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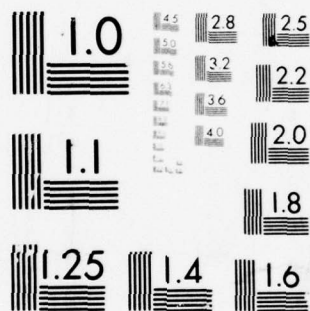


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DEFENSE SYSTEMS MANAGEMENT COLLEGE



PROGRAM MANAGEMENT COURSE INDIVIDUAL STUDY PROGRAM

A GUIDE TO INTERFACE MANAGEMENT

STUDY PROJECT REPORT

PMC 76-2

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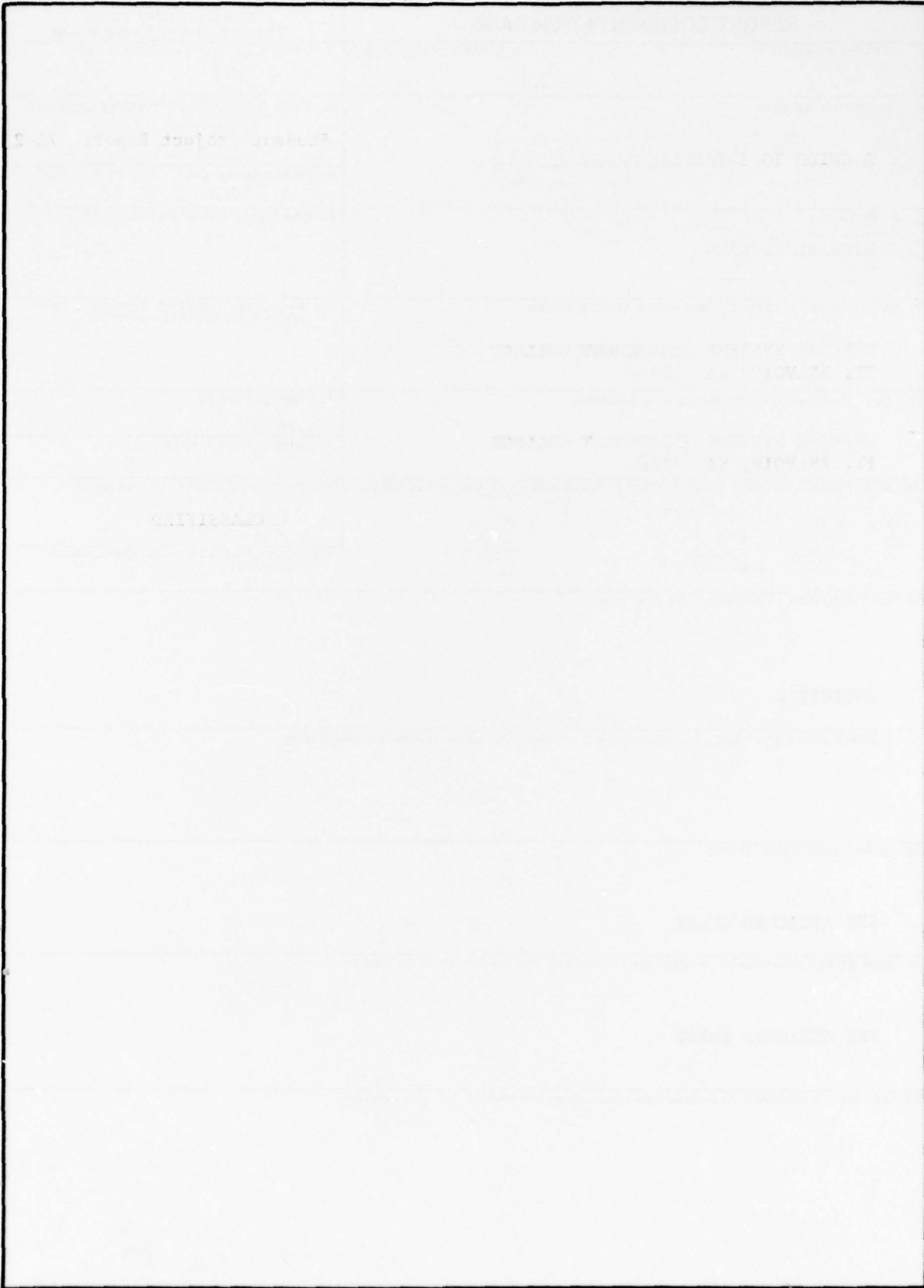
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STUDY TITLE: A GUIDE TO INTERFACE MANAGEMENT

STUDY PROJECT GOALS:

To identify a representative set of interface management issues and discuss their applicability in the acquisition process.

✓ STUDY REPORT ABSTRACT:

The purpose of the report is to develop a guide for use by program management personnel in managing an interface between two or more weapon systems or portions thereof provided by two or more different contractors or government agencies.

Existing USAF interface management guidance was identified, reviewed and evaluated with respect to its value to program office personnel in establishing and executing an interface management program.

Interface management documentation from past and present USAF programs as well as the writer's experience constituted the source from which the interface management documents that exist at the various management levels and the corresponding interface management issues were identified. The applicability of each of the interface management issues to the acquisition process was discussed.

The result of the identification of the representative interface management related documents, the identification of interface management issues that historically merit consideration is establishing an interface management program, and the discussion of the applicability of the issues is a guide to interface management that recognizes the complexities of today's acquisition environment and provides program management personnel with the means to establish and execute an effective interface management program.

It is concluded that current USAF interface management guidance is inadequate in light of the government's increasing interface management responsibilities. It is feasible to develop an improved form of interface management guidance as accomplished in this report. ↗

It is recommended that Air Force Systems Command develop interface management guidance in a form similar to that developed in this report for all interface management situations and include it in Chapter 15 of AFSCP-800-3.

SUBJECT DESCRIPTORS: Interface, interface management, integration

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A GUIDE TO INTERFACE MANAGEMENT

**Study Project Report
Individual Study Program**

**Defense Systems Management College
Program Management Course**

Class 76-2

by

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November 1976

**Study Project Advisor
Mr. Wayne Schmidt**

This study project report represents the views, conclusions and recommendations of the author and does not necessarily reflect the official opinion of the Defense Systems Management College or the Department of Defense.

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EXECUTIVE SUMMARY

The increasing cost and complexity of today's weapon systems have forced the system acquisition tasks to be distributed over an increasing number of government Program Management Offices and contractors in order to maintain effective management and technical control. As a result the government is assuming a greater responsibility for managing the interfaces between major elements of weapon systems to assure successful integration.

The current USAF concept of interface management, as reflected in AFSCP 800-3 and MIL-STD-483, does not recognize the government's expanding interface management role as an active participant in the management of major system interfaces. Through application of the systems engineering process the USAF continues to do well in identifying and meeting technical interface requirements. However, there is a procedural and organizational interface associated with each technical interface that the government, in its expanded interface management role, must be able to manage as well as it does the technical interface. Additional interface management guidance is necessary if program management personnel are to be able to effectively manage the organizational and procedural interfaces.

The interface management guidance developed in this report consists of two parts. This first part identifies the interface management related documents that exist at each management level from Service Headquarters through the contractor's operating levels. The second part identifies and discusses the applicability of interface management issues that historically have been identified as meriting consideration in establishing an interface management program. With this type of guidance the program management

personnel will be able to apply their expertise and knowledge of their system to identify those interface management issues that should be considered and tailor them to meet the needs of the specific situation.

It is recommended that Air Force Systems Command expand the guidance developed herein to include all interface management situations and incorporate it into Chapter 15 of AFSCP 800-3.

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SECTION I

INTRODUCTION

Purpose of the Section

The purposes of this section are to present the purpose of the report, define the terms interface and management, develop a definition of interface management, discuss the government's role in interface management, discuss the importance of interface management, and present the methodology to be used in and organization of the report.

