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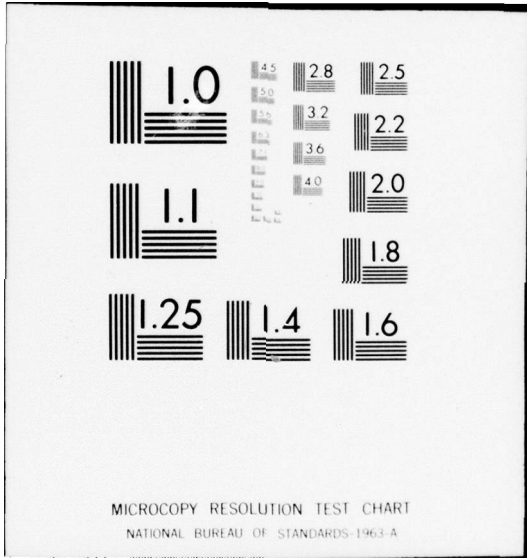
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DEFENSE SYSTEMS MANAGEMENT SCHOOL

STUDY TITLE:

PROGRAM MANAGER IN AFLC

STUDY GOALS:

To examine the modification process in the US Air Force, determine major problems associated with modification management & recommend improvements.

STUDY REPORT ABSTRACT

The modification program in the USAF is big business, it has an impact on major weapon systems, DOD budgeting, planning and execution. It is subject to Congressional scrutiny and criticism. The Air Force has a clear and well defined modification management program. Major problem areas are in decisions to modify or buy new systems; design and development of mod kits; proof of modification capability; use of kit inventory and training of capable modification managers. The writer recommends the above problem areas be addressed by the Air Force to better manage its mod program.

KEY WORDS: ORGANIZATION ANALYSIS PROGRAM MANAGEMENT MODIFICATIONS
CONFIGURATION MANAGEMENT

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DEFENSE SYSTEMS MANAGEMENT SCHOOL



PROGRAM MANAGEMENT COURSE INDIVIDUAL STUDY PROGRAM

PROGRAM MANAGER
IN AFLC

STUDY REPORT
DSMS 74-1

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FORT BELVOIR, VIRGINIA 22060

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THE PROGRAM MANAGER IN
AIR FORCE LOGISTICS COMMAND,
IS HE NEEDED?

An Executive Summary
of a
Study Report
by
Herbert G. Bryant
GS-12 DAFC

May 1974

Defense Systems Management School
Program Management Course
Class 74-1
Fort Belvoir, Virginia 22060

EXECUTIVE SUMMARY

This paper examines the modification process in the United States Air Force, determines the major problems associated with modification management, and recommends improvements.

The writer hypothesizes that AFLC management of modification programs is satisfactory, but less than optimum.

The writer feels that the Air Force and AFLC have clear and well defined modification management objectives. These objectives are broadly defined as: (1) maintenance of equipment in an operational configuration that enhances safety of personnel and property; (2) changes to configuration that will result in reduced support costs; and (3) equipment revisions required for new or improved missions.

The writer concluded that overall the Air Force manages its modifications in an effective manner. Responsibility and authority are well defined and modifications are being carried out relatively well. Progress is measured at AFLC/AFSC quarterly reviews of each major modification.

The writer recommends that program management training for individual key members of AFLC Air Logistic Center Systems Managers would be helpful. This would provide these modification managers with the proper management tools to preclude or reduce the typical program problems of cost overrun, poor performance, non-reproductibility, bad data, etc. that plague most major modifications to some extent.

The writer also feels that the Air Force should adopt a formal verification program for those modifications costing over \$5 million in order to determine that the proposed capability is actually achieved.

Contents

Executive Summary	ii
Introduction	1
The Program Manager in Air Force Logistics Command, Is He Needed?	3
I. The Modification Process in the U. S. Air Force	3
II. Size & Worth of the U. S. Air Force Modification Program	30
III. Problems Associated with the Air Force Modification Program	36
IV. Summary on Air Force Management of the Modification Program	48
Annotated Bibliography	52

THE PROGRAM MANAGER IN
AIR FORCE LOGISTICS COMMAND,
IS HE NEEDED?

STUDY REPORT

Presented to the Faculty
of the
Defense Systems Management School
in Partial Fulfillment of the
Program Management Course
Class 74-1

by

Herbert G. Bryant
GS-12 DAFC

May 1974

This study represents the views, conclusions, and recommendations of the author and does not necessarily reflect the official opinion of the Defense Systems Management School nor the Department of Defense.

THE PROGRAM MANAGER IN
AIR FORCE LOGISTICS COMMAND,
IS HE NEEDED?

Introduction

In order to maintain an up-to-date and balanced military force for the nation, many critical decisions are required of our government leaders - the President, members of the Congress, the civilian leaders of the Executive Branch, and our military leaders. Hard budgetary decisions have to be made - choices between spending for military defense programs versus spending for vital domestic programs. After the size of the nation's military budget has been determined, further decisions are required of the civilian and military executives in the Department of Defense as to the distribution of the defense dollar between the three services and between weapons systems within the services.

The top level decision process does not stop at that point. For example, a choice to modify an existing weapon system to make it capable of performing a new mission to meet an enemy threat may be more cost-effective than developing a new weapon system. This principle was expressed by Mr. Robert S. McNamara, Secretary of Defense from 1960 to 1968, in his remarks to the subcommittee of the Committee On Appropriations, House of Representatives, in support of the Fiscal Year 1965 Department of Defense Budget (1:3,4).

As expressed above, there are at least two possible ways of countering an enemy threat: (1) procuring a new weapons system that will be

mission effective, or (2) modifying an existing weapons system to make it capable of performing the required mission. Systems analysis can help in making this choice. In fact, with the particular emphasis being placed on systems analysis by the Department of Defense, new weapons systems are developed and procured only after careful determination that existing weapons systems cannot be modified to meet the new mission. An analysis is made to determine that it will be cost-effective to modify an existing weapons system and that sufficient utility value will reside in the existing system after it is modified. It is the purpose of this research to: (1) make a review and analysis of the modification process in the United States Air Force; (2) determine problems associated with the modification management process; and (3) recommend improvements.

The writer hypothesizes that the Air Force (AFLC) management of modification programs, while not unsatisfactory, is less than optimum.

I. THE MODIFICATION PROCESS IN THE U. S. AIR FORCE

A. RESPONSIBILITIES AND AUTHORITY FOR MODIFICATION

The Air Force receives its authority to manage all aspects of its weapons system selection, maintenance, operation, and modification from the Secretary of Defense as set forth in Title VI, Section 202 of the National Security Act of 1947. The Secretary of Defense is the principal assistant to the President in all matters relating to the Department of Defense, and therefore receives his authority from the President (2). The President receives his authority from Article II, Section 2 of the Constitution (3). Executive Order 9877 lists specific functions to be performed by the U. S. Air Force. These are: (1) to organize, train and equip air forces, and (2) to develop weapons, tactics, techniques, organization and equipment of Air Force combat service elements (4:5005-5007). The modification of aeronautical equipment is included in the responsibility for equipping air forces and the development of weapons, techniques, and organization.

1. AIR FORCE HEADQUARTERS RESPONSIBILITY AND AUTHORITY

The Chief of Staff of the Air Force is responsible for the execution of the Air Force modification program. He exercises this responsibility through his principal deputies and by delegation of a major portion of the tasks to the major commands. The Chief of Staff provides guidance through the Air Force Directive system. In the area of modification, the published instructions are thorough, complete and, when required, are changed and updated.

Regulation 27-18 (6:4).

1. Accomplishes any required cost effectiveness studies to evaluate modifications of equipment that have less than two years of use after completion of modification.

B. FORMULATION AND EXECUTION OF THE AIR FORCE MODIFICATION PROGRAM

1. OPERATIONAL REQUIREMENTS REVIEW PROCESS

The policies, responsibilities, and procedures for obtaining new and improved operational capabilities are set forth in Air Force Regulation 57-1 (7). As stated previously, the Air Force, by law, is required to "organize, train and equip" aerospace forces (4:Sec IV). The goal of the Air Force operational requirements review process is to fulfill the "equipping" portion of that responsibility. The operational requirements process is the conceptual planning and program initiation phase of the overall Air Force effort to effect timely improvement of operational capabilities in terms of new or improved systems, equipment, or facilities. It begins with the initial identification of an operational deficiency or need through an analysis of the military missions and tasks, the threat, and known operational capabilities. It involves consideration of applicable technology and cost-effectiveness of alternate solutions. It continues until a specific program or project is conceived, formulated, proposed, advocated, approved, and funded (or until the deficiency is eliminated in some manner). The operational requirements process is the most important step toward the goal of obtaining new or improved equipment (7:2).

The Air Force has published a specific regulation on the modification and modernization of systems and equipment (5). In Air Force Regulation 57-4, the Air Force has written policy on the modification of aeronautical equipment.

