THE A-7E WEAPON SYSTEM TRAINERS: AN ACQUISITION ANALYSIS

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THESIS

THE A-7E WEAPON SYSTEM TRAINERS:
AN ACQUISITION ANALYSIS

BY

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practical tradeoffs in terms of trainer capability, cost and schedule. The intent is to illustrate the significant areas which warrant management's attention throughout the entire acquisition process.

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ABSTRACT

To better understand the process and the conflicts inherent in the acquisition of training devices, a case history of A-7E Weapon System Trainer procurements is presented. An analysis of the role of training device procurement within the framework of the "total ILS concept" as applied to weapon system programs is attempted. Changing managerial perspectives are viewed as a consequence to "lessons learned" and the attendant realization of the need for practical tradeoffs in terms of trainer capability, cost and schedule. The intent is to illustrate the significant areas which warrant management's attention throughout the entire acquisition process.

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I. INTRODUCTION

A. PURPOSE

The acute concern by military planners and weapon system operators for cost effectiveness, training effectiveness and more recently fuel conservation has led to a heightened awareness of the benefits accruing from the use of training devices. The procurement of an aircraft training device is but one element in the costly and complex process of supporting an aircraft weapon system. A heavy reliance on state-of-the-art technologies has caused aircraft procurement to be replete with problems that are difficult and costly to solve. On a much smaller scale, but no less difficult, are the technical and administrative problems experienced in training device procurement - procurements which must frequently follow in lock-step fashion with the aircraft acquisition program.

The purpose of this thesis is to determine, through an in-depth analysis of A-7E Weapon System Trainer procurements, the significant factors which warrant management's consideration during the process of providing one element of logistic support - the acquisition of training devices - for an aircraft weapons system program. A secondary purpose is to provide, by means of the cases presented, an educational tool for students of Weapon System Acquisition Management. The intent is to illustrate the conflicts and problems which "would be" program managers must learn to identify and

resolve, if future projects are to survive and meet their objectives.

B. RESEARCH METHOD

In conducting the research for this study, full advantage was taken of the opportunity to examine all pertinent records available in the Offices of the Naval Air Systems Command, Weapons Training Division (AIR-413), and the Naval Technical Equipment Center, Orlando, Florida. Although extensive interviews were conducted with a significant number of Government personnel, time and funding precluded meeting all persons associated with the projects, particularly those in industry.

C. ORGANIZATION OF THESIS

Section II briefly describes the background and relevant significance of training devices within the military environment. The process for acquiring training devices is presented in Section III. Sections IV and V are included so that the reader may acquire a perspective for subsequent case histories and discussions which follow in Sections VI and VII.

D. ACKNOWLEDGMENTS

The author wishes to express his appreciation to the many people, whose gracious allocation of many hours from their schedules made this study possible. A debt of gratitude is owed to the staff personnel at the Naval Air

Systems Command, Attack Training Branch (AIR-413) and at the Naval Training Equipment Center, Orlando, Florida, who supported this effort and assisted in making travel arrangements, in scheduling interviews, and in solving the numerous other problems associated with thesis research.

To gain an insight into the real world of training device acquisition management, interviews with the following were conducted:

Mr. D. B. Adams, General Engineer, Weapons Training Division, Attack Training Branch (AIR-4131)

Mr. J. Schreiber, General Engineer, Weapons Training Division, Attack Training Branch (AIR-4131D)

Mr. E. H. Sweeney, Contract Negotiator, Air and Research Procurement Division, Attack and Air Defense Trainers Branch (N-611)

Mr. J. Burns, Engineer, Air Warfare Systems Division, Attack Trainers Branch (N-2221)

Mr. L. Lanchoney, Air Program Control Officer, Program Planning Division (N-3201)

Commander G. C. Warneke, Director of Procurement Services Department (N-6)

Lieutenant Commander R. Norton, Officer-in-Charge, Fleet Aviation Specialized Operational Training Group Detachment, Naval Air Station, Lemoore, California

Mr. M. E. Biciocchi, Deputy Director of Procurement Control and Clearance Division (NMAT 022B)

II. AIRCRAFT TRAINING DEVICES: BACKGROUND

A. EVOLUTIONARY DEVELOPMENT

In its simplest form, simulation means "copying." Simulators are training devices employed in copying conditions and phenomena likely to occur in actual performance. The use of simulators as a training tool has increased proportionally with increases in technology which enable higher fidelity "copying" of actual operational conditions.

The high cost of flying and a realization that the aircraft itself is probably the poorest classroom ever devised gave birth to a need for some kind of ground trainer as a substitute for the aircraft. From the time Ed Link fabricated the first model in 1929, the evolution of flight simulators has been characterized by remarkable advances in "copying" fidelity. Over the years the value of flight simulators has been amply proven. The Link trainer which was widely used for pilot training in the Second World War was a precursor to a variety of much more elaborate sophisticated devices used today for training astronauts, military and commercial aviators, as well as for research and developmental purposes.

The early training devices were intended to furnish training in aircraft normal and emergency flight procedures. Little effort was directed toward replicating the performance or mission characteristics of a specific aircraft model. During the sixties, rapid advances in computer technology

radically altered the capabilities of simulator state-of-the-art. It now became possible to "simulate" every possible performance characteristic of an aircraft through mathematical modeling and computer programming.

The capability to "authentically" simulate a specific aircraft model, so as to provide training "realism", has been pursued and accomplished through the use of actual aircraft components integrated with simulator subsystems. Features such as radar and visual presentations, motion systems, and programmed control stick forces can now provide a realism that approximates the operational characteristics of the parent system to a heretofore unbelievable degree.

B. SIGNIFICANCE

Many of today's training devices are far more costly than the aircraft of World War II, but they can readily pay for themselves from the benefits accrued from their use. The potential net savings derived from simulator usage is dependent upon the amount of actual flight time that simulator training can replace, i.e. the amount of performance learned in a training device which is transferable to performance in an aircraft. The cost of operating simulators is considerably less than the cost of flying an aircraft.

For example, the average hourly operating cost for an A-7 aircraft is approximately $853 compared with $80 for the simulator.[1]

A Navy and Air Force sponsored study predicted that with improved simulators and training techniques, flight hours during basic pilot training could be reduced in the mid-1980's by about 46 to 49 percent. The extent that simulator training can replace flight training in tactical aircraft used in intermediate (training) and operational squadrons is unknown. No standard of measurement exists to accurately assess the amount of flight training in tactical aircraft which can be replaced by future simulator use, nevertheless substantial savings are possible. According to 1973 GAO estimates, annual savings approximating $455M (million) can be realized from a replacement of 25 percent of operational training by training in simulators; a 50 percent replacement would save about $910M annually.[2]

The cost saving features of simulators can be extended to increases in safer training while learning to fly complex and expensive modern aircraft. The prevention of a single accident resulting in the loss of an aircraft and possibly that of its crewmember(s), when attributable to a transfer of training acquired in a simulator, justifies

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[1]U.S. Comptroller General's Report to the Congress, Greater Use of Flight Simulators in Military Pilot Training Can Lower Costs and Increase Pilot Proficiency, doc. B157905, August 9, 1973, p. 16.

[2]Ibid., p. 17.

and demonstrates the worth of training devices. The possibility of an accident always exists during a flight, but such opportunities are absent while using a simulator. Training in high-stress situations, e.g. emergencies such as engine or flight control malfunctions, is not always feasible nor practical without imposing undue risk to the pilot and the aircraft. Simulators afford such training opportunities and as often as is deemed necessary for each individual pilot.

The time spent in simulators allows pilots the opportunity to devote a greater percentage of actual flying time practicing the complex maneuvers which cannot be fully simulated. Pilot proficiency is further enhanced by the "real-time" and instant playback features made possible by digital computers. Programmers can insert every possible performance characteristic of an aircraft into the computer. Thus, any move by a pilot operating a simulator can be instantly analyzed and recorded for future playback. More accurate measures of pilot proficiency are possible using objective grading criteria rather than relying on subjective judgments inherent in inflight evaluations.

Aircraft freed from use in the training role could be reassigned to operational squadrons, thereby increasing operational readiness. The support effort required to maintain training aircraft is also transferrable to operational units.

Breakthroughs in simulator technology in the sixties and the enactment of a Federal Aviation Administration regulation in 1967 - essentially allowing the airlines to replace much of their flight training with simulators - have enabled the commercial airlines to reduce to an absolute minimum, the amount of time spent in aircraft training.[3] Airline pilots can transition to and be certified in new type aircraft through simulator training and the satisfactory demonstration of a minimum number of inflight maneuvers - most of which can be performed within the duration of a single flight.

Military aviators, in addition to learning the more routine flight skills required of commercial pilots, must also acquire tactical skills such as bombing, strafing, air-to-air combat maneuvering, etc. The military services, unlike the airlines, have not always purchased the most advanced simulators as technology became available. This was true partly because of operational priorities and requirements dictated by commitments in Southeast Asia, and, to some degree, because simulators and aircraft compete for the same procurement funds. In addition, the services in the past had been cautious in recognizing advancements in simulator state-of-the-art technology. Principally because of the costs involved, they have not sufficiently funded

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[3] Ibid., p. 9.

the development of improved simulators which could satisfy many of the complex military training needs.[4]

Military disengagement from the Southeast Asian Conflict and the return to peacetime operations, overshadowed by a drastically shrinking defense budget in terms of buying power, have resulted in an increased emphasis by the services in simulation. Current accelerated efforts emphasizing the improvement of simulator capabilities can be attributed to an increasing concern for cost effectiveness, training effectiveness, safety and more recently fuel conservation.

C. TYPES OF AIRCRAFT TRAINING DEVICES

Training devices are developed and procured to satisfy a variety of military needs for simulation in ground, air, surface and subsurface related functions. To provide familiarization, transition and refresher training for aircrews, flight simulator (aircraft cockpit simulator) design incorporates provisions for:

1. Aircraft normal and emergency procedures,

2. Navigation procedures and techniques utilizing onboard aircraft systems,

3. Aircraft flight performance capabilities and limitations,

4. Aircraft tactical procedures utilizing on-board aircraft equipments, and

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[4]Lt. Gen. William V. McBride, USAF, "Simulation in Undergraduate Pilot Training," Commanders Digest, XVI, August 15, 1974, p. 4.

5. Aircraft weapon system delivery use/operation.

To accomplish the basic training provided for in item 1., the Navy procures Cockpit Procedures Trainers (CPT). These devices normally do not provide any weapons delivery, radar or navigation capability. Operational Flight Trainers (OFT) are procured to fulfill items 1., 2., and 3. training requirements. Weapon System Trainers (WST) are procured to satisfy full mission training needs encompassing items 1. through 5.

Occasionally, specialized training devices are procured which have an unusual combination of two or more of the five training capabilities and are designed to provide intensive training in a particular aspect of the aircraft mission. In the A-7E program, two such special devices, Night Carrier Landing Trainers (NCLT), were procured possessing item 1., 2., and 3. training capabilities in addition to a simulated visual system. The NCLT provides specialized training in night carrier aircraft operations.[5]

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[5]U.S. Naval Air Systems Command, Weapons Training Division, Attack Training Branch Files, A-7 Attack Aircraft File N00019-72-C-0988, Negotiation Clearance Memorandum, No. 11800, December 20, 1972, p. 2.

III. AIRCRAFT TRAINING DEVICES: THE ACQUISITION PROCESS

A. THE INTEGRATED LOGISTIC SUPPORT CONCEPT

The procurement and operation of military weapon systems are complex and costly processes. To optimize the performance of weapon systems throughout their life cycles while ensuring that an optimum balance in resource expenditure is achieved, DOD Directive 5000.1, SECNAVINST 5000.1 and other related issuances direct the consideration of integrated logistic support (ILS) planning as a principal design parameter. A total operational system can be divided into the prime mission system and the support system. The prime mission system is that set of resources and functions required to perform the mission with which it is concerned. The logistic support system is a composite of resources and functions required to keep the prime mission system in a state of readiness to perform the mission. The word "integrated" refers to a concurrent consideration of requirements for both the prime system and the logistic support system during all phases of system acquisition.

One of the many functions essential to the integrated logistic support concept is the necessity to provide training support for all weapon systems introduced into the Fleet. An integral element in the training support required in major aircraft programs is the design, development and production of aircraft training devices.

B. ORGANIZATIONAL ACTIVITIES

Essential to the establishment and continued support of suitable training programs is the close and effective coordination among the Offices of the Chief of Naval Operations, Commandant of the Marine Corps, Chief of Naval Material, Chief of Naval Personnel, Chief of Naval Training, Fleet Commanders in Chief and other principals. The primary activities which are specifically tasked with formulating and implementing the actions necessary for procurement of aircraft training devices are as follows:

Chief of Naval Operations, Aviation Manpower and Training Division (OP-59)

The lead agency responsible for the overall supervision of Naval Aviation Training Programs is the Aviation Manpower and Training Division (OP-59). Acting under the guidance of the Director, Naval Education and Training (OP-099), the Division's mission is to fulfill the responsibilities of the Deputy Chief of Naval Operations (Air Warfare) with respect to aviation manpower and training requirements of the Navy.

The preparation of plans and coordinating the establishment of requirements incident to aviation training devices is a function of the Aviation Training Device Requirements Branch (OP-596). The Branch provides planning and programming information relative to aircraft training devices for incorporation into the Navy Five Year Plan, and assists in the preparation of planning and programming documents relating to

associated budget submissions. As an element sponsor in aircraft programs, OP-596 sponsors research and development, directs evaluation and controls the assignment of aviation training devices.

Naval Air Systems Command, Project Manager (PMA)

The Project Manager (PMA) is chartered by the Commander, Naval Air Systems Command, and is responsible for ensuring that all vital elements of a completely effective and combat-ready aircraft weapon system are obtained on a properly phased basis to meet operational requirements. The PMA's role places a premium on coordinated planning, scheduling, and funding of all elements, the continuous evaluation of progress, the early identification of significant deficiencies or slippages, and expeditious corrective action in problem areas.

Integrated Logistic Support Manager

The ILS Manager, a principal member of the project office staff, is directly responsible to the PMA for the development of integrated logistic support planning and its execution. He coordinates the planning, monitoring and project management control functions for each of the individual organizational entities performing logistic support tasks.

Logistic Element Manager

A Logistic Element Manager is responsible for ensuring that adequate planning for and availability of his integrated

logistic support element (e.g. supply support, facilities, personnel and training support, etc.) is accomplished in accordance with the milestones identified in the Weapon System Integrated Logistic Support Plan. In providing appropriate qualitative and quantitative inputs to the logistic support of a weapon system, a Logistic Element Manager frequently acts as an Acquisition Manager, i.e., he performs functions similar to those of a Project Manager, but only those functions that relate to the procurement of specific subsystems, devices or equipment.

Naval Air Systems Command, Weapons Training Division (AIR-04)

The Weapons Training Division (AIR-04) is responsible for the planning, development, establishment, and follow-on support of training programs which provide for the training of Navy personnel in the operation and maintenance of aviation weapon systems. Division personnel function as Logistic Element Managers for personnel and training support within project office organizations for aircraft weapon system programs.

