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The TFX Program: An Analysis of the McNamara Management and Decision-Making Technique in Major Weapon System Procurement

John Charles Sweeney
College of William & Mary - Arts & Sciences

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THE TFX PROGRAM:
AN ANALYSIS OF THE MCNAMARA MANAGEMENT AND DECISION-MAKING
TECHNIQUE IN MAJOR WEAPON SYSTEM PROCUREMENT

A Thesis

Presented to
The Faculty of the Department of Government
The College of William and Mary in Virginia

In Partial Fulfillment
Of the Requirements for the Degree of
Master of Arts

by
John Charles Sweeney
1972

APPROVAL SHEET

THE TFX PROGRAM:
AN ANALYSIS OF THE MCNAMARA MANAGEMENT AND DECISION-MAKING
TECHNIQUE IN MAJOR WEAPON SYSTEM PROCUREMENT

Master of Arts

John C. Sweeney
Author

APPROVED: February 1972

James M. Rehearty
(Supervising Professor)

William L. Morrow

Jack P. Edwards

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PREFACE

The TFX airplane has been the subject of endless investigation and examination from its very inception. Although the amount of material concerning the TFX is substantial, in terms of governmental reports for the most part, there has been little research done on the topic from the perspective of public administration and public management.

It is my intention to examine the TFX case from just such a perspective, beginning with its origins in 1961 and following through to its termination in 1971.

My analysis takes the form of a case study approach. However, I have tried to analyze the TFX in terms of its parts, rather than chronologically. Consequently, each section of this study should be viewed as a unit and not as a sequence in the history of the TFX. No attempt has been made to record every event in the history of the TFX. Rather, the emphasis has been on the significant factors relating to public administration and management.

The major source of information used in this study has been the fourteen volumes that constitute the TFX Contract Investigation made by the Permanent Subcommittee on Investigation for the Committee on Government Operations of the U. S. Senate, in 1963 and again in 1970.

Several other sources of unpublished primary data were used and cannot be included in the appendices due to their bulk. These items, such as the letters, reports and memorandums between Comptroller General

Staats and several congressmen, will be submitted for your review, subject to such a request.

It should be stated that interviews were conducted with several members of the Permanent Subcommittee on Investigation and the Government Accounting Office - while requests for similar interviews were denied me by both the General Dynamics Corporation and the Department of Defense.

I would like to express my appreciation for the understanding, assistance and direction given me by Dr. James M. Roherty and Dr. Richard E. Brown of the Department of Government.

November 29, 1971

ABSTRACT

The procurement of the TFX weapons system (F-111) has proven to be one of the most controversial development programs in the history of Department of Defense spending. The development of the TFX aircraft provides us with a novel example of weapons procurement. It is, in fact, the original use of the so-called "revolution" in procurement policy as devised by Robert S. McNamara in his role as Secretary of Defense.

In light of this, I attempt to show that the TFX program is a failure in that its end product, the F-111 airplane, is incapable of fulfilling the specifications and of performing the missions for which it was intended. I attempt to show that it was not in keeping with Secretary McNamara's avowed policy of the best use of limited dollars and resources. I also attempt to show that the failure of the TFX program is due, in part, to the civilian analyst's inability to fit the complex requirements of a major weapons system within the parameters of their new management technique, and that these techniques directly challenged the role of the professional military officer by rejecting their expertise concerning weapons procurement.

My analysis takes the form of a case study approach. However, I have tried to analyze the TFX in terms of its parts, rather than chronologically. Consequently, each section of this study should be viewed as a unit and not as a sequence in the history of the TFX. No attempt has been made to record every event in the history of the TFX. Rather, the emphasis has been on the significant factors relating to public administration and management.

The available evidence enabled me to draw several well-founded conclusions. One, there can be no doubt that the TFX was unable to meet the specifications and requirements for which it was designed. Its size and weight severely affected its capability and maneuverability. Two, the program failed to produce the much vaunted \$1 billion savings for which it was intended. Three, there was a lack of cooperation between the civilian administrators in the Pentagon and their military advisers. Four, part of the reason for the deterioration of relations between the civilian analysts and the military was the use of esoteric theories and arbitrary decisions by the civilian administrators. Five, the utilization of the procurement innovations of "commonality" and "program definition phase" by the civilian analyst proved to be ineffective in containing development costs. Six, the direct result of the TFX is the repudiation of the new management techniques of Robert McNamara and the return to the original procurement practice of independent weapon development and the cost-plus-incentive fee contract.

CHAPTER I

INTRODUCTION

Background History of TFX

In 1959, General F.F. Everest, commander of the Tactical Air Command of the Air Force, drew up an outline for a new fighter aircraft. Based on concepts developed by the NASA Laboratory at Langley, Virginia, this new fighter would be the pristine application of the variable-sweep wing. The Tactical Air Command wanted a plane that would replace the F-105 tactical fighter-bomber. Consequently, the new variable-sweep wing aircraft would be required to perform three different missions: (1) to gain air superiority in the battlefield, that is to say, it would require air-to-air combat ability; (2) to penetrate enemy defenses in order to interdict his supply caches and routes, this meant bombing and strafing behind the battlefield area; and (3) to provide close air support for the ground forces of the Army, this required air-to-ground combat ability.¹ The new variable wing gave practical potential to these normally conflicting requirements.

By 1960, the requirements for this new aircraft were resolved. On June 14, 1960, the Air Force issued a Specific Operational Requirement specifying the minimum performance levels the new plane must achieve, and with it, the TFX - Tactical Fighter, Experimental - program was initiated.²

At the same time, the Navy was developing a new airplane for the purpose of fleet defense. This program, entitled the Missileer, was for

the development of a subsonic plane fashioned with a long-range missile, the Eagle. This new Navy aircraft was designed for subsonic "loitering" on an airborne patrol around the fleet. The long-range air-to-air Eagle missile was the real combat arm of the program. Its purpose was to seek and destroy enemy aircraft that might threaten the fleet. It was felt, however, that a fleet defense system based on a subsonic plane was a regression in the state of the art. Outgoing Secretary of Defense Thomas Gates discontinued funding for the Missileer project in December, 1960 when he issued the directive that "he did not want to proceed with the development of a major weapons system in view of the fact that there would be a change in administration."³

The Gates Directive was also applied to the Air Force TFX program. Thus, the Eisenhower administration's reluctance to commit the incoming administration to several new weapons systems forced the Air Force to postpone issuing its request to the aerodynamics industry for development of the TFX. It also prevented the Navy from continuing its work on the Missileer system.

The new administration took office in January of 1961, and Robert S. McNamara became the new Secretary of Defense. In the middle of February, 1961, Secretary McNamara ordered all services to study development of a single tactical fighter based on the TFX proposal then under consideration by the Air Force.⁴ It should be noted that throughout the period 1959 to February, 1961, the TFX project remained a single-service operation, that of the Air Force.

The period from February to December, 1961 saw the TFX program take on a totally new perspective. During that time, the TFX program was reoriented from a single-service plane to a biservice aircraft. Both the Navy

and the Air Force agreed that a single plane suitable to both services could be built - "provided that the other service would give up on its critical mission requirements."⁵

Consequently, Secretary of Defense McNamara on June 7, 1961 ordered the Air Force and the Navy to prepare a single work statement based on the multimission approach of the TFX and within the criteria of the biservice restrictions.

Thereafter, both the Air Force and the Navy performed additional studies pertaining to the new biservice TFX, as opposed to a separate plane for each service.

Concluding from these studies, each service recommended that it be permitted to develop its own separate aircraft to fulfill the extremely different missions of each service.⁶ Due to the problems of excessive weight and high cost of development, the Air Force and the Navy both agreed that a compromised biservice TFX would be less than suitable for their purpose.

This exhortation was rejected by Mr. McNamara and on September 1, 1961, in a directive to both the Secretary of the Air Force and the Secretary of the Navy, Mr. McNamara stated:

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.⁷

This memorandum officially inaugurated the TFX program as a joint venture. It specified the technical parameters of weight and dimension which the services had failed to agree upon. Secretary McNamara also ordered that "changes to the Air Force tactical version of the basic aircraft to achieve the Navy mission shall be held to a minimum."⁸

The above statement is the first elaboration of what was to become known as the concept of commonality.

The TFX Work Statement was sent to the aircraft industry on October 1, 1961. The proposals of the various contractors were delivered to the Department of Defense on December 6, 1961.

Thereafter, the Air Force Systems Source Selection Board (hereafter referred to as SSSB) was given the proposals for review and evaluation. After four evaluations covering the period from January 19, 1962 to November 2, 1962, the military's SSSB unanimously recommended that Boeing be selected as the primary source for the development of the TFX over General Dynamics, the only remaining competitor.

Then, on November 24, 1962, the Pentagon publicly announced the award of the TFX development contract to General Dynamics for 22 prototype planes at a cost of \$439 million. Robert S. McNamara, supported by the Secretaries of the Navy and the Air Force, "overruled one colonel, four major generals, six lieutenant generals, five generals, five rear admirals, one admiral, and literally hundreds of lesser rank officers."⁹

The research and development contract with General Dynamics was signed by the Pentagon on December 21, 1962, just a few hours after the Chairman of the Committee on Government Operations had requested a delay in the contract awarding subsequent to a review of the facts by the Committee.

Just one month later, February 26, 1963, the Permanent Subcommittee on Investigations for the Committee on Government Operations of the United States Senate opened hearings on the TFX contract. The first series of hearings lasted from February 26, 1963 through November 20, 1963. The hearings centered on who had the power and authority to decide who would manufacture the aircraft and what type of plane it would be. The develop-

ment of one of the most controversial weapons systems in history also proved to be the longest congressional investigation ever. A second series of hearings were held some seven years after the initial investigation. Lasting from March 24 through April 28, 1970, this second group of hearings centered on the performance capabilities of the TFX, then designated the F-111.

To date, the TFX or F-111 program is still functioning. Although greatly emasculated from the original concept, the Air Force has found it necessary to procure 514 F-111 aircraft for use in its strategic bomber force. This is a sizable reduction from its initial quantity of 2400.¹⁰ The Pentagon issued a stop-work order on the F-111B on July 10, 1968 after the House Armed Services Committee along with the Senate Armed Services Committee refused budgetary authorization for the Navy version of the TFX.¹¹ This was an historical first in that no other major weapons program had ever been terminated by Congress over the objections of the civilians in charge of the Pentagon.

The costs for the TFX program have inflated considerably since its inception. In 1963, the F-111 program was to be by far the largest procurement contract ever let by the United States. It called for some 1,700 to 2,400 planes at a total cost of \$7 billion.¹² Defense Department appropriations for fiscal year 1972 now show that the present run of 454 F-111 aircraft has cost \$7.9 billion.¹³ This seems a long way from the promised \$1 billion savings which the "commonality" between the Navy and Air Force was designed to achieve.¹⁴

The above history is but a brief recapping of significant developments in the ten year life of the TFX. It is not meant to be a complete history, but, rather, is meant to serve as an introduction and background for

an in depth consideration of the more important factors involved in the TFX decision. These factors and the previously mentioned historical gaps shall be dealt with in other sections of this study. A complete chronology is included in Appendix #6.

Working Hypothesis

As I have stated before, the procurement of the TFX weapons system has proven to be one of the most controversial development programs in the history of Department of Defense spending. This fact alone is ample reason to study the TFX program as an exemplary case of procurement deficiencies. The development of the TFX aircraft, however, provides us with an even more novel example of weapons procurement. It is, in fact, the original use of the so-called "revolution" in procurement policy as devised by Robert S. McNamara in his role as Secretary of Defense.¹⁵ McNamara's new management technique consisted of two major factors:

- (1) a set of basic premises which set the intellectual stance of the McNamara group,
- (2) management tools which established the working methodology.¹⁶

The basic premises of the McNamara management technique can be described rather effectively in terms of their function within the decision-making process.¹⁷ First, the rational function is the quantitative analysis approach of cost effectiveness. "It is the mechanism through which financial budgets, weapons programs, force requirements, military strategy and foreign policy objectives are all brought into balance with one another."¹⁸ Second, role definition is the process used to determine the distribution of political risks and establish political and administrative roles. For McNamara, this process was the 1958 amendments to the National Security Act which enabled him to reorganize "the entire Defense Estab-

lishment [into] a single approved plan....and permits the top management of the Defense Department....to focus their attention on the tasks and missions related to our national objectives, rather than on the tasks and missions of a particular service."¹⁹ This unification of objectives and definition of role centralized authority in the Department of Defense in the hands of the chairman of the Joint Chiefs of Staff and the Secretary of Defense.²⁰ Third, the legal function is the process by which decisions are given a presumption of legitimacy. For McNamara, this presumption came less as an appeal to military authority and expertise to legitimize policies, and more as an application of personal philosophy:

either of two philosophies of management could be followed by a Secretary of Defense. He could play an essentially passive role—a judicial role. In this role the Secretary would make decisions required of him by law by approving recommendations made to him.

On the other hand, the Secretary of Defense could play an active role providing aggressive leadership - questioning, suggesting alternatives, proposing objectives, and stimulating progress. This active role represents my own philosophy of management.²¹

The basic premises of the group of McNamara civilian analysts were the superstructure upon which all Pentagon decision-making was grounded. The management tools were the "planning-programming and budgeting systems and the cost-effectiveness studies of systems analysis"²² which were utilized to accomplish the overall objectives of McNamara's policy, which was "choosing strategies and weapons systems...[and] how best to use our limited dollars and limited resources."²³

The introduction of this new management technique into procurement policy was a radical departure from the established system of service division of the military budget and competition through prototype de-

velopment.

In the TFX case, we have our first glimpse of the previously mentioned basic premises of the new civilian analysts in the Pentagon. At the same time, the TFX program provides us with only a partial example of the new management tools. Planning-programming and budgeting was not used at all in the developmental stage of the TFX. Cost realism, commonality and program definition phase were the innovating techniques used to analyze the TFX project.²⁴ The controversy over the TFX arose from the application of these new management approaches and the changes they wrought in the traditional relationship between the civilian and military sectors of the Defense Department. It is a case history of "how the civilians in the Pentagon gained operating control over the Military."²⁵

The fact that a significant change in civilian-military relations occurred during this time of innovative management is quite important. Equally notable is the result that such a change in procedure effects in the goods produced. In light of this, I shall attempt to show that the TFX program is a failure in that its end product, the F-111 airplane, is incapable of fulfilling the specifications and of performing the missions for which it was intended. That is to say, it was not in keeping with Secretary McNamara's avowed policy of the best use of limited dollars and resources. I shall also attempt to show that the failure of the TFX program is due, in part, to the civilian analyst's inability to fit the complex requirements of a major weapons system within the parameters of their new management technique, and that these techniques directly challenged the role of the professional military officer by rejecting their expertise concerning weapons procurement.

Assumptions

Before beginning an analysis of my hypothesis, I would like to posit two basic assumptions:

- (1) That within the bounds of any hypothesis there are two types of variables: (a) endogenous and (b) exogenous.²⁶
- (2) That the endogenous variables can be examined, studied and sometimes measured and then related to the hypothesis for possible acceptance or rejection of that thesis.

That the exogenous variables, while they may affect the hypothesis do not lend themselves to measurement and thus, cannot be applied to the hypothesis for acceptance or rejection.

Along with these two assumptions, two facts pertaining to this study must be noted:

- (1) Due to the lack of cooperation from the General Dynamics Corporation, the information available concerning the relationship of General Dynamics with the then Secretary of the Navy Korth and Deputy Secretary of Defense Roswell Gilpatric is highly selective. As a result, the use of this information may reflect a bias against the activities of the above mentioned firm and their relationship with Messrs. Korth and Gilpatric. Although the record shows a potential conflict of interest on Secretary Korth's part, and an actual conflict of interest on Mr. Gilpatric's part, it is hard to measure and assess their interest and influence in the TFX decision.²⁷
- (2) The exact nature and extent of Presidential and Vice-Presidential influence in the TFX decision-making process has never been fully disclosed. Indeed, the fact that the TFX program

had many political implications cannot be denied.²⁸ With regard to this particular case, Mr. McNamara has never spoken out on the President's role in the TFX. As one commentator noted, "only two men ever really know the answer to that, and one of them is dead."²⁹ Thus, it seems that at this point in history it is impossible to truly measure the role that Presidential political influence played on the TFX decision.

The purpose of this study is to examine the TFX case from a public administration-public management point of view. The areas I will examine will be concerned chiefly with the administrative and management issues of civilian-military relations and procurement policy. The endogenous factors will be: configuration, cost overrun, contract selection, civilian-military relations, commonality, and non-prototype competition.

The exogenous variables, conflict of interest and political influence in the decision-making process, will also be dealt with in the context of this study. However, it should be noted that the conclusions of this study are only as valid as the measurable effects of the variables considered. In the case of the exogenous factors, the conclusions are limited by the incomplete nature of the material available for analysis.