Overall control and central direction of the modification program is retained by Headquarters USAF. Primary responsibilities exercised at Headquarters include (5:8):

a. Final approval authority for new or revised systems and equipment modernization and maintenance programs. These are major modification programs involving major systems or equipment which are accomplished at depot level maintenance activities in accordance with Air Force Regulation 27-8 (6:1).

b. Approval authority for all Class IV modifications (safety, equipment deficiencies) having a budget impact of \$5 million or more.

c. Approval for all Class V modifications (improve or change systems operational capability).

d. Approves or disapproves the initiation or completion of Class V modifications when, because of early phaseout or installation schedule delays, the anticipated system or equipment program life is less than two years (this is a cost-effective or utility function).

e. Designates those systems for which modernization programs are to be established.

f. Directs a quarterly review of the systems and equipment modernization and maintenance program as reported on the modernization

and maintenance program forms as set forth in Air Force Regulation 27-8 (6:4).

g. Resolves any disagreements between major air commands on modification programs.

h. Determines the requirements for review of the plans for engineering, development, acquisition, testing and performance of major components, and prototype installations.

To carry out the primary responsibilities outlined above, the responsibilities and authority for the management of the modification program are distributed between the major air staff divisions within Air Force Headquarters.

2. JOINT RESPONSIBILITIES AND AUTHORITY OF AIR FORCE LOGISTICS COMMAND AND AIR FORCE SYSTEMS COMMAND

The Air Force Logistics Command (AFLC) and the Air Force Systems Command (AFSC) are assigned the responsibility for the technical aspects of the modification program. Some technical functions are jointly shared while others are peculiar to each command. In general, AFSC is responsible for the development, acquisition and overseeing the production of aircraft weapons systems. AFLC is charged with the responsibility for the maintenance and support of aircraft weapons systems after they are in operation.

The jointly shared responsibilities include (5:6):

a. Engineering Change Proposals.

b. Modifications or Updating Changes to Correct Deficiencies

That Have Caused Accidents.

- c. Class V Modifications or Updating Changes.
- d. Feasibility Studies.

3. AIR FORCE SYSTEMS COMMAND RESPONSIBILITIES AND AUTHORITY

Those responsibilities which are peculiarly related to weapons system development and acquisition are assigned AFSC. The more important functions of AFSC are (5:6):

- a. Approve in-production changes, updating changes and correction of contractor deficiency changes.
- b. Provide engineering assistance to AFLC as required.
- c. Provide engineering approval for modifications in support of testing and evaluation programs.
- d. Provide Headquarters USAF with feasibility studies or best preliminary estimates (BPEs) for the updating program.
- e. Maintain a master list of all updating changes.
- f. Obtain command certification of essentiality for updating changes and modifications during the acquisition phase.
- g. Provide all military assistance program (MAP) recipients all updating changes to assure that the systems or equipment meets the full intent of the requirements action directive (RAD).

4. AIR FORCE LOGISTICS COMMAND RESPONSIBILITIES AND AUTHORITY

Responsibilities and authority assigned specifically to Air Force Logistics Command, which have to do with the modification of systems and equipment already in operational service, are listed below. Only the main efforts required of AFLC are shown (5:7):

- a. Conducts periodic meetings to review and evaluate all modifications. Safety modifications that could ground airborne systems or inactivate ground systems are given special handling.
- b. Conducts, along with using commands, an annual review of all time compliance technical orders (TCTOs) for continued essentiality.
- c. Certifies essentiality of deficiency correction modifications to Headquarters USAF.
- d. Provides logistics support data to AFSC for incorporation into AFSC prepared feasibility studies or best preliminary estimates.
- e. Designates modification proposals as Class I, II, III, IV or V modifications.
- f. In collaboration with the using commands, designates which modifications are to be accomplished at organizational and field level within the operating commands.
- g. Performs modifications requiring depot level skills and facilities.
- h. Maintains a master control list of all Class IV and Class V modifications.
- i. Obtains Headquarters USAF approval for Class IV modifications that have an annual budget impact of \$5 million or more.
- j. Prepares annual modification budget and forwards to Headquarters USAF.
- k. Prepares and presents to Headquarters USAF, on a quarterly basis, a status report on all modifications in process and proposed for in-service equipment. This report is in accordance with Air Force

After the operational requirements review and approval process is completed and selection of an operational alternative is made, the Air Force must justify to the Office of Secretary of Defense its selection from among all other possible alternatives. There are various approaches that the Air Force considers in satisfying operational needs. When a change in tactics will not correct an operational deficiency or satisfy the need for an improved operational capability, the Air Force, must either (1) develop and acquire new systems, or equipment; or (2) modify existing or in-production systems or equipment.

It is the writer's opinion that the Air Force has set forth in its directives system its policies, responsibilities, and procedures for obtaining new and improved operational capabilities in understandable, forthright and concise terms. Air Force Regulation 57-1 covering required operational capabilities, when used in conjunction with Air Force Regulation 57-4 covering the modification of systems, equipment, and munitions, provide the basic framework for the management of the Air Force's modification program.

Portrayed in Figure 1 is a chart depicting the modification requirements review process for in-service equipment.

The Air Force system for modification of in-service weapons, systems and equipment provides for generation of requirements from all Air Force commands, Headquarters USAF, other government agencies, and the manufacturers of the weapons, systems and equipment. The major command operating the equipment is primarily concerned with the correction of safety deficiencies, or correction of material deficiencies that detract

from effective performance of the command's mission, including improvements in equipment maintainability and reliability. Equipment maintainability and reliability have an effect on logistic support costs and capabilities, equipment down time, and equipment capability improvements.

The manufacturer (contractor) should be concerned with any defect in his product as well as the opportunity to make major improvements in performance capability. Other government agencies, such as the Federal Aviation Agency (FAA), are also interested in aeronautical equipment modifications or new developments that might contribute significantly to safety. Headquarters USAF and its subordinate commands are vitally interested in those requirements related to significant improvements in operational capability, performance, or safety particularly where a weapons system is being modified from one mission configuration to another. Modification proposals may originate from any of these organizations.

Modification proposals for in-service equipment are sent to the AFLC Air Logistics Area (ALA) having prime responsibility for the logistic support of the equipment to be modified. It is the responsibility of the prime ALA to evaluate the feasibility of the proposed modification, determine cost and availability of resources, and certify that the proposal is in accordance with Air Force policy and regulations.

If the modification proposal is within the approval authority and resource capability of the prime ALA, the modification may be approved. If it exceeds ALA authority or funds availability, it is forwarded to Headquarters AFLC for disposition. The limits of approval authority of the ALA is discussed in further detail on page 16. All proposals

forwarded to AFLC by a prime ALA must include recommendations for approval or disapproval, with supporting justification.

Upon receipt of the modification proposals at AFLC, they are evaluated, and acted upon within the authority and resource availability at AFLC. All proposals pertaining to an improvement in performance capability, and any modifications requiring funds in excess of AFLC authority or capability, are forwarded to Headquarters USAF. All proposals forwarded must include recommendations for approval or disapproval, with supporting justification.

Headquarters USAF retains final approval/disapproval authority of all modification proposals involving an improvement in performance capability, or those involving significant expenditure of resources. If the modification proposal is acceptable, and if funds are available, the modification proposal is approved and returned to AFLC for execution. If funds are not available within the modification sub-head or within authorized threshold limits of reprogramming authority, Headquarters USAF can take action to request the needed funds from OSD through the regular budget cycle; or if the timing is out of phase with the budget cycle, request reprogramming action from the OSD via the program change request/program change proposal route. The OSD can, if funds are available and he approves the modification proposal, provide the funds to meet the requirement. If funds are not available at the OSD level, and depending upon the urgency of the requirement, the Secretary of Defense can (1) include the requirement in a supplemental request to Congress, (2) defer the request until the next regular budget submission cycle, or (3) disapprove the request altogether and suggest different alternatives.