The focal point for initiating and implementing the efforts directed toward satisfying the training requirements of attack aircraft programs is the Attack Training Branch (AIR-413). When exercising its authority as Principal Development Activity (PDA), AIR-413 coordinates the required programmatic, technical and contractual functions for aircraft training device acquisition. Facilities planning is

coordinated with the Naval Facilities Engineering Command for construction or modifications of structures required for training device installation.

Naval Training Equipment Center

The Naval Training Equipment Center (NTEC) responds to requirements from the Chief of Naval Training and the Chief of Naval Material incident to the acquisition/support of training material. As the principal technical agent for Naval training programs, NTEC, when directed, functions as either the Principal Development Activity (PDA) or "Other Support Activity" for training device procurement.

Fleet Project Team

The Fleet Project Team is a group of knowledgeable representatives from the Fleet or other user Commands, designated by Cognizant Commander(s) to assist and advise the PDA on operational training matters in the development, acquisition, acceptance and introduction of aviation training devices.

C. REQUIREMENTS DETERMINATION

The planning process utilized for training device requirements determination and procurement is intimately tied to the selection and planning process for acquisition of the aircraft weapon system. During the conceptual phase, the need for a weapon system is defined by CNO and stated in an Operational Requirement (OR). The OR solicits a Development

Proposal (DP) from NAVAIR in which the technical basis for the aircraft acquisition program is established through feasibility studies. Basic operation and support concepts are identified, and early logistic support planning commences. An iterative process, developed through a formal and informal dialogue between OP-59 and AIR-04, cites the applicable training requirements and cost elements that relate to the logistic support of the proposed program.

D. THE NAVY TRAINING PLAN PROCESS

The establishment of procedures and the assignment of responsibilities for planning, programming and implementing actions necessary to provide training support for new system development is promulgated in OPNAVINST 1500.8G. Total training requirements are addressed including shipboard, staff and student billets, personnel, training equipment, devices, aids, instructional material, military construction/modification of training facilities, services and all other resources to support initial and follow-on training operations. Ideally, these requirements are incorporated in the planning, programming, and budgeting process at the inception of system development and made increasingly definitive as development progresses.

The source document serving as the official statement of personnel and training requirements to support introduction and use of new systems, equipments and other developments is the Navy Training Plan (NTP). The format for a standard NTP

addresses the following major areas: Technical Program Data, Billet/Personnel/Training/Schedule and Financial Requirements, Major Milestones, Decisions Required, and Points of Contract. It is the NTP wherein the requirement for procurement of a training device to support an aircraft program is stated.

Further guidance for the preparation and implementation of Navy Training Plans for the aviation community is provided in OPNAVINST 1500.11G. This instruction establishes policies, responsibilities and procedures for the Naval Aviation Training Program, serves as a reference point for related directives, and provides for coordination among the various elements of the program.

The multiple functions of project management are set into high gear when approval for development of a new capability, such as that provided by an aircraft weapon system, is granted by the Defense System Acquisition Review Council (DSARC). So as to provide the resources and functions necessary to assure the effective and economical support of the aircraft weapon system throughout its life cycle, a Logistic Support Analysis (LSA) is initiated by the ILS Manager. The development and continuing update of a Navy Training Plan normally originates as a response to the LSA process and the subsequent formulation of an Integrated Logistic Support Plan (ILSP).

Naval Air Systems Command (NAVAIR) is the Principal Development Activity (PDA) for aircraft programs. The focal

point for all activity associated with the acquisition program is the PMA. The Project ILS Manager acts as an agent for the PMA in all logistic matters. Providing functional assistance to the ILS Manager as ILS Element Managers for personnel and training is the Weapons Training Division (AIR-04).

Subsequent to approval of a new aircraft program, it is AIR-04's responsibility to examine the human factors involved and to recommend to OP-59 the establishment of a training requirement through the Navy Training Plan process.

Based on AIR-04's recommendation, OP-59 initiates action to develop a draft NTP by soliciting information as required from concerned bureaus, commands and offices. The convening date of a Navy Training Plan Conference (NTPC) is announced and the draft NTP, compiled by AIR-04 and submitted to OP-59, is distributed to all principals.

The planning time frame for NTP preparation must allow sufficient time for training support to be accomplished before personnel are required to operate and maintain the new system in the Fleet. Hence, critical time elements have been established as follows:

1. Technical Program Data is to be provided within 90 days of CNO approval of a new system development.

2. A formal approved NTP is required at least three years in advance of the planned weapon system IOC (Initial

Operational Capability) date. (The need for flexibility in processing accelerated procurement programs is acknowledged.)

The NTPC, convened and chaired by OP-59, provides the principal forum for modifications to and ratification of the draft NTP. Based on the inputs received during the NTPC, AIR-04 prepares and distributes a revised NTP proposal for review and for comment by CNO as appropriate. Approximately 30 days after distribution of the proposed NTP, CNO approval action is taken and the NTP is promulgated for implementation. As the weapon system progresses in detail and accuracy, the NTP is further developed and kept current by updating conferences.

The approved NTP is a primary source document for programming and budgeting purposes. Budget requests for elements identified in the NTP are formulated by AIR-04 and submitted to CNO in accordance with established directives for inclusion in the DOD Budget. Authorized funds are in turn allocated to AIR-04 either by the PMA or directly by CNO for the purpose of accomplishing the NTP. Other action includes incorporation of the NTP into the Integrated Logistic Support Plan for the aircraft program as well as incorporation of essential elements of the NTP such as schedules, personnel and training resource requirements, etc., into the Advanced Procurement Plan and similarly related documents.

The contractual and technical responsibility and authority to develop and acquire a specific aircraft training

device is either assigned to NTEC or retained by NAVAIR as per an agreement delineated in NAVMATINST 5450.28/CNTINST 5450.8. The matrix organizations of NAVAIR and NTEC are comparably structured in the functional areas of project management, material acquisition and logistic support to adequately support the administration of a training device project by either activity. In those procurements in which AIR-04 functions as the PDA, NTEC acts as "Other Support Activity" by providing technical cognizance for trainer development and life cycle management. As the prime source of engineering support, NTEC in most cases has been the principal originator of technical documentation requirements, e.g. Military Characteristics, Statements of Work, Specifications, Data Item Descriptions, etc., as well as the formulator of cost estimates for budgeting purposes. When NTEC functions as the PDA, AIR-04 provides program guidance as the ILS Element Manager.

To assist the PDA, a Fleet Project Team is assigned to act as the Cognizant Commander's representative in operational training matters concerning the development, acquisition, acceptance and introduction of aviation training devices. As the PDA's interface with the Fleet, the Team functions in an advisory capacity as reviewer, inspector and testor in order to coordinate and validate projected trainer capabilities, and thereby ensure that the end product satisfies the user's needs.

E. THE ACQUISITION TIME FRAME

When viewed over time, the duration for the planning, programming and development phases of an average training device acquisition approximates three to four years. The planning phase extends from the initial determination of a requirement for a training device to NTP approval by CNO 10 to 12 months later. During this period Military Characteristics are written and preliminary budget proposals are submitted. During the 8 to 10 month programming phase, technical requirements are specified, a procurement package is assembled, and funding allotments are approved. Procurement solicitation, proposal evaluation, negotiation and contract award is usually an additional three to five months in duration. Contractor lead time in recent procurements has been approximately two years after award for design, fabrication and installation of an aircraft training device.

IV. PERSPECTIVES IN PROCUREMENT

Characteristics which permeated the military procurement environment throughout the 1960's affected the manner in which military programs have been and are currently being conducted. The increasing size, complexity and cost of weapon systems created challenging new problems and, hopefully, the means to cope with them. Differing managerial approaches, many originating at the Secretary of Defense level, were advocated and implemented. For example, policy and practice in the mid-1960's called for fixed price type development contracts with the contractor taking the risk for successful program completion. Once having awarded a contract, the military was expected to involve itself very little in managing the program. On the other hand, the quickening pace of technology resulted in a proliferation of contract modifications and constructive changes as program sponsors and project managers strived to keep their systems abreast of the state-of-the-art advances during development programs lasting at times beyond four or five years. The ability of industry to accommodate changing military requirements, while assuming and retaining the risk for contractual performance, was frequently lacking. A well publicized outcome has been a cost growth phenomenon that draws attention from Congress and the public alike.

Overshadowing the entire spectrum of defense procurement during the mid and late 1960's was the need to support the

military effort in Southeast Asia. The Armed Services have traditionally operated under the assumption that weapon systems and equipment, on an individual basis, must possess the maximum performance that technology can provide. The pursuit of technical superiority in defense programs bordering on the edge of state-of-the-art technologies inevitably relegated all other program considerations to roles of secondary importance. The emphasis on "performance" received a running mate when the Vietnam War created an urgent need for the rapid development, production, and deployment of systems and equipment to augment and/or replace those in operation. Now along with performance requirements, the consideration of "schedules" became a principal criterion which encapsulated many defense program decisions. During the requirements determination phase, military planners selected IOC dates based on the operational need for a particular weapon system or hardware. The schedule for the acquisition program was then structured to achieve the specified IOC date. The opportunities for tradeoffs within a program were minimized due to the explicit constraints of performance and schedules requirements. Aside from the resultant cost growth phenomenon, the sense of urgency stemming from the Vietnam Conflict manifested itself in other forms such as less than adequate planning for logistic and life cycle support, a recourse to the most expedient but not necessarily the most accepted administrative and contractual practices,

program acceleration efforts, acceptance of lower field reliability, and similar outcomes.

By the end of the decade, unit costs of weapon systems had risen to such an extent and funds available to DOD were becoming so limited that a considerable disparity between requirements and resources had developed. There came a realization that the "best" system design is not necessarily achieved by maximizing individual unit performance only, but is a function of need, performance, life cycle cost and quantities needed to address the threat. It became widely recognized in principle that current cost pressures dictate a total system approach (development, production, operating and support).

To provide coherence and structure to defense acquisition policy, Deputy Secretary of Defense David Packard directed the issuance of DOD Directive 5000.1, "Acquisition of Major Defense Systems" in July 1971 (See Appendix B). The primary objective of the Directive is the establishment of policy that seeks an optimum balance between requirements and resources. The focus of effort is directed toward an iterative process of program planning, assessment, and execution with recourse to practical tradeoffs made between system capability, cost and schedule.

It is primarily in the light of DOD Directive 5000.1 that the history and analysis of A-7E WST procurements, contained herein, shall be presented.

V. A-7 AIRCRAFT PROGRAM HISTORY

The A-7 aircraft is a land/carrier-based, subsonic, medium range, visual light attack aircraft capable of carrying tactical nuclear weapons and practically all types of conventional ordnance in the Navy's inventory, while performing close tactical air support or interdiction missions. The A-7E provides a substantial increase in navigation accuracy, weapons delivery accuracy, radius, and load carrying capability over the A-4 and earlier versions of the A-7 which it is replacing.

On 19 March 1964 BUWEPS contract Now 64-363F was awarded to LTV Aerospace Corporation for developing and producing the A-7A aircraft. On 28 March 1966, just after the last 17 of 199 aircraft were purchased on the A-7A contract, an Advanced Procurement Plan (APP #5-67) was issued that covered the continued purchase of the A-7 series for the Navy. On 31 March 1966, Determination and Findings (D&F) #0003-67 approved the procurement of 230 A-7 type aircraft. Contractually the procurement began 11 July 1966 when the Navy added a long lead-time supplement to the basic A-7A contract. In November 1966, the Navy separated the long lead-time funding for 230 A-7B's from the A-7A contract. A letter contract was issued, later to be finalized on 29 July 1968 as a firm fixed price contract, the Navy having decided to procure only 196 A-7B's.

Advanced Procurement Plan #53-68 of 17 July 1967 was one of the first official documents addressing the Navy's consideration of the A-7E program. Externally, the A-7E appeared to replicate the A-7A and A-7B. Internally, however, the radically new A-7E design called for computer-integrated navigation and weapon system avionics that pushed the state-of-the-art, a rapid-fire Gattling gun and a new turbo-fan engine rated at 30% more thrust than that of the A-7B. Because of these technology advances, it proved difficult throughout the aircraft development phase to establish firm aircraft specifications. (This problem significantly impacted the development of the A-7E Weapon System Trainer, Device 2F84B.)

Under authority of D&F #0003-67 on 7 December 1967, the Navy decided to immediately buy the A-7E. This was possible because only 196 A-7B's were ordered while 230 A-7 type aircraft had been authorized by the D&F. With this authority, long lead-time items and funds all available, the Navy chose not to proceed through the normal budget lead-time, and the A-7E decision was written into that fiscal year's procurement. A Business Clearance Memorandum was approved on 28 February 1968 to issue a letter contract to LTV for 7 A-7E's.

On 20 June 1968, an additional 150 A-7E's were added to the original A-7E letter contract. Subsequent single and

multi-year contracts have continued to be issued keeping the LTV A-7 production line open to this date.[6]

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[6]Christopher S. Gates, "Letter Contracts Case," The A-7 Attack Aircraft; Contract History Emphasizing The Navy Business Clearance Process, Thesis G245, Naval Postgraduate School, Monterey, California, (1973), pp. 46-57.

VI. DEVICE 2F84B PROJECT HISTORY

A. INTRODUCTION

The A-7 Weapon System Program was no exception to the conflicts, problems and constraints inherent in systems acquisition during the late sixties. No less a victim of the circumstances and factors influencing project management decisions was the procurement of A-7E Weapon System Trainers, Device 2F84B. The requirement for an accelerated trainer procurement to coincide with the aircraft program necessitated an abbreviated planning phase - the net effect of which was realized in a series of technical, administrative and contractual problems which persisted well beyond the scheduled trainer delivery dates. Timely trainer delivery was optimistically predicated on the availability of aircraft parts and data, no financial difficulties, and no manpower problems. With the exception of ample funds, these problems, exacerbated to some degree by contractor performance, precluded the accomplishment of a successful procurement.

B. ORGANIZATIONAL AGREEMENT

Meetings with cognizant NAVAIR (AIR-04) and Naval Training Equipment Center personnel in 1964 resulted in an agreement in which NTEC would function as the Principal Development Activity for managing the procurement, development and production of A-7 Weapon System Trainers. As the ILS Element Manager for Weapon System Training Support, the

primary role of AIR-04 was to monitor and provide guidance as necessary to the training device projects. The efforts required to logistically support the trainer projects were conducted by NTEC somewhat independent of the formal aircraft ILS program. Coordination between the A-7 Project Office and NTEC was effected by the AIR-04 ILS Element Manager interfacing directly with the A-7 Project Manager (PMA-235) and with cognizant NTEC personnel.

C. DEVICE 2F84

In May 1966, a prototype A-7A WST, Device 2F84 was delivered to the Navy. The WST flight section was designed and developed by Melpar Inc. and the tactics portion was provided by the Link Group, General Precision Systems, Inc. The first production A-7A WST was delivered in September 1966. The third and fourth units of Device 2F84 were scheduled for delivery by 1 June 1967 and 1 March 1968, respectively, under fixed price incentive contracts.

The third unit was delivered to and accepted at Marine Corps Air Station, Beaufort, South Carolina. Subsequently, however, a Presidential Memorandum terminated the requirement for operation of A-7 aircraft by the Marine Corps. The device was then shipped to the Pentagon, Washington, D. C., for a week of display purposes, after which it was delivered to and installed at the Naval Training Equipment Center, Orlando, Florida. It remained at NTEC until direction was

provided to update it to the A-7E WST, following which it was returned to the Melpar Plant in Falls Church, Virginia.