Outline of the Study

In order to examine my hypothesis, I have constructed a series of questions related to the variables to be considered.

Has the TFX met its original performance goals?, and have costs for the program been excessive? are both examined with regard to the configuration of the aircraft and cost overruns. How was the TFX contract

awarded?, and were the military pleased with the award system? will be considered with relation to the variables of the contract selection process and civilian-military relations. How useful has the TFX plane been to the services?, and what will be the rules for future development contracts? are discussed in an analysis of commonality and non-prototype competition.

In order to answer these questions, I will look at the issue of the failure of the TFX program in terms of configuration and cost overruns in Chapter II of this study. In Chapter III, I will analyze civilian management of the military in light of the special problems of contract selection and civilian-military relations. Finally, in Chapter IV, I shall discuss the problem of the procurement innovations of the civilian analyst, that is, commonality and non-prototype competition. The question of who is ultimately responsible for the TFX failure will be taken up in Chapter V, the conclusion.

CHAPTER II. THE FAILURE OF THE TFX PROGRAM

CONFIGURATION

Original Concept

On October 1, 1961, the United States Air Force issued a work statement to the aerodynamics industry requesting bid proposals for a new fighter plane. The Defense Department's "want ad" for a new aircraft indicated that the TFX - tactical fighter, experimental - should be:

A single aircraft for both the Air Force tactical mission and the Navy fleet air defense mission...Changes to the Air Force tactical version of the basic aircraft, to achieve the Navy mission shall be held to a minimum.¹

The description in the work statement was a radically different approach in military aircraft design and purpose. Normally, military aircraft are designed as single-purpose airplanes, each plane intended to perform a specific function or mission within the limits of its designed role.

Fighter aircraft were designed to climb and maneuver rapidly. To accomplish this mission, they were forced to limit their payload and fuel capacity and thus shorten their range. Strategic bombers were designed to carry heavy ordnance over long distances at high altitudes. Unfortunately, strategic bombers prove to be quite cumbersome in air-to-air and air-to-ground combat. They were also found to be unable to penetrate distant targets at a low altitude and lacked the speed to evade enemy radar at such a low level.

Consequently, each type of aircraft required its own separate back-up of ground support equipment and personnel, spare parts and aircrew training. All of this tends to be quite large and rather expensive.

With the issuance of the October 1, 1961 work statement, the TFX would become the first aircraft built specifically to reverse this historic trend toward specialization. Utilizing a NASA Laboratory breakthrough in aerodynamic design, "the variable-sweep wing",² the TFX would be a new step forward in aircraft versatility. By incorporating this major advance in airframe construction with the advanced technology of fan afterburning engines, the TFX promised to be aerodynamically efficient for short takeoff and landing, supersonic dash or long-range cruise from the slowest to the fastest operating speeds.

Performance Specifications

Specific performance qualifications were included in the work statement. Not only would it have the new variable-geometry which would fold the wings back along the fuselage for high-speed flight, but it would also be required to perform either nuclear or conventional bombing missions against well-defended targets in any type of weather, day or night; launch air-to-ground missile or rocket attacks with a variety of weapons; ground-strafe or attack aircraft in the air with 20-millimeter cannon fire; perform low or high-level reconnaissance missions against defended targets; take off or land on sod fields; fly supersonically at sea level and fly transoceanic distances on internal fuel only, and thousands of miles further with external fuel tanks.³

The TFX had to perform these missions within the parameters of the Air Force's specific performance requirements:⁴

- (1) Takeoff weight.....69, 122 lbs.
- (2) Maximum Speed, high altitude.....2.5 mach
- (3) Maximum Speed, sea level.....1.2 mach
- (4) Cruise Speed, high altitude.....2.2 mach
- (5) Combat Ceiling.....62, 300 ft.
- (6) Acceleration time, M=.9 to M=2.2.....1.45 min.
- (7) Takeoff distance.....2,780 ft.
- (8) Landing distance.....2,250 ft.
- (9) Supersonic dash distance.....210 miles
- (10) Ferry range.....4,180 miles

The flight envelope of the TFX - a plotted graph showing all of the above speeds and altitudes - would by far exceed that of any other U. S. aircraft ever produced since it would combine the capabilities of both high and low-speed aircraft.

The development contract for this unique and novel airplane was let to the General Dynamics Corporation in late December, 1962 amid unprecedented controversy. This issue, however, will be covered more thoroughly in another section of this study.

Performance Realizations

General Dynamics began work on the TFX, officially designated F-111 (hereafter used interchangeably), as soon as the contract was announced. The refinement of design ideas contained in the TFX work proposal proceeded for over two years before the first F-111 was finally constructed. On October 16, 1964, the first F-111 was unveiled at the General Dynamics plant in Fort Worth, Texas.

The new airplane was immense for a fighter, over 73 feet in length - equal to that of a B-17 bomber.⁵ It had a wing span of 63 feet when fully extended and stood 17 feet high. See Appendix #1 for full configuration design. Outfitted with the latest developments in aerodynamic knowledge, the F-111 was to be the mainstay of the U. S. airpower through the 1970's. It contained the new variable-sweep wing which, in effect, enabled the

pilot to redesign his aircraft while in flight. Extending the wing increased the surface area of the plane for maximum lift, enabling short takeoffs and landings. The surface area was reduced by sweeping the wings back against the fuselage, increasing speed to allow for supersonic flight.

The twin turbofan engines were to provide low fuel consumption for long-range subsonic flight, while their afterburners would offer more thrust for takeoff and supersonic speed. The landing gear was designed to permit high speed landings on sod or dirt airfields. The forward door of the main landing gear also served as an aerodynamic speed brake.

The flight control system was completely self-adaptive, automatically adjusting for deviations in the flight path. The crew module of the F-111 was designed as a self-contained, independent vehicle within the aircraft. If the crew is forced to abandon the airplane, an explosive cutting cord shears the cockpit module from the fuselage, a rocket motor ejects it upward and it then can descend to the ground or sea by parachute where it would serve as a survival shelter.

No doubt the most outstanding feature of the newly unveiled TFX was its "radar navigation systems"⁶ or its avionics. The avionics systems provide the capability for communications, navigations, terrain following, target acquisition and attack, penetration of enemy defenses and safe return of the aircraft.

The Mark I avionics system of the F-111 was the most advanced analog computer-controlled navigation system ever built. The avionics system was actually composed of five major subsystems: (1) a navigation and attack set to provide navigation and guidance data; (2) an attack radar set to give high resolution pictures of the ground or air-borne targets;

(3) terrain-following radar (TFR) enabling the crew to fly the plane automatically at a selected low-level clearance above the ground for concealment from enemy radar; (4) a low altitude altimeter set to feed information to the TFR on the plane's altitude at any given moment; (5) a lead computing optical sight set and missile launch computer to allow the aircrew to fire guns and missiles precisely by using data shown on a transparent optical display in the crew module.⁷

The airframe and wing carry-through section of the F-111 was composed of steel and aluminum in an effort at maintaining simplicity of materials and lower costs.⁸

The F-111 made its first test flight on December 22, 1964. Since then it has logged over 52,000 hours of flight time.⁹ An analysis of the aircraft's actual performance record between December, 1964 and October, 1969 indicates that the plane "does not meet initial contract specifications in basic weight, takeoff and landing distance, ferry range, combat ceiling, maximum speed and supersonic dash range on the deck"¹⁰ - otherwise referred to as low level flight.

The work statement and contract specifications call for a maximum takeoff weight for the TFX at a little more than 69,000 lbs. The actual takeoff weight has turned out to be approximately 13,500 pounds more than specifications. That is a deficiency in performance of 20%. Since this weight affects takeoff distance, the present distance required for takeoff is 3,550 feet or 28% more than the specification of 2,780 feet. Concomitantly, the landing distance is 3% over the requirement at 2,320 feet instead of 2,250 feet.¹¹

The contract spelled out an unrefueled ferry range without external tanks of fuel of 4,180 miles. The F-111 is capable of only 2,750 miles,

about 34% short of the contract goal. The combat ceiling of the aircraft is 58,000 feet. Compared to the specification of 62,300 feet, that is a deficiency of 7%.¹²

Although the airplane has been able to meet the specifications of maximum sustained speed at high altitude of 2.2 mach and a sustained speed at sea level of 1.2 mach, its supersonic dash distance capability is only thirty miles. The contract called for a supersonic dash distance of 210 miles, that is an 85% loss of performance. The most egregious deficiency in the F-111's performance capability is its acceleration time from mach .9 to mach 2.2. The contract required an acceleration time of 1.45 minutes, the actual performance figure is four minutes or 275% over the requirement.¹³ A complete chart of specified performance versus actual performance can be found in Appendix #2.

It is quite clear that the TFX aircraft produced by General Dynamics Corporation has been unable to fulfill the specifications required of it. An examination of the production changes and modifications between 1964 and 1969 sheds some light on this particular problem of the F-111.

Changes and Modifications

In a statement before the Senate Subcommittee on Appropriations in 1969 and reprinted in the 1970 TFX Hearings (Vol. 1, p. 169), Lt. Gen. John W. O'Neill, Vice Commander, Air Force Systems Command stated that he:

would like to review for you [the Subcommittee] now the significant development problems in this program... These are:

1. The weight growth of the basic airframe;
2. The engine air inlet problem;
3. Other engine problems;
4. The flight control system actuator valve weldment failure;
5. The wing carry through structure fatigue test failures.

It is interesting to juxtapose Gen. O'Neill's list of the significant development problems with Secretary of Defense McNamara's enumeration of the reasons why the General Dynamics' proposal was technically superior to the Boeing Corporation submitted design. In a statement prepared for the 1963 Permanent Subcommittee on Investigations hearings into the TFX contract and read by Department of Defense General Counsel J.T. McNaughton, Secretary of Defense McNamara stated:

There were three aspects of the Boeing proposal which, on their face, complicated the development of the aircraft. Three problems in particular stood out in my mind. The first problem was Boeing's proposed use of engine thrust reversers...to date [March 13, 1963] engine thrust reversers have never been used in flight on operational fighter aircraft, nor have they ever been employed on supersonic aircraft...The second area which...seemed likely to produce more complicated development problems was its proposed powerplant installation with top-mounted inlets...location of the inlets on top of the fuselage...results in significant distortion of the airflow at the engine face under most conditions...The third area which...involved greater development risks was its extensive use of titanium in its wing carry-through structure...it was not advisable to use titanium...because of a lack of data relating to such use...I realized that not only would the operational capabilities of the Boeing plane suffer, but additional costs would be incurred.¹⁴

As a result of considering Boeing's proposal which included the above mentioned potential problem areas and General Dynamics' proposal which was less "exotic"¹⁵, Mr. McNamara selected the proposal of General Dynamics "which seems likely to involve less change with consequent delays and increased costs."¹⁶

By reexamining General O'Neill's list of significant development problems and Secretary McNamara's list of potential development problems in the Boeing design, we can see that Mr. McNamara was quite skilled in anticipating future design problems. Of course, this fact is known

only because the General Dynamics design encountered the problems which were used as the basis for eliminating the Boeing proposal.

Since the "more straightforward design of General Dynamics"¹⁷ ran into development problems, it is hard to assess what the results of the more advanced Boeing design would have had on the development of the TFX aircraft. However, with regard to the General Dynamics and Boeing proposals, some facts are available. Concerning the General Dynamics design:

- (1) There have been approximately 3,900 changes;
- (2) The program has slipped behind schedule by four years;
- (3) The program production schedule has been cut by 40%, from 2,000 planes to about 500;
- (4) The program cost has risen from an estimated initial outlay of \$5.5 billion for 1,388 planes, to a cost of \$7.466 for 547 planes.¹⁸

In addition, tests performed by the Langley Research Center as early as June of 1963, indicated that the General Dynamics TFX would need to be redesigned because:

- (1) The F-111 design would not meet the Air Force specifications for the primary mission dash requirement.
- (2) The airplane would not develop the maneuver capability at supersonic speeds specified by the contractor.
- (3) Its directional stability was extremely low at supersonic speeds.¹⁹

The findings of the Langley Research Center questioned the performance capability of the TFX in its multimission role. Its primary mission was to be that of a strategic fighter, with a bombing capacity as well. In an exchange between Senator Henry Jackson and Air Force Secretary Zuckert in 1963, Zuckert defended the TFX's fighter predominance:

Jackson: ...Wouldn't it be better to call it a fighter-bomber, rather than just a fighter?
Zuckert: You can call it anything you want, Senator, and these are a question of degree. But this is because of its speed, altitude, maneuverability, and other things, it is more like a fighter than it is like a bomber.

Jackson: It is predominantly a fighter, you would say?

Zuckert: I have always thought of it as a fighter, because of its maneuverability...and because it can engage in aerial combat in a fashion that a bomber can't engage in aerial combat.²⁰

In the 1970 TFX Contract Investigation hearings Lt. General O'Neill, when asked by Senator Gurney and Senator McClellan to define the mission for which the F-111 would be utilized, stated:

O'Neill: We intend to utilize the F-111 principally as a deep interdiction strike aircraft. By that I mean to deliver bombs, either conventional or nuclear, on enemy targets which are deep behind the battleline.

McClellan: ...We would be told it was a fighter and then we would be told it was something else.

Now we have whatever we have, and it is not a fighter plane, is it?

O'Neill: It is not an air superiority fighter aircraft.²¹

The Chief of Staff for the United States Air Force, General John D. Ryan, in testimony before the House Subcommittee on Appropriations hearings for the Department of Defense Appropriations for 1972, cited that the F-111:

is the finest airplane in the world for bad weather, night interdiction missions.²²

General Ryan also stated that there was a "need for an air superiority fighter."²³

Although there appears to be some disagreement on just exactly what the mission role and design capabilities of the F-111 are, there is one self-evident fact, as Vice Admiral T.F. Connally, Deputy Chief of Naval Operations, pointed out:

We sit here and discuss all the things wrong with the F-111. There are some things that the F-111 can do. It can fly...It won't serve the pilot's needs

like it should, and it ought to be fixed properly,
but it still can fly...²⁴

The Langley Research team recommended redesigning the TFX in order to improve on its maneuverability and speed. Yet, there appear to be a number of other problem areas that call for a redesigning of the General Dynamics F-111.

General James Ferguson, Commander of the Air Force Systems Command, in a prepared statement before the Senate Armed Services Committee in 1970, testified that not only did the F-111 have a weight problem but that:

another development problem involved matching of the aircraft engine and its air inlet...the F-111's inlets have been redesigned to accommodate the air flow requirements of the advanced engine design.²⁵

Secretary of the Air Force Robert C. Seamans, while giving testimony before the same Armed Services Committee, noted that metal fatigue on the F-111 was due to structural flaws because "high strength materials, be they aluminum or steel, have a characteristic that they rip like cloth under certain circumstances."²⁶

Deputy Secretary of Defense Paul H. Nitze, before the Senate Subcommittee on Appropriations in July, 1967 when questioned by Senator John McClellan concerning the adequateness of the F-111's present air brake, replied:

The original speed brake design caused moderate to severe buffet at high speed...It is anticipated that the redesigned speed brake now being tested will be operable throughout the flight envelope with an acceptable level of buffet.²⁷

I have documented the fact that the General Dynamics design was found to be deficient as far back as 1963. Unfortunately, nothing was done to correct those problems as they arose. By deployment time in 1967, three serious problems had arisen. First, the use of steel and aluminum in the

airframe had caused an increase in weight as well as structural flaws. Second, the air inlets or air scoops needed to be redesigned to assure maximum efficiency. Third, the use of the forward door of the main landing gear as a speed brake was ineffective and had also to be redesigned. All of these factors led Admiral David L. McDonald, the Chief of Naval Operations to observe:

we don't have an optimum plane.²⁸

At the same time, there are several facts concerning the Boeing proposal that should be examined. As I have stated before, three of the principal reasons for Secretary of Defense McNamara's rejection of the Boeing proposal were the use of titanium in the air frame, the use of overhead air inlets, and the use of thrust reversers rather than speed-brakes to slow the aircraft down. All three were considered to be novel applications of new technology to a fighter aircraft and, therefore, would require more costly study and development, or, at least, that is what Mr. McNamara testified.