MODIFICATION REQUIREMENTS REVIEW PROCESS
FOR U. S. AIR FORCE IN-SERVICE EQUIPMENT

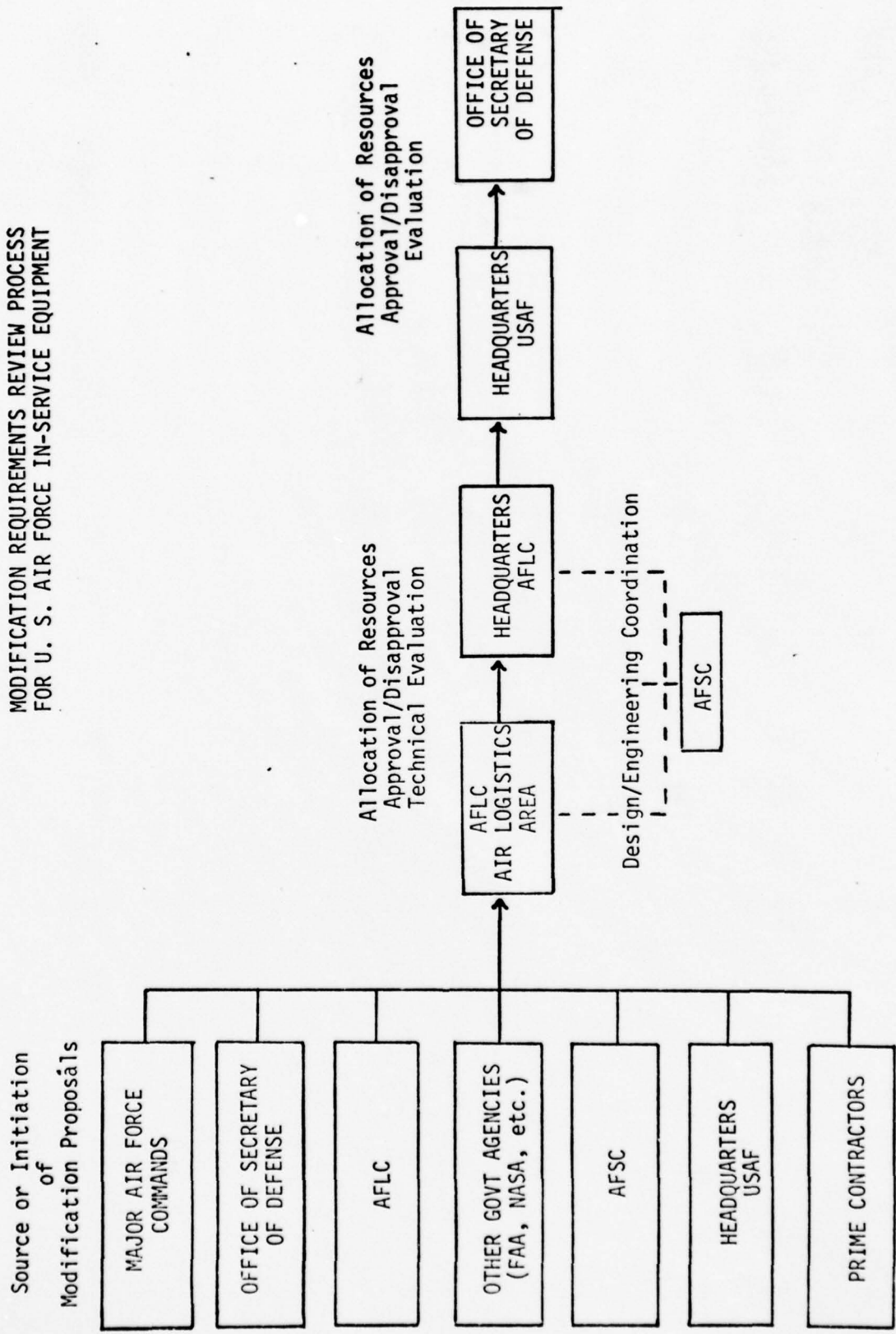
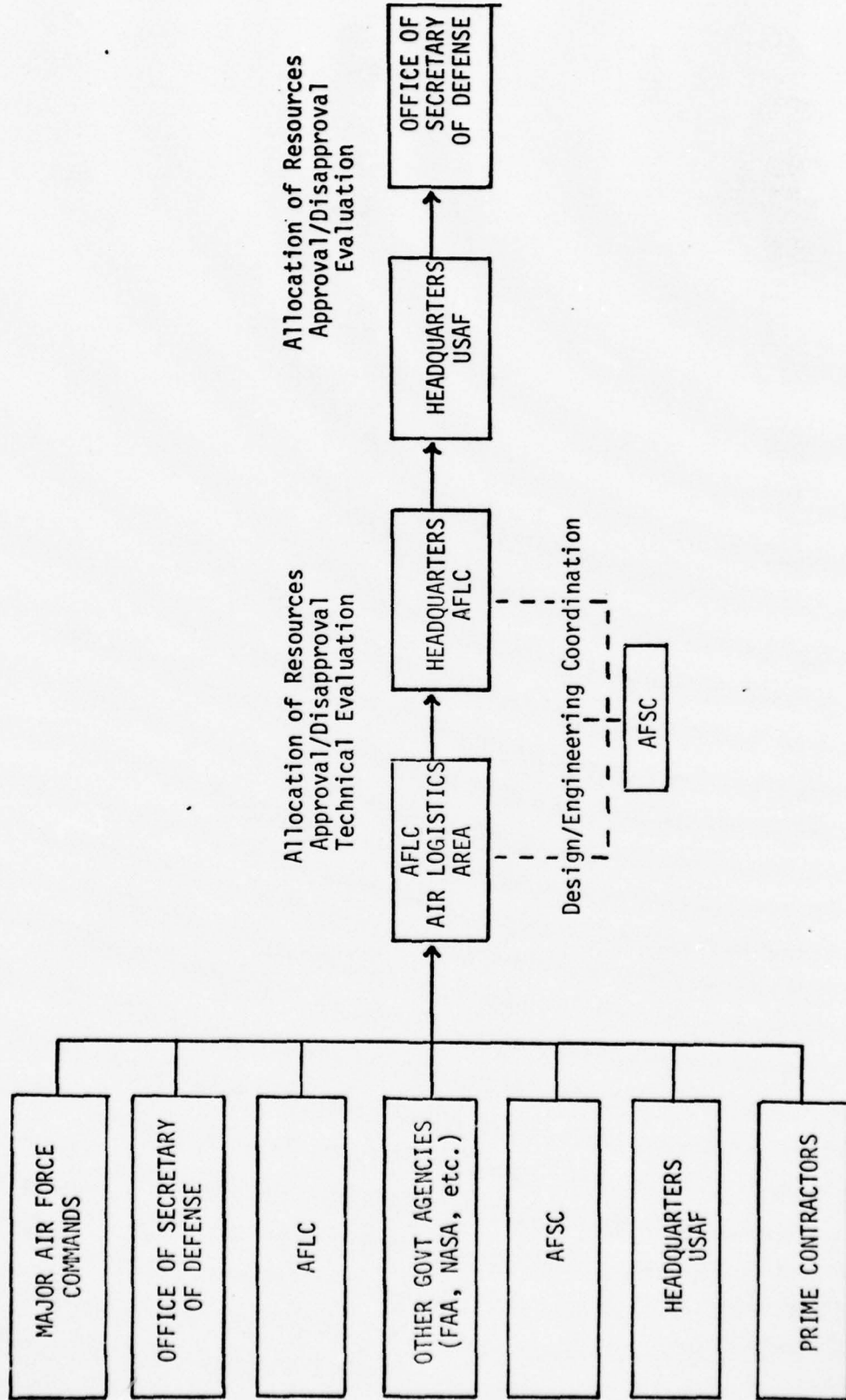


FIG 1

MODIFICATION REQUIREMENTS REVIEW PROCESS
FOR U. S. AIR FORCE IN-SERVICE EQUIPMENT

Source or Initiation
of
Modification Proposals



2. APPROVAL, DIRECTION, AND ACCOMPLISHMENT OF MODIFICATIONS

a. Policy and Criteria for Approval

Prior to approval of a modification, the approval authority must satisfy itself that the proposed modification will meet Air Force criteria before making the change. The final criteria, regardless of the specific reason used to justify the proposed modification, is that all changes will help the Air Force carry out its mission.

The written policy of the Air Force with regard to modification is that systems and equipment will be modified or altered by updating changes only when essential to accomplish one or more of the following:

- (1) *An assigned mission:*
 - (a) Of the Air Force.
 - (b) In support of another government agency.
 - (c) Of an allied military force supported under military assistance programs (MAP), which will include modification of selected USAF aircraft for transfer to MAP recipients.
- (2) Testing, elimination of safety hazards, or substantial improvement in reliability or maintainability.
- (3) Value engineering.
- (4) Significant improvement in:
 - (a) Logistics.
 - (b) Electromagnetic compatibility with the electromagnetic environment.

Each major command must independently certify and justify all proposed updating changes and all deficiency, safety, and improvement

capability modifications before submitting them to the approving Headquarters (6:13-16). Each proposed modification or updating change must be evaluated against certain criteria and factors. These include:

- (1) Essentiality to mission accomplishment.
- (2) Improved safety of operation, including a certification that the total system safety has not been degraded.
- (3) Compatibility with other modifications and updating changes (both proposed and approved) to the system and its supporting equipment.
- (4) Compatibility with existing and programmed Air Force personnel resources.
- (5) Increase in systems effectiveness, in reliability, or in maintainability.
- (6) Increase in operational availability of the system or equipment. This must be supported by an analysis of down time of the equipment.
- (7) Impact of the modification on training support, including trainers, skill adjustments, and any amendments to personnel authorizations.
- (8) Effect on logistic support costs. Particular attention is given to adjustment in spares, by quantity and type. Ground support equipment is evaluated for compatibility with the new equipment configuration. A determination is made that required facilities are or will be available to support the proposed modification.

b. Approval Authority

Modification approval authority is clearly set forth in a table in Air Force Regulation 57-4 (5:3). This table displays the modification classes and lists the approval authority for each modification and type. These classifications are as shown below:

Class I: Temporary installation or removal of equipment to satisfy local mission requirements and where the system or equipment can be returned to the standard configuration within 48 hours.

Class II: Temporary modifications required to support research, development, or operational test and evaluation programs, or demonstration and shakedown operations.

Class III: Modification required to insure production continuity of a new system or equipment. Ordinarily this consists of substitutions of other components for planned items, or the installation of items delivered too late for installation during production.