D. PLANNING PHASE

In May 1967, a Program Change Request was drafted by the A-7 Project Office proposing procurement of an improved version of the A-7 aircraft. Preliminary design data for the new A-7E aircraft was made available to NTEC for the purpose of developing Military Characteristics for A-7E Weapon System Trainers. Military Characteristics, approved in June, were formulated by NTEC with the intent of designing and fabricating new A-7E trainers. Nevertheless, for purposes of expediency and anticipated cost savings, PMA-235, supported by AIR-04, made the decision to modify the A-7A WST, Units #3 and #4 to the A-7E configuration. A meeting was held at NTEC on 19 October 1967 and both the Flight Contractor (Melpar) and the Tactics Contractor (Link) were advised of the Navy's intent to update these units to the A-7E configuration and, as a consequence, the Navy desired to extend delivery of the fourth unit through June 1968. Both contractors stated their willingness to cooperate acknowledging a credit would be due the Government for those items not performed and stated that additional costs would result from storage of the incompleted trainer.

In December 1967, Secretary of Defense approval of the Program Change Request officially provided for procurement of A-7E aircraft by the Navy. The formulation of a Navy

Training Plan for the A-7E Weapon System Program was initiated, and a Cost and Lead Time Estimate for weapon system trainers was prepared. Based on aircraft parts being available seven months after contract award, the earliest likely WST RFT (Ready for Training) date was estimated to be 14 months after award of contract.

During the Navy Training Plan Conference held in February 1968, it was decided that, based on the need to provide weapon systems trainers by March 1969 and the technical and administrative difficulties of having another contractor modify the existing units, sole source procurement was deemed necessary. Sole source procurement with Link and Melpar was justified pursuant to 10 U. S. Code 2304(a)(14) based on the fact that these contractors were doing current A-7 work and had a substantial investment in this type trainer. Competitive procurement may have resulted in considerable duplication of effort. NTEC, however, had stated that achieving a March 1969 RFT date was not feasible because the aircraft design was not firm enough to permit completion of a procurement package. In addition, the availability of parts was estimated to be eleven months after order. Therefore, Link and Melpar were queried on 18 March as to the earliest delivery dates to which they would commit themselves. Both contractors stated that if data were available and aircraft parts could be delivered six months after contract award, a trainer could be delivered eleven months

after award. Meeting this delivery date was predicated on timely delivery of aircraft parts and data, and no financial difficulties nor manpower problems.

The increasing tempo of air operations in Southeast Asia imposed a singular urgency to the A-7E program. PMA-235 stated that WST RFT dates of March and May 1969 were critical for providing timely pilot training support compatible with the aircraft IOC date. In an attempt to expedite contract administration lead-time so as to facilitate achieving the stated RFT dates, NTEC decided that the optimum approach was to issue Change Orders to Link and Melpar under existing contracts.

E. CONTRACT PERFORMANCE

1. Parts and Data Problems

On 2 May 1968, contract modifications were issued to Melpar and Link providing direction to modify and update Device 2F84 (A-7A WST), Units #3 and #4 to Device 2F84B (A-7E WST), Units #1 and #2. RFT dates of 31 March 1969 and 30 April 1969 were specified. A Clarification Conference was held in mid-May with the contractors and LTV representatives for the purpose of discussing the Government's technical requirements.

Following receipt in early July of the contractors' proposals (See Exhibit (VI-1) for proposed delivery schedule), considerable effort was directed at technical clarification of the specifications for the aircraft and the weapon

system trainer. This effort continued through August, and in early September it became evident that serious problems had arisen. A meeting convened in Dallas, Texas, and attended by representatives from Link, Melpar, LTV and NTEC focused discussion on the following major areas:

a. Data

Adequate data was not being received from either LTV, the aircraft manufacturer, or from IBM who held proprietory rights to the computer math model. It appeared that it would be necessary for Melpar and Link to negotiate directly with IBM to acquire the necessary computer data. Data was essential not only for the detailed design effort, but also for programming the computer software for simulation of the aircraft operational flight characteristics and for the integration of the various avionic subsystems.

b. Aircraft Parts

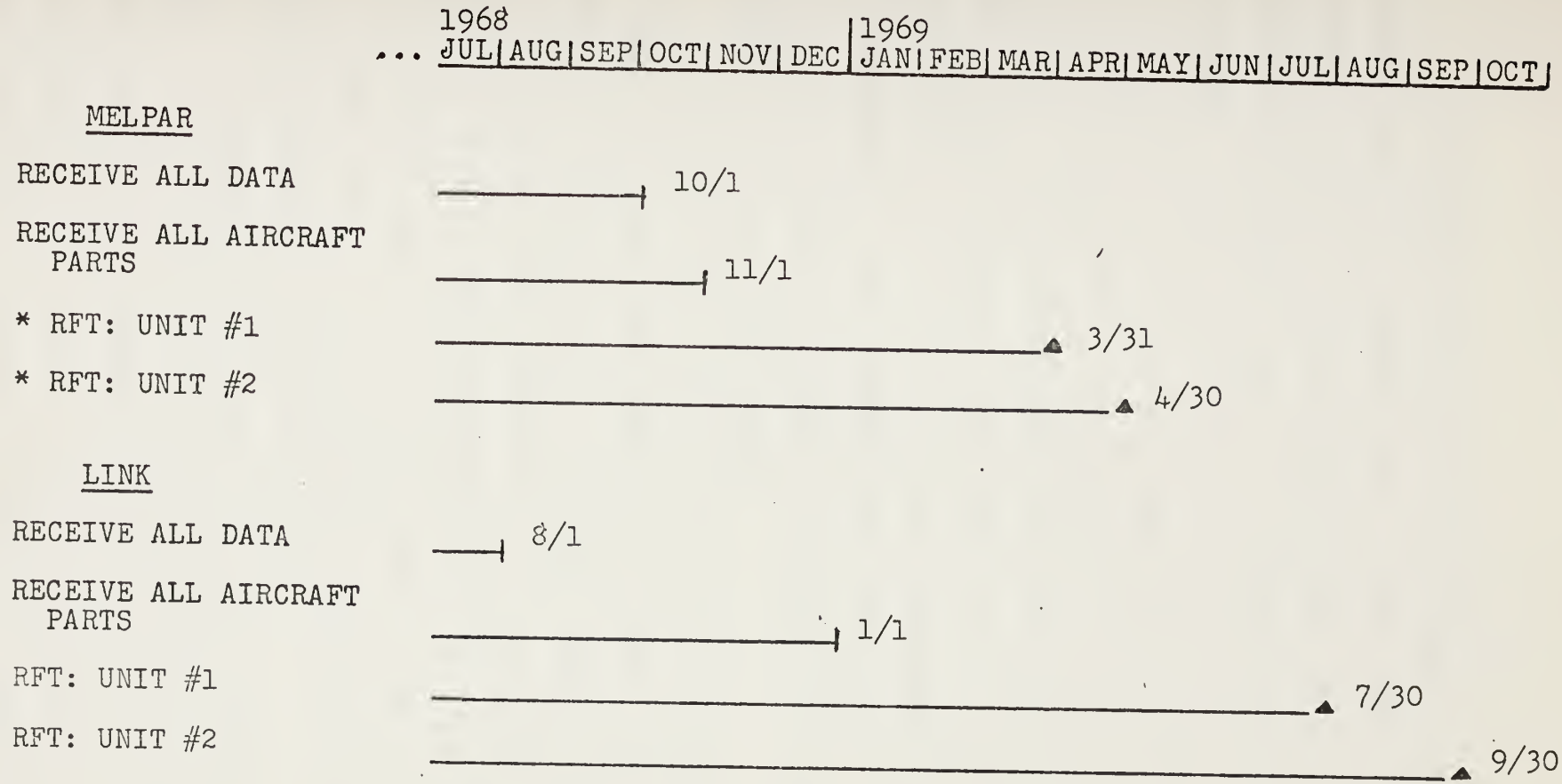
Delivery schedules for aircraft parts provided by LTV did not meet the delivery dates required by Link and Melpar. Unless firm contractual commitments relative to price and delivery of parts were received from LTV by Melpar and Link, a slippage of the RFT dates appeared likely.

c. Design

The aircraft design was changed to include the Projected Map Display. The impact of this new requirement on the trainer design was still to be evaluated.

EXHIBIT (VI-1)
A-7E WST DELIVERY SCHEDULE

(JULY 1968 - CONTRACTORS PROPOSALS)



*RFT DATES SPECIFIED IN CONTRACT CHANGE ORDERS

The monthly Progress Status Review of the A-7E WST Project was held by NAVAIR on 2 October 1968. Milestones established during the Dallas Parts and Data Meeting for determining the ultimate impact of delayed parts and data were analyzed. It was determined that the delivery dates for aircraft parts quoted by LTV ranged from $2\frac{1}{2}$ to 5 months later than that required by the trainer contractors to meet the RFT dates. Data availability was approximately one to two months behind schedule, and a NASA priority contract had delayed delivery of components for the flight section computer. Consequently, a new schedule was established. The RFT dates for Link remained unchanged; the dates for Melpar had slipped to May and August 1969.

In response to the project delays, PMA-235 directed LTV to accelerate delivery so as to make available all parts by 31 December 1968. Increased communication between LTV and the trainer contractors was encouraged to identify and resolve the more significant data problems. At this time, PMA-235 made the decision that A-7E WST, Unit #1, should be delivered with less than all subsystems operable, if deemed necessary to meet the RFT date.

A-7E WST funding status was also reviewed at this time. As a result of an underestimate of the price of aircraft parts and an extended period of performance due to the unavailability of aircraft parts and data, an increase over the contractors' proposed costs existed. NTEC had been

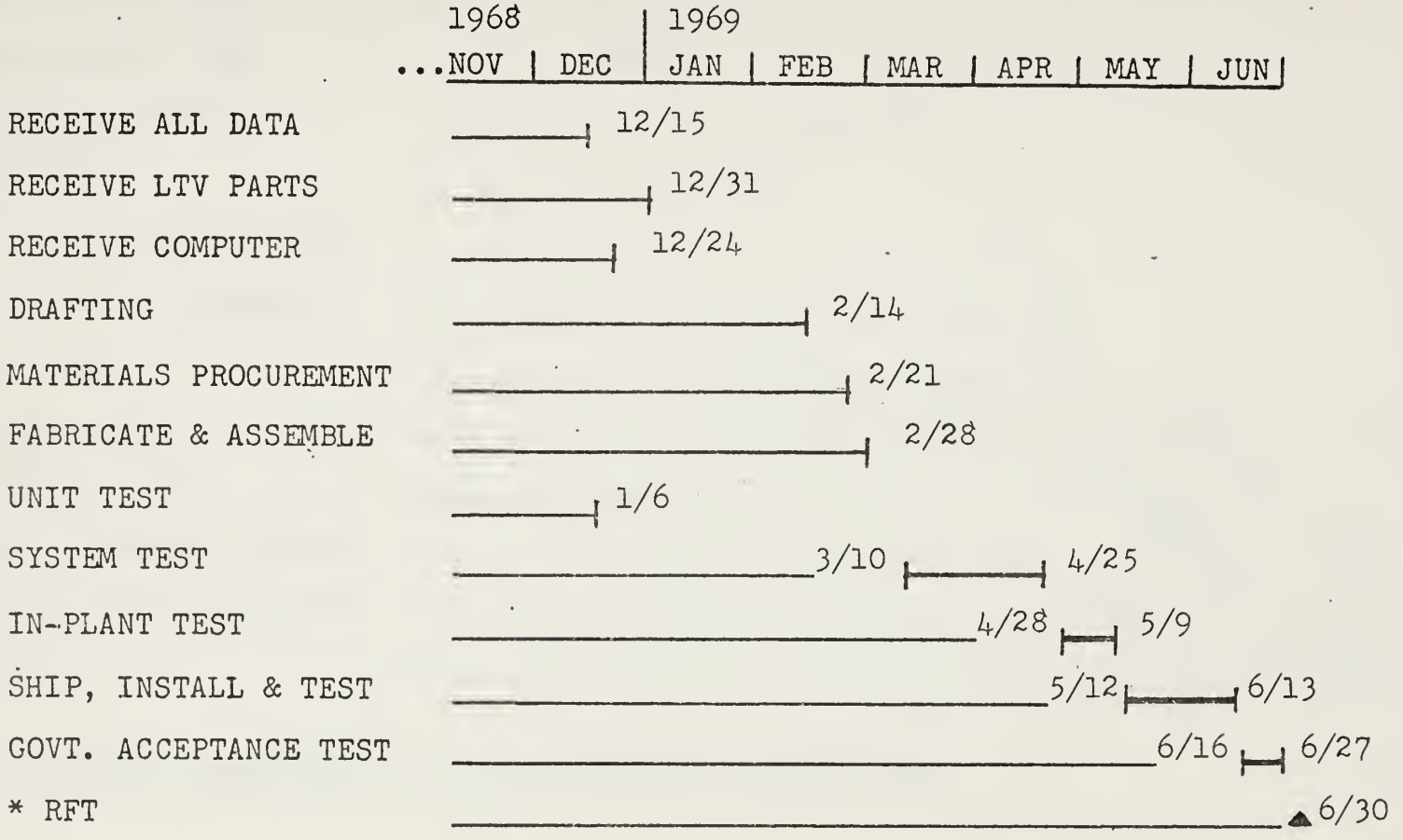
provided $3.1M (million) for the modification of the two trainers and the contractors' proposals now totalled $4.5M. To satisfy the $1.4M funding shortage for Units #1 and #2, funds were reclaimed from follow-on WST procurements which had already been planned and programmed.

The A-7E WST Progress Status Review held on 18 November 1968 made it apparent that many of the conditions on which the RFT dates were predicated could not be met and that the RFT dates would slip accordingly. (See Exhibits (VI-2) and (VI-3) for the revised delivery schedules.) LTV indicated that all requested aircraft data would be available as of 15 December 1968 rather than the previously scheduled date of 22 October. Link had begun to experience failure of aircraft component parts and long lead-times in obtaining replacement items. Melpar's difficulty in obtaining adequate support from IBM regarding computer data still had not been resolved. PMA-235, displeased with the lack of contractual agreements between Link and LTV directed both parties to take positive action to rectify the problem. The Project Manager further stated that if there were any additional delays, all parties would have his personal support so as to expedite the A-7E WST development.