In point of fact, the TFX work statement actually encouraged the use of titanium in the design proposals in order to conserve weight:

Materials and components: The design and operational objectives stated in this work statement support the conclusion that the... [TFX] air vehicle and subsystems can be successfully produced from readily available and economical-to-use raw materials... However, special consideration shall be given to the use of titanium with a view toward reducing weight of the aircraft.²⁹

Aviation Week and Space Technology magazine in 1964 stated that, "industry sources report at least 4,000 pounds of titanium will go into each General Dynamics F-111. The amount is expected to continue to climb to reduce the weight problem in both the Air Force and Navy versions."³⁰

This same issue carried an article discussing the merits and

capabilities of a then super-secret aircraft, the Lockheed A-11. The article pointed out that the A-11 is a Mach 3.5 long-range aircraft, whose mission altitude exceeds 100,000 feet and whose range is in excess of 4,000 miles. Developed by the Lockheed Corporation as a reconnaissance plane, it was then being used as an interceptor. It was mainly composed of titanium. It also was powered by two turbojets with afterburners and thrust reversers. It had been under development since 1959.³¹

Senator McClellan stated during the TFX hearings that contrary to Mr. McNamara's assertion, titanium was a proven metal since the Air Force had developed and was purchasing planes that had 95% of their weight in titanium.³² On February 19, 1964, President Lyndon B. Johnson commented on the A-11:

One of the most important technological achievements in this project has been the mastery of the metallurgy and fabrication of titanium metal which is required for...aircraft travelling at more than three times the speed of sound.³³

The use by Boeing of thrust reversers and the location of the air inlets were also questioned as doubtful technological achievements. However, the Air Force's most advanced high-speed aircraft, the A-11, employed thrust reversers as its brake system. In fact, as the testimony of Boeing's Vice President noted, "our new model 727 short-range jet transport, with three engines of the same type and some 20% larger than the engine proposed for the TFX...has a thrust reverser essentially identical in detail design to that proposed for the Boeing TFX."³⁴

Mr. Edward C. Wells, Boeing's Vice President, also noted that:

The top-mounted engine inlets are another design feature which has been questioned with regard to technical risk...the only question seems to be whether or not it will work. The answer is an unqualified "Yes". The model 727 airplane is currently flying with a

top-mounted engine inlet which has already proven completely satisfactory over a wide range of speed and angle of attack.³⁵

Disregarding the advice and admonitions of various groups of experts, and despite the inability of the TFX to meet its original expectations, the multimission concept was expanded even further than originally planned. A whole family of F-111 airplane types were begun, to include not only the Air Force F-111A and The Navy's F-111B, but also an RF-111A reconnaissance plane; an FB-111 strategic bomber, an F-111C for the Australian Army and the F-111K for use by the United Kingdom, as well as several modifications on the F-111A version which were designated F-111D, F-111E and F-111F. A complete rundown of each aircraft can be found in Appendix #3.

Having examined the configuration and performance goals of the TFX aircraft, I will now turn to the cost goals of the TFX program.

COST GOALS AND COST OVERRUNS

Original Program Costs

In December of 1962, the press made known to the United States public the fact that a contract between General Dynamics and the United States Air Force had been signed. In their account of this particular transaction, several facts were revealed. According to the published reports, General Dynamics was to build 22 prototype airplanes at a cost of \$750 million. It was also revealed that the expected production run of the aircraft would total 1,500 planes over the next five years at a total cost of approximately \$5 billion, or \$2.9 million a plane. Defense Secretary McNamara was reported to have felt that it would cost \$1 billion less to develop a basic plane for both military services rather than a different plane for each branch.³⁶

By November, 1963, when the Contract Definition Plan was officially announced, the total number of aircraft to be constructed had risen from 22 to 1,370. The estimated cost of this project was put at \$5.5 billion. This estimate represented the cost of 1,370 F-111A tactical fighters for the Air Force, 18 Research and Development aircraft and common research and development for both the Air Force and the Navy version of the airplane. The unit price for the new TFX was then established at \$3.96 million a plane.³⁷

A subsequent proposal to increase the number of F-111 aircraft to 1,726, allowing for the Navy's 300 planes, brought the total cost of the

program to \$5,803 million, and pushed the unit price up to \$4.1 million respectively.³⁸ During the ten year history of the TFX program estimated orders for the number of aircraft to be produced escalated to as many as 2,411. Unfortunately, the Air Force did not submit an estimate of cost to the Office of the Secretary of Defense for the 2,411 order.³⁹ Consequently, there is no way of determining the total cost for the proposed full complement of aircraft and we are, perforce, left to deal with the documented figures of \$5,803 million for 1,726 planes at a unit cost of \$4.1 million.

Development Overruns

The initial research and development contract covered research and development, testing, evaluation, and the production of 18 F-111A airplanes and 5 F-111B planes and included static and fatigue testing on these airplanes. Provisions were included which allowed for the ordering of training devices and spare parts which were to be priced at a later date than the December 21, 1962 signing of this contract.

The initial target costs for this first research and development contract called for the development of the F-111A at a cost of \$290,390,500. The manufacture of 18 F-111A planes was estimated at \$117,477,000 and 5 F-111B planes at \$33,132,500. A target profit of \$39,375,000 was included, to bring the total cost of the initial research and development contract to \$480,375,000.⁴⁰

The actual definitive contract was not signed until August 31, 1969 some six years later. This research and development contract had been expanded to include the development of the entire family of F-111 aircraft, the RF-111, F-111C, F-111K, F-111D, FB-111 strategic bomber and

the advanced F-111E airplane. This increased the target cost by some \$324.5 million for development. Due to changes in the F-111A test aircraft the target cost of the aircraft themselves had inflated by \$14.1 million. There was an increase in cost due to the aforementioned provisions for training devices and spare parts which totaled an additional \$166.5 million. A concomitant increase in the allowed profit brought that figure to \$77,847,274. As a result, the total net increase in target cost was \$511.4 million, which brought the total definitive costs to a grand total of \$992 million as of August, 1969.⁴¹ By December 31, 1969, General Dynamics had re-estimated its definitive costs for development to \$1,718 million. Additional costs for engines were also included, so that by March of 1970 the total cost of the research and development contract was complete at \$2,160 million, some \$1,680 million above the original target cost of \$480,375,000.⁴²

Production Overruns

The initial production contract covered only 493 aircraft over a four year program from 1965 through 1968. On the original contract, 469 of the planes were priced as F-111A's and 24 were priced as F-111B's. The initial target costs for this contract called for \$1,671,503,267 for total costs plus a target profit of \$150,435,294, bringing the entire price of the first production contract to \$1,821,938,561.⁴³

During its inception there were a number of model and program changes which forced an extension of the contract to include six fiscal years, 1965 through 1970. These increases due to changes in the basic aircraft design, including the introduction of the other F-111 type airplane, e.g. FB-111, F-111, C, D and E series, plus training devices

and spare parts increased the costs to \$2,375,300,000 including an updated \$189.3 million profit for General Dynamics.⁴⁴

By December 31, 1969 when the definitive contract was signed, the production cost for 1,704 aircraft with engines and support equipment, which was estimated by General Dynamics to be \$4,912 million and then readjusted upwards by the Air Force to \$5,092 million, was again readjusted. This time the contract called for a total cost of \$4,733 million for only 491 airplanes, since the Navy's F-111B had been abandoned due to high costs and extreme weight. Thus, the costs were reduced by \$359 million, but the production run in aircraft was cut by 1,213 planes.⁴⁵ The production unit cost of one F-111 would be just about \$10 million, almost \$7 million more per plane than the original 1962 price of \$2.9 million.

The production program for the F-111 was still being reconsidered every fiscal year. In 1969, the then Secretary of Defense, Clark Clifford, recommended that the total force level of the F-111 program be reduced,⁴⁶ even though it had been increased during that same year from 491 to 547 with the addition of the F-111F series, pushing the program cost up to \$8,652 billion, with a unit cost of \$15.8 million per copy.⁴⁷ In a prepared statement before the House Subcommittee on Appropriations in 1971, Secretary of the Air Force Seamans called for the concluding of the F-111 procurement even at the expense of some reduction in the number of aircraft. In an exchange with Representative Mahon of Texas, Secretary Seamans stated:

I do not know how we got into it [F-111 program] but I know that in the last two years we have been pressed to procure fewer F-111's than we are now procuring. The Office of Management and Budget has recommended that we cancel out one of the wings, have only three wings rather than four.⁴⁸

This action, if implemented, would end the present program with 454 F-111 aircraft at a cost of \$7,989 million, or just about \$17 million per airplane,⁴⁹ some \$14 million over the original unit price per plane.

Causes of Cost Growth

The increase in the unit cost of the TFX system as witnessed above can be attributed to a number of factors.

1. Decrease in the number of aircraft to be produced;
2. Increase in the number of versions or models of the TFX, including those later abandoned;
3. Weapon systems capability improvements;
4. Inflation;
5. Technical problems.⁵⁰

However, in a study done by the General Accounting Office on the "Status of the Acquisition of Selected Major Weapon Systems" of which the F-111 was a component system, the General Accounting Office concluded that:

one of the most important causes of cost growth is that decisions are made to begin the process of initiating a program before it has been demonstrated adequately that the prerequisites for advancing into the contract definition phase have been satisfied.⁵¹

I believe that there are several good reasons for accepting the above proposition as being true in the case of the TFX project. In a series of letters between Mr. Elmer B. Staats, Comptroller General and Senator John McClellan, Chairman of the Permanent Subcommittee on Investigations, we have documented proof that certain components of the F-111 program had not been satisfactorily proven adequate, yet the contract definition phase had already been entered into.

On March 21, 1967 Mr. Staats notified Senator McClellan that "the aircraft's main wing carry-through assembly buckled during a static

test".⁵² Again on April 28, 1967 Mr. Staats wrote Senator McClellan that the target cost of the crew escape module used in the F-111 and manufactured by the McDonnell Company, "was established solely for the purpose of reaching a definitive base line for further negotiations and ... did not reflect McDonnell's realistic estimate of the cost of the currently authorized program."⁵³ On that same day Mr. Staats also mailed a study to Senator McClellan pertaining to the costs of the engines used in the F-111. The study showed that the development costs of the Pratt and Whitney TF-30 jet engine were exceeding the requirements of the development contract as early as 1962, yet on December 31, 1966 the Navy entered a production contract with Pratt and Whitney for their TF-30 engine even though it did not meet cost specifications.⁵⁴

These letters record flagrant cases of cost requirement and aerodynamic specification violations which the United States Air Force and Navy chose to ignore and consummated a production contract despite the lack of prerequisites for approval.

The General Accounting Office's study also concluded that:

another significant cause for cost growth can be traced to the initial documents which define system mission requirements and technical performance specifications, including the estimate of costs to achieve them.⁵⁵

Again, in a letter report from the Comptroller General Mr. Staats to Representative George H. Mahon, Chairman of the House's Committee on Appropriations, the facts show that:

While the Air Force has ... certain controls and procedures governing the procurement of engineering data, these are designed primarily to effect savings in the cost of acquiring and storing the data and do not extend to the Government's obtaining accurate, complete and unrestricted data - one of the essential prerequisites for competitive procurement. The cost of the future procurement of parts for the F-111 program can increase significantly unless corrective measures are adopted.⁵⁶

Comptroller Staats recommended that the Air Force "require closer monitoring of the quality of the technical data obtained for the F-111 aircraft weapon system from the prime contractor."⁵⁷

In the final analysis, it would seem that cost inflation in the TFX program was a function not of the expected problems of capability improvements, inflation and technical problems, but also of the unsatisfactory demonstration of the adequacy of the project and insufficient utilization of data to define performance specifications and control costs at the outset of the program.

SUMMARY

Has the TFX met the original performance goals spelled out in the initial work statement?

The answer, of course, is a resounding "no". The TFX failed to perform up to expectation in terms of its weight, acceleration, altitude, distance performance and ferry range. As a result, it was unable to fulfill the multimission requirements for which it was designed. The United States Navy version, the F-111B, was inadequate for aircraft carrier use due to its considerable weight, and the British and Australian Governments both canceled their purchase of the F-111 due to its excessive costs. The F-111's lack of maneuverability due to its size and weight make it unacceptable as a tactical fighter, and thus its mission has been reduced to that of interdiction bombing.

Have the costs of development and production of the TFX been excessive?

The development overruns totaled more than \$1.6 billion, and the production overruns have been so excessive as to raise the unit price from its originally estimated \$2.9 million to just short of \$17 million per aircraft. The causes of this increase in cost are many and varied. Appendix #4 contains a dollar breakdown of the reasons for cost growth and the actual amount of inflation on a point by point basis.

Having established the fact that, (1) the TFX program failed to produce a plane capable of performing the mission for which it was designed and (2) was equally unable to maintain control over the cost of

the project, I would like to turn now to a consideration of the management factors that, I believe, contributed to the downfall of the TFX program.

CHAPTER III. CIVILIAN MANAGEMENT OF THE MILITARY

CONTRACT SELECTION

Source Selection Process

In order to comprehend the rationale behind the selection of a contractor for the production of a major weapons system, it is necessary to understand the selection process.

The United States Air Force, in concert with the Navy, was given the responsibility of developing the TFX. The Air Force policy is that the selection of all weapons systems and subsystems should be determined by what they call "system source selection procedures."¹

The normal procedure is to set up a System Source Selection Board (SSSB). This Board investigates, evaluates and makes recommendations on a preferred source or sources for the development and production of a weapons system. The SSSB is composed of Air Force personnel who are qualified and experienced in weapons procurement.

Accordingly, the objective of the SSSB is to evaluate the specific proposals that are presented to it by the private aerodynamic firms competing for a systems contract. The use of this technique derives from a realization that the operational date for weapons delivery is a very crucial factor in ascertaining the true value or utility of a new weapons system. Thus, the purpose of the SSSB is to save as much time as possible in the development period, by reducing the time during which the Air Force can maintain direct control, that is, during

the formal competition to select the best company. System Source Selection is thus a technique to determine which private firm can most effectively produce the requested weapons system, and to make this determination in the shortest possible time.² Of course, the SSSB is geared to shortening the development cycle, but it is also supposed to increase the probabilities that the decisions being made are the best possible ones.

As a result, the Board designates an evaluation group to perform specified duties. This evaluation group may be subdivided into several teams to consider specific areas, such as tactical feasibility, logistics, production and management. Each group analyzes and evaluates each proposal from the private corporations and scores each proposal accordingly. The groups then meet to determine which company has the highest score. This is done by totaling the scores that each company received in each of the group evaluations. The chairman of the group evaluation then submits these scores and their accompanying analyses to the Source Selection Board.

After the Source Selection Board has finished considering the recommendation of the evaluation group, it will then make its own evaluation. The Board then, in a secret vote, decides which firm it recommends as the source for the new system. The Board recommendation and the evaluation group study are sent to the Air Force Council, which is composed of the general officers who are the Deputy Chiefs of Staff. They in turn pass their recommendations on to the Chief of Staff of the Air Force, and in the TFX case, to the Chief of Naval Operations as well. The decision of the Chiefs of Staff is then forwarded to the civilian Secretaries of the services, who then pass their

decision on to the Secretary of Defense for review and concurrence. The Secretary of Defense, in all cases, has the ultimate authority and responsibility in making the decision.³

The Military's Choice

The proposals from the private aerodynamic companies arrived at the Pentagon on December 6, 1961, just two months after the Air Force issued its work statement for TFX designs.

TFX research and development proposals were submitted by six contractors: Lockheed, McDonnell, North American, Republic, Boeing and General Dynamics. These proposals were delivered to the evaluation group of the SSSB for their immediate analysis. In early January of 1962 the evaluation group reported that none of the six submitted designs were acceptable. The group then recommended that further study contracts be given to both Boeing and General Dynamics, the two firms with the highest rating.

After further study was done by Boeing to redesign its airframe around another engine, and General Dynamics to redesign its airframe to better suit the Navy's uses, their proposals were resubmitted. The Source Selection Board on January 19, 1962, unanimously recommended that Boeing be given the contract to develop the TFX. At that time the Navy believed that Boeing Corporation had a better comprehension of the design problem that carrier flight entailed, and felt that the Boeing design would be satisfactory with changes. The Navy found the General Dynamics proposal unacceptable.⁴ The Air Force Council recommended limited study contracts be let to both companies, since it felt that the Source Selection Board's recommendation to choose Boeing "could not

help but appear to be risky, premature and unjustified",⁵ since the Boeing proposal still had not worked out all the problems of its design. Secretary Korth and Zuckert ordered a new ninety day study from both firms.

During this first evaluation all recommendations concerning the selection of a source indicated that Boeing Corporation be selected as the prime contractor. There were no positive recommendations for the General Dynamics design.⁶

On April 2, 1962 the second group of proposals from Boeing and General Dynamics were received by the evaluation group. This time, the Navy made an independent evaluation of the design and its compatibility with carrier flight. The Navy concluded that neither design was acceptable for their use. They added, however, that they felt that the Boeing design was substantially better than the General Dynamics proposal.⁷

The Source Selection Board recommended for the second time that the Boeing Corporation be chosen as the source to develop the TFX. The Navy dissented in this vote, stating that they refused to approve the Boeing design as acceptable.