Purpose of the Report

The purpose of the report is to develop a guide for use by program management personnel in managing an interface between two or more weapon systems or portions thereof provided by two or more different contractors or government agencies. The guide identifies interface management issues and discusses significant points relative to their application. The guide developed herein, therefore; is not a "cookbook" but rather is a set of generalized interface management issues from which program management personnel can select and tailor those that are appropriate for the specific interface management program to be developed. To provide a common frame of reference the terms interface, management, and interface management must be defined.

Definitions

The terms interface and management are defined below. From these two definitions a definition of interface management is developed.

Interface - Interface is defined as: "The functional and physical characteristics required to exist at a common boundary between two or more equipments or computer programs that are provided by different contractors or government agencies " (5:15-1). There are two key points in this definition that merit special emphasis. First, an interface is defined in terms of its physical characteristics (i.e. form and fit) and its functional characteristics which are action related characteristics that cross the interface boundary causing a function to be performed. Second, interface as defined above applies only to equipments or computer programs provided to the government by different contractors or government agencies.

Management - Management has almost as many different definitions as there are management text books. Management is often defined in terms of its functions. There is not complete agreement as to what these functions are, but planning, organizing, directing, and controlling are a reasonable consensus (1:154). Other schools of thought view management as a process. There are various versions of the process but "getting things done through others" is representative (1:14). By combining the definitions of interface and management, a definition of interface management can be derived.

Interface Management - Using the process definition of management as the framework into which the functional definition of management and the definition of interface are incorporated results in the following definition of interface management. Interface management is the planning, organizing,

directing, and controlling of government and contractor personnel and other resources required to achieve physical and functional compatibility between two or more equipments or computer programs provided by different contractors or government agencies. It is necessary at this point to understand the significance and extent of the government's responsibility in interface management in the acquisition of DOD systems.

The Government's Role in Interface Management

The increasing complexity and cost of today's weapon systems has caused the responsibility for major portions of new weapon systems to be distributed to a larger number of industrial firms or government agencies. Therefore a weapon system that formerly would have been the responsibility of one government Program Management Office (PMO) and a single prime contractor is now often spread over a number of PMO's and contractors. The result is a tremendous increase in the number of interfaces that must be managed by the government. There are often two or more PMO's each responsible for one of the major elements of a weapon systems and mutually responsible for managing the interface between the elements. The PMO to PMO interface resulting from the hardware/software weapon systems interface represents the government's role in interface management.

The technical interface challenges of the new weapon systems are increasing at a rate proportional to the increased complexity of the new weapon systems. The technical requirements of the interface are, therefore, normally met in the course of developing and testing the new weapon systems.

However, there have been instances in the recent past in which the technical requirements of an interface were not met. The lack of technical interface compatibility was not the result of too severe technical requirements, but rather a lack of a well defined procedural and organizational interface between the interfacing PMO's. An effective procedural and organizational interface provides the means by which a compatible technical interface can be achieved. When an effective procedural and organizational interface does not exist additional development time and money is normally required to achieve technical interface compatibility. This is the risk the government assumes when it accepts responsibility for major weapon systems interfaces. It also highlights the government's need for management practices that will allow it to effectively discharge its interface management responsibilities.

The management environment that confronts the government when it assumes interface management responsibility is often uncertain and ill-defined. When the government, through two or more different PMO's, is interfacing two or more major systems into one weapon system there are inherently conflicting goals that must be merged. Each PMO's system is essentially controlled by Congressional and DOD action that often has little regard for the interface between the two programs. Each PMO has its own contract which may or may not provide for interface management activity on the part of the respective contractors. Each program's funds are normally scarce. To convince one PMO to expend funds to preserve compatibility with the other systems is often extremely difficult.

The interface management environment within the government is one in which the technical requirements receive the most attention while the procedural and organization aspects of the interface management function receive little attention at the outset. It is only after interface compatibility problems arise that the interface management procedures receive much attention. The attention at this point is a "one time fix" of the problem with little consideration given to changes in the interface management procedures that would prevent reoccurrence.

As the government assumes interface management responsibility it would do well to benefit from the contractor's experience in this area. Contractors who have had the responsibility for interface management applied significant numbers of highly qualified personnel to the task. The personnel normally had extensive experience in the interface management function and had developed in-house procedures to standardize their management approach. The government personnel who must execute the interface management function are more mobile than their industry counterparts. They do not normally perform its interface management function for program after program, thereby building the experience so vital to effective interface management. Due to the nature of the military and civilian personnel systems it is unlikely that this situation will change significantly. The impact of personnel turnover on the interface management function is compounded by the apparent lack of thorough interface management guidance. Before time and effort are expended developing interface management guidance and establishing specialized interface management personnel training or functions it is necessary to discuss the importance of interface management in the complete context of weapon systems acquisition.

The Importance of Interface Management

The importance of interface management has increased with the complexity of today's weapon systems. As more and more contractors and government PMO's become involved in the development and procurement of a single major weapon systems, the task of coordinating the many detailed requirements and procedures becomes more diluted. The responsibilities for program management and systems engineering that usually belonged to a single PMO and its prime contractor are now often distributed to a number of PMO's and contractors. As a result many of the program management and systems engineering tasks become interface management tasks. This apparently subtle shift in emphasis can have a major impact on the process of weapon systems acquisition. Interface management is now coequal with program management and systems engineering in determining the success of weapon systems acquisition. In this coequal role interface management must be successfully accomplished, along with program management and systems engineering, in order to successfully develop and procure today's and tomorrow's complex weapon systems.

Because of the increased importance of interface management additional consideration must be given to the requirements of program office personnel for more useful guidance on the theory, organizational relationships, and procedures of interface management. The guide for interface management developed in this report will provide more specific guidance for establishing and executing interface management programs. The method by which the guide is developed is through a synthesis of existing guidance, review of current interface management documentation, and the writer's interface management experience.

Methodology

The methodology followed in this report consists of the following steps:

1. Review and evaluate published Air Force guidance on interface management and existing interface management documentation
2. Identify key interface management issues
3. Discuss the applicability of the interface management issues

Air Force regulations, manuals, pamphlets, and military standards will be reviewed to identify those that provide guidance on interface management. Each of the documents so identified will be reviewed and summarized. The guidance will be evaluated with respect to its adequacy for establishing and executing an interface management program. Deficiencies noted in the existing guidance will be resolved as the interface management guide is developed.

An interface management program is unique to the program and situation to which it is applied. However, when a large number of interface management programs are considered a fairly consistent set of interface management considerations develop. A comprehensive set of interface management considerations, or issues, will be developed by reviewing interface management documentation currently in effect on on-going programs and from the writer's experience.

After having identified key interface management issues the same sources will be used to provide a discussion of the applicability of each of the issues. The discussions will consider the management situations, funding responsibilities, and phase of the acquisition cycle that should be considered when assessing the applicability of the issues.

The result of following this methodology will be a set of interface issues along with a discussion of the applicability of each that can be used as a guide in developing a comprehensive interface management program tailored to the specific needs of the situation.

Summary

Because of the increased complexity and cost of today's weapon systems the government must often contract for major system elements with individual contractors or government agencies and assume the responsibility for integrating the elements into a complete weapon systems. This responsibility requires a highly competent and effective interface management function be performed by the government. Because of the relatively high turnover of government personnel comprehensive interface management guidance is required for the government to effectively accomplish its interface management functions. The fact that this guidance is currently lacking will be shown in Section II. In Section III additional guidance in the form of interface management issues will be developed. Section IV will contain the conclusion of this report.

SECTION II

INTERFACE MANAGEMENT GUIDANCE

Purpose of the Section

The purposes of this section are to identify the Air Force documents that provide interface management guidance, to review and summarize this guidance, and to evaluate the guidance with respect to its value to program office personnel in establishing and executing an interface management program.

Interface Management Documentation

A review of Air Force program management guidance resulted in the identification of the following documents that contain material pertaining to interface management.

1. AFSC Pamphlet 800-3, dated 9 April 1976, Subject: A Guide for Program Management.
2. MIL-STD-483 (USAF), dated 31 December 1970, Subject: Military Standard Configuration Management Practices for Systems, Equipment, Munitions, and Computer Programs.