The December 1968 and January 1969 A-7E WST Progress Status Reviews showed Link to be progressing on schedule despite a parts failure problem. Action was taken to the extent of taking replacement parts off the aircraft

EXHIBIT (VI-2)

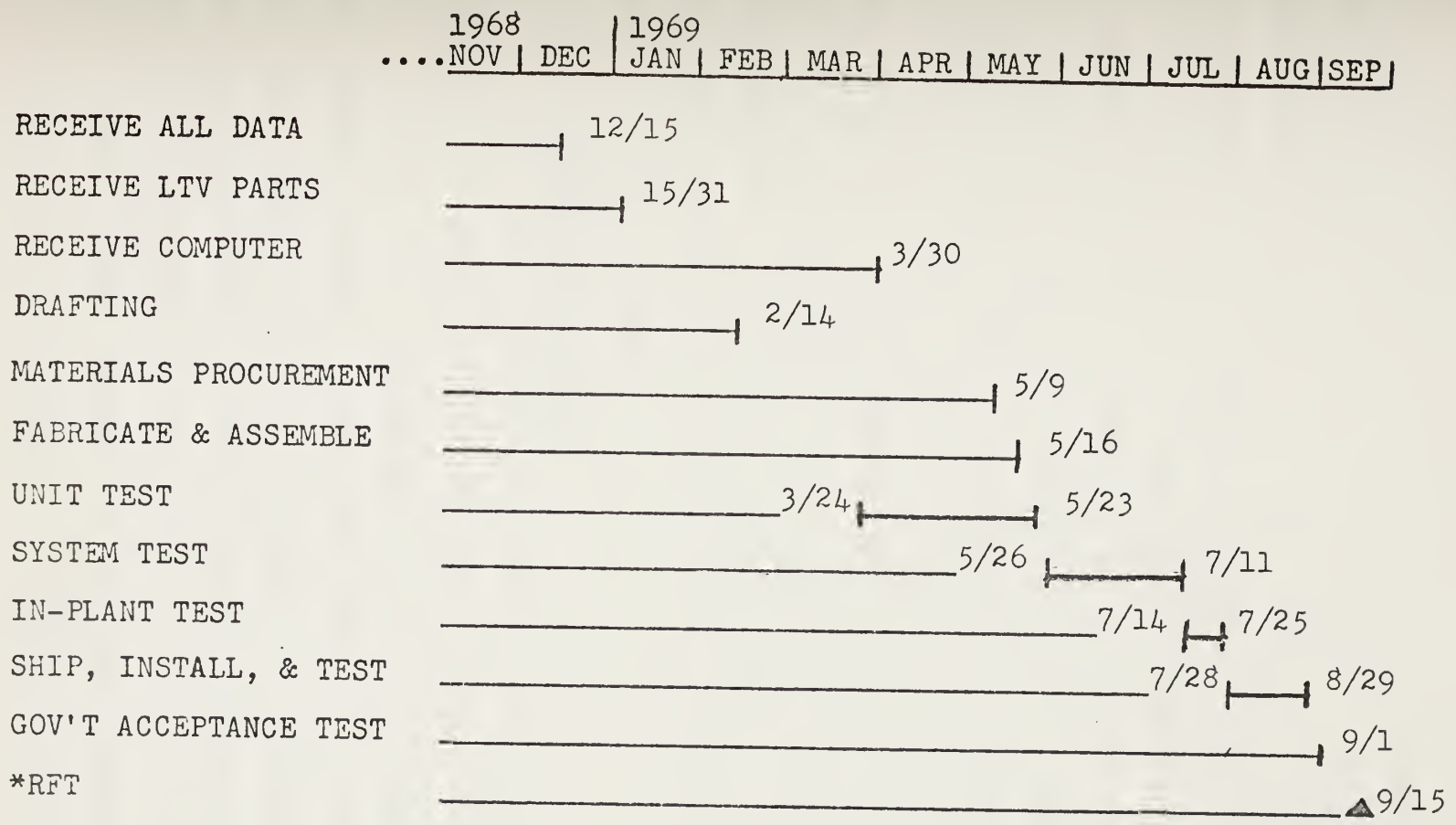
A-7E WST DELIVERY SCHEDULE UNIT #1
(NOVEMBER 1968)



* DESIGNATED SUBSYSTEMS TO BE RETROFITTED AT LATER DATE.

A-7E WST DELIVERY SCHEDULE UNIT # 2

(November 1968)



*DESIGNATED SUBSYSTEMS TO BE RETROFITED AT LATER DATE.

production line and supplying them to the contractor. Melpar had received almost all of the LTV data required as of January, but was still plagued by insufficient data from IBM. Substantial progress was made in the areas of design, programming and math modeling. The only "critical" effort remaining at that time was the design and modeling of the Navigation/Weapon Delivery Computer along with the integration of a new avionics subsystem. The success of this effort was contingent upon the timely acquisition of data from IBM. The delivery of aircraft parts was approximately 55% complete as of 14 January 1969. Several critical parts, however, had not been delivered on the scheduled dates, and it was expected that continued slippage of the trainer RFT dates would ensue. One component - the trainer digital computer - was delivered one week earlier than promised, thereby eliminating a potentially critical problem.

2. Acceleration Efforts

The timely delivery of aircraft parts and data was a problem which persisted despite the progress which was being made. Delays in the development of critical components of the aircraft's avionic subsystems resulted in production delays which impacted the WST schedule. The trainer contractors were confronted with a number of Trainer Change Proposals (TCP) stemming from aircraft Engineering Change Proposals (ECP) as the aircraft design was modified during integration of various avionic subsystems. An erroneous interpretation

of the aircraft data by Link required a design change by Melpar to accommodate the tactics radar. The net effect of the various problems and delays was an estimated RFT schedule slippage to September and October 1969 for both Link and Melpar.

A September RFT date for Unit #1 was unacceptable to PMA-235 who directed that maximum effort be exerted to meet a 1 August 1969 RFT date. During the Progress Status Review Meeting held in February 1969, Melpar was asked to investigate the possibility of improving the delivery of A-7E WST, Unit #1, in order to achieve an RFT date of 1 August 1969.

Melpar's reply stated that a 1 August RFT date was achievable subject to agreement on certain conditions. NTEC immediately advised AIR-04 of the proposed plan, the calculated risk of operating a partially completed integrated WST, the probability that meeting the RFT date was marginal, and that the operating performance was questionable. (It was the intent of the Navy to derive the maximum pilot training available from a partially completed trainer, while the contractors completed their performance on a time sharing basis with the user activities.) Melpar's plan was forwarded by AIR-04 to PMA-235 who approved the proposed acceleration effort and authorized the use of funds to implement the proposed plan. (See EXHIBITS (VI-4) and (VI-5).) On 28 March 1969, change orders were issued to Link and Melpar directing

EXHIBIT (VI-4)
A-7E WST DELIVERY SCHEDULE UNIT #1
(MARCH 1969)

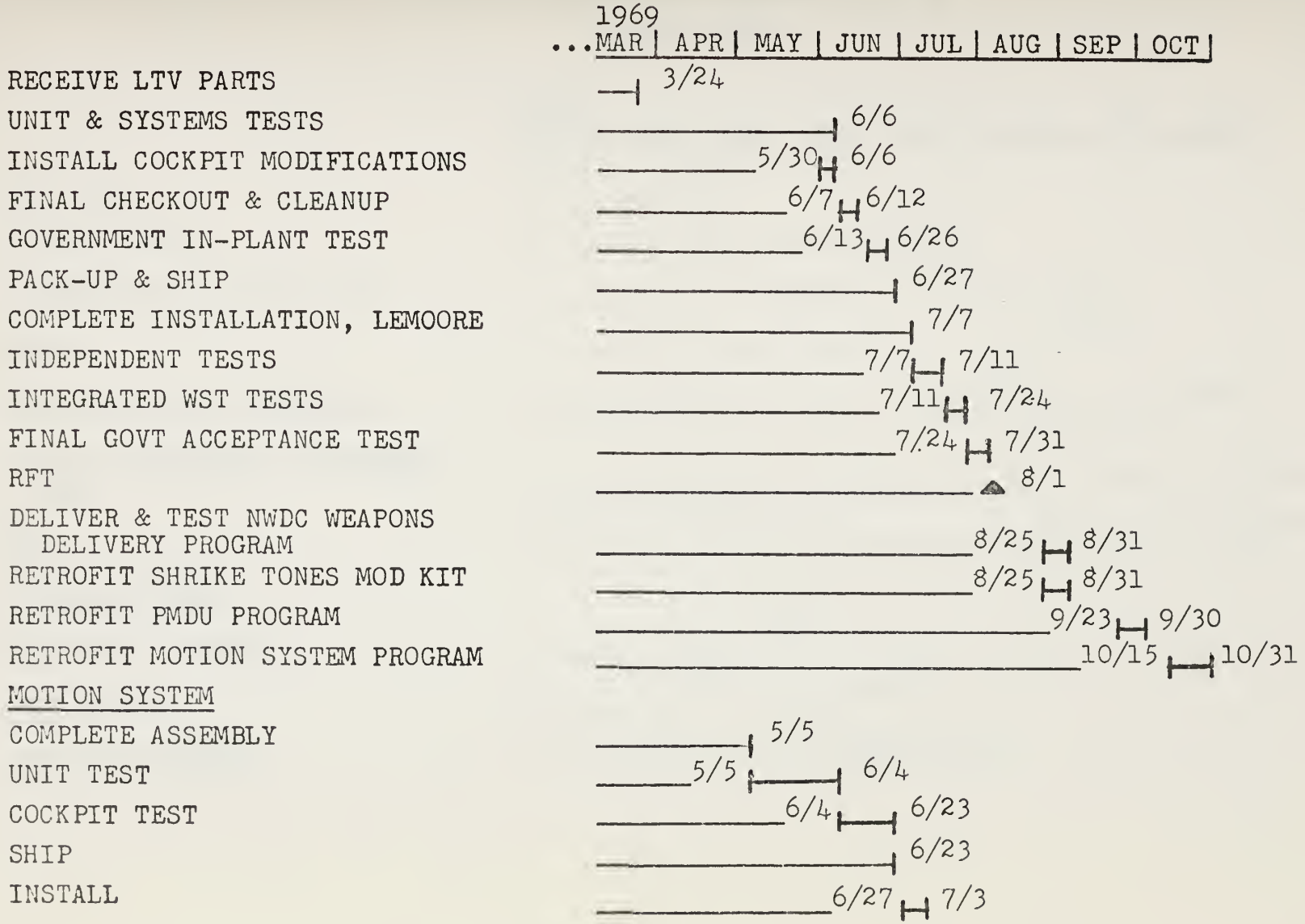
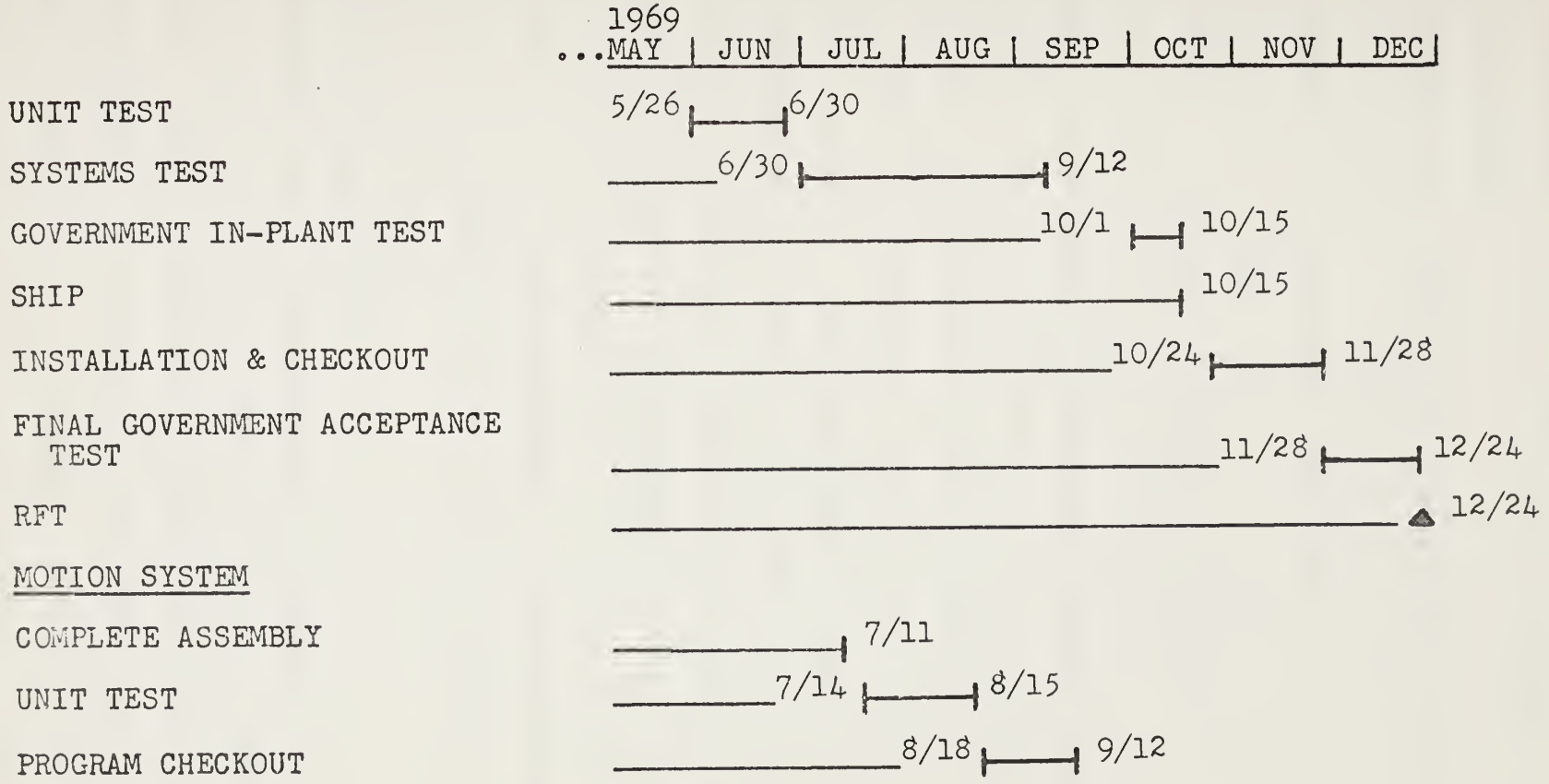


EXHIBIT (VI-5)

A-7E WST DELIVERY SCHEDULE UNIT #2

(MARCH 1969)



a schedule acceleration with an RFT date of 1 August 1969 for A-7E WST, Unit #1.

Throughout the remainder of the program, contractor performance was monitored in detail on a day-by-day basis. Although substantial progress had been made by the end of May, it appeared that Melpar would not be able to meet the revised schedule. Technical problems in debugging the computer program accounted for most of the slippage. Inadequate planning caused Melpar to frequently solicit technical clarification and guidance from NTEC. In many instances, Melpar's requests for clarification were submitted too late for NTEC to respond in sufficient time for the contractor to meet an action due date. Their performance frustrated by technical and managerial obstacles resulted in some Melpar personnel leaving the project. Delays, non-productive efforts and increased costs ensued. As problems mounted, the management of American Standards, Inc., the parent company, became more involved in project decisions. Notwithstanding Melpar's apparent slippage, both contractors contended that the RFT dates would be met.

3. Installation Problems

Throughout June, Link remained on schedule, but Melpar acknowledged that they were approximately two weeks behind schedule. In July 1969, Link shipped the tactics portion of the trainer to NAS Lemoore. Government in-plant tests of the flight portion, started in mid-July at Melpar, were suspended at the end of the month. It was evident that

the goal of achieving a 1 August RFT date by means of acceleration efforts had been abrogated. Melpar was directed to correct numerous deficiencies and inoperable systems before Government testing could continue.

In-plant Government testing at Melpar was resumed the following month. Although there existed a number of performance deficiencies, the flight section of the trainer was shipped to NAS Lemoore with the understanding that the major deficiencies would be corrected prior to a 29 September 1969 RFT date. At this point, effort was being diverted from Unit #2 of the flight section to prevent further schedule slippage of Unit #1.