Since the TFX was to be a biservice plane and since Secretary McNamara, in his memo on the TFX, made it quite clear that the only way the Air Force would get its TFX was through a biservice program, the Navy "literally held a veto over the TFX."⁹

At the Secretarial level the decision was made to call for another evaluation. The "short round",¹⁰ as it was called, gave the two companies only three weeks to correct the deficiencies in their designs, which at this time stemmed from the fact that neither design was suitable for carrier type take-off and landing.

All recommendations made during the second evaluation, as was true

of the first, stated that Boeing be chosen. There were no recommendations for General Dynamics.¹¹

The evaluation group of the third or "short" round proposals called for the immediate approval of Boeing as the single source of development for the TFX. On June 20, 1962, the Source Selection Board recommended for the third time that Boeing be selected as the source since the Navy had now approved its design. The choice of Boeing was then sent on to the Air Force Council where it was unanimously recommended that Boeing be given the contract.

This recommendation was given to both Secretary of the Air Force Zuckert and Navy Secretary Korth. They both, in turn, refused to sign the recommendation of the Air Force Council. Instead, Secretary Zuckert sent notice to Boeing and General Dynamics giving them another paid study contract for sixty days at \$2.5 million a piece.¹²

The fourth and final round of competition utilized a new rule that differentiated it from the other three rounds. In the fourth competition, the evaluation group was allowed to work with each firm as though it were the selected contractor. Secretary McNamara instructed the Air Force to forgo the usual practice of remaining uninvolved for the sake of objective neutrality. Instead, McNamara authorized the Air Force to work closely with each competitor, permitting the Air Force to identify deficiencies in each design as they arose, not after the competition was over, as was usual. The Air Force was even allowed to suggest specific ways of correcting the problem, although the Air Force could not tell the contractor what to use or which correction would best solve the problem.¹³ Apparently, McNamara felt that if "pure" competition could not produce a satisfactory design, then he would rig the competition so that it would.¹⁴

Secretary McNamara actually went so far as to tell both Boeing and General Dynamics what he wanted in their designs. Letters were sent to the presidents of both companies through the Deputy Secretary of Defense, Roswell Gilpatric. In these letters, McNamara indicated the areas on which he would center in evaluating their proposals. The areas were: the plane's operational capability, the degree of commonality, and the realism of the cost proposals.¹⁵

The final proposals were submitted on September 10, 1962. The evaluation groups designated Boeing as its final choice. The Source Selection Board, on November 2, 1962, concurred with the selection and unanimously recommended the selection of Boeing as the source for the TFX Development. The Board indicated that the reasons for the selection of Boeing's design were:

1. Superiority in all major aspects of operational capability.
2. Lower quoted cost.
3. Positive ground deceleration mechanism - thrust reversers.
4. Less risk of foreign object damage and missile exhaust degradation of engine performance due to overhead air scoops.¹⁶

The Air Force Council approved the selection of Boeing as the contractor on November 8, 1962. Their recommendation was then passed on to Secretary Korth and Zuckert, but neither of the Secretaries signed their approval to this recommendation.

During the fourth round, as was true of the other three, all recommendations made concerning the selection of a development source chose the Boeing Corporation. In fact, the fourth evaluation showed complete unanimity. There was absolutely no disagreement in any group. The entire

military chain of command recommended the Boeing Corporation.¹⁷

Secretary McNamara's Decision

Even though the numerous generals, admirals and sundry other officers of the military chain of command recommended the selection of the Boeing Corporation for the development of the TFX, the civilians at the Secretarial level had other ideas.

After a breakfast meeting with Deputy Secretary of Defense Gilpatric, Secretary of the Air Force Zuckert and the Assistant Secretary of the Navy for Research and Development, Dr. James H. Wakelin, Secretary of Defense McNamara decided to select General Dynamics as the TFX contractor. In an official memo, dated November 21, 1962, and released to the public on November 24, 1962, the Secretary of Defense announced that the General Dynamics Corporation had been awarded the contract for the development of the 22 prototype TFX aircraft.¹⁸

If the TFX project was to prove controversial, certainly the first step in that direction was the decision to give the development contract to General Dynamics. The circumstances surrounding this decision were absolutely unprecedented. In the history of Pentagon procurement, this was the longest time ever taken to make a decision on a major source selection. Never before had there been four individual evaluations of contract proposals for the development of a major weapons system. Above all, this was the first time that the civilian administrators of the Pentagon had ever overruled the unanimous recommendation of their top military officers on a major source selection without first consulting them.¹⁹

The sole justification for the selection of General Dynamics was

the short secretarial "memorandum for the record" of November 21, 1962. Approved and signed by the Secretary of the Air Force Zuckert, the Secretary of the Navy Korth and Secretary of Defense McNamara, this written statement gives the rationale for the choice of General Dynamics over the Boeing design. The memorandum stated that:

Inasmuch as either of the proposed aircraft can perform the mission required by both services, and the evaluation of the proposals provide no overriding margin between the competitors, it is necessary to consider other factors in evaluating these aircraft.²⁰

The "other factors" considered were the degree of commonness, the tooling and manufacturing of the aircraft, and the cost proposals of both companies. Specifically, the three Secretaries declared that the General Dynamics version of the TFX had a higher degree of commonality of parts, 85% as opposed to the 60% commonality of the Boeing design. This greater similarity in the General Dynamics plane, they felt, would "reduce weapons system costs by maximizing similarities of Air Force and Navy versions and by maximum use of common equipment and structure."²¹ They also felt that Boeing's proposed tooling and manufacturing process would reduce the commonality of the Navy version and "further manufacturing problems may be introduced which are not envisioned by Boeing at this time."²² Finally, they felt that "the Boeing formula for estimating the cost of the aircraft resulted from an overoptimistic impression of the complexity of the TFX."²³ The Secretaries felt that Boeing's proposed use of thrust reversers, sweep wing, titanium and overhead air-scoops were examples, "if our experience is any guide, that much redesign and testing would be necessary, contrary to the reduced engineering estimates and cost indicated in the Boeing proposal."²⁴

They noted, conversely, "that the General Dynamics proposal applies extensive engineering and test effort to the development program and could be considered as conservative. It is felt that this approach is more likely to meet the development milestones and cost goals than the Boeing proposal."²⁵

This memorandum of November 21, 1962 was the only document used at the Secretarial level to justify the reversal of the Source Selection Board. There were no detailed studies, reports, or analyses to support the reasoning used in the memorandum, as had been done by the SSB in their decision-making process.

The undocumented and somewhat vague criticisms of the Boeing proposal, as well as the undocumented and vague commendations of the General Dynamics proposal, seem less reasonable when one considers the fact that none of the Secretaries who signed the document had had any previous background or training in aerodynamics. Therefore, the abovementioned "experience as guide" was non-existent.²⁶

The unjustifiable nature of the civilian decision to reverse the recommendation of the Source Selection Board is magnified by the knowledge that the civilian Secretaries did not discuss the reversal with their Air Force and Naval advisers, nor did they consult them prior to making their final decision.²⁷

The 1963 Congressional hearings on the TFX dealt, in large part, with the so-called "other factors" of the November 21 memorandum. Civilian and military technical experts testified about the proposed use of thrust reversers, over-head air scoops and titanium, as well as the other "optimistic" features of the Boeing design. All of the various scientists refuted the technical criticism of the Boeing proposal as

recorded in the memorandum from the Secretaries.²⁸ The concept of commonality as a major cost-saving innovation was dismissed by several experts²⁹. This topic will be explored more fully in Chapter IV of this study. The Investigating Subcommittee examined the Secretarial idea of "cost realism" in great detail.

The 1963 Hearings established the fact that an elaborate system of cost estimating had been worked out by the Pentagon. There were three sets of TFX cost estimates available to the Secretarial decision-makers. First, the contractors' proposals as prepared and submitted by the cost accounting departments of both Boeing and General Dynamics were in the hands of the Pentagon. These figures showed General Dynamics' proposal to have been \$5,455.5 million for development and production of 1,704 aircraft. The Boeing proposal was \$5,364.3 million for the same production run. The contractors' proposal showed Boeing's cost estimate to be \$91.2 million lower than General Dynamics'.

Second, the Air Force cost team of the evaluation group found it necessary to make certain adjustments to the contractors' proposals because the contractors had not followed the format for categorizing costs as prescribed by the Air Force. The result of the Air Force adjustment was the correction of the Boeing figures to \$5,387.5 million and the General Dynamics figures to \$5,803.5 million for the total program. This again gave Boeing the lower bid and had increased the distance between the two proposals by \$416 million.³¹

Third, the "Air Force Cost Standards Estimates" was the attempt by the cost team of the evaluation group to arrive at realistic figures for what each contractor's presentation of the TFX would actually cost,

not just what the contractors said it would cost. The figures were based on learning curve projections of estimates made by the cost team. The Air Force Cost Standard Estimates showed the Boeing total program costs to be \$6,983 million and the costs for General Dynamics to be \$7,083, a difference of \$100 million.³² The General Dynamics proposal was said to be more realistic, however, since it differed from the Air Force cost standards by 18% whereas the Boeing proposal differed by 22%, with an individual difference of 4%.³³

However, errors were discovered in the Air Force Cost Standards Estimates calculations. The errors were in the projection of the learning curves used in the cost estimation. When the errors were corrected and the cost estimate reprojected, it was discovered that the Boeing program was now \$7,273 million compared to \$7,423 million for the General Dynamics proposal. Now, even though the Boeing proposal was still \$150 million lower than the General Dynamics bid, the difference between the proposals was only 2% as compared with the Air Force cost standards. At the same time, the Air Force's cost engineer for the TFX had stated that when the negotiated price fell within 3% of each other, then costs would not be sufficiently low enough to warrant using price as the sole determinant in awarding the contract.³⁴ Since the price of the two proposals was well under the 3% barrier, Secretary McNamara was asked to discuss the matter before the Investigation Subcommittee. Mr. McNamara sent a prepared statement to the Subcommittee in which he said:

the letter [Subcommittee's invitation to discuss the matter] states that the cost standards prepared by the Air Force were "used by the Department of Defense in making its decision on the award of the TFX contract."

The fact is, however, that at the secretarial level the cost estimates prepared by the Air Force were considered so unreliable as an indication of the ultimate differential in research, development, and production costs between the programs of the two contractors that they could not be used as a foundation for the source selection.³⁵

Secretary McNamara's dismissal of the Air Force cost estimates as unreliable prompted an immediate investigation into the question of how Mr. McNamara arrived at the conclusion that the General Dynamics proposal was the most realistic of the two cost bids.

The General Accounting Office interviewed Secretary McNamara on April 16, 1963. The investigators from the GAO sought to establish the factual grounds on which the TFX decision was made. Mr. William A. Newman of the GAO testified before the Investigating Subcommittee that:

We requested any information that was prepared at his level concerning the cost estimates inasmuch as he had stated that the cost standards prepared by the Air Force were unrealistic.

Secretary McNamara went back, back to the beginning, to give us the story of the whole philosophy of the program and the planning. When it came time to examine the records, and we had access to anything we wanted, he stated that he had the figures in his head, indicating to us that he did not have them on paper.³⁶

Mr. Hassell B. Bell, also of the GAO gave a similar response to the question concerning the cost realism figures. In an exchange with Senator Henry Jackson and Senator John McClellan before the Subcommittee, Mr. Bell made these remarks:

Bell: Mr. McNamara told us at the time he was reviewing the documents, that certain engineering problems occurred to him in which, in his judgement, Boeing had estimated their costs lower than they should have been...

Jackson: If cost realism is one of the key points, as I understand the Secretary's position,

along with commonality...wouldn't he have to determine the validity of the cost figures as proposed by the competing companies?

Bell: Both Secretaries [Zuckert and Korth] told us they were relying upon their experience in the field previously, and that they were able to make rough judgments.

McClellan: Make what kind of judgments?

Bell: Rough judgments. I think that is the word Mr. McNamara used; yes.³⁷

In the final analysis, there was no actual evaluation of the costs before the decision was made. The decision was made on the basis of a non-existent "experience in the field". The only review of the cost proposals confirmed the fact that Boeing did, indeed, have a lower cost bid. The official document justifying the award of the contract to General Dynamics used the concept of greater "cost realism" as the basis of the award, yet there are no figures to substantiate this claim. In effect, there was no systems analysis done on the TFX proposal.

Robert Art, in defense of the McNamara decision, states that:

Ultimately, therefore, the TFX decision did not turn on who was right or wrong on the technical issues. Rather it turned on the group that had the greater power to make its judgments on those issues prevail.³⁸

Before considering the "group that had the greater power to prevail", the civilian analyst, I would like to examine a few factors that are less tangible than cost realism figures, but which come to light in any examination of the TFX project.

Politics, Economics and Conflict of Interest

Decisions on military spending and defense procurement are never made in a socio-economic-political vacuum. Within the political process there are diverse and legitimate interests, as well as personal interests and political expediency. In the case of the TFX, the political

prudence and political process may have been displaced by the technical rationality of the "new management" techniques, yet the vestiges of political favoritism and personal aggrandizement are everywhere evident.

There were certain political implications that were quite obvious. The Vice President, Lyndon B. Johnson, the former Secretary of the Navy John Connally and the new Secretary of the Navy Korth were all from the state of Texas. General Dynamics President Roger Lewis was a former Assistant Secretary of the Air Force. The fact that he was assisted in bringing the TFX contract to General Dynamics was underscored by the press. It was reported that Mr. Lewis got help from "that charming arm-twisting Texan, Lyndon B. Johnson. Pentagon insiders were said to refer to the TFX as the LBJ".³⁹

The President was not unaware of the political implications of selecting a contractor for the largest aircraft contract ever let. Texas and New York, where General Dynamics and Grumman - the major subcontractor - would build the plane, commanded sixty-nine electoral votes, far exceeding the nine votes of Washington, where Boeing made its headquarters, and the eight of Kansas where it planned to build its TFX.⁴⁰ Noticeable, also, was the fact that John Kennedy carried both Texas and New York in 1960, while losing both Kansas and Washington to the Republicans.

In testimony before the Investigating Subcommittee, Senator Sam Ervin asked Secretary of Defense McNamara if the fact that the Vice President of the United States was a resident of the state of Texas had anything to do with the awarding of the TFX to General Dynamics of Fort Worth, Texas. Secretary McNamara replied "absolutely not" and went on to say that:

to the best of my knowledge, no one has submitted any evidence whatsoever indicating that I was influenced in the slightest degree by political matters. Specifically, the Vice President never discussed the matter with me ... nor, to the best of my knowledge, did any other political figure in the country discuss the matter with me.⁴¹

Nevertheless, in a memorandum for the Secretary of the Navy and the Secretary of the Air Force dated January 30, 1962, Secretary McNamara stated:

I have told the President that we propose to discuss with him our recommendations regarding the final award of the TFX contract before the contract is let.⁴²

If the political implications were not apparent to President Kennedy, certainly the economic aspects of the TFX contract were. General Dynamics was in severe economic trouble in 1962. The B-58 bomber program was ending production, General Dynamics had suffered a \$425 million loss on commercial jets and it cried that if it lost out on the TFX it would have to lay off 5,000 workers at its sprawling Fort Worth plant.⁴³ There is certainly little guessing involved as to just how important the TFX contract proved to be for General Dynamics. Forbes magazine noted that without the F-111 "General Dynamics will be out of the military aircraft business within a year or so."⁴⁴ Senator John McClellan, the chairman of the Investigations Subcommittee even went so far as to state that he could accept the decision if McNamara would admit that the Pentagon really wanted to keep the almost idle General Dynamics plant open in the interest of national defense.⁴⁵ McNamara, of course, insisted that the best design proposal had won out.

A third and final factor that the TFX contract investigators brought out was the activity of two of McNamara's top aides, Deputy Secretary of Defense Gilpatric and Secretary of the Navy Korth.

Roswell Gilpatric came to the Department of Defense from the prestigious New York law firm of Cravath, Swain and Moore. As a private lawyer Mr. Gilpatric had served as legal council to General Dynamics. Before coming to the Pentagon, Gilpatric was to have severed his connections with the New York law firm and with General Dynamics as a consequence of that action. He stated that he did not take a leave of absence from the law firm, but rather, that he resigned from Cravath, Swain and Moore.