Class IV: Modifications required to insure safety of personnel, system, or equipment by eliminating operations, nuclear, or biophysical hazards necessary to correct equipment deficiencies, including deficiencies that affect maintainability and reliability. Deficiencies requiring correction for the improvement of logistic support purposes are also included in this classification.

Class V: Modification of a system or equipment required to improve system operational capability. This type of modification will change operational requirements for performance that provide for (1) a mission capability not included in the base line, or original configuration of the system or equipment; (2) a capability to accomplish an

assigned mission that the basic system or equipment was not originally designed to accomplish; or (3) removal of a capability no longer required.

In general, the Air Force Systems Command has the authority to approve changes for continuity of production and other modifications required to correct equipment deficiencies, or to insure safety of personnel, systems or equipment for those systems still in the acquisition phase. However, if the annual cost of the modification exceeds \$5 million, Headquarters USAF approval is obtained. The Commander, AFSC, has delegated the authority for approving modification changes to the Air Force Systems Center having cognizance over the system or equipment in production.

The Air Force Logistics Command has the authority to approve modifications for the correction of all safety of flight and correction of material deficiencies for those systems or equipment out of production and in operational use, except that Headquarters USAF must approve those changes that have a budget impact of \$5 million or more on an annual basis. The Commander, AFLC, has delegated authority to approve these categories of modifications to the Air Logistic Areas to the limit of \$100 thousand for a single modification.

For those modifications involving an improvement in logistic support, AFSC approves the change if the system is still in the acquisition phase; AFLC after acquisition. If the annual cost of the change exceeds \$5 million, Headquarters USAF must approve before the change is incorporated. Also, before the change is approved, it must be shown that one of the following benefits will result:

- (1) Significant improvement in maintainability or service life.
- (2) Improved logistic support by modification of present equipment in lieu of new procurement.
- (3) Reduced costs by modifying present equipment rather than buying new equipment.
- (4) Reduced costs by standardizing equipment configuration.

All modification proposals required to provide a new or improved operational capability or to remove an existing capability must be approved by Headquarters USAF. Before a change is approved, it must be shown that the modification will change operational requirements for performance to provide for:

- (1) A capability not inherent in the present base line configuration.
- (2) A capability to accomplish an assigned mission that the basic system, equipment, or munition was not originally designed to accomplish.
- (3) Removal of capability no longer required.

Major air commands may approve modifications to equipment in their possession to the extent that mission capability is not altered and that the modification is such that the equipment can be returned to its original configuration within 48 hours.

The Director of Operational Requirements and Development Plans, Deputy Chief of Staff, Research and Development, acts as the

approving authority for the Chief of Staff, U. S. Air Force for all modifications referred to Headquarters USAF for disposition (5:12). Coordination must be obtained from interested Air Staff agencies at directorate level before a formal modification requirement (MR) can be approved. The scope of coordination required is set forth in Headquarters USAF Operating Instruction 57-4. In the main, the modification requirement (MR) is looked at by (1) Air Staff Operations to insure that it is compatible with operational concepts, and for the assignment of an operational priority number; (2) by the Director of Maintenance Engineering as to the practicality of approach, engineering data feasibility, feasibility of costs and schedules, compatibility with reliability and maintainability goals, maintenance capability to support the modified systems, and funds availability; (3) by the Director of Supply and Services for determining spares support, and the impact of obsolete system spares, and (4) by the Director of the Budget to insure compatibility with the approved budget and current fiscal policies. Most modification proposals (referred to Headquarters USAF) concern capability improvements for in-service or in-production systems and the correction of material deficiencies having significant impact upon the budget or operational availability.

After the Air Staff fully coordinates on the tentative modification requirement, the Director of Operational Requirements and Development Plans assigns the modification a priority number, and if funds are available, authorizes the modification by signing and publishing a formal modification requirement (MR). Publication of the

modification requirement (MR) is the formal authorization to accomplish the modification.

The Director of Maintenance Engineering will issue all logistic and procurement instructions (modification program directives) pertaining to those modifications affecting in-service systems or equipment which will be directed to AFLC for implementation. The Director of Production and Programming will issue such logistic and procurement instructions (systems program directives) as are required for in-production systems or equipment which will be directed to AFSC for accomplishment.

The Director of Operational Requirements and Development Plans maintains and publishes on a quarterly basis a list of modifications (LOM). This list contains all tentative modifications and all authorized modifications not completed. This office keeps a master copy of the LOM current at all times. A change is made on the master copy whenever a tentative requirement is authorized, an authorized requirement is physically completed, or a requirement is added or withdrawn.

For those modifications approved below Headquarters USAF level, appropriate directives and instructions are published by the approving command (5:Table 1,3).

c. Installation of Modifications

The Air Force Logistics Command, in coordination with the using commands, determines the optimum level (e.g., organizational, intermediate, or depot) for accomplishing those modifications for which AFLC has the modification management responsibility. In general, this determination covers modifications to existing, in-service systems or

equipment. The Commander, AFLC, assists the Commander, Air Force Systems Command, in this function upon request for updating changes and modifications assigned to AFSC for management. Coordination with the using commands is also effected.

In making a decision as to where the modification will be accomplished, equipment down time as well as the number of man hours required to make the modification are considered. If the change is urgent and requires out-of-commission time for the system or equipment, the change is usually accomplished at the organization or field level, particularly if relatively few man hours and lower level skills are required. If the change is less urgent, requires extensive out-of-commission time for systems or equipment, or involves a relatively large expenditure of man hours and higher level skills, it is normally accomplished at depot level. Depot level accomplishment can be either in-house or at a contract facility. Because of the size of some modifications, they must be accomplished by the use of specific modification programs, the use of field teams, and the integration into existing depot work packages, equipment repair, or overhaul programs.

3. PROGRAMMING AND CONTROL OF THE MODIFICATION PROGRAM

One of the main objectives of the Air Force systems modernization and maintenance programs is to provide Air Force commanders with improved systems and equipment. These modernization and maintenance programs provide a way to plan, schedule, control, and coordinate modernization, modification, and related depot level maintenance of systems, components, equipment, special training devices, and peculiar test equipment (6:2).

The execution of the modernization and maintenance programs provides for management of the modernization of selected systems and equipment in coordination with procurement programs, and of other systems in coordination with scheduled depot level maintenance.

The modernization and maintenance programs provide back-up data for the aircraft, missile, and equipment modification portion of the AFLC/AFSC buy program and budget estimate. Further, data are available to facilitate simultaneous review and balanced reprogramming, procurement, modernization, and maintenance of systems, components, equipment, and special training devices in agreement with other depot level maintenance programs.

The modernization and maintenance programs help to insure that the budgeting and funding action is consistent with each planned program and that each planned program is within program funds availability.

The AFLC is the primary organization of the Air Force concerned with the preparation of the modification program for in-service equipment. Quarterly, the AFLC prepares a proposed system modernization and maintenance program for each USAF aircraft and missile type, or for systems and equipments designated by Headquarters USAF. The prime air logistics areas (ALAs) actually prepare the proposed programs for their designated systems or equipments and submit them to the AFLC. The AFLC reviews the proposed programs to insure that:

- a. The work being accomplished is in accord with the approved modification requirement.

b. All programmed (scheduled and unscheduled) depot level maintenance workloads have been included for each system or equipment.

c. The modification schedule for each system or equipment agrees fully with all interrelated depot level maintenance programs, financial plans, and budget programs.

d. The scheduled workload is within the Air Force capability (i.e., within fund availability, personnel ceilings, kit availability, and facilities).

e. The availability of the system or equipment to meet programmed schedules for the current fiscal year has been coordinated with each using command.

f. Equipment and materials required to support these programs will be procured only after a certification that they are not available from Air Force assets, or that their diversion from Air Force assets would cause an unacceptable delay in the program.

g. Contractual obligations have been properly considered in proposed revision of previously approved programs.

h. Proposed programs are in accord with established Air Force policies and program guidance.