AFSC Pamphlet 800-3 - AFSC Pamphlet 800-3, A Guide for Program Management, describes the considerations involved in managing the acquisition of a weapon system (5:1). Chapter 15, Interface Management, identifies interface management requirements and procedures. The interface management requirements for the PMO, contractors, and supporting/using commands in each of the

acquisition cycle phases are identified. The procedures for establishing an Interface Management Agreement (IMA) between PMO's and an Interface Control Working Group (ICWG) between contractors are described.

MIL-STD-483 - Appendix II to MIL-STD-483 sets forth criteria and guidance for establishing interface control of all physical and functional interfaces of systems, equipment, munitions, computer programs, facilities, and installation requirements. MIL-STD-483 is applicable to all contractors to the Government whose configuration items have an interface with other configuration items which are the responsibility of another contractor or government agency. Appendix II provides general guidance for establishing interface requirements, interface control, and the use of the ICWG. Appendix II provides more specific guidance on the role and makeup of the ICWG and the use of Interface Control Drawings (ICD's) for interface definition and control (4:21).

Summary of Interface Management Guidance

The interface management guidance in AFSCP 800-3 and MIL-STD-483 are summarized in three categories:

1. Responsibilities
2. Procedures
3. Interface Control Working Group (ICWG)

Responsibilities - Interface management should be instituted where interface control is necessary as determined by the procuring activity. Interface management responsibilities will be defined in the Statement of Work (SOW) for contractors and memoranda of agreement for government agencies.

The procuring activity will identify and document interfaces in specifications. Interface management tasks will be incorporated into prime and associate contractor contracts. The prime contractor will develop items to be compatible with interface requirements. The prime contractor will establish joint working agreements with associate contractors and provide interface source data. The associate contractors will develop items to be compatible with interface requirements. The associate contractors will also establish joint working agreements with the prime contractor and incorporate prime contractor provided source data into their design. The Air Logistic Center (ALC) will provide interface management inputs on items already in the inventory. The ALC will assume responsibility for interface management at Program Management Responsibility Transfer (PMRT).

Procedures - Develop an Interface Management Agreement (IMA) to document a set of agreed upon operating instructions formally established to define responsibilities of organizations involved in interface management. The IMA should include specific responsibilities to be accepted and accomplished by each organization by phase of the acquisition cycle. Interface control procedures should be identified and defined, including the use of the Interface Control Working Group (ICWG) and the Interface Control Working Board (ICWB).

Interface Control Working Group (ICWG) - The use of an ICWG will be specified by the procuring agency as the interface control activity. The procuring agency will normally specify the integrating or prime contractor as ICWG chairman. The ICWG will consist of a member from each participating organization. The ICWG serves as the official communications link between program participants to resolve interface management problems, document

interface agreements, and coordinate Engineering Change Proposals (ECP's). Interface control drawings will be used to record interface design agreements and provide a means to evaluate and control interface design parameters. ICD's and ECP's will be developed by any participating organization, reviewed by all organizations, forwarded to the ICWG for review and approval or disapproval. ICWG recommendation or disagreements will be forwarded to the procuring agency for action or resolution.

The interface management guidance provided by AFSCP 800-3 and MIL-STD-483 represents the guidance available to the PMO in establishing and executing an interface management program. The degree to which this guidance satisfies the needs of program management personnel will in part determine how effectively the interface will be managed.

Evaluation of the Interface Management Guidance

To evaluate the interface management guidance it is helpful to visualize the organizational and contractual relationships of the procuring activity, the contractors, and the other government agencies participating in the interface management program. AFSCP 800-3 and MIL-STD-483 do not specify any particular organizational relationship. However, it can be inferred from these documents that the organizational relationship shown in FIGURE 1 was being considered.

For the purposes of this discussion an example of a hypothetical mobile, tactical, surface-to-surface missile system, System X, is used. System X consists of four missiles, command and launch equipment, and a transporter vehicle. The transporter vehicle and the missile warhead are provided as

INTERFACE MANAGEMENT RELATIONSHIPS

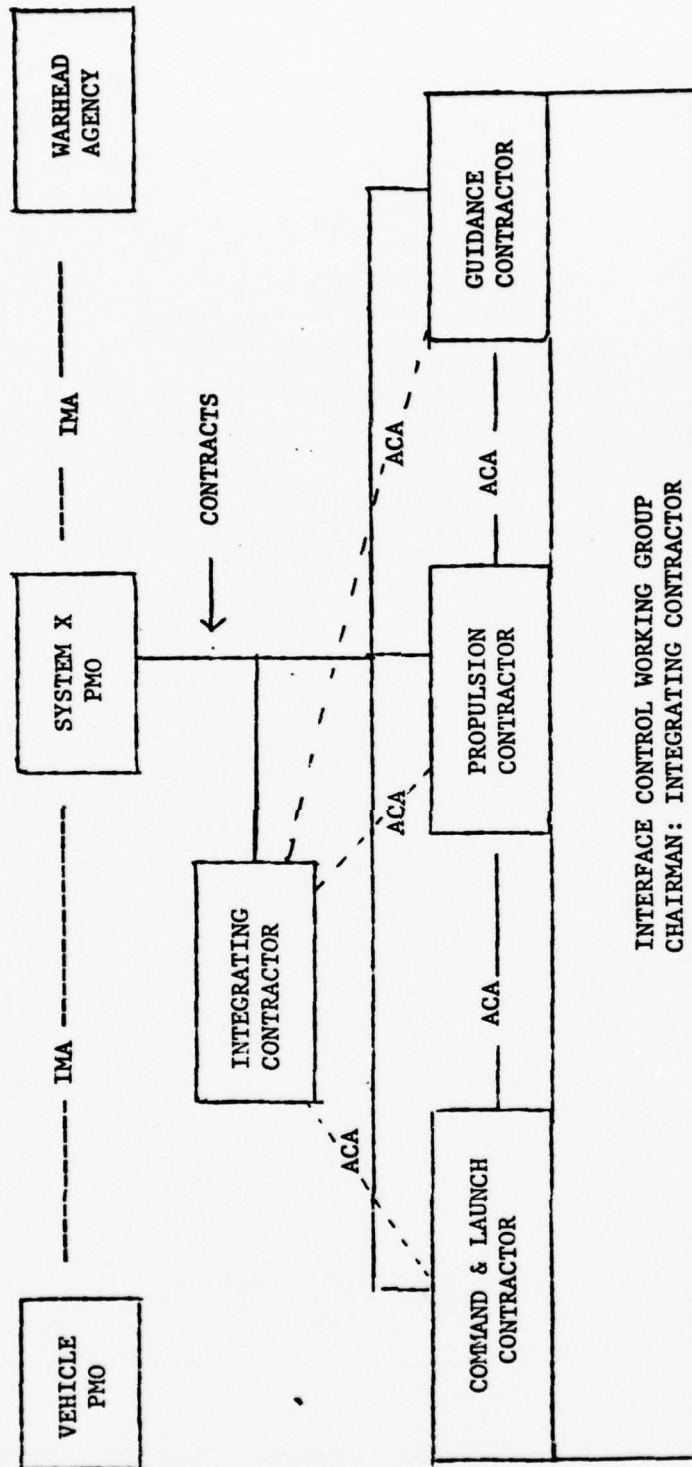


FIG 1

Government Furnished Property (GFP) to the integrating contractor. The remainder of the system is developed and tested by the integrating contractor and the various associate contractors. System X has the following interfaces:

1. propulsion section to guidance section
2. propulsion and guidance sections to warhead
3. missile to command and launch equipment
4. command and launch equipment to transporter vehicle

The AFSCP 800-3 and MIL-STD-483 guidance focus on interfaces 1 and 3 which are the responsibility of the associate contractors. Interfaces 2 and 4 involve contractor to government agency interfaces which the guidance indicates are managed via IMAs between the PMO and the government agencies. If the GFP was off the self hardware that did not require any modification prior to incorporation into System X, the organizational relationships depicted in FIGURE 1 may be appropriate.