Investigation of Gilpatric's association with General Dynamics showed that (1) Mr. Gilpatric had spent approximately one-third of his total time working for General Dynamics before accepting the Defense Department post, (2) he had billed General Dynamics for \$110,000 in fees for the work, (3) he had acted primarily in a policy level advisory capacity for the General Dynamics Corporation, including attendance at a majority of the board of directors' meetings, and (4) he had been replaced as council for General Dynamics by his senior partner, who subsequently joined the board of directors of General Dynamics. The record also shows that Mr. Gilpatric attempted to conceal from the Subcommittee the significance of his past association with General Dynamics and that he was apparently on a leave of absence from the law firm since he was drawing \$20,000 a year under a severance agreement with the partnership firm and the firms insurance underwriters recorded him as being on leave of absence, not retired.⁴⁶

Despite the potential for conflict of interest in his background, Mr. Gilpatric refused to disqualify himself from the TFX award decision. He stated clearly before the Investigating Subcommittee that:

As Deputy Secretary of Defense,...my part in the TFX source selection process consisted primarily of informing myself as to the elements in the program determination and source selection and giving the Secretary my best judgement to assist him in making his decision.....it was my conclusion in November 1962, when Mr. McNamara made his decision, and it is my view now, that the decision to select the General Dynamics proposal rather than the Boeing proposal for the TFX contract was the right one.

Upon leaving his Pentagon post on January 20, 1964, Mr. Gilpatric rejoined the law firm of Cravath, Swaine and Moore. Gilpatric was advanced in seniority in the firm and moved above six other partners to become the fourth ranking partner within the firm.⁴⁸

Fred Korth became Secretary of the Navy on January 3, 1962. Mr. Korth was a former Assistant Secretary of the Army and he was returning to the Pentagon from the presidency of Fort Worth's Continental National Bank.

Secretary Korth, in his appearances before the Subcommittee on Investigations stated that he had participated in the TFX decision-making process. At the same time, Mr. Korth emphasized the fact that he remained completely objective in the TFX decision. In a prepared statement read before the Subcommittee Secretary Korth said:

I am aware that public confidence in our public process demand not only impartiality but also the appearance of impartiality. Conscious that my home is in Fort Worth, and recognizing the minor part that the Navy has in the total procurement, I therefore deliberately refrained from taking a lead role in reaching the decision and consciously viewed the two proposals with complete objectivity...I, in my best judgement, made the decision for the Navy and I stand

firm today in the conviction that the General Dynamics and the TFX offers the Navy the best aircraft in the time available and at the least program cost.⁴⁹

In a propaedeutic appearance before Congress, Mr. Korth stated that he intended to return to his Fort Worth based bank after his government service. He related that he was retaining \$160,000 worth of stock in his bank. Thus, the facts of Mr. Korth's financial background were made public in an effort at maintaining objectivity and avoiding conflict of interest while in public office.

Unfortunately, public knowledge of Secretary Korth's financial interests were not enough to sustain his image as a man of integrity. Investigations performed by the Subcommittee revealed that Mr. Korth had at least sixteen contacts with officials of the General Dynamics Corporation during the TFX selection process. Letters unearthed by the investigators disclosed that various bank officials wrote Korth after he became Secretary of the Navy, thanking him for securing small accounts. Korth's own letters to former associates in Texas included invitations to come to Washington, D.C. for a visit aboard the Navy yacht Sequoia, some of these personal letters being written on his official stationary.⁵⁰

Korth had testified that he did own stock in the Continental National Bank and that his bank did business with General Dyanmics on a modest scale while he was president. When pressed by Senator Carl Mundt on what he meant by "modest scale" of business, Mr. Korth stated:

I can define it to this extent, that the loan limit of the bank at the time I was there was \$600,000.⁵¹

In testimony before the Permanent Subcommittee on Investigations on July 23, 1963 Secretary Korth offered a challenge to Senator Mundt:



Senator Mundt, I repeat that I believe that I am a man of integrity. If you find or this committee finds that I am not, certainly you should so recommend to the President and I will promptly hand in my resignation.⁵²

Other information compiled by the Subcommittee concerning Secretary Korth and his business interests were handed over to the Justice Department. Attorney General Robert F. Kennedy suggested that a resignation was in order. On October 14, 1963 Secretary Korth submitted his resignation citing the demands of private business as the reason for his retirement.⁵³

It should be noted that the Justice Department ruled that both Secretary Korth and Deputy Secretary Gilpatric were innocent of any illegal conflict of interest.

CIVILIAN AND MILITARY RELATIONS

McNamara's Philosophy

Secretary of Defense McNamara indicated the major factors underlying his innovations in defense procedures and organization when he stated:

We do have a basic management philosophy that we are trying to establish as a foundation for our day-to-day administration. It is a philosophy based on a decision pyramid and a system of administration in which all possible decisions are pushed to the bottom of that pyramid.⁵⁴

At the same time, Mr. McNamara, while ruminating about the role of the Secretary of Defense, relates that:

the Secretary of Defense could play an active role providing aggressive leadership--questing, suggesting alternatives, proposing objectives and stimulating progress. This active role represents my own philosophy of management.⁵⁵

McNamara's active management at the top is antithetical to his previously quoted philosophy of a decision pyramid that would push all possible decisions to the bottom of the pyramid. It has been stated that with active management at the top there is "an inevitable tendency in bureaucracies for decisions to be made at higher and higher levels."⁵⁶ This, in fact, is exactly what happened at the Department of Defense during Secretary McNamara's tenure there. By fully utilizing the statutory authority of the 1958 National Security Act, McNamara asserted and maintained control over the Pentagon.⁵⁷ He took management control of the national defense effort away from the military and placed it in the hands of a civilian bureaucracy, which he erected and which operated

at his command. He made no attempt to effect this change through the existing Pentagon bureaucracy. McNamara simply superimposed a new bureaucracy over the already existing one.⁵⁸ In this new bureaucracy, McNamara's team of civilian analysts became the dictators and economic efficiency was their rule of law.

The power in the Department of Defense had become overcentralized in the hands of a civilian Secretary. McNamara realigned the administrative channels into a monolithic instrument of government. On major defense problems, McNamara made his own analysis and arrived at his own conclusions --no matter who else might be working on them.⁵⁹ His adamant stance on self drawn conclusions led to charges of "arrogance"--and with some justification. When Navy and Air Force officials recommended discontinuing the Navy version of the F-111 due to its inability to land on aircraft carriers, McNamara retorted that "the Navy will take it whether it wants it or not."⁶⁰

The new bureaucracy demolished the morale of the military and contributed greatly to the lengthening delays in the development and production of new weapons systems. McNamara's civilian analysts believed that the technological revolution was over and thus were reluctant to spend large sums on new weapons research.⁶¹

McNamara's New Bureaucracy

Secretary of Defense McNamara erected a hierarchy of civilian administrators in the Pentagon. They were an atavism of the World War II Ivy League team of Lovett, McCloy and Forrestal.⁶² Deputy Secretary of Defense was Roswell L. Gilpatric, a corporate lawyer and graduate of Yale. Later, Gilpatric was replaced by Cyrus R. Vance, another corporate lawyer

and Yale graduate. Others were Secretary of the Air Force Eugene M. Zuckert of Yale, Secretary of the Navy Paul H. Nitze from Princeton, William P. Bundy, Assistant Secretary for International Security Affairs, a Harvard graduate, and political trouble-shooter Adam Yarmolinsky, the Special Assistant to Secretary McNamara, a Harvard graduate with a law degree from Yale.

Directly below the Ivy League administrators was another echelon of civilians, often referred to as the "Whiz Kids".⁶³ This group of Pentagon civilians was composed of economic and mathematical analysts who were enjoined by Secretary McNamara to measure precisely the military needs of the nation.

The "Whiz Kids" were dominated by three distinct personalities. Charles J. Hitch was appointed comptroller of the Department of Defense. Hitch was the former Chairman of the Research Council of the RAND Corporation and an expert in economic analysis and defense. Alain C. Enthoven, the Assistant Secretary for Systems Analysis, was an economist who specialized in strategy and strategic weapons. He was also a colleague of Hitch at the RAND Corporation. It was the efforts of Charles Hitch and Alain Enthoven that produced the new McNamara technique of cost-efficiency in strategic weapons procurement.⁶⁴ Finally, the Director of Research and Engineering for the Pentagon was Dr. Harold Brown, the former director of the University of California's Livermore Laboratory.

In essence, McNamara substantially increased his own staff and at the same time increased their responsibility without significantly enlarging the two thousand man Office of the Secretary of Defense.

Secretary McNamara increased the responsibility and importance of his personal staff by setting up task forces on the most immediate and important issues within the Department of Defense, staffing them from within his own office and demanding quantitative answers "with the numbers in them."⁶⁵ Each task force project raised questions about how things were done in a particular area, and then asked how things could be done better. The projects ranged from basic questions of military strategy to detailed technical enquiries into the procurement process.

As I have stated before, the key staff member in all of these projects was the Defense Department's Comptroller, Charles J. Hitch. It was Hitch's responsibility as Assistant Secretary of Defense to initiate a new system of functional budgeting into the Pentagon. With the assistance of Alain Enthoven and his systems analysis group, Hitch prepared the basic data, the facts and figures, that would justify changes in the existing Department of Defense system of budgeting.

The staff of Dr. Harold Brown in the Research and Engineering Department of the Pentagon was called upon by Hitch to review the entire spectrum of scientific and technical activity that would shape the weapon systems of the military over the coming decade. The staff of Systems Analysis and Research and Engineering would then examine the available data and determine what weapons system configuration was most efficient and effective.

The data and information compiled by the "Whiz Kids" was communicated back up the bureaucracy to Secretary McNamara and his team of administrators, who would then make the ultimate decisions regarding weapons system procurement.

It goes without saying that responsible decisions can only be made on the basis of adequate information. In this case, the information was as adequate as the system used in analyzing each weapon.

I would like to turn now to an examination of the McNamara system of analysis as it was applied to the TFX program.

Civilian Analyst and Military Procurement

During the McNamara years in the Pentagon a number of revolutionary techniques in military procurement were initiated. These new techniques stemmed from Secretary McNamara's belief in the ideal of accomplishing national security objectives at the least possible cost. The emphasis was on the most efficient use of resources. McNamara and his civilian analysts reduced the concept of a military decision, including the elements of policy and strategy, to that of an economic decision. Their rationale was summed up in the statement:

Military decisions, whether they specifically involve budgetary allocations or not, are in one of their important aspects economic decisions.⁶⁶

The important aspect that links military decisions to economic decisions was the selection of alternatives or what economic theory would call "the logic of choice".⁶⁷ In economics, the logic of choice prescribes that each unit of input into the economic system - be it capital, labor or government spending - must produce the maximum unit of output utility, because we live in a world in which input resources are limited.⁶⁸

The civilian analysts in the Pentagon worked under the assumption that military-economic studies which compared alternative ways of accomplishing national security objectives, and which tried to determine the

alternatives that contribute the most utility for a given cost, or achieve a given objective at the least cost, was the best way to decide on a weapons system.

This technique demanded that all possible alternative methods of approaching each military problem be costed before and not after the decision had been made on which alternative to use.⁶⁹ Thus, the selection of the weapons system was based on economic criteria. Economy was the true test of the alternatives, and economy would decide what was to be chosen for development.

This new method insisted that costs be considered while formulating the programs to meet the military requirements, instead of the old practice of drawing up programs exclusively on the grounds of military requirements, costing them and then deciding whether there was a budgetary allotment capable of paying for such a program. Under McNamara's method the budget would not predetermine the strategy to be followed; rather, the strategy would determine the size and structure of the defense budget.

These military-economic studies or cost-effectiveness techniques would thus relate the output or military effectiveness of a program to its cost, the input factor.

In the case of the TFX, the Air Force work statement called for the development of an aircraft that was a bomber, a fighter, a reconnaissance craft, and a transoceanic plane as well. It would be used for nuclear and non-nuclear missions, and it would be used in a strategic as well as a tactical role. McNamara reasoned that if the TFX could be designed with so many capabilities, then these same capabilities could be used to meet the requirements of all the military services, not just

the Air Force. McNamara and his analysts felt that the potential effectiveness of the TFX would be more fully realized if it were not confined to use by the Air Force alone.⁷⁰

If the TFX concept were expanded to include the other services, McNamara knew, the duplication of tactical fighters for all four branches would be eliminated. With the end of multi-service duplication, the costs of developing and producing one tactical fighter to fulfill the needs of all the services would bring a corresponding reduction in costs, or so it was believed.⁷¹

However, in the case of the TFX, as I have stated before, there were no real systems analysis or cost-effectiveness studies performed before the decision to develop it was made.⁷² In effect, a vicarious concept of cost realism was used in place of cost-effectiveness. The civilian analysts introduced the idea of commonality as the integral element in cost reduction for the TFX. At the same time, the insertion of what the "Whiz Kids" labeled PDP, or "program definition phase", into the procurement competition was an attempt to protect the Department of Defense from committing large sums of money to a program before it was fully defined. The function of commonality and program definition was to bring about a development program that would produce an effective TFX at the least cost to the government - both of these innovations will be examined in depth in the next chapter.

Despite the fact that cost-effectiveness studies were not used in the TFX decision, the criterion of economic efficiency remained intact. So that when Mr. McNamara made his decision to select General Dynamics as the source for the TFX, he couched his motives in terms of cost realism.

I would like to consider the reaction of the military professionals in the Defense Department to the sudden incursion of the civilian analysts in the field of military procurement, before moving on to the innovations of commonality and program definition.

Military View of the Civilian Analyst

Even prior to Secretary McNamara's November 21, 1962 decision to overrule his military advisors and select General Dynamics for the TFX project, the TFX program had a history of service opposition. The new management technique of the civilian analysts was the major irritant in civilian and military relations.

The McNamara team of analysts demanded that the military services combine their separate development programs for tactical fighters into a single common program. The military professionals saw that a biservice TFX program would lay the groundwork for a paradigm that would decrease the autonomy of the services and enlarge the powers of the Office of Secretary of Defense in development programs. It was the feeling of the military that a superior civilian authority might portend the end of all effective service programs in the area of weapons development. The civilians' use of the "military-economic studies, which are touted as the new mode of strategic planning" was seen as "the greatest challenge to military professionalism."⁷³

The military men at the Pentagon during the McNamara years resented the implication that computer calculations, operational analysis and obscure theories somehow had greater weight in the decision-making process than the experience of military men and the lessons of military history. Their thinking was represented by the view that:

setting the goals of military planning within the framework of overall national political goals, is central to military professionalism; providing a series of alternative means for the achievement of military goals is also central to military professionalism. There is no scientific basis for supposing that the civilian analyst has superior or even comparable credentials for such tasks.⁷⁴

This is not to say that the service professionals were uncomfortable with the idea of systems analysis or cost realism. Rather, the military officers of the Defense Department were concerned with the fact that cost effectiveness seemed to be working at the wrong level of administration - above the professional military echelon instead of in an advisory capacity to the military.⁷⁵

The military professionals were quite outspoken and frank in their depiction of McNamara's new management technique. Air Force General Thomas D. White represented most of the professional officers in the Pentagon when he said that "in common with other military men I am profoundly apprehensive of the pipe-smoking, trees-full-of-owls type of so-called defense intellectuals who have been brought into this nation's capitol."⁷⁶ In the 1963 hearing on the TFX, both General Curtis LeMay, the Air Force Chief of Staff, and Admiral George W. Anderson, the Chief of Naval Operations, openly criticized the Secretary of Defense's selection of General Dynamics over the Source Selection Board's choice of Boeing.⁷⁷ The result of this criticism had direct effects upon the individuals concerned, the results of which ramified throughout the services. Only weeks after testifying before the Subcommittee on Investigations, Aviation Week reported that "Admiral George W. Anderson was not reappointed as chief of naval operations because he capped a series of disagreements with Defense

Secretary McNamara by refusing him a copy of testimony he was going to give to the Senate Subcommittee investigating the TFX contract award ... the testimony was among the most critical of McNamara's decisions that any witness has given."⁷⁸ The partial reappointment of General LeMay for only a year's tenure as Air Force chief of staff was conditioned in some part by his public disagreements with Secretary McNamara.⁷⁹

The end result of this type of arbitrary and vindictive action was to lower the confidence and trust between the civilian and military echelons in the Pentagon.⁸⁰ A group of admirals interviewed in the July, 1967 issue of Armed Forces Magazine summed up their feeling about the management revolution in the Pentagon and the TFX in particular, when they stated that:

[The] F-111 project performance strongly suggests that when officer experience and expertise is left out of a weapon development evaluation, the Defense Department is not necessarily better off. Indeed, economic analysis, with its attendant characteristic of making certainties on paper out of technological uncertainties, in fact, seems to have produced precisely the program overruns, time slippage and performance degradation that same analysis promised to avoid.⁸¹

In effect, Mr. McNamara's revolution in management at the Pentagon transformed the expert career military officer into the neophyte at procurement and the inexperienced political appointee into the seasoned professional in military decision-making.

SUMMARY

How was the TFX contract awarded?