Progress at the installation site was plagued by technical problems and two accidents. On 2 September, a fire in the cable trenches destroyed some cables, and on 18 September, employees of a Melpar subcontractor damaged additional cables when gun-driven studs passed through the false flooring which was being installed. A major revision to the IBM data was received by Melpar on 12 September which substantially changed the nature of the simulation. Although the impact of the data revision on the RFT dates could not be determined, 20 October 1969 and 24 March 1970 became the estimated RFT dates.

Government testing of the now integrated flight and tactics portions began in mid-October and continued through 10 November. The performance of the trainer was not

acceptable due to several systems being essentially inoperable and to a substantial number of discrepancies in other systems. Link encountered serious technical problems in the tactics portion including details of some radar operating modes, aircraft parts failures, electrical noise, NADIR elevation, and optics problems. It was decided that training on the tactics section was not feasible at that time. In spite of the performance deficiencies, it was determined that some training could be accomplished with the flight section. Consequently, after discussions among NTEC, NAVAIR and the user activities, it was decided that the flight section would be made available for training on a 40 hour per week basis. Additional contractor effort to complete the trainer was rescheduled so as not to interfere with training. Due to the effort and the materials diverted from Unit #2 to Unit #1, the schedule for Unit #2 slipped approximately three to six weeks as new estimated RFT dates were established.

The completion dates for the flight sections of both Units #1 and #2 slipped an additional three weeks due to malfunctions in the digital computer on Unit #2 in early December. The plan of operation was for the Unit #2 computer to be used in-plant for debugging portions of the computer program needed to complete both trainers. Efforts to complete radar simulation in the tactics section met with similar lack of success.

The absence of adequate progress caused NTEC to meet with top level management of Link and Melpar in early December. The intent was to assess the project schedule, to establish realistic completion dates which could be met, and to solicit assurance of full company commitment to the revised schedule. On 18 December 1969, a revised schedule was submitted to CNO and NAVAIR.

Throughout January 1970 and into February, Link continued to have problems with the radar simulation. Melpar lost two weeks on Unit #1 due to problems with the Direct Memory Access. Additional Melpar effort was necessitated when parts of the cockpit motion system were inadvertently discarded by Navy personnel at NAS Lemoore. Correction of deficiencies noted in testing had slipped to 13 February and revised RFT dates of 10 April 1970 and 14 July 1970 were set.

Due to Melpar's poor technical performance, the correction of deficiencies noted in November 1969 were not corrected until 21 March 1970. Subsequent Government testing revealed unsatisfactory correction of some deficiencies as well as uncovering others. The use of incorrect data for simulation of the Navigation/Weapon Delivery Computer by Melpar and similar examples of less than optimum performance caused further schedule slippages to 22 June and 25 August. Before Government testing could resume in June, Melpar encountered substantial technical difficulties with the cockpit motion system. Link resolved their major

technical problem (NADIR elevation); however, both contractors were required to perform additional work following Government testing of Unit #1 in June 1970.

In September 1970, Unit #2 was delivered to NAS Cecil Field. Although installation of the WST was hampered by an incompleted facility, training commenced in late November. The technical difficulties remaining after installation of both units of Device 2F84B were not resolved to the complete satisfaction of the Government. Eventually, the existing deficiencies were corrected - some by Navy maintenance personnel - thereby enabling formal acceptance of the training devices by the Government on 25 August 1971.

Approximately four years elapsed during the interval (1967-1971) in which planning was initiated for procurement of A-7E WST's; and fully operational, discrepancy-free trainers became available for Navy use. The initial requirement for March 1969 and May 1969 RFT dates was promptly superseded by a series of schedule slippages and related occurrences that deny the possibility of identifying the actual RFT dates realized in this procurement.

F. CONTRACTUAL EFFORTS

1. Scope

On 2 May 1968, Change Order P009 to Contract N61339-66-C-0220 was issued to Melpar and Change Order P007 to Contract N61339-66-C-0221 was issued to Link providing direction to modify and update two A-7A WST's to the A-7E

configuration. Within a few months, both contractors began to experience contractual difficulties paralleled by technical problems. Contractual efforts were focused on negotiations with: a.) LTV for provision of aircraft data and parts, b.) IBM for proprietory computer (math model) data, and c.) NTEC for definitization of the Government issued contract change orders.

Contractual hurdles were initially caused by the lack of firm aircraft specifications and a paucity of related data. As data was incrementally received and analyzed, areas were uncovered which indicated that more data, additional costs, and increased contractor effort would be required. This dilemma hampered an early definition and resolution of contractual agreements. Nevertheless, by December 1968, contractual accord had been reached with LTV and IBM for the necessary data and aircraft parts. Subsequent to negotiations conducted in November and December, Link definitized Change Order P007 on 11 December 1968 by signing a fixed price incentive contract which stated a target price of $1,460,500. Attempts to achieve a firm contractual agreement between Melpar and the Government, however, developed into an interminable six year effort - an effort exacerbated by managerial and personnel disruptions wrought within the Melpar Corporation.

2. Change Order P009

The potentiality for contractual difficulties with Melpar surfaced early in the A-7E WST Project. On 7 June

1968, Melpar's parent company, Westinghouse Air Brake Company, merged with American Standards, Inc. In a late response to the issuance of Change Order P009, Melpar, in early July, offered the Government a Delta Change proposal[7] which had been due for submission on 15 June. Melpar attributed the delay in proposal submission to the disruption in management caused by the merger and a subsequent loss of key personnel associated with the A-7 WST Project. Following receipt of the contractor's Delta proposal by the Contracting Officer, considerable effort ensued in an attempt to reach preliminary contractual accord. In August 1968, Melpar submitted a revised proposal based on additional information obtained regarding the A-7E aircraft.

A reticent stance engendered by Melpar permeated the contractual history of the A-7E WST Project. A reluctance to negotiate was initially demonstrated in early December, when Melpar requested that contract negotiations scheduled for mid-December be postponed due to program changes they claimed were beyond their control. However, since the Pre-Negotiation Clearance had been submitted and approved, NTEC considered it to be in the best interest of the Navy to

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[7]A Delta proposal is a contractor's formal reply to a Government issued contract change order. It becomes the basis, along with Government estimates, for the formulation and negotiation of a supplemental agreement. A supplemental agreement, when fully executed, connotes a contractual modification mutually agreed upon by both parties.

conduct negotiations and to definitize Change Order P009, which was then outstanding for more than seven months.

During negotiations on 17 December 1968, Melpar requested that a Memorandum of Understanding be prepared and attached to the Certificate of Current Cost and Pricing Data. The purpose of this memorandum was to establish a period for which Melpar would submit an add-on proposal from a cut-off date of 30 August 1968 through the conclusion of negotiations on 19 December 1968. Melpar's request was honored and a Memorandum of Understanding was accepted by NTEC. Despite this contractual acquiescence by the Government, subsequent negotiations with Melpar became necessary.

The contract with Melpar consisted of three lots:

a. Lot I pertained to the basic procurement.

b. Lot II covered movement of one of the trainers from MCAS Beaufort to the Pentagon for a firm fixed price.

c. Lot III established the update of Lot I units from A-7A (flight section) to an A-7E configuration under a fixed price incentive basis.

Supplemental Agreement P013, drawn up by NTEC, proposed an equitable adjustment to the contract price for contractor performance on Lot III as well as an adjustment for the impact of Change Order P009 on (the incompleted portion of) Lot I.

In January 1969, Melpar submitted credit proposals for Lot I contract items (items not completed on A-7A WST,

Unit #4). The credit proposals which should have been made available for negotiation in December were negotiated on 4, 5 and 6 February 1969. The Post Negotiation Clearance was submitted to the Chief of Naval Material on 14 February and approved on 27 February.

In order to expedite the execution of Supplemental Agreement P013, an advance copy was forwarded to Melpar in early March 1969. Repeated efforts were made by NTEC to expedite return of the Supplemental Agreement. Executed by Melpar on 29 April, it was returned accompanied by a letter citing thirty-six exceptions to the schedule and the specification for Device 2F84B relative to intent and language. (It should be noted that the contractor had the specification in his possession since Change Order P009 was issued on 2 May 1968, after which numerous clarification conferences were held. The specification and schedule were discussed and reviewed with contractor representatives during contract negotiations and prior to preliminary distribution of the Supplemental Agreement. At this time, few, if any, minor differences had been voiced by Melpar.) The thirty-six exceptions became the subject of numerous subsequent meetings with various contractor personnel and were all eventually resolved. Supplemental Agreement P013 was fully executed on 10 July 1969 and reflected a bilaterally agreed to price for all requirements except for the period from 30 August 1968 through 19 December 1968.

3. Change Order P014

The schedule slippages experienced in the A-7E WST Project were translated into the contractual realm in March 1969 when Change Order P013 was issued to Link and Change Order P014 was issued to Melpar directing a schedule acceleration for WST, Unit #1. In response to the Change Order, a Delta proposal for acceleration and add-on contractor effort was submitted by Link in May and definitized through negotiations conducted in October. In June, Melpar provided additional information to support the Delta proposal that had been submitted the previous month. On 18 August, Melpar withdrew their proposal for acceleration and add-on effort by stating:

> Examination of the subject proposal, in light of events which have transpired since its submission, indicate significant omissions in the data presented and the need for considering additional items within the context of both acceleration and post-August matters. Subject proposal is therefore non-valid and is withdrawn pending further review and correction.[8]

Melpar again demonstrated a reluctance to resolve contractual matters in October 1969, when they advised NTEC that it was also their intent to withdraw the proposal submitted covering their contractual efforts performed prior to or beyond 30 August 1968. In reply, the Government Contracting Officer advised Melpar that withdrawal of both proposals

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[8]U.S. Naval Training Equipment Center, Procurement Services Department Files, A-7 Weapon System Trainer file N61339-66-C-0220, Business Clearance Memorandum, P00029, May 20, 1974.

and a subsequent untimely resubmission would adversely impact negotiations and deleteriously effect profit considerations. An explicit detailed explanation of the situation was requested from Melpar.

Contending that costs for the acceleration Change Order could not be segregated, Melpar resubmitted proposals increasing in aggregate amounts on 28 November 1969 and on 12 January 1970. The cost allocations, contained therein, were lump sum dollar estimates. The Contracting Officer determined the proposals and the cost exhibits later forwarded by Melpar to be in noncompliance with accepted Government cost justification guidelines. The Contracting Officer reemphasized the need for detailed back-up cost data.

On 10 February, the Government negotiator telephoned Melpar for the cost data, which Melpar had promised to submit on 5 February. He was told that "Melpar was going in circles in an attempt to resolve how the costs could be apportioned to the cost factors requested by the Government."[9] The only solution known to Melpar was to use the services of personnel working on Unit #2, which was not desirable based on the recognized urgency to meet the RFT date for Unit #1. Effort to date had consisted of personnel not directly related to the A-7 project attempting to achieve a contractual resolution - a date which Melpar could not forecast.

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[9] Ibid., p. 7.

In late February 1970, in an attempt to resolve Melpar's problems, a meeting was convened by the management of American Standard, Inc. (ASI). This meeting was interrupted in order to permit Melpar personnel to participate in an interview with the Defense Contract Audit Agency (DCAA) concerning the subject proposal.

The DCAA Audit Report was received by NTEC in early March. In the report, the audit team questioned $559,015 of the contractor's proposed non-incentive costs for lack of supporting documentation. Melpar's proposed costs-to-complete were supported by lump sum estimates for each line item, e.g. Maintenance, Augmented Support, Repair Parts, Maintenance Kits, Aircraft Parts and Data, etc. It was not possible for the audit team to adequately evaluate the proposed amounts since they had not been segregated by component element, i.e. labor, overhead, and other direct/indirect costs. Based upon a review of the audit report which demonstrated the contractor's failure to segregate costs, the local Government Cost Advisor recommended that Lot III of the contract be converted to a firm fixed price settlement.

In April, estimated allocations for the cost impact areas in the January 1970 proposal were again submitted by Melpar, but these were also determined to be inadequate by NTEC. To ensure that the Government's request for cost information was understood, a Clarification Conference was held at the contractor's plant on 29 and 30 April 1970. The

information made available to the NTEC representatives at this time was minimal. Melpar alleged that in order to provide the requested details, it would be necessary to divert personnel from the project and further delay the RFT date.

In June 1970, based on a preliminary engineering estimate, the Contracting Officer made a settlement offer of $350,000 which was rejected by the management of ASI. Subsequent to the Government's offer, Melpar agreed to attend another Clarification Conference. At this meeting, Melpar agreed to provide further clarifying cost data. This information was not received by the Government until the first incremental submittal was provided by ASI on 27 January 1972 - 2½ years later. Three successive incremental submittals followed in letters of 30 May 1972, 6 September 1972, and 28 December 1972.

4. A Novation Agreement

Melpar experienced another disruption in management and a subsequent loss of personnel after negotiations commenced in May 1970 between American Standard, Inc., and Reflectone, Inc., a subsidiary of the Otis Elevator Company. The negotiations focused on the sale of the Melpar Simulation Department to Reflectone. In June, the Contracting Officer received confirmation of the intended sale, and a copy of a Novation Agreement was forwarded to NTEC in September. According to the terms of the Novation Agreement executed on 24 August 1970, Reflectone assumed all responsibility for

continued performance under Contract N61339-66-C-0220. (A separate agreement between ASI and Reflectone was established to settle the equitable adjustment of the contract.) In separate letters, NTEC was advised by ASI of their intent to pursue the successful settlement of the contract, and by Reflectone that they would be completing performance under the contract.

Despite the fact that the major technical hurdles had already been overcome in the A-7E WST Project, the Contracting Officer's immediate response was to issue a "show cause" letter requesting ASI to explain why the contract should not be terminated for default. The Contractor's letter response stated in part:

> The contract cannot be terminated for default because there are, at this time, no legally binding RFT dates or schedule; ...mutually acceptable and realistic RFT dates must be based on consideration by both parties of all factors affecting our performance.[10]

5. Settlement Offers

A meeting was convened at NTEC on 29 September 1970 for the purpose of discussing and resolving, if possible, all existing contractual problems. The Contractor's claim revised upward to $2.3M was rejected by the Contracting Officer stating that a settlement based on total costs incurred was non-negotiable. Up to this point in time, any attempt to obtain detailed supporting cost information from ASI had been

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[10] Ibid., p. 10.

futile. The Government's settlement offer based on engineering estimates and expertise in the A-7 program was rejected by ASI.

In further attempts to settle by negotiation during the succeeding year, five separate Government proposals, increasing in amount and based on information amplifying the preliminary engineering estimate, were offered. All were rejected by ASI. The impasse led the Contracting Officer to notify ASI in October 1971 that there was no recourse but to make a unilateral determination as to a fair and reasonable price adjustment.

Following a series of conferences and exchanges of correspondence, two of four submissions of technical discussion and justification, as well as cost data to support pricing, were provided by ASI by June 1972. The major portion of the supporting data still remained to be submitted. Since the Government's "final" offer of $1.35M was rejected in May 1972 and ASI was unwilling to settle for less than $1.73M on a total cost basis, the Contracting Officer issued a unilateral determination on 30 June 1972 in the amount of $0.8M.