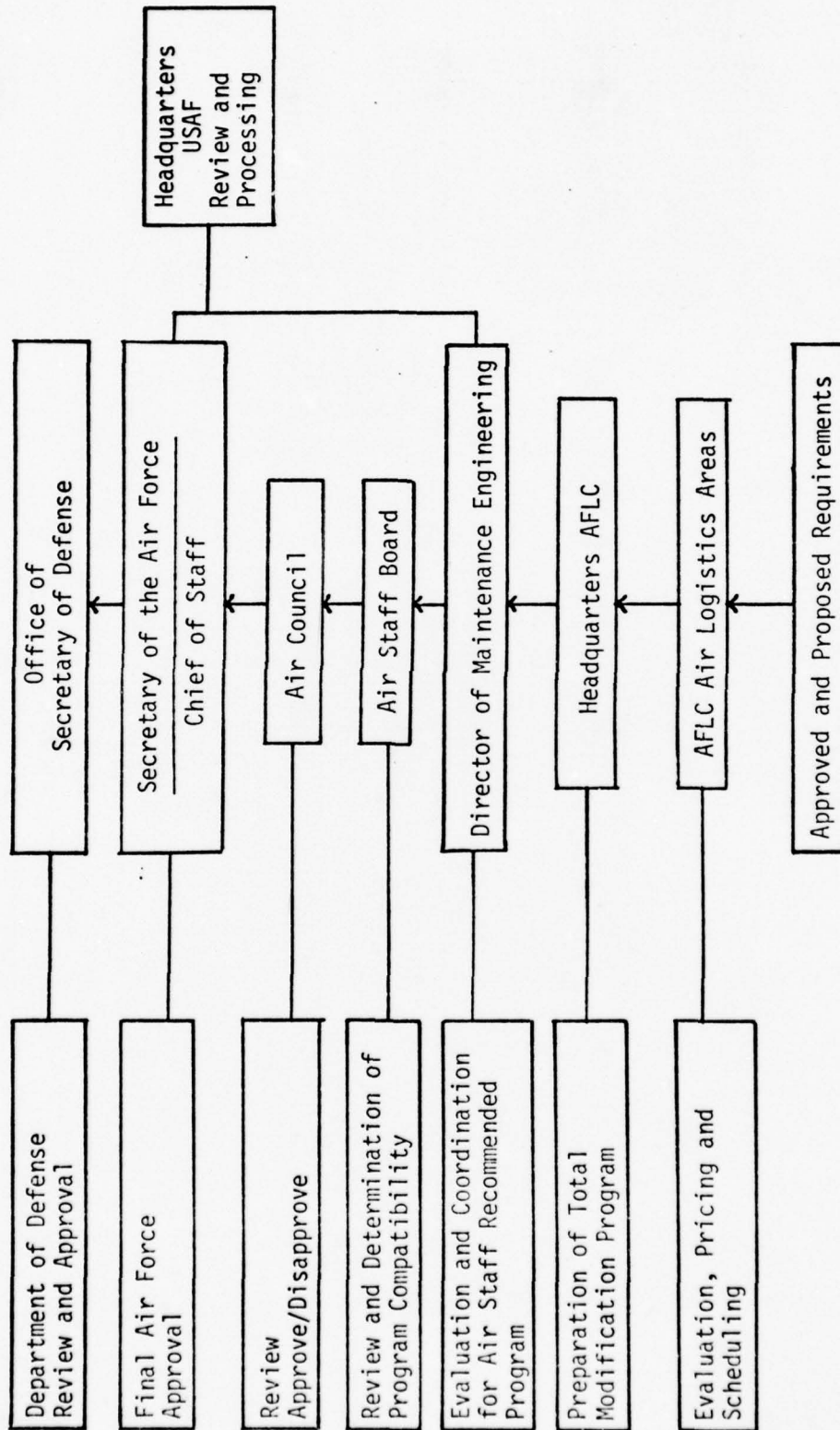
The proposed program for each system or equipment, by type and model, covers the current year, plus 36 months.

Figure 2 presents a portrayal of the sequence of review for the modification program for in-service equipment. The process begins with a prime air logistics area (ALA) organization evaluating, pricing, and scheduling the approved or proposed modification requirements. After

the ALA evaluation is completed and approved by the ALA commander, the proposed program is forwarded to Headquarters AFLC for review. If approved, the proposed program is then included with all other ALA proposals into an overall AFLC proposed program and forwarded to Headquarters USAF over the signature of the Commander, AFLC.

The review of the overall proposed program at Headquarters AFLC is conducted as a joint review with representatives from Headquarters, USAF Air Staff in attendance. Representatives from the Air Staff are primarily from the Directorate of Maintenance Engineering, the office assigned as office of primary responsibility (OPR) in the Air Staff for the in-service modification program. The review is conducted in a very businesslike manner with the Maintenance Engineering staff actively participating in the review. This expedites the process, eliminates additive reviews at Headquarters USAF, and permits evaluation of the latest changes and directions at a point early in the program preparation. During these quarterly reviews at AFLC, each proposed program is carefully examined to see if it is in agreement with approved Air Force/OSD programs and policy; to insure that there will be no degradation to Air Force combat capability because of too many weapons being out-of-commission and in a down-status at any given period of time; and to insure that the program is in balance with other Air Force material and technical actions in process. After the detailed review is completed at Headquarters AFLC, the proposed program is forwarded to Headquarters USAF for final review, approval, and submission on up through the Secretarial level.

SEQUENCE OF REVIEW, AIR FORCE MODIFICATION PROGRAM FOR IN-SERVICE EQUIPMENT



The Directorate of Maintenance Engineering is the office assigned as being directly responsible for the management of the Air Force in-service modification program within the Air Staff (8:221). This Directorate receives the proposed program from AFLC - which has just been reviewed by representatives of the Directorate at AFLC Headquarters - coordinates with interested and affected Air Staff directorates, and presents the recommended program to the Air Staff Board. This Board, composed of key directors in the Air Staff, reviews the proposed modification program for compatibility with Air Force plans and objectives; for assurance that each proposed modification is essential to the Air Force in carrying out its primary mission; and that the proposed program is in compliance with OSD direction and intent.

Upon completion of the review, the Air Staff Board submits the proposed modification program to the Air Council for its review, approval, and submission to the Air Force Chief of Staff and the Secretary of the Air Force. The Air Council, composed of the five Deputy Chiefs of Staff and the Comptroller of the Air Force, makes the final review of the proposed modification program prior to its presentation to the Chief of Staff. The purpose of this final review is to assure that the proposed program supports the Air Force mission, is technically attainable within the budgeted costs, and that the program is in agreement with Air Force and national defense strategy.

Upon approval of the Chief of Staff and the Secretary, the program is presented to the Office of the Secretary of Defense for review, approval, and inclusion in the President's budget to Congress. After the normal OSD/BOB budget hearings are held and the program budget

decisions (PBDs) are received, the approved modification program is placed in the formal force structure and financial plan. The program is then implemented to the extent that authority and funds are approved by the Congress and apportioned to the Air Force by the OSD.

4. BUDGETARY REVIEW PROCESS OF MODIFICATIONS

The budgetary review process for the modification program generally follows the same sequence as the program preparation and review. Usually, they coincide in time and are processed concurrently, and approval through the budgetary chain is the final approval. The same offices having program responsibility are responsible for the preparation, presentation and justification of the related budget requirements for the modification program.

The modification budget is based on the approved program plus any program revisions approved by OSD/BOB during the budget cycle, and as reflected in program budget decisions (PBDs) issued by the Office of Secretary of Defense. Program revisions made during the budget cycle are then included in a revised modification program.

Upon approval of the revised modification program, it becomes a part of the President's budget and is presented to Congress. Presentation and justification to Congress is the responsibility of the Department of Defense. The Deputy Chief of Staff, Systems and Logistics, and the Comptroller of the Air Force are responsible for presentation and justification of the Air Force modification budget to Congress. The Directors of Maintenance Engineering, Production and Programming, Budget, and Plans and Programs assist in the budget justification to Congress

and serve as back-up witnesses to supply additional details if necessary.

Following appropriation by Congress, funds are apportioned by OSD to the Air Force for implementation and execution of the modification program. Apportionments are requested by the Air Force at the beginning of each fiscal year and must be justified again at the apportionment and mid-year reviews in the same manner as was the original budget submission to OSD. These successive reviews are believed necessary to assure the OSD/BOB that the actual program authority and funding requested will be effectively used by the Air Force to support the modification program as approved by OSD/BOB. There is a considerable time span between the initial preparation of the budget and the apportionment of funds. This span normally averages 18-21 months. During this period of time, significant changes in the modification program can be expected. Proper management and the expenditure of relatively large amounts require that a continuous review be made of the modification program before final expenditure takes place.

Program and budget control is exercised by each level of organization in the Air Force (5:4). They vary in detail and significance with each organizational level. One important control exercised by the major operating command is the required, continuous review and certification of all proposed and approved modifications for essentiality to the Air Force and command mission.

One of the main elements of budgetary control exercised by the U. S. Air Force is through the issuance of the approved funding plan by Headquarters USAF to all cognizant commands. This summary,

"System/Equipment Modernization/Maintenance Program Fund Requirements", shows detailed fund requirements as approved during the combined quarterly reviews of proposed programs held by Headquarters USAF with AFLC and AFSC (6:4). The Director of Maintenance Engineering, Headquarters USAF, issues quarterly procurement authorizations to implement each approved program, and issues procurement authorizations to amend approved programs, as required.

The AFLC and AFSC incorporate the approved programs into program documents and use them as the basis for development of budget estimates and execution of financial plans.

The Headquarters USAF grants the AFLC and AFSC a certain amount of flexibility over funds allotted, and permits price adjustments not to exceed 20 percent providing such adjustments can be supported within the overall program budget availability to the Command. On modification programs costing \$5 million or above, the maximum increase that can be approved by AFLC or AFSC is restricted to \$500 thousand.

The Secretary of the Air Force is responsible for the management of the modification program and budget as approved by the OSD/BOB and the U. S. Congress. Program and budget deviations are controlled by programming instructions issued by the OSD and budget limitations imposed by OSD/BOB and the U. S. Congress. Generally, program deviations are limited to individual project adjustment of \$2 million, and weapons system program changes not to exceed \$5 million (9).

Congress also imposes restrictions on appropriation adjustments by the Department of Defense. For modification categories, \$10 million

has been established as the upper limit unless prior approval of the appropriate appropriations sub-committee has been obtained.