If, however, the transporter vehicle or the warhead was in parallel development or required modification for use with System X, FIGURE 1 greatly oversimplifies the interface management relationships. This latter case, more closely represents the acquisition environment of today's complex systems. A recent example of this more complicated interface relationship is the FB-111/AGM-69 interface. The FB-111 was finishing development and entering production while the AGM-69 was in development. Each of these systems was managed by a separate System Program Office (SPO) at Wright-Patterson AFB, Ohio. The FB-111 required modification to accept the AGM-69A avionics and missile. Managing this interface required close coordination between two SPO's and between the two prime contractors. This same type of interface

management relationship currently exists between the B-1 and the AGM-69. In the System X example, if the transporter vehicle is in parallel development with the remainder of the system and the warhead must be developed specifically for System X, the interface organizational relationships are more accurately depicted in FIGURE 2. In FIGURE 2 the existence of three distinct management groups is more apparent. As a result it is easier to identify the need for interface management coordination at each of the levels. The failure of AFSCP 800-3 and MIL-STD-483 to recognize this increasingly common interface management organizational relationship is a serious deficiency in the existing interface management guidance. This deficiency prevents the current guidance from considering the complete range of interface responsibilities and procedures that exist in today's interface management environment.

The interface management guidance that is included in AFSCP 800-3 and MIL-STD-483 merely advises the program management personnel to identify the interfaces, establish interface relationships with contractors through the contract, establish interface relationships with other government agencies through Interface Management Agreements (IMA's), and direct the contractors to form an ICWG using the general procedures provided. The guidance does not provide any recommendations on how these interface management tasks are to be accomplished.

The guidance does not discuss any areas that should be considered in identifying the interfacing systems or defining the interface itself. Other than in the most general terms the guidance does not identify any specific interface management tasks should be required of the contractor through the

INTERFACE MANAGEMENT RELATIONSHIPS

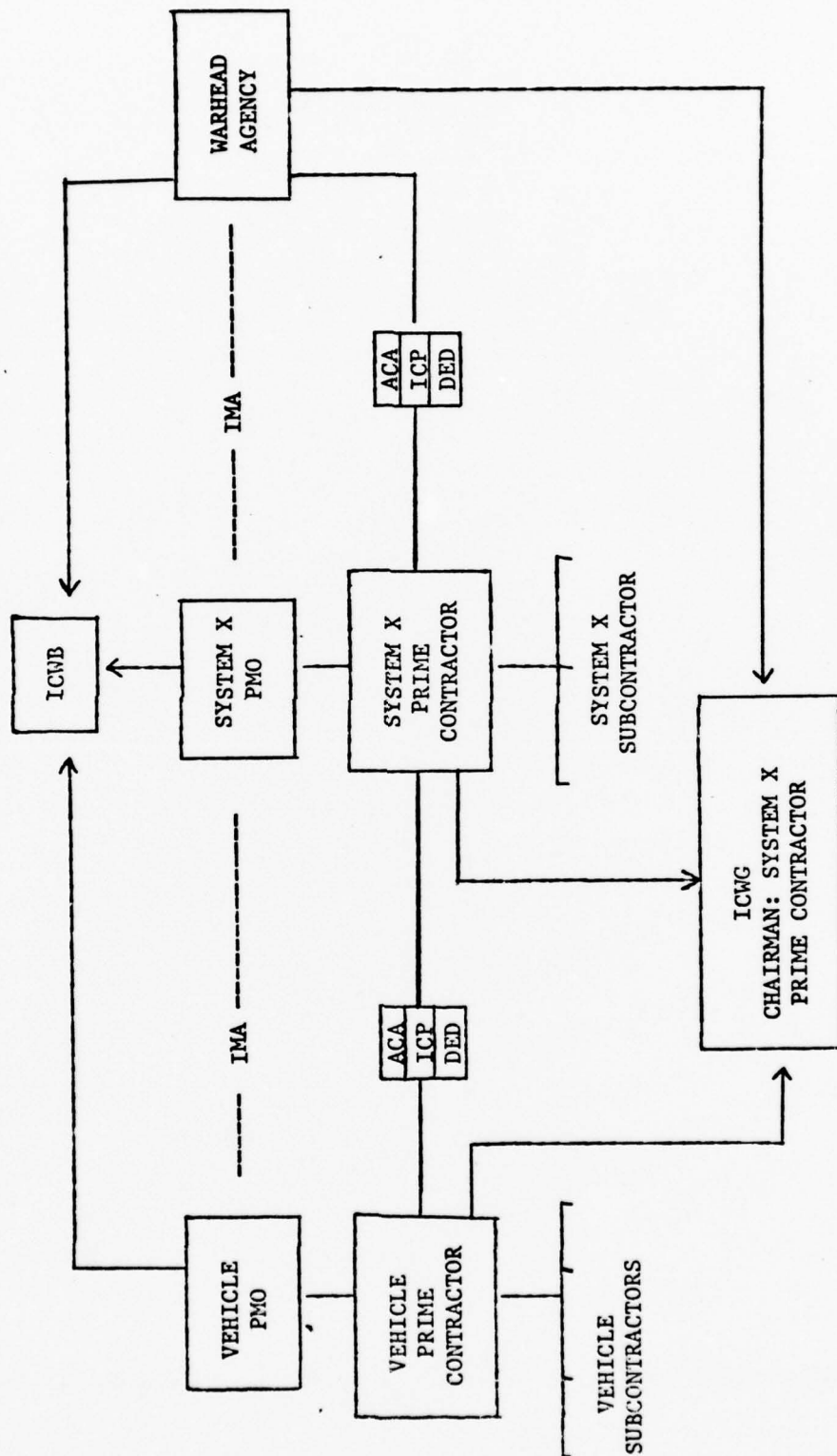


FIG 2

SOW and the contract. The guidance does not discuss any detailed interface management considerations that should be included in the IMA. The guidance adequately considers the issues associated with establishing and operating the ICWG as well as its relationship to the government's Interface Control Working Board (ICWB). However, the guidance does not suggest a means for government visibility of ICWG activity. In addition the guidance does not directly discuss the purpose and procedures of the ICWB. The guidance also does not provide a standard by which the government is able to evaluate the adequacy of the contractor interface management documentation.

Some of the deficiencies in the guidance noted above can be attributed to interface management organizational relationships (FIGURE 1) implied in the guidance. It is assumed that in these relationships the prime or integrating contractor accomplishes the majority of the interface management effort. As long as the GFP interfaces are not complicated this approach is marginally acceptable. However, even under these circumstances it behoves the government to be knowledgeable of interface activity and relationships. Normally design tradeoffs must be made at the interfaces in the process of system development. If the government is not knowledgeable and involved, the contractors will make these tradeoffs in their best interest. The contractor's best interest is not always the government's best interest. If the GFP interfaces are more complicated, as discussed in the System X example, the guidance is totally inadequate.

Summary

AFSCP 800-3 and MIL-STD-483 constitute the interface management guidance that is currently available to program management personnel. The interface

management guidance provided by AFSCP 800-3 and MIL-STD-483 is very general in nature and apparently assumes a situation in which the prime or integrating contractor assumes almost all of the interface management responsibility and the GFP interface is relatively minor. In today's acquisition environment the GFP interface often consists of another complete system and is very complex and dynamic. In this situation the current interface management guidance does not provide program management personnel with sufficient information to enable them to establish an effective interface management program.

SECTION III

A GUIDE TO INTERFACE MANAGEMENT

Purpose of the Section

The purposes of this section are to identify interface management related documentation that exists at the various government and contractor management levels and to develop a generalized set of interface management issues that correspond to the documents at each of the management levels. The identification of interface management related documentation and associated interface management issues will constitute a comprehensive guide for use by program management personnel in establishing and executing an interface management program.