6. ASBCA Appeal

On 3 August 1972, ASI appealed to the Armed Services Board of Contract Appeals (ASBCA). Discussion during a prehearing on 6 February 1973 centered around Supplemental Agreement P013, negotiations thereof, and the Memorandum of

Understanding attached to the Certificate of Current Cost and Pricing Data. The Board member advised the appellant that to prove that P013 was simply a funding action (which was the appellant's contention) would be difficult. ASI, directed by the Board Member to file an amended complaint by 20 February 1973, did so on 8 March 1973.

A subsequent delay, caused by the appellant's counsel becoming a member of the Board, was instrumental in both parties agreeing that an out-of-court settlement should again be attempted. On 20 August 1973, the Board issued an order of dismissal removing the appeal from the ASBCA Docket without prejudice to its reinstatement, should the parties not be able to reach a settlement.

7. Contract Settlements

Contractual agreements with Link were finalized in April 1973 following the issuance of additional contract change orders and the satisfactory resolution of a claim submitted by the contractor in 1971. The claim for additional costs owed to Link was based on delays in delivery and failure of aircraft hardware and other factors which the contractor claimed were beyond his control. The Contracting Officer, however, asserted that a significant impact on the cost areas specified by Link had been caused by the negligence and fault of Link's co-contractor. After considerable discussion, Link accepted the negotiator's position, and an equitable adjustment was agreed upon by both parties.

In September 1973, ASI submitted a collation of all of its claims under the Melpar contract, which was an attempt to cross-reference all associated costing or pricing previously submitted. Nevertheless, despite subsequent correspondence and negotiations, it was determined by March 1974 that ASI had not provided sufficient information to the Government.

Confronted by an indeterminable date for ASI's submission to support their claim, the last being submitted in December 1972, the Government made a final attempt at negotiated settlement. The negotiation approach that was considered, in effect, closed out the entire contract and converted the incentive portions to fixed price amounts, thereby settling all claims for a total contract price. After a series of offers and counter-offers were made during negotiations on 2 May 1974, a final agreement of $1,234,238 was reached increasing the total contract price to $6.8M.

G. ACQUISITION ANALYSIS

The management decisions relating to the procurement of Device 2F84B were encapsulated by the requirement to obtain weapon system trainers on an urgent basis. The following analysis is presented in an attempt to assess the factors which brought about the problems which caused the trainer project to be late in meeting its schedule.

The requirement for Device 2F84B was somewhat unique in that determination came about in mid-stream of the aircraft

program rather than during program initiation. The planning time frame which led to a contractual commitment for procurement of the first A-7E aircraft was approximately eleven months in duration (May 1967 to March 1968). This abbreviated planning phase precluded an adequate assessment of all essential program considerations in terms of engineering design, integrated logistic support, and trainer contract award and administration as indicated by the following:

1. It was acknowledged that firm aircraft specifications had not been established for the A-7E, nevertheless the decision to immediately procure weapon system trainers was made. It is readily apparent that the Navy, the aircraft manufacturer, and the trainer contractors underestimated the technical risk involved. The A-7E aircraft was considered to be simply a refined version of previous A-7 models, when in reality the development and integration of the avionics subsystems proved to be a significant departure from previous effort. As a result, many early decisions were made without adequate assessment of their potential impact on the trainer development effort. For example:

a. The degree of effort required to update the A-7A WST's to the A-7E configuration, in lieu of the estimated effort to fabricate new devices, proved to be of greater magnitude than initially envisioned.

b. The determination that an A-7E WST could be designed, fabricated and installed in nine months when it was

known that the minimum time in which aircraft parts and critical data would initially become available was six months.

c. The establishment of a WST RFT date approximately concurrent with the aircraft IOC date. It was not recognized that the pacing factor in a training device project is the aircraft program itself. Trainer development under the selected method of procurement must sequentially follow development of the aircraft, and an additional time lag necessitated by delivery of parts and data must be recognized.

d. The degree of effort required in clarifying technical specifications and requirements initially considered to be adequate for design purposes.

2. The compressed schedule of the Device 2F84B project resulted in contractual decisions that proved to be exceedingly difficult to administer and troublesome to resolve. For example:

a. The decision to abbreviate the procurement administration lead-time by issuing Change Orders P007 to Link and P009 to Melpar rather than issuing new contracts. It is DOD policy not to have production equipment (e.g. A-7A WST, Unit #3), that has been delivered and accepted, reworked under a change to the production contract. Instead, a new contract is issued for the rework.

b. Change Orders P007 and P009 were issued without being contractually priced or subject to an established ceiling. Resolution of the contract with Melpar was an interminable six year effort after issuance of Change Order P009.

c. The decision to contract on a fixed price incentive basis with Melpar. A prerequisite to the issuance of a FPI contract is the assurance that the contractor's accounting system adequately provides for the allocation of costs so that the necessary cost data will be available for a final negotiation of profit. It appears that a contractual dilemma existed. The deficiencies in Melpar's accounting system warranted the use of a firm fixed price contract; however, recourse to this type of contract would have been inappropriate due to the lack of firm, definitized WST specifications.

d. The failure of the Navy to establish and adhere to firm RFT dates to which the contractors could be held liable. Repeated changes of RFT dates negated the Contracting Officer's option to terminate the contract for default for reasons of delinquency in delivery.

e. The decision to commence training using a partially completed trainer, in effect, committed the Navy to accepting the device regardless of its ultimate performance capabilities or lack thereof.

3. The procurement of Device 2F84B was not planned as an integrated element of the Integrated Logistic Support

Plan. Instead, the view was held that acquisition of training devices are isolated procurements whose end products, upon acceptance by the Navy, are to be added as training support to the aircraft program. This rationale was demonstrated in the following examples:

a. The relationship of the aircraft manufacturer and subcontractors to the trainer contractors was not identified. Link and Melpar were dependent upon the support of LTV and IBM; however, in the absence of contractual relationships, LTV and IBM had no obligation to respond for reasons other than their own interest in a successful program.

b. Supply support during trainer development was not adequately addressed as evidenced by the parts reliability problem and long lead-time experienced by Link and Melpar in obtaining replacement parts.

c. The opportunity to establish realistic work breakdown structures by Link and Melpar was negated by the late and intermittent availability of aircraft and computer data.

d. The involvement of the A-7 ILS Manager in the planning, coordination and direction provided to the trainer project was not evident. PMA-235 was the principal interface between the project office and other principals involved.

4. Every program/acquisition manager should anticipate the occurrences of "unknowns" which may detrimentally influence the success of a project. In the case of the acquisition

of Device 2F84B, many "unknowns" were provided by the contractors as evidenced by:

a. The loss of key contractor personnel associated with the A-7 WST Project as a consequence of the merger of Melpar's parent company, Westinghouse Air Brake Company, with American Standard, Inc. In the development of training devices, such personnel losses may significantly impair a contractor's ability to perform under a specific contract.

b. The less than desired progress achieved by Melpar and Link during project acceleration and subsequent trainer integration.

c. The reluctance/inability of Melpar to provide cost data in a format suitable for timely contract resolution.

H. IMPLICATIONS FOR FUTURE PROCUREMENT

1. An approved Navy Training Plan is the official statement of personnel and training requirements to support the introduction and operational use of new systems, equipments and other developments. If an NTP is to be a viable instrument relative to the acquisition of aviation training devices, there exists a need for the establishment of RFT dates in consonance with reasonable trainer procurement lead-times. It appears that RFT dates are currently established based solely on operational needs, and the schedule for the trainer acquisition program must then be structured accordingly. A common consequence is a compressed schedule characterized

by late and inadequate planning, which detrimentally influences program implementation. To aid in avoiding the conflicts and problems experienced in past trainer procurements, the requirements determination process should identify RFT dates and authorize training device procurement as early as possible and in accordance with the planning time frame specified in OPNAVINST 1500.8G. If DOD Directive 5000.1 is to be implemented in training device acquisition, military planners must consider procurement lead-time in addition to the need and urgency of Fleet operational requirements, so that practical and meaningful tradeoffs between trainer capability, cost and schedule may be implemented.

2. DOD Directive 5000.1 directs consideration of logistic support as a principal design parameter in the acquisition of weapon systems. If the ILS concept is to receive proper emphasis within aircraft weapon system programs, it is imperative that the project office functionally reflect these changing perspectives relative to training device acquisition. The organizational focal point for decision making and tradeoff analysis for logistic support is the ILS Manager. Successful ILS planning and execution requires his active participation and cognizance over all elements of logistic support including the acquisition of training devices.

3. It has been noted that planning for the acquisition of training devices in an isolated manner divorced from the

weapon system logistic support effort hinders efficient and timely procurement. A current Navy objective, as stated in NAVMATINST 4000.20A, is to "...provide for an orderly, systematic method to determine, in an integrated manner, the requirement for logistic support resources." The translation of the need for training devices into the weapon system ILSP, in an integrated manner, demands a dynamic planning process iterative in nature. These iterations necessitate, not only the planning effort for training device procurement taking into account the implications of those decisions that interrelate with the total ILS effort, but also require formulating the ILSP so as to incorporate the trainer procurement effort. Specific guidance identifying this iterative process is delineated in NAVMATINST 4000.20A in terms of documentation, requirements to be met, assignment of responsibilities, etc. Ideally, the inputs to the NTP, including those relating to procurement of trainers, should be considered by all cognizant project personnel on an iterative basis and be incorporated in all relevant planning documents (e.g., Development Proposals, Advanced Procurement Plans, Request for Proposals, Project Master Plans, etc). Opportunities for practical and meaningful tradeoffs in terms of cost, schedule and trainer capabilities will then be enhanced and the ramifications of related decisions such as contractor source selection, method of contracting, etc., will be afforded increased visibility.

VII. EPILOGUE: DEVICE 2F111 PROJECT HISTORY

A. PRECONTRACT PHASE, A-7E WST, UNIT #3

The requirement for A-7E WST, Units #3 and #4, identified at the time the Navy decided to buy the A-7E aircraft in 1967, was reinstated in the Weapon System Planning Document of 13 February 1969. The Navy's original intent had been to issue Letter Contracts to Melpar, Inc., and the Link Group, General Precision Systems, Inc., who were currently performing under contract for design and fabrication of A-7E WST, Units #1 and #2. However, the lack of satisfactory progress on Units #1 and #2 led to a temporary withdrawal of the requirement for additional weapon system trainers.

The need for a second A-7E WST with a RFT date of 1 July 1974 to be sited at NAS Lemoore was again identified in a CNO message of September 1972. NTEC responded to the requirement by proposing a competitive procurement with subsequent contract award by late fourth quarter, FY73. NAVAIR (AIR-04), however, recommended sole source procurement with LTV, the Aircraft Prime Contractor, for the following reasons:

1. An abbreviated procurement lead-time could be achieved by award of contract to LTV prior to 31 December 1972. The obligational authority of funds already programmed for WST procurement would expire on that date and subsequent budget submittals would be necessary.

2. The administration lead-time required for a competitive procurement could jeopardize meeting the stated RFT date by not allowing ample contractor lead-time.

3. An estimated savings of $1M could be achieved from spillover of LTV's engineering efforts in developing the Night Carrier Landing Trainer and the availability of the IBM math model and essential test equipment.

4. WST design was to provide for future incorporation of TRAM (Target Recognition Attack Multisensors), a series of state-of-the-art multisensors permitting a night weapons delivery accuracy for the A-7E comparable to visual daylight delivery accuracy. LTV had recently been awarded Contract N00019-72-C-0627 for development of TRAM.

5. The lessons learned from procurement of Device 2F84B and additional justifications stated in NAVAIR D&F No. 5013-032-3, dated 20 December 1972 (See Exhibit (VII-1) supported sole source procurement.

PMA-235 concurred with the recommendation for sole source procurement and on 27 September 1972 a Procurement Request was submitted to Vought Systems Division (VSD), LTV Aerospace Corporation. Following negotiations and approval of the Business Clearance in mid-December, an agreement was signed with VSD on 27 December 1972. Modification No. P00026 to the A-7 aircraft production contract - Contract N00019-72-C-0988 - stipulated a firm fixed price of $5.2M for design, fabrication and installation of Device 2F111.

EXHIBIT (VII-1)

DETERMINATION AND FINDINGS

Authority to Negotiate an Individual Contract

NAVAIR D&F No. 5013-032-3

Upon the basis of the following findings and determination which I hereby make as Agency Head, the proposed contract described below may be negotiated without formal advertising pursuant to the authority of 10 U.S.C. 2302 (a) (14).

Findings

1. The Naval Air Systems Command proposes to procure by negotiation one (1) A-7E weapon system trainer together with related supplies and services consisting of design data, final corrected data, engineering drawings, publications, Navy site, training program for Navy personnel, provisioning and interim spare parts and repair parts. This weapon system trainer will realistically simulate all flight and tactics parameters peculiar to the A-7E aircraft and will be used for flight instruction of Navy pilots transitioning into A-7E Squadrons. The weapon system trainer is deemed to be of a technical or special nature within the meaning of paragraph 3-214 of the Armed Service Procurement Regulation.

2. Procurement by negotiation of the above described equipment is necessary because the manufacture of this trainer by any supplier other than Vought Aerospace Corporation would result in duplication of the necessary preparation which would unduly delay the procurement of the equipment. Likewise, the equipment is so specialized and complicated that its manufacture requires a substantial initial investment and if manufactured by any supplier other than Vought Aerospace Corporation would duplicate high starting costs already borne by the Government for related training equipment produced by Vought Aerospace. The manufacture of the weapon system trainer requires detailed familarity with the design of the A-7E aircraft and math-modeling of the IBM computer utilized in the aircraft. Vought Aerospace Corporation has recently been awarded Contract N00019-72-C-0627 for development of TRAM (Target Recognition Attack Multisensors), a series of "state-of-the-art" multisensors which will permit aircraft to fly night as well as day missions. The weapon system trainer will incorporate provisions for TRAM. Time consuming physical preparation and extensive production engineering will be minimized by acquiring the trainer from Vought Aerospace Corporation due to contractual access to all such data and design commonality with previous

A-7E aircraft simulators produced by Vought Aerospace Corporation. Starting costs such as preliminary engineering and development of simulation techniques and other manufacturing preparations by Vought Aerospace Corporation, the developer of similar A-7E aircraft simulation equipment, have been recovered by the contractor under other Government contracts. Generally, this work would not be useful to or usable by any other supplier. Therefore, manufacture of this trainer by any other supplier would result in a duplication of these costs and would likely result in additional costs to the Government by reason of such duplication. Deliveries of the weapon system trainer and related supplies and services are required to commence in August 1974 and be completed in December 1974. Vought Aerospace Corporation has acquired the special skills, manufacturing techniques and experience necessary to manufacture this equipment and can meet the required delivery schedule. No other supplier possessing the special skills and experience necessary to manufacture acceptable equipment in time to meet the delivery schedule is known. Accordingly, manufacture by any supplier other than Vought Aerospace Corporation would require an extended period of preparation for manufacture which would delay delivery of the equipment. Similarly, the ability of Vought Aerospace Corporation, as the prime aircraft contractor, to make important aircraft design provisions in the trainer (such as TRAM) will enhance future trainer operations by minimizing subsequent design change engineering efforts and optimizing both future change production and cost goals.