In Chapter III, I discussed the military source selection process which was designed to evaluate and determine which private aerodynamics firm would be the most efficient producer of the aircraft. In essence, the Source Selection Board represented the military's choice for the contractor, since it was composed of military officers who were experts in the field of weapons procurement. The Source Selection Board, after four complete evaluations, chose the Boeing Corporation to be the prime contractor in the TFX program.

However, at the Secretarial level, the recommendation of the military's Source Selection Board was overruled. Secretary of Defense McNamara and his so-called "whiz kids" made the final judgement and awarded the contract to General Dynamics, defending their decision on the grounds that the General Dynamics design was more cost realistic despite the fact that they had never done any cost-effectiveness studies on the TFX, and disregarding the fact that Boeing's design was less costly as well as operationally superior.

Consideration was given to the fact that there were certain political, economic as well as personal implications in this arbitrary decision, from which no definite conclusions can be drawn, but which surround the decision in a penumbra of doubt.

Was the military establishment pleased with the new management techniques and its resulting TFX contract award?

The military professionals of the Pentagon were quite apprehensive about the overcentralization of power in the hands of the civilian analysts as a result of the revolution in defense management. The establishing of a new bureaucracy of civilian administrators and analysts over the military professionals, using economic and mathematical analyses to make strategic military decisions without regard to the military's experience and expertise in that area, demolished their morale.

In the end, the total effect of the new management techniques was the lowering of confidence and trust between the civilian and military echelons in the Department of Defense and an outright rejection by the military of the product of those techniques - the TFX aircraft.

It would appear that Mr. McNamara forgot that the Defense Department was not a corporation, and that, in a democracy, important disputes have to be settled by persuasion and compromise, not just by giving orders. It is certain that Secretary McNamara failed to carry the high-ranking Pentagon brass with him to the extent that he might have, had he remained more in tune with the rules and standards of a political democracy.

CHAPTER IV. PROCUREMENT INNOVATIONS OF CIVILIAN ANALYST

COMMONALITY

Conceptual Origins

Secretary McNamara's efforts at cost control and the most efficient use of resources took the form of two radically new innovations - commonality and non-prototype competition.

"Commonality" was the abbreviated Pentagon terminology for the McNamara idea of designing a weapons system that would fulfill the mission requirements of two or more branches of the service. The idea was based on the principle of the interchangeability of parts between the different versions of the TFX for each service. McNamara reasoned that if the service requirements for a new fighter aircraft could be built into one airplane, then the resulting non-duplication of aircraft by the service branches for essentially the same mission, and the economies of scale offered by a large buy for all the services would substantially reduce the cost of development and production.¹

The idea of building a multiservice fighter-bomber utilizing a common airframe and parts goes back to Secretary McNamara's first weeks in office. In an effort at understanding and controlling the functions of the Department of Defense, Secretary McNamara commissioned a series of studies to be undertaken on all segments of Defense responsibility and national security objectives. Out of the study on limited war conducted by Assistant Secretary of Defense Paul Nitze, came the first recommenda-

tion for the development of a multiservice aircraft capable of both conventional and nuclear warfare.²

The concern of the Secretary of Defense for greater efficiency and lower cost elevated the concept of commonality from a theoretical desire to an absolute necessity. In his September 1, 1961 memorandum establishing the work-statement requirements for the new TFX program, McNamara included the charge that "changes to the Air Force tactical version of the basic aircraft to achieve the Navy mission shall be held to a minimum."³

The TFX work statement that was delivered to the private airframe companies for their contract bids carried more detailed instructions:

Common design and common equipment will be used whenever possible, to satisfy the requirements of both services...A single aircraft for both the Air Force tactical missions and the Navy fleet air defense mission will be undertaken.⁴

Thus, the concept of commonality was originated by the civilian staff of the Secretary of Defense and was brought to fruition in the TFX program.

Implementation in the TFX

In his decision to select General Dynamics as the source for development of the TFX, Secretary McNamara stated that his choice of General Dynamics stemmed from a number of factors:

The first of these is the degree of commonness. A high degree of commonness will initially provide a larger number of identical parts ... and a future higher rate of common maintenance and operating spares. General Dynamics has a distinct edge in this area and more closely adheres to the Secretary of Defense guidelines "to reduce weapons system costs by maximizing similarities of Air Force and Navy versions and by maximum use of common equipment and structures."⁵

Accordingly, commonality was a measure of the degree of structural deviation between one version of the TFX for the Air Force and another version for the Navy. The General Dynamics' distinct edge in commonness was summed up in terms of the percentage of identical parts in its design, 83.8% compared to 60.4% in Boeing's proposal.⁶

McNamara analyzed the commonality figures and determined that the General Dynamics design had the higher degree of identical parts and structure.

However, a March 1967 General Accounting Office examination into the procedures and controls that were established by the Defense Department to maintain control of the commonality between the Air Force and Navy versions of the TFX aircraft, showed that:

The contractor [General Dynamics] has been including many insignificant parts, such as bolts, nuts, rivets, sealants and wiring, in its commonality computation. For example, approximately 30 per cent of the items being compared for commonality at the time of our review were commercial - standard bolts, nuts and rivets. Minor parts such as these were counted by the contractor and given the same weight in computing commonality as more costly items... A jet engine was counted on the same basis as an airframe rivet.⁷

Boeing's computation did not include minor parts such as nuts, bolts and rivets. The Boeing percentage was based on an 18,000 major part total, while the General Dynamics included a 15,059 major part total and a 62,000 part total including the minor items. The result of the inclusion of the minor parts by General Dynamics was an inflated commonality percentage.⁸

Furthermore, Comptroller Staat's report to Representative Mahon pointed out that there was no available information concerning commonality of group support, parts to be stocked, or training equipment for the F-111 aircraft.

A follow-up study done by the GAO on the biservice logistics and support planning for the F-111 concluded that:

the maximum economies attainable through implementing biservice support of the F-111 aircraft weapon system will not be realized unless improvements are made in the logistics support plans.⁹

In sum, these reports showed that not only were the General Dynamics commonality percentages inflated beyond proportion, but they also showed that the much sought after cost saving was evaporating and that changes in the concept of commonality were necessary if the F-111 program was to show a cost savings anywhere near the \$1 billion projected by Secretary McNamara in 1963.¹⁰

A concrete example of the true worth of the idea of commonality will be viewed in an examination of the Navy's version of the TFX - the F-111B.

The Navy's F-111B

When the TFX contract was signed in December of 1962, the program goals at that time were to buy 22 Research and Development airplanes plus 1,704 production models for a total buy of 1,726 airplanes. The Air Force was to receive 1,473 production models called the F-111A. The Navy was scheduled to receive 231 production models of its own called the F-111B. The sole differentiating factor between the F-111A and the F-111B was to be a lower weight limit on the Navy version to enable it to take-off and land on an aircraft carrier. Weight is a vital factor in Navy planes because there is only a small margin between carrier operability and inoperability.

As the design of the F-111 progressed through 1963, it became

apparent that General Dynamics was having trouble containing the weight factor. The original weight requirement for the F-111B in September of 1962 was 38,804 pounds. By November of 1963, the weight had increased to 40,284 pounds.¹¹ Then on December 17, 1963, the Investigating Subcommittee reported that the weight of the F-111B had climbed to 45,259 pounds. In only 26 days the aircraft weight increased by almost 5,000 pounds.¹²

In 1964, the Navy, at the urging of Secretary McNamara, proceeded to make an attempt to salvage the F-111B by cutting back on the weight of the craft. The program had two distinct phases. The first part of the weight reducing program was designated SWIP, for "Super Weight Improvement Program".¹³ During this stage, the Navy, General Dynamics and Grumman, the major subcontractor, worked together to reduce the weight of the airframe. This stage of weight reduction proved to be ineffective and another study was begun. This new phase was entitled CWIP-III, for "Contractor's Weight Improvement Program",¹⁴ because it was initiated solely by the contractors, General Dynamics and Grumman.

The CWIP-III design study recommended changes in the F-111B structure to accomplish the Navy mission by reducing unwanted weight. The study recommended:

- Redesign the basic fuselage "from scratch" by --
- Eliminating the bomb bay;
- Redesigning the landing gear...;
- Retaining side-by-side seating and the cockpit arrangement but eliminating the escape capsule provisions;
- Steeping the current windshield...;
- Shortening the fuselage as much as practical...;
- Relocating the electronics systems...;
- Utilizing SWIP component weight savings where applicable.¹⁵

The CWIP-III study pointed out that "it is clearly indicated that as the SWIP savings increase, commonality suffers somewhat; when the transition from SWIP to CWIP-III is made, this commonality suffers even more."¹⁶ The resulting decrease in commonality with the F-111A due to the CWIP - redesignated "Colossal Weight Improvement Program" - would have reduced the F-111B from 30% down to 29% commonality.¹⁷

The Navy, realizing the plight it was in with the F-111B, sent the weight and performance estimates of the F-111B to the Secretary of the Navy and to Deputy Secretary of Defense Cyrus Vance as well as Secretary McNamara, recommending that the F-111B program be stopped. This recommendation was rejected at the Secretarial level.¹⁸

Secretary McNamara's insistence on the importance of commonality and of the superior design characteristic apparently had the cogency to irrevocably commit the Pentagon to the TFX design with its collateral commonality. The Navy program foundered beneath the increase weight and the decreased commonality until congressional action in 1968 refused to authorize funds for further production of the F-111B.

The results of the Navy's TFX program are an impressive array of dubious achievements:

- (1) It failed to produce a useful aircraft.
- (2) It wasted over \$378 million in research and development costs over and above the R&D expenditures on the F-111A.
- (3) It set back the Navy's fighter development by six years.¹⁹

With the cancellation of the F-111B program, the concept of commonality was virtually abandoned. In the wake of the sinking F-111B, several other versions of the F-111 succumbed. The British F-111K was cancelled in 1968 due to rising costs. The reconnaissance versions, the

RF-111A and RF-111D, were likewise cancelled after an expenditure of over \$118 million. The Australian F-111C has been deferred indefinitely.

In toto, the concept of commonality cost the American government over \$523 million in research and development of an aircraft that was virtually inoperable.

Necessity of Commonality

Commonality was justified on the basis of cost and cost alone. Secretary McNamara said that commonality would reduce the cost of development, procurement and operation of the new aircraft.²⁰ Money would be saved because inter-service duplication of aircraft would be eliminated. Commonality was necessary because it would reduce cost and end duplication.

The question, of course, is, was it really necessary? Certainly no one will argue that cost savings are not to be desired. Since savings never materialized from the use of commonality in the TFX, it is easy to argue that duplication is a necessary adjunct in aircraft procurement. This, of course, cannot be proven, but what is interesting to note is the fact that the TFX or F-111 was a duplication of existing aircraft, with certain advantages, but a duplication nonetheless.

That is to say, the end result of the TFX program is a supersonic deep interdiction bomber and not an air-to-air fighter. It was designed to replace the F-4 fighter, but, in fact, it merely duplicates the Navy's A-6 subsonic interdiction bomber. The point was made clear in an exchange between Air Force Brigadier General Alfred L. Esposito, the program director for the F-111 project, and Senator John McClellan and

his general council, Mr. Jerome S. Alderman, before the Subcommittee on Investigations concerning the use of the F-111 in Vietnam:

Gen. Esposito - I should point out that the aircraft was selected because it was the only aircraft available that could do all-weather, night missions with the kind of delivery accuracies that were needed...

Mr. Alderman - General Esposito, isn't it true that the Navy A-6 has been doing the same mission since 1965?...

Gen. Esposito - It is doing an all-weather mission, yes, sir.

Mr. Alderman - And that is a subsonic plane ?

Gen. Esposito - Yes, sir.

Mr. Alderman - It was designed to be a subsonic plane?

Gen. Esposito - Correct, sir.

Mr. Alderman - The F-111 was designed as a supersonic plane but was used in a subsonic mission?

Gen. Esposito - The conventional mission is a subsonic mission.

Sen. McClellan - How could you say...you had no other planes to do the mission? The A-6 had been doing it all the time.²¹

Mr. John Brick, the chief investigator for the Subcommittee, also stated that "the A-6 is just as good as the F-111. It is not as fast, but it is less costly - the A-6, in fact, has the same avionics equipment as the F-111."²²

Thus, Secretary McNamara's emphasis on commonality produced a plane that fulfilled the mission of an already existing Navy aircraft, yet was unable to meet the standards required of the fighter aircraft it was designed to replace.

Finally, one must certainly question the logic of a strategy that necessitates the use of commonality, when this commonality is applicable to less than one-sixth of the planes to be produced, or only 200 Navy planes out of a projected run of 1700 aircraft.²³

NON-PROTOTYPE COMPETITION

Program Definition

One of the most novel procurement innovations during the McNamara years at the Defense Department was the introduction of what the civilian analysts called "program definition phase" or PDP.²⁴ Program definition phase or as it was later called CDP for "contractor definition phase" - the name changed, but the process remained the same - was an attempt to insure the Pentagon against an overcommitment of funds to a weapons program before it was fully defined. Program definition forced the competing aerodynamics firms to fully define the purpose and possibilities of each new project before the Pentagon could order large scale development of the system.

PDP was designed by the "Whiz Kids" to yield more reliable and more realistic estimates about the cost, time, and quality of the development process. Its basic goal was to reduce the costs of a new weapon system by eliminating the tendency of competing companies to "buy into" a procurement program.²⁵ Specifically, in complex weapons systems, such as missiles and aircraft, a decision is reached fairly early in the contracting process on whether the contractors bidding for the new system should compete by actually building a prototype plane or missile, or produce only a set of estimates, called "brochuremanship" or buying into the contract.²⁶ That is, a firm enters its brochure of estimates on the system, but deliberately underestimates its development cost in an effort at winning the contract.

In the case of the TFX, all but two of the competitors were eliminated early and the remaining two firms, General Dynamics and Boeing, were assigned the task of carrying out the rest of the competition on paper.

Thus, the selection of a prime contractor for the TFX was based on paper analyses and wind tunnel testing of models, in an effort at avoiding the cost of producing two prototype planes for the competition.

Albeit the program definition phase was employed to reduce costs, it has been shown that the PDP requires enormous investments in manpower, money and facilities. Martin Meyerson, in a study done in 1967, showed that in the program definition phase "companies always seem to spend significantly more money during this phase than the contract value received..." and that "at the peak of activity it takes about half as many men to implement contract definition as does the actual development of hardware."²⁷ Translated into figures, this means that the manpower range for a major system contract definition would be between 500 and 2,000 men and would require about seven years and 90% of the value of the development program. While on the other hand, a major weapon system without contract definition averages only 4½ years and 96 men at about 7% of the value of the development program.²⁸

The Comptroller General of the U. S. Elmer Staats, after reviewing the effects of the TFX program definition stage, concluded that:

The competition on the basis of "paper design studies" for the F-111 program appears to have contributed to the development of cost estimates, by both the contractor and the Air Force, which experience shows were not realistic...efforts to achieve these requirements have added to the cost and otherwise affect the program...We expressed the opinion that improvements in the quality and completeness of preliminary planning, including prototyping,

would include the knowledge which would contribute substantially to the accuracy of initial cost estimates.²⁹

Before turning to a consideration of the full implications of non-prototype competition, I would like to briefly examine the TFX contract which made it possible.

The TFX Contract

During the decades of the 1940's and 1950's, the government, operating in an atmosphere of emergency due to the pressures of World War II and the Cold War, chose to attract weapons producers through the utilization of the cost-plus-fixed-fee contract - CPFF. Under this type of arrangement the government guarantees the contracting firm a fixed profit above the total cost of the development program, or the target cost.

The McNamara analysts felt that contractual incentives for cost reduction and cost realism were at a minimum under the CPFF arrangement because the target cost was not binding on the seller since the government agreed to reimburse the contracting firm for all costs incurred by them in the process of fulfilling the contract.

The Pentagon civilians under Secretary McNamara reasoned that the simplest way to insure cost efficiency and cost realism was to utilize a fixed price contract for a specific quantity of a specifically defined product. This arrangement, they felt, would redistribute the risks more equally between the government and the producing contractor. The new TFX contract was called a fixed-price-incentive-fee contract - FPIF. Under the FPIF contract, the seller would estimate its total costs including in this total his target profit, or the profit it expected to make. The government would then set an upper limit to the price the Department of Defense would pay the firm to develop the new weapon.

This governmental limit was the ceiling price and was expressed as a percent of the target or total costs. Any costs above that would be borne completely by the contracting firm. Any overruns between the contractor's target cost and the government's ceiling price would be negotiated on a sharing formula.