Philosophy of Interface Management

Interface management has two facets. If a hardware or software interface exists, an organizational and procedural interface must also exist. The organizational and procedural interface must be properly managed if a compatible hardware or software interface is to be achieved. For any one hardware interface there may be a number of different organizational and procedural interfaces. As two interfacing systems pass through the phases of the acquisition cycle the relationship of the responsible government organizations will change with the cycle phase. The combination of the time dependent nature of interface management and the multitude of hardware and software interfaces that can exist results in an almost limitless number of different interface management situations.

Because of the variability of interface management situations it is not possible to develop a definitive form of guidance that specifies the exact actions to take to manage a given interface. As a result program office personnel, faced with an interface management task, repeat the approach they used last time or develop a new or modified approach based on an informal lessons learned technique from a fairly limited experience base. This rather loose method of developing an interface management program is not consistent with the importance of interface management in today's complex weapon systems.

There is a way to give program office personnel interface management guidance that takes into account the variability of the interface management situations. This approach is based on the following four assumptions:

1. If the organizational and procedural interface is properly managed, the technical interface requirements will almost always be satisfied.
2. In order to effectively manage the organizational and procedural interface, interface management must be addressed at all levels; from Department Headquarters through the Program Management Office to the operating levels within the contractor's organization.
3. At each level there are certain types of documentation that should address interface management issues.
4. For each level from the Department Headquarters to the contractor's operating organization there is a set of generally consistent interface management issues that should be considered for applicability to specific interface management situations.

If the above assumptions are true, interface management guidance for program office personnel need only to consist of two categories of information.

1. A description of the type of interface documentation appropriate for each level and an explanation of how the documentation applies to an interface management program.

2. The interface management issues that should be considered for incorporation into the documentation at each management level.

Given the above two categories of information those program office personnel responsible for establishing an interface management program will have an improved base on which to structure an interface management program. The initial step is to identify the interface management documentation that is appropriate at each of the management levels.

Interface Management Documentation

Interface management documentation is found in all levels of the documentation hierarchy. The following documents should consider the appropriate interface management issues at each of the management levels.

1. Department Headquarters direction
2. Developing Command direction
3. Program Management Plan
4. Interface Management Agreements (IMA's) between interfacing government organizations
5. Interface Specifications
6. Government to Contractor Statements of Work (SOW)

7. Associate Contractor Agreements
8. Contractor Interface Control Procedures
9. Interface Control Working Group (ICWG) Action Plans,
Interface Control Documents (ICD's), and Interface Memoranda (IFM's)

Department Headquarters Direction - Department Headquarters direction is the document that formally tasks the developing command to accomplish certain broad tasks necessary to develop a system to meet an operational requirement. The Air Force document is the Program Management Directive (PMD). It includes schedule requirements and funding data.

Developing Command Direction - Developing Command direction forwards the Department Headquarters direction document to the Program Management Office (s) who executes the direction. The Developing Command may also add more specific direction for the PMO and identify specific tasks for other elements within the Developing Command. Air Force Systems Command documents its direction in an AF Form 56.

Program Management Plan - The Program Management Plan (PMP) is the document by which the Program Manager describes all the facets of his program. The PMP serves as a planning tool within the PMO and as a source of information for those other organizations that are associated with the PMO in the conduct of the program.

Interface Management Agreements - Interface Management Agreements (IMA's) are documents executed between two or more PMO's or government agencies that document the mutual responsibilities and procedures that exist for accomplishing a given interface management task. Generally IMA's are jointly developed and negotiated and are approved by the Program Manager from each PMO.

Interface Specifications - Interface specifications document the physical and functional interface requirements and the tests that will be accomplished to verify that the interface requirements have been met. Interface requirements can be included in the system specification or in an addendum thereto.

Statement of Work - The Statement of Work (SOW) is the document that, when referenced in the contract, requires the contractor to accomplish certain tasks in satisfying the requirements of the contract. The contractor's interface management responsibilities and tasks should be specified in the SOW.

Associate Contractor Agreement - The Associate Contractor Agreement (ACA) is the document in which co-equal contractors identify their respective responsibilities and the general procedures they will use in interface management activities. The ACA normally establishes the Interface Control Working Group (ICWG).

Contractor Interface Control Procedures - Contractor Interface Control Procedures are included in a document that is jointly developed by the contractors associated with the interface. The Procedures are the mutually agreed upon method for handling associate contractor to associate contractor interface management activities.

Interface Control Working Group Action Plans - ICWG Action plans are the documents that formally document ICWG actions. ICWG Action Plans must be signed by both associate contractors.

Interface Control Documents - Interface Control Documents (ICD's)

consist of two parts. Part I defines the system requirements and functional design requirements (2:11). Part II defines the detailed design requirements (2:11).

Interface Memoranda - The Interface Memorandum (IFM) is the controlled method of correspondence between interfacing associate contractors.

The above documents correspond to the various management levels that are involved in the management of the interfaces between two systems. At each of the management levels there are certain interface management issues that must be considered to assure that a complete and effective interface management program will be developed and implemented.

Interface Management Issues

The various levels of management that are involved in the management of an interface have different perspectives and therefore, different interests. The higher government levels are interested in broad issues such as operational requirements and how the interfacing systems fit into the force structure. The PMO is interested in interface management responsibilities between the participating government agencies and how these agencies will discharge those responsibilities. The contractors are concerned with satisfying their contractual requirements with respect to the interface and the detailed procedures necessary to achieve the requirements. Because of the different emphasis on interface management activities resulting from the different levels of management involved, there are interface management issues that are more appropriately considered at one

level than at another. However, because of the wide variety of interface management situations and associated organizational structures it is not possible to pin point the exact level at which certain interface management issues should be considered. The interface management issues that are presented and discussed below are oriented in accordance with the type of interface management documentation and the associated organizational structure presented above. There are obviously interface management situations which do not fit this example. In these instances the interface management issues should be considered at adjacent or corresponding management levels.

Department Headquarters Level Interface Management Issues - Headquarters level direction is the basis on which a program is structured. Recent emphasis has been placed on Program Manager (PM) participation in the drafting of this direction. When two programs are involved in an interface effort there is usually one PM who is more interested in the interface effort than the other. It is important that the more involved PM attempt to get the other involved in the development of the interface direction that applies to both programs. Dual participation by the interfacing PM's is an important issue to be considered at the outset of any interface management program. If both PM's are involved they are more likely to be more committed to jointly discharging the assigned interface direction.

Some systems are required to interface with one system in the near term and with one or more other systems in the future. The issue of multiple interface requirements is crucial to the PM in structuring his program. This requirement may appear as an advantage to a PM struggling to get his program

approved. However, in the subsequent development effort the requirement to maintain interface compatibility with future, not yet completely designed systems may represent an unnecessary technical challenge and a source for cost growth. The PM should strongly challenge the requirement for multiple interfaces at the outset and continue to do so as the program progresses. If multiple interfaces are required, the following issue should be considered.

If the interfacing systems are not being developed in parallel it may be necessary to establish interface modification limits for the more mature system. These limits are generally technical in nature, but are driven by the economic considerations associated with modification and retrofit of an existing operational system. In the situation where the new system has near and far term interface requirements, the new system design may be constrained by interface modification limits on the near term interfacing system. Ideally, then, the new system would have interface modification limits with respect to the far term interfacing system.

The interface management issues to be considered at the Department Headquarters level are:

1. Interfacing PM's should all be directly involved in the development of the direction that defines the interface requirements.

2. The PM's should assure that the direction specifies the interfacing systems and that any requirement for multiple interfaces is noted. If the interfacing systems are in different subordinate commands, the PM's should assure that they both get complementary guidance.

3. Any interface modification limits that may be required should be defined in sufficient detail to permit design definition.

Development Command Level Interface Management Issues - The Developing Command passes the Headquarters level direction on to the PMO and adds specific Command level guidance as necessary. Normally a large proportion of system to system interfaces are managed by Developing Command PMO's. The Developing Command, therefore, is in the proper position to define mutual responsibilities with respect to the management of an interface.