3. The Vought Aeronautics Corporation, Dallas, Texas, which designed and developed the A-7 series aircraft, has demonstrated the technical knowledge and expertise necessary to design and fabricate an A-7E Weapon System Trainer. The manufacture of production aircraft and simulators to support those aircraft necessitates detailed familiarity with the aircraft design and specifications, extensive production engineering and physical preparation, all of which can only be acquired through previous design, development or production effort conducted by the manufacturer. The Vought Aeronautics Corporation, under Naval Air Systems Command contract N00019-68-C-0075, has successfully designed, fabricated and delivered two (2) A-7E "Night Carrier Landing Trainers" simulators (2F103) which are presently being utilized by the Fleet. The proposed A-7E "Weapon System Trainer" will incorporate approximately 90% of the design characteristics of the "Night Carrier Landing Trainer" and will retain approximately 60% hardware commonality. The proposed A-7E WST will incorporate the actual computer, thus permitting the utilization of the actual aircraft software program in the A-7E

simulator. This new motivative concept will negate the costly and time consuming task of reprogramming the simulator after each subsequent change in the aircraft software program. The Vought Aeronautics Corporation is the only known contractor who has successfully integrated the TC-2 aircraft computer with A-7E Weapons Delivery System. This integration will be accomplished in the proposed A-7E WST and will generated complete systems compatability. This proposed concept will reduce future logistics cost and will enhance the configuration control process by reducing necessary lead time, deleting duplication of engineering effort (such as drawings, parts cataloging, etc.) and will standardize, to some degree, those parts required in the Navy inventory. Therefore, contracting with LTV for the proposed WST will (1) optimize Government time to contract award; (2) reduce the WST design and fabrication time frame; (3) substantially reduce initial WST support costs; (4) reduce follow-on A-7E WST costs for accommodating aircraft changes; and (5) meet Fleet delivery requirements while optimizing acquisition costs.

4. Use of formal advertising for procurement of the above described equipment is impracticable because such method may result in procurement from another source which would require duplication of necessary initial investment and preparation to produce this equipment and would likely result in additional cost to the Government and delay the procurement of this equipment by reason of such duplication.

Determination

The proposed contract is for equipment of a technical or specialized nature which requires a substantial initial investment and an extended period of preparation for manufacture, and procurement thereof by formal advertising would likely result in additional cost to the Government by reason of duplication of investment and result in duplication of necessary preparation of which would unduly delay the procurement of the equipment.

B. PRECONTRACT PHASE, A-7E WST, UNIT #4

The requirement for a second A-7E WST to be sited at NAS Cecil Field was established by CNO in September 1973 and a RFT date of 1 August 1975 was stipulated. NTEC was requested to provide a lead-time estimate for a competitive procurement. Based on actual contractor lead-time for the A-6 and P-3 programs, the NTEC estimate was thirty-six months - a twelve month contractual lead-time prior to award followed by twenty-four months of contractor lead-time.

Rather than pursue a competitive procurement approach, AIR-04 recommended that sole source procurement with VSD would best serve cost, schedule and performance parameters because:

1. VSD, under contract for delivery of A-7E WST Unit #3, would save nine months in design effort because of prior and current experience in building A-7 training devices. Procurement from a source other than VSD would necessitate an extended period of preparation and duplication of costs and the substantial engineering design effort already in progress.

2. LTV is the only source possessing a proven capability of integrating the A-7E aircraft avionics to provide an integral operational system - a feat expressly described as "highly technical and specialized" by cognizant Navy engineering personnel.

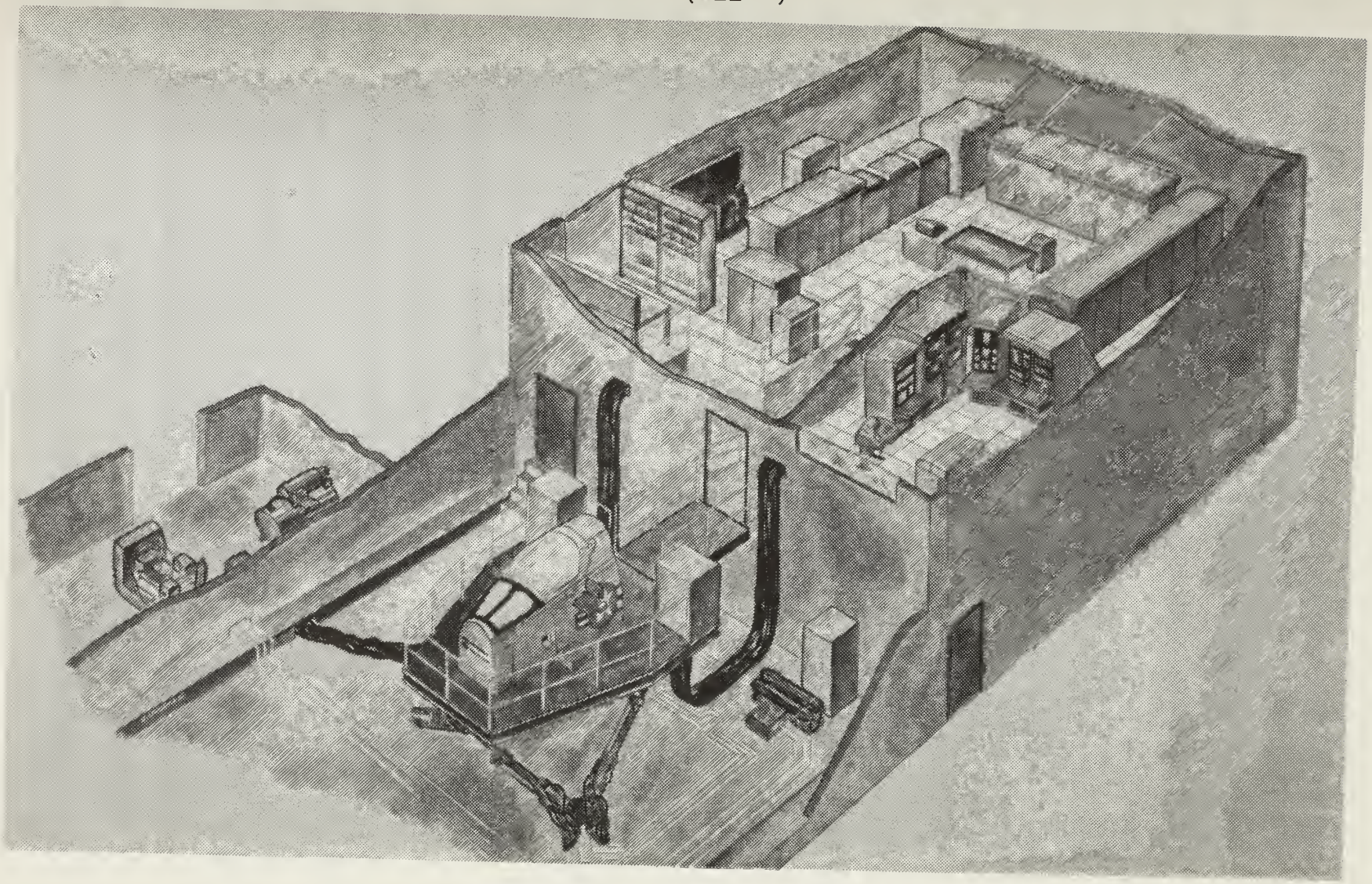
3. The proposal of $3.7M by VSD is comparable to the price of $5.2M negotiated for Unit #3. The $1.5M investment cost savings primarily in the areas of engineering and material are an addition to the $1M savings spillover from development of the NCLT by VSD. The $3.7M proposal favorably compared to NTEC's estimate of $7.8M and $5.2M for procurement of two A-6 WST's - devices of similar complexity.

Contract negotiations conducted with VSD were concluded on 25 January 1974. To condense the administrative lead-time, the contractual vehicle was once again the A-7 production contract - Contract N0019-73-C-0302. Supplemental Agreement P00041 stipulated a Fixed Price Incentive Contract with a target price of $3.9M and a ceiling price of $4.3M for the second Device 2F111.

C. DEVELOPMENT PHASE

Based on the design specifications drawn up by VSD, the major portions of Device 2F111 are being fabricated as subcontracted items. As a result of bids solicited by VSD from the simulator industry, Honeywell is currently developing the Radar Land Mass System; University Computing Company is to provide computer and peripheral equipment; and Burtek Inc. has been tasked with fabrication of the Flight Simulation System, Instructor Station, Trainee Station and electrical power supply. VSD's primary engineering effort will occur during integration, installation and testing of the completed system.

EXHIBIT (VII-2)



A-7E WEAPON SYSTEM TRAINER
DEVICE 2F111

D. ACQUISITION ANALYSIS

An analysis of the A-7E Weapon System Trainer procurements reveals in microcosm the changing scenario of weapon system acquisition at large. By taking into account the contemporary environment which gave birth to the A-7E trainers and by tracing through the problems and conflicts which arose and the corrective action taken in subsequent procurements, the effects of changing military acquisition policies can be discerned.

The acquisition of Device 2F111 appears to be a case of "lessons learned" from previous trainer acquisitions as well as an application of the policy and program considerations delineated in DOD Directive 5000.1. New perspectives are being established in the acquisition of aircraft training devices as evidenced by the rationale presented in Exhibit (VII-1) and by the following analysis of current policy and practices:

1. With the increasing complexities of modern weapon systems and the attendant realization of the worth of the total ILS concept, it has become apparent that, in many cases, more efficient and timely procurement can be achieved by procuring training devices from the prime weapon system contractor as a standard element of the total training package. From a managerial viewpoint, the concentration of responsibility for training device development entrusted to the prime contractor is the primary and most significant

benefit to be derived. The resultant factors favorably supporting this method of procurement are:

a. Sole Source vs Competitive Procurement

Competition has always been the preferred method of procurement for military supplies and services. The selection of a prime contractor to develop a training device for an associated weapon system, however, means sole source procurement in regards to the trainer acquisition. Nevertheless, if the training device is viewed as an integral element of the weapon system logistic support, then sole source procurement with the prime contractor is justified. Few, if any, prime contractors possess all of the specialized capabilities needed for training device design, fabrication and installation. By necessity, subcontractors from the simulator industry furnish the majority of effort required. If competition is to exist, it is at the subcontracting level where its application can be directed.

b. Delivery Date

The probability of an "on schedule" delivery is increased by dealing directly with the prime contractor since concurrent initiation of effort on the weapon system and the associated training device is possible. The parallel development of the weapon system and the trainer under the same contract reduces the administrative effort that is required to implement and to coordinate separate procurements, and also provides a greater degree of scheduling flexibility.

The prime contractor's pride and self-interest in successfully accomplishing the "total" weapon system program is a motivating factor that further enhances timely trainer delivery.

c. Funding

Contracting for the weapon system and training devices from a single source 1) simplifies and expedites funding actions, and 2) provides increased funding flexibility to effect essential reprogramming actions and tradeoffs within total funding packages and time limits.

d. Cost

A precursory analysis would indicate that contracting directly from the trainer industry would reduce the costs of training device procurement. The savings accrue from the reduction of the "middle man" management profit realized by the prime contractor for his services in subcontracting to the trainer industry. However, when viewed in terms of a life cycle cost analysis, these savings are somewhat eroded by costs incurred due to such factors as 1) the need to procure special consultant services, data, and supply support items from the prime contractor, and 2) historically demonstrated difficulties associated with the coordination of separate weapon system and trainer procurements characterized by conflicts and delays, which eventually surface as increases to trainer program costs.

e. Data Flow

Maintaining a flow of technical data from the weapon system development source to the trainer designer, that is both timely and accurate, can best be achieved when the contractor who is responsible for generating the data is also responsible for the training device. Lines of communication are shortened, problems associated with the transfer of proprietory information are eliminated, and the contractor having dual responsibility for the trainer and the data is motivated towards developing an optimum system for data transfer.

f. Supply Support

Centralizing the responsibility for the trainer and the weapon system parts and equipment required for the trainer fabrication in the hands of the prime contractor minimizes potential problems by 1) early identification of long lead-time items, 2) incorporation of current equipments into the trainer that match those ultimately installed in the weapon system, 3) facilitating the establishment of procedures to replace and/or repair failed components, and 4) minimizing purchase costs for weapon system components by means of a single coordinated procurement.

g. Configuration Control

Contracting by the Principal Development Activity for Trainer Change Proposals (TCP), submitted by the trainer industry as follow-on actions to weapon system

Engineering Change Proposals (ECP), introduces administrative lead-times that aggravate the lag of the trainer configuration with that of the weapon system. These delays are minimized when the prime contractor is responsible for the weapon system and the training device. Engineering effort for the weapon system and the trainer is performed simultaneously, and a TCP and an ECP can be processed as a single document. Problems associated with the incorporation of TCP's are further minimized by the coordinated parts and data flow previously described.

2. Because of close association with the early development of training devices for the Navy, NTEC historically has been delegated the authority by NAVAIR to separately contract for aviation training devices as well as to perform the technical functions required. As a result of changing perspectives relating to training devices within a total ILS concept, NAVAIR now does its own contracting, however, the full services of NTEC are still utilized. NTEC project officers and engineering personnel perform the same functions, and the services of the contracting personnel are still employed as cost analysts, negotiators, etc.

There exists a need to retain the expertise relating to training devices as developed at NTEC a) for the technical administration of trainer development, and b) as an alternate contracting source for use when the prime weapon system contractor's estimates are excessively high, or when he is

not equipped or interested in handling the development and production of training devices.[11]

[11]Naval Air Systems Command, Weapons Training Division Memorandum for RADM T. R. McClellan, Operator Trainer Procurement Procedures, August 24, 1971.