II. SIZE & WORTH OF THE U. S. AIR FORCE MODIFICATION PROGRAM

Except for two years the U. S. Air Force modification program cost has exceeded \$500 million each year since fiscal year 1963, and has been over \$700 million for two of these years (1967 & 1975).

The yearly estimated aircraft modification costs of the U. S. Air Force for fiscal years 1963 through 1975 are shown in Figure 3 (10). The information contained in Figure 3 was obtained from internal Air Force records established for the purpose of identifying all Air Force modification costs except in-house Air Force installation labor and the use of government-owned facilities. These figures portrayed include cost data on engineering, prototype and associated tests, kits for components and parts, technical data, special tools, test equipment, and the related items of costs incurred in the procurement of materials required for accomplishing the modification.

The yearly actual installation costs in man hours for fiscal years 1969 through November 1973 are shown in Figure 4. These figures are for Class IV, Class V and update modifications (10).

Cost for use of government-owned facilities in the modification program are not identified due to the inability to prorate the usage of space, utilities, and fixed facilities. Generally, modification projects are accomplished within existing facilities, and new facilities are not constructed solely for the accomplishment of modification changes. If new facilities would be required, or if a modification program is beyond the capability of in-house Air Force facilities, contracts are

negotiated with firms in the aerospace industry for the accomplishment of the desired modification.

Because of the magnitude of the Air Force modification program, it is safe to assume that if the Air Force deleted its modification program or accomplished its modifications by contract with the aerospace industry, the requirement for facilities would decrease by approximately 15-20 percent. Therefore, it is reasonable to conclude that significant facility costs are incurred in support of modifications.

A. MODIFICATION COST AS COMPARED TO AIRCRAFT INVENTORY INVESTMENT

Figure 5 relates the modification program costs of existing weapons systems to dollars expended on the procurement of new weapons systems. This indicates that a very significant portion of improved operational capability of aircraft will be satisfied through the modification route rather than from the development of new weapons systems.

If the modification cost figures were adjusted to reflect the in-house installation labor and related indirect costs, the ratio of modification costs to new aircraft procurement would rise to an average of 40 percent per year. Aircraft procurement for fiscal years 1961 through 1964 is considered to be abnormally low due to the build-up of the Air Force intercontinental ballistic missile inventory at the expense of new aircraft procurement.

Because of: (1) the program dollar size; (2) the prevalent trends now being exhibited by the relationship of modification costs as compared to existing inventory value and new procurements; and

(3) the contribution of modifications to increased Air Force weapon capability, the modification program warrants the concerted attention of Air Force top management.

AIRCRAFT MODIFICATION COSTS
FISCAL YEARS 1963 THRU 1975

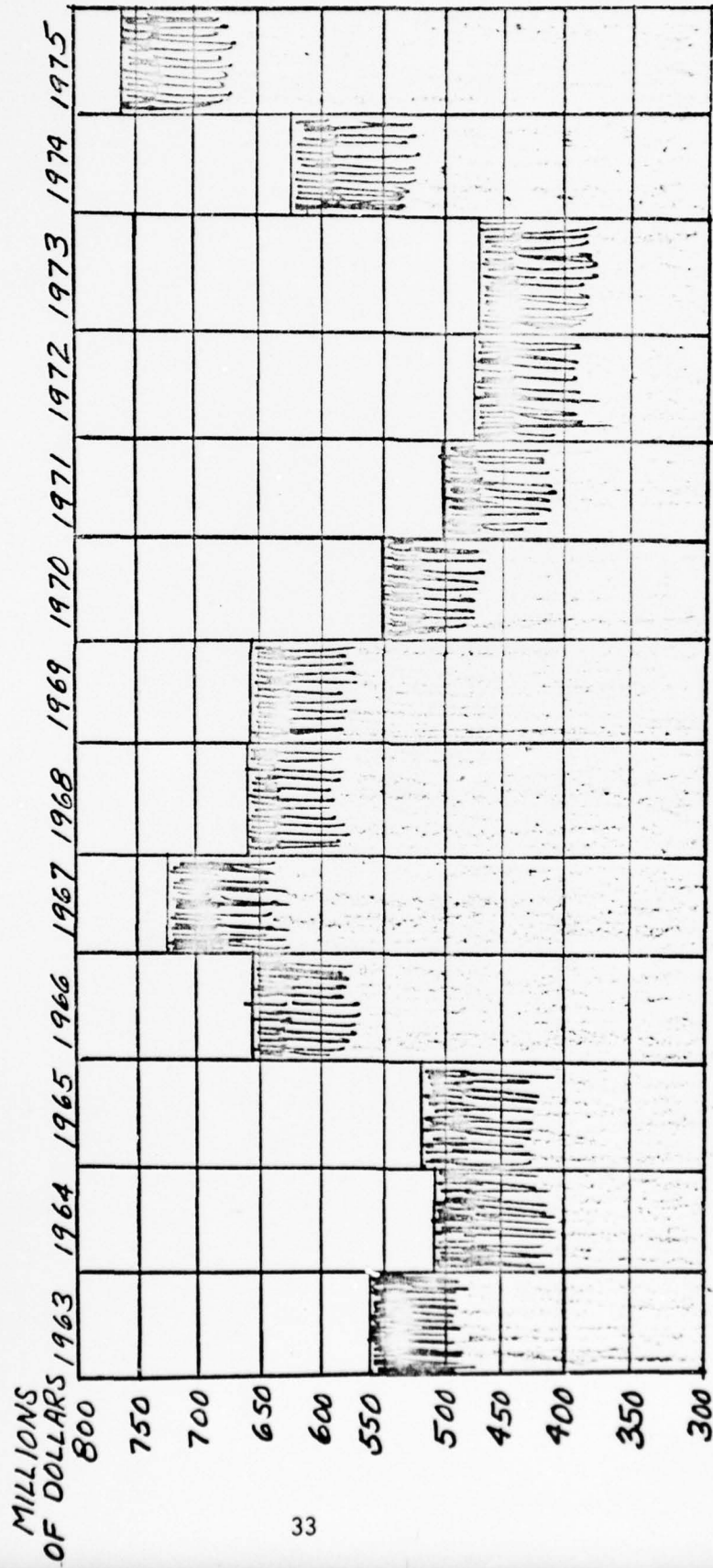
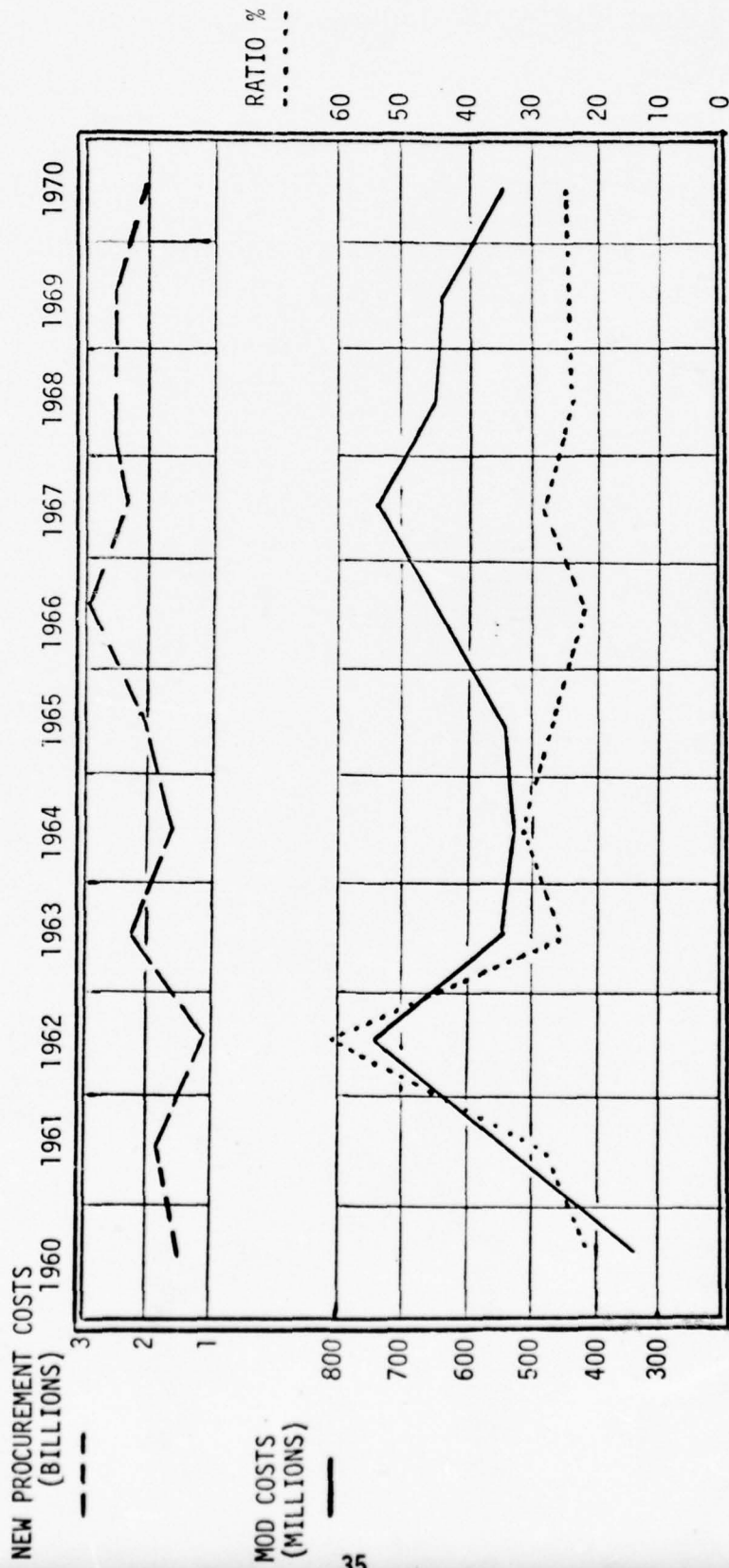