An issue to consider is that the two interfacing PMO's should receive complementary direction in sufficient detail to determine the mutual responsibilities with respect to managing the interface. Many times Headquarters level direction is relatively silent on interface requirements and/or responsibilities when the interfacing systems are under the cognizance of the Developing Command. If the expenditure of significant funds and the utilization of critical assets are required to support an interface program, their use in the conduct of the interface effort should be included in Command level direction. A situation may also exist in which one of two partners in an interface effort is much less motivated to commit the necessary time and funds to assure interface compatibility. Interface efforts are sometimes viewed as activities that are off the mainstream of the PMO's effort and therefore, dilute the effort to develop and procure the PMO's system. In such a situation Command direction to the reluctant PMO should include sufficient detail to assure that the necessary interface support will be made available.

Normally the Command level personnel responsible for monitoring two interfacing systems do not know the detailed interface support requirements that should be included in Command direction. It is the responsibility of

the interfacing PM's to identify their mutual interface direction requirements and communicate them to Command personnel for inclusion in Command direction.

The interface management issues at Command level are:

1. Command level direction should specify interface responsibilities in a complementary fashion to both PMO's.
2. Command level interface direction should be in sufficient detail to enable interfacing PMO's to understand their mutual responsibilities.
3. Interfacing PM's must develop the detailed interface requirements and responsibilities information and take direct action with Command personnel to get it included in Command direction.

Program Management Office Interface Management Issues - The Interface Management Agreement (IMA) and Interface Specifications document the interface relationships between two organizations and two systems at the PMO level. The IMA is the primary means for establishing interface management responsibilities, tasks, and procedures between two interfacing organizations. The organizational relationships used in this example to provide some structure to the discussion of interface management issues result in the IMA being applied at the PMO level. For programs such as the Space Shuttle, IMA's will occur in some form at much higher levels as well as at the PMO level. Such higher level IMA's must address more basic management issues which are provided for by DOD and Service instructions and regulations for PMO level IMA's.

The single most important issue to be addressed in the IMA is the mutual responsibilities of the interfacing PMO's. The IMA should include the basic

responsibilities that each PMO has for its entire program, not just the interface responsibilities. After the basic responsibilities have been set forth the mutual interface responsibilities of each PMO as defined in Headquarters and Command direction must be specifically enumerated. The PMO's must also identify, negotiate, and document any additional interface management responsibilities in the IMA that are considered necessary in the conduct of the interface management program. An example of additional interface management responsibilities is the determination of development, funding, and procurement responsibilities for equipment from one system which is incorporated within another, requiring modification to equipment within the host system. The PMO for the host system would normally be responsible for the development, funding, and procurement of the modification of the host system to accept the equipment from the other system. The other PMO would be responsible for the equipment that would be installed in the host system. Once these mutual responsibilities have been agreed upon, additional responsibilities must be defined in the IMA concerning the responsibilities for the impact of changes in the interfacing equipment within the host system. The question of who funds changes in one system resulting from changes in the other must be answered. The PMO initiating the change could be responsible for funding the changes on both sides of the interface or the PMO's could both fund for the changes on their own side of the interface. Failure to define and document these responsibilities at the outset can often lead to serious program delays as each interface change is individually negotiated between the PMO's.

A second interface management issue concerns the exchange of management and technical support between the PMO's at the outset of the interface management program. Generally the newer of the two interfacing system needs detailed technical information about the more mature system and often needs assistance from the PMO of the more mature system in evaluating this information with regard to the new system. In other situations there is a mutual need for management and technical information from interfacing PMO's. Source selection support from one PMO to another is an example in which personnel from one PMO may be required to devote significant amounts of time and effort in support of the other PMO. Other examples include participation in technical reviews, configuration audits, and program reviews. To the extent that one PMO supports these activities for the interfacing PMO, the personnel are not available to work on the supporting PMO's own program. This type of mutual interface support may not appear very substantial at the outset, but it can become very significant in a short time. It is to the advantage of both PMO's to estimate the amount of mutual support they will require and document it in the IMA. This will help assure that the support will be provided when it is asked for and provide justification for the manpower allocations necessary to provide the support.

Another issue similar to the last one involves the PMO of the more mature system providing support from his contractor to the PMO of the newer system and his contractor. This contractor support is often limited to informational type briefings and meetings. However, this support may also require significant contractor effort such as developing an interface baseline document for the newer PMO to use in its RFP. Normally the PMO of

of the newer system would fund this effort, but it may be helpful to use the other PMO's contract as a vehicle to initiate the effort in a timely fashion. The responsibilities surrounding such an effort should be documented in the IMA.

The second type of interface documentation between PMO's other than the IMA is the Interface Specification. The responsibilities of developing, approving, and placing the Interface Specification on contract are issues that should be documented in the IMA. Normally the PMO of the newer system or one of its contractors is responsible for developing the Interface Specification with assistance from the other PMO and its contractor. These factors should be documented in the IMA along with the requirements for approval of the Interface Specification by both PMO's and their contractors. The IMA should also record the requirement on both PMO's to place the Interface Specification on contract with their respective contractors. The IMA should require that the interfacing PMO's and/or contractors reach agreement on the specification prior to its being placed on contract.

Another interface management issue that is related to contract requirements concerns the Associate Contractor Agreement (ACA) clause. This clause requires the contractor to enter into an Associate Contractor Agreement with the other PMO's contractor to define their relationships, responsibilities, and procedures with respect to the interface. The ACA clause must be in both interfacing contractor's contracts. This requirement should be documented in the IMA.

By placing the ACA clause and MIL-STD-483 on contract the PMO's require the interfacing contractors to form an Interface Control Working Group (ICWG)

to jointly manage their interface management activities. In light of this contractor interface group an issue to consider is the need for a similar government interface group. When such a group has been formally established it has been called the Interface Control Working Board (ICWB). The ICWB would normally be composed of the PM's from the interfacing PMO's with representatives from the user and support organizations as required. The ICWB serves as a court of appeal for the contractor ICWG should it not be able to reach an agreement on an interface management matter. If interfacing PMO's intend to use an ICWB to resolve contractor and government interface related differences it should be documented in the IMA. The IMA should delineate the ICWB charter, the members, the chairman, and the procedures for calling and conducting meetings. Documenting the ICWB in the IMA provides a pre-established means of communication for resolving interface differences. Without the ICWB the process of escalating problems to the PM level takes much longer and often results in conflict rather than a joint problem solving process.

The issue of mutual contractor data requirements is one that should also be documented in the IMA. It may not be possible to document each specific piece of data that is to be exchanged between the PMO's but certain types of data can be identified. The types of data may include; system and lower level specifications and changes thereto, program schedules, test plans and reports, and technical review and configuration audit minutes. In addition to the types of data to be exchanged the IMA should also include the procedure whereby a PMO can identify a data requirement to the other PMO. An initial review of each other's CDRL plus participation in future data calls

could be stipulated in the IMA.

The issue of Government Furnished Property or Equipment (GFP/GFE) provided by one PMO to the other for its contractor and vice versa should be documented in the IMA. Often development and developmental testing activities require components of the interfacing systems be made available by the PMO to one of the other PMO's contractors. The contractor will normally identify the requirement for such hardware, software, or technical support in the GFP document or elsewhere in the contract. If the Contractor's GFP document is approved by the PMO, the requirements therein are binding on the PMO. The PMO may be subject to claims by the contractor should it fail to meet the GFP requirements. The interfacing PMO is often the only source for equipment used in its system. If one PMO requires GFP from the interfacing PMO, the requirement should be documented in the IMA prior to approval of the contractor's GFP document. It should be realized that agreement to provide GFP in an IMA is not the same as a contractual commitment. A PM may not be able to provide the GFP he promised in the IMA because of an operational requirement, developmental problems, or some other circumstance beyond his control. However, identifying the required GFP in the IMA requires that the availability be discretely determined; which is better than not considering the availability at all. In cases where all the required GFP cannot be identified at the outset, procedures for identifying GFP requirements and determining availability should be included in the IMA. The IMA should distinguish GFP that is being loaned to the interfacing PMO from that which is being purchased. For GFP that is being loaned the IMA should specify the need date, the duration, the location, and the condition in which the GFP is to be returned. For GFP that is being purchased by the interfacing PMO the

need date and price or agreement to pay should be identified in the IMA.

