increase. With the M-61 we tripled it for 650 pounds, I was concerned about the weight. It would have been extremely difficult to get the Air Force to put the Mark IV gun in, and the jointness was important. . . . I supported it after fighting as hard as I could for the Mark IV.
>
> With the big fuselage change, and all the air conditioning and things you have to do when you make this kind of a gun change because of the physical requirements for the magazine of the M-61 gun and the chuting and so forth, that was the time for the Navy to do the avionics. We could not wait for the ILAAS ideas to be tested.[35]

In addition to the opportunity presented by the required fuselage change, the manner in which the McNamara decision had been directed over the wishes of the Navy staff was perceived as an implicit threat for further changes. This was the view expressed by Captain Doss,

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[35] Interview. By this time in late September the concern that ILAAS would be placed in the A-7 apparently receded. A Project Management Office briefing noted that the ILAAS program was reoriented to a new Navy fighter, the VFAX in September. In October, the Secretary of the Navy recommended another reorientation because of ILAAS' soaring costs and unrealistic schedule. During November ILAAS was redirected to research and development. Aviation Daily, March 27, 1967, p. 28. Flight tests for ILAAS were first scheduled for fall, 1967, then February, 1968, then slipped to summer 1968, Aviation Week and Space Technology, April 10, 1967, p. 97, April 8, 1968, p. 81.

> I felt like if I had just stood aside and let the Air Force go ahead with their RAD and build their version of the airplane, the very next year DOD would direct us to buy their version. I had seen that in the M-61 [gun] which happened in the early fall.[36]

To Doss, this was just another reason why he had better make the Navy position felt on the new avionics--so the Navy wouldn't be left behind if DOD directed a common avionics system.

The Project Management Office Initiates a New Series of Avionics Studies

The product of the efforts of Captain Doss and Colonel Hails was the initiation of a series of avionics studies by agencies within and without the government.[37] These studies were in addition to the first series conducted by LTV (January--April 1966) and were in greater detail than the earlier studies. Because of contractual procedures the Project Management Office was required to divide the LTV effort into two studies--one for each

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[36] *Ibid.*

[37] Doss and Hails continued to spend most of their time on the design and definition of the avionics to go in the A-7D and A-7E. The Project Manager was now Captain Thomas J. Gallagher, who had replaced Captain Cruse in September. Captain Gallagher told of his concept of the operation of the office, "The A-7A and B program was my objective at the time. I could not be concerned in the D and E. . .because my objective was to get the A-7A deployed on schedule in November 1967. So therefore, my two deputies, Captain Doss and Colonel Hails, were configuring the D and E together."

Interview, February 27, 1970. The A-7A airplanes that had already been accepted by the Navy were preparing to begin carrier qualification flights in December, 1966. In addition, the Project Management Office was in the process of requiring LTV to perform a series of engineer-service. It was decided to have LTV first do a trade-off study of the avionics on the Air Force version of the A-7. This study was one of the items included in the first official Air Force contract with LTV, signed October 31, 1966.[38]

The LTV avionics studies were later described by the A-7 Vice President/Program Manager, Sol Love. He began by describing the initial study (January--April) and carried on to the later studies:

> There was about a year where we [LTV] were doing considerable trade-off studies in avionics and Bob Hails started getting involved. The trade studies were fairly straight forward with a pretty direct objective. The Air Force position--and I support it--was "OK, we're going to get a ground attack airplane. . . ." They established some requirements which were: "If I'm going to go into the ground support business, I want an airplane that can deliver a bomb on target, and a target I've preselected. So we want some accuracy for bomb delivery. You [LTV] tell me that you have a 20 mil system in the A-7A; that's not good enough for us. So what do we want to look at in terms of what can we get for what cost?"
>
> So we started a long series of trade studies, looking at different types of systems from the A-7A simple analog, to a more sophisticated analog, to a digital system, and eventually to a heads-up

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ing changes to the production A-7A's to make them capable of carrier qualification and operational service.

[38]Office of the Secretary of Defense (Public Affairs) <u>News Release</u> No. 923-66, October 31, 1966. The letter contract was for $19 million and included instructions for additional design effort, tool fabrication, long-lead time materials, and a study of alternatives for avionics. The avionics study was to consider types of weapon system computers, stabilized sights, radars and other avionics components. The news release also envisioned the delivery of the first Air Force A-7 in 1968 with a full wing in operational service in 1969. These delivery dates were

> display from the point of pilot training and what it might do to increase accuracy for a novice pilot to do just as good as a top-notch pilot.[39]

The organizational position of LTV was divided on the avionics issue as it had been over the change to the Spey engine. Once again the military customer was expressing dissatisfaction with the version of the A-7 then in production and proposing a more complex, more expensive development. LTV representatives noted they had not tried very hard to market avionics to the Navy or to the Air Force.[40] LTV engineers said they had not placed enough justification in the initial avionics study (January--April 1966) to warrant the Air Force changing to a 10 mil system at that point. That is why, LTV said, the second series of studies was requested.

The uncertainties of the whole A-7 program loomed large in the view of LTV. Some members of the corporation were convinced that Colonel Hails was personally selected from the Office of the Secretary of the Air Force to "kill" the program.[41] At the same time LTV people developed a great deal of respect for the manner in which

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predicated on a February 1967 decision from OSD to proceed with the program. Air Force and Space Digest, December, 1966, p. 22.

[39]Interview, April 2, 1970.

[40]Interviews at LTV.

[41]*Ibid*.

Hails was managing the program. They saw him as exceptionally forceful and determined to manage even the smaller details of the program. LTV perceived Colonel Hails to have a great deal of formal and informal authority. The company noted that as the Air Force deputy, he seemed to have more discretion, and in fact more authority, than did the Navy Project Manager.[42]

As an example of the depth of the misunderstanding between LTV and the Air Force over the avionics improvement, part of two interviews will be quoted. The first is to demonstrate the difference between Air Force and Navy project management. The difference was brought out when Colonel Hails went to LTV in the fall of 1966 with his RAD for increased accuracy. LTV tried to talk Hails out of changing the avionics, but LTV did not understand the importance of the stated requirement in the Air Force. Colonel Hails noted,

> I think this is important. LTV thought they were selling the Navy an airplane for the Air Force, instead of selling the Air Force an airplane for itself. They had done business with the Navy for 25 or 30 years and never had a major Air Force program . . . .
>
> They had no philosophical understanding of the way we go about establishing

[42] *Ibid*.

> requirements, and how we buy airplanes and who has what authority in the Air Force.[43]

Similarly, one of the LTV A-7 project managers said,

> It took us a while to see what Hails and Doss were working for in an improved avionics system.[44]

From LTV's point of view, the change to an improved avionics system was just another opportunity to further endanger the status of the program. One LTV representative noted, "We always felt it [the program] was on the verge of cancellation," and later that "The total environment was one of fear that the program would be cancelled."[45] The avionics changes threatened to endanger the program by increasing the cost, delaying the start of production, increasing the technical uncertainties, and possibly reducing the total numbers to be purchased.

LTV personnel recognized that Systems Analysis was a natural ally in LTV's attempt to keep the A-7 simple and uncomplicated, and that Sprey and Rosenzweig were especially strong on this issue. However, the LTV representatives later noted that they had not prepared sufficiently to approach Systems Analysis, and an alliance of interests was never established.[46] On the

[43] Interview.

[44] Interview at LTV.

[45] _Ibid_.

[46] Interviews at LTV.

other hand, LTV's relationship with DDR&E were much better than they were with Systems Analysis, and DDR&E was beginning to increase its interest in the A-7 avionics.

During the fall of 1966, LTV continued to perceive that certain parts of the Air Staff were against the A-7, and that the possibility existed those elements hostile to the A-7 could use the cost of the improved avionics to justify termination of the program. One of the results of these fears, perceptions of hostility, and predictions of program cancellation was a tendency on the part of LTV to resist any changes on avionics that would increase the cost of the aircraft, increase the technological uncertainty, or delay the signing of a final contract.

Colonel Hails was able, however, with the assistance of personnel within LTV, to override this tendency and to convince the company that the Air Force had a requirement for increased accuracy (the RAD) and really did need the additional capability in the aircraft. After a period of questioning, LTV management began to perceive the authority Hails projected, and the discussions changed to issues of how to best incorporate the improved avionics to achieve better accuracy. From then on into the spring of 1967 the primary questions at LTV were those relating to whether LTV should assume the avionics integration responsibility or have the avionics incorporated into the aircraft by an avionics contractor (like IBM or Sperry).

In addition to LTV, Doss and Hails went to the ILAAS contractor, Sperry and had the engineers there do two or three avionics studies. Then Captain Doss had the Naval Ordnance Test Center at China Lake, California, and the Naval Air Development Center at Johnsville, Pennsylvania, begin independent avionics studies.[47]

The avionics studies being supervised by the Project Management Office were the subject of continued interest in the Air Staff, Tactical Air Command and the office of the Secretary of the Air Force. General Disosway, the Commander of TAC, wrote to General

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[47] The second LTV study for the Air Force A-7D avionics was conducted from October to December 1966. The LTV study for the Navy A-7E avionics ran December 1966--February, 1967. The China Lake and Johnsville studies were run November 1966--January 1967. Undated, unclassified Project Management Office Briefing notes. Captain Doss, interview.

McConnell on November 17 and stated TAC's request again for an adverse-weather, night attack capability in the A-7.[48]

General McConnell's reply was dated December 6, 1966, and reviewed the OSD/USAF Study to procure a visual attack aircraft and the rationale for the A-7 buy. It went over the reasons for the April 1966 decision on the A-7 configuration and noted,

> This decision was necessary so that we could hold the cost as low as practicable in consonnance with cost/effectiveness studies.[49]

The letter noted that other forms of radar equipment were available to perform part of the all-weather weapon delivery mission and that the F-4 was a prime candidate for the incorporation of more sophisticated avionics.[50]

About the same time General Disosway was expressing TAC's need for improved avionics in the A-7, TAC assigned an experienced combat pilot as the TAC Liaison Officer to the Colonel Hails' 9-man Project Management

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[48]Letter, Commander, TAC, to Chief of Staff, November 17, 1966. General Disosway noted in an interview, "Yes, we figuredif we were going to get a ground support airplane, then we should get one that was right up to the state of the art. . . . The A-7 in our opinion was bought to do close air support and interdiction, and you needed avionics to do that job, period."

[49]Letter, Chief of Staff, USAF, to Commander, TAC, December 6, 1966.

[50]*Ibid*.

Office staff. His job was to see that the systems being developed for the A-7 were compatible with the needs of TAC and to express the views of the pilots who would have to fly the airplane. He was almost immediately assigned the responsibility for monitoring the cockpit redesign with the incorporation of the avionics proposals.

The industry studies were also being followed in the Office of the Secretary of the Air Force. The Assistant Secretary for Research and Development had the responsibility for avionics developments, and Mr. Harry Davis, the Deputy Assistant Secretary for Special Programs was following the A-7. Mr. Davis received word of the three levels of avionics capability proposed by Sperry for the A-7. The three levels were:[51]

		Cost (plus installation)
Level 1	Digital Computer Heads-Up Display Accuracy: 10-20 mils Continuous Solution Computation	$55,000
Level 2	Level 1 plus Radar Bombing Capability	$79,000
Level 3	Level 2 plus Inertial Navigation System Accuracy: 5-10 mils	$156,000

[51] Secretary of the Air Force (Research and Development) Weekly Staff Digest, November 21--25, 1966. Hails in a later interview noted that this Sperry proposal was really an increment of ILAAS, and it thus held most of the uncertainty of that ill-fated program.

On November 23 the Assistant Secretary of the Air Force (R&D) wrote to the Director of Operational Requirements and Development Plans, General Catton, about the three options for avionics improvement which Sperry proposed. The Assistant Secretary noted he leaned toward Level 1 as being the greatest increase in capability compared to cost.[52]

General Catton answered that his staff had seen the Sperry proposal:

1) they agreed with the need for accuracy.
2) they had a Requirements Action Directive requiring increased accuracy.
3) the Project Management Office was having trade-off studies conducted, and they were in progress.
4) his office was skeptical of Sperry's costs and schedules.[53]

Secretary Brown was also interested in the A-7 avionics, and on December 9, he requested a report on the developments from Davis.[54]

Davis followed up on the Sperry proposals, and on December 16, he wrote to both General Catton and General Goldsworthy (Director of Production and Programming, DCS/S&L). Davis indicated that Secretary Brown was of the opinion that, "Level 1 is probably justified. Perhaps 2." Davis further indicated discussions with Sperry brought out that Sperry had not been contacted by LTV for firm costs and schedule

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[52]Memorandum, Harry Davis to Secretary of the Air Force Secretariat, "A-7 Avionics," December 16, 1966. SAF File 233-66.

[53]*Ibid.*

[54]*Ibid.*

information. Davis wondered if this indicated a possible lack of interest in Sperry's proposals. It was expressed that while Sperry was not the only contractor available, their proposals should be given careful consideration. Mr. Davis noted that he and officials in DDR&E were impressed with Sperry's careful thinking and obvious capability.[55]

In a separate letter to General Goldsworthy Davis asked again for the LTV study, "Please let me know when we expect to hear the LTV evaluation and also when we may expect an Air Staff decision."[56]

General Goldsworthy answered Davis' inquiry and stated, ". . .the Air Force intends to incorporate modest improvements to the A-7D avionics package. . . we propose to have the Air Force Program Director, Colonel Robert E. Hails, visit your office and informally discuss both the original constraints placed on the A-7D program, as well as the approach being taken by the Air Force to arrive at the ultimate A-7 avionics configuration."[57]

As the end of the year of 1966 was approaching, the Air Force A-7 program was drawing closer to another major decision point. The initial decision of General

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[55]Memorandum, Harry Davis to Director of Operational Requirements and Development Plans, DCS/R&D, and Director of Production and Programming, DCS/S&L, December 16, 1966, SAF File 233-66.

[56]Memorandum, Harry Davis to DCS/S&L, December 16, 1966.

[57]Letter, SPD to SAF-RD, December 27, 1966.

McConnell and Secretary Brown on April 7, 1966, to incorporate a modest improvement in the A-7 avionics had been written into the first A-7 RAD. The requirement had also stated the need for very accurate weapons delivery. The A-7 project managers had conducted an intensive search for alternatives, with the result that several avionics studies were underway to examine various approaches. The studies were not yet complete at the end of 1966, but they were in the final stages and were expected any day.

Many organizations had participated in the avionics discussions on the Air Force A-7 during 1966. The Air Staff was actively involved in the preparation of the RAD after the April avionics decision, and it continued to monitor the program. Tactical Air Command had participated in the RAD preparation and had expressed the view that the A-7 should have the capability for very accurate weapons delivery. The A-7 Project Management Office was deeply involved in the translation of the RAD into an operational avionics system. The Air Force and Navy project managers were monitoring a series of studies to determine what the best approach to the avionics should be. LTV had initially expressed the opinion that the Air Force did not need an improved avionics system, but the company was now conducting one of the studies for the project management office.

Within OSD, Systems Analysis had only monitored the progress of the Air Force A-7 program intermittantly. The original Systems Analysis concept of the A-7 had been as a low cost aircraft with a simple, unsophisticated, and highly reliable avionics system. As Systems Analysis saw the Air Force drift away from this concept in search of increased bombing accuracy through a more complex avionics system, the position of the organization had begun to resist the increased avionics. However, the improved avionics system had not been fully defined or come to OSD for a decision, and no one knew the exact action Systems Analysis would take on such a proposal.

Up to this point in December 1966, DDR&E had not taken an active role with regard to the Air Force A-7 avionics. DDR&E had participated in the Navy ILAAS program, but ILAAS had been redirected to research and away from incorporation in the A-7. Yet DDR&E had the direct responsibility within OSD to advise the Secretary of Defense on issues of a scientific or technical nature. If the A-7 avionics were going to be brought to any kind of a decision, the position of DDR&E would be very important. The intercession of DDR&E in the A-7 avionics issue would mark the beginning of another phase in the decision process.

CHAPTER VII

THE 1967 DECISION FOR AN IMPROVED AVIONICS SYSTEM

Until December 1966 DDR&E had not indicated any strong interest in the A-7 avionics issue. However, in that month Mr. Charles A. Fowler, the Deputy Director of DDR&E for Tactical Warfare Programs, initiated a series of actions that were to have far-reaching effects on the eventual decision to incorporate an improved avionics system in the A-7.[1]

DDR&E had not been very interested in the avionics on the Navy A-7A and A-7B because the equipment used almost no advanced technology.[2] DDR&E had been involved

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[1] Fowler was one of seven Deputy Directors of DDR&E in 1966, at a level immediately below the Director, Dr. Foster. Fowler was the head of all DDR&E's tactical warfare programs except for special projects being conducted for use in Southeast Asia. The Tactical Aircraft Systems office, which was run by Mr. Muse and had participated in the Spey decision, reported directly to Fowler, also. Fowler had a B.S. in engineering physics but had specialized in electronics in industry before coming to DDR&E in 1966. He had previously served on one of the panels of the President's Science Advisory Committee that had looked into the advanced Mark II avionics for the F-111. Fowler and the panel had recommended the incorporation of the Mark II system in the F-111.

[2] Interview with Dr. Brown reflecting on his opinion of the original A-7 avionics while he was the Director of DDR&E, 1961-1965.

in the development of ILAAS, but ILAAS had been redirected to a research status and away from a tactical application. With the possibility that a new avionics system could be designed for the Air Force and Navy A-7's using some of the concepts of ILAAS and advances in digital computer technology, DDR&E's interest in the A-7 was increasing.

The DDR&E Memorandum

Fowler had replaced Dr. Thomas Cheatham on October 1, 1966. In early November 1966 Fowler and Dr. Foster took a trip to (among other places) Sperry and North American Autonetics. While at Sperry the subject of ILAAS came up, and specifically the possibility of reducing some of the ILAAS complexity on a less expensive system for the A-7 was discussed. Fowler was particularly impressed with the possibilities Sperry proposed for a Heads-Up-Display and the reattack capability their proposal outlined.

The trip to North American, on the other hand, helped to confirm in his mind the extreme complexity of the F-111 Mark II avionics. When Fowler came to DDR&E he had been an advocate of advanced avionics. But as he looked at the number of integrated systems with high costs and very long development times, he began to modify his position toward a more critical one. Accordingly, he recommended to the Assistant Secretary of the Air Force for Research and Development, Dr. Alexander H. Flax, that the F-111 avionics be simplified.[3]

During December Fowler was in communication with both the Air Force and Navy to inquire about the status of the A-7 avionics. He had discussed this matter with Dr. Flax and Harry Davis, but he did not know about the Hails' and Doss' efforts at this time. Fowler, Flax and Davis agreed that some of the ILAAS concepts and Sperry's technical competence could be useful in improving the A-7. When Fowler found informal interest in both services for an improved avionics system, he drafted a memorandum for the Director of DDR&E, Dr. John S. Foster, Jr. The memorandum went out from Dr. Foster's office on December 23, addressed to the Assistant Secretaries of the Air Force and Navy for Research and Development. The central thrust of the memorandum was,

> Recent advancements in avionics technology permit major improvements to be made in the accuracy of navigation and weapons delivery, ease of system operation and flexibility of attack and re-attack. Such a capability is of significant importance in a single place aircraft. The technique of built-in-test, combined with the inherent reliability of micro-electronics offers a high probability of reduced total cost of ownership that is particularly attractive, as well as increasing the mission success rate. This quantum improvement can be

[3]Interview with Mr. Fowler, August 18, 1970. Fowler's earlier position on avionics is attested to by his article in the Armed Forces Journal, July 25, 1970, pp. 24-28. Note, "When I came to the Pentagon I placed 'integrated systems' just below God and Country and well above motherhood." (P. 26.)

> obtained at a relatively modest increase in initial unit cost.[4]

The memorandum directed the Air Force and Navy to conduct a joint study of avionics improvements and their cost and schedule implications. The study was to specifically include avionics developments from ILAAS.[5]

The DDR&E memorandum had the effect of "pre-empting" the Air Force from continuing with an avionics systems management plan, solely for the A-7D. Now a joint program would have to be worked out with the Navy before either the A-7D or A-7E aircraft programs were approved. On January 16, General McConnell made the jointness official Air Force policy. In a message to Air Force Systems Command, McConnell quoted Fowler's memorandum and directed that the DDR&E objectives be included in the avionics study underway by the Project Management Office.[6]

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[4] Memorandum, DDR&E to Assistant Secretaries of the Air Force and Navy (R&D), December 23, 1966. The memorandum was signed by Finn Larsen for Dr. Foster, and titled "A-7 Aircraft Avionics."

[5] *Ibid*. Mr. Fowler indicated in an interview that he believed the increased accuracy offered by new avionics was important, but that the greatly improved sighting ability offered in the Heads-Up-Display and the ability of the digital computer to memorize the target location and guide the pilot back for a reattack, was much more important than mere accuracy. He stressed that the improved capability of the avionics was especially important in a single pilot aircraft because it could simplify the pilot's job. He indicated he had informal talks with individuals in Systems Analysis and saw them agreeing *in principle* with the avionics improvement. Once this memorandum was sent, he said DDR&E's job was mainly to keep in touch with the technical aspects of the A-7, and to say when appropriate that the aircraft was a good one.

[6] Message, Chief of Staff, USAF, to AFSC, January 16, 1967.

The Origin of the A-X Close Air Support Aircraft

The A-7 program was not operating in a vacuum; indeed, it had been adopted by the Air Force to perform a significant portion of the close air support mission for the Army. The A-7 was continually affected by developments in Army Aviation and in other programs of tactical air. Although the A-7 met many of the Army's requirements for a specialized close air support aircraft, it was both heavier and more expensive than what General McConnell envisioned as an optimum Army support aircraft. The concept of a new, heavily armored, propellor-driven, heavy-load-carrying aircraft had been developing for some time. This was essentially the same concept that General McConnell had unsuccessfully proposed to Secretary Zuckert and Secretary McNamara in May, 1965. Now it was given additional backing and named the A-X (Attack Experimental). General McConnell mobilized support for the new aircraft by sending a letter to the Air Staff on January 4, 1967. He stated the Air Force had a growing need for a specialized close air support aircraft, which will be "more suitable and less expensive than the A-7."[7]

General McConnell went even one step further than supporting the A-X to the Air Staff. He wrote to

[7]Letter, Chief of Staff, USAF, to Staff, "Specialized Close Air Support Aircraft A-X (U)," January 4, 1967. He noted, "4. (U) I am requesting your full support in the endeavor to expedite the development and procurement of the A-X, if the concept formulation indicates that a replacement for the A-1, more suitable and less expensive than the A-7 can, in fact, be produced."

the Army Chief of Staff, General Harold Johnson, and stated the Air Force intent to develop the A-X. He stressed that the A-X would be especially designed to meet Army needs for Close Air Support, and asked General Johnson for Army assistance in the development of the aircraft.[8]

The Project Managers Propose an Improved Avionics System

Captain Doss and Colenel Hails had been working on the new avionics system since about September. They had personally visited or had written communications with Sperry, North American Autonetics, Hughes, IBM, Litton, General Precision, General Motors, Elliot of England and of course LTV.

Before describing the results of this intensive effort it is important to establish why the Project Managers were going to all this effort and time-consuming work. Colonel Hails later described the philosophical, professional motivation of a project manager in Air Force Systems Command. He was asked whether there was a professional difference between the Air Force officers in the Air Staff and in the project management offices.

[8]Letter, Chief of Staff, USAF, to Chief of Staff, U.S. Army, January 23, 1967.

I think this, that the knowledgeable program directors have had a turn in the Air Staff, so we have been in both places. The performance /of the aircraft/ must be paramount. This is the classic underbelly of our whole disagreement with McNamara; they /OSD/ became economically oriented and cost/effective instead of effective. They often homed in on the cost aspects of it. McNamara put out a rule-of-thumb paper in early 1961 that unless we have 10% enhancement as a minimum /in cost/effectiveness/ we'll just write it /the proposed program/ off entirely.

Whereas the military, requirements-wise, we're looking at performance. If the airplane doesn't perform the way it's supposed to, we don't want it, no matter what it costs.

The relationship established between the Air Force /Headquarters/ and the Systems Command as set forth in most of the regulations-375 series--and the philosophy that is imparted is that we don't set requirements in the Systems Command. They are set by the Air Staff, which is a product of interactions and dialogue between the user, the Air Staff (and its myriad pockets of interest) and the contractor's proposal, which is often just selling new technology to sell another product.

But once the requirements are laid down, they come forth in the RAD, then it becomes Systems Command's /responsibility/ to find out what is the state of technology capable of responding to that requirement with. If it's way out of the ball park, we may go back and force the issue of requirements and say, "You can't have that, because it won't be here for another ten years or five years, or it will run the cost up. . .to price the thing out of the market. But our Bible, if

> there is such a thing, is fundamentally that the requirements are sacrosanct, once we assure ourselves as a program director that they are within the realm of developmental achievement, within some reasonable cost/dollar. Once we've gotten that sold to the Air Staff, you can haul it back in and say. . ."Do you still want it?" Then our job is to press on and get that at the lowest cost.[9]

Colonel Hails went on to describe what he interpreted the RAD to specify,

> The RAD didn't address the thing, as I remember the words in it, to say it would be a low-cost airplane. It may have implied that in the way it was expressed, but I don't think the RAD said that. It said the airplane would be capable of doing this, that, and the other. . ./very accurate weapon delivery, etc./ It was the first time, the only time to my knowledge, that we committed ourselves to buy an airplane without a requirement; we had to go invent the requirement. The requirement was clear in Dr. Brown's mind, I think, that the A-7 was going to do for him the mission that the /prop-driven/ A-1 was doing effectively out there /Vietnam/[10]

Colonel Hails had taken the requirement as stated in the August 1966 RAD and had gone to LTV to request additional avionics studies. When Captain Doss joined him they both participated in the supervision of the various studies and the selection of appropriate alternatives.

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[9] Interview.

[10] Interview.

The Air Force portion of the LTV avionics study was received on January 4 and was immediately studied by the Project Management Office and the Air Staff. The essence of the study was that a "best estimate" accuracy of 7-8 mils could be achieved if the equipment selected for the aircraft included a central digital computer, a heads-up display and various other components.[11] The cost of the avionics improvement was estimated to be about $220,000 per aircraft.[12] The cost of the A-7 at the time was $1.47 million unit flyaway cost.[13]

Colonel Hails described his concept of the avionics improvement.

> Once I got the thing sized, and it was about a $2.2 million airplane, it seemed the height of folly to me not to go for 10 percent more investment to make the <u>total</u> worthwhile. So by pouring in another $200,000 you really made an airplane that would effectively do the mission you had alleged to have bought

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[11] Interviews at LTV, April 1-5, 1970, verified the 7-8 mil estimate.

[12] Project Management Office Briefing, undated, unclassified, "Avionics."

[13] <u>New York Times</u>, April 17, 1967. Article by Hanson Baldwin. The term "unit flyaway cost" denotes the lowest of the many terms that can be used to describe the cost of a complex weapons system. A basic understanding of the range of costs and cost terms is necessary to the later discussion. The "unit flyaway cost" is the recurring cost of parts which physically are installed in the aircraft. The other most important cost figure is the "program unit cost" which includes all the costs on the program divided by the number of aircraft to be

> it for. That was the thesis that I sold the Air Staff on. I said, "Look, you're going to buy $2.2 million worth of airplane but it won't do anything for you. From a cost/effective point of view this last 10 percent of investment would make the airplane. And you're going to get them." I said, "Look, McNamara and all of them are committed; we're going to own A-7's on some Air Force base at some time, so why don't we make it where it will at least be an effective airplane."[14]

<u>The Avionics Proposal is Presented to the Air Force Board Structure</u>

Colonel Hails now had to take the avionics briefing to the Air Force Board Structure to get a formal decision on the configuration. He started with the Tactical Panel, and then on January 17, 1967, went before the Air Staff Board. Maj. General Jack J. Catton had been moved from his position in Requirements to the Director of Aerospace Programs, which automatically placed him as chairman of the Air Staff Board. Previously, General Catton had been very firm that the avionics on the A-7 should be held to a minimum unless the change

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purchased. The "program" cost includes the "recurring flyaway" cost plus such things as ground equipment, spare parts, and the large development costs. For instance, while the unit flyaway cost in early 1967 was only $1.47 million, the program cost was about $2.0 million per aircraft.

[14] Interview. Colonel Hails was referring to the program cost of the A-7 which was about $2.0-2.2 million at this time.

was fully justified by an increased weapon delivery accuracy.[15]

The briefing was presented to the Board, outlining the possibilities of increased accuracy with the avionics improvement. The Board was not inclined to recommend approval of this costly an increase in the A-7 program. In fact, the Board directed the briefing officers to review the April 1966 decision on the A-7 configuration.[16]

Colonel Hails then had to brief the Designated Systems Management Group, including the Chief of Staff. At this session General McConnell apparently displayed much displeasure with the present approach to the avionics. Colonel Hails' notes later described his idea as being for a simple, low performance avionics system.[17] However, no decision was made at that time.

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[15] General Catton had expressed his views on the necessity to demonstrate new methods to <u>visually</u> acquire targets before avionics improvements would be justified. See his February 27, 1966, letter to Mr. Harry Davis.

[16] Briefing Notes, Tactical Division of the Directorate of Operational Requirements and Development Plans. Colonel R. W. Priest reviewed the April 1966 Secretary of the Air Force and Chief of Staff Decision with the Deputy Director of Operational Requirements for General Purpose and Airlift Forces.

[17] Colonel Hails "Briefing Notes" of the January 24, 1967, Designated Systems Management Group meeting. AFSC File 4-30-1. These notes included the notation that the A-7D Project Management Office had not directed any studies or effort which conflicted with directives issued from higher Headquarters.

General McConnell and Secretary Brown Appear Before Congress

General McConnell and Secretary of the Air Force Brown had more to worry about on the A-7 program than avionics. They were continually forced to consider the force structure implications of the A-7. On February 2, 1967, Brown and McConnell appeared before the Senate Armed Services and Appropriations Committees. At this point in 1967 the official DOD five-year plan called for a total force of 614 Air Force A-7's versus the 387 requested by Secretary Brown and General McConnell in their November 1965 request to OSD.[18]

Senator Margaret Chase Smith was particularly interested in the number of A-7 aircraft and wings and OSD influence on the number. She asked,

> Last year the committee had the impression that the Air Force had sought only [deleted] wings, and that perhaps the Department of Defense [OSD] was acquiring in its program more A-7's than the Air Force thought desirable. Will both you and General McConnell comment. . . ."[19]

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[18] See Appendix X. The figures of 614 and 387 A-7's were published in DOD Appropriations FY 1970, Part 4, p. 34.

[19] U.S. Congress, Senate, Committee on Armed Services, Military Procurement Authorizations for Fiscal Year 1968, Hearings before the Committee on Armed Services and a Subcommittee on Department of Defense of the Committee on Appropriations, U.S. Senate, 90th Cong., 1st sess, February 2, 1967, p. 881. Hereafter called the DOD Authorizations FY1968.

Secretary Brown replied,

> ...Whether the optimum mix is somewhat different, whether one should have more F-4's or more F-111's, fewer A-7's or vice versa, is a difficult question to answer.
>
> Having been out to Southeast Asia, I am more convinced than ever that we want the A-7's as a substantial portion of our force, because our pilots who are doing close support say they want aircraft like that /A-7/ and so I certainly support /deleted/ wings.[20]

General McConnell's answer reaffirmed his reason for choosing the A-7,

> When we first made the proposal, I personally proposed to the Secretary of Defense that we get some A-7's for the main purpose--practically the sole purpose--of giving better close air support to the ground forces. At that time I asked for /deleted/ wings, and at that time /deleted/ wings were all that I thought we should have.
>
> I am still of the opinion that /deleted/ wings are enough of that type of aircraft. I still believe that I would prefer to have a better aircraft than the A-7, which also can give close support.[21]

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[20] Ibid.

[21] Ibid. During the same session of Congress, Major General Duward L.Crow, Director of the Air Force Budget testified before the Senate Appropriations Committee on the A-7 program, "the Air Force proposes to limit initial contracting action to the procurement of that quantity of aircraft required to support a three-wing force. . ." and "The increase /from FY67/ represents a recomputation of aircraft quantities to support a programmed five-wing force, . . ." U.S. Congress, Senate Committee on Appropriations, DOD Appropriations, 1968, Hearings, before the Committee on Appropriations, 90th Cong., 1st sess., 1967, p. 716.

Later in the same hearing Senator Cannon asked General McConnell why he substituted the extra A-7 wings for the F-4 or the F-111 wing.

General McConnell. "I didn't substitute them. The Secretary of Defense substituted them.

Seantor Cannon. Was that over your objection?

General McConnell. I haven't objected to it yet, because I don't consider it to be time yet. It is still on a program basis. I have time to object to that."[22]

Secretary Brown shortly thereafter testified to the very question that was before the Air Force Board Structure, the avionics improvement. He noted,

> We have got enough space in the A-7 to put in better avionics equipment and make it an all-weather aircraft, if we decide that the avionics is good enough and it is worth the money.[23]

Joint Air Force/Navy Action on the Avionics

The problem of whether it was worth the money was receiving attention from many quarters. On January 24 the two Assistant Secretaries for Research and Development (Navy, Dr. Robert A. Frosch; Air Force, Dr. Alexander H, Flax) wrote to Dr. Foster, DDR&E to inform him of the progress on achieving a joint avionics program on

[22] DOD Authorizations FY1968, op. cit., p. 941.

[23] Ibid.

the A-7. The memorandum was in answer to Foster's December 23 inquiry, and noted that Doss and Hails were working closely together and had been since September. It added there was no difference in Navy and Air Force thinking at the project management level. It closed with the promise that the study results and a joint Air Force/Navy decision would be forwarded to DDR&E as soon as possible.[24]

The LTV study on the application of the Air Force A-7D avionics to the Navy A-7E was received in the Project Management Office in early February, and was combined with the other studies into a general briefing. Captain Doss explains and summarizes his operations and strategy during the previous six months.