The fixed-price-incentive-fee research and development contract for the TFX contained a 90/10 sharing arrangement -- 90% shared by the Pentagon, 10% by the contractor -- a 9% target profit and a ceiling price of 120% of the target cost.³⁰

The FPIF production contract called for a much more complicated sharing arrangement formula. According to the terms of the contract, the sharing was to be 75/25 under target cost and 75/25 over target cost for the first 7%. That is, if the aircraft were built at a cost under the target cost, the government would take 75% of the savings incurred and the contracting company would get the other 25% of the savings as well as its target profit. The same arrangement would obtain if the costs were above target costs, the government would pay 75% and the firm would pay the rest.

Beyond 107%, the sharing formula was 85/15 to the ceiling price of 130% of target cost, with the government again sharing the largest portion of the formula.³¹

The research and development contract as well as the production contract both contained terms and conditions which obligated the contractor to develop for a fixed price an aircraft meeting certain stated performance characteristics or, in the event of failure to do so, it would suffer certain penalties, reductions in price, or even termination for default. However, both of the contracts contained clauses that

precluded making acceptance of the airplane by the Pentagon contingent upon the aircraft's meeting the performance requirements. These facts were brought to light in an exchange between Senator McClelland and Mr. John Walsh, investigator for the Subcommittee on Investigations:

Walsh - The production contract goes on to say...that:

"In the event that the specifications incorporated herein require revisions as a result of actions taken under provisions of paragraph 3...such specification revisions shall be accomplished and the contractor shall comply therewith, at no change in the target cost, target price or ceiling price."

The words would appear to prevent General Dynamics from terminating the production contract because of performance deficiency.. Once General Dynamics is in an overrun condition, the Government pays all costs.

Sen. McClellan - In other words, General Dynamics is insulated from any loss?

Walsh - That would be my conclusion, Senator.³²

Recapitulating, it would appear that in absence of well-defined performance standards, the government's right to impose penalties was considerably weakened, the sharing formula was meaningless and the stated goal of cost efficiency was reduced to mere verbiage, as is attested to by the cost figures recorded in Chapter II of this study.

Consideration will now be given to the lessons learned from the TFX contract.

The Future of Non-Prototype Competition

Secretary of the Air Force Zuckert was opposed to a prototype competition between Boeing and General Dynamics because he felt that prototyping the TFX would be too costly - around \$800 million - as well as time-consuming - about three years worth of research and development and several more years before the integration of the weapon

system into our national defense.³³

The issue of prototype versus non-prototype competition became a heated one when the Chairman of the Subcommittee on Investigations, Senator McClellan, suggested that prototype competition was more economical and time-saving than Secretary Zuckert's approach of "paper airplanes."³⁴

Senator McClellan buttressed his remarks by quoting from a RAND Corporation report entitled "The Role of Prototypes in Development."³⁵ The RAND study examined twenty-two weapon system programs over a ten year period of time which had utilized both the development-procurement approach of non-prototyping and the prototype approach. The RAND Corporation outlined three significant advantages to prototype development:

- (1) The prototype approach allows a given sum of money to be used on more programs and cover a greater range of contingencies -- that is, there are a variety of prototype aircraft under development which gives a hedge against strategic uncertainty.
- (2) Prototyping provides a hedge against technological uncertainty. By having several alternative aircraft to perform a given mission means that there is a higher probability of achieving the desired capability.
- (3) Even when there is only a single prototype aircraft funded, the prototype approach promises a more efficient and relatively economical method of determining what is being bought.³⁶

The RAND report concludes from their analysis that:

We have found no statistical support for the hypothesis that development programs involving large initial commitments have cost less than prototype programs.

We have found no statistic support for the hypothesis that development-production programs have resulted in substantially reduced development times...We have attempted to examine and compare the advantages of two approaches to development: the development-production and the expedited prototype methods. We have been unable to find consistent support for the advantages claimed for the first method, whereas, the second seems

to offer substantial practical advantages.³⁷

A short time after the publishing of the RAND Report - February, 1963 - the Defense Department started to show an increased interest in a return to multiple prototype aircraft. On April 22, 1963, Dr. John H. McLucas, the Deputy Director of Defense Research and Engineering for Tactical Warfare, stated that "the RAND Report shows that the prototype method avoids freezing design and weapon options early in the program."³⁸

However, it was not until July of 1969 that the idea finally took hold in Washington, D.C. In testimony before the Senate Judiciary Subcommittee on Antitrust and Monopoly, the Comptroller General Elmer Staats explained that the GAO was recommending selective prototyping for these reasons:

- (1) Better performance, price and delivery because:
- (2) Physical hardware can be tested before going ahead with production;
- (3) Cost overruns will diminish because contractors will have visible products on which to base their costs;
- (4) The Defense Department will be able to back off from doubtful design concepts before heavy investments are sunk in them.³⁹

Finally, in the 1970 Senate Armed Services Committee hearings on military procurement for 1971, Secretary of Defense Melvin Laird stated that under his tenure the emphasis on Pentagon procurement will be "on actual prototyping and hardware test rather than paper evaluation, [p]rototyping should result in better adherence to cost and schedule plans."⁴⁰ Laird also stated that in an effort to avoid the pitfalls and inflexibility of the McNamara procurement concept, the Pentagon "will employ cost-plus-incentive-fee type contracts" as well as prototyping in the development of the new advanced manned strategic bomber, the B-1.⁴¹

SUMMARY

The civilian analysts on Secretary McNamara's staff, following his directive to reduce costs in weapon system procurement, developed the concept of commonality to eliminate duplication of aircraft by the various branches of the service.

The TFX is the pristine example of commonality in development, an airplane designed for both the Air Force and the Navy, utilizing the same airframe, parts and logistics. Commonality became so important to the McNamara team, that it was used as one of the two main justifications for the selection of General Dynamics as the prime contractor, since their design offered 24% more commonality than the Boeing proposal.

Government Accounting Office investigations uncovered the fact that the General Dynamics Corporation's computation of commonality was greatly inflated and the cost savings of such a design was not to be had. The results of their efforts at commonality was the expenditure of over \$523 million on an airplane that was later to be cancelled by the United States Congress as an unworkable and far too costly a weapon, an historic first in American procurement spending. The death of the Navy's F-111B also signaled the decline and cancellation of several other versions of the so-called "versatile F-111".

McNamara's concept of commonality failed to produce a workable aircraft for the Navy, who were to receive only 200 of the proposed 1700 models to be produced. The excessive costs of the Navy version

hampered the development of the Air Force version as well, forcing the Air Force to cut their purchase of the F-111 from 1500 to only 500. The benefits of such a strategy are incomprehensible and certainly lead one to question the logic of a process that so heavily emphasized the less appreciable component of the TFX ratio, the Navy's F-111B.

The introduction of "program definition phase" or PDP into the procurement of the TFX appears to have contributed greatly to the increases in the cost of the TFX program, rather than in their reduction as planned by the "Whiz Kids".

Another procurement innovation utilized by the civilian analysts to reduce costs was the fixed-price-incentive-fee contract. Unfortunately, the ill-defined nature of the FPIF contract reduced the effectiveness of the reward versus penalty incentives of the agreement and, in the end, had no significant effect on the reduction of development costs. In point of fact, the Department of Defense has completely scrapped the idea of non-prototype competition and FPIF contracts and has reverted to its original practice of employing CPIF contracts and prototype competition as the basic tenants of its procurement policy.

How useful has the TFX been to the various branches of the service for which it was designed?

We can say with certainty that the bi-service commonality approach of the TFX has been a total failure. The Navy project was cancelled, the Air Force version reduced to a third of its original total, and at the present time, both the Navy and Air Force are developing fighter aircraft, independently of each other, to perform the mission that the F-111 could not provide for them.

What will be the rules for the future in terms of weapon system procurement?

For the immediate future, it appears as though the Department of Defense will require three essential elements in any new procurement agreement:

- (1) Independent service development of systems;
- (2) fully tested prototype development;
- (3) and a cost-plus-incentive-fee contract for both the research/development, as well as for the production stage of the program.

CHAPTER V. CONCLUSION

I think that the evidence available enables us to draw several well-founded conclusions.

One, there can be no doubt about the fact that the TFX program has been unable to meet the specifications and requirements for which it was designed. Its size and weight have so severely affected its dash capability and maneuverability, that its mission role has been reduced from that of a tactical fighter-bomber to the mere role of all-weather interdiction bombing - a mission that is better accomplished by the less costly A-6 aircraft.

Two, it is quite apparent that the TFX program has failed to produce the much vaunted \$1 billion savings for which it was intended. In fact, the cost overruns for the research and development phase of the program total more than \$1.6 billion, while the production overruns have been so great as to raise the unit price of each aircraft from the originally estimated \$2.9 million to almost \$17 million per plane.

Three, there was an apparent lack of cooperation between the civilian administrators in the Pentagon and their military advisers. The result of this non-cooperation was the selection of a weapon system by the civilians that was unacceptable to the military professionals. The resulting clash of interests produced a lowering of confidence and trust between the civilian and military echelons in the Pentagon and in the end, the outright rejection of the TFX by the military.

Four, part of the reason for the deterioration of relations between the civilian analysts and the military professionals was the use of esoteric theories and arbitrary decisions by the civilian administrators, and the wholesale disregard shown by the civilians for the advice and expertise of the professional military officers concerning the procurement process.

Five, the utilization of such procurement innovations as "commonality" and "program definition phase" by the civilian analyst proved to be ineffective in containing development costs. At the same time, these innovations not only failed to contain costs, but they, in fact, proved to be the source of much of the cost overrun and led to the cancellation of the Navy TFX program, as well as to the reduction of the Air Force version to only a token force of aircraft.

Six, the direct result of the TFX failure is the repudiation of the new management techniques of Robert McNamara and his "Whiz Kids" and the return to the original procurement practice of independent weapon development among the services and the utilization of full prototype development and the cost-plus-incentive-fee contract.

Consequently, I believe that the evidence is substantial enough to allow me to accept my hypothesis and assert that the TFX is a failure and that part of the responsibility for this failure can be laid on the civilian analyst's inability to fit the requirements of the TFX weapon system into the parameters of the McNamara management technique of economic analysis over military experience in procurement decision-making.

There are, of course, certain important variables that should have been considered, but were not, for one reason or another. Variables

such as the role of the President in the decision-making process, the economic plight of General Dynamics and its role in national security, the electoral vote factor of Texas versus Kansas, and the effects of the personal interests of Korth and Gilpatric in the TFX. All of these factors could have proven vital to this study. Since that information was not available, however, it was not considered. Thus, what is lacking in the analysis of my hypothesis is also lacking in my conclusion. The conclusions of this study are only as valid as the factors examined, and although there are several variables missing, the conclusion, I believe, is the best possible for the information available.

The lessons of this study are threefold. First, the TFX program clearly points up the necessity of military professionals. One cannot say with complete assurance that had the civilian administrators listened to the advice of the military, the outcome of the TFX program would have been more successful. Nevertheless, one can say with certainty, that the expertise of the military in military matters is a desirable thing to have available, and that the disregard for such experience cannot be justified. As Marshall Dimock has stated:

without the professional military mind...
the U. S. would be like a farmer using a
horse-drawn plow when tractors are avail-
able.¹

Second, when a man reaches the highest level of administration, such as the Secretary of Defense, he must develop the acumen and skill in the use of strategy that distinguish the successful businessman or politician. He must acquire an understanding of all facets of program administration, including the political. What is required for the

smooth functioning of a national policy, is an administrator capable of gaining the support of his superiors, his colleagues and subordinates, his supporting pressure groups, and his legislative committees in Congress, or his program will falter.² At the center of this effort is an affirmation of the political process which alone can be productive of policy.³ In short, the executive public administrator must be a political man, in the purest sense, that is, one capable of bargaining, negotiating and compromise.

Third, the TFX amply demonstrates the limits of the McNamara approach to weapons procurement. McNamara's analytical approach towards making decisions led him to the choice between Boeing or General Dynamics for the source of the TFX. It enabled him to consider the alternatives and to weigh the effectiveness of each alternative; yet when it came to making the actual decision, intuition, hunches or rough judgements were still the necessary ingredients.⁴

The final truth is that there are no infallible tools that will guarantee the correct decisions.

In the end, Secretary McNamara's own words sum up the reality of military procurement as he was wont to view it:

There are many factors which cannot be adequately quantified and which therefore must be supplemented with judgement seasoned by experience.⁵

Unfortunately, in the TFX case, the decision of Secretary of Defense McNamara was supplemented by necessary judgement without the needed experience.

FOOTNOTES

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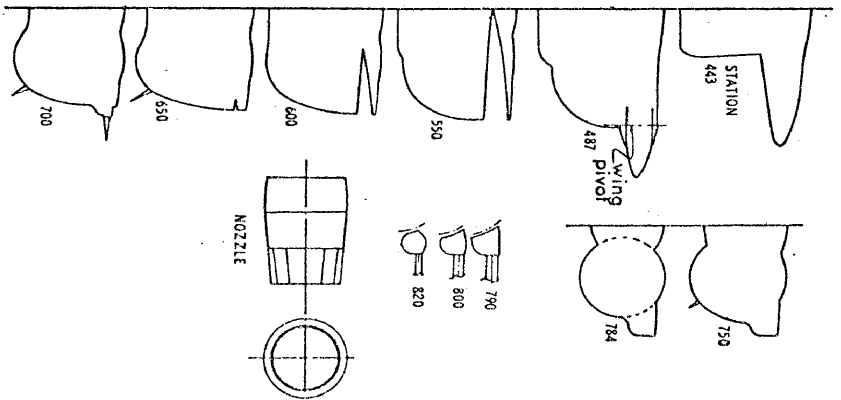
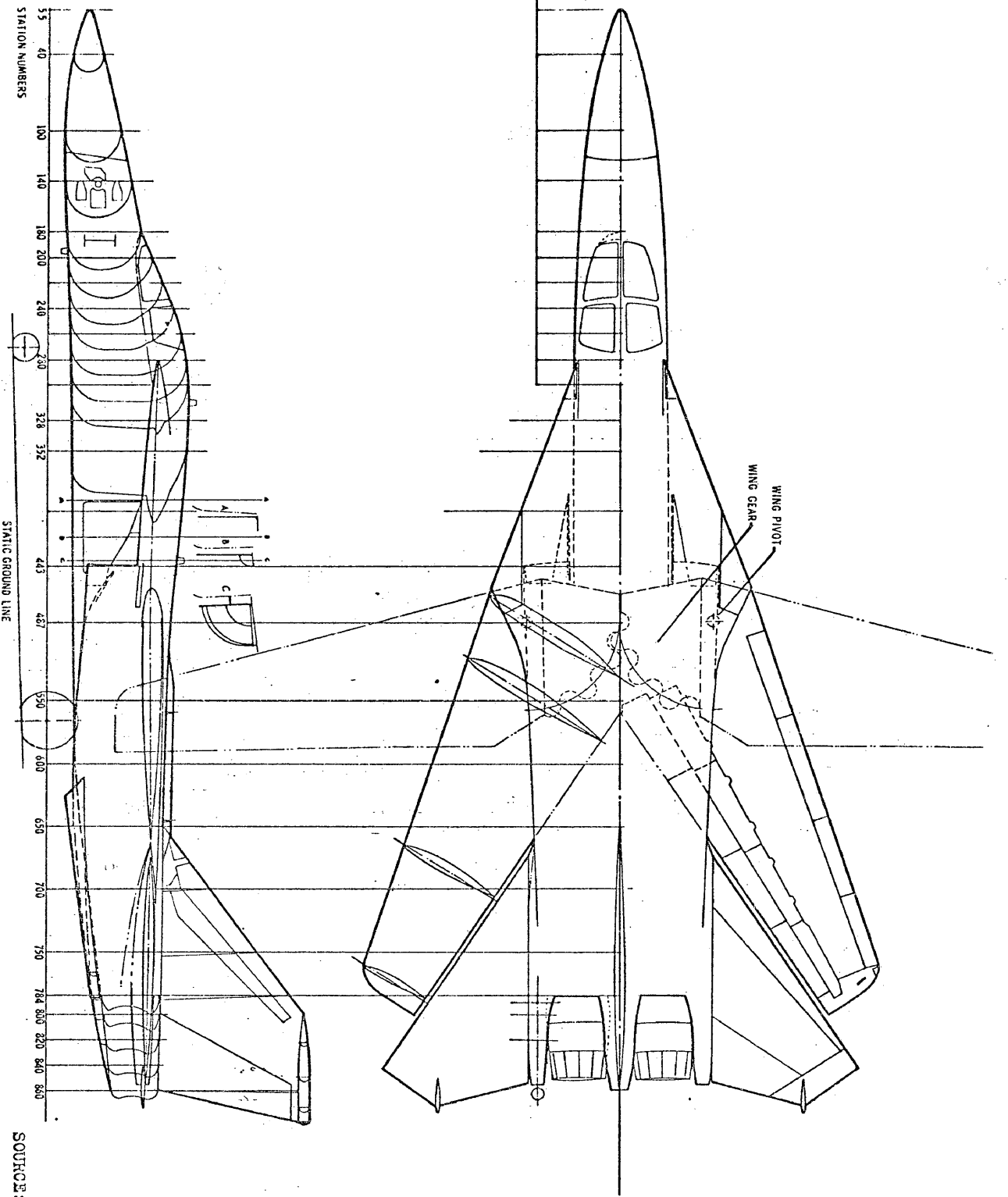
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APPENDIX 1



SCALE $\frac{1}{80}$

SOURCE:

USAF F-111A
 Variable-sweep-wing tactical fighter

For additional copies, write
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APPENDIX 2

AIR FORCE PLANE-F-111A SPECIFIED PERFORMANCE VERSUS ACTUAL CAPACITY

| | Specification Performance | Actual Performance | Deficiency (percent) |
|---------------------------------------|------------------------------|-----------------------|-------------------------|
| Takeoff weight..... | 69,122 lbs.... | 82,500 | 20 |
| Maximum speed, high altitude..... | 2.5 mach..... | 2.2 | 12 |
| Maximum speed, sea level..... | 1.2 mach..... | 1.2 | 0 |
| Cruise Speed, high altitude..... | 2.2 mach..... | 2.2 | 0 |
| Combat ceiling..... | 62,300 ft..... | 58,000 | 7 |
| Acceleration time, M=.9 to M=2.2..... | 1.45 min..... | 4.0 | 275 ¹ |
| Takeoff distance..... | 2,780 ft..... | 3,550 | 28 |
| Landing distance..... | 2,250 ft..... | 2,320 | 3 |
| Supersonic dash distance..... | 210 mi..... | 30 | 85 |
| Ferry range..... | 4,180 mi..... | 2,750 | 34 |

¹Over requirement.