Closely related to the GFP issue is the issue of test and evaluation support. In addition to hardware and software support, interface testing often requires support from both contractors to plan, conduct, and evaluate the testing. This support is often beyond the scope of the mature system contractor's contract. The test support requirements should be documented in the IMA at the outset in order to provide sufficient lead time to budget and contract for the effort.

The final interface management issue to be considered in the IMA is vital because it draws together the means of accomplishing the other issues. This issue is the documentation in the IMA of the day-to-day operating procedures that the interfacing PMO's will follow in conducting interface management activities. A key part of this issue is the identification of a single point-of-contact in each PMO through which interface matters will flow. The point-of-contact need not participate in every interface meeting nor generate all interface correspondence but he must be kept informed of and control interface activities between the PMO's. One of the major duties of the single point-of-contact is assuring that interface changes receive timely and thorough consideration in coordination with the interfacing PMO. Interface changes will occur as the interface design matures. The IMA must clearly define the procedures the interfacing PMO's will use to jointly process these changes. The PMO's should have members on each other's change boards authorized to indicate his PMO's position on the changes. The IMA should also require that when interface changes are required to both systems that they be simultaneously implemented.

Contractor Interface Management Issues - The interface management program established by interfacing contractors is largely determined by their contracts with their respective PMO's. If, however, the contractors both have an ACA clause in their contracts, it can be expected that they will jointly develop an Associate Contractor Agreement, contractor interface control procedures, and a data exchange document. It behoves the PMO's to reserve the right of approval for the ACA and the interface control procedures and to informally review the data exchange document with the contractors.

At the contractor level, the interface management program becomes specifically oriented to the particular hardware interface under consideration. The issues to be considered with respect to the contractor's interface management program are not specifically to aid the contractor in developing his interface management documentation but rather to aid the PMO personnel in assessing the adequacy of the contractor's interface management program as reflected in his interface management documentation.

In identifying interface management issues that should be considered in the contractor's documentation the Associate Contractor Agreement and Interface Control Procedures developed by North American Rockwell Corporation and The Boeing Company to manage the interface between the B-1 bomber and the AGM-69 Short Range Attach Missile are used.

The Associate Contractor Agreement consists of nine Articles each of which addresses a different interface topic. In the first article the contractors identify their respective contracts; pictorially portray the interface management relationships between the government, contractors, and working groups; and list the supporting documentation that will provide

a basis for conduct of the interface management program.

Article II of the ACA discusses the responsibilities that the contractors must mutually assign and accept in order for the interface requirements in their contracts to be satisfied. Both contractors agree to participate in the development of the Interface Control Document (ICD) and recognize that the interface, performance, and demonstration requirements are controlled by the ICD. The ICD when approved by the government will be the interface design requirements baseline and be placed under Class I change control by both contractors. The contractor for the newer of the two systems is responsible for preparation of the ICD. The specifications that specify limits within which the interface is to be defined are listed.

Article III, Implementation, both contractors agreed to work as a team and to provide technical assistance and data to one another as called for under their respective contracts. The contractors establish an Interface Control Working Group (ICWG) and designate the chairman and membership. Each contractor designates an Interface Manager (IM) and Deputy IM who have full authority to conduct the interface management program for their respective contractors. The ICWG will meet to establish interface program policies, provide guidance, and to resolve interface problems.

Article IV, Change Provisions, identifies the procedures the contractors will follow to change ICDs prior to mutual agreement, after mutual agreement, and after government approval of the ICD. Prior to mutual contractor agreement on an ICD, the technical representatives, by mutual agreement, can change the ICD. After contractor agreement the ICD must be changed through

agreement by the ICWG. After government approval the government must approve ICD changes which were submitted by the contractors after ICWG agreement.

Article V, Problem Identification and Resolution, provides procedures for the contractors to jointly develop and recommend corrective action should interface considerations result in one or both systems not meeting their system performance requirements. Both contractors agree to exchange the information necessary to define the problem and develop an effective solution. The corrective action is submitted to the PMOs through the ICWG.

Article VI, Disputes, identifies the recourses the contractors individually have in the event they fail to agree on an interface issue. If agreement between the contractors cannot be reached, the matter will be presented to the government Interface Control Working Board (ICWB) through the ICWG. The decision of the ICWB is binding on the contractor when it is contractually implemented.

Article VII, Exchange of Technical Information, documents the agreement of the contractors to exchange the data necessary for them to discharge their interface responsibilities. The contractors also agree on a procedure for control of proprietary information exchanged for interface purposes.

Article VIII, Special Clauses, limits the contractors efforts under this agreement to that specified in their respective contracts. To that extent, the contractors agree to accept the provision of the ACA. An employee of one contractor can not act as an agent of the other under the terms of the ACA. Neither contractor will charge the other for work required as a result of the ACA.

Article IX, Duration, defines the duration of the ACA as the period during which both contractors are under contract to the government for the specific systems addressed by the ACA.

In reviewing a contractors ACA the PMO can expect that the contractor will normally assure that his interests are well covered. The PMO should, therefore, determine if the government's interface management issues as identified in the program direction and IMA are also considered and carried through into the contractors' ACA.

The ACA is the top level interface agreement document between interfacing contractors. Normally the ACA is supported by joint interface control procedures which specify in greater detail the day-to-day operating procedures the contractors will use to control the interface. The interface control procedures are specifically tailored for the interface situation being considered. The purpose of the following discussion of interface control procedures is not to provide a recommended approach for contractors developing interface control procedures but rather to provide the PMO with some insight into the general areas that might be considered. If the interface management personnel in the PMO are generally familiar with the contractor's interface control procedures they are better able to monitor the contractor's interface definition and interface problem resolution activities.

Contractor Interface Control Procedures maybe composed of four sections, Introduction, Management Relationship, Procedures and Practices, and Approval.

Section 1: Introduction, indicates what areas the procedures cover such as management of the ICWG, data exchange, and ICD development, changes and configuration controls. The procedures are developed to be in consonance with

the PMO IMA and the contractors' ACA. The procedures apply to only those areas that require joint contractor effort. The procedures may require PMO review and/or approval prior to implementation. Three interface documents are described:

1. Interface Control Document (2 parts)
2. Data Interchange Document
3. Contractor Interface Control Procedures

The procedures for maintaining and changing the interface control procedures are defined.

Section 2: Management Relationships, pictorially presents the organizational relationships between the PMO's, contractors, ICWG, and ICWB. Engineering support that one contractor is to provide the other is defined in terms of purpose and location. The administrative details concerning ICWG meetings are specified. The responsibilities of the ICWG and both the interfacing contractors are specifically identified.

The primary responsibilities of the ICWG are:

1. Develop ICD
2. Further identify detailed interface requirements
3. Coordinate ECP's prior to submittal to the government
4. Request ICWB meeting for problems the ICWG cannot resolve
5. Send ICWG schedule, agendas, and minutes to respective PMOs

The primary responsibilities of the interfacing contractors include the following areas:

1. Centralized interface control management
2. Administrative services
3. Chairmanship of the ICWG

4. Maintaining a file of ICWG documentation
5. Obtaining each others agreement on ICDs
6. Coordinating schedules for documentation and hardware development and related test programs
7. Submission of interface ECPs after ICWG approval
8. Identification of test support and hardware requirements

Section 3: Procedures and Practices, identifies the two part ICD as the document that controls the technical interface between the systems. Part I defines system and functional design requirements. Part II defines the detailed design requirements. After government approval the ICD becomes the interface design baseline.

ICWG Action Plans are used to define action required to develop the ICD, interface ECP, and/or define technical problem resolution. Each contractor has a block of ICWG Action Plan numbers which denote which contractor initiated the Action Plan. In the event the contractors are not able to resolve an interface problem each contractor will include the following information on an ICWG Action Plan for submittal to his PMO.