> But we didn't let it stay at that by just letting the prime contractor [LTV] to do the studies; with Bob Hails' concurrence I went to the Naval Weapons Center at China Lake and gave them a Weapons Task Study. However, the ILAAS system had been run by the Naval Air Development Center at Johnsville, . . .so I integrated a Johnsville team into the China Lake team. The purpose here was to have an independent avionics configuration study. I met with them nearly every week, either in Johnsville or Washington or at China Lake, California, and I ran the study myself. We had LTV membership in the team so that we had a totally integrated, multiple thrust study effort. I knew exactly what I wanted for the airplane. I wanted to settle all the debate in-house and to leave no issue for the DOD staffs to pick on. And it turned out to be extremely effective, because when it came time to present it, we just said, "Study

[24]Memorandum, Assistant Secretary of the Air Force (R&D) and Assistant Secretary of the Navy (R&D) to DDR&E, "A-7 Avionics," January 24, 1967, SAF File 233-66.

> A says that; Study B says that; Study C says that; we all say that; OPNAV agrees, and Air Staff agrees." What could they do?[25]

With the several studies consolidated and the briefings smoothed down, Colonel Hails took the A-7D avionics back to the Board Structure in February. He started by briefing the Tactical Panel, then to the Air Staff Board on February 17. General Catton was again the chairman. The briefing consisted of a series of viewgraphs which built up to the decision climax.

The highlights of the briefing were:

1) The Navy test flights in the A-7A acceptance program had shown the weapons delivery accuracy of the aircraft to be insufficient--20-40 mils.

2) The Air Force requirement stated in the RAD was difficult to meet without an improved avionics system.

3) A range of five avionics options was presented.[26]

Colonel Hails, Captain Doss and the Project Management Office were recommending Option IV, a system with 10 mil accuracy.

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[25]Doss interview.

[26]A-7D Project Management Office Viewgraph, undated, unclassified.

Table 6. Avionics Options and Costs

Option	Computer	Sight	Accuracy	Cost*
I	Analog	Servoed	23 mils	$1.50
II	Analog + radar	Servoed	14	1.53
III	Digital	Servoed	14	1.59
IV	Digital + radar	Heads-Up Display	10	1.65
V	Digital + radar + Map display	Heads-Up Display	10	1.74

* Unit Flyaway Cost--The cost is an estimate of the price of each aircraft averaged over a total buy of some 1200 avionics sets (800 Navy, 400 Air Force). Source: Project Management Office Viewgraph.

The Board noted that any improved avionics would mean a slipped schedule with the aircraft coming off the production line later than originally planned. It also discussed the possibility that a more expensive avionics could mean that fewer aircraft would be available under a fixed budget. It was recognized that the costs were "optimistic" and the labor, overhead, and engineering change proposals could cause the costs to exceed the present programmed cost.

System I on the briefing was essentially the avionics components specified by the April 7, 1966, Secretary of the Air Force/Chief of Staff decision with an analog combing computer and a serveod sight. It was estimated to have an accuracy of only 23 mils. The Board noted that Option II would give a "reasonable improvement" over I, and III would be about the same improvement over II. It was added that even if Option IV was more expensive, it added to the visual delivery system accuracy. The Board recommended Option IV with the Digital Computer and the Heads-up Display. Additionally, the report recommended the aircraft buy be reduced as necessary to stay within the allocated budget.[27]

The avionics briefing was subsequently given to the Air Force Council and the Designated Systems Management Group. Colonel Hails described the briefing process.

> We had two "dog and pony" shows; I went with them to present theirs to Admiral Connolly. . .and I took it up through the Air Force channels. By then we had a complete change in the guard in the Air Council. The whole cell had changed. . . . When I went back through there in 1967. Their attitude this time around, when the Air Staff said they thought that we should go this route if we were going to invest in the airplane. (They gave me hell

[27]Briefing Notes, Tactical Division, Directorate of Operational Requirements and Development Plans, DCS/R&D.

> everytime I went in there because the price had gone up.) I gave them outside limits on the price, and there were no real ardent or <u>vocal</u> antagonists for the airplane at that point in time.[28]

Secretary Brown discussed his view of the avionics changes and Colonel Hails' presentation,

> The avionics. . .seemed important because by that time I think we were beginning to realize that it wasn't how much you dropped, but how well you dropped it. I had the impression at that meeting of a well-thought-out series of avionic design changes which would make a very much better aircraft.
>
> . . . .
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> There were some more arguments about the avionics, but again they didn't seem to be major. It was really <u>an</u> Air Force package versus a Navy package, and there were some wrinkles on the Air Force package, but there didn't seem to be <u>much</u> argument--even from my own staff, which always did question Air Staff suggestions to make certain that the cost implications had been considered.[29]

General McConnell and Secretary Brown approved the avionics improvement as briefed by Colonel Hails. General McConnell later discussed his decision on the

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[28] Colonel Hails took the A-7 avionics to the Air Force Council in 1966; several of the generals at the Deputy Chief of Staff level had let it be known they wanted the A-7 to have a very "austere" avionics system. When he took the avionics issue back to the Council in 1967, most of those generals had been reassigned outside of the Air Staff due to the normal Air Force 4-year "tour of duty" rotation policy, and he noticed the attitude the second time around was more favorable to the improved avionics system. Interview.

[29] Interview.

issue. He was asked what made him decide the increased avionics would be worth the additional cost. He replied,

> Because nobody could deny then that we would be able, if they worked like they were supposed to work, no one would be able to deny that we weren't meeting our responsibilities to be able to support them /Army/ day and night under any kind of conditions right up next to the FEBA /battle line/.[30]

The result of the briefings to the Air Force Board Structure was that the new avionics configuration was approved within the Air Force. In the meantime, Captain Doss had briefed the Office of the Chief of Naval Operations. Admiral Connolly, the Deputy Chief of Naval Operations for Air, approved the configuration and praised both the Air Force and the two deputy project managers--Doss and Hails--for taking the initiative in the avionics improvement.[31] Then, on March 1, the briefing was set for OSD (DDR&E and Systems Analysis).

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[30] Interview with General McConnell

[31] Admiral Connolly said, "Actually, Captain Doss and Colonel Hails. . .I think, were the two principal architects of the A-7D and E. It was a lot of their thinking mixed with what they got from contractors and what they got from all the technical people. . . .But ~~that's where the real initiative lay. This is the way~~ it really is. It's a combination of the contractor. . . and our own people who want to bring along good airplanes."

Captain Doss described the March 1, 1967, confrontation with Systems Analysis:

> We had lots and lots of these kinds of briefings. He [Hails] was always briefing in the Air Staff and I was briefing in Naval Air Systems Command and OPNAV [Office of the Chief of Naval Operations]. But the critical one was where we finally came together and we had the Navy and Air Force in agreement, and we went to DOD [OSD] to say, "This is what we want to do and this is why." DDR&E bought it lock, stock and barrel, and supported us against Systems Analysis. Systems Analysis turned some people to studying it. I went over, tried to talk to them and cooperate, help them.
> *
> We had more systems analysis/cost effectiveness in our series of studies than they could have produced in six months, which is about the time we had applied to it. We had all kinds of efforts--North American, [Sperry, LTV, IBM, Litton, General Precision, General Motors, Teledyne, etc.][32]

Although the presentation went very well, and the technical changes were favorably received, only an implicit concurrence was given by DDR&E to the detailed configuration. Approval to proceed with the contracting the avionics was to be contingent on additional study and analysis of technical and funding details.[33] The major decisions

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[32]Interview. The intense organizational interest in avionics within DDR&E can be seen reflected by a statement Dr. Foster made to Congress in 1967 very shortly after the A-7 presentation. Dr.Foster testified that the immediate goals of DDR&E for the coming year were to be: "Improved accuracy ordnance and bomb delivery systems to reduce the required number of sorties," and "Better all-weather navigation and ground-directed bomb delivery systems." U.S. Congress, House, Committee on Armed Services, Hearings on Military Posture, House of Representatives, 90th Cong., 1st sess., April 17, 1967, p. 1405.

[33]Directorate of Production and Programming, A-7 Program Element Monitor, History, January 1, 1967-June 30, 1967, p. 6.

having been rendered, the project managers went to Naval Air Systems Command to work out the details of funding, schedules and the selection of subcontractors in conjunction with LTV.

Systems Analysis was beginning to fulfill Doss' prophesy of applying new, lower Vietnam aircraft attrition rates onto the A-7 program. On April 10, OSD Systems Analysis sent a memorandum to the Secretary of the Air Force, suggesting a revision in the number of A-7's programmed to maintain the force structure. The reason given was the reduced attrition in fighter/attack aircraft over Vietnam. The result was to reduce the planned Air Force A-7 buy in Fiscal 1967 from 20 to 12, and in Fiscal 1968 from 181 to 100.[34]

Even though the numbers of projected A-7's were being reduced, the project managers continued to work with LTV and the avionics contractors to refine the details of the avionics configuration and the management responsibility for its integration. The Project Management Office, it will be remembered, was keeping the pressure on LTV by having outside companies compete for the avionics integration contract. This meant that there were really two different types of competitions going on. First, there was a competition to see which of the avionics corporations would supply the equipment to the avionics integrator.

[34]A-7D Attack Fighter, Cost Estimate Track, p. 32. Also detailed in Aviation Week and Space Technology, July 10, 1967, pp. 30-31, and Aviation Daily, July 18, 1967.

Second, there was a less formal competition to see whether LTV or one of the avionics corporations would get the "avionics integrator" responsibility. Captain Doss explained the thrust of both competitions,

> We got unsolicited proposals, and meant to do it, meant to bring in other industry on support equipment. . . as a means of keeping competition alive in a single source procurement. That's how these companies really get you, you see. We had five lots of airplanes out of LTV before we got into the A-7E, and then we were no longer protected. The minute we lost that protection [of a fixed-price contract] the cost began to go up. On LTV's side we were beginning to get inflationary factors. When they bid on the airplane there was no General Dynamics F-111 effort in the Fort Worth/Dallas area, and labor was very available. It was not our intent to not recognize those factors. We did not want them to lose money; we just simply wanted to represent the public's interest and keep it under control.
>
> *
>
> It looked to us like it was going to be a two-way competition. Sperry was very strong, and Hughes looked very strong. North American finally said, "We're not going to continue. We have enough trouble ourselves." So we did everything we could to keep IBM alive in this thing. . .I wanted to keep a three-way competition on these guys, because when there's just two there's just too much visibility.[35]

LTV was in the process during the spring of 1967 of modifying its management team on the A-7 project. Vought Aeronautics made a major effort to convince the Air Force and Navy that it could handle the avionics integration job and do it effectively. Mr. Robert S. Buzard was put in charge of the A-7 avionics section, and

[35]Doss interview, March 13, 1970.

under his leadership the LTV avionics capability increased. As a result, the commander of Naval Air Systems Command decided that whoever the avionics contractor was going to be--Sperry, Hughes, or IBM--it would supply the equipment to LTV for final installation. The concept of having an avionics associate prime contractor was discarded when LTV agreed to support the configuration and to provide an avionics integrator as a subcontractor. The contractor/project management office combination worked out the details on schedules, costs, and performance, and the plans were submitted to Secretary Brown.

The Air Force and Navy Secretaries Ratify the Improved Avionics

The Secretary of the Air Force sent a formal memorandum to the Secretary of Defense on May 5, 1967, requesting permission to install the improved avionics in the A-7. A selection from that memorandum gives the rationale,

> Flight test results to date have revealed the need to improve the weapon delivery capability of the A-7. The Air Force and the Navy have jointly studied the problem and have agreed on a common weapon delivery avionics configuration that included a digital computer, heads-up display, and inertial measurement unit. The total cost increases associated with these changes will vary somewhat between the two Service programs, and will be

> contingent upon Navy and Air Force sharing of common non-recurring costs. Air Force cost and funding implications are discussed herein. Expected visual delivery accuracies will be comparable to or better than the F-4 and A-6 aircraft. We are agreed that the recommended changes are necessary and desirable from a cost-worth viewpoint.[36]

The Secretary of the Navy, the Honorable Paul Nitze, recommended approval of the Navy A-7E avionics to OSD on May 11, 1967, noting,

> Southeast Asia experience has shown that higher weapon delivery accuracies are needed in our light jet attack aircraft. No single improvement factor can make a greater contribution to cost and effectiveness than a marked improvement in Circular Error Probable (CEP).[37]

The next day, May 12, McNamara wrote to the Assistant Secretary of Defense for Installations and Logistics. He stated he understood the Air Force and Navy were considering an avionics improvement and desired to move the production schedule back. Such a slippage was approved, he wrote, but no approval for the avionics change was mentioned.[38]

The formal answer to the requests of Brown and Nitze to go-ahead with the improved avionics was rendered by DDR&E. On May 17, Dr. Foster replied to the Assistant

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[36] Unclassified paragraph of Memorandum, Secretary of Defense, "A-7 Program (U)," May 5, 1967. SAF File 448-67.

[37] Memorandum, Secretary of the Navy to Secretary of Defense, "A-7 Aircraft Avionics Improvement (U)," May 11, 1967. SAF File 448-67.

[38] Memorandum, Secretary of Defense to Assistant Secretary of Defense (I&L) May 12, 1967. SPD File 67-2592-A-7.

Secretaries (R&D) with approval of the concept of improved avionics. However, only implicit approval was given to the actual configuration. Final approval to let the contractor proceed would have to be contingent on a re-submission of the two Services joint development plan, the selection of subcontractors, and new "schedules, etc."[39] This information was discouraging to the project management people and to LTV, because they had expected the Pentagon decision process to take only about two or three months. Captain Doss explained the Project Management Office's dilemma,

> We underestimated badly on how fast we could get our decision out of DOD. We got all kinds of assurances. We walked over there right after the first of the year, having studied the hell out of this thing, had a solid case that Navy and Air Force were backing, and yet we didn't get our money for seven or eight months. And until you get the money [you can't do anything]. The prime contractor thinks that the minute you get the money you're going to roll it down there in a wheelbarrow. We were fighting for our prime so hard that he thought that as soon as we broke it loose, he'd get a go-ahead. Well, hell no, we had to make this guy [LTV] negotiate with us for guarantees.[40]

One incident of brightness which was to give all the people associated with the A-7 a sense of pride at this time was the flight of two A-7A's from Maryland to Paris. The flight of 3900 miles had, of course, been made many times by airliners and larger military aircraft, but the

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[39] Memorandum, DDR&E to Assistant Secretaries of the Navy and Air Force (R&D), May 17, 1967. SPD History.

[40] Doss interview.

two A-7A's achieved the distinction of being some of the first fighter/attack aircraft to make the flight without refueling. The accomplishment pointed out the distinctive advantages of the turbofan engine for tactical aircraft.

The summer of 1967 dragged on with the project management people working on the new schedules and developments plans. Various letters flew back and forth among the Services, their Secretaries and OSD, most of them recommending approval of the avionics change. The Navy was especially concerned over the lack of approval, because without the OSD go-ahead it had no A-7E program in Fiscal 1967.

With additional information and joint development plans for the A-7D and E, the Services again put forward requests for approval of the avionics. On July 20 the Air Force wrote to OSD and compared the incremental costs of the new system with the previously approved avionics. The recommendation for the new system was that it would pay for itself in the increased accuracy of the bombing system which would require fewer sorties to complete a mission. The added avionics would cost about $183 million out of a total investment cost for the A-7 of $1,263 million.[41] The unit flyaway cost of the airplane was expected to increase to about $1.8 million.

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[41]A-7D Cost Estimate Track, p. 32.

The OSD answer was partially supplied by DDR&E, when on July 28, the Deputy Director wrote to Dr. Flax and Dr. Frosch. The memorandum stated concurrence in the belief that the performance, cost and reliability targets would be met and the schedule risks would be acceptable. DDR&E formally complimented the outstanding inter-service cooperation on the project.[42] At this point the avionics decision had apparently been finalized. The two Services had their development plans, and OSD had given formal approval for the program go-ahead. The OSD decision, however, was not to be as uniform as it appeared.

Systems Analysis Reduces the A-7 Force by 20%

When Nitze was the Secretary of the Navy he had signed the Navy request for approval of the avionics improvements. On July 1, 1967, he moved to a position as the Deputy Secretary of Defense, directly under McNamara. The Air Force and Navy requests for the improved avionics system and Nitze's position was later commented on by Murray in Systems Analysis:

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[42] Memorandum, DDR&E to Assistant Secretaries of the Navy and Air Force (R&D), July 28, 1967. The memorandum was signed by the Deputy Director of DDR&E, Mr. Finn Larsen. Unclassified portion of History of the Tactical Division, Director of Operational Requirements and Development Plans, DCS/R&D, July 1--December 31, 1967.

The Navy came up, and at that time Paul Nitze was still Secretary of the Navy. He wrote a letter that said, "NADC Johnsville has done the analysis, and they show that each one of these airplanes will be three times as effective with the new system as it would be with the old system. We /Systems Analysis/ were skpetical of such claims /but/ we were unable to stop that particular one.

. . . .

When we approved this thing, begrudgingly-when McNamara approved it--we got into an interesting discussion there which I think probably created a lot of ill will and resulted in a reduction in the force. The thought was that we would pay for the increased cost of the fancy avionics system by having a smaller number of airplanes. We reduced the force by 20%. . . . The idea there wasn't really to be nasty; the idea was to hopefully get the guys who were making these decisions to consider whether they really believed what they were writing. If they honestly believed it was three times as good, then that's one thing, but giving them the option of sticking with the old force or accepting a force 20% smaller would make them stop and think, we hoped.

We weren't just trying to be budget cutters there. What we really wanted to do was to make sure that the "operators"--the guys that would be stuck with this thing--aren't just trapped by what the research and development community is thinking up. We thought that was the case with the A-7. You couldn't argue that the Soviet threat had gone up. It may have incidently gone up, but the only thing that happened was that the United States R&D community--independent of anything else that was going on in the world--had thought up a new "gadget." You could really say that with

> a new gadget that's all that more effective, all we have to do--since McNamara believed the effectiveness of the force was high enough to begin with--is to maintain that same effectiveness and take it all out in saving.[43]

This consideration of the real worth of the avionics improvement on a cost/effectiveness basis was also a primary concern of Dr. Enthoven. He noted,

> There were some very glowing letters. I think the one we got from the Navy said something about it offered two to ten times the cost/effectiveness of the other plane /A-7A/. They pushed for it very hard. Instead of fighting it because we felt that if you really could get substantially better accuracy. . .if you really could cut the miss distance in half, that would be worth a lot of money. We thought it was probably right, provided that the claims were true. We proposed that the way to pay for it would be, in the case of the Air Force, to go from five wings to four. . . . The Navy said two to ten times as effective, and we made some equal cost trade with them. . . .The argument, which was one that I think the Services really have got to learn to understand and accept, is that if the thing costs 20% more and it is much more than that effective, then they ought to expect that they'll buy 20% fewer. . . . We could have argued that if one new A-7 is as good as two old A-7's, we'll just buy half as many of the new kind. . . .
>
> I recalled that trade but I thought at the time that it was going to raise the cost from $1.2 to 1.4 million. . . . I recall to my horror /later/ finding it had gone up to $1.8 million. Then the

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[43] Interview (Emphasis added)

> whole question of the Air Force A-7 started to be called into question. Certainly an important part of the case for it was that it was a lot cheaper /than the F-111 and F-4/.[44]

The OSD decision memorandum was approved, signed by Nitze, and was sent to the Services on August 7. It formally approved the avionics change, but OSD Systems Analysis in the same action reduced the number of Air Force A-7 wings from five to four.[45] The Air Force force structure for tactical fighter wings was correspondingly reduced from 24 to 23. A similar reduction was made in the Navy A-7 force. While General McConnell and the Air Staff had stated many times that they only

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[44] Interview. This reduction in wings has been cleared as unclassified by DOD. Note, Senator Thurmond asked General McConnell in Congressional testimony, "What is the effect of the reduction of tactical air forces from your planned figure of 24 wings to 23?" General McConnell's answer was, "The loss of one wing from the planned tactical fighter and attack force will reduce the force by /deleted/ aircraft. Five wings of A-7's were programmed for Army close air support requirements. We will now have four." U.S. Congress, Senate, Committee on Armed Services, Authorization for Military Procurement, Research and Development, Fiscal Year 1969, and Reserve Strength, Hearings before the Committee on Armed Services, U.S. Senate, 90th Cong., 2d sess., 1968, p. 766. The A-7 force was said to be five wings in June by Technology Week, June 19, 1967, p. 7.

[45] Ibid.

wanted a small number of A-7 wings in the Air Force, they had not envisioned any reduction in the 24-wing force structure.[46] The Air Force position was that the A-7 wings should be included, but kept to a small number. Every one of the rest of the 24 wings was needed, the Air Force stated, for either F-4's or F-111's.

Review of the Organizational Positions on the Avionics Issue

The avionics improvement had mobilized a great amount of support by the time it came to a decision, even within the Air Force. Tactical Air Command had been on record for over a year, stating that such a capability was required in the aircraft. The Requirements Action Directive had been written in the Air Staff with an accuracy requirement that would have been difficult to attain without greatly improved avionics. The Air Force project manager had initiated contractor trade-off studies that showed it possible to get the increased accuracy.

The briefings to the Air Force Board Structure--the formal decision process--were well-staffed and presented a range of options. After some initial comparisons with the April 1966 decision on the configuration, the recommendations for the improvement spread. Secretary

[46] Interview with General McConnell.

Brown had already envisioned the possibility of increased avionics, because he stated that as one of his reasons for selecting the A-7 over the F-5 in the first place.[47] General McConnell was interested in providing the Army the best possible--which included the most accurate--close air support aircraft.

Brown later recalled,

> I did not regard this as one of the more controversial Air Force decisions, or one that polarized the Air Force very much. At least it didn't seem that way at Headquarters level.[48]

The Navy was slightly more committed to the original concept of the A-7 as a low-cost, simple aircraft. Captain Doss knew when he began, this approach was part of the tradition of the naval attack forces. The Navy A-7 program was affected by the existence of the ILAAS system and was later disrupted by the incorporation of the Air Force M-61 gun. Captain Doss initiated trade-off studies with several major avionics contractors as well as a series of studies within the Navy development organizations.

When the studies were presented to the Navy decision process they met with interest, partly generated by the combat experience in Southeast Asia. Admiral Connolly recalled,

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[47]Interview.

[48]*Ibid*.

> About the time the A-7 came into being so did Southeast Asia. It didn't take very long to realize that a good light attack airplane needed a more accurate weapon delivery system. Furthermore, advances in stable platforms and computer technology avionics--showed how this could be done. It would be possible. . .to greatly improve the weapon delivery accuracy. This is a very important goal to reach; it is a very efficient thing to be attempting to do. At the same time, the prospect of heads-up display became something real, that we could get a hold of. And also the fact that the Air Force began to take an interest in the A-7, it looked as though by combining our efforts and combining some of our financial assets, maybe together we could make a real valuable improvement in the A-7 together.[49]

The position of DDR&E on the avionics improvement was both optimistic and cautious. The avionics engineers in DDR&E appreciated how much the addition of a digital computer to the system could add in the way of accuracy. Fowler's memorandum had certainly indicated DDR&E's interest in the improved avionics and projected DDR&E's authority into the issue. At the same time, DDR&E realized the very real development risks and the cost implications of the equipment. DDR&E held up the approval until the plans had been worked out to a sufficient degree that the risks were reduced and the costs were well understood. But in the end they agreed to the joint schedules and backed the program.

[49]Interview.

Systems Analysis personnel, on the other hand, had a completely different perspective on the avionics improvement, as they had to changes in development programs in general. They were not opposed to accuracy, just as they were not opposed to increased thrust. But they were generally opposed to increasing the cost of the aircraft, and they viewed with suspicion any change which might reduce the reliability of the weapons system. Thus, Systems Analysis, as expressed by the views of Enthoven and Murray, was opposed to the avionics improvement on the A-7.

Systems Analysis was concerned that the request for improved avionics might be just a move to increase the capability of the airplane without considering the cost it would add to the program. This can be detected in a statement of Dr. Heyman.

> But part of the problem was that although the Air Force heard McNamara and Systems Analysis say that there was nothing magic about the number of wings and that it is cost/effectiveness that is the objective, they really didn't believe it. So the criteria was not maximum effectiveness per million dollars spent, but max effectiveness per wing. The Air Force feeling was that OSD would be willing to spend whatever was necessary to keep the wings. . . .[50]

Systems Analysis in 1967 was not willing to spend whatever was necessary to keep the wings. As Murray later noted, they were unable to stop the change to more

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[50]Interview.

complex avionics, but they were able to influence the determination of the A-7 force structure. The result was that the number of A-7's in the Air Force was cut by 20% by reducing the number of combat wings from five to four. In addition, Systems Analysis recommended the first major reduction in the total level of USAF tactical air forces since the establishment of the 24-wing force structure early in the McNamara administration.

Review of the Issues on the Program

Although there were to be other changes on the A-7, the avionics decision of August 1967 represents the last of the major configuration decisions. The avionics decision was doubly significant, however, because it demonstrated the difference in perspective among various of the organizations in the decision process. A brief review of the issues on the program may assist in developing the general themes of the study.

The A-7 program was initiated by the Navy as a follow-on to the A-4 attack aircraft, and it was backed by Systems Analysis because the program promised to be a fairly low cost, low risk venture. When members of Systems Analysis nominated the A-7 for Air Force use they ran into several obstacles. First, the expertise of the Air Force professionals had led them to believe that underthrusted attack aircraft were excessively vulnerable to enemy ground fire and air-to-air attack. Second, the A-7, as basically a single-purpose aircraft, would have to compete with the multipurpose tactical fighters for force structure and funds. Third, if the A-7 was not going to incorporate any advances in weapon delivery accuracy over the F-4 and F-105, the desirability of having the new aircraft would be seriously questioned.

Through the computer studies of 1964 and 1965 the Air Force underwent a process of organizational learning which demonstrated the value of a lower-cost aircraft. That the Air Force was capable and willing to change its policy on this point is a factor demonstrating the professional nature of the Air Force organization. However, these same professional perspectives operated on the development decisions to incorporate a more powerful engine and a more advanced avionics system.

The engine and avionics decisions were made at the highest levels of DOD, but they were uniquely influenced by the military professionals in the project management office and the headquarters staffs. In these two cases the organizational division of responsibility and the specialized knowledge of the project managers led rather than followed the process. At the same time the action taken by the project managers was generally consistent with the goals of their organizations because of their training, experience and professional values. The changes they proposed were basically incremental, followed the due process established by the organizations, and were limited to what was administratively feasible. Their goal was the "best possible" A-7 for each of their Services, and the decisions were the product of their experience and initiative.

Chapter VIII

THE 1969 CONGRESSIONAL DECISIONS

The avionics decision had the largest impact on the A-7 program of any single configuration decision. It represented the largest investment of funds and took the longest to decide. It was both a discrete decision and an increment in the total development process. The avionics offered the opportunity for greatly improved accuracy, but the costs of this improvement, when combined with the other costs of the program, were to eventually cause the program to be temporarily cancelled. This chapter will describe the internal dynamics and external pressures that caused the program's value to be called into question before Congress.

The Air Force Protests the Reduction in the A-7 Program

The approval of the avionics improvement on August 7, 1967, was received with relief in the Air Force, but the reduction in the number of A-7 wings was a surprise.

Secretary Brown notified his staff on August 9 that it must reclama the one wing reduction.[1] The attempt was to prove futile.

Air Force Relations with Ling-Temco-Vought

OSD approval of the improved avionics system for incorporation in the Air Force A-7D and the Navy A-7E initiated a new phase in LTV/Air Force relations. The chief management problem at this point was to negotiate the details of the avionics and to arrive at a mutually agreeable set of specifications for cost, schedule and performance. These details had been discussed and general agreement reached to some degree during the year (August 1966--August 1967) when the avionics were being further defined. However, when it came time to establish firm performance and reliability guarantees for the navigation/weapon delivery avionics, LTV's proposals were not acceptable to Colonel Hails and the Air Force Project Management Office.[2]

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[1]Memorandum, Executive Assistant to the Secretary of the Air Force to the Assistant Vice Chief of Staff, August 9, 1967. Interviews with Dr. Brown and General McConnell.

[2]It is particularly important to remember that Colonel Hails had specialized for most of his career in program management, and he had just served for over three years as the military assistant for weapons systems management to the Assistant Secretary of the Air Force (Charles) for Installations and Logistics, the office that specialized

Part of the problem from LTV's point of view was that the company was being asked to accept almost full responsibility for the performance of an advanced technology system with a high degree of technical uncertainty and risk. The major disagreements between LTV and the Air Force were over exactly what degree of accuracy LTV was to guarantee and who would pay for any modifications to achieve that accuracy. Since all the avionics components were being developed and built by subcontractors, LTV was naturally reluctant to assume full responsibility for the correction of defects perhaps caused by a subcontractor. However, LTV was being paid for the assumption of this responsibility as the prime contractor.

When Doss and Hails had started the long series of avionics studies, they had actively considered using a method of contracting whereby LTV would build the basic A-7 airframe, and the installation of the avionics would be supervised by a major electronics manufacturer (like IBM or Sperry). This form of government contracting was known as the "associate contractor" method, because LTV would be the prime contractor and the avionics manufacturer would be the "associate" contractor. While LTV

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in contracts and contracting strategies. During the period to be discussed, Colonel Hails was in frequent contact with Assistant Secretary Charles and had the backing of the Secretary of the Air Force.

would retain responsibility for the total weapon system, the major responsibility for the avionics subsystem would fall to the associate contractor.

Another method that had been used on the unsophisticated avionics of the Navy A-7A and B was to have the Government supply the components to the prime contractor--Government-Furnished Equipment (GFE). The prime contractor, LTV, would merely install the equipment, and if it didn't work, the responsibility belonged to the government.

LTV was undecided during the early stages of Doss' and Hails' efforts in the fall of 1966, whether to bid for the avionics integration responsibility. The company had no past experience on the avionics integration on a major aircraft program. LTV avionics engineers and top management had reportedly gone through a period of soul-searching over LTV's ability to successfully manage the complex avionics, but the decision had been made at the vice-presidential level in Vought Aeronautics that LTV would attempt to get the full contract for the airframe and the avionics integration.

The Commander of Naval Air Systems Command, Admiral R. L. Townsend, had reportedly made the decision during

June or July 1967 that LTV would be the avionics integrator, regardless of whichever avionics manufacturer won the contract for the navigation/weapons delivery system.[3] That is, LTV would retain the responsibility for managing the detailed specification and performance guarantees of the electronics equipment. In return for accepting this development risk, LTV would receive a contract to cover overhead as well as the cost of the avionics equipment itself. LTV would then subcontract the avionics development to several companies and pay each of the subcontractors itself.

On the same day that Deputy Secretary Nitze's approval was sent out, LTV was making recommendations to the Project Management Office on the selection of avionics subcontractors. The finalists for the major portion of the contract were Hughes, Sperry and IBM. When the LTV management and the project managers agreed on IBM, the two groups briefed the commander of Naval Air Systems Command and then Dr. Frosch and Dr. Flax. On August 9, LTV and the project managers briefed Dr. Foster at DDR&E. Concurrence was given to LTV to select IBM as the winner.[4] LTV announced that IBM was "technically equal to Sperry, but that Sperry the early popular leader in the contest was 'substantially higher in price.'"[5]

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[3]Interviews in the Navy A-7 Project Management Office.

[4]Project Management Office, Semi-Annual Historical Report, July 1-December 31, 1967.

[5]Aviation Daily, September 14, 1967, p. 15. IBM received the largest contract of the six subcontractors--$168.5 million--to build the central digital computer.

However, the formal OSD decision approving the improved avionics and the selection of IBM as the major avionics subcontractor had not resolved the Air Force/LTV dispute over accuracy, reliability guarantees, and responsibility for the correction of defects. During the last half of August, Colonel Hails notified his commanders at Air Force Systems Command of this unresolved problem. He stated the contractor's proposed performance and guarantees on the navigation/weapon delivery system were not acceptable to the Air Force project management office.[6]

This was actually the tip of an iceberg-sized area of disagreement that had been growing between LTV and the Air Force. It dated back to the time when Colonel Hails and Captain Doss were examining alternatives to gain more accuracy (August-December 1966).

When asked if LTV was in favor of the avionics improvement, Colonel Hails said,

> They were opposed to the route that we went. It was tough. [LTV said] "you don't need that." Later, I made them eat their study that we paid [them to do]. When we finally got the Air Staff committment to go that route, we went through this tremendous donneybrook with their management on a head-to-head knocking basis. We said, "Look, we're not buying "promises," "best effort." You came in here with that study that I paid you to do, saying the airplane would do that. That's all I'm asking you for, but I want you to give me a contractual committment, a guarantee for that." They didn't want to do that. The Navy had never

[6]Project Management Office, Top Management Information Report (Rainbow), August 25, 1967.

> made them do that before; they would come in with goals and give them whatever came out the pipe.[7]

There had been a misunderstanding between the Air Force and LTV over the nature of the original LTV trade-off study which Hails had asked for in January 1966. There was apparent agreement on the conduct of the study itself, but the statement of the result was open to question. The study showed that a weapons delivery accuracy of 7-8 mils was possible if all the right components were integrated into an avionics package.[8] LTV subsequently viewed this accuracy as a "best estimate."[9] Colonel Hails and the small staff of the Air Force A-7 Project Management office viewed the study as an independent, professional analysis and not as a proposal.

Doss and Hails had apparently rounded off the LTV estimate of 7-8 mils to 10 mils for their briefings of the headquarters staffs and OSD. But Colonel Hails was insistent that LTV "guarantee" the 10 mil accuracy. LTV, viewing the development risk with the integration of six subcontractors' equipment, was naturally reluctant and reportedly offered to guarantee 14-15 mils, but not 10.[10]

A significant part of LTV's reluctance to guarantee the 10 mil accuracy was the need to reach agreement on how the accuracy was to be measured. The RAD reportedly

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[7]Interview with General Hails, March 30, 1970.

[8]Interviews at LTV and in the A-7 Project Management Office.

[9]Interview with LTV avionics personnel.