FIG. 3

AIRCRAFT TCTO's
(M/H IN MILLIONS)

	TOTAL	CL IV	CL V	UPDATE	NUMBER
JUNE 1969	29.9	17.9	9.4	2.6	4,952
JUNE 1970	23.5	12.1	8.4	3.0	4,782
JUNE 1971	24.1	14.0	7.6	2.4	6,029
JUNE 1972	26.6	13.2	10.2	3.2	5,998
JUNE 1973	34.3	15.9	13.0	5.3	5,230
NOV 1973	34.6	16.4	12.8	5.4	5,131

MODIFICATION COSTS TO USAF AIRCRAFT
AS COMPARED TO
NEW PROCUREMENT OF AIRCRAFT FISCAL YEARS 1960-1970



III. PROBLEMS ASSOCIATED WITH THE AIR FORCE MODIFICATION PROGRAM

A. SCOPE AND IMPACT OF THE MODIFICATION PROGRAM

A program as large and as important as the Air Force's modification program has problems associated with it which require management resolution. Many of the in-house problems are relatively minor, and only require routine management determinations and resolution of any in-house conflicts. However, a few of the problems are of great importance and have significant impact upon the Air Force and other elements of national defense. Some of the problems associated with the Air Force modification program are aired in congressional hearings, and the resolution and decision level moves on up from Air Force officials to higher levels within the Executive Branch and the Congress. As discussed below, the B-52 modification versus a manned-bomber for its replacement would be a good example of an Air Force decision problem being aired at upper echelons of the government.

B. MODIFY EXISTING EQUIPMENT OR DEVELOP NEW EQUIPMENT

To modify existing equipment, or develop new equipment - this is one of the most serious problems facing the Air Force in the management of its aeronautical inventory. Air Force officials try to determine if it is more economical and cost-effective to add to the original investment, the cost of making a proposed modification, or if it is more cost-effective to replace existing equipment with a new weapons system. Has the point of diminishing returns been reached? Is the cost of the proposed modification greater than its worth to the improved capability to

be achieved? Questions such as these apply, and answers are needed, regardless of the size or economic value of the particular item in question. For the majority of modification decisions, the application of normal, routine management procedure supplies the answer to most of these questions. For modifications costing \$5 million or more, a thorough analysis is made as to whether it would be most cost-effective to modify existing equipment, or to replace such equipment with new procurement. Trade-off studies on the cost-effectiveness of replacing versus the time and dollars required to make the modification serve as the basis for reaching proposed decisions on specific programs.

The most difficult decisions often involve a series of changes to a weapons system that is essential to the national defense. Probably the best known Air Force example is that involving changes to the B-52, and the complementary question as to whether the Air Force is to be allowed a manned-bomber replacement (1:50-57). This particular problem has been with the Department of Defense, the Air Force, and the U. S. Congress for many years. Because of its significance, both from a national defense standpoint, and also from a political standpoint, this problem has been studied and re-studied, and very thorough examinations have been made of all known alternatives. The conclusion of the Air Force, the Department of Defense, and the Congress is that the B-52 will be capable of performing its assigned mission through 1978 and, according to former Secretary of Defense Laird in his December 1969 testimony before a subcommittee of the Committee on Appropriations of the U. S. Senate, the modified B-52 is the only Air Force weapon available during

the early 1970s for countering the threat to the U. S. for which the B-52 was designed to counteract (11:46). However, advance procurement funds are being used for development of the B-1 manned-bomber to replace the aging B-52.

The modification of an existing weapons system normally represents economical exploitation of the growth potential of that particular weapons system. Radical improvements in weapons system capability are usually associated with major technological breakthroughs - such as those brought about by the substitution of jet engines in the 1950s for the piston-driven reciprocating engines used in World War II aircraft. Because of these factors, major, expensive and extensive modification programs to existing weapons systems are studied carefully and only those which contribute effectively to performance of the basic Air Force mission are undertaken.

C. CURRENCY AND ACCURACY OF CONFIGURATION CONTROL RECORDS

A major problem associated with modification of weapons systems in the Air Force is that of configuration control. A vital part of configuration control is the maintenance of data files containing master records of all major components and systems existing on aircraft or other major weapons systems so that they are current and accurate for all users. Configuration records are maintained in a current status in order to provide interested commands with sufficient information on the make-up of specific weapons systems to (1) determine mission capability to meet operational requirements, and (2) provide the necessary logistic support. To support specific mission-equipped aircraft properly, information on

the make-up of equipment incorporated therein must be available to all concerned. One such example is the requirement to respond speedily to the electronic countermeasures threat in Southeast Asia. Because of the urgency of changes such as these, configuration status accounting for quick reaction capability (QRC) changes may get out of control. Priority is given to incorporating the change by quick-fix methods, and often-times the logistic support for the change lags considerably, or may be completely lacking.

Further complicating configuration control is the accomplishment of a series of modifications to a specific weapons system, such as the B-52, over a long period of time. The employment of a specific weapons system requires that the operational planner have complete knowledge of the system's capability at all times, and that the logistics agent have this same information in order that the required logistic support will be available. To accomplish this, the configuration records of each must be in synchronization at all times.

The Air Force uses several different procedures to control configuration management of weapons systems. The Systems Project Office (SPO) to which the weapons system is assigned by the Air Force Systems Command for management of the system is charged with the maintenance of the production configuration and changes during the acquisition phase of the weapons system. This begins with the initial production of the weapons system and is completed with the receipt and acceptance of the last production item into the Air Force Inventory (12:4). The Air Force Logistics Command prime Air Logistics Area having responsibility for the

logistic support of a particular in-service system or equipment is charged with the responsibility for configuration management control, and for keeping the master configuration record in an accurate and current status at all times.

The major problems associated with configuration management control are: (1) the worldwide dispersal of weapons systems; (2) the sheer size of the weapons inventory for a given system; (3) the multitude of differences in missions that a particular weapons system can perform by just changing its suit of equipment; and (4) the thousands of persons performing the maintenance, accomplishing modification changes, and administering configuration status accounting records. Just the language and communications problems associated with the understanding of common written instructions contribute significantly to the problem and therefore play a major part in complicating the product. However, the Air Force has made significant progress in the last few years by mechanizing major portions of the status information system. This has contributed to the accuracy and currency of configuration data. However, the basic problem will remain as long as a multitude of employees and servicemen must individually record information that, by its very nature, is subject to misinterpretation.

D. MODIFICATION KIT MANAGEMENT DEFICIENCIES

The management of aeronautical modification kits has also been a problem in the Air Force. In April 1969, the Assistant Secretary of Defense for Installations and Logistics addressed a letter to the Army, Navy and the Air Force informing them that he was concerned about the deficiencies in the management of modification kits (13). The Army,

Navy, and Air Force made a joint study of the problem and the Air Force input into the study indicated that the policies and procedures used by the Air Force in the management of kits were adequate for determining kit requirements, accounting, stocking, issuing, accomplishment reporting and recording, and for the disposition of excess modification kits. However, the Air Force found, despite the previous statement that their policies and procedures were inadequate, that kits were being retained in stock for extended periods of time, not because of deficient modification kit management policies and procedures, but rather as a result of other management practices which have a direct impact on modification kit management (14:61-64).

The following practices were considered to be the main factors contributing to the deficiency:

1. Changes to engines and equipments that had no scheduled depot overhaul cycle. In many instances, specific engine overhaul times had been extended due to better engine reliability. As a result, some engines had not cycled for depot overhaul as originally scheduled and for which modification kits had been purchased.

2. Modification kits retained for aircraft engaged in test programs. In some cases, the affected systems to be modified had been removed from test aircraft and the kits could not be installed until completion of the test program and when the affected systems are reinstalled in the test aircraft.

3. Kits retained against crash-damaged or battle-damaged aircraft. The kits for aircraft in this status will either be installed

when a decision is made to repair such aircraft and return them to operational status, or to dispose of the kits if an engineering decision indicates that the aircraft should be salvaged.

4. Kits to modify spares in the supply system which could not be updated in the same time period as the installed equipment. This occurs because specialized repair activities and depot overhaul facilities are overloaded with scheduled maintenance repair tasks, and the updating of spares are handled on an "as available" basis.