APPENDIX A

A-7E WST PROCUREMENT HISTORY

A. DEVICE 2F84B: PROCUREMENT HISTORY

May 1967	Initiation of Program Change Request for procurement of A-7E aircraft
Jun 1967	Requirement for Device 2F84, A-7A WST terminated. Military Characteristics for A-7E WST approved
Jul 1967	A-7E Aircraft Program officially addressed in APP #53-68
Oct 1967	Link and Melpar informed of Navy's intent to modify A-7A WST, Units #3 and #4, to the A-7E configuration
Dec 1967	OSD approval for procurement of A-7E aircraft
Feb 1968	NTPC held. NTEC states the improbability of achieving a March 1969 RFT date
May 1968	Contract Change Orders issued to Link and Melpar directing modification of A-7A WST, Units #3 and #4, to the A-7E configuration
Jun 1968	Westinghouse Air Brake Company merges with American Standard, Inc.
Aug 1968	Clarification of proposals apparently completed
Sep 1968	Initial identification of parts and data problems
Oct 1968	Parts and Data Meeting. Decision to accept partially completed trainer to meet revised RFT date
Dec 1968	FPI contract with Link established. Negotiations with Melpar initiated
Feb 1969	Negotiations with Melpar resumed. WST development problems cause RFT schedule slippage
Mar 1969	Supplement Agreement P013 forwarded to Melpar. Change Orders directing schedule acceleration issued to Link and Melpar
Apr 1969	Supplemental Agreement P013 executed but 36 exceptions cited by Melpar

May 1969	Melpar and Link submit proposals for acceleration effort
Jul 1969	Link delivers tactics portion to NAS Lemoore. Government in-plant tests suspended at Melpar plant
Aug 1969	Melpar delivers flight portion to NAS Lemoore. Proposal for acceleration effort withdrawn by Melpar
Sep 1969	Two accidents at installation site and a major revision to IBM data cause schedule slippage
Oct 1969	Melpar notifies NTEC of intent to withdraw proposal for initial and follow-on efforts. Contractual accord with Link regarding acceleration Change Order P013
Nov 1969	Aggregate Proposal of $1.2M submitted by Melpar. Government testing of integrated WST suspended. Training begins on partially completed trainer
Dec 1969	Meeting with Melpar and Link to assess project schedule. Revised schedule submitted to CNO
Jan 1970	Aggregate proposal of $3.2M submitted by Melpar
Mar 1970	DCAA Audit Report of Melpar. Government testing temporarily resumes. RFT dates of 22 June and 25 August established
Apr 1970	Clarification Conference held with Melpar
Jun 1970	Majority of WST technical problems resolved. Settlement offer rejected by Melpar
Aug 1970	Novation Agreement between ASI and Reflectone
Sep 1970	"Show cause" letter forwarded to ASI. ASI submits revised claim for $2.3M. WST, Unit #2, delivered to NAS Cecil Field
Mar 1971	Claim settlement with Link
Jun 1972	Two of four submissions of cost data submitted by ASI. Contracting Officer issues unilateral determination
Aug 1972	ASI appeals to ASBCA
Feb 1973	ASBCA pre-hearing

Apr 1973 Final contract settlement with Link

Aug 1973 Case removed from ASBCA Docket

Sep 1973 ASI submits collation of claims

May 1974 Final contract settlement with ASI

B. DEVICE 2F111: PROCUREMENT HISTORY

Feb 1969 Requirement for A-7E WST, Units #3 and #4, re-stated

Sep 1972 CNO authorizes procurement of WST, Unit #3

Dec 1972 Contractual agreement with VSD for Device 2F111, Unit #1

Sep 1973 CNO authorizes procurement of WST, Unit #4

Jan 1974 Contractual agreement with VSD for Device 2F111, Unit #2

July 13, 1971

NUMBER 5000.1

DDR&E

Department of Defense Directive

SUBJECT: Acquisition of Major Defense Systems

I. PURPOSE

This Directive establishes policy for major defense system acquisition in the Military Departments and Defense Agencies (referred to as DoD Components).

II. APPLICATION

This Directive applies to major programs, so designated by the Secretary of Defense/Deputy Secretary of Defense (referred to as SecDef). This designation shall consider (1) dollar value (programs which have an estimated RDT&E cost in excess of 50 million dollars, or an estimated Production cost in excess of 200 million dollars); (2) national urgency; (3) recommendations by DoD Component Heads or Office of Secretary of Defense (OSD) officials. In addition, the management principles in this Directive are applicable to all programs.

III. POLICY

A. Mode of Operation - Successful development, production and deployment of major defense systems are primarily dependent upon competent people, rational priorities and clearly defined responsibilities. Responsibility and authority for the acquisition of major defense systems shall be decentralized to the maximum practicable extent consistent with the urgency and importance of each program. The development and production of a major defense system shall be managed by a single individual (program manager) who shall have a charter which provides sufficient authority to accomplish recognized program objectives.

Layers of authority between the program manager and his Component Head shall be minimum. For programs involving two or more Components, the Component having dominant interest shall designate the program manager, and his charter shall be approved by the cognizant official within OSD. The assignment and tenure of program managers shall be a matter of concern to DoD Component Heads and shall reflect career incentives designed to attract, retain and reward competent personnel.

1. The DoD Components are responsible for identifying needs and defining, developing and producing systems to satisfy those needs. Component Heads are also responsible for contractor source selection unless otherwise specified by the SecDef on a specific program.

2. The OSD is responsible for (a) establishing acquisition policy, (b) assuring that major defense system programs are pursued in response to valid needs and (c) evaluating policy implementation on each approved program.

3. The OSD and DoD Components are responsible for program monitoring, but will place minimum demands for formal reporting on the program manager. Nonrecurring needs for information will be kept to a minimum and handled informally.

4. The SecDef will make the decisions which initiate program commitments or increase those commitments. He may redirect a program because of an actual or threatened breach of a program threshold stated in an approved Development Concept Paper (DCP). The DCP and the Defense Systems Acquisition Review Council (DSARC) will support the SecDef decision-making. These decisions will be reflected in the next submission of the Program Objective Memorandum (POM) by the DoD Component.

E. Conduct of Program - Because every program is different, successful program conduct requires that sound judgment be applied in using the management principles of this Directive. Underlying specific defense system developments is the need for a strong and usable technology base. This base will be maintained by conducting research and advanced technology effort independent of specific defense systems development. Advanced technology effort includes prototyping, preferably using small, efficient design teams and a minimum amount of documentation. The objective is to obtain significant advances in technology at minimum cost.

1. Program Initiation

   a. Early conceptual effort is normally conducted at the discretion of the DoD Component until such time as the DoD Component

determines that a major defense system program should be pursued. It is crucial that the right decisions be made during this conceptual effort; wrong decisions create problems not easily overcome later in the program. Therefore, each DoD Component will designate a single individual, such as the Assistant Secretary for R&D, to be responsible for conceptual efforts on new major programs.

b. The considerations which support the determination of the need for a system program, together with a plan for that program, will be documented in the DCP. The DCP will define program issues, including special logistics problems, program objectives, program plans, performance parameters, areas of major risk, system alternatives and acquisition strategy. The DCP will be prepared by the DoD Component, following an agreement between OSD and that Component on a DCP outline. The Director, Defense Research and Engineering (DDR&E)(or the Assistant Secretary of Defense (Telecommunications) for his programs) has the basic responsibility for coordination of inputs for the DCP and its submittal to the DSARC for consideration and to the SecDef for subsequent decision. If approved, the program will be conducted within the DCP thresholds.

. Full-Scale Development. When the DoD Component is sufficiently confident that program worth and readiness warrant commitment of resources to full-scale development, it will request a SecDef decision to proceed. At that time, the DSARC will normally review program progress and suitability to enter this phase and will forward its recommendations to the SecDef for final decision. Such review will confirm (a) the need for the selected defense system in consideration of threat, system alternatives, special logistics needs, estimates of development costs, preliminary estimates of life cycle costs and potential benefits in context with overall DoD strategy and fiscal guidance; (b) that development risks have been identified and solutions are in hand; and (c) realism of the plan for full-scale development.

. Production/Deployment. When the DoD Component is sufficiently confident that engineering is complete and that commitment of substantial resources to production and deployment is warranted, it will request a SecDef decision to proceed. At that time, the DSARC will again review program progress and suitability to enter substantial production/deployment and forward its recommendations to the SecDef for final decision. Such review will confirm (a) the need for producing the defense system in consideration of threat, estimated acquisition and ownership costs and potential benefits in context with overall DoD

strategy and fiscal guidance; (b) that a practical engineering design, with adequate consideration of production and logistics problems is complete; (c) that all previously identified technical uncertainties have been resolved and that operational suitability has been determined by test and evaluation; and (d) the realism of the plan for the remainder of the program. Some production funding for long lead material or effort may be required prior to the production decision. In such cases, the SecDef will decide whether a DSARC review and revised DCP are required. In any event, full production go-ahead will be authorized by approval of the DCP.

Program Considerations

1. System need shall be clearly stated in operational terms, with appropriate limits, and shall be challenged throughout the acquisition process. Statements of need/performance requirements shall be matched where possible with existing technology. Wherever feasible, operational needs shall be satisfied through use of existing military or commercial hardware. When need can be satisfied only through new development, the equivalent needs of the other DoD Components shall be considered to guard against unnecessary proliferation.

2. Cost parameters shall be established which consider the cost of acquisition and ownership; discrete cost elements (e.g., unit production cost, operating and support cost) shall be translated into "design to" requirements. System development shall be continuously evaluated against these requirements with the same rigor as that applied to technical requirements. Practical tradeoffs shall be made between system capability, cost and schedule. Traceability of estimates and costing factors, including those for economic escalation, shall be maintained.

3. Logistic support shall also be considered as a principal design parameter with the magnitude, scope and level of this effort in keeping with the program phase. Early development effort will consider only those parameters that are truly necessary to basic defense system design, e.g., those logistic problems that have significant impact on system readiness, capability or cost. Premature introduction of detailed operational support considerations is to be avoided.

4. Programs shall be structured and resources allocated to ensure that the demonstration of actual achievement of program objectives is the pacing function. Meaningful relationships between need, urgency,

risk and worth shall be thereby established. Schedules shall be subject to trade-off as much as any other program constraint. Schedules and funding profiles shall be structured to accommodate unforeseen problems and permit task accomplishment without unnecessary overlapping or concurrency.

5. Technical uncertainty shall be continually assessed. Progressive commitments of resources which incur program risk will be made only when confidence in program outcome is sufficiently high to warrant going ahead. Models, mock-ups and system hardware will be used to the greatest possible extent to increase confidence level.

6. Test and evaluation shall commence as early as possible. A determination of operational suitability, including logistic support requirements, will be made prior to large-scale production commitments, making use of the most realistic test environment possible and the best representation of the future operational system available. The results of this operational testing will be evaluated and presented to the DSARC at the time of the production decision.

7. Contract type shall be consistent with all program characteristics including risk. It is not possible to determine the precise production cost of a new complex defense system before it is developed; therefore, such systems will not be procured using the total package procurement concept or production options that are contractually priced in the development contract. Cost type prime and subcontracts are preferred where substantial development effort is involved. Letter contracts shall be minimized. When risk is reduced to the extent that realistic pricing can occur, fixed-price type contracts should be issued. Changes shall be limited to those that are necessary or offer significant benefit to the DoD. Where change orders are necessary, they shall be contractually priced or subject to an established ceiling before authorization, except in patently impractical cases.

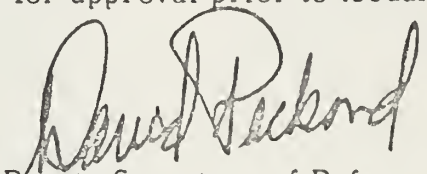
8. The source selection decision shall take into account the contractor's capability to develop a necessary defense system on a timely and cost-effective basis. The DoD Component shall have the option of deciding whether or not the contract will be completely negotiated before a program decision is made. Solicitation documents shall require contractor identification of uncertainties and specific proposals for their resolution. Solicitation and evaluation of proposals should be planned to minimize contractor expense. Proposals for cost-type or incentive contracts may be penalized during evaluation to the degree that the proposed cost is unrealistically low.

9. Management information/program control requirements shall provide information which is essential to effective management control. Such information should be generated from data actually utilized by contractor operating personnel and provided in summarized form for successively higher level management and monitoring requirements. A single, realistic work breakdown structure (WBS) shall be developed for each program to provide a consistent framework for (a) planning and assignment of responsibilities, (b) control and reporting of progress, and (c) establishing a data base for estimating the future cost of defense systems. Contractor management information/program control systems, and reports emanating therefrom, shall be utilized to the maximum extent practicable. Government imposed changes to contractor systems shall consist of only those necessary to satisfy established DoD-wide standards. Documentation shall be generated in the minimum amount to satisfy necessary and specific management needs.

MPLEMENTATION

. Each DoD Component will implement this Directive within 90 days and forward two (2) copies of each implementing document to the SecDef.

. The number of implementing documents will be minimized and necessary procedural guidance consolidated to the greatest extent possible. Selected subjects to be covered by DoD Directives/Instructions or joint Service/Agency documents in support of this Directive are listed in Enclosure 1. Each DoD Component will forward the joint Service/Agency documents for which it is responsible to the SecDef for approval prior to issuance.



Deputy Secretary of Defense

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RELATED POLICY

Responsibility for the following policy documents is assigned to the Cognizant Office indicated. In each case, the Cognizant Office shall (a) generate the policy, or (b) delegate authority to a lead DoD Component for preparation and subsequent issue of a joint Service/Agency regulation, agreement or guide after approval by OSD.

Policy Subject	Cognizant Office	Responsible DoD Component
The DoD Technology Base	DDR&E	
The DCP and the DSARC	DDR&E	
Defense System Engineering	DDR&E	Air Force
Proposal Evaluation and Source Selection	ASD(I&L)/ DDR&E	
Cost Analysis	ASD(SA)	
Acquisition of Data	ASD(I&L)	
Cost/Schedule Control Systems	ASD(C)	Air Force
Test and Evaluation	DDR&E	Navy
Priorities and Allocations	ASD(I&L)	
Manufacturing Technology	ASD(I&L)	
Quality Assurance	ASD(I&L)	
Logistic Support	ASD(I&L)	
Standardization	ASD(I&L)	
Value Engineering	ASD(I&L)	

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OPNAV Instruction 5430.48, Chief of Naval Operations Organizational Manual, July 5, 1974.

NAVMAT Instruction 4000.20A, Integrated Logistic Support Planning Policy, March 18, 1971.

NAVTRAEQUIPCEN Instruction 5400.1E, Naval Training Equipment Center Organization Manual, August 10, 1973.

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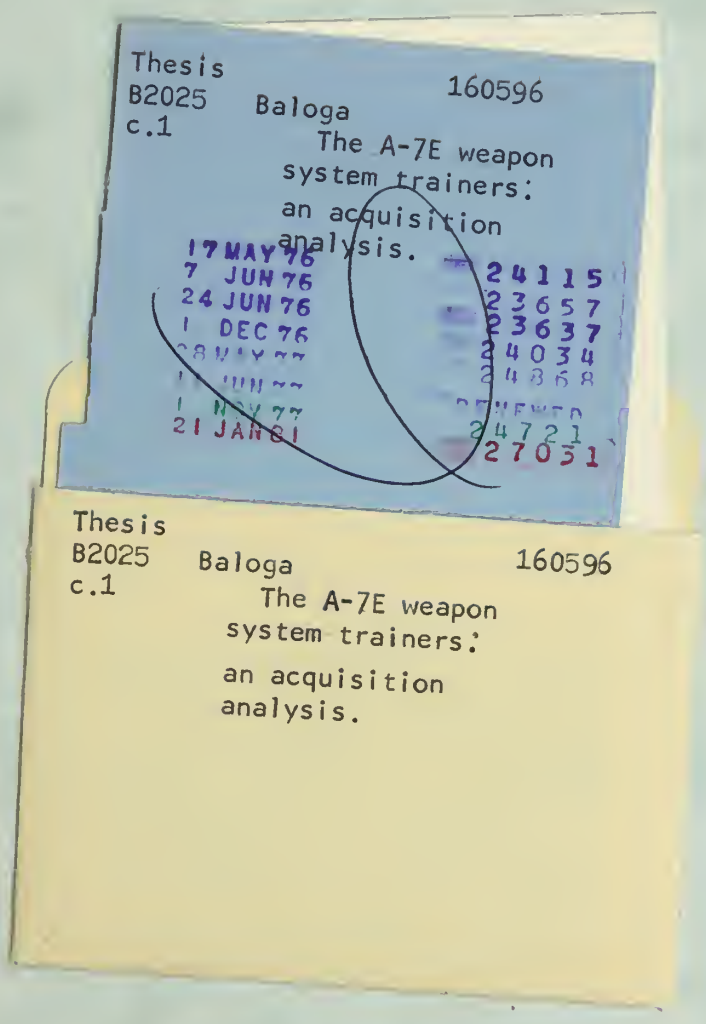

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