[10]Interview with Lt. Col. John R. Albright, engineer in the Air Force A-7D Project Management Office, May 8, 1970.

called for "unconstrained weapon delivery" which meant that the accuracy was to be obtained for all weapons dropped or fired, and it theoretically could be measured at all dive angles, all airspeeds, and all ranges from the target (out to a certain classified limit). In an effort to narrow this infinite number of possibilities, LTV offered to satisfy the requirement at 4 points of accuracy determination.[11] (Each point was to be a specific dive angle, airspeed, and range.) The Project Management Office was holding out for a higher number of points to be tested.

In addition to the disagreements over the accuracy and the number of points of accuracy determination, LTV and the Air Force disagreed over the proposed reliability guarantees and the correction of latent defects. LTV had proposed a 20% premium over the costs and an indefinite duration for the correction of the defects. Colonel Hails and the Air Force were opposed to any premium.[12]

The issue of the accuracy guarantee was resolved through negotiation, with LTV accepting responsibility for guaranteeing 10 mil accuracy, and for twelve points of accuracy determination. LTV representatives noted that Hails had, in fact, made LTV guarantee its "best estimate."[13] The issue of reliability guarantees and latent defects proved

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[11]"Briefing Notes," Program Element Monitor, Directorate of Production and Programming, DCS/S&L, July 12, 1967.

[12]Unclassified, undated briefing, Tactical Division, Operational Requirements, File 17-3-1-3, "Talking Papers."

[13]Interview with Mr. Robert S. Buzard, LTV Vice President, A-7 Programs, April 3, 1970.

more difficult for the Air Force to accept. (The Navy accepted LTV's "final, best offer" on October 4, 1967, and issued a formal go-ahead for the A-7E program.)

Colonel Hails communicated his difficulties with LTV to Assistant Secretary Charles, who spoke with Dr. Brown. Brown sent a strong letter to Mr. Clyde Skeen, President of LTV, Inc., the parent company of LTV Aerospace, on October 18, 1967. Dr. Brown stated the Air Force concern over the delay in the program and the possible impact it might have on the cost. It was imperative, he stated, to reach agreement in order to avoid a stop-work order on the contract.[14]

LTV replied to Secretary Brown's letter on October 20 and noted that LTV would cooperate in every way. In addition, Skeen made reference to a continuing factor in joint service programs--different requirements.

> I acknowledge with regret that we should have realized sooner that the system requirements and operational philosophies differ in some respects between the Air Force and Navy and this undoubtedly contributed in part to the impression in some quarters in the Air Force that we, as a contractor, were unresponsive and non-cooperative.[15]

One result of the letter exchange was a meeting of representatives of the three organizations--LTV, Navy and Air Force--on the same day, October 20, 1967, in which most of the outstanding differences were resolved. LTV was

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[14]Letter, Secretary of the Air Force to the President, LTV, Inc., October 18, 1967.

[15]Letter, LTV, Inc. President to the Secretary of the Air Force, October 20, 1967.

to make two A-7 aircraft available to the Air Force for an immediate, accelerated flight evaluation, and LTV was to resubmit its proposal for correction of latent defects.[16]

The result of the letter exchange, the meeting of the Navy, LTV, and Air Force representatives and the subsequent accelerated Air Force flight evaluation of the A-7 proved satisfactory. LTV revised its proposal on latent defects from a 20% premium and an indefinite duration for corrections on November 6, 1967, to one of a 2% net profit and only 18 months. Colonel Hails was still not satisfied with the proposal. He recommended the Air Force accept the LTV position on an 18-month time period, but he continued to maintain that LTV should bear all costs for latent defects.[17] After another period of negotiation, LTV reluctantly agreed to these terms, and on November 17, 1967, LTV supplied Colonel Hails with ceiling prices on all items. On November 22 Colonel Hails told Assistant Secretary Charles that the recent contractor negotiations had proven satisfactory. General Ferguson, Commander of Air Force Systems Command, formally recommended a contractual go-ahead to the Chief of Staff on November 27, 1967, and the disagreement was apparently resolved.[18]

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[16]Memorandum, "A-7D," Director of Production and Programming, DCS/S&L, to the Secretary of the Air Force, October 23, 1967. The meeting was attended by Mr. Paul Thayer, President of LTV Aerospace, Rear Admiral R. L. Townsend, Commander of Naval Air Systems Command, and Maj. Gen. Thomas S. Jeffrey, Director of Production and Programming.

[17]"Talking Papers," Directorate of Requirements, October, 1967, File 17-3-1-3, p. 16.

[18]Project Management Office, Historical Record, July 1--December 31, 1967.

The Navy A-7 Begins Combat Operations Over Vietnam

One of the primary goals of both the Navy and Air Force had been to get the A-7 ready for combat service as soon as possible. The first flight of the A-7A had been on September 27, 1965; the first aircraft was delivered to the fleet thirteen months later, October 1966. In another thirteen months (November 1967), the first Navy squadron (VA-147) was deployed with the aircraft carrier Ranger and arrived off the coast of Vietnam. The squadron included Air Force personnel--three pilots, one maintenance officer and twenty-one enlisted men--in addition to its normal Navy contingent.[19] One of the effects of this deployment on the program was the generation of some 100 requested changes, about 60 of which were incorporated.[20]

The Air Force A-7D program, on the other hand, was still in the development phase. In November, 1967, Rolls-Royce had just completed the first test run of the TF-41 Spey engine in Great Britain. LTV still did not have a

[19]See Norman Polmar, "Corsairs for the Air Force," Air Force and Space Digest, February, 1968, and Commander James C. Hill, "The Corsair II As I See It," United States Naval Institute Proceedings, November, 1968, pp. 38-42. Commander Hill was a believer in visual delivery systems, noting, "A professional viewpoint, derived from association with the development of the Navy's all-weather delivery system, might be stated in this manner: while I am absolutely convinced of the requirement for the offensive capability such systems offer, I must maintain my immediate support for the best possible fast-response, visual platform, that can economically meet the demands of brush-fire war." (P. 39). Hill was the squadron commander for VA-147.

[20]Interview with Lt. Col. Charles W. McClarren, one of the Air Force pilots on the deployment and in 1970, the commander of the Air Force Category III testing squadron.

firm definitized contract to build any Air Force A-7D's, although original OSD planning had envisioned delivery of Air Force aircraft as early as February 1967.

The Survivability/Vulnerability Changes to the A-7D

One of the effects of the Vietnam war on the A-7D was the generation of an Air Force-wide requirement for additional protection from ground fire. The Air Force had formalized a requirement for new aircraft to have features which would reduce their vulnerability and increase their survivability in a hostile environment.[21] Secretary McNamara directed the Air Force to conduct the survivability study, which was delegated to Air Force Systems Command. In late November, AFSC presented its results to Headquarters USAF and recommended the incorporation of foam-filled fuel tanks, three separate (triple redundant) flight control systems, and extensive ceramic and steel armor in the A-7D. The cost of the changes was estimated to be $70,000 for each aircraft, with $32 million to cover the entire program.

The Navy did not incorporate these survivability/ vulnerability changes in the A-7E. The A-7D and E versions had already diverged from commonality by having different engines, wheels, brakes, refueling systems, antennas, lights, oxygen and ejection seat systems, radios, engine

[21]The requirement was stated in Southeast Asia Operational Requirement (SEAOR) #76. An initial study on the effect of ground fire on aircraft was conducted by AFSC in April 1967, but the results were not decisive.

starters, and many other components. The Air Force survivability/vulnerability changes were to make the D and the E even less common. LTV personnel later noted they "were at a complete loss to reconcile the Air Force and Navy differences" over the survivability changes.[22]

The survivability/vulnerability features were another change in the military requirement for the A-7 that was to increase its cost, but the value of having the features was difficult to debate. As Colonel Hails described it,

> From a redundancy and hostile fire point of view, it had poor survivability characteristics. For us to be buying a new airplane in 1967 without deliberatecon-sideration to install features that would give it a high survivability. . . . We lost so many airplanes out there in North Vietnam because the rudder would get shot up, and the pilot would eject because he didn't have redundancy to get him home. We introduced them in the Air Force air-plane as a deliberate design intention.[23]

The survivability/vulnerability features and the many other smaller changes were driving the cost of the A-7D upward. Although progress had been made toward definitizing the Air Force/LTV contract, no program go-ahead had been given. After extensive briefings and recommendations of the Air Staff and the Project Manage-

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[22] Interviews at LTV, April 2, 1970.

[23] Interview.

ment Office, General McConnell gave approval on December 19 for the Air Force to proceed with the program. In his decision letter he noted the cost had risen from $1.4 to $1.95 million unit flyaway, and that the survivability/vulnerability changes would increase it another $100,000. The Air Force plans at this time called for a total buy of 517 aircraft with an initial operational capability in March 1970. The combination of increased accuracy and the reduced vulnerability were estimated to provide the A-7D with 2.8-5 more combat effectiveness than the A-7A.[24]

General McConnell said this about his decision to proceed,

> The main factor is that we had something, and God knows when we would get an A-X. I don't know whether we'll ever get one yet; I wouldn't put much money down on it. It was getting to the point that. . .The Army says the F-4 is not a close support aircraft. Well, it wasn't; it wasn't built for that, but it did pretty well. And it can fight its way in and out, and it can drop its bombs and run.[25]

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[24] Project Management Office, Historical Report, July 1 --December 31, 1967. Aerospace Daily, January 25, 1968, p. 4, quoted the cost of the A-7 as being "about" $2 million unit flyaway, cited the weapons delivery accuracy of the new avionics was 2 or 3 to the previous 1, and said the avionics improvement would delay acquisition about 8 months.

[25] Interview with General McConnell. Although General McConnell did not mention the status of the Army armed helicopter program (Cheyenne) as a factor in this decision, the Cheyenne had just had its first flight in September 1967, three months previous. The program looked like it was moving along with a successful development of this technologically difficult design.

The high performance of the F-4 was still not an impressive factor to the Army, and the demand for a specialized close air support aircraft had not diminished.

The Cost of A-7 Avionics Ground Equipment Soars

One of the first events to affect the A-7 program in 1968 was the revision of the cost for avionics ground equipment. In November 1967 LTV had estimated the cost at $32 million for the whole A-7 program. As the company got into the details of this complex automatized equipment, they recognized that estimate as unrealistic and submitted a new estimate of $107.7 million in February 1968. This would increase the unit program cost of each A-7D about $150,000. This increase in program cost alone almost caused the program to be cancelled, but the details are not known, and the program continued.

Robert S. McNamara Leaves the Department of Defense

Robert S. McNamara had been Secretary of Defense since 1961, longer than any other man in that position. He submitted his resignation to President Johnson and left the Department of Defense to accept a position as president of the World Bank on February 29, 1968. The President nominated Clark M. Clifford as his successor.[26]

The Navy Changes From the TF-30 to the TF-41 Spey Engine

The Navy switch from the Pratt and Whitney TF-30 engine to the TF-41, which the Air Force planned to use in the A-7D, is significant for several reasons. First, it showed the pressure for increased thrust existed in the Navy as well as the Air Force. Second, it demonstrated once again how joint programs constantly place another degree of complexity into development decisions.

The Navy has always appreciated the value of having the most powerful engines available in its aircraft. By the time the Air Force joined the A-7 program, the Navy had a substantial contract with Pratt and Whitney for TF-30's. The whole Navy logistics system was filled with TF-30 parts and experience. When the Air Force decided to use the TF-41 Spey instead of the TF-30, the Navy recognized the increased thrust of the new engine but could not justify changing engines in the middle of the A-7A program. The Navy contracted with Pratt and Whitney for an increased thrust version of the TF-30, which they put

[26] New York Times, January 20, 1968, p. 1., March 2, 1968, p. 3:2.

in the A-7B. This engine, the P-8, developed severe problems with turbine cracks, and in January 1968, all P-8 engines were grounded and new engines were refused from the factory.[27]

When the first Spey engine was test run in November 1967 and demonstrated nearly 15,000 pounds of thrust, the Navy interest in the engine increased. However, Pratt and Whitney, by this time, had a proposal for a 15,000 pound thrust engine called the TF-30-P-18. On March 18, 1968, Secretary of the Navy Paul R. Ignatius sent a memorandum to Secretary Clifford outlining a proposal to obtain the performance of a 15,000 pound thrust engine. Ignatius reported he was leaning toward the Spey engine, but that it was unproven. He requested $4 million to develop the TF-30-P-18 as a "back-up" engine.

This information was picked up by the Air Force and was the subject of a memorandum from the Deputy Assistant Secretary of the Air Force (R&D) Joe C. Jones, to Secretary Brown. Jones noted the Navy problems and added that the Air Force program with the Spey was doing very well and was planned for flight test in August 1968. He recommended the Navy join the Air Force in the Spey program.[28]

[27]U.S. Cong., House Committee on Appropriations, Department of Defense Appropriation for 1969, Hearings before a Subcommittee of the Committee on Appropriations, House of Representatives, 90th Cong., 2d sess., Part 3, 1968, p. 167.

[28]Memorandum, Deputy Assistant Secretary of the Air

Secretary Brown made a comment to the Air Staff about how this would affect the Air Force program. The response was in a memorandum which read, in part,

> "1. (U) Reference is made to your comment relative to the Navy A-7 engine program, whether this 'would make it any easier for us to drop the A-7D if we want to. . . .'"[29]

Ostensibly, the letter indicated that if the Navy did buy the TF-41, it would make it easier for the Air Force to cancel the A-7 program and give the excess engines to the Navy. This would seem to indicate that LTV's fears that the program was continually in danger of being cancelled were very real.

The first Air Force A-7D was accepted from LTV in April 1968 with a TF-30 engine temporarily installed.[30] The delivery was one year and three months behind the extremely optimistic plans of December 1965, when OSD envisioned Air Force A-7 as a virtual copy of the Navy A-7A then in production. The Air Force change to the Spey engine, the improved avionics, and the many other changes in the program had caused the revision in the date of this initial acquisition.

Force, (R&D) to the Secretary of the Air Force, March 21, 1968. SAF File 1000-68.

[29]Letter, Brig. Gen. Edward A. McGough, III, to Secretary of the Air Force, March 22, 1968.

[30]The first Rolls-Royce Spey engine was delivered to the Air Force for testing during August 1968, and it was successfully test flown at Edwards Air Force Base on September 26, 1968. Early production A-7D's that had

The Senate Tactical Air Power Hearings of 1968

The A-7 received particular attention in the Senate Armed Services Committee during the program's entire life. The chairman of the committee in 1968 was Senator Richard B. Russell, (Dem., Ga.), and the committee included such leading Senators as John Stennis (Dem., Miss.), Stuart Symington (Dem., Mo.), Henry M. Jackson, (Dem., Wash.), Howard W. Cannon, (Dem., Nev.), Margaret Chase Smith (Rep., Me.), and Strom Thurmond (Rep., S. Ca.).

The field of tactical airpower was the special province of a subcommittee of the Committee on Armed Services, called the Preparedness Investigating Subcommittee. The chairman of the subcommittee in 1968 was Senator Stennis, and it contained most of the senior members of the parent committee including all those listed above.[31] In May of 1968, the subcommittee began

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been accepted with the TF-30 engines were later retrofitted to the Spey engine. The first A-7D with the Spey engine was A-7D #3, accepted by the Air Force in August 1968. The first A-7D with the avionics system installed was #5, accepted on December 11, 1968. Aircraft #27 and subsequent had the survivability/vulnerability changes incorporated. Project Management Office, Top Management Information Report (Rainbow), December 1968.

[31] The Preparedness Investigating Subcommittee had long been a major body of the Senate. It was originated during the Korean War, and was chaired by Lyndon B. Johnson when he was in the Senate. Senator Russell had served as its chairman before Senator Stennis. The 1968 hearings were part of the Subcommittee's annual examination of tactical operations and readiness. (Interview with staff members of the committee.)

a series of hearings on the U.S. tactical airpower program. The hearings were to examine military requirements, the participation of Systems Analysis in defense decision-making and the progress of several tactical aircraft programs.

The purpose of the hearings was set forth by Senator Stennis,

> The purpose of this inquiry is to assess where we stand now and where we will stand in the future in this important field in relation to our potential adversaries.
>
> Earlier this week we heard from Lt. Gen. Joseph F. Carroll, Director of the Defense Intelligence Agency, General Carroll's testimony confirms the fact that the Soviets are challenging us all across the board in both the strategic and tactical war fields. This raises the question of whether we can afford to rest on our present and programmed cababilities.
>
> Many qualified persons in this area feel that to stay abreast in the area of tactical air power requires of us a vigorous program of aircraft development to the extent that the present state of the art and current technology. Certainly our aviators are entitled to the finest and most modern equipment if and when they are called upon to fight for their country. . . .
>
> Today, we start to explore the military requirements for tactical aircraft which have been laid down by the services. We intend to explore the justification for these stated requirements, the extent to which they have been approved by civilian authority, and the reasons for the denial of or reduction in

> the service requests where this has occurred.[32]

All of the witnesses before the subcommittee were high-ranking military officers with the exception of two--Dr. Alain Enthoven and Mr. Russell Murray. Senator Stennis noted that civilian authorities had made significant reductions in military requests for tactical aircraft and directed questions toward the two systems analysts.

The first question related to the background of the Assistant Secretary for Systems Analysis:

> Senator Stennis. On these matters that you stated which call for a military judgment--and this is not a personal question--you do not have a major military background, do you?
>
> Dr. Enthoven. No, sir.
>
> Senator Stennis. On these matters and opinions that do reflect a military judgment, am I correct in assuming that you are supported by what you consider top military advice and counsel, is that correct?
>
> Dr. Enthoven. Yes, sir. This is all based on years of extensive work with the Joint Staff, and with the services.
>
> *
>
> Senator Stennis. Of course, I know there is always some dissent, in the ordinary course of things on professional matters of this kind.
>
> Dr. Enthoven. Yes, There is inevitably going to be disagreement among the experts.

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[32]U.S. Congress, Senate, <u>U.S. Tactical Air Power Program, Hearings</u> before the Preparedness Investigating Subcommittee of the Committee on Armed Services, U.S. Senate, 90th Cong., 2d sess., 1968, pp. 1-2. Hereafter called the <u>Tactical Air Power Hearings</u>.

Senator Stennis. Yes.

Dr. Enthoven. And debate, I think, Mr. Chairman, there are always going to be differences in emphasis that depends on your point of view and where you sit in the organization.[33]

A few minutes later Senator Symington probed deeper into the matter of Enthoven's qualifications.

Senator Symington. Now. . .the testimony that you have given with respect to this, which in my opinion in effect denigrates the performance of the new Soviet airplanes as against our airplanes is not in accordance with the testimony given to this committee by the Air Force, in many categories.. . . Dr. Enthoven, this matter has gotten to a point where some of the members of this committee believe that /deleted/. With that premise, I would ask have you any background in engineering of any kind in the way of a degree?

Dr. Enthoven. No.

Senator Symington. I ask this with great respect.

Dr. Enthoven. No, Senator. Although I have a doctorate from MIT, it is in economics and mathematics.

Senator Symington. Thank you. Now, a Mr. Rosenzweig is your Director of Tactical Air Programs Division.

Dr. Enthoven. Yes.

Senator Symington. I notice he has a degree in mechanical engineering at the City College of New York, and a master's degree in philosophy at the UCLA, also that he is studying to be a

[33] Ibid., pp. 153, 154 (Emphasis added.) Testimony on June 6, 1968.

doctor of philosophy. He is the Director of Tactical Air Division Office of Assistant Secretary of Defense for Systems Analysis.

Dr. Enthoven. That is correct.

Senator Symington. He was interviewed by the staff, and I quote from the staff report, and I would ask you if you agree with these statements. Mr. Rosenzweig said:

There is no need to modernize the aircraft in the Guard or Reserve force though they are in the strategic reserve, because if they were called to active duty, they would be fighting equally obsolete Soviet aircraft.

Do you agree with that?

Dr. Enthoven. I wouldn't state it that way, Senator Symington, but I certainly support the Defense Department program which does not plan to modernize the Reserve and Guard at this time, and that is right, and the reason is because considering our total tactical air, <u>I think that our total airpower is enough</u>, and these aircraft in fact are better than the ones they would oppose. I do agree with that.

Senator Symington. Dr. Enthoven, Mr. Rosenzweig said that "the total number of aircraft possessed by the United States and friendly forces compared to the Soviet and potential enemy forces," and I am quoting, "is not too meaningful." Do you agree with that?

Dr. Enthoven. I think, Senator Symington, that I do agree with that. The number of aircraft, independent of the capability of the aircraft, is in fact, one indicator, but it is a very limited indicator. I could visualize a situation in which we might have twice as many aircraft,

> but lose the war because they weren't of good quality. I think that the qualitative factors are very important, and that, by themselves, just the numbers of aircraft are not a good indicator of the total capability and effectiveness of the force.
>
> However, I included and showed the numbers in my statement because I think the numbers are one of the things we have to consider. But the point I think that Mr. Rosenzweig is making, and I certainly agree with this, is that you have to give balanced consideration to the full range of factors, the quality of the aircraft, the training, the ordnance that they carry, and so forth.[34]

Enthoven later went more deeply into the subject of the requirements process. He said, in part,

> There is no such thing as a pure military requirement. . . . After all, the military forces are nothing other than one of the instruments of our foreign policy, and all of those factors have to be balanced and considered. I do not think that at the level of total forces that there really is a meaningful, sensible concept that you could call a pure military requirement independent of questions of foreign policy, political factors, cost, and so forth.[35]

The discussion went on to other matters, but later it turned to the A-7 program specifically. The questions were directed by the subcommittee's director of investigations, Mr. Ben J. Gilleas.

> Mr. Gilleas. Doctor, do you believe that increased effectiveness of aircraft is a logical basis to reduce the numbers of aircraft?

[34] _Ibid._, pp. 156-157. (Emphasis added.)

[35] _Ibid._, p. 195.

Dr. Enthoven. It may be. I think that you can't draw a general rule on this. . . .

Mr. Gilleas. I have in the mind the A-7 where I understand you will have one less wing by virtue of having increased effectiveness.

Dr. Enthoven. Right. That is correct. . . . Now what the Secretary of Defense said in effect is: "That [the A-7D avionics] is great, let's buy it, but I do not see why the invention of this new, more effective capability should be a reason to spend more money in this particular case. Therefore, let us plan to pay for this more expensive capability by holding the cost approximately constant, and take the extra effectiveness as a bonus."[36]

The whole question of the relationship of Systems Analysis with the A-7 and the tactical fighter force level was very much in evidence throughout the hearings. The interest of the subcommittee in Systems Analysis as an organization was also apparent, as the hearing with Enthoven and Murray did not adjourn until 6:40 p.m.

The previous week the Preparedness Investigating Subcommittee had heard testimony from General McConnell and General Disosway, in which the tone had been somewhat different. Disosway informed the committee that he was about to retire.

Senator Symington. I am sorry I have not had the privilege of knowing you better. Our paths did not cross in the old days, and unfortunately not much in these days. All I can say is I deeply regret you have decided to leave the Air Force.

General Disosway. Senator, I did not decide to leave. That is the law.

[36] *Ibid.*, pp. 218, 219.

> Senator Symington. I am sorry so many of my colleagues were so shortsighted.[37]

Senator Symington continually indicated his concern with the slow speed of the A-7, even in comparison with the F-100. (The F-100 Super Sabre had been the standard tactical fighter during the late 1950's with 16 Air Force wings; there were still several wings of F-100's in Vietnam in 1968.)

> Senator Symington. If you are going to replace the F-100 with the A-7, what is the speed of the F-100?
>
> General McConnell. It is a supersonic aircraft, . . .
>
> Senator Symington. What is the speed of the A-7?
>
> General McConnell. [Subsonic] Mach.
>
> Senator Symington. We have testimony before this committee from civilians in the Department of Defense, that we no longer need supersonic aircraft to defend the United States. Do you agree with that?
>
> General McConnell. No, sir; I do not agree to that.[38]

Senator Symington continued to highlight the alleged in-ability of the subsonic A-7 to defend itself in a hostile air environment. He directed his questions toward General Disosway.

> Senator Symington. I think you said the A-7 can be used [only] where we do not have any major air defense capacity on the part of the enemy; any danger from the air.

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[37] *Ibid.*, p. 94. Testimony May 28, 1968.

[38] *Ibid.*, p. 95.

General Disosway. From air attack?

Senator Symington. Yes; air attack.

General Disosway. The A-7 has to be operated in a permissive atmosphere free from air attack.

Senator Symington. So the A-7 is being designed primarily to be used against a country that does not have a first-class air defense force; correct?

General Disosway. That is correct, sir.[39]

Minutes later the questions turned to the subject of the A-7 force level.

Mr. Gilleas. General, is it a fact that the Department of Defense projected inventories, for fiscal year 1973, show a trend toward smaller numbers of aircraft in the Air Force as a result of increased unit aircraft capability? I have in mind, of course, the A-7D aircraft, which, as I understand it, will have superior avionics. As a result, the Department of Defense says that you can go from 24 to 23 wings by cutting out a wing of A-7's,because of increased unit aircraft effectiveness?

General McConnell. That was a statement that was made by OSD at the time that they cut that wing out.

Mr. Gilleas. Do you agree with that?

General McConnell. Theoretically--no, sir; I do not agree with it--theoretically, if you can fly two sorties per day instead of one sortie per day, and if you can have a CEP of 100 feet instead of a CEP of 200 feet, then you ought to be able to cut your force down considerably. But you actually do not have adequate numbers of aircraft. You are exposing these aircraft to enemy action as if you did have the numbers, and, therefore, your attrition is going to eat up your force a lot faster than it would if you had the numbers plus the performance.

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[39] _Ibid._, p. 96.

> In addition to that, in some instances you want large numbers of airframes. I believe in increased performance, but I do not agree with the rationale that because you have increased the performance of the A-7 that you can cut a wing out.[40]

The subcommittee was not only interested in the reduced numbers of the A-7 and in its slow speed. The senators were worried about the organizational forces behind the Air Force decision to buy the A-7.

> Senator Symington. So, to the extent that the A-X would replace the A-7 was the A-7 foisted on the Air Force before your time?
>
> General McConnell. No,sir. I asked for the A-7, Senator, because we needed something to give close air support to the ground forces. We did not have any.
>
> Senator Symington. I was told by people in the Air Force that the Defense Department forced the A-7 on the Air Force.
>
> In any case, when you have testimony that the Navy is going to have [deleted] attack squadrons in 1975, and that there will not be a single supersonic airplane in any of these many squadrons, to me that is incredible. The A-X can do what the A-7 can do, and the A-X is one-half the price, roughly, of the A-7; correct?
>
> General McConnell. That is about right, sir.[41]

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[40] Ibid., pp. 122-123.

[41] Ibid., p. 126. In May 1968 when the Tactical Air Power Hearings were occurring, the A-X was still in the very early stages of Concept Formulation. The Air Force Specific Operational Requirement had been written in December, 1966, and the first Request For Proposal had gone to industry in March 1967. But the program continued to move very slowly with a lack of funding. Although the A-X was backed by Representative Pike, the House Armed Services Committee recommended the $12 million DOD request for the A-X in Fiscal 1970 be cut to zero. The Senate Armed Services Committee pushed for the A-X, and a compromise of $2 million was reached. See the Armed Forces Journal, April 25, 1970, p. 25.

Senator Symington was not the only person who appeared worried about the cost of the A-7. General McConnell had been following the cost of the A-7 closely. After Senator Cannon listed the types of aircraft in the fighter inventory, General McConnell added,

> Yes, sir; and the A-7, should also be added to the fighter inventory unless the price of it keeps on going up. If the price of it goes up much more, we cannot afford it.
>
> Senator Cannon. What is the present price of the A-7?
>
> General McConnell. About [deleted] million.
>
> Senator Cannon. How much has it gone up since production first started?
>
> General McConnell. About $600,000.
>
> *
>
> Senator Cannon. Does the price look as though it will continue to rise?
>
> General McConnell. If it goes up much higher, Senator Cannon, I do not know what we are going to do with it.[42]

The A-7 program was clearly highlighted in the hearings on tactical airpower in 1968. The cost of the program was discussed and would remain a public issue into the next session of Congress.

<u>Congressional Pressure Forces the President to Reduce DOD Funds</u>

At the same time the A-7 was coming under fire in the

[42] Ibid., p. 101. The cost of the A-7D during the 1968 Hearings was approximately $2.1 million unit flyaway and was later released.

Senate Armed Services Committee because of its subsonic performance and its rising cost, the A-7D program was entering a period of financial crisis within DOD. This crisis was partially generated by the increased A-7 costs, but it was primarily affected by a series of events involving the President, the Congress, and the general economic condition of the country.

The nation had been undergoing an accelerated economic inflation for several years. The causes of the inflation were widely debated, but it was generally agreed by the Federal Reserve Board, the Administration, and Congress that some form of fiscal restraint would be necessary to control the economy.

The President, on the advice of his economic advisors and the Joint Economic Committee, had asked Congress for a 10 percent surcharge on the income tax on August 3, 1967. The position of the Congress was basically that if restraint was necessary, the government as well as private citizens should reduce spending. Accordingly, Representative Wilbur D. Mills (Dem., Ark.), chairman of the powerful Ways and Means Committee, refused to act on the President's proposal until sizable cuts were made in the Administration's budget.[43]

While the surcharge proposal was being held up by the Ways and Means Committee, the President reportedly was

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[43]For a more complete account of the background and extent of the debate over the tax increase and the ensuing expenditure reduction, see Lawrence C. Pierce, The President Versus Congress on the Tax Surcharge, forthcoming publication by the Inter-University Case Program, 1970.

attempting to reduce expenditures to meet the demands of the House.[44] As a part of this general effort to reduce government expenditures and before any tax surcharge bill was maneuvered through the House, the President apparently directed that the Defense budget be reduced in areas not considered essential to the Vietnam War. This expenditure reduction was not as massive as the one to be imposed on Defense after the passage of the bill under consideration by the Ways and Means Committee, but it was sufficient to cause a $158 million reduction to be specified for the tactical aircraft production programs.[45] The $158 million reduction impacted directly on the A-7 and the situation was made worse by the A-7D's rising costs.

The costs of the A-7D since the Chief of Staff's decision to proceed with the program in December 1967 had been influenced by several factors:

1) The total number of aircraft planned for production had changed many times, and the reduction from five to four wings had increased the unit cost.

2) The cost of the additional survivability features had to be added in.

3) Production authorization had been delayed due to the lengthy contract negotiations.

4) There were extra costs associated with the more stringent performance, maintainability and reliability guarantees

[44]*Ibid.*, p. B-22.

[45]Project Management Office, *A-7D Semiannual Historical Report*, January 1--June 30, 1968.

negotiated after the previous year's impasse.
5) The country was undergoing a continued economic inflation.
6) Engineering Change Orders were continually necessary to make minor adjustments in the aircraft.
The result of all these factors was to increase the total cost of the A-7 program through Fiscal Year 1968 to a figure $50 million beyond the programmed amount of $1,389 million.[46] The Air Staff not only had to figure a way to handle the extra $50 million the A-7 program needed, it had to cut $158 million from among the F-111/F-4/A-7 funds. Colonel Hails gathered the financial material together and prepared a lengthy set of briefings for the Air Force Board Structure. In May he briefed the Tactical Panel, the Air Staff Board, the Air Force Council and the Designated Systems Management Group. Some of the Committees were briefed several times during the month of May and on into June and July.

Colonel Hails recorded four items of agreement after a May 6 briefing to the Air Staff Board: (1) The A-7 cost rise was largely due to the avionics ground equipment; (2) The overall DOD budget specified a $158 million reduction in tactical aircraft production; (3) There was a continued need for the A-7 to give close air support to the Army; (4) The cancellation of either the F-4 or the A-7 production would be hazardous to national security.[47] Colonel Hails

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[46]Project Management Office, <u>Top Management Information Report</u>, July 26, 1968.

[47]Project Management Office, <u>A-7D Semiannual Historical Report</u>, January 1--June 30, 1968.

recommended the A-7 program be fully funded.

Before a final decision could be made on the A-7 financial problem, Congress passed the President's proposed 10 percent surcharge. The bill was entitled the Revenue and Expenditure Control Act of 1968 and passed the House on June 20, 1968.[48] It gave the President the surcharge, but it cut Fiscal Year 1969 expenditures by $6 billion and reduced the new obligational authority by $10 billion.

President Johnson and Secretary of Defense Clifford subsequently agreed that an additional $3 billion of the Fiscal 1969 expenditure reduction would be taken out of the Defense budget. When the $3 billion was portioned out to the various programs, a sizeable part of the cut was given to the Air Force A-7 program. This reduction caused a severe financial crisis in the program.

The A-7 Program is Stretched Under Financial Pressure

The Air Staff made a decision in August 1968 to meet the funding crisis by reducing the quantity of A-7D's in the first three years of production and increasing the numbers substantially in the later years. The January 1968 program for the Air Force A-7D production had called for a total of 517 aircraft, with 220 in the first three years (FY67-69). The Air Staff proposed to increase the total number of aircraft from 517 to 774, but to reduce the numbers produced

[48] Congressional Record, Vol. 114, No. 106 (June 20, 1968), p. H5320.

in the first three years from 220 to 26.

Table 7. Air Staff Proposed Reprogramming for Expenditure Reduction

	Budget	Reprogram	Change
FY 67	12 A-7D's	5	-7
FY 68	62	8	-54
FY 69	146	13	-133
3 Year Total	220	26	-194

Source: USAF Air Staff, "Synopsis of A-7/F-4 Reprogramming," August 30, 1968.

The reduction in A-7D's for the first three years of production was estimated to save $543.6 million. However, the Air Staff proposed simultaneously to increase the procurement of F-4E's (with the internal gun) by the purchase of 94 aircraft in Fiscal 1969 at a cost of $259.5 million. When the cost of the additional F-4E's was subtracted from the savings on the A-7 production, only $284.1 million remained to be applied against the $3 billion demanded by the President and the Revenue and Expenditure Control Act. The proposed change was made into a reprogramming request and submitted to the Armed Services and Appropriations Committees of Congress on August 23, 1968.