The Air Force input to the study recommended that certain actions be taken to improve the management of modification kits with existing Air Force facilities, personnel and systems. Among these are the following:

1. The establishment of stringent controls over the approval of all modifications. The recommendation included the establishment of configuration control boards at more than one level, with lower level boards consisting of personnel from the functional areas of material management, engineering, and procurement. The approval of modifications at the system/item management configuration control board level would be limited to certain low-cost safety and essential mission requirements to first line systems and equipment. All other modifications would be referred to a higher level centralized configuration control board that has authority for approval and funding of all modifications.

2. The review of all outstanding modifications to establish a chronological listing by aircraft, missiles, and equipments. This chronological listing would be for the purpose of developing a plan to

clean-up all outstanding modifications that are past-due their planned accomplishment date.

3. The establishment of a one-time forced generation priority schedule for depot level accomplishment of outstanding modifications for designated aircraft engines; and the specification of a mandatory depot recycle time for all aircraft engines. This would help insure that all outstanding engine modifications are incorporated, and would give a higher degree of confidence to Air Force officials that future modifications would be incorporated as planned.

The Air Force input also recommended the establishment of periodic modification packages for designated aircraft, missiles, and equipments. Modifications requiring work in the same general area would be generated during a specified period, consolidated and released as a configuration package against the applicable systems or equipment. At the present time, modifications are released independently upon approval and no thought is given to batching or blocking.

These recommendations have been approved and proved beneficial to the Air Force in the management of its modification program.

E. PROGRAMMING AND BUDGETING PROBLEMS

In the management of the modification program, top management officials in the Air Force are faced with many programming and budgeting problems associated with the management of any relatively large, dynamic program. The Air Force modification program is dynamic and subject to quick changes in that modification projections into the future contain many unknowns. One of the Air Force's major problems is that of

projecting future program and budget requirements in advance of actual need. It is not expected that the Office of Secretary of Defense or the Bureau of the Budget will change the required supporting data, and therefore emergency, unplanned program changes will have to be supported through revision and adjustment to existing programs with the attendant aggravating disruption.

F. MEASURING EFFECTIVENESS OF MODIFICATION

The primary objectives of the incorporation of most changes or modifications is to improve or change mission capability through the addition of more modern or new equipment or to correct safety or material deficiencies of existing systems or equipments.

The effectiveness of modifications made to correct safety deficiencies are reasonably clear and fairly conclusive. If the modification was designed to correct a material deficiency that had caused accidents, and the accidents are no longer occurring, then it can be said that the modification was effective. The same measure of effectiveness generally applies to other material deficiency corrections. However, if the change was designed to improve safety or performance such as decreasing the wear-out rate or improving the reliability of an equipment during its operation, some period of time may be required before it can be determined that the improved conditions have been attained.

The results of mission capability change or improvement modifications vary greatly. Where the modification or change involves a new mission capability, the result is usually apparent and can be readily assessed. However, if the modification involves changes or improvements

in electronic countermeasure devices, the results may be very difficult to evaluate.

The Air Force does not have a systematic verification procedure for determining the benefits derived or results achieved from its modification program. Data available from the maintenance program involving operational ready rates, spares consumption rates, and manpower factors serve as useful indicators and these permit the Air Force to draw meaningful conclusions. However, these data are not correlated in a formal system or method to provide management with an objective evaluation of the efficacy of its modification program. The writer found that the Air Force requirements review and approval process for the processing of modifications is being adhered to at all levels. Therefore, the writer believes that a formal system for the evaluation of most modification projects may not be needed, would prove to be a costly burden, and subject the Air Force to another bureaucratic system. However, for those modification programs costing over \$5 million the writer believes that some sort of a formal verification program is needed to insure that proposed improvements are achieved.

G. EFFECT OF MODIFICATIONS AND UPDATING CHANGES ON SPARES AND REPAIR PARTS

Most modifications in the Air Force require some change to the spares and repair parts inventory. The changes to spares and repair parts take many forms, such as: (1) the introduction of new items; (2) modification of spares and repair parts presently on hand; (3) changes in the quantity of spares and repair parts required because of changes

in the consumption rate; (4) substitution of a new item for one currently in stock; (5) the deletion from the inventory of an item altogether; (6) recognition of when the old item should no longer be purchased and disposal action taken; and (7) timely delivery of spares to support the operational, maintenance, and overhaul programs of modified weapons systems.

The modification of equipment requires the establishment of proper consumption rates for modified spares and the timely procurement of the needed quantity of new spares that may be introduced with the modification. This becomes involved and quite complex because historical data are not available to support the expected wear-out rate of the new spares. Some modifications have the effect of obsoleting all spares used on a given component. However, since all equipments are not modified at a single point in time, the inventory manager must maintain a stock of the old items on hand to support those equipments not yet modified and insure that he has sufficient stocks of the new items to support the modified equipments. These efforts to properly balance stocks become more complex where there are interservice support arrangements or single manager assignments such as for those items assigned to the Defense Supply Agency for management. It is difficult to maintain proper balances on the new and the old items and the inventory manager often ends up with an excess of stock of the old item and no stock of the new item at the time required. When these situations occur, the inventory manager is accused of poor demand forecasting, the effect of which is the over-procurement or under-procurement of spares and repair parts.

If there is an imbalance in the installation of a modification kit, it is usually the spares, supply support, and maintenance effort that suffers because concerted management attention is given to the modification of the weapons system itself.

IV. SUMMARY ON AIR FORCE MANAGEMENT OF THE MODIFICATION PROGRAM

The effective management of any project or program rests on the clear understanding of the project or program objective. The Air Force has identified the overall objectives of its aeronautical equipment modification in an Air Force regulation (5). These objectives are broadly defined as: (1) maintenance of equipment in an operational configuration that enhances safety of personnel and property; (2) changes to configuration that will result in reduced support costs; and (3) equipment revisions required for new or improved missions.

The writer concluded that overall the Air Force manages its modification program in an effective manner. Air Force regulations clearly define modification management objectives and policies. Further, the responsibility and authority for the management of the modification program within the Air Force is well defined, the basic principles are easily comprehended, and as records reveal, individual modifications are being carried out relatively well.

The requirement for a combined Air Staff/AFLC/AFSC quarterly review of each major modification project determines adequacy of progress as well as assuring the compatibility and essentiality of each project with the current mission and needs of the Air Force.

Each major weapons system procured by the Air Force has a built-in growth potential. The services, the Office of the Secretary of Defense, and the Congress have an interest in seeing that full exploitation of this growth potential is achieved. The modification of existing equipment serves to achieve this exploitation as well as serving the economic

interests of management (15:29,45). Many military requirements are satisfied through relatively minor changes (although no changes are really simple) to existing models of basic aircraft types. Also, many of the changes that are incorporated do not, nor are they designed to, advance the technological state-of-the-art but do satisfy a specific requirement through a change in configuration. The Air Force effectively uses its modification and modernization programs to serve these exploitation goals as well as serve the economic interests of management.

The success of a proposed modification program is measured by how well did the program meet its stated objectives. For those changes made to improve safety of operating equipment, safe flight after modification is usually the only measuring device required. Changes made to correct material deficiencies or to improve logistic support are usually verified through physical inspection and are reported as having been accomplished through the time compliance technical order (TCTO) routine. Modifications for improved capability or for a change in mission capability may require extensive development and engineering, and therefore a relatively long period of time is required before these can be completed. Quite often, emphasis may be directed toward accomplishment of a modification or change to meet an urgent operational requirement, such as electronic countermeasures for Southeast Asia. In a fast moving environment where technological change or enemy threat impinges upon an already approved program, there may be changes and amendments which preclude precise identification of the completion or success of a previously directed program.

The Air Force assumes that a modification project is successful unless the operating commands indicate otherwise. For those modification projects costing over \$5 million, the writer believes that the Air Force could monitor, in a more definitive way, the efficacy of its more costly modifications by placing on the major command initiating the original modification proposal the responsibility for performance verification. Prior to initial approval to proceed with the modification, the major air command would be required to indicate how such performance verification would be accomplished.

In summary, the writer believes that Air Force management of modifications is accomplished in a logical manner. Air Force directives and procedural guidelines provide for the attainment of specific goals in accordance with clearly defined policies. Responsibility and authority to approve and perform modifications have been placed at the organizational level possessing the necessary data to make proper decisions. Headquarters USAF retains overall program control, but permits the major air commands to execute the modification program within established guidelines. The writer believes that the modification program is effectively carried out by the major commands and is accomplished with a minimum of interference from headquarters.

The writer recommends that the Air Force adopt a more formal verification program for those modifications costing over \$5 million in order to determine that the proposed improvement or change in capability is actually achieved.

Additionally, the writer recommends that program management training be provided for individual key members at the AFLC Air Logistic Centers. AFSC now sends its promising program manager candidates to the Defense Systems Management School at Fort Belvoir, Virginia. However, the AFLC logistician is primarily concerned with spare parts provisioning. The writer's observation is that most system managers (SMs) are not educated or equipped to properly manage large Class IV and Class V modification programs. Schooling would provide these system managers with the proper management tools to preclude or reduce the typical program problems of cost overrun, poor performance, bad data, etc.

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