Source: TFX Hearings - Second Series, Vol. 1, p. 59.

APPENDIX 3

A Description of the F-111 Series Aircraft

F-111A: The basic airplane, a tactical fighter able to operate from "austere" runways and carry a warload of almost 30,000 pounds of bombs on underwing pylons, plus up to 3,000 pounds in the fuselage bay, or a nuclear weapon. Max TO weight: 98,000 pounds, with a single nuclear weapon and two externally-stowed Sidewinders. F-111s usually carry, in addition, a belly-mounted 20mm Gatling-type cannon with 2,000 rounds of ammunition, and can handle Walleye guided bombs and Falcon Air-to-Air Missiles. Production aircraft are equipped with TF30-P-3 afterburning turbofans of about 22,000 pounds thrust—a 20-percent improvement (with a 10-percent drop in fuel consumption) over the TF30-P-1s of the research aircraft. The Air Force order is now not expected to exceed 235.

RF-111A: Similar to the F-111A with reconnaissance equipment; R&D aircraft for the more advanced RF-111D.

F-111B: Air-superiority fighter intended to carry six 1,000-pound Hughes Phoenix Air-to-Air Missiles. In spite of a "Super Weight Improvement Program (SWIP)," the aircraft has been plagued by overweight and excess drag, which reduced its required radius of action by 50 percent. The Navy was extremely dissatisfied with the aircraft, and required important modifications; these were effected, but in July, 1968 DOD ended the program after the Senate refused to vote \$460 million for the purchase of 30 aircraft in addition to the six already delivered for a total R&D cost of \$212.5 million.

FB-111: McNamara's choice over the Air Force supported AMSA (Advanced Manned Strategic Bomber) project, for interim replacement of 455 B-58s and B-52s to be phased out of SAC by 1970; a strategic bomber version of the F-111 combining the F-111A-type fuselage with the extended wing tips and TF30-P-12 engines of the F-111B, plus the Mark 2B avionics system, for a full overload weight of about 100,000 pounds with a 41,250-pound warload. The prototype first flew on July 30, 1967.

F-111C: The Australian version; based on a quoted price of \$5.2 million per airplane, including ground-support equipment, training and a year's supply of spares, Australia ordered 24 F-111s in 1963 as Canberra replacements, accepting an open-ended contract. The cost of the 24 aircraft has since risen to \$12.3 million per airplane, or, in all, about a quarter of the country's entire 1968-69 defense budget. The price is likely to continue rising, but cancellation of the contract would cost Australia about \$225.6 million in penalties. The F-111C is outwardly identical to the FB-111, but uses the earlier Mark 1 avionics.

F-111D: F-111A with the Mark 2 advanced avionics system due in late summer of 1969. An RF-111D prototype, scheduled to go into production in 1971, first flew in December, 1967. Of its multi-million unit cost, \$2.2 million is avionics and sensors.

F-111E: Incorporated extensive intake modifications on one hundred sixtieth and subsequent aircraft to remove restrictions imposed by compressor stall at high angles of attack, high speeds (above Mach 2.2)

and high altitudes; more advanced avionics.

F-111F: New high thrust P-100 engine with a 35% increase in power over the original P-3 engine. The F-111F is scheduled for delivery in the fall of 1971. These F-111Fs will be a modern, high-performance, long-range, all-weather attack airplane with the new low cost avionics, good bomb-carrying capacity, and flight performance equal to the F-105 and F-4 class in speed, acceleration and rate of climb.

F-111K: F-111A-type fuselage and wings, improved FB-111 undercarriage, Mark 2K avionics and RAF mission equipment for long-range strike/reconnaissance duties; 50 were ordered by the UK to replace the British-designed TSR-2 scrapped by the Labor government in 1965. The order was cancelled in February, 1968, at a cost of \$130 million in penalties, in the face of U. S. refusal to quote an overall cost for the order, and British estimates of a final cost of \$7.4 million per airplane.

Source: "The People vs. the F-111," an article by John Fricker in Flying Magazine, May, 1969, p. 17. Reprint.

TFX Hearings - Second Series, Vol. 3, p. 515.

APPENDIX 4

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ATTACHMENT A
PAGE 1

REASONS FOR COST GROWTH
AS REPORTED IN DEPARTMENT OF DEFENSE
SELECTED ACQUISITION REPORT FOR THE F-111 SYSTEMS
AS AT DECEMBER 31, 1969

(millions of dollars)

| | <u>F-111</u> | | |
|---|------------------|----------------|--------------|
| | <u>A/C/D/E/F</u> | <u>FB-111A</u> | <u>Total</u> |
| Contractor Price Changes (increases) | | | |
| General Dynamics | \$ 218 | \$ - | \$ 218 |
| Pratt-Whitney | 138 | 51 | 239 |
| Grumman | 207 | 14 | 221 |
| McDonnell-Douglas | 64 | 4 | 68 |
| Spares | 70 | - | 70 |
| Miscellaneous | 12 | - | 12 |
| Subtotal | <u>759</u> | <u>69</u> | <u>828</u> |
| Impact of schedule/production rate changes | <u>458</u> | <u>40</u> | <u>498</u> |
| Avionics Configuration changes | | | |
| F-111D (Mark II) | 297 | - | 297 |
| Mark II support | 42 | 47 | 89 |
| Change to Mark II components | - | 36 | 36 |
| F-111D/F configuration changes | 233 | - | 233 |
| Subtotal | <u>572</u> | <u>83</u> | <u>655</u> |
| Penetration aids additions | <u>199</u> | <u>6</u> | <u>205</u> |
| Engine development/propulsion | | | |
| Engine/propulsion improvements | 188 | 51 | 239 |
| F-100 engine development | 79 | - | 79 |
| Subtotal | <u>267</u> | <u>51</u> | <u>318</u> |
| Impact of F-111B and F-111K cancellations | <u>99</u> | <u>63</u> | <u>162</u> |
| Southeast Asia Deployment | 30 | - | 30 |
| Systems testing | 37 | - | 37 |
| Expanded flight test | 66 | 35 | 101 |
| Addition of Sparrow AIM-7G capability | 19 | - | 19 |
| Data requirements | 33 | - | 33 |
| TAC deployment concept | 118 | - | 118 |
| Test base support | 28 | - | 28 |
| Super Weight Improvement Program | 28 | - | 28 |
| Miscellaneous changes | 282 | 33 | 315 |
| Facilities expansion (General Dynamics) | 60 | - | 60 |
| Crash position indicator/recorder | 8 | - | 8 |
| Wing box and other correction of deficiencies not included in other categories | 65 | - | 65 |
| Depot AGE | 63 | - | 63 |
| Flight to mission simulator | 38 | - | 38 |

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ATTACHMENT I
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(millions of dollars)

| | <u>F-111</u> | | |
|----------------|----------------------------|----------------|----------------|
| | <u>A/C/D/E/F</u> | <u>FB-111A</u> | <u>Total</u> |
| Spares | 86 | 49 | 135 |
| SRAM interface | - | 34 | 34 |
| Total | <u>\$3,915¹</u> | <u>\$463</u> | <u>\$3,778</u> |

¹December 31 SAR's program cost totals indicated cost growth of \$3,913 million, exclusive of construction cost of \$22.7 million. However, the Air Force's cost variance analysis shown in the SAR accounted for \$3,915 million.

(UNCLASSIFIED)

Source: Statement of Comptroller General of the United States before the Permanent Subcommittee on Investigations hearings on "The F-111 Aircraft Program" April 28, 1970.

APPENDIX 5

Individuals Interviewed:

1. Mr. Paul Kamerik, Assistant Council, Permanent Subcommittee on Investigations.
2. Mr. John Brick, Investigator, Permanent Subcommittee on Investigations.
3. Mr. Leon F. Hartley, Supervisor, Defense Division, Government Accounting Office.
4. Professor Leonard Rapping, Professor of Industrial Management, Carnegie-Mellon University.

Interviews were sought with members of the General Dynamics Corporation team that work on the TFX, as well as with members of the Department of Defense. These interviews were denied me by the organizations concerned.

APPENDIX 6

CHRONOLOGY

- April, 1960 - Tactical Air Command and NASA agree on program for TFX.
- October, 1960 - Director of Research and Development orders holdup on source selection pending review by Secretary of Defense.
- June 7, 1961 - McNamara concludes TFX should fulfill requirements of only Air Force and Navy.
- August 22, 1961 - Air Force and Navy report to McNamara that they are unable to reach agreement over joint requirements of TFX.
- September 1, 1961 - McNamara unilaterally sets requirements for Air Force and Navy on TFX.
- October 1, 1961 - Air Force issues request to airframe industry for proposal and work statement.
- December 6, 1961 - Airframe companies submit their proposals to Source Selection Board.
- January 19, 1962 - Source Selection Board votes unanimously to recommend Boeing as winner of TFX contract.
- January 24, 1962 - Air Force Council rejects Source Selection Board's decision and recommends 8-week extended competition between Boeing and General Dynamics-Grumman.
- January 30, 1962 - McNamara memo to Korth and Zuckert to discuss TFX with President Kennedy.
- April 1, 1962 - Boeing and General Dynamics submit second proposals to Source Selection Board.
- May 14, 1962 - Source Selection Board (May 14) and Air Force Council (May 24) recommend award to Boeing, but Navy refuses to go along.
- June 1, 1962 - Korth and Zuckert reject decision and order third 3-week competition between Boeing and General Dynamics.
- June 14, 1962 - Boeing and General Dynamics submit third proposal to Source Selection Board.
- June 20-21, 1962 - Source Selection Board and Air Force Council again recommend award of TFX contract to Boeing, but Navy again refuses to go along.
- June 29, 1962 - Sec. Zuckert's final runoff between Boeing and General

Dynamics on basis of open "pay-off points."

- September 10, 1962 - Boeing and General Dynamics submit fourth proposal to Source Selection Board.
- November 2, 1962 - Source Selection Board (Nov. 2) and Air Force Council (Nov. 8) recommend contract award to Boeing.
- November 13, 1962 - President Kennedy informed that General Dynamics will get contract.
- November 21, 1962 - Zuckert, Gilpratric and McNamara decide tentatively to award contract to General Dynamics.
- November 24, 1962 - Pentagon publicly announces award of TFX development contract to General Dynamics, production of 1,726 airplanes is planned.
- December 5, 1962 - Permanent Subcommittee on Investigations informs Secretary of the Air Force and Secretary of the Navy that it is making an investigation into circumstances leading to selection of General Dynamics proposal on TFX upon the request of Sen. Jackson of Washington for an investigation on Dec. 4, 1962.
- December 21, 1962 - Research and Development contract signed by Air Force and General Dynamics at Wright-Patterson AFB, Dayton, Ohio, even though Subcommittee requested they wait.
- February 26, 1963 - Senate Subcommittee opens hearings on TFX.
- October 16, 1964 - TFX unveiled at Fort Worth, Texas.
- December 22, 1964 - F-111 makes first flight.
- January 6, 1965 - F-111 test flight canceled.
- March 16, 1965 - Department of Defense confirms technical troubles of F-111.
- December 10, 1965 - McNamara and Johnson agree on new FB-111 bomber.
- 1966 - Product and testing of F-111 at Fort Worth.
- August 25, 1966 - McNamara takes charge of F-111 "Project Icarus".
- January 21, 1967 - F-111A crashes during test flight.
- February 18, 1967 - Second F-111A crashes during test flight.

- February 19, 1967 - Third F-111A crashes during test flight.
- April 22, 1967 - F-111B crashes during test flight.
- May 10, 1967 - Department of Defense signs \$1.82 billion contract on F-111; Sen. McClellan says costs will be doubled.
- October 17, 1967 - First F-111A arrives at Nellis Base, Nevada.
- October 20, 1967 - F-111A crashes in test flight.
- November 4, 1967 - U. S. Navy Admiral Moore requests cancelation of F-111B for Navy.
- January 3, 1968 - F-111A crashes on training flight.
- March 26, 1968 - F-111A on first combat mission in Vietnam.
- March 29, 1968 - First F-111A missing in action in North Vietnam; Senate Armed Services Committee votes to terminate F-111B program.
- March 31, 1968 - Second F-111A shot down in Vietnam action.
- April 1, 1968 - All F-111's grounded.
- April 13, 1968 - F-111's resume combat mission after correction of malfunction.
- April 24, 1968 - Third F-111A crashes in Thailand.
- May 19, 1968 - F-111 crash lands at Holloman Air Force Base.
- May 22, 1968 - USAF grounds F-111 for repairs.
- June 15, 1968 - A few F-111's released for flight after replacement of parts.
- July 3, 1968 - House Armed Services Committee votes to terminate F-111B program.
- July 11, 1968 - Department of Defense cancels F-111B program.
- August 18, 1968 - F-111 crashes.
- September 12, 1968 - F-111 crashes.
- September 25, 1968 - USAF grounds F-111 for second time after 11th crash since March.
- October 8, 1968 - Sen. Symington urges cancellatin of F-111 program.

- October 15, 1968 - Great Britain pays \$60 million to cancel order of 50 F-111's.
- February 14, 1969 - F-111 crashes at night.
- March 5, 1969 - Second F-111 crash in less than three weeks and 13th since January, 1967.
- June 21, 1969 - Sec. of Defense Laird reports F-111 costs have risen by \$407.5 million since February, 1966.
- November 15, 1969 - F-111 grounded for third time due to heat duct leak.
- December 20, 1969 - New weaknesses found in F-111 wing structure, overhaul will cost \$80 million.
- December 23, 1969 - F-111 grounded for fourth time after 15th crash.
- January 14, 1970 - Department of Defense cuts purchases of F-111 for 1971-72 by at least \$1 billion and cuts future orders as well.
- March 5, 1970 - USAF to keep all 232 of its F-111's grounded until new tests are given at cost of \$20 million.
- March 15, 1970 - Sen. McClellan reports new Subcommittee hearings on F-111 to establish that original costs of F-111 have grown some 400% and will seek to place responsibility for the problems of development of the aircraft. Department of Defense reduces production from 668 to 547 planes.
- March 25, 1970 - Subcommittee opens hearing on TFX.
- December 19, 1970 - Subcommittee report submitted by Sen. McClellan charges F-111 program is "fiscal blunder of worst magnitude"- charges Secretary McNamara with repeated errors and deliberate attempts to conceal the truth.
- March 25, 1971 - USAF announces that it has reduced total purchases of F-111's to 514 aircraft.

Source: New York Times
Washington Post
Wall St. Journal

VITA

John Charles Sweeney was born in Philadelphia, Pa. on October 7, 1944. He graduated from West Philadelphia Catholic High School in 1962 and entered St. Joseph's College in Philadelphia, Pa. in September, 1964. After receiving his degree of Bachelor of Science in Economics from St. Joseph's College in 1968, he entered the Peace Corps as a volunteer in India. He returned from India in 1969 and began working with the Philadelphia National Bank as an Asia specialist in their International Division and remained in the employ of this company until he entered the Graduate School of the College of William and Mary in September, 1969.

Permanent Address: 1074 Academy Avenue

Glenolden, Pennsylvania 19036