Representative L. Mendel Rivers (Dem., S.C.) chairman of the House Armed Services Committee challenged the proposed reduction in the A-7 program by a letter to the Deputy Secretary of Defense on August 28. The letter stated the need to discuss the reprogramming and reiterated the position of the Committee that the country needed the A-7D to provide close air support, especially in the Viet-nam situation. Subsequently, the reprogramming was modified by the Air Staff to increase the A-7D three-year total from 26 to 74. The net result was to cancel the Fiscal 1969 buy of 146 aircraft and to spread the 1967 and 1968 purchases over the three years.[49] The approved A-7D program for the period became:

FY 67	FY 68	FY 69	Three-Year Total
5	12	57	74

The modification of the reprogramming request to increase the A-7D portion from 26 to 74 aircraft necessitated a reduction in the number of F-4E's proposed (from 94 to 68), and the total amount to be applied to the Revenue and Expenditure Control Act of 1968 was reduced.

The financial crisis for 1968 had been resolved with this reprogramming. The numbers of A-7's purchased was reduced sufficiently to offset both the DOD expenditure reduction and the increased cost of the program. However, the stretchout was, itself, to cause additional price changes

[49] *Armed Forces Journal*, August 31, 1968, p. 28.

which would be transmitted into the following year.

Colonel Hails was reassigned in July 1968 before the reprogramming was finished. He was selected for promotion to Brigadier General and moved to the position of Assistant Deputy Chief of Staff for Maintenance and Engineering at Air Force Logistics Command Headquarters.[50]

He picked his replacement in the Project Management Office, Colonel Harold W. Stoneberger. Colonel Stoneberger had followed the A-7 program when he was a division chief in DCS/Systems and Logistics in the Air Staff. He had just graduated from the Industrial College of the Armed Forces and was regarded by Colonel Hails and other Air Force professionals as an outstanding programmer. He reported to the A-7 program in July 1968.

Captain Doss also left the program in the summer of 1968. He was selected by the Navy to attend the prestigious National War College, normally an indication that an officer is being strongly considered for promotion to star rank. While at the National War College Captain Doss had his first opportunity to review the written fitness reports covering his performance on the A-7 project. After reading these reports he decided that his future was limited in the Navy. He resigned from the National War College to retire and start a new career as the head of his own technical consulting company. In his own words,

[50]Hails was subsequently selected for a second promotion to the rank of Major General.

> It takes perseverance to get things done in bureaucracy; perseverance means conflict, combat, losses. I erred in how much of my energy I devoted to the battle versus how much I spent watching my six-o'clock. Fighter pilots will know what I mean. It was fun and worthwhile but I could have done it better. A strong instinct for survival is essential to career success. That's as it should be.[51]

Systems Analysis Views on the Air Force Tactical Air Programs

The A-7 project managers and the staff officers assigned to monitor the A-7 in the Air Staff were continually aware that the program was influenced by two other major tactical aircraft programs--the F-4 and the F-111. This was especially true because OSD Systems Analysis continually emphasized the comparison of alternative programs in its cost/effectiveness studies. During the fall of 1968, Systems Analysis conducted a series of studies that compared the A-7 with the F-111 and resulted in more pressure on the Air Force to increase the A-7 force above what General McConnell desired.

The comparison of the F-111 and the A-7 had two essential features: the relative performance of the aircraft and the relative costs. Systems Analysis personnel were later asked how closely they followed the cost aspects of the A-7 and the changes to the program. Dr. Enthoven emphasized the office did not have the primary responsibility

[51] Letter from Captain Doss to the author, October 25, 1970. The tension in the A-7 project office was also felt by Colonel Hails, who had submitted his own resignation earlier in the program. He was, however, persuaded by senior Air Force officers that his efforts in this difficult position were being noticed and were perceived as sincere and worthwhile.

or the personnel to follow the changes and said:

> I don't think that I personally did, but Russ Murray might have. It wasn't an issue that I thought that I had to be involved in. I do recall being surprised at various times at these unexplained cost increases.[52]

Mr. Murray was asked how closely he tracked the price of the A-7.

> It was sort of intermittant. Intermittantly we would get the latest word on what the cost had gone to, and how high it was getting. It was all the stuff they were sticking on it, primarily. And we were sorry to see that happen. I still have the opinion that putting that fancy [avionics] system on the A-7 was a bad idea.[53]

Even though the A-7 was increasing in price, the cost of the other new aircraft in the Air Force tactical air program, the F-111, was also going up. The program cost of each F-111 in 1968 was about $8 million.[54] The program cost of the A-7D was about $2.8 million.[55] The result was that, although the A-7 was growing more expensive, Systems Analysis still preferred it over the F-111. Secretary Brown described the Systems Analysis view as he saw it from 1965-1968.

> They were looking for this [A-7D] as a way to replace the high F-111 cost, and eventually

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[52]Interview.

[53]Interview.

[54]The fiscal year 1969 unit flyaway cost was listed as $7,539,000 by the Air Force in Congressional testimony. The fiscal 1970 program cost was given as $8,881,000. U.S. Congress, Senate, Committee on Appropriations, Department of Defense Appropriations Fiscal Year 1970, Hearings, before the committee on Appropriations, 91st Cong., 1st sess., August 5, 1969, Part 4, p. 459, 460.

[55]Ibid., p. 451.

> the F-4 as well. This swayed back and forth over the following years. They were, as became clearer in later years, unconvinced about the deep interdiction mission which fundamentally governed the magnitude of the F-111 buy. They kept looking at costs, and from beginning to end the ratio of costs of the F-111 to the A-7 was about three to one. The cost of both of them went up a lot, but it always stayed a very high ratio.[56]

This view that Systems Analysis was opposed to the F-111 was confirmed by Mr. Murray who said, " . . . the Systems Analysis office was violently against the F-111 and had been from the start."[57] One of the results of this Systems Analysis view was a cost/effectiveness study done in September 1968. The Tactical Air Division, which contained Rosenzweig, Sprey, and others, performed an analyses on a comparison of the capabilities of the F-111D and the A-7D. The general conclusion that the Systems Analysis study promoted was that the F-111D was more expensive and less capable than the A-7D. Systems Analysis saw "no reason" for introducing the F-111D into the inventory.[58]

The Air Force refuted the Systems Analysis study and reinforced the position that the F-111 was needed in large numbers. The A-7, the Air Force stated, was also needed.[59] The issue did not die there, however, because the Systems Analysis pressure continued to be felt by the Chief of Staff. General McConnell was later to testify to the pressure of Systems Analysis, "they wanted to

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[56]Interview.

[57]Murray Interview.

[58]Interviews.

[59]Interviews.

substitute these aircraft [A-7's] on a 1-for-1 basis with the F-111 and in my opinion it was getting me in a corner."[60]

<u>The Election of 1968 and Changes of Command in DOD</u>

The presidential election of 1968 brought Richard M. Nixon to the White House and a new line-up of politically appointed officials in the Department of Defense. The position of Secretary of Defense was filled by Representative Melvin R. Laird, while Dr. Robert C. Seamans, Jr. became the Secretary of the Air Force. Dr. Harold Brown became the President of California Institute of Technology. Dr. Alain Enthoven also left the Department of Defense and accepted a vice presidency in Litton Industries. (Murray, Rosenzweig and Heyman were to leave within eighteen months.)

The A-7 program continued to move along in 1969, and finally on February 19, a definitized contract was signed with LTV. The Project Management Office had been working with LTV on this contract since the first Air Force letter contract in October 1966. The many configuration changes, the engine, avionics, survivability changes and changes in the total force level for the A-7 were significant factors in delaying the signing. The multi-year contract defined firm ceiling prices on all items.

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[60] <u>Department of Defense Appropriations</u>, 1970, <u>op. cit</u>., p. 122. Testimony July 29, 1969.

Roles and Missions: The Army Problems with the Cheyenne

At the same time the Air Force A-7 program was getting accelerated with the signing of a definitized contract, the Army was having increasing problems with the development of its new armed helicopter--the Cheyenne. The AH-56 Cheyenne was being developed by Lockheed and had first flown in September 1967. Full production was approved by the Army in January 1968, and $429 million was requested in the FY-70 budget before Congress. But the company began having severe flight control problems with the test vehicles. After a series of incidents, Lockheed's chief test pilot was killed and a Cheyenne completely destroyed in an accident March 12, 1969. The crash and the resultant publicity threw the whole Cheyenne program into a period of uncertainty. Early in April 1969, the Secretary of the Army Stanley R. Resor sent a notice to Lockheed to demonstrate plans to correct the "failure to make satisfactory progress towards Cheyenne production and delivery." The Army Secretary noted, "Certain technical difficulties were brought into focus by the crash."[61] The technical problems included rotor instability, inadequate directional control and excessive control difficulty in maneuvering. Lockheed was given until April 25, 1969, to produce a plan to correct these defects. The Army was

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[61] Cited in Armed Forces Journal, April 16, 1969, and April 25, 1970, p. 25.

considering the cancellation of the entire Cheyenne contract.[62]

The Senate Armed Services Committee Again Questions the A-7

The Department of Defense Budget for Fiscal Year 1970 contained $374.7 million for procurement of 128 Air Force A-7D's and $727.2 million for F-111's. The prices of the A-7D in this budget were $2.4 million unit flyaway cost and $2.8 million unit gross weapon system cost.[63]

The first congressional body to call Air Force witnesses for the budget hearings was the Senate Armed Services Committee. Senator Russell had retired from the chairmanship of this committee, and the new chairman was Senator John C. Stennis, who had been the chairman of the Preparedness Investigating Subcommittee during the previous year when the Tactical Air Power hearings had been held. Secretary Seamans and General McConnell appeared before the full committee on April 16, 1969.

General McConnell read a prepared statement giving the broad responsibilities assigned to the strategic forces and general purpose forces and included details of the Air Force performance in Southeast Asia,

> General purpose or tactical offensive forces must be capable of responding to any level of conflict. . . .
> *

[62] _Ibid._, April 25, 1970, p. 25.

[63] U.S. Congress, Senate, Committee on Armed Services, _Authorization for Military Procurement, Research and Development, Fiscal Year 1970, and Reserve Strength, Hearings_ before the Committee on Armed Services, 91st Cong., 1st sess., on S.1192 and S.2407, Part 2, April 29, 1969, p. 1519.

> Close air support for our ground forces in Vietnam continues to hold a very high priority within our tactical air forces.
> *
> In accomplishing close air support and interdiction mission in Southeast Asia throughout 1968, our tactical strike forces flew thousands of attack sorties and expended 465,000 tons of ordnance against a variety of targets in Southeast Asia.[64]

General McConnell continued with a description of the A-7D, but added that the research and development program on a new air superiority fighter was a top priority.

> Our new A-7D fighter can deliver more than three times the bomb load of the F-100 over a given combat radius. It will provide added capability for the close air support and short-range interdiction missions in other than heavily defended environments.
> *
>
> Our first priority, . . .must be devoted to providing an air-to-air tactical fighter system that can operate within heavily defended hostile environments and outperform the first line enemy fighters which we can expect to face in the 1975-80 time frame. Technology is now at the point where an outstanding air-to-air fighter--the F-15--can be built for employment in that time period.[65]

Senator Margaret Chase Smith was particularly concerned about the roles and missions issue with the services appearing "to be going in opposite directions and running a little race of their own with five different aircraft to perform air support for ground troops." General McConnell answered,

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[64]U.S. Congress, Senate, Committee on Armed Services, Authorization for Military Procurement, Research and Development, Fiscal Year 1970, and Reserve Strength, Hearings before the Committee on Armed Services, 91st Cong., 1st sess., on S.1192 and S.2407, April 16, 1969, Part 1, pp. 936, 939, 940.

[65]*Ibid.*, pp. 942, 943.

> First, the roles and missions of each service are, of course, never very clearly specified, and everybody runs into overlaps with other services' roles and missions. Roles and missions give the Air Force the responsibility for close air support. The Army has always wanted to have its own close air support.
>
> *
>
> I do not agree that the AFFSS, the AH-56, [Cheyenne] is an appropriate weapon system to take over an Air Force responsibility when, in my opinion, we can do it better with other weapon systems. However, that is the Army's problem.[66]

General McConnell proceeded to discuss the A-7:

> The A-7 is an aircraft which we began to procure some 3 years ago. It is a subsonic, close air support aircraft. It carries a very high ordnance weight, about 15,000 pounds.
>
> There are two things wrong with the A-7. One is that the unit weapon systems cost increased from the $1.5 million that we thought it was going to cost up to $2.8 million. The other is that it cannot operate out of short fields right up next to the ground forces. . . . We asked for [deleted] wings. We are now programmed for [deleted] wings. [Deleted] wings are all we wanted. We are now programming [deleted] because the A-7 costs less than the F-111. We can make good use of those [deleted] wings.[67]

General McConnell and Secretary Brown had requested 387 A-7's in their 1965 decision. At the time of the hearing in 1969, there were 645 A-7's programmed[68] and 550 F-111's.[69]

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[66]*Ibid.*, p. 988.

[67]*Ibid.*, p. 989.

[68]*A-7D Project Management Office Chart*, unclassified.

[69]U.S. Congress, Senate, Committee on Appropriations, *Department of Defense Appropriations Fiscal Year 1970, Hearings* before the Committee on Appropriations, 91st Cong., 1st sess., 1969, Part 4, p. 460.

Senator Goldwater. We were discussing the A-7 versus the 111. I don't believe the A-7 is an airplane the Air Force particularly wanted; am I right in that?

General McConnell. Let me give you the history of that, Senator. We bought the A-7 because it was supposed to be a reasonably cheap modification of the F-8.

Senator Symington. Of the F-what?

General McConnell. F-8, a Navy airplane. We bought it for one purpose and that was to be able to supply heavy payloads with long loiter time in direct close air support of the ground forces.

At that time the cost of the airplane was estimated at $1.5 million, . . .

* *

Since then the price of the A-7 has gone up . . . and we have since then been programmed for . . . additional wings. . . .

The reason for that is because the A-7 costs so much less than the F-111A. The F-111A costs about three times as much, so we cut down on the F-111A, and we substituted the A-7.

The A-7 is not as effective an aircraft by any manner of means, but of course it is only about one-third as expensive. The A-7 has to operate from fields that are back far enough to where a hard surface can be built because it takes about 8,000 feet for take-off. It hasn't turned out to be the airplane which we had envisaged it would be at all when it is fully loaded with 15,000 pounds of bombs.

It does have a good range. It does have a very high degree of accuracy. It has long loiter time if it is not based too far back but it has two drawbacks.

One, it costs too much, and the other is that it must be based further back than we would like to have it. We want to give immediate close air support to the ground forces, right in front of them. We do not want to have to go from here to here because it takes too long to get there. For these reasons, then, we have proposed the development of the AX.

Senator Goldwater. You don't have this airplane yet, and I think it is at least a year overdue in delivery.

General McConnell. Yes.

Senator Goldwater. Is there anything wrong with the idea of forgetting about the A-7 and putting that money into the 111, although it is a more costly airplane? Would you rather have that?

General McConnell. I personally would rather have the F-111 and the F-4. I will tell you what we are scheduled to have now. . . .

Let me go by squadrons. . . . My personal choice would be to delete six of the [deleted] squadrons of A-7's, and take that money plus some more, and distribute that between F-111S's and D's, and F-4's. . . .

* *

Then,because I don't know whether we are going to get out of the A-7's or not, the other position would be to do without the . . . A-7 wings and distribute them between the F-4's and F-111's.

Senator Goldwater. I figured out the other day, my figuring perhaps was not too good, if you could get out of that A-7 deal even at the increased cost of the 111, you could pick up over [deleted] F-111's, and it sounds to me like a much better airplane, a much more modern airplane, and one that can do the job for you that you want to do.

General McConnell. It is a much better all-round airplane. It is not as good in close-in support, which we got the A-7 for, and for that reason I would rather hang onto the [deleted] A-7 wings.[70]

The discussion changed to the subject of pilot training, Soviet missiles, Anti-Ballistic Missiles (ABM), and the $3 million cost of the Cheyenne. The subject of the A-7 was not brought up again, and the hearings adjourned

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[70]Senate Armed Services Committee, Authorization Hearings 1970, op. cit., pp. 1000-1001.

for the day.

The following day, April 17, 1969, the Armed Services Committee convened, but Senator Goldwater was not present. Senator Cannon (Dem., Nev.) probed the question of the survivability of the Cheyenne versus the A-7 and the development problems with the Cheyenne.

> Senator Cannon. Are you familiar with the fact that the Cheyenne is having some very serious problems, that the company has been given notice to cure them, and they are in danger of default at the present time?
>
> General McConnell. I know they have had very serious problems, and I know the Army has given them 15 days to come up with the solution to those problems.
> My personal information is that they already have the solution or at least they think they have the solution.
>
> Senator Cannon. General, how may active tactical air wings does the Air Force have today?
>
> General McConnell. Twenty-three wings. . . .
>
> *
>
> Senator Cannon. Yesterday you stated that you would prefer [deleted] F-4 wings, [deleted] F-111 wings, and [deleted] A-7 wings; is that correct?
>
> General McConnell. Yes, sir.
>
> *
>
> Senator Cannon. In other words, you have one more F-4 wing than you would prefer. You have two more A-7 wings than you would prefer, and you have three less F-111 wings than you prefer for your optimum tactical force; is that correct?

General McConnell. Yes, sir; that is correct.[71]

The discussion then turned to a comparison of the relative costs of the A-7 and the F-111. General McConnell also noted,

> The F-111 is not too good for close air support, it is mainly an interdiction aircraft and was built for that. <u>I would like seven wings of these</u>.[72]

General McConnell once again specified his preferred force mix including a certain number of A-7 wings:

> Senator Cannon. And you would still retain some of the A-7's--.
>
> General McConnell. For close air support and interdiction.[73]

According to later Air Force testimony to the committee, the number of A-7's in General McConnell's <u>preferred</u> force mix was <u>three</u> wings.[74]

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[71]*Ibid.*, p. 1044. (Emphasis added.)

[72]*Ibid.*, p. 1045. (Emphasis added.)

[73]*Ibid.*, p. 1046.

[74]"So the Air Force structure, fighter force structure, as stated by the Chief of Staff included <u>three wings</u> of A-7's for close air support." Testimony of Major General George S. Boylan, Jr., Director of Aerospace Programs, DCS/Programs and Resources, cleared for open publication in *Authorization for Military Procurement, Research and Development, Fiscal Year 1970, and Reserve Strength, Hearings* before the Senate Committee on Armed Services, op. cit., Part 2, April 29, 1969, p. 1497. (Emphasis added.)

The Relative Cost of the F-4 and the A-7

An important part of the decision-making on the A-7 program revolved around the aircraft's cost in relation to the F-111 and to the F-4 Phantom. Early models of the F-4 cost as much as $7 million per aircraft, but as the production of this fighter continued, the cost decreased. In the Fiscal 1969 Air Force budget (the previous year) there had been 77 F-4E's with an average unit flyaway cost of $2.97 million.[75] This compared closely with the $2.8 million figure of the A-7D, but there were two important differences. The A-7D $2.8 cost was for the entire program, while the F-4E $2.97 was a unit flyaway cost. The A-7D unit flyaway cost was only $2.4 million. Also, there were no F-4E's in the Fiscal 1970 budget, so the figures were for two different years. (The 1969 unit flyaway cost for the F-4E later came out to be $3.1 million.)

[75] Senate DOD Appropriations FY1970, op. cit., p. 454.

Table 8. A-7D Unit Cost Growth

	Cost Increment	Unit Weapon System Cost
1. Initial estimate (Assumed 1149 Navy A-7A's)		$1.375 million
2. Actual Cost (Only 395 A-7A's and B's)		1.575
3. USAF A-7D Changes:		
Navigation/Weapon Delivery Avionics	$ .224	1.799
Survivability/Vulnerability Changes	.113	1.912
Other Requirements Changes	.111	2.023
4. Program Stretchouts and Economic Escalation	.157	2.180
5. Non-Recurring Costs Associated with above:		
Non-Recurring Costs--LTV (Survivability changes and others	.146	2.326
Non-Recurring Costs--Engine (tooling, repair capability)	.045	2.371
Other Services	.007	2.378
6. Non-Recurring Outside Normal Aircraft		
Weapons Certification Program--Testing	.037	2.415
7. Peculiar Support (Avionics Ground Equipment, Training Equipment, data)	.423	2.838

Source: USAF Headquarters, Program Element Monitor, Briefing Fall, 1969. Also, see U.S. Congress, House, Committee on Appropriations, DOD Appropriations for FY 1970, Hearings before a subcommittee of the Committee on Appropriations, 91st Cong., 1st sess., Part 3, p. 843.

The House Armed Services Committee Backs the A-7

General McConnell was unable to attend the hearings of the House Committee on Armed Services when they were held on May 8, 1969. The Air Force was represented by the Assistant Secretary for Research and Development, Grant L. Hansen, the Deputy Chief of Staff for Research and Development, Lt. Gen. Marvin L. McNickle, and Maj. Gen. Boylan. The House committee was known to be in favor of the A-7 program. However, the members of the committee had heard of the discussions in the Senate hearings over the rising costs of the A-7D. They were also aware that General McConnell had stated a preference for two fewer wings of A-7D's than were programmed in the official DOD budget.

The chairman of the House Armed Services Committee was Representative L. Mendel Rivers, but the Air Force witnesses were questioned by the chief counsel of the committee, Mr. John R. Blandford.[76]

> Mr. Blandford. Mr. Chairman, on the A-7D--is there any question in your mind now about the position of the Air Force on the A-7D?
>
> General Boylan. Mr. Blandford, the Air Force approved program authorizes [deleted] wings of A-7's within our 23-wing force structure.
>
> *
>
> In answer to questions by the Senate Armed Services Committee, the Chief of Staff, in reply to a direct question as to his preferred

[76]Mr. Blandford has been Counsel to the Committee since 1947 and was a strong critic of OSD Systems Analysis. See his article, "A Congressional Requirement: To Keep America Militarily Strong," Government Executive, October, 1969, pp. 49-54. He is also a major general in the Marine Corps Reserve.

force structure mix, stated that his preferred fighter mix was [two fewer] wings of A-7's, [three more] wings of F-111's, and [one less] wings of F-4's.

Mr. Blandford. What would that do to the unit cost of the A-7, to start with, and how much would it increase the total expenditure for the F-111D. . . .

* *

General Boylan. I don't have the figures here, but obviously the procurement cost of [deleted] wings of F-111's would be on the order of $700 million a wing.

* *

Mr. Blandford. So we are talking here in terms of pretty close to [deleted] million dollars if we follow this suggestion that General McConnell put forward, I assume when he was asked for his "druthers".

But the official position of the Department of Defense as of now is you want [deleted] wings of A-7's, you want [deleted] wings of F-111D's, and you want [deleted] wings of F-4E's.

* *

Is there any reason why we should not approve the Department-approved program here?[77]

General Boylan's answer led to a discussion of force structure projections over the years until 1974, and the expected development of the F-15, the Air Force's new air-to-air fighter to replace the F-4.

Mr. Blandford. So, doesn't it make sense to you, General, to continue the program on the A-7, to proceed with the F-15, to get the F-15 into the inventory as soon as you can, which will be undoubtedly the most modern fighter in the world, and to proceed as scheduled on the F-111D?

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[77]U.S. Congress, House, Committee on Armed Services, Hearings on Military Posture and Legislation to Authorize Appropriations during the Fiscal Year 1970 for Procurement of Aircraft, etc. before the Committee on Armed Services, House of Representatives, 91st Cong., 1st sess., Part 1, May 8, 1969, pp. 2707-2708.

General McNickle. Yes. I think the question was if you were given your "druthers" what kind of a program would you want?

Mr. Blandford. Are you satisfied with what I just said, this is a reasonably sound program to proceed as scheduled on the A-7D, proceed as scheduled on the F-111D, and proceed as fast as we can on the F-15?

General McNickle. Yes, sir.

Mr. Blandford. Thank you very much.[78]

With the two Armed Services Committees of Congress discussing the possible cancellation of the A-7D program, the congressmen were naturally interested in the amount the Air Force had invested in the program. Since the program was being paid by public funds the implication was that a cancellation would mean a waste of the taxpayers' money.

The money under consideration was the significant amount of $531.5 million that had been invested in the Air Force A-7D program through fiscal 1969.

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[78] _Ibid._, p. 2709

Table 9. Air Force A-7D Funding History
(millions)

	FY 66	FY 67	FY 68	FY 69	Total
Aircraft Quantity	--	5	12	57	74
R&D Cost	$19.5	$ 10.6	$ 19.6	$ 7.4	$ 57.1
Production Cost	--	132.3	106.9	186.0	425.2
Initial Spares		11.0	25.3	12.4	48.7
Military Construction		--	.5	--	.5
Total	$19.5	$153.9	$152.3	$205.8	$531.5

Source: Senate Hearings, DOD Appropriations 1970, Pt. 4, p. 452.

The Army Cheyenne Program is Cancelled

The history of the close air support mission has been influenced by the capabilities of both Army and Air Force weapons. The development of the armed helicopter had been viewed as a direct threat to the Air Force supremacy in this mission. After the March 12, 1969, crash of a prototype vehicle, the Cheyenne program was in trouble. The Secretary of the Army had given Lockheed until the 25th of April to submit a plan to correct all of the aircraft's deficiencies. In May, he cancelled the entire Cheyenne production contract.[79] The effect on the Air Force A-7D program was immediately recognized.[80]

[79] Armed Forces Journal, April 25, 1970, p. 25.

[80] Interview with General McConnell.

The Senate Armed Services Committee Calls General McConnell

The Senate Armed Services Committee called General McConnell on the morning of June 25, 1969, and requested he appear before the Committee in Executive Session. General McConnell responded and later described the committee session,

> We had $374 million in the 1970 budget, and I was asked point blank if I'd rather spend that money for F-4E's or spend it on A-7's. And I said considering the fact that you could buy only six less F-4E's for the money than you could buy A-7's for the money, and the F-4E had already demonstrated that it could do the close tactical air support--I would prefer to take that money and put it on F-4E's. . . .But I had a provision in there. I said provided that we can dispose economically of the 74 that we've got.
>
> *
>
> I reneged on it and said we'll just have to use the F-4 and wait for the A-X. Because by that time the AAFSS [Cheyenne] had been killed, so we had a little waiting period. We could support the Army with these F-4's.[81]

The Official Air Force summary of the session later provided these details.

> When the Air Force appeared on 25 June 1969 before the Senate Armed Services Committee, in Executive Session, the discussion centered on whether or not the Air Force desired to purchase A-7 aircraft or F-4 aircraft with the $374.7 million line item in the FY-70 budget for 128 A-7 aircraft.
>
> The Air Force already has 74 A-7's in production which have been procured in prior years. The Air Force testified that if the 74 A-7's could be appropriately disposed of, it would be

[81] Interview.

> preferable to apply the $374.7 million to the purchase of 120 F-4's.[82]

The Senate Armed Services Committee Cancels A-7D Funds

Immediately after the Executive Session with General McConnell, the Senate Armed Services Committee began the mark-up of their report to the Senate on the Fiscal 1970 Department of Defense budget. The report was filed with the Senate on July 2, 1969, and noted,

> The bill as presented to the Committee contained a procurement request of $348.2 million with an additional $26.5 million for A-7D tactical type fighter aircraft. The committee is recommending that the procurement of the A-7 aircraft be cancelled and that the same funds be used for the procurement of the F-4E aircraft.
>
> *
>
> When originally conceived the A-7 was to have been a relatively inexpensive, subsonic aircraft optimized for close air support of ground forces. It is no longer cheap. There have been many changes to the aircraft as well as many schedule slips. As a result the costs have more than doubled. For roughly the same costs in the fiscal year 1970 budget the Air Force can procure the more versatile F-4E aircraft presently in Air Force inventories. . . .
>
> The A-7 can operate only in a Vietnam type environment where our forces have complete control of the air. The F-4, on the other hand, can largely do the job of the A-7 and in addition can do unescorted interdiction and deep penetration missions, as well as air-to-air combat missions, which the A-7 cannot do. It, thus, makes good sense to buy the aircraft which can do the most for roughly the same procurement costs. . . .
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> *

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[82] Headquarters USAF, "unclassified Summary Statement," undated, probably July 9, 1969. This statement was a part of the Air Force reclama presented on July 9 to the Senate.

> The large costs that have gone into the A-7D are recognized. However, the Secretary of Defense should be able to make arrangements for the Navy to take over the Air Force A-7D aircraft which is quite similar to the Navy A-7E.[83]

The Effect of the Cancellation on LTV

LTV had suspected for several years that the Air Force was not as committed to the A-7 as it was to the F-4 and other supersonic aircraft. Virtually everyone who understood the long-standing relationship between LTV and the Navy had recognized that the Air Force had different concepts, doctrine and operational philosophies regarding tactical aircraft. Many managers at LTV were of the opinion that the A-7D program was under continuous danger of cancellation.

When General McConnell had testified before the Senate Armed Services Committee in April and indicated his concern over the high cost of the A-7D, LTV knew the program was in danger. LTV's top management wrote a letter to General McConnell and stressed overall lower program costs of the A-7 over the F-4.[84]

When the Senate committee recommended cancellation of the program in its July 3 report, the potential loss to LTV was even more than the $374.7 million in the Air Force budget. The effect of the Senate action was not

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[83]U.S. Senate, Report No. 91-290, to accompany S.2546, July 3, 1969.

[84]Letter, LTV Senior Vice President to the Chief of Staff, USAF, April 23, 1969.

only to cancel the 128 Air Force A-7D's, but to eliminate the entire 1970 Navy procurement of A-7E's--27 aircraft. This would result in loss of another $104 million to LTV. The mandate of the Senate action was to convert 27, and, if possible, all 74, Air Force A-7D's to the Navy configuration.

LTV engaged in a vigorous campaign to get the program reinstated.[85] Since the House Committee on Armed Services had not yet made its recommendation, it was the logical place to start. A paper was drafted to present the facts of the case to the legislature. It stated, in part,

> Knowing the facts of the A-7 program and weighing them against the dollars saved if the A-7D program is cancelled, one must conclude that the [Senate] Committee does not have all the facts.[86]

The paper went on to trace the history of the program, the avionics improvement and the potential gains it offered the Air Force. The performance characteristics were compared to other aircraft in the close air support mission and emphasized the bombing accuracy, range and load carrying capability of the A-7D. It also stressed the impact of the cancellation on the many subcontractors who, acting in good faith, had invested heavily in facilities for the A-7 program. The prime contractor, it noted, had made an investment of over $30 million in facilities expressly for the A-7D. The paper closed with the opinion

[85] Interview with General McConnell.

[86] Undated, untitled paper.

that the A-7D program was badly needed by the Air Force and the cancellation of it would mean the gross waste of hundreds of millions of taxpayers' dollars.[87]

The Air Force Asks the Navy for Cancellation Costs

It was generally assumed that the Air Force A-7D and the Navy A-7E were virtually identical, especially since they had the same Spey engine and the same gun, and the avionics improvement had been a joint effort. General McConnell approached Admiral Moorer, the Chief of Naval Operations, to find out how much it would cost to convert the 74 Air Force A-7D's to Navy carrier configuration.

When the staffs and the project management office finished with the analysis, it appeared that the two aircraft had amazingly little production commonality. They looked the same on the outside, and they contained essentially the same avionics equipment, but the aircraft wiring, cockpit instruments, oxygen systems, survival kits, radios, wheels, tires, brakes, starters and plumbing were almost completely different. Upon analysis, it appeared that the two models were only about 30-40% common in the production line.

Seventeen of the seventy-four aircraft already contracted for were considered uneconomical to modify. The remaining 57 aircraft, it was estimated would cost

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[87] Ibid.

$73.2 million to modify to the Navy configuration. In addition, the disruption of the LTV production line and the conversion of 128 Spey engines was estimated to cost $111.5 million, for a total conversion cost of $184.7 million. (See Table 10.)

Table 10. A-7D/A-7E Conversion Costs

	($ in Millions)
1. Costs to modify 57 A-7D's to A-7E's	
Non-recurring airframe	$ 11.0
Recurring airframe ($700,000 ea.)	39.9
Airframe changes	2.0
Engine modifications	5.8
Other Government Furnished Equipment	14.5
Sub-Total	$ 73.2
2. Production line disruption	
Stretch-out delivery of 160 FY-69 Navy A-7E's over a two-year period to preclude a break in production	$ 44.0
Increase in overhead and other fixed costs at prime contractor facility	14.1
Engines (termination, stretch-out, and breaking option on multi-year contract)	8.2
Convert 128 Air Force configured engines for Navy use as production and spares	13.2
Increased cost on engine spare parts	3.2
Navy funding of Air Force share of joint flight tests	15.0
Sub-Total	$ 97.7
3. Unknown cost increases (estimated) resulting from interrupting present A-7E schedule	$ 13.8
Total	$184.7

Source: Insert for the Record, Senate Armed Services Committee, Subcommittee on Tactical Air Power, February 17, 1970, Page 507, line 10. Originally prepared July 23, 1969, and inserted into record of Senate Appropriations Committee, Defense Subcommittee.

When the total conversion cost of $184.7 million was subtracted from the original $374.7 million, the result was only $190.0 million that could actually be used to purchase F-4E's. The actual price of any F-4E's that were to be contracted for in 1969 would have cost $3.108 million each.[88] The total result was that only about 61 F-4E's could be purchased if the 128 A-7D's were cancelled.

The Air Force Presents a Reclama to the Senate Action

When the facts of the conversion cost became known, the Air Staff was in a difficult position. The Senate had recommended the elimination of all A-7 funds, which would leave the Air Force with 74 very expensive aircraft. The utility of such a small number would be extremely limited, and the cost of setting up a normal supply system would be prohibitive. The alternative of giving them to the Air National Guard was discussed, but discarded for the same reason.

The Air Staff was not completely of the opinion that the A-7D was such a bad airplane anyway. No one on the Air Staff had exactly the same perspective as the Chief of Staff, because they were not subject to the full range of pressures that impacted on any service chief. Generally, the closer the staff members were to the program, the more they believed in it and saw the advantages the A-7D

[88] Senate Hearings, DOD Appropriations, 1970, op. cit., p. 454.

presented to the Air Force. These officers knew the cost of the aircraft was high, but they felt the distinctive performance characteristics of the aircraft warranted the expenditure.

While the decision was being made about what to do in the face of the Senate action, Air Staff officers were preparing papers comparing the A-7D with the F-4E. The A-7 program Element Monitor, Lt. Col. Leo J. Gagnon, was the focal point for much of this activity. Gagnon prepared a set of mission profiles comparing the range and loiter time of the A-7D and the F-4E with similar bomb loads. For a typical interdiction mission the range of the F-4E was shown to be about 190 miles while that of the A-7D was 450 miles. The comparison in the close air support mission for the Army showed the A-7D to have double the loiter time (over two hours) over the F-4E. Both these advantages were basically the result of the low fuel consumption of the turbofan engine in the A-7.[89]

When all the factors were considered, it was decided the only viable alternative was to reclama the Senate action and request reinstatement of the A-7D funds. At the same time the reclama was to be an attempt at reducing the programmed A-7D force structure to that desired and expressed by General McConnell on so many occasions. Accordingly, the reclama was prepared and presented by

[89]USAF, A-7D Briefing, Program Element Monitor, undated, Summer, 1969.

General McConnell to Senator Cannon. It read in part,

> The Air Force has now discussed the problem with the Navy and it is estimated that modifying the Air Force version of the A-7 to the Navy version would cost from $800,000 to $1,000,000 per aircraft. This cost together with the cancellation costs and increased unit cost for the Navy aircraft would reduce the budgeted $374.7 million to such an extent that it is most likely the Air Force buy of F-4 aircraft would be on the order of 50-60 aircraft instead of the previously contemplated 120 aircraft. This would reduce the total Air Force tactical fighter inventory below minimum acceptable levels.
>
> Therefore, the Air Force has submitted to this Committee a reclama of the Committee's action to prohibit the procurement of additional A-7 aircraft. The Air Force now requests that the $374.7 million be restored for the acquisition of three wings of A-7D's.[90]

After the reclama was presented to the Senate the reinstatement of the funds for the A-7D was still not assured. The Senate Armed Services Committee had already submitted its Report to the floor of the Senate and it was reluctant to change that Report. Senator Cannon described the committee recommendation, the Air Force reclama and made a reference to systems analysis in a presentation to the floor of the Senate on July 10.

He began by describing the hearings,

> It was clear from Air Force testimony that they are not enthusiastic about the A-7 aircraft. It was clear, further, that former civilian officials in the Department of Defense had been very enthusiastic about this aircraft because it was supposed to be economical. Originally, it was to cost slightly over $1.2 million. Its present cost approximates $3 million

[90] Headquarters, USAF, Unclassified Summary Statement, undated, probably July 9, 1969, op. cit.

> which is comparable to the present cost of the F-4 fighter aircraft. It is clear that the F-4 is our only air superiority-type aircraft.
>
> *
>
> Subsequent to the testimony by the Chief of Staff of the Air Force the committee eliminated all A-7 procurement and recommended purchase of the F-4 aircraft instead. I should add that the Chief of Staff of the Air Force called on me yesterday to furnish information recently developed by the Air Force.
>
> The information indicates that after a new reappraisal, for various reasons, including financial, the Air Force prefers to continue purchasing the A-7's. I have not had time to completely evaluate this most recent Air Force information nor to discuss it with other members of the subcommittee and am not prepared to make any other recommendation. I firmly support the committee's position.[91]

At this point, the $374.7 million was still directed toward the procurement of F-4E aircraft. On July 11 the staff of the Senate Preparedness Investigating Subcommittee requested that Navy and Air Force representatives meet with them to discuss the A-7 program. The meeting was held on July 14, and the many and complicated factors surrounding the cancellation of the A-7D were discussed.

A summary of the meeting indicated the Subcommittee Staff appeared to draw several conclusions from the discussion. Those conclusions were generally that it would be prohibitive to modify more than about 27 A-7D's into A-7E's and that there was only 30-40% production commonality in the two aircraft. In addition, it was noted that unless a

[91] U.S. Congress, Senate, Congressional Record, July 10, 1969, p. S7861.

decision to continue the A-7 program was made in the near future--perhaps as early as August--the cost to LTV of long-lead time equipment might raise the cost of each aircraft by $100,000-$200,000. The Subcommittee Staff did not indicate they would make any attempt to change the present Bill before the Senate, but they were discussing the economic details which would allow a decision to be made in the joint Senate/House conference.[92]

General McConnell Prepares to Retire and General Ryan Faces A Hearing

General McConnell had entered the Army Air Corps after graduation from West Point in 1932, and by 1969 had served over 37 years. The tour of duty for a Chief of Staff was four years, and General McConnell had been appointed on August 1, 1965. He was to retire on July 31, 1969. His successor was to be General John D. Ryan, previously the Vice Chief of Staff.

General Ryan appeared before the Senate Armed Services Committee on July 24 for a hearing on his confirmation. The committee questioned General Ryan on procurement, national defense strategy, and, noting he had spent half of his military life in bombers, the need for a new manned bomber. Chairman Stennis closed with an oblique reference to the A-7D and congressional decision-making.

[92]Office of the Secretary of the Air Force, Memorandum for the Record, A-7D Program, July 15, 1969.

> We do the best we can, General, around this table to write up a bill, and consider the testimony before us, and everything. But then when we do write it up and send it to the floor of the Senate it is the committee's bill, and it is our responsibility. And it is up to us to handle it the best we can.
>
> I don't think it is time then to see changes, for any of the services to see changes--I just mention this to you now for your information--unless there are some extraordinary circumstances. There are ways within the legislative channels, as you know, to have changes made. A big bill like the authorization bill, for instance, where you have $20 billion involved in many of the items in there, is hotly contested. The committee cannot go up and change its position or change its mind on the same set of facts. I just mention that for your information.[93]

The hearing lasted only twenty-five minutes, and General Ryan was subsequently confirmed by the Senate on July 25.

<u>General McConnell Makes A Final Appearance Before the Senate Appropriations Committee</u>

Two days before his retirement, General McConnell appeared before the Senate Appropriations Committee, where he was questioned by Senator Symington and Senator Russell on the A-7 program. General McConnell gave a lengthy and complete history of the A-7 and the factors which had led him to first promote and then recommend cancellation of the program. The dilemma of what to do with the 74 aircraft previously funded was discussed in detail. Then Senator

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[93]U.S. Congress, Senate, Committee on Armed Services, <u>Gen. John D. Ryan, Chief of Staff, U.S. Air Force, Hearing before the Committee on Armed Services</u>, 91st Cong., 1st sess., July 24, 1969, p. 9.

Russell inquired as to the possibility of the Air Force still wanting F-4's in place of A-7's.

> Chairman Russell. General McConnell, assuming that some procedure can be worked out whereby these 74 A-7 aircraft can be used by the Navy, Air National Guard, or for some other purpose, is it your personal opinion that it would be better for the Air Force to proceed with the procurement of additional F-4's?
>
> General McConnell. No, sir. The Air Force has evaluated all of the alternatives to disposition of the 74 A-7D's and none was found acceptable. It is necessary and advantageous to continue with the programmed modernization of the active fighter force which requires maintaining the A-7D program as requested by the USAF in the fiscal year 1970 budget.[94]

DOD Backs the A-7D and Congress Reinstates A-7D Funds

The Secretary of Defense, Melvin R. Laird, sent a reclama to Representative Rivers, chairman of the House Armed Services Committee, and requested restoration of \$986.8 million cut by the Senate. Among these funds, he specifically requested the \$374.7 million for procurement of 128 A-7D's for the Air Force.[95]

The new Chief of Staff, General Ryan, in an attempt to clarify the position of the Air Force and to build internal unity, issued a policy statement on the A-7D. It

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[94] Senate Appropriations Committee, DOD Appropriations 1970, op. cit., p. 126.

[95] Letter, Secretary of Defense to Chairman, Committee on Armed Services, House of Representatives, August 2, 1969. See Aviation Week and Space Technology, September 15, 1969, pp. 26-27. During August the A-7D was the subject of a hearing called by Senator Proxmire which resulted in much publicity, but did not seriously affect the DOD decision-making process. It involved the alleged misconduct of B.F. Goodrich Company in the qualification of testing the A-7D brakes. See U.S. Congress, Senate, Joint, Economic (cont.)

appeared as a headline in the September 1 issue of the Air Force Policy Letter for Commanders and read,

> It should be clearly understood that we need the A-7D. In the close air support role it is superior to any other aircraft available today. We need it to replace the aging F-100's. The planned A-7D force will provide a significant increase in the capability of our strike force in the 1970's.[96]

The Washington Post attempted to magnify the importance of the Air Force change of command in the case of the A-7. It noted, "The abrupt reversal on the proposed purchase of A-7 Corsair II's apparently resulted more from a change of command than a change of mind."[97] Despite the publicity and the strong position General Ryan took backing the program, there is no evidence that the change of command had any effect on the decision to stay with the A-7. General McConnell had already stated to the Senate Appropriations Committee that he did not want the $374.7 million in the FY-70 budget to go for F-4's. In addition, General Ryan stated internally to the Air Staff that he did not disagree with General McConnell's position.[98]

Committee, Air Force A-7D Brake Problem, Hearing before the Subcommittee on Economy in Government of the Joint Economic Committee, 91st Cong., 1st sess., August 13, 1969.

[96]Office of the Secretary of the Air Force, Air Force Policy Letter for Commanders, September 1, 1969, p. 1.

[97]Washington Post, August 7, 1969, p. 1

[98]Interviews. Headquarters USAF, USAF A-7 Position, July 28, 1969, Directorate of Aerospace Programs, SAF File 234-69.

The House Armed Services Committee submitted its report to the floor of the House on September 26, with a recommendation that the entire $374.7 million be restored to the Air Force A-7D program. It noted that the A-7 was a superior aircraft to the F-4E with respect to range, loiter time, and bombing accuracy. The report discussed the number of F-4's that were expected from the A-7 funds and traced the cost of modification through to show how the number of F-4E's purchased could only be approximately 61. The report flatly stated, "The committee finds this totally unacceptable."[99]

Accordingly, the House passed the A-7D authorization bill on October 4, 1969, as recommended by Chairman Rivers and the Armed Services Committee. In the House and Senate Committee of conference, the Senate receded on its language concerning the use of the $374.7 for F-4E's, and the money was authorized for the A-7D.[100] Subsequently, the full amount was appropriated for the A-7D program on December 29, 1969.[101]

The following year's budget request (Fiscal 1971) submitted in January 1970, included $242.7 million for the

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[99]U.S. Congress, House of Representatives, Report No. 91-522, September 26, 1969, p. 66.

[100]U.S. Congress, House of Representatives, Conference Report, No. 91-607, November 4, 1969. Public Law 91-121, 91st Congress, S.2546, November 19, 1969, p. 1 (83 Stat. 205).

[101]U.S. Congress, Senate, DOD Appropriations Bill, 1970, Report No. 91-607, December 12, 1969, and House of Representatives, Report No. 91-698, December 3, 1969. Public Law 91-171, H.R. 15090, December 29, 1969, p. 8 (70A Stat. 590).

procurement of 88 additional A-7D's for the Air Force. This number brought the total Air Force A-7 buy to 290, completing the second tactical attack wing, and starting the third. None of these wings was combat-ready in 1970, but Secretary Laird announced that the first A-7D wing would have an Initial Operational Capability (IOC) in 1971.[102]

One of the results of the 1969 Congressional debate over the A-7 had been to focus attention on the original Air Force (McConnell/Brown) request for only 387 A-7D aircraft. With the increased emphasis on decentralization under Secretary Laird and the reduced DOD budget, the Air Force was not likely to be forced to purchase more A-7D's than it had originally requested. Accordingly, in March 1970, the Air Force announced to Congress that the ultimate force planned for the A-7D had been reduced to three wings.[103]

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[102] U.S. Congress, House of Representatives, DOD Appropriations for 1971, Hearings before a subcommittee of the Committee on Appropriations, 91st Cong., 2d sess., Part 1, p. 274, testimony of Secretary of Defense Melvin R. Laird, February 25, 1970.

[103] The exact statement was given in testimony by General James Ferguson, commander Air Force Systems Command, on March 16, 1970. "The number of aircraft requested in the fiscal year 1971 President's budget [88] will enable us to meet the currently planned fiscal year 1971 procurement level. A subsequent buy in fiscal year 1972 is planned in such a manner as to protect reorder leadtime in fiscal year 1973 should the ultimate force decision be for more than the three wings now planned." U.S. Congress, House of Representatives, Committee on Armed Services, Hearings on Research, Development, Test, and Evaluation Program for Fiscal Year 1971 before Subcommittee No. 3 of the Committee on Armed Services, House of Representatives, 91st Cong., 2d sess., 1970, Part 2, p. 8186.

The debate over the A-7 involved many complex issues in addition to the technical performance of the aircraft. These issues will be discussed in the concluding chapter. Although it is extremely difficult to definitively evaluate the performance of tactical aircraft, a brief mention will be made here of the testing of the Air Force A-7D. The Air Force has established three levels of testing for new aircraft. Category I tests are generally run by the manufacturer and investigate airworthiness and basic flying qualifies in addition to preliminary weapon delivery runs. Category II is conducted by the Air Force Systems Command and investigates weapons delivery, climatic and adverse weather qualities. Category III tests are run by the receiving command (TAC) and are operational tests and evaluation.

By late 1970 the A-7D showed promise of completing all these tests successfully. A Project Management Office report on a total of 1480 test flights in the Category I program showed the manufacturer had met or exceeded all performance guarantees. As examples, the guaranteed speed with 8-750 pound bombs was 531 knots; the aircraft demonstrated 532 knots in flight testing. The guaranteed weapon delivery accuracy was 10 mils; the A-7D proved capable of 8.3 mills accuracy.[104]

[104] Project Management Office, Program Assessment Review--Category I Flight Test Program, Summary, May 6, 7, 1970.

The Category II tests showed equally good results. The bomb delivery tests demonstrated a high degree of probability of meeting the required 10 mil accuracy. The climatic hangar tests were completed successfully in October 1969. In November 1969 the tropic tests were accomplished in Panama with the A-7D being noted as the best aircraft to ever run this test.[105]

The Category III tests were still underway when this conclusion was written, and the results will be classified when rendered. However, interviews with the USAF Fighter Weapons School pilots running the tests indicated they were pleased with the performance of the aircraft. They were uniformly convinced the A-7D would make a valuable contribution to the tactical forces and provide a close air support capability unmatched in the Air Force.[106]

The cost/effectiveness of the improved avionics is a more difficult evaluation, because any such judgement must be based on the future tactical need for a very accurate weapon delivery system. The increased effectiveness of the new system was almost universally accepted in 1970. Aviation Week pointed out that the Navy A-7E's, with the same system as the Air Force A-7D, were able to dive bomb with "substantially improved" accuracy over the A-4's and A-7A's and B's in the fleet. The magazine cited the dive bombing accuracy of the A-7E as averaging 60 feet

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[105] Air Staff, DCS/R&D, Directorate of Production, Semi-Annual History, December, 1969, p. 11

[106] Interviews, Luke Air Force Base, Arizona, April 7, 1970.

CEP's, versus 95-100 feet for A-4's and 70-75 feet for A-7A's and B's. Testing was accomplished with the first Navy squadron to deploy with the A-7E, and some optimism was expressed that with experience the A-7E accuracy should shrink to 40 feet.[107]

[107] Aviation Week and Space Technology, February 16, 1970, "Navy Phasing A-7E's into Operation."

Chapter IX

CONCLUSIONS

There is no finality to the stream of history--no black and white decisions. The stream of history is always flowing and problems between nations never end. --James Forrestal

This study was begun with three broad purposes in mind. The first was to discover and describe the nature of the decision-making process on a defense research and development program. The second was to attempt to relate the findings to several decision-making models to see if the models were serviceable without drastic modification. The third objective was to examine some of the large organizations that are responsible for national security, but whose inner operations and combined interrelationships are inadequately understood.

In addition to these objectives there were several issues of public policy that were highlighted by the A-7 case. These issues included: the use of cost/effectiveness analyses in weapons selection, the relationship of national defense strategy to weapons development, the effect of technology on weapons development, the significance of service roles and missions, the effect of external factors on weapons programs, and the conduct of project management.

Before discussing the data in the light of these objectives and issues, it may be well to warn the reader of several potential limitations of any conclusions. The case, as it was developed through the collection and presentation of the data, was an attempt to identify and relate the most important factors affecting the A-7 program. A conscious effort was made in the research phase to seek out and understand the significant influences. The combination of the data into a meaningful narrative was accomplished with the hope that it would provide the participants in the process, as well as outside observers, with a meaningful view of the events. Several earlier versions of the study were submitted to the major participants as a check against the criterion of accuracy. The subjectivity of any human researcher is a factor that is difficult to eliminate, but these efforts were taken to minimize the effect of any personal bias.

Although the data in the narrative was succeptable to a certain amount of subjectivity in selection and description, the conclusions must be even more so. For the conclusions are based on a simplification of the data which is based on a simplification of reality. The result may be an unavoidable oversimplification of what was an extremely complex decision process. For this reason the major contribution of the case may be in the mere presentation of the data.

It is recognized that the conclusions are based on selective hindsight and subject to all the errors of time and memory distortion. The author was not present in the inner environment when the crucial decisions were being made. The recreation of those events and situations is at the same time partial and imperfect. Nevertheless, an attempt will be made to draw out from the data those elements that contribute to or cluster around the several objectives and issues mentioned. The conclusions are not intended as criticism of any person or organization; in every case the participants were sincere, honest and dedicated to their concept of the public interest. What follows is solely an attempt to understand and interpret the extreme complexity of the decision-making process.

Brief Recapitulation of the Six Decisions

The A-7 development has been approached from the perspective of six of the major decisions that marked the program. The first one was the 1963 Navy decision to develop the LTV A-7 as a follow-on attack aircraft to the A-4 Skyhawk. The Navy had wanted for years to increase the range and load-carrying ability of the carrier attack forces, and the technological innovation of the turbofan engine provided that opportunity. Organizationally, the selection of LTV as the winner of the A-7 competition was well-received in OSD, partially because the personnel in Systems Analysis had a high regard for the professional capabilities of the Navy's evaluation division.

The second decision involved the conduct of two Air Force computer studies--the Bohn Study and the Fish Study--in which the requirement for a specialized close air support aircraft was validated. These studies were conducted in a period of increasing tension over service roles and the close air support mission. Secretary McNamara had challenged the Air Force to increase its close air support capability or be threatened with the loss of that mission to the Army. Although the Air Force was not convinced the A-7 was as survivable as the supersonic F-4 Phantom, the A-7 was selected in 1965 over the F-5 for the role of a specialized close air support aircraft.

Once the A-7 was selected for development by the Air Force, the decision had to be made on the configuration of the aircraft. An Air Force project manager was appointed, and he worked with the Air Staff and Tactical Air Command in developing recommendations for a decision. The initial Chief of Staff/Secretary of the Air Force decision (1966) on the A-7 configuration was for an afterburning Pratt and

Whitney engine similar to that in the Navy A-7A and for a moderate improvement in the avionics to provide increased weapon delivery accuracy.

The fourth decision (1966) was to replace the afterburning Pratt and Whitney engine with a non-afterburning British Spey engine which promised a higher thrust, lower fuel consumption, better contract guarantees and a lower cost. The Spey decision was accomplished in a very short time due to the acknowledged need for an engine with the increased thrust and the desire to find an outlet for the U.S. purchase of British products in return for the United Kingdom purchases of the F-4 and F-111.

The fifth decision involved the joint Air Force/Navy request to develop an improved avionics system and resulted in the modification of the initial Air Force decision on the A-7 configuration. This modification was decided on after the Project Management Office had studied the Air Force requirement for accuracy and proposed an integrated digital system that would meet the requirement. The Air Force Secretary and the Chief of Staff agreed on the need for the increased accuracy in providing close air support to the Army and recommended the improvement in conjunction with the Navy and DDR&E. Systems Analysis agreed that the increased accuracy--if it could be obtained--would be important, but held that the funds programmed for the tactical forces should not be increased. Systems Analysis then recommended a 20% cut in the A-7 force structure to pay for the new system.

The sixth decision, the 1969 Congressional actions, was of a qualitatively different type. The research did not focus on the nature of Congressional decision-making; therefore, this decision will not be discussed further here but will be left to future researchers.

What Did the DecisionsDecide?

The question of examining what exactly the decisions decided may appear rhetorical on the surface, but it is one of major significance to students and practitioners of public policy and decision-making. Many theoretical works state that decision-making is the heart of administration and management. The implication is clear that if decisions do not decide or alter events in any measurable or meaningful way, there is little use in continuing to associate decision-making with administration. Similarly, if decisions are ephemeral, there is little utility in using them as a focus or perspective in the study of public policy making.

The 1963 Navy decision on the need for an A-7 and that LTV should be the prime contractor was sustained by subsequent events so that its effect was lasting and without major changes until the 1967 decision on a joint avionics system. Actually, the Navy decision on what configuration the A-7 was to employ was an incremental one, with the first increment of several hundred aircraft to have a relatively simple avionics system and the remainder to incorporate the more sophisticated ILAAS when it became available. ILAAS did not prove its worth to the Navy, and the A-7 program reverted to the original A-7 concept with minor improvements in the Pratt and Whitney engine. The first significant change to the Navy A-7 program came when Secretary McNamara directed the incorporation of the Air Force M-61 gun in both aircraft in September 1966. Although the gun change, the avionics change, and the later engine change to the Spey all modified the Navy A-7, the original decision held steady for three years before it was significantly altered. The 1963 decision itself significantly influenced the development of the Navy's attack aviation force.

The 1965 Air Force decision to develop the A-7 for its own use was also an incremental decision. Whereas the Navy Sea-Based Air Strike Force Study had generally determined the requirements and characteristics of the Navy A-7, the Air Force Fish Study did little more than take the basic Navy A-7A and add an afterburner. The Air Force decision to develop the A-7 in November 1965 was sustained by later events, in that the program was not cancelled before the planned procurement was obtained. The decision specifically did not end the discussion over what kind of aircraft the A-7 should be, and there is no evidence that the decision eliminated completely the belief that a single-engine subsonic attack aircraft was extremely vulnerable to enemy ground fire and the counter-air threat. What it did decide was that the Air Force would have an A-7 program.

The decision in April 1966 that the Air Force A-7 would employ the Pratt and Whitney TF-30 engine and incorporate a moderately improved avionics system was not sustained by later events. In fact, the decision was made only three months later to switch to the Rolls-Royce/Allison engine. Why didn't the decision have a longer life? There are two possibilities: first, the decision may have been premature; second, the uncertainty may have been recognized by the decision-makers at the time, but for many reasons the decision was made anyway. The first possibility, that the decision should have been delayed until more was known about the engine details, is not sustained by the evidence. To draw such a conclusion is to disregard the climate surrounding the decision-makers in April 1965.

The Pike Report criticising the Air Force for the neglect of the Close air support mission had just been published in February; in early March Secretary McNamara had approved the formation of the Army's second Air Cavalry Division; the Vietnam war was intensifying; and the day before the April 7 decision on the A-7 configuration the Army/Air Force Roles and Missions agreement had been signed, giving the Army a clear mandate for the development of armed helicopters. These inputs to the decision process created a climate of pressure and tension that was attested to by Air Staff officers and almost demanded the Air Force decide on an A-7 configuration quickly and get on with the program.

Mary Parker Follett has pointed out that decisions generally take the form of one of three alternatives. Either they represent the domination of one group over another, or they represent a negotiated compromise. Both these cases, she emphasizes, leave residual disagreement and disappointment. Only in the case of creative integration are the participants mutually satisfied.[1] Viewed in this perspective, both the decision for the afterburning TF-30 and the "moderately improved" avionics were essentially compromises from what some of the participants thought were "ideal" states. Both decisions left the Air Force moderately unsatisfied with regard to the configuration on the A-7.

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[1]Mary Parker Follett, "Constructive Conflict," in Dynamic Administration: The Collected Papers of Mary Parker Follett, ed. by Henry C. Metcalf and L. Urwick (New York: Harper and Brothers, 1941), pp. 32-36.

This state of dissatisfaction was reinforced by the uncertainty over the technical feasibility of the afterburner, and it was represented by the inclusion of the clause in the decision document that specified the incorporation of the afterburner was only to be after its performance was demonstrated. The intent of the decision was certainly not to preclude Colonel Hails from investigating further to find a better alternative. Thus, when he discovered the Spey engine was technically feasible, Colonel Hails was engaged in a process of creative integration which met the goals of all the agencies concerned.

Similarly, the avionics part of the April 1966 decision was a decision for a system incrementally better than the Navy A-7A bombing system. It was not as advanced as TAC desires had stated, yet it was designed to produce a more accurate system than the A-7A. This decision was also changed, but the change process took longer (until August 1967, sixteen months later). Why was it changed? That is one of the most complex questions of this study, but certain elements stand out as tentative answers.

First, the need for accuracy in attack aircraft had long been recognized as a critical factor--practically <u>the</u> critical factor along with survivability. If historical examples have any relevance, the lack of accuracy had been one of the reasons for the demise of the specialized attack aircraft category in the Air Corps of the early 1940's. The demands of close air support in the Vietnam War and especially the bombing of pinpoint targets in North Vietnam had more than demonstrated to Air Force leaders the need for a precise weapon delivery system. In addition, the Tactical Air Command, Pacific Air Forces, Systems Command, DDR&E and portions of the Air Staff supported a system with more accuracy. When Colonel Hails, after eight months of study with LTV and the avionics contractors, determined the equipment specified in the April 1966 decision would not yield the accuracy stated in the Requirements Action Directive, he and Captain Doss investigated a system that showed greater possibilities of delivering the required accuracy.

Second, the uncertainty surrounding the initial determination of avionics components was recognized during the decision. It was not mentioned in the Chief of Staff's decision document of April 8, 1966, which specified the avionics hardware; it was, however, specifically pointed out in Secretary Brown's memorandum to the Secretary of Defense on April 9, which said that the avionics was recognized as being undefined at that point. Thus, although an initial decision on the A-7 configuration had been made, the project manager was still the designated authority to "manage" the evolving weapon system and to recommend on the feasibility of the implementation of the avionics decision.

In addition, the April 1966 decision on the A-7 configuration addressed other questions. (There were nineteen changes authorized to the basic Navy A-7A.) Every one of these other items was incorporated in the Air Force A-7. It is granted that the engine and avionics system were the two largest of the nineteen changes; still, the April decision could be defended as timely even if it was just to get the program moving on the seventeen other items. One other effect of the decision was to mobilize Air Force efforts on the program and to provide a policy guide around which the Requirements Action Directive could be written. The decision did not end discussion on the proper amount of avionics, as is indicated by General Disosway's letter to the Chief of Staff, November 17, 1966, and the many Air Staff communications on avionics during December 1966.

The fourth decision, to replace the Pratt and Whitney TF-30 engine with a derivative of the Rolls-Royce/Allison Spey, came in July 1966 and had the unanimous support of the agencies involved. It was a terminal decision in the sense that it resolved the engine issue for the Air Force and provided the required thrust to allow the A-7 to takeoff from land bases with a sufficient margin of safety. The decision definitely ended the search for engine alternatives for the Air Force A-7. Later, the Navy changed to the Spey engine and developed a slightly modified version that had even higher thrust.

The fifth decision, to incorporate an improved avionics system in both the Air Force and Navy versions, was complicated by many technical, organizational and professional issues. It was not an easy decision because the promise of a high degree of accuracy had to be balanced against the high cost, the development risk, and the delay of an initial operational capability. The decision, when it was rendered and finalized by OSD, was double-forked. It approved the avionics improvement and thus ratified the major change in the weapons delivery system, but it also reduced the overall tactical force structure. (In the Air Force the most significant change was the reduction of the 24-wing tactical fighter force ceiling to 23 wings, not the change from five to four A-7D wings. The number of A-7D wings was to change many times before the program was complete.) The 1967 avionics decision almost ended the search for new avionics equipment, but several minor changes were later added in the course of the development process.

The result of this brief survey of the major A-7 decisions leads to the conclusion that there were significant phases to the A-7 program and that these phases were generally marked by high-level decisions. The decisions were not all final in the sense that the participants neglected the generation of new knowledge and alternatives. They were, however, decisive to the degree that they mobilized support and organized action to direct the program toward the goal of system acquisition. Further, it may be concluded that, in this case, the use of the decision-making perspective as an approach to research had some degree of utility.

Comparison of the Process with the Models--The Rational Policy Model

The Rational Policy Model as stated by Allison posits that decisions are made by a unitary, national actor, making value-maximizing choices among alternatives ranked according to their cost/benefit ratios. The translation of this model into a A-7 decision process would generally specify that the A-7 was selected by a unitary defense decision-maker to miximize some portion of the national defense strategy of

Flexible Response.

Each of the A-7 decisions could be measured against this model to see the type of explanation that might result. In the case of the 1963 Navy decision to develop the A-7, the analyst would probably infer that the strategy of Flexible Response demanded an increased range/payload capability in the tactical forces of the Navy; hence the incorporation of a turbofan-powered, subsonic attack A-7 that was only slightly more expensive than the then-current A-4. The selection of the A-7 for Navy use by a unitary, rational decision-maker (the Department of Defense) would be cost/effective and value maximizing.

The 1965 Air Force decision to develop the A-7 would be viewed as the same kind of choice--to maximize the range and load-carrying capabilities of the tactical air forces in conjunction with the national strategy of Flexible Response. At this point the question arises, if the 1963 Navy decision on the A-7 was a rational choice, why did the Air Force not make the same decision at the same time. The Rational Policy Model which views the Department of Defense as a single, rational decision-maker would appear to have no answer to this logical question.

The April 1966 Air Force decision for an afterburner engine and avionics configuration could be explained in terms of making the aircraft capable of a higher speed and increase its load-carrying capability, but the Rational Policy Model would have difficulty in providing the basis for an explanation of the relatively differential interest in the engine and avionics changes in the Air Force and in OSD.

Similarly, the change to the Spey engine and the decision for an improved avionics system could be justified on the basis of providing a "better," more capable airplane. The increase in the cost of the aircraft with the new avionics system would tend to decrease the perceived value of the new system, unless of course, the value and probability of obtaining the increased accuracy outweighed the perceived negative value of the cost increase. The judgment on these two decisions could be swayed by either the increased military capability or the cost factors being the most important in the value system of the decision-maker.

These explanations of the decisions are not meant to be caricatures although they may take on that appearance because of their brief, single factor analyses. To a degree, this is a useful way to explain the A-7 decisions, but the simplicity of the explanation so conceived loses most of the richness and strength of the reality. Specifically, it does not take account of the dynamics of organizational loyalty, professional perspectives or individual influences in the decision process.

One of the observations of the research is that one particular organization--Systems Analysis--seemed to repeatedly use a variation of the Rational Policy Model.[2] Thus, Enthoven could well have been using Hammond's concept of "scientific due process" when he spoke of decisions needing "more objectivity, more logic" and "more scientific method" to be implemented by the "introduction of techniques of rational economic analysis."[3]

In discussing the A-7 program with the personnel of Systems Analysis it was continually emphasized that their analyses started from the base of Flexible Response and worked to the need for the A-7 as a means to that end. It was also apparent that the major reason Systems Analysis thought the A-7 was the best aircraft for the job was because of its low cost in relation to the other alternatives.

In contrast with this approach, the Air Force did not view the A-7 strictly as a means of implementing the new national strategy. As one of the Air Staff officers later noted,

> We [the Air Staff] didn't ever address it [the A-7] as a part of Flexible Response

[2]This was also the conclusion of James M. Roherty who linked the Systems Analysis approach with that of Secretary McNamara and wrote, "The terms and categories of economic analysis provided the model of rational decision-making for Mr. McNamara." Decisions of Robert S. McNamara (Miami: University of Miami Press, 1970), p. 71.

[3]Enthoven's address before the Naval War College, in Tucker, op. cit., pp. 142, 143.

> strategy; it was purely and simply that we recognized that in structuring our tactical forces we would need an airplane that would be able to do the close air support and interdiction job (particularly close air support) and that you would need a certain proportion of the force always able to do this. The A-7 would be able to do a particularly good job at this.[4]

The emphasis of the Air Force on the effectiveness rather than the cost of the A-7 is clearly evident. But more than this is present. Systems Analysis and the Air Force differed in their views of the aircraft and its later development fundamentally because they were performing different functions in DOD. This, by itself, breaks the mold of the unitary Defense decision-maker. If an understanding of Systems Analysis as an organization will assist in the explanation of the A-7 decisions, let us move on to the Organizational Process Model which takes into account differing organizational patterns.

The Organizational Process Model

The essence of the Organizational Process Model is that governmental behavior is less the result of the "choices" on a monolithic actor than it is the output of organizational interaction. The actors in this model are large organizations, each with a certain responsibility for a part of the national defense, but with specialized patterns of behavior.

[4]Interview. This was also confirmed by Dr. Brown in a letter to the author, September 9, 1970.

One of the conclusions of this research is that the Organizational Process Model is rather better than originally indicated, and it appears to hold great promise for future research. Based on the concepts of the Organizational Process Model, the 1963 Navy decision could be viewed not only as an implementation of Flexible Response, but as an output of the Navy/OSD interaction over the preceeding two years (which included the effect of the TFX decision on the Navy). The approval of the Navy selection of LTV was in notable contrast to the TFX contract award and was eased, no doubt, by the relatively agreeable relationship between Systems Analysis and the Navy on the attack aircraft issue.

The 1965 Air Force decision to develop the A-7 was a more organizationally complex process, largely because the Air Force requirements process had never generated a need for a subsonic attack aircraft of the A-7 type. Air Force doctrine, even as informal as it was, had for many years specified the use of multipurpose tactical fighter aircraft. There is little doubt from the evidence that Systems Analysis played a central role in nominating the A-7 for use by the Air Force. Yet, the process of getting the Air Force to accept the concept of a subsonic attack aircraft was not simple; it took support from DDR&E in the form of Dr. Brown's memorandum of June 1, 1964, the Bohn and Fish computer studies and pressure from the Army and Congress for a better close air support capability. These factors all involved organizational action to accomplish change.

One of Allison's major propositions in his Organizational Process Model is that organizations place a very high value on administrative feasibility as a decision criterion. Hammond calls this "administrative due process" and links the concept with the traditional military requirements generation process. An example of this criterion being applied in the A-7 case is General McConnell's notation that the Air Force needed a concurrence out of General Disosway as the commander of the organization that was going to employ the aircraft. General McConnell went on to describe why the concurrence of the TAC commander was important in the specific environment of the American political system. The Congress, he said, would ask General Disosway if he had agreed with the selection of the A-7, with the obvious implication that Congress would expect him to have been consulted in the feasibility of the decision. While there is no attempt to slight the use of a "scientific due process" or "technical rationality" in the selection of a weapons system, the evidence would seem to indicate a strong argument for the inclusion of an "administrative due process" in organizational decision-making.

It is important to remember at this point that the Air Force was not solely opposed to the Navy A-7A for doctrinal reasons; there were also technical factors that made the aircraft appear less desirable. The most significant of these was the lack of thrust in the original TF-30-P-6 engine. When compared to the extremely heavy load the A-7A could carry, the engine was considered insufficient by the Air Force and only marginally effective by the Navy. In fact, the thrust-to-weight ratio (one of the major determinents of performance) of the A-7A was considerably less than that of the A-4. Only after the Air Force developed the TF-41 Spey did the thrust-to-weight ratio of the A-7 come back up to approximately that of the A-4. The Air Force was not so much opposed to the A-7A because it was subsonic, but because it was considered to be woefully underpowered. Thus, the Air Force used technical rationality and applied it through organizational channels, with Headquarters USAF and TAC having the major roles.

The initial 1966 Air Force decision on the A-7 configuration was also influenced by organizational issues. Here it was apparent from the documents and interviews that the Air Force was not a monolithic body, but that different parts of the service wanted different capabilities from the new A-7. The Spey decision and the later avionics decision were both attempts to improve the technical quality of the aircraft, but they were the result of organizational and individual actions. This was in addition to the fact that the recommendations for the decisions were the product of a highly organized decision-making process in the Air Force Board Structure.

The question under study is not whether the Rational Policy Model or the Organizational Process Model is completely accurate--both may be useful in understanding public policy. The essential point is that the models show different aspects of the same process. Whether one is more useful in understanding the complexity of the decision process is for the author to suggest and for the reader to decide. But before we discuss these two models further let us examine the third model in the light of the A-7 case.

The Individual Influence Model

Allison's Model III, which we have chosen to call the Individual Influence Model, does not replace either of the other two models of policy analysis. Whereas these two models have highlighted aspects of national purpose and organizational interaction, the Individual Influence Model concentrates on the individuals in the policy process--individuals who are players in a competitive environment. The actors do not confine their attention to a single strategic issue, but act "according to various conceptions of national, organizational, and personal goals."[5] Once again it is important to state that this does imply any dishonest behavior or any lack of concern with the national defense or the public interest; the point is simply that honest men differ in their view of the best policy. Allison stated the situation of the actors in his Model III:

> The nature of problems of foreign policy permits fundamental disagreement among reasonable men concerning what ought to be done. Analyses yield conflicting recommendations. Separate responsibilities laid on the shoulders of individual personalities encourage differences in perceptions and priorities. But the issues are of first order importance. What the nation does really matters. A wrong choice could mean irreparable damage. Thus responsible men are obliged to fight for what they are convinced is right.[6]

The A-7 decision process viewed through the lens of the individuals involved looks quite different than the same process through other lenses. With this perspective one should ask what difference did it make that it was Robert S. McNamara who was Secretary of Defense from 1961 to 1968 instead of (say) Clark Clifford or Thomas S. Gates. From the evidence it seems fair to conclude that it made a great deal of difference that McNamara was the Secretary of Defense, that Dr. Enthoven was heading the

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[5]Allison, op. cit., p. 707.

[6]Ibid.

Systems Analysis office, and that Dr. Brown was the head of DDR&E. On the 1963 Navy decision to develop the A-7, one can conclude that it also made a significant difference that Murray was the primary Systems Analysis official to oversee the Sea-Based Air Strike Forces study and the following competition. Murray's experience at Grumman had acquainted him with Navy people, so that he was much more acceptable (to the Navy) as a critic than others in Systems Analysis.

The Air Force decision to develop the A-7 was accomplished after the computer studies had shown that <u>some</u> low-cost attack aircraft would increase the capability of the force, but in retrospect it seems fair to conclude that Dr. Brown's move from DDR&E to Secretary of the Air Force was also a factor. It is, after all, a personality characteristic to be known as a "rational man," and Brown established a reputation for objectivity among defense officials. It is also significant that General McConnell and Secretary Brown developed such a close working relationship.

One of the clearest examples of the utility of the Individual Influence Model is indicated by the effect of the project managers on the A-7. We have noted (strictly as observers) that Hails and Doss made contributions that were clear and pivotal to the A-7 program. The evidence indicates that their personal knowledge of the systems management business, the intricacies of joint service development, and the other individuals in the decision process played an important role in their management of the A-7.

The initial configuration decision was really a joint effort of the Air Staff and representatives from TAC and the Project Management Office. On the other hand, the Spey engine decision was uniquely the result of Hails' personal efforts, although General McConnell had previously paved the way for the reentry of Allison into the jet engine business.

Colonel Hails also played a very important part in the development of the improved avionics system, but all the evidence (including Hails' own accolades) point to the conclusion that Captain Doss deserves a large part of the credit for the avionics. Indeed, the magnitude of Doss' accomplishment can only be fully understood if one understands the driving nature of his personality. This is not a random conclusion of the author, but it is confirmed by virtually every participant in the decision process who knew Captain Doss.

Having said this--that decisions are influenced by individuals, organizations and national goals--what can we say about the relative utility of the models?

Allison has pointed out that the Rational Policy Model has been, for many political scientists, the implicit explanation of national behavior. Such a simplification of reality is often useful and even necessary in a complex world of almost two hundred nation-states. That so many events and international crises arise unexpectedly is ample evidence of the need for more sophisticated models.

Allison has proposed two additional models for investigation, but his line of demarkation between them is not clear. For instance, his Model III actors are "players in positions," but the positions they occupy are organizational chairs, and the argument they use are often generated by organizational factors. Partially as a result of this overlap other researchers have expanded the number of applications of the models, but have merged Models II and III into a single alternative.[7]

There is also the question of data requirements, and here the three models differ greatly. The requirements of the Rational Policy Model are relatively modest. A knowledge of history and macroeconomics will go far in suggesting general "national objectives" and "historical trends." The Organizational Process Model requires more complex kinds of data--on the participant agencies, their histories, constituents, and standard operating procedures. Still, these kinds of data are generally available and

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[7]One of the most recent of these is Morton H. Halperin, "The Decision to Deploy the ABM: Bureaucratic Politics in the Pentagon and White House in the Johnson Administration," unpublished paper delivered before the Sixty-sixth Annual Meeting of the American Political Science Association, Los Angeles, California, September 8-12, 1970. See his forthcoming book, Bureaucratic Politics and Foreign Policy.

accessible to the diligent researcher. On the other hand, the Individual Influence Model requires either a quantum jump in the amount of data or an especially talented researcher. (In some cases both may be required.) Should the data be available, there is little doubt that policy analysis will benefit greatly from the application and extension of Allison's Model III. The example of Richard E. Neustadt's, Alliance Politics is a classic case in point.[8] If the data, as indicated in Neustadt's work, is sophisticated and the analysis requires expertise and sensitivity, the pay-off's in terms of understanding and prediction are great. However, the costs of such research and talent are high, and advances in the near term may also be obtained from organizationally-oriented analysis.

A few final comments about the relationship of each of the three models to the research at hand may be in order. First, it should be clearly understood that almost every actor described his participation in terms of what was the "right" course of action. That is, they all saw their activity in terms of rationally fulfilling national, organizational, and personal goals. However, this individual rationality is not the same as the Rational Policy Model which assumes a unitary, national decision-maker and a single strategic issue against which policy is measured.

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[8]Richard E. Neustadt, Alliance Politics (New York: Columbia University Press, 1970).

To the extent that the Rational Policy Model would explain the A-7 as a means to the strategic end of Flexible Response, that model was not sustained. The participants in the process, when interviewed, seldom referred to Flexible Response as the base of their actions. From this we may infer--however valid and important a national strategic policy may be,--that there were other issues of vital significance to the participants.

The evidence indicated that both organizational and personal factors were of primary importance to the actors. In general, the references to these factors described <u>how</u> the many organizations in the process differed in their approach to the A-7, but they did not explain <u>why</u> they were different. The next model was generated by the author in an attempt to answer some of the questions about why the organizations and individuals differed in their approaches to the A-7.

The Professional Organization Model

The conception of an alternative model was initiated with the hypothesis that professions might somehow be important in the environment of defense. Based on this an original model was outlined around the four basic professions of Economics, Engineering, Military Operations, and Military Systems Management. The research was not very far along when this limited model was recognized as being inadequate. One of the participants who commented on the merger of organizational influences with the professional perspectives was Dr. Victor Heyman. When asked how strong the economics influence had been in Systems Analysis he said,

> It's not economics but the concept of quantitative analysis and marginal utility. It is really systems analysis. All of us had this perspective; we either had it when we came or we learned it damn quick.[9]

At this point in the research the idea of a "professional model" was dropped,or rather expanded to incorporate the profession/organization merger indicated by Heyman. The Professional Organization Model that evolved was an attempt to abstract the essential features of the decision-making process on the A-7 aircraft. Allison's Organizational Process Model provided the base upon which this model was built, although some of his Model III concepts were used also.

The use of the term "professional" in this model is restricted to Huntington's three requirements: expertise, responsibility, and corporateness. As such, it incorporates those individuals who perceive themselves to be part of a distinctive group based on a proven body of knowledge and with a tradition of service. One of the important contributions of professionalism to this model of policy

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[9]Heyman interview, March 12, 1970

making is the establishment of shared values, such that the actors seldom consciously realize they are conforming; they are instead merely doing what is "right" according to their standards.

The model is outlined below:

<u>I. Basic Unit of Analysis</u>: Decision-Making is the Product of Intra and Inter-Organizational Bargaining, Strongly Influenced by Professional Perspectives and Environmental Constraints.

<u>II. Organizing Concepts</u>:

A. Actors: The actors in the process are mostly individual professionals (some of whom are political appointees) participating largely through organizational channels.

B. Division of Responsibility and Authority. The complexity of modern technology and the power of specialized knowledge require that organizations distribute responsibility and authority into various parts of the agency. The result is to magnify the role of discretion and permit the development of selective perception based on professional concepts and doctrine.

C. Decisions are Politically Important Choices strongly influenced by:

1. Consistency. The desire to be consistent generally leads the organization to maintain positions

unless there is a thoroughly justified requirement for change.

2. Consultation. The decision-making process in large organizations attempts to generate a wide base of internal support; therefore the major segments of the organization will be consulted in some regularized manner on every major decision.

3. "Satisficing." Since it is virtually impossible to generate internal concensus if the decisions are consistently dominated by one group, there will be a tendency to satisfy (satisfice) as many groups as possible. This is, in fact, a process of continual internal bargaining among professional groups.

4. Time pressure. The press of external events and the demands for action disrupt the smooth flow of coordinated organizational activity and causes the organization's attention to problems to be sequential.

5. External bargaining. Organizations seek to reduce the amount of substantive uncertainty in their operation. Therefore, they will seek to negotiate agreements with other organizations as to their respective roles and missions. These agreements increase the overall efficiency of the agency, but they must be updated frequently because of the rapid advance of technology. The nature of external bargaining can be either formal or tacit, but

both forms have the effect of being "policy."

6. Technological Change. The rapid and unpredictable nature of technological change and innovation places great stress on the decision-making process. It does so for two reasons. Technical innovation has the capability to make roles and missions agreements obsolete because of the difficulty of precisely defining the appropriate mission for newly developed systems. Second, rapid technological change impacts directly on the personnel structure and forces the continual evolution of new professions which differ from the traditional professions that established the organization.

7. Organizational learning and incremental change. The organization's requirements for internal consistency temper the demands for organizational change to what is administratively feasible. Learning, and especially the learning of new analytical techniques, does occur, and it is a vital force for change in the organization. However, revolutionary changes endanger the very fabric of organized action; therefore, most change will be evolutionary, incremental, and only taken after extensive consultation.

D. Central Coordination and Control. Areas of specialized knowledge and the division of organizational responsibility place very real limits on the centralization of decision-making authority. The development of sub-professions in these many areas make centralization even more difficult in the large organization. The propensity of problems to overlap areas of professional competence and organizational responsibility presents the opportunity for centralized control through a structured decision process. The maintenance of democratic responsibility almost requires that the diverse efforts of the specialists be coordinated and controlled at some responsible point. However, the development of professional norms and values within the members tends to unify that portion of the organization. Central coordination and control in the professional organization will tend to be proportional to the degree to which the goals of the large organization are congruent with the values of the sub-profession directly involved.

E. Decisions of Government Leaders. International events, crises, Congressional requests, competing programs, and self-imposed deadlines combine to demand that decisions be made. The difficulties, uncertainties and risks under such circumstances are an inseparable part of the decision-making process. The role of politically appointed officials at the head of an agency is especially important because they have some opportunity to select the issues, programs and doctrine to be employed.

III. Dominant Inference Pattern. Since decisions are the product of organizational output and professional perspectives in a bargaining environment, each of these three factors influences the decisions. The organizational influence is explained by discovering the channels of communication, the patterned modes of behavior, and the formal and informal authority of the actors. The influence of professional perspectives can be determined by a knowledge of the agency's history, its operational doctrines, and concepts.

The influence of the bargaining environment is especially important when organizations do not immediately agree on the course of action to be undertaken. In this situation the priority of an individual program and the prestige of its advocates must be related to other programs that were under consideration. The model's explanatory power comes from the description of: the actors, their intentions and perceptions of each other; the organizations and their professional perspectives; and the overall environment which required decisions to be the resultants of pluralistic bargaining.

IV. General Propositions.

A. Organizational action is generally limited to that consistent with professional doctrine. The actions taken will reflect the concepts and practices of the profession and will be influenced by the routines, programs and plans of the agency. Where actions or programs are not consistent with professional doctrine, resistance to those actions or programs may be expected.

B. The internal requirements for predictability and consistency dictate that when organizational change occurs it will generally exhibit limited flexibility and incremental change.

C. The decision criteria applied by large organizations will usually include administrative feasibility--the concept of "administrative due process." This is especially true in professional organizations where the standards of performance are internally generated and based on expertise and competence. In such organizations, there is very likely to be a strong informal--if not formal--decentralization of decision-making authority to the level where specialized knowledge dominates.

The professional organizational model is not presently equipped to determine which of several policies is the best course of action. Its value lies more directly in the appreciation of what is happening within a large organization. Specifically, it cannot predict which set of actors will prevail in the decision process, but it hopefully can aid in determining which of several actor-groups are most directly affected. Once the impact of a policy or a proposed policy on several groups is determined or approximated, a general expectation of reaction can be developed by comparing the proposed policy with the history of professional values and norms of the affected groups. When the product of this process is combined with the knowledge of individual personalities, the result may well be a prediction of who will react with what energy. This, in turn, may lead to a prediction of the eventual resultant policy.

It may aid, for instance, actors in large organizations in identifying trends and positions in their own decision-processes. The potential for this subtle analysis was implied in Dr. Enthoven's reflection on the A-7 development. He was asked to what degree the professionals in Systems Analysis were perceptive to the issues and individuals in the other DOD organizations:

> I think that as a general point that the dominant point of view in Systems Analysis, in the Office, was an analytical one. The reason that most of the people were there was their training in analytical method and their knowledge of how to analyze. We were all generally pretty oblivious--I certainly became more aware of it personally in later years, how strong the feelings were on some of these things--but they tended to be not very sensitive. We did, I think, underestimate the depth and intensity of the feelings.[10]

Although there is a common tendency to divide technical rationality and personal feelings and to view

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[10] Enthoven interview.

them as competing arguments over policy choices, this study indicates that the two are difficult to separate. Thus, Systems Analysis wanted the A-7 because it was the rational means to the end of Flexible Response, but the Air Force and the Navy wanted a close air support/interdiction aircraft with a sufficiently powerful engine to survive. The fact that the Services had experience with underpowered aircraft over the years confirmed the pilot's opinions that underpowered aircraft were dangerous, suffered high losses in combat, and were an overall bad investment. This points out that the Services and Systems Analysis were all basing their arguments on rational grounds, but many of the actors viewed each other as having only emotional attachment to policy alternatives. On this issue, Allison's three models and the Professional Organization Model interact, because each of them provides insight into a part of the overall process. The engine decision was a combination of rational, organizational, individual and professional issues, all intertwined.

This outline of the Professional Organization Model is not meant as a general decision model for all organizations. It is meant as more or less a residual category that explains certainly not all, but when used in conjunction with the other models, has the capability to provide analysis that will explain more of the process than previous studies. What does the Professional Organization Model suggest as explanations for the decisions in this study?

The 1963 Navy decision has been explained in terms of an implementation of Flexible Response, as an organizational interaction between Systems Analysis and the Navy, and as the result of individual activity. In addition to these portrayals it was influenced by two professional factors. First, the Navy had for some time developed two specialized groups of pilots--attack and fighter pilots--each of which had more or less been preeminent in a specialized area of naval warfare. In addition, aircraft had been generally divided in the Navy into attack and fighter categories (plus others), because technology was incapable of producing an aircraft to meet both the air-to-ground and air-to-air requirements of the Navy. That the professional attack pilots believed in the concept of a subsonic attack aircraft was attested to by Captain Suerstedt, Navy A-7 project manager, "You don't carry coal in a Cadillac and you don't race a pick-up truck at Indianapolis."[11] Captain Suerstedt reportedly went on to relate how the A-7's slow speed and non-afterburning engine were an advantage when attacked by enemy fighters. The important point to be made about this professionalism is not that the attack pilots argued for another subsonic aircraft irrespective

[11]Quoted in Aviation Week and Space Technology, March 30, 1964, p. 16.

of its technical merits; the point is that the attack pilots believed that the concept of a subsonic attack aircraft was technically viable, tactically valuable, and a definite contribution to the national defense.

The second example of professionalism entering the 1963 decision was the ease with which the Navy selection of LTV at the competition winner was accepted by OSD. Although there may have been other reasons too, Murray noted that his organization respected the professional qualifications of George Spangenberg and accepted the recommendations of his Evaluation Division.

> George Spangenberg did his usual, first-rate,excellent job on the competition. . . Nobody in our shop was competent and nobody in DDR&E was competent to second guess George on what the airplane was going to do and how much the contractors' estimates should be changed. From my point of view having known George for a long time, I figured that anything he said was the most knowledgeable, authoritative source on performance.[12]

The Air Force decision on the A-7 showed many aspects of professionalism, but in a different organizational context. The Air Force had no specialized attack pilots in 1965, but it did have a large group of pilots with experience in multi-purpose tactical fighters, and it had an informal doctrine on the value of multi-purpose fighters. The experience of this group of pilots did not rule out the possibility that a subsonic attack aircraft

[12] Murray quote from page 207.

could be used, and used effectively under certain conditions of war. (The Air Force was already using the 140-knot A-1E in Vietnam.) However, there was a widespread belief that the subsonic aircraft with a low thrust-to-weight ratio would not have the survivability of a supersonic one, and that to buy aircraft that were not survivable in an intense enemy environment would be inefficient, ineffective, and jeopardize national security.

The two computer studies had the effect of modifying the Air Force doctrine on multipurpose fighters, and this in itself showed the professional nature of the decision process. Studies have demonstrated that professional organizations in the public service--when confronted with reliable data on changing conditions--have been among the most receptive to organizational innovation.[13] Thus, the primary result of the Bohn Study was to show the Air Force planners that the overall force would be improved by some small number of specialized close air support aircraft, even if that aircraft was to be subsonic. The Fish Study reaffirmed this conclusion and proceeded to show how the capabilities of theA-7 could be compared to the other candidate aircraft.

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[13]See, for instance, the case of the nurses in a mental hospital welcoming changes based largely on their professional training which helped determine the nurses values and precepts and gave them a strong inclination toward innovation. Leonard I. Pearlin, "Sources of Resistance to Change in a Mental Hospital," American Journal of Sociology, Vol. 68 (1962), pp. 325-334. See also, Frederick C. Mosher, The Reorganization of the California State Personnel Board, Inter-University Case No. 32 (University, Alabama: University of Alabama Press, 1961).

Another aspect of professionalism on the two decisions to develop the A-7--the Navy and Air Force decisions--was that Systems Analysis consistently backed the A-7 because it met the economic criterion of a low cost/high cost-effective aircraft. As the aircraft was changed by the Air Force and Navy to incorporate new systems and an advanced weapon delivery capability, the cost necessarily rose. Whether the exact ratio of cost-effectiveness kept pace with the rising cost is difficult to prove conclusively, but the evidence shows that Systems Analysis did not believe it did. The result was that as the A-7 began to creep outside of the category of a low cost aircraft, Systems Analysis turned against additional procurement except where it was viewed as an alternative to the much more expensive F-111.

Two of the major changes to the Air Force A-7D from the original A-7A were the incorporation of an improved avionics system and the inclusion of survivability/vulnerability features. These changes increased the cost of the aircraft, but they were changes directly in line with what the Air Force considered essential for a specialized attack aircraft. Although it may not have been consciously present in the decision-makers' minds during this period, the major reason for the demise of the attack category in the Air Force in the late 1930's had been the lack of weapon delivery accuracy and the extremely high attrition rate in low level attacks on close air support targets. The technological capabilities which allowed the multi-purpose World War II fighters to perform the ground attack role successfully reinforced the decision to do without the disadvantages of the attack aircraft. However, the extremely high attrition rate in the ground attack mission was proven in World War II, the Korean War and again in Vietnam. The lessons the Air Force learned from this and incorporated into informal doctrine were that if aircraft were to be used extensively in the close air support mission, they had to be capable of very accurate weapon delivery and they had to be survivable. Thus, the avionics and survivability changes were not only in line with Air Force professional thinking, they provided the aircraft with a significant improvement in cost-effectiveness despite the increased cost.

Many of the other elements of the Professional Organization Model can also be shown to have operated during the process. The Air Force did use "standard operating procedures" in the Air Force Board Structure that recommended the changes to the A-7. Standard programs, repertoires and plans were used in the computer studies. One of the best examples of "uncertainty avoidance" is the Air Force/Army negotiation of the 1966 Roles and

Missions agreement right in the middle of the A-7 decision process.

This agreement stated that the Air Force would operate all cargo/airlift aircraft, but that the Army would be allowed to operate and develop rotary-wing aircraft. This gave the Army a green light for the continued development of the Cheyenne armed helicopter, which was viewed in the Air Force as a direct competitor with Air Force fixed-wing aircraft in the close support mission. The Air Force was placed in the position of having to continue to demonstrate its interest and activity in developing new weapons for close air support, and the A-7 was the prime example of that activity. The roles and missions agreement was an attempt at a "negotiated environment", which would regularize relations between the Army and the Air Force. Thus, by continuing to develop the A-7, the Air Force was protecting a large investment in tactical air forces--an investment it considered essential for national security.

Professionally, the decision to begin development of an afterburner TF-30 engine and add a moderate improvement on the Navy avionics system were incremental changes, but both were in line with long-held Air Force views (more power and better bombing). The Spey was an unusual decision in that it met the professional criteria of all of the organizations involved--more thrust, higher thrust-to-weight ratio, lower fuel consumption, lower cost, and had the additional, unexpected advantage of providing an opportunity to buy from the British in an exchange agreement.

The decision on the improved avionics system also demonstrates features of the Professional Organization Model because of the recognized activities and discretion of the Project managers. The concept of project management was seen to work very well in an organization where the range of personal behavior was limited by professional values and concepts.[14] Thus, the project managers had a certain discretion, but it was consistent with their training and was additionally constrained by the administrative due process through which they had to submit their proposals.

Once again the 1969 Congressional decisions do not seem to fall into the too-neat categories of our model. There were, however, professional qualities present in even this overtly political environment. For instance, it was an acknowledged fact that the Senate Armed Services Committee was more inclined to favor supersonic, multi-purpose aircraft programs (the F-4) than was the House Armed Services Committee. The presence of Senators Goldwater, Cannon and Symington (two Major Generals in the Air Force

[14]For the classic study of professionalism as a unifying and control mechanism, see The Forest Ranger: A Study in Administrative Behavior, by Herbert Kaufman (Baltimore: Johns Hopkins Press, 1960).

Reserve and one former Secretary of the Air Force) may have contributed to that committee's understanding of professional Air Force values and doctrines. The Tactical Air Power Hearings of 1968 indicated that the committee did not share a similar set of values with the Systems Analysis organization.

What is the overall fit of the A-7 decision process with the Professional Organization Model? The most important result may have been to explain some additional reasons for the decision processes unfolding or moving the way they did. Some of the organizational and individual aspects had been mentioned previously in two other models, but this model added the dimension of the professional differences and values of the decision groups. It is hoped that this discussion has highlighted some of the reasons the groups differed in their approaches to the A-7, although the exact casual relationship is never exact or certain.

There is one vital aspect of the decision process that should be added to the Professional Organization Model if additional research is to be done. This became apparent as the research was being conducted. It is based on the fact that this model was conceived largely around the concepts of organizations being the important influences. In the research it became apparent that to ignore the individuals as specific inputs to the process would be to lose not only the vitality and initiative of the participants, but an essence of reality itself. One of the most complex issues that needs more research is an understanding of the cross-pressures on individuals from their immersion in or exposure to different professional standards. This is doubly true in technological areas, because the evolving technology affects, and is affected by, the continual development of new professions and sub-professions. Thus, many of the actors in the A-7 case had to train themselves and exercise judgment, not in the tradition of the original profession they were trained in, or even the secondary one, but in the new professions of the 1960's. The example of the relatively new profession of project management is clear. Project management unified certain actors in the case, but it is not a simple combination of professional skills; it is a subtle marriage of many elements where the product does not resemble any of the ingredients.

Therefore, a recommendation for further research in this area is that scholars find methods to incorporate more of Allison's Model III into the research methodology and aim at moving to greater precision and refinement in providing for individual personalities. This will be a most difficult task. The basic problem is in the requirements for data. As we have noted, the Rational Policy Model has very simple requirements; the Organizational Process

Model and the Professional Organization Model impose increasingly greater requirements. On the other hand, the Individual Influence Model expands the data requirements tremendously, incorporating as it does many of the vagaries of human personality. While the case study method makes some provisions and is useful for this approach, the amount of research can be overwhelming unless the topic is narrowed perceptibly.

These recommendations to broaden the models to include more account of individual personalities are made in the hope that the resultant analysis will be more realistic, more perceptive, and provide the basis for better judgments. There are an increasing number of studies with this focus, starting with Neustadt's Alliance Politics, an analysis of the U.S./U.K. relationships during the Skybolt and the 1956 Suez crises.[15] The studies thus produced reinforced in the author the belief that such an approach would be useful, but they did not originate it. The genesis of the recommendation came from the participants in the decision process, as they were advising on ways to understand the extreme complexity of the A-7 decisions. I have now taken their advice.

But the models are not the only important part of the A-7 case. Whatever they may contribute to the understanding of public policy and decision-making is welcomed,

[15]Other policy analysts who are contributing to the advance of this new frontier include Halperin, Hilsman, and Schilling. James M. Roherty in Decisions of Robert S. McNamara also takes the position that "it is the men" that make the policy, op. cit., pp. 17-18.

but there are several issues that fall outside of or are not neatly compartmented into policy models. They are issues of significance in the field of national defense that were prominent in the milieu of the A-7 program. They, too, hopefully will add something to our understanding of government and defense.

Issues Highlighted by the A-7 Program--Systems Analysis and Computer Studies

When Systems Analysis was originated as an office in the Comptroller shop of OSD in 1961 the state of the art in defense planning and computerized analysis was much less advanced than it is today. The application of computer studies and large, theater-wide war games to planning and the selection of weapons had been pioneered by the RAND Corporation, and many of RAND's former employees carried an advocacy of the new techniques. Thus, one of the formal jobs given to the Systems Analysis office by Secretary McNamara was to increase the use of quantitative analysis by the agencies of DOD.

For many of the practitioners of the new technique there seemed to be a genuine belief that quantitative analysis and the systems approach would provide the technical "answers" to the problems of weapons selection and force planning. To a large degree they were undoubtedly correct, although the field of strategic weapons systems (bombers, intercontinental missiles, etc.) proved to be more tractable to quantification than the field of tactical weapons. As noted by Dr. Thomas P. Cheatham, the Deputy Director of DDR&E for Tactical Warfare Programs (in 1965):

> While strategic alternatives are mostly scientific and logical in nature, we find tactical warfare alternatives are a blend of both science and art, where changing and imaginative tactics are a significant variant.[16]

The major obstacle in the way of making the decisions on the A-7 into "technical" decisions--and therefore capable of resolution solely by synoptic analysis--was the fundamental disagreement over the nature of tactical warfare. There was little disagreement between Systems Analysis and the Air Force on what bomb-load the A-7 could carry or even in how fast it could fly. The major areas of contention during the Fish Study were over the determination of a realistic attrition rate in the air-to-air and air-to-ground battles and--even more critical--how much close air support was to be done in comparison with the other tactical air missions. Thus, the supposedly technical decision of selecting the most cost-effective aircraft in the war game was vitally affected by the value elements that were in turn influenced by professional experience. As General Graham put it for the operations profession,

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[16]Cited in Report of the Pike subcommittee, 1966, op. cit., p. 2.

> There is help and there are things you can eliminate because of the capacity of the computer, but you still have to build the airplane, and you still have to take advantage of the experience of people who have built and flown airplanes.[17]

The softness of the data was often recognized in the staffs of the Services and Systems Analysis. Although there were many areas where the data was reliable and agreed upon, it would be wrong to assert that Systems Analysis forced every variable into a quantitative strictness. Heyman later commented on the recognized subjectivity of some of the analytical studies,

> Each year at least I would make a trip down to TAC. . . and when you got down to the working level, if what I was saying didn't make sense to them [the pilots] I got awfully weary with our analyses because I never did trust them very far. They were terribly unsophisticated, and if you made them sophisticated you just didn't have real numbers to plug into them.[18]

This is not meant to indicate that studies were not objective or scientifically valid. Participants in the process noted constantly that there were great benefits from the use of explicit analysis, and that their contributions would undoubtedly provide better, more accurate decisions. It is perhaps sufficient to add that decisions must still consider value judgments, and that there is room for honest disagreement about many of the important variables.

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[17] Interview, February 11, 1970.

[18] Heyman interview.

Beyond the question the objectivity of analyses, the A-7 program demonstrated several examples of the use to which studies were put. The Bohn Study was done by the Air Force and demonstrated that within a large enough force structure the quality of the tactical forces would be improved by the addition of some specialized close air support aircraft. The study was cited by Secretary Zuckert's memorandum as supporting the recommendation to buy F-5's for the Air Force. The Bohn Study was subjected to a Systems Analysis critique which pointed out certain limitations. In turn, the Air Force prepared a counter-critique that showed where the Systems Analysis critique had gone beyond the data in discussing the Bohn Study. The same type of interplay was present in the 1968 A-7/F-111 force structure studies.

It could be argued that these different studies demonstrated the futility of ever obtaining agreement on important issues. That would be a difficult thesis to maintain, and it would neglect an important value of analysis in providing another criterion to measure policy, and--perhaps more importantly--the degree to which the analyses provoked thought and new approaches.

The conclusion about the value of conflicting studies raises the question about the importance of different points of view in defense decision-making. It was a point that was emphasized by Dr. Enthoven when he was asked about the contribution of his organization.

> I wouldn't want to give you the impression that everything was serene, cool objectivity in the Systems Analysis office, nor would I want to defend the existence or the record of the office on that ground. I think there's no doubt that people in the office did "fall in love with their findings". . ., and my defense of that would be that if they come at it from a different point of view that is independent of the services and try to come at it from the point of view of accomplishing what the Secretary of Defense does or wants to accomplish, that will give the Secretary of Defense and the Department some alternatives, some choices, some competing points of view and will be likely to lead to a better solution than if the whole thing were approached from the Service point of view.[19]

At the same time that policy decisions stand a chance to be improved by the interplay of different views, the possibility exists that one view may come to dominate the others. This was one of the concerns of James R. Schlesinger of the RAND Corporation as he was writing in 1968 of some of the lessons of the McNamara administration.

> Although OSD may set out to examine alternative actions systematically, there is danger that the system will work to shorten the list of alternatives that are seriously entertained. . ..
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> The heavier the reliance on one group's views, the greater the risk of neglecting alternatives. . . Affirmative control or the attempt to exercise such control in an organization as large as the Department of Defense requires arraying the alternatives quickly, focusing on the main considerations quickly, and making choices quickly. All this means the rapid screening and disposition of alternatives and the use of rules of thumb to help with this task. In

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[19] Enthoven interview.

> other words, the pressures on a small group at the top make the cost of fully exploring numerous alternatives high, and eventually the quest for alternative solutions is likely to become less eager.[20]

These tentative conclusions on the nature of an organization like Systems Analysis and its studies must be tempered by the limitations of the single set of data relating to the A-7. Still, certain tendencies of the organization were demonstrated in the narrative. Although Systems Analysis and the Services talked in terms of cost-effectiveness, Systems Analysis personnel continually emphasized the cost, and the services emphasized the effectiveness of proposed systems. Murray noted that, "They [the Services] never got as concerned as we did about the cost."[21] On the other hand, General McConnell stressed that, "With the very survival of our country at stake,. . . the real aim is not 100 per cent efficiency, but 100 per cent effectiveness."[22] The difference in perspective is due largely to the respective roles the organizations were assigned in the national defense system and in the types of people those organizations attracted.

The Systems Analysis emphasis on cost, and specifically on the low cost of the original A-7A, led the organization

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[20]James R. Schlesinger, Defense Planning and Budgeting: The Issue of Centralized Control (Rand P-3813, May, 1968), pp. 22 and 25.

[21]Murray interview.

[22]Remarks by General John P. McConnell at the 51st Annual Dinner Meeting of the American Ordnance Association, Washington, D.C., May 14, 1969.

to view changes that threatened to increase the cost with skepticism. From the Systems Analysis point of view, the A-7 became more expensive than the aircraft's effectiveness would justify. This view was apparent in the process and in some later remarks by Dr. Enthoven. He was asked what conclusions he drew from the A-7 case, his words relay not only his feelings about cost-effectiveness and the importance of the administration of decisions, but about the role and power of the Secretary of Defense and OSD:

> I suppose one of them would be that it's really important when a decision is made to see to it that the implementation of the decision is controlled along the lines that it was intended to be made. . . .
> It shows a lot of other things; it shows that the powers of the Secretary of Defense are really much less than are commonly supposed. You get the impression from the popular press, especially when McNamara was in office, that the Secretary knows all and controls all, and that really isn't the case. The Secretary of Defense, even with McNamara, is sort of just one influence on the thing and it is largely a negative kind of control He can prevent bad things from happening. . .but it is very hard for him to make things positively happen.[23]

National Defense Strategy and Weapons Development

This study was begun with the thesis that there was an important interrelationship between the selection of a national defense strategy and the subsequent development of weapons. While the relationship between the two is

[23]Enthoven interview.

usually classified in the rhetoric of "ends-means" analysis, the research points out a few limitations to a narrow conception of this dichotomy. While it is certainly granted that the specification of a national strategy is an important part of defense policy, it appears there are potential dangers in any inflexible selection of weapons to satisfy a single strategic policy. The A-7 provides a case in point.

The Navy developed the A-7 primarily to improve the qualities of its carrier attack force. The conceptual origin of the aircraft was actually during the era of Massive Retaliation (1960) although it was not approved for development by OSD until 1963. The aircraft was approved for the Navy and promoted for Air Force use by Systems Analysis under the strategy of Flexible Response. Yet when the national strategy changed from Flexible Response to the Nixon Doctrine in 1969, the Air Force A-7 was still not operational. The enemy threat in 1970 was vastly different from that in 1963, as was the economic condition of the nation and a host of other factors. The question arises, if a weapon system could be perfectly developed to maximize one particular specialty under a single strategic policy, to what degree would it be completely obsolete under a different policy? The underlying question is how should the nation's research and development community deal with strategic uncertainty?

Schlesinger answered this question and combined his answer with an admonition against the too-early specification of weapon and mission effectiveness,

> . . .since the future is dominated by uncertainties and since both future strategic threats and opportunities can be discerned only in the grossest terms if at all, it is impossible to be even roughly accurate in indicating the nature of missions assigned to new weapon systems or in measuring their effectiveness. The Services should resist attempts by OSD to obtain precise specification of the mission of systems right through the development cycle, pointing out that uncertainty regarding future strategic contexts precludes mission specification and that under the circumstances precise estimates of effectiveness are contrary to the ground rules of cost-effectiveness analysis. One may infer that the demand for precise mission specification at an early state in the development cycle suggests an inclination to resist development under existing conditions.[24]

This conclusion should not be taken to mean that weapons can be developed independent of a national strategy for their use, quite the contrary. The hope is that when the time comes to use weapons in the interests of national defense, there will be a strong link between the weapons and the strategy for their employment. The difficulty lies in predicting the future. To neglect the future uncertainties because they are difficult to specify, quantify or comprehend, is to tie future weapons development to current theories. This is closely akin to the development of

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[24] Schlesinger, Defense Planning and Budgeting, op. cit., pp. 51-52.

weapons designed to win the last war, a philosophy for which the military services in many countries have been criticized.

In the case of the A-7, the very real issue was whether and to what extent the Services should have developed weapons to fit the unique characteristics of the Vietnam War. On this issue there was a significant divergence of opinion, both inside and outside of DOD. General McConnell was very firm in his insistence that there was too much pressure to get an aircraft to fight the Vietnam War, an aircraft that might not be able to stand up in a more intense enemy environment elsewhere. This issue was heightened because of the lack of agreed upon empirical evidence to prove conclusively to all parties (OSD, Air Force, Navy) the cost-effectiveness of supersonic versus subsonic attack aircraft.

Another of the difficulties of relating the development of the A-7 directly with a national strategy was the fact that the participants in the decision generally did not combine the two. We have noted how the Navy viewed the A-7 as merely a follow-on to the A-4 in the attack forces, and that the Air Force merely wanted an aircraft that was particularly good at close air support.

Even though the participants in the decision may not have addressed the A-7 as a means to the end of Flexible

Response, it is extremely difficult to say that what they described was not, in fact, the same thing. That is, how can one separate the implementation of Flexible Response (which included the build-up of tactical air forces) from acquiring a better capability for close air support and interdiction? Similarly, if the Air Force developed the A-7 in response to an Army demand for increased close air support, can this be denied to be a part of Flexible Response?

The point of this conclusion is that it is very difficult to separate ends and means, and it is especially tenuous with research and development programs that may take five or ten years to produce an operational capability. A concurrent point should be made however. That is,that changes in weapons development programs--however originated-- alter not only the program intended, but affect the national strategic capability as well. This extends from the fact that the weapons are an embodiment of the national strategy; there can be no viable national defense strategy without the means of implementation. Thus, when a weapons program is cut back because of inflation, or a modification is made to add a certain capability, the net effect is to alter the national strategy. This is only another way of saying that relatively minor changes to one part of the national defense establishment have a way of affecting other parts as well, and the total effect may be significant and quite other than that intended.

Technology and Weapons Development

The A-7 also presents a case on the interaction of technology with weapons development. The turbofan engine and the improved avionics system were two technical innovations that were proposed to increase the capabilities of the tactical forces. Whereas the turbofan engine met almost no resistance, there was a significant amount of skepticism over the cost-effectiveness and reliability of the avionics system. Why was this so, and what does the data show about the different organizations and professional attitudes toward technology?

The first use of the turbofan engine in an operational aircraft was in the TFX/F-111, although it had been planned earlier for the Navy's Missileer. The new engine promised to increase significantly the range of tactical aircraft and was the primary reason for the replacement of the A-4 Skyhawk by the A-7 in the Navy. Although the turbofan engine promised an increase in range, it offered no corresponding increase in thrust or speed, but the aircraft carrier's catapult system provided an assist to get the planes into the air. The data showed that one of the reasons the Air Force was not as interested in the

A-7 as the Navy had been was the relatively low thrust of the Pratt and Whitney TF-30 engine. Lacking the catapult system, the Air Force was looking for a more powerful engine to provide a shorter take-off roll, and the Air Force strongly desired the increased performance. This was demonstrated by the Air Force insistence on an afterburner and then the change to the Spey engine. This is not to say that the Air Force did not appreciate the value of the increased range offered by the turbofan; it does show that the Services had different requirements for their attack aircraft.

The avionics system decisions show a somewhat different sequence. The Navy A-7 was originally planned to incorporate the ILAAS system, but the ILAAS development did not progress to the point where it showed adequate promise. There is little doubt that the initial push for an improved avionics system came from Tactical Air Command, although there was considerable support in Air Force Systems Command and in the research and development specialists in the Air Staff. This demonstrates the general rule that--while the military has been accused of being slow to adopt technological innovations in the past--since World War II the operations profession has pressed for the maximum capability possible. Why is this? The conclusion is that the military has come to realize and emphasize the Doctrine of Quality--that the power of a fighting force depends largely, if not wholly, on the perfection of its equipment.

The Doctrine of Quality was seen to correspond with the general philosophy in many organizations influencing the A-7. It was represented in TAC's demand for accuracy, in Fowler's memorandum from DDR&E, in the philosophy of Colonel Hails, and in the vigor of Captain Doss. Thus, we may conclude, as Fowler did, that "There is, in fact, a natural tendency and even a strong pressure within the system to incorporate into the specifications what technology will permit."[25] With the demise of ILAAS it is difficult to conceive that the improved avionics system would have been incorporated in the A-7 had it not been for the significant advances in the state of the art in digital computer techniques.

It was also quite obvious from the data that the same philosophy did not operate in Systems Analysis. There, a more skeptical attitude toward technological advances prevailed. The analysts were not opposed to the increased accuracy, but they were more skeptical of the reliability and cost-effectiveness of the new system. It could also be noted that, although the decision to incorporate the improved avionics system was made based largely on the estimated cost of the equipment in the aircraft, the cost

[25] Charles A. Fowler, "Defense R&D: Characteristics, Problems, and Trends," Armed Forces Journal, July 25, 1970, p. 25.

of the avionics ground equipment turned out to be one of the most significant factors in the increased price of the aircraft.

This discussion of the interaction of technology with weapons development in the case of the A-7 has only been a brief summary of the many and complex issues involved. The purpose of the study has not been to prove that any particular product of technology should have been incorporated. The value of the study in this area, if any,will be measured by the degree to which it adds to our understanding of how and why technology interacts with weapons development. The problem of ascertaining whether technological advances are worth their costs is left to future decision-makers.

Project Management

The A-7 is also a case history with implications for project management. The narrative shows how the project managers assumed their duties, coordinated with the many organizations involved in the decision process, and moved the aircraft along the cycle toward system acquisition. It is hoped this study will add to the growing literature on project management in such a manner as to provide insight into the many problems and challenges presented in this specialized profession.

The thought had been expressed by one of the Air Force officers in the Air Staff that no one but Colonel Hails could have managed this program and had it come out successfully. Of course, there is no definitive way to prove that statement, but after researching the A-7 case for over a year, I am inclined to agree. This leads to the conclusion that the selection of project managers is one of the most critical decisions of the whole decision process.

James E. Webb, formerly the Administrator of NASA, has ventured the opinion that with all his experience on the space program, he never found a technique of predicting who would make a good project manager. The best way has seemed to be to train managers in the lowest levels of a project team, and then give them a project all their own. In fact, this is now becoming a firm policy in most civilian and military R & D organizations. They seldon consider giving an important project to a person without some experience in the unique environment of project management.

Both Captain Doss and Colonel Hails had some thoughts on the qualities required of a project manager. Doss emphasized the quality of perseverance. "You have to have perseverance in this town," he said, and his intonation implied you had to combine it with rugged determination. His statement also implied that project management was especially controversial in Washington, where the decision process is centralized and conflicts often erupt into the open press. Perseverance is one of the important qualities, because there are so many factors that are completely outside the control of the project manager.

He operates in an environment that is fluid, and often the real decision process is undefined. The project manager is assigned to monitor a system within an evolving state of the art. Usually he has less formal authority than he would like, requiring large doses of informal authority to keep the project going. He is almost always operating between his own and other organizations where his personal or professional reputation is his only mainstay. In the public arena the decision process is made more complex by the requirements of accountability and funds are usually limited to those appropriated yearly by Congress.

Colonel Hails added another quality that is very important for prospective project managers. That is the quality of "awareness." He needs to be aware, Colonel Hails said of what is going on around his project; he needs to be broad-gauged and capable of perceiving much more than the technical aspects of the program. "The subtleness of that awareness is seldom appreciated," Hails emphasized.[26] What the quality of awareness gives to the project manager is an ability to capitalize on an opportunity that may be distant, dimly perceived, and

[26]Hails interview August 31, 1970, after reading the first draft of this study.

fleeting. Awareness allows the project manager to seize "targets of opportunity" that may never come again.

It might be added that this awareness is really the ability to put the project in its proper perspective. It is the quality that allows the manager to know what the exact policy of the organization is, whether it be stated or as nebulous as a comment in the New York Times. It is the quality that guides subordinates to do what is right without being told, and it allows commanders to know how far they can expect their men to go.

Colonel Hails reported that he was very aware of the commitment the Air Force had made to OSD and the Army to demonstrate an additional capability for close ai: support, and that this knowledge gave him self-confidence with his development of the A-7.

Project Management in the 1960's also intersected with another important factor--joint service programs. The evidence on this subject is scattered and inconclusive, but several thoughts will be mentioned. First, joint service development was a factor that contributed to the overall complexity of the A-7 decision process. The jointness of the program was a factor in almost all of the decisions. It certainly was one of the reasons Systems Analysis pushed the aircraft into consideration for Air Force use. The jointness was a factor in the decision to use the Air Force gun and was a critical factor in the decision on the improved avionics. When the 1969 Congressional decision came around, the jointness was a principal factor in determining the outcome. The point was quite obvious that the calculation of conversion costs transferred the initiative to another Service.

The whole theory and justification for project management is based in the concept that technological projects have an ad hoc character, a dynamic all their own, which requires a special form of management. This is closely akin to what Mary Parker Follett called the "Law of the Situation."[27]

The uniqueness of the A-7 development taxes our abilities to generalize. Here the limits of the single instance are upon us, and they should not be minimized in evaluating the study. On the other hand, the events surrounding and affecting the A-7 program were many of the most important defense issues of the 1960's. The story of the A-7 was just one thread around which to weave the fabric of the decade.

One of the larger defense issues is the feasibility of joint service development programs. Do two services developing one basic airplane end up with one airplane or two? To what degree did the F-111, F-4, and the A-7 development programs produce common aircraft for the Air

[27]Mary Parker Follett, "The Giving of Orders," in Dynamic Administration, op. cit., p. 58.

Force and the Navy? The data in the A-7 case would seem to show that the Services did indeed have two different sets of requirements, though they were accomodated to an unusual degree in the design of the A-7. On the management level there was a striking degree of teamwork between Doss and Hails. As Captain Doss noted, "We just simply didn't have any Air Force/Navy problems." Yet there were many difficulties in maintaining the jointness of the aircraft. These difficulties were present even though the basic Navy attack mission corresponded in large measure with the Air Force missions of close air support and interdiction. However, the Navy was primarily looking for the A-7 to perform in an intense enemy environment similar to North Vietnam, while the Air Force (due to its commitment to the Army) was generally developing the A-7 more for a permissive environment, as existed in South Vietnam. Another difference between the Services was that the Navy had been working on the VAL requirement for several years before the decision to buy the A-7; the Air Force had to draft the requirement <u>after</u> its decision to buy the aircraft. Given the amount of difficulty with the jointness of the A-7 program, one can only imagine the extreme problems that must have been encountered with the jointness of the technologically advanced F-111.

The factors that contribute to the complexity of joint development programs have been demonstrated to be many and diverse. They extend not only from the differences in mission, but from organizational and professional differences as well. Whether the decade of the 1960's will, in retrospect, provide an example of progress in joint development programs is difficult to conclude. The A-7 would seem to be an example of a successful joint service project. The only difficulty with proving that statement is that we have no alternative by which to measure. In addition, considering the overall cost and time span of the A-7D program, one can only wonder if both time and money would have been better spent by allowing the Air Force to develop its own AX as it was proposed by General McConnell in the Spring of 1965.

One of the conclusions of this study is that many of the difficulties of joint service development extend from differing professional values and training. To the extent that this is ture, it is hoped that this volume will provide insight into some of the background, characteristics, and significance of the professions involved in the defense process.

Roles and Missions

When this study was begun, one of the purposes was to determine how significant the issue of service roles and missions was in the development of the A-7. The opinion had been widely expressed that Secretary McNamara's technique of centralized management had largely relegated roles and missions to a minor position. The wealth of data on the Army demand for a specialized close air support aircraft--and the need for that aircraft to have an accurate weapons delivery system--indicates that this issue was a significant factor. In fact, of all the influences on the A-7 program, the issue of roles and missions stands out as the most prominent.

Several factors contributed to this prominence. First, Secretary McNamara identified close air support as a critical issue early in his administration. His memorandum to the Secretary of the Air Force in April 1962 threatened the Air Force with the loss of the close air support mission and outlined the ground rules for the ensuing A-7 debate. McNamara indicated that the primary reason he selected the F-4 for use in the Air Force was that it would provide a better close air support capability than the F-105.

The F-4 assumed a critical role as an influence on the A-7 program, because there developed a genuine difference of professional opinion whether the F-4 represented a sufficient Air Force capability for close air support. General McConnell indicated that the Army did not recognize the F-4 as a close air support fighter, and he selected the A-7 to fill that role. It is important to note that the Air Force did not buy the A-7 merely as a response to an Army demand. The data indicates the Air Force bought the A-7 in order to provide a better close air support capability, which can be translated into increasing the effectiveness of the tactical air forces and implementing Flexible Response.

However, the A-7 was not developed by the Air Force in complete neglect of its cost implications. When the price of the A-7 rose to where it seemed to be more expensive than its effectiveness warranted, the value of the program was called into question before Congress. This is an indication that the Air Force did use the cost-effectiveness criterion originally pushed so hard by Systems Analysis. Behind the recommendation to cancel the A-7 program was the stated Air Force position that it could adequately deliver close air support to the Army with the F-4 and other aircraft in the force structure. In addition, the AX had been proposed as a more efficient vehicle, specifically designed for the close air support mission.

The issue of roles and missions also includes the question of whether the competition of the services leads to better weapons systems and a more effective national defense establishment. Huntington's comment that "Inter-service rivalry was the child of unification" is often cited to show the central position of the role of this competition. The data on the A-7 case seems to indicate a close correspondence between support for the A-7 and the Army development of the armed helicopter.

This would lead to the conclusion that significant benefits can come from the competition of the services to perform roles and missions that may not be overlapping, but are similar. The essential nature and purpose of the roles and missions agreements, as they are negotiated between the services, is not to achieve perfect efficiency by the strict avoidance of overlapping functions; the important issue is the development and delivery of the most effective weapons for national defense. Indeed, effectiveness has been called the single, most important criterion of success.

The importance of effectiveness should not be allowed to obscure the central issue of the selection of the proper weapons, however. Efforts have been made, and should continue to develop, measures of objective testing of weapons delivery techniques, tactics, and effectiveness. The defense effort is too large, too diverse, and too expensive to be able to afford the duplication of functions and the misallocations of resources. Where one service is clearly superior by its weapons capabilities, tactics, and training to perform a function, roles and missions agreements provide an important means to establish that obligation.

It should be mentioned that there are really three means for establishing roles and missions delineations. Any of the three can establish functional principles or merely decide by individual weapon systems. The first is the direct negotiation between (or among) the Services. The second is for the adjudication of roles to be by the decision and direction of OSD, the National Security Council, the Office of Management and Budget, or the President. The third is by the authorization and appropriation process of Congress. In 1970 the Army and the Air Force were to a position where the Cheyenne and the AX were considered to be competing for funds under the mission of close air support. The Senate Armed Forces Committee took a strong stand and denied the Cheyenne funds--thereby deciding for the time being another roles and missions debate.

The importance of Congress in the weapons development process should not be underestimated. There are many organizations and offices that are responsible for and influence the design, selection, and procurement of military weapons. None are more important or have more ultimate authority than the Congress. The response of General Ryan during his nomination hearings in 1969 is instructive for students of defense policy:

> Senator Dominick. General, who determines the number of wings that should be in an Air Force complex? Who makes the ultimate decision?
>
> General Ryan. Well, I would say the ultimate decision is probably made by the money that is appropriated, Senator.[28]

The Effect of External Factors on Weapons Development

One of the disadvantages of the case method is that the resultant studies often give the impression of an all-too-neat package of the issues. The processes and decisions discussed are sometimes presented in an order and with a seeming clarity that does violence to the more complex and bewildering milieu that was reality. General Graham emphasized this in saying, "You just can't separate the A-7 out and ask how it got decided, because it is so interwoven with the F-111, the F-4 and the Southeast Asian picture."[29] For this reason, a few comments will be made about the major externalities that affected the A-7 program.

Probably the single, most important factor external to the A-7 decision process was the Vietnam War. In fact, the war was such a direct factor that it is debatable whether one could even call it external to the program. Secretary Brown placed primary emphasis on the Vietnam War as instrumental in his decision to buy a specialized

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[28]Hearing before the Senate Armed Services Committee, July 24, 1969, p. 6.

[29]Graham interview.

close air support aircraft,

> It was perfectly clear by late 1965 and early 1966 that the Air Force was going to be put to the test both by the existence of the Vietnam War and its nature--however representative or unrepresentative they would be of a war somewhere else. . . .[30]

Secretary Brown also stated the Vietnam War strongly influenced his conclusion that the Air Force needed an aircraft with a large payload, both to carry bombs and to provide an opportunity for heavy avionics equipment. Thus, the war directly influenced not only the original Air Force decision to buy the A-7 but the later decision to incorporate an improved avionics system.

A second major externality affecting the A-7 was the combined effect of the F-111 and F-4 programs. There is little doubt from the data that the original Navy proposal for the A-7 was treated favorably by OSD, partially because the Navy was considered to have taken a beating on the TFX. At least that was the feeling of many of the participants. Had the F-111 gone along and met its goals of performance, cost and schedule, the demand for the A-7 might have been much different. As it was, Systems Analysis consistently viewed the lower-cost A-7 as a replacement for the high cost F-111 in the Air Force force structure. The F-4, by proving itself to be a reliable, versatile, high performance aircraft, came to be somewhat of a darling to

[30]Brown interview.

the Air Force, and was constantly considered as an alternative to the A-7.

All of the systems in the weapons acquisition process during the late 1960's were affected by another externality of vital importance--the national economic inflation. Although the roots of the inflation were wide and diverse, the effect was to increase the cost of these weapons programs and to focus more public attention on the general subject of weapons costs. Specifically, the three billion dollar reduction in the President's budget as a condition of the income tax surcharge in 1968, resulted in a major stretch-out of the A-7 program. The stretch-out, in turn, caused an increase in the unit cost of the A-7 and added to the vulnerability of the program.

The conclusion based on this brief recapitulation of some of the externalities is a general one. It relates directly to the difficulty of the planning function--the forecasting of the future. If the precision of the planning process is such to forecast accurately the outline of the future, the decision-making process would do well to place a high reliance on specific plans. If, on the other hand, the actual consequences of decisions differ significantly from those intended, the process would be better served by more general planning.

The data in the A-7 case supports the view that weapons programs have been, are, and will continue to be strongly affected by factors completely external to the program, the Department of Defense, and even the nation. The magnitude of these factors and their impact on the decision-making process is so significant that a recommendation for incremental decision-making seems warranted. Weapons programs could be designed with more flexibility, leaving options open during the research and development cycle for major changes in the threat, international relations, the nation's economy, and the state of the art. The cost of this flexibility in the R & D cycle would undoubtedly be increased time between concept formulation and system acquisition. The principle of "concurrency" in design and testing would have to be discarded or reserved to those special systems with a unique need for an early Initial Operational Capability (such as the ICBM). The result of having flexible programs and a maximum of prototype testing is unknown, but in 1970 these techniques were in the process of being introduced. The overall change was one to place rather less emphasis on specific, closed-system planning and more on general, open-ended analysis.

The A-7 and the Decision Making Process

This study began as an attempt to find the simple story of the A-7--where it came from, how it changed, and where it was going. As it turned out, that story was not available without a vast oversimplification that would have done violence to reality. What has emerged bears little resemblance to what was intended in the first place. That, perhaps, is the best way to describe the defense decision-making process. Decisions that begin as simple policy alternatives have a way of ending up all entangled with the other vital issues of the day. Once this turmoil occurs (and there is no denying that it does) to pursue the original specific goal is often to exclude an important part of the decision-making process.

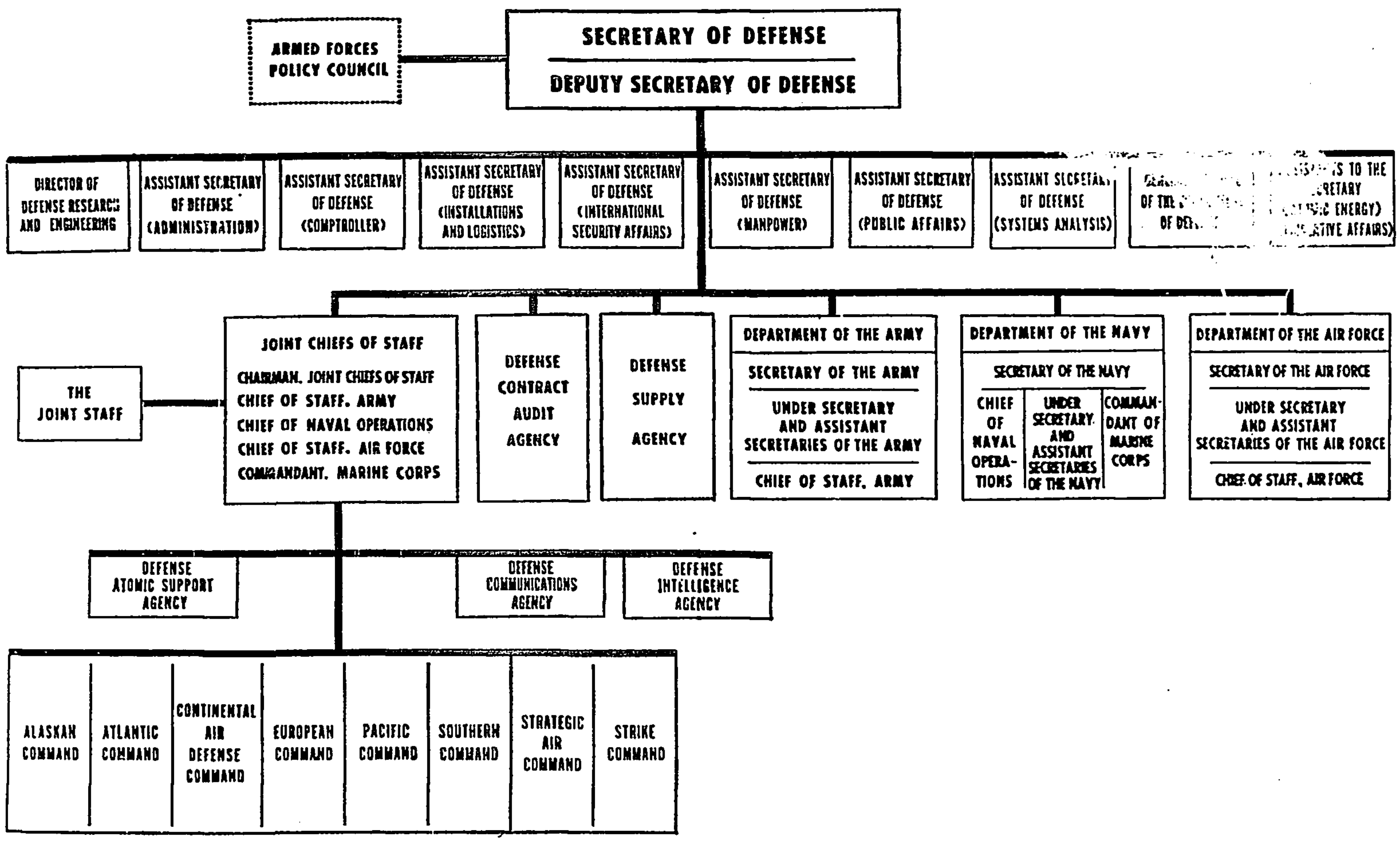
On reflection, the decision by General McConnell and Secretary Brown in November 1965 seems unusually significant. There were really five outcomes to that decision, although each outcome was only an increment in another decision process. The first was that the Air Force tactical force structure would be modified to include a certain, small number of specialized aircraft. The second was that the Air Force would have an A-7 program. The third outcome was the modification of the doctrine on multipurpose fighters. The fourth was the increased justifivation for an internal gun in the F-4. The fifth was the beginning of concept formulation for the Air Force's new air superiority fighter, the F-15.

The A-7 case as it developed from 1965-70, showed the tenuous nature of that decision under the impact of many complex factors. But, in the end, the A-7 decision was sustained. The multipurpose fighter was retained because it represented a far more flexible weapon for the variety of tactical air missions. There is little doubt that the majority of Air Force tactical units will be, or should be, designed around multipurpose weapons with superior performance. The A-7, however, was introduced to provide a specialized capability in the Air Force, and that decision represents an innovation.

Reflecting on broader issues of how decisions are made and programs executed, the lesson seems clear. The single, strategic decision did not emerge. What did emerge was the process of bargaining and consensus-building that made the decisions possible. Each of the outcomes extending from these decisions depended on a multitude of factors for their execution. The number of independent inputs to the decision process and the variety of goals they represented closely approximated the political process as a whole.

The distribution of power and influence in the decision process was not uniform; neither was it confined to those at the top of the organizational pyramid. In several specific instances the power of specialized knowledge was shown to possess a great deal of leverage. Knowledge in this case--when applied with initiative and perseverance--was an important factor in the process of persuasion that preceeds and follows every major decision. Not all of that knowledge was confined to the technical issues; knowledge of the processes and personalities of the decision-makers was also a vital factor. If the process is to produce better decisions in the future, the influence of that knowledge will have to increase. This study is dedicated to that goal.

APPENDICES

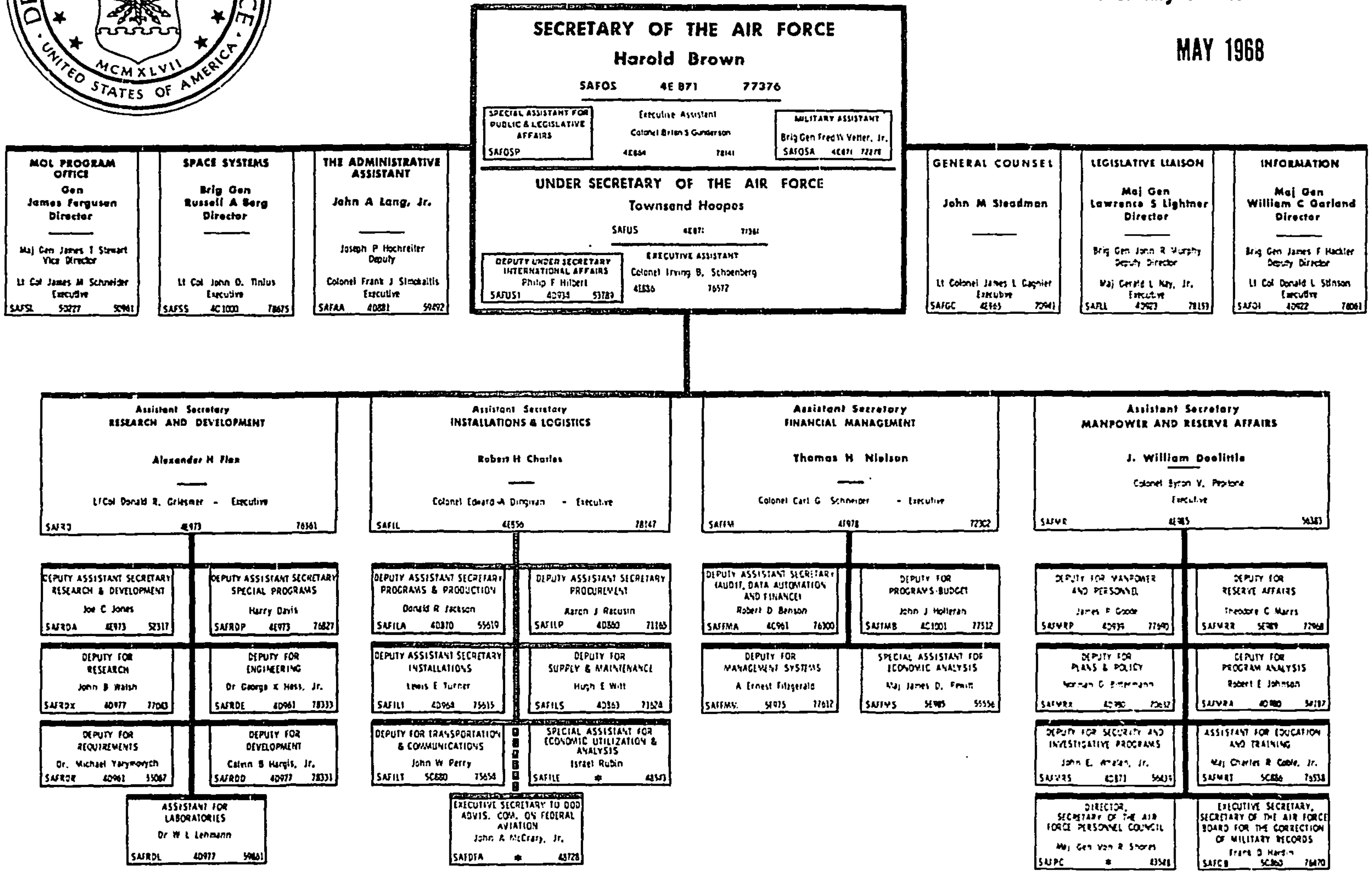


DoD organization.

Office of the

Secretary of the Air Force

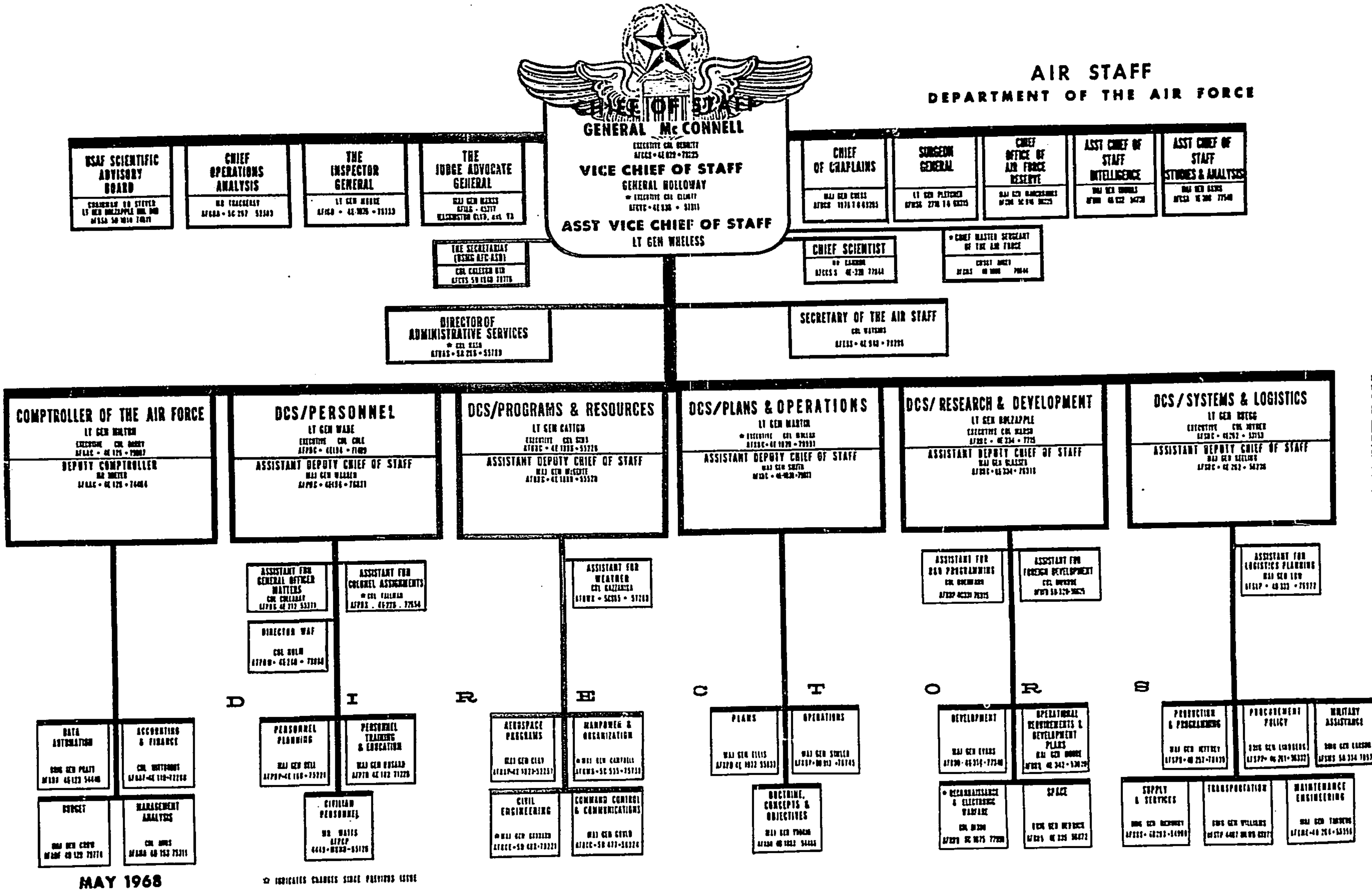
MAY 1968



* 1111-19th St N., Arlington, Va

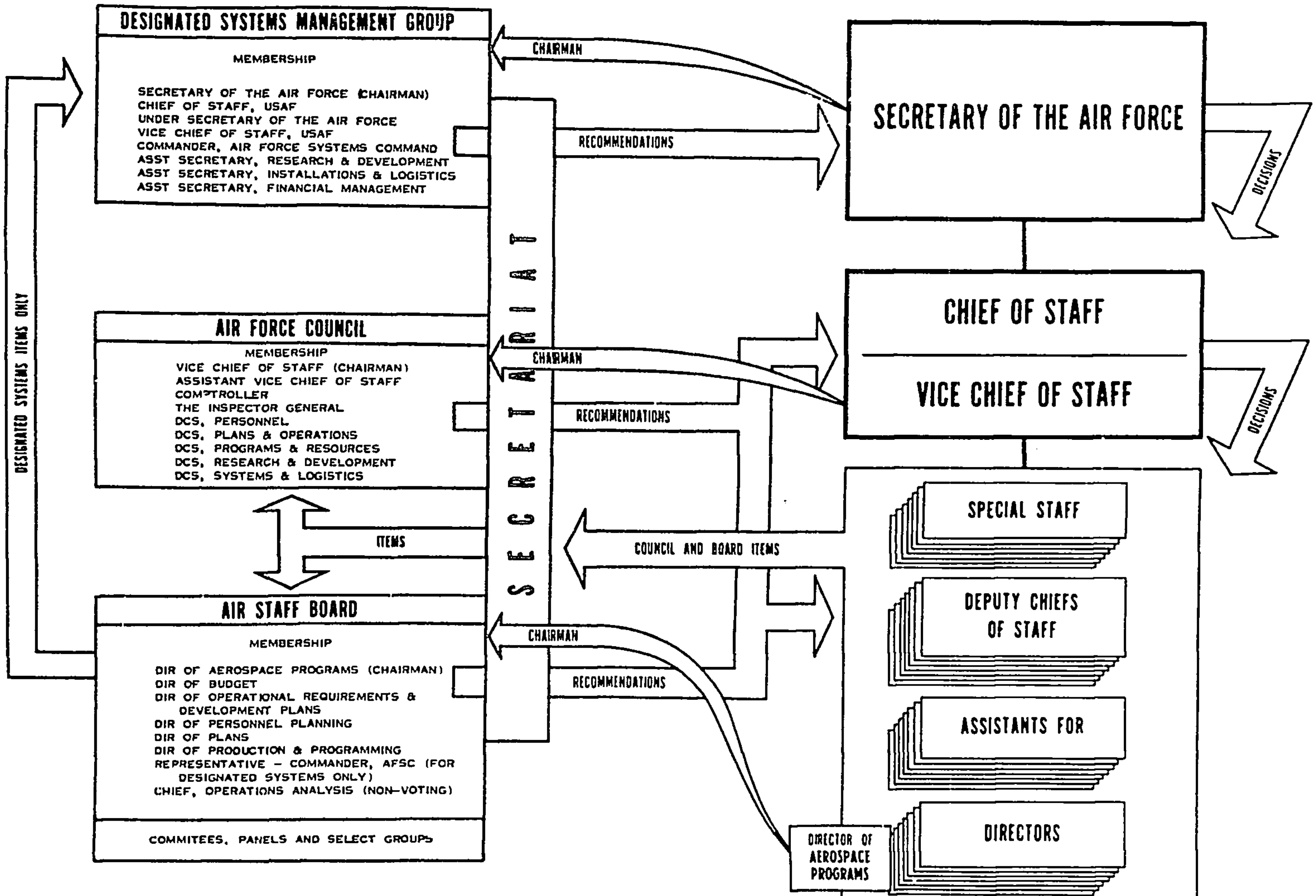
* 1800 N. Kent St., Arl., Va.

APPENDIX II

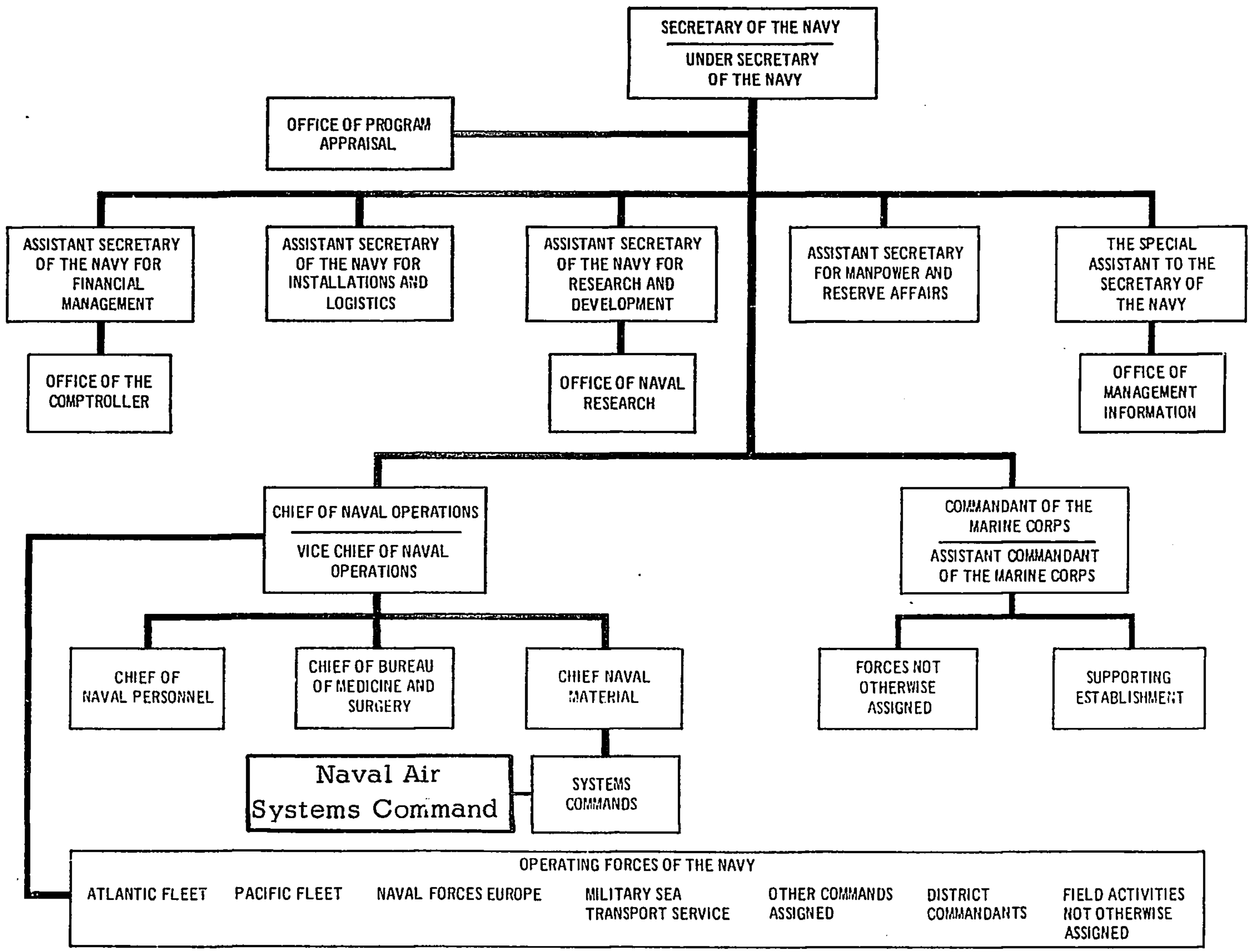


APPENDIX III

DAF BOARD STRUCTURE



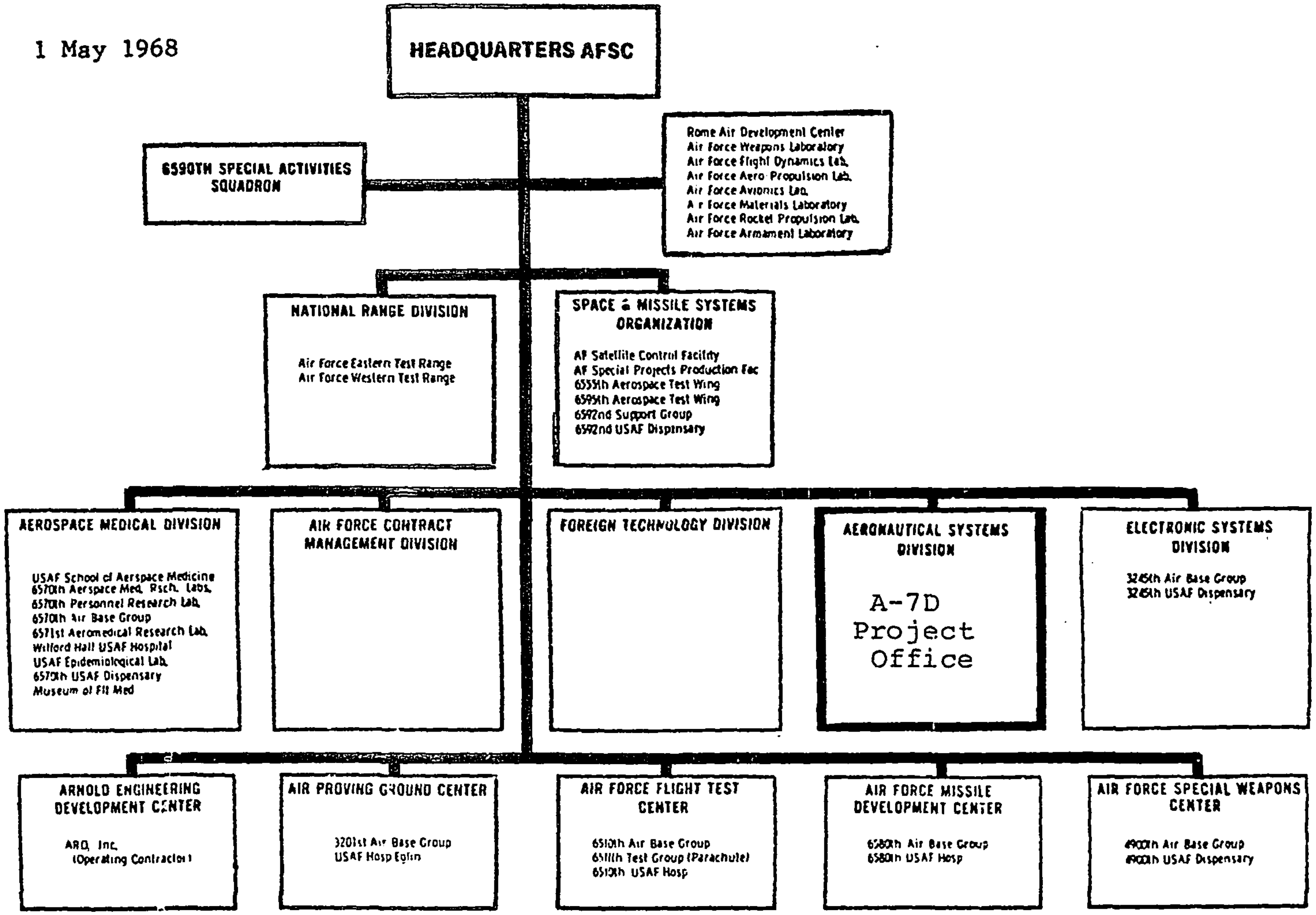
OCTOBER 1967



Organization of the Department of the Navy for project management.

AIR FORCE SYSTEMS COMMAND

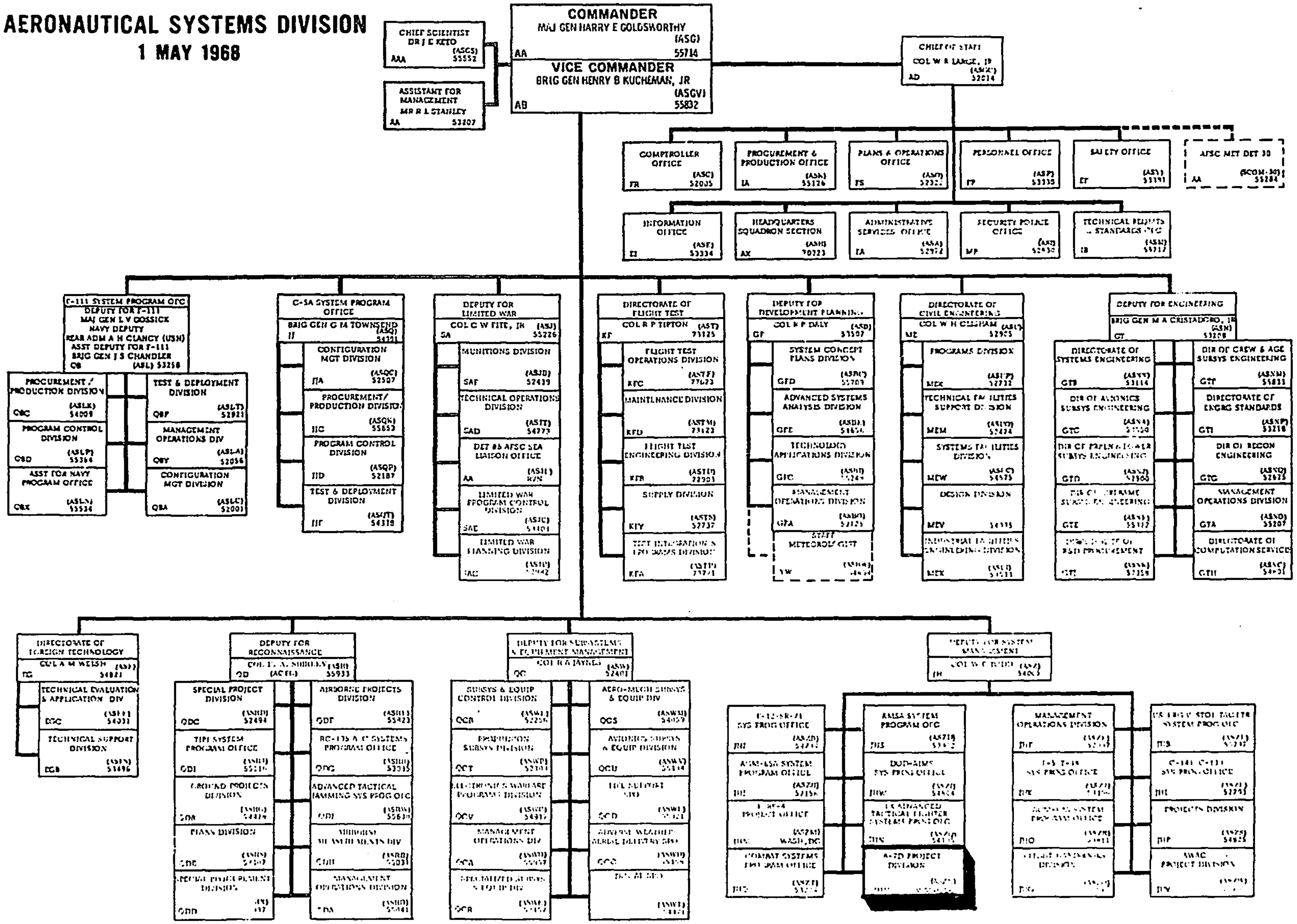
1 May 1968



APPENDIX VI

AERONAUTICAL SYSTEMS DIVISION

1 MAY 1968



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APPENDIX VII

A-7D PROJECT OFFICE NASC-WASH. D. C. ASZN

8 SEPTEMBER 1969

MANPOWER / PERSONNEL SUMMARY

	AUTHORIZED	ON BOARD
OFFICER	16	12
CIVILIAN	19	15
TOTAL	35	27

☆ PROJECTED OUT ★ PROJECTED IN
▬ OVERSTRENGTH ⊘ VACANT
○ DETAILED OUT ● DETAILED IN
A/O AUTHORIZATION OUT (OTR INDICATED)

DEPUTY PROJECT MANAGER

NAME	TITLE	PCN	GRADE	AFSC
COL H. W. STONEBERGER	PROJECT MGR	065805	COL	G2926
T. R. FARRINGTON	ASST PROJ MGR	1877	801-15	2926
LT COL R. L. GREGORY	A-7D LIAISON OFCR (Du Sta: G. P. TEXAS)	041358	MAJ	2916
R. M. MATTFELD	SECTY (STENO)	4798	318-06	70070
D. L. KIRTLEY	ADMIN OFF	2616	341-09	70170
J. F. DVORAK	CLERICAL ASST	4219	301-05	70250
E. M. VAUGHN	CLERK-STENO	2544	312-05	70050
E. EGGLESTON	CLERK-STENO	3697	312-05	70050
⊘	CLERK-STENO	4422	312-05	70050

PROGRAM CONTROL

NAME	TITLE	PCN	GRADE	AFSC
LT COL J. E. DOYLE, JR	CHIEF	065509	LT COL	2916
E. W. BASTER	FINANCIAL MGR	2790	501-13	0730
J. W. ALFORD	BUDGET ANALYST	2913	560-12	0730
Vacant	FINANCIAL ANALYST	5698	501-11	0730
CAPT W. H. POTTERTON	PLNS & DOCU SPECL	073721	MAJ	2944

CONFIGURATION MANAGEMENT

NAME	TITLE	PCN	GRADE	AFSC
★ LT COL R. H. BEAUKU	CHIEF	[illegible]	LT COL	2916
MAJ A. J. FERZACCA	CONFIG MGR (ACTG CHIEF)	[illegible]	MAJ	2916
L. R. LONG	CONFIG CONTR SPECL	2428	301-12	2944
D. E. HETSCHITZ, JR	DATA MANAGER	4825	301-12	2935
⊘	CONFIG CONTR SPECL (EPTS/TR)	[illegible]	301-07	[illegible]

ENGINEERING

NAME	TITLE	PCN	GRADE	AFSC
LT COL W. M. HARRIS	CHIEF	065286	LT COL	2816
⊘	PERSONNEL TRNG EQUIP	065675	CAPT	2925
CAPT W. H. EVANS	AVIONICS MGR	065670	MAJ	2235A
MAJ E. M. VOYT	AGE MGR (MECH)	065672	MAJ	2235B
CAPT S. J. STEVENSON	ARMAMENT SS MGR	065671	MAJ	2835A
CAPT G. C. HEATH	REL MAINT MGR	065674	MAJ	2275G
⊘	AIRFRAME SS MGR	065129	MAJ	2235A
* MAJ C. R. GREATHOUSE	PROPUL SS MGR (Du Sta: Wash D. C.)			
* MAJ WRIGHT	AGE ELEC (Du Sta: Wash D. C.)			

PROCUREMENT AND PRODUCTION

NAME	TITLE	PCN	GRADE	AFSC
H. M. GAYNOR	CHIEF	2424	1102-13	6516
L. M. HOPPE	INDUS SPECL	4795	1150-12	6526
R. E. HARRINGTON	INDUS SPECL	4391	1150-12	6526
E. L. COMES	INDUS SPECL	3694	1150-12	6526
Vacant	PROC CLERK	3093	1106-05	65150
M. H. WARD	CONTRACT ASST	2384	1102-07	65270
☆ 2 LT J. COLOMB	PROC OFCR	065957	CAPT	6526

TEST AND DEPLOYMENT

NAME	TITLE	PCN	GRADE	AFSC
LT COL J. T. EDWARDS	CHIEF	[illegible]	LT COL	[illegible]
MAJOR R. J. [illegible]	FLT TEST MGR	[illegible]	MAJ	2816

APPENDIX VIII

30 Sept. 1969

APPENDIX IX. COST FIGURES ON THE A-7

Date		Unit Flyaway Cost ($Millions)	Unit Weapon System Cost ($Millions)
August 1963	Figure entered into the VAL selection	$1.0	
October 1965	Figure entered into the Fish Study	1.2-1.3	
December 1965	Figure immediately after OSD approval	1.4	1.5
September 1966	Figure after the Spey engine decision	1.47	1.56
August 1967	Figure at time of OSD approval of avionics	1.8	
December 1967	Figure at time of Chief of Staff go-ahead	1.95	2.2
January 1968	Figure at time of FY 69 Budget submission	2.1	2.3
April 1969	Figure at time of FY 70 Hearings	2.4	2.8
January 1970	Figure at time of FY 71 Budget submission	2.6	3.2

APPENDIX X. AIR FORCE A-7D PROGRAM CHANGES

Date	FY66	FY67	FY68	FY69	FY70	FY71	FY72-74	Total
November 1965 (USAF)								387*
November 1965 (OSD)	23	97	180	169	92			561*
March 1966	5	122	180	180	74			561
April 1966	5	94	164	98				361
August 1966		20	181	240	126			567
September 1966		20	181	240	173			614*
May 1967		12	100	240	240	21		614
June 1967		12	100	220	228	64		624
October 1967		12	62	220	174	36		504*
January 1968		12	62	146	174	76	X	517*
August 1968		5	8	13	128	174	X	774
September 1968		5	12	57	128	114	X	516
October 1968		5	12	57	128	170	X	774
November 1968		5	12	57	128	150	X	645

Source: A-7D Project Management Office Chart, 1970. Figures indicated with an asterisk (*) have previously been released in: U.S. Congress, Senate, Committee on Appropriations Department of Defense Appropriations Fiscal Year 1970, Hearings before the Committee on Appropriations, 91st Cong., 1st sess., July 29, 1969, Part 4, p. 34. Testimony of Secretary of the Air Force Seamans.

APPENDIX XI. F-111 PROGRAM QUANTITIES

Date	Quantities: Tac Fighter F-111's	Quantities: All F-111's
October 1961		876
July 1962		1726
May 1963	1406	1923
March 1964	1406	2411
Various dates 1965-1969		1372 (maximum)
June 1969	567	728

1969 F-111 Program Total Consists of:

Air Force Tactical Fighters F-111A/D	567
SAC FB-111	77
Reconnaissance RF-111D	60
Australian Air Force	24
Total	728

Source: U.S. Congress, Senate, Committee on Appropriations, Department of Defense Appropriations Fiscal Year 1970, Hearings, before the Committee on Appropriations, 91st Cong., 1st sess., July 29, 1969, Part 4, p. 34. Testimony of Secretary of the Air Force Seamans.

GLOSSARY

AFSC--Air Force Systems Command

AX--Attack aircraft, experimental

CAS--Close Air Support

CEP--Circular Error Probable

DCNO--Deputy Chief of Naval Operations

DCS--Deputy Chief of Staff

DDR&E--Director of Defense Research and Engineering

I&L--Installations and Logistics

JCS--Joint Chiefs of Staff

LTV--Ling-Temco-Vought, Inc.

OPNAV--Office of the Chief of Naval Operations

OSD--Office of the Secretary of Defense

RAD--Requirements Action Directive

RDT&E--Research, Development, Testing and Evaluation

TAC--Tactical Air Command

VAL--Light Attack Aircraft

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LIST OF SELECTED INTERVIEWS

Mr. John B. Allyn, Vice President, LTV Washington Operations.

Colonel R. C. Allen (USAF, ret.), Manager A-7D Requirements, Vought Aeronautics Division, LTV.

Dr. Harold Brown, Director of Defense Research and Engineering; Secretary of the Air Force.

Mr. Robert S. Buzard, Vice President A-7 Programs, Vought Aeronautics Division, LTV.

Colonel Edward A. Chavarrie, Staff officer in DCS/Plans and Operations.

Vice Admiral Thomas F. Connolly, Deputy Chief of Naval Operations for Air.

Captain Carl M. Cruse, A-7 Project Manager, Naval Air Systems Command.

Mr. Harry Davis, Deputy Assistant Secretary of the Air Force for Special Programs.

Major General Kenneth C. Dempster, Deputy Director of Operational requirements for General Purpose and Airlift Forces.

Vice Admiral Vincent P. de Poix, Deputy Director of DDR&E for Administration, Evaluation, and Management.

General Gabriel P. Disosway, Commander, Tactical Air Command.

Mr. Lee E. Dolan, Air Force Office of Operations Analysis.

Captain Robert F. Doss, A-7 Deputy Project Manager, Naval Air Systems Command.

Lt. Commander Charles M. Earnest, OSD Systems Analysis.

Colonel William R. Edgar, Director of Information, Tactical Air Command.

Dr. Alain C. Enthoven, Assistant Secretary of Defense for Systems Analysis.

Colonel Howard M. Fish, Special Assistant for Analysis and Force Plans.

Mr. Charles A. Fowler, Deputy Director of DDR&E for Tactical Warfare Programs.

Lt. Col. Leo J. Gagnon, A-7D Program Element Monitor, Directorate of Production and Programming.

Captain Thomas J. Gallagher, A-7 Project Manager, Naval Air Systems Command.

Mr. Ben J. Gilleas, Director of Investigations, Preparedness Investigating Subcommittee of the Senate Committee on Armed Services.

Mr. Edward M. Glass, Assistant Director of DDR&E for Laboratory Management.

Lt. General Gordon M. Graham, Vice Commander, Tactical Air Command.

Mr. George Haering, Systems Analysis Division of the Office of the Chief of Naval Operations.

Lt. Colonel Richard A. Haggren, Directorate of Operational Requirements and Development Plans.

Major General Robert E. Hails, A-7D Deputy Program Manager.

Mr. Paul Hare, A-7D Program Director, Vought Aeronautics Division, LTV.

Dr. Victor K. Heyman, OSD Systems Analysis.

Colonel James R. Hildreth, Directorate of Operational Requirements and Development Plans.

Colonel Claude G. Horne, Deputy Director of Requirements, Tactical Air Command.

Mr. C. F. Horton, DDR&E, Staff Assistant to the Assistant Director for Land Warfare.

Mr. Bernard Kornhauser, Air Force Office of Operations Analysis.

Mr. J. W. Lankford, Director of Marketing, Vought Aeronautics Division, LTV.

Mr. Sol Love, President, Vought Aeronautics Division, LTV.

Mr. Burt W. Marshall, Jr., Air Force Requirements Manager, Vought Aeronautics Division, LTV.

Mr. James E. Martin, Vice President, Engineering and Logistics, Vought Aeronautics Division, LTV.

Lt. Colonel Charles W. McClarren, Commander, Detachment 1 57th Fighter Weapons Wing (A-7D Category III test).

General John P. McConnell, U.S. Air Force Chief of Staff.

Mr. Whitney McCormack, A-7D Program Director, Vought Aeronautics Division, LTV.

Mr. Russell Murray, 2d, OSD Systems Analysis, Principal Deputy Assistant Secretary of Defense.

Mr. Thomas C. Muse, Assistant Director of DDR&E for Tactical Air Systems.

Dr. William A. Niskanen, Jr., OSD Systems Analysis, Deputy Director for Special Studies.

Colonel John E. Pitts, Jr., Tactical Division, DCS/Plans and Operations.

Colonel Royce W. Priest, (USAF, ret.), A-7D Program Element Monitor and later Assistant A-7D Program Manager, Vought Aeronautics Division, LTV.

Colonel William Ritchie, Directorate of Operational Requirements and Development Plans.

Dr. Dieter Schwebs.

Mr. George A. Spangenberg, Director of the Evaluation Division, Naval Air Systems Command.

Mr. Donald F. Spencer, DDR&E.

Mr. Pierre M. Spey, OSD Systems Analysis, Tactical Air Division.

Mr. Raymond M. Standahar, DDR&E office of Tactical Air Systems.

Mr. George W. Stickle, Assistant Chief, Office of Operations Analysis, Tactical Air Command.

Colonel Harold W. Stoneberger, A-7D Deputy Program Manager.

Mr. Edwin F. Cvetko, Vice President for Manufacturing and formerly A-7A/B Program Director, Vought Aeronautics Division, LTV.

BIOGRAPHICAL DATA

Name: Richard Glenn Head

Date and Place of Birth: January 6, 1938; Mason City, Iowa

Elementary School: Johnson School, Cedar Rapids, Iowa
Graduated 1950

High School: Franklin High School, Cedar Rapids, Iowa
Graduated 1956

College: United States Air Force Academy, Colorado,
B.S., 1960

Graduate Work: Syracuse University, Syracuse, New York
M.P.A., 1969

BIOGRAPHY

UNITED STATES AIR FORCE

BRIGADIER GENERAL RICHARD G. HEAD

Retired May 1, 1987.

Brigadier General Richard G. Head is deputy director for operations, National Military Command Center, Organization of the Joint Chiefs of Staff, Washington, D.C. He is directly responsible for the operational management of the command center which is the focal point for information and order between the Joint Chiefs of Staff and the Unified and Specified commands.

General Head was born in 1938, in Mason City, Iowa, and graduated from Franklin High School in Cedar Rapids, Iowa, in 1956. He entered the U.S. Air Force Academy, Colo., with the second class and graduated in 1960 with a bachelor of science degree in engineering science. In 1968 he was selected for graduate education at Syracuse (N.Y.) University, graduating first in his class with a master's degree in public administration. He was awarded a doctor of philosophy degree in political science in 1971 after writing a dissertation, "Decision-Making on the Air Force A-7 Attack Aircraft Program."

The general completed Squadron Officer School by correspondence and was awarded the distinguished graduate citation. In 1976 General Head attended the National War College at Fort Lesley J. McNair, Washington, D.C., where he was appointed a student faculty member, associate fellow, senior fellow and distinguished graduate. While a student, he completed a book (with Robert C. McFarlane and Frisco W. Short), "Crisis Resolution: Presidential Decision-Making in the Mayaguez and Korean Confrontations." He was nominated by the Air Force to the National Council on Foreign Relations in June 1977 and served as a military fellow at the Council for the year 1977-1978. While there, he published "Technology and the Military Balance" in "Foreign Affairs," April 1978.

His operational career began with pilot training at Bartow Air Base, Fla., and Williams Air Force Base, Ariz., where he graduated first in his class with the outstanding student award. After receiving his pilot wings in September 1961, the general entered combat crew training in F-100s and won the outstanding pilot award. From the Cuban missile crisis in October 1962 until December 1964, he flew F-100s with the 31st Tactical Fighter Wing in Florida, Japan, Korea and Turkey. From February 1965 to March 1966, General Head flew 325 combat missions in A-1 Skyraiders over North Vietnam, the Republic of Vietnam and Laos while assigned to the 602nd Fighter Squadron at Bien Hoa Air Base, Republic of Vietnam. Returning to the United States, he became an instructor in F-4 Phantom IIs with the 4453rd Combat Crew Training Wing, Davis-Monthan Air Force Base, Ariz.

Following graduate studies at Syracuse University, General Head joined the department of political science at the U.S. Air Force Academy in September 1970. He taught international politics, the politics of science, and defense policy and edited a major textbook, "American Defense Policy," Third Edition, which was widely used by the Reserve Officer Training Corps, the Air University, and more than one hundred colleges and universities.

In 1973 he returned to flying and was assigned as operations officer with the 421st Tactical Fighter Squadron at Udorn Royal Thai Air Force Base, Thailand. His next assignment was Clark Air Base, Philippines, where he served as chief, Aircrew Evaluation Division, and commander, 90th Tactical Fighter Squadron, flying F-4D's and E's. In addition, he initiated and commanded the Cope Thunder (Red Flag) combat training exercise program for Pacific Air Forces.

Following graduation from the National War College in 1977 and completion of the year with the National Council on Foreign Relations, General Head was assigned as military assistant to the undersecretary of Defense for policy, Office of the Secretary of Defense, Washington, D.C. From April 1979 to July 1983, he served with the Organization of the Joint Chiefs of Staff initially as director of the Crisis Planning Assessment Group, and subsequently as special assistant to the director of the Joint Staff. Following selection for brigadier general, he served for two years as the deputy commander of the North Atlantic Treaty Organization's 5th Allied Tactical Air Force at Vicenza, Italy. He assumed his present duties in July 1985.

The general is a command pilot with more than 3,000 flying hours, 700 of them in combat. His military decorations and awards include the Silver Star, Defense Superior Service Medal, Distinguished Flying Cross, Meritorious Service Medal with oak leaf cluster, Air Medal with 12 oak leaf clusters and Air Force Commendation Medal.

He was promoted to brigadier general Oct. 1, 1983, with same date of rank.

(Current as of January 1986)