1. Statement of the problem, including reason for disagreement
2. Contractual impact
3. Background
4. Alternatives with cost, schedule, and performance impacts
5. Statement of the proposed solution

Coordination of interface changes is required on the part of both interfacing contractors. Changes to the ICD are accomplished by an Interface Revision Notice (IRN). The action to resolve a proposed interface change is documented in an ICWG Action Plan. An interface change on the part of one

contractor's system will require a companion change from that contractor. The ICWG will assess the technical and schedule impact of the changes. The contractors are responsible for assuring that the impact of the change on both sides of the interface is accounted for. The ECPs from both contractors are submitted concurrently to each PMO's change board.

The interfacing contractors agree to use an Interface Memorandum (IFM) correspondence system to document activities, meetings, discussions, telephone calls, and transmit IRN/ICWG Action Plans. The IFM's are numbered in a manner that identifies originator, subject areas, and sequence.

The interface control procedures reviewed above represent an approach that two contractors took to control a specific weapon systems interface. As such the specific procedures are not universally applicable, but the PMO personnel would do well to consider the areas that were addressed in evaluating their contractor's interface control procedures.

Interface Documentation - In the course of managing the interface both PMO's will receive certain types of contractor generated interface management documentation. If the contractor's interface program is structured as defined in the ACA and Interface Control Procedures previously discussed, the PMO would expect to receive the following contractor interface documentation.

1. Interface Control Document, Parts I and II
2. Interface Revision Notices, included as a part of ECPs which propose changes to the ICD
3. ICWG Action Plans which describe the coordination activities between the contractors in developing the IRNs.
4. Interface Memoranda (IFM) which document any interface related activities and transmit IRN/ICWG Action Plan packages.

The ICD is a joint document which defines the interface baseline for both PMO's and contractors. The IRN is also a joint document, but the ECP that accompanies the IRN is unique to each contractor. The IRN represents the joint change that both contractors desire to make. The ECP represents the different efforts on the part of each contractor that is required to make both sides of the interface compatible. ICWG Action Plans and IFMs can be initiated by either contractor. Each PMO should receive copies of ICWG Action Plans and IFMs initiated by either contractor. If both PMOs are aware of each contractor's interface responsibilities and detailed operating procedures as set forth in the ACA and Interface Control Procedures, it is possible for the government to closely monitor the contractors' interface program through the documentation generated by the contractors to accomplish the interface management program. The increased visibility of the contractors' interface management effort enables the PMO to identify potential interface problems at an early date. The PMO then has the option to surface the problems for immediate consideration or to monitor the contractor's progress towards resolution of the problems. In monitoring the contractor's efforts the PMO will be able to identify the need to modify a contractual or technical requirement in the early stages of resolving an interface problem. The PMO has the opportunity to make the requirement change at that time and thereby eliminating the time and effort the contractors might spend trying to solve the interface problem within the existing requirements.

Summary

Interfaces in today's complex weapon systems have two components. The first is the hardware and/or software interface. The second is the

organizational and procedural interface. The ability to properly manage the organizational and procedural interface usually dictates the success with which the requirements of the hardware/software interface are met. There is very little published guidance concerning the management of the organizational and procedural interface. To be effective, interface management must be considered at all levels of the government and contractor management hierarchy. There are specific types of documentation at each management level that scope and define the interface management effort. The origin and content of each type of management documentation were discussed.

At each management level there has historically been a set of interface management issues that deserve consideration in establishing an interface management program for a specific system. Each of the interface management issues was identified and discussed. The result is a generalized list of interface management issues that are to be considered in developing interface management documentation. This information can be used by program office personnel, based on their knowledge of the specific system, as a guide in developing and tailoring an interface management program for their specific application.

SECTION IV

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this section is to draw conclusions with respect to today's interface management environment, the Air Force's concept of interface management, the value of current Air Force interface management guidance, and the feasibility of developing more detailed and comprehensive interface management guidance. This section will include a recommendation on how to provide program management personnel with more detailed and comprehensive interface management guidance.

Conclusions

Today's weapon systems are growing more complex and costly. Both of these factors have caused the tasks associated with developing new weapon systems to be distributed over an increasing number of government PMO's and contractors in order to maintain effective management and technical control. The increasing cost has also forced the Air Force to use common subsystems, and support/maintenance systems to the maximum extent practicable. As a result of these factors the government is assuming a greater responsibility for assuring that the elements of major weapon systems are developed to be compatible with one another. On the scale that it is occurring today this increase in the government's interface management responsibility represents an important and relatively new management challenge.

The Air Force's current concept of interface management is oriented toward the environment in which the prime or integrating contractor for a given weapon system manages most of the interface activities. The government monitors the contractor's efforts and resolves interface management problems that conflict with contractual requirements. The government manages those interfaces that exist with GFP provided by other government agencies. Under the current concept the GFP is normally of a fixed configuration or being developed to meet a firm interface requirement. The Air Force's current interface management concept does not recognize the complexities and uncertainty surrounding today's interface management environment.

This lack of realization is reflected in the Air Force emphasis on the technical aspects associated with interface compatibility. The Air Force has done well and continues to excel in the application of the systems engineering discipline to identify and satisfy technical interface requirements. However, today's interface environment superimposes an organizational and procedural interface over the technical interface. The effective management of this organizational and procedural interface is virtually a prerequisite to successfully meeting the requirements of the technical interface. The failure of the Air Force's concept of interface management to recognize the complexities of today's interface management environment and therefore the existence of the organizational and procedural interface requirements is reflected in Air Force interface management guidance.

Current Air Force interface management guidance is contained in AFSCP 800-3 and MIL-STD-483. These documents fail to provide the PMO with the detailed interface management guidance that is necessary if the PMO is to effectively discharge its increasing interface management responsibility. The PMO is no longer simply an interface monitor. It must now conduct a complete interface management program with other PMO's or government agencies to integrate major, complex elements into an effective operational weapon system. To accomplish this task effectively the PMO needs detailed guidance on what needs to be done and how it should be done. It is recognized that today's interface management environment is so fluid and complex that interface management guidance in the form of a simplified "cookbook" would not be practical or effective. What is required is a more flexible type of guidance that identifies the types of interface management documentation that exist and the issues that history has shown merit consideration in establishing an interface management program.

In this report the types of interface management documentation that could exist from the Department Headquarters level down through the contractor's operating levels are identified. Interface management issues are identified that correspond to the management concerns that should be considered in the documentation at each level. The result is a guide to interface management that bounds the entire interface management function and provides program management personnel with checkpoints in the form of interface management issues to be considered in establishing an interface management program. The guide does not prescribe specific interface management techniques but rather depends upon the expertise of the program

management personnel and their knowledge of the unique interface requirements of their system to cull from the issues those that apply and tailor them for the specific needs of the situation. The type of interface management guide developed herein is a feasible alternative to the current very general guidance and other extreme of a "cookbook" approach which, if possible to develop, would be too cumbersome to be effective.

Recommendations

The guide to interface management in this report was developed under severe time constraints and with little access to the broad Air Force interface management experience base. This fact does not alter the writer's conclusion that the current Air Force interface management guidance is inadequate in today's interface management environment and that a feasible alternative exists for providing the type of interface management guidance required. However, with more time and resources a more useful guide to interface management can and should be developed.

This report specifically addressed the situation in which there were two or more PMO's, each responsible for major elements of a weapon system. The situation apparently considered by the current guidance in which the PMO has contracts with a number of different contractors for subsystems and a contract with another for integration will continue to exist. The situation in which a subsystem or support equipment item is common to many larger systems will probably increase in frequency in the future. These three interface management situations represent crucial management challenges. The program management personnel who will be asked to meet these challenges

should have the best guidance available to help them. AFSC with its wealth of talent and experience should develop a guide to interface management that covers the three interface management situations and should incorporate it into Chapter 15 of AFSCP 800-3.

BIBLIOGRAPHY

1. Davis, Ralph C. The Fundamentals of Top Management. New York: Harper and Row, Publishers, Incorporated, 1951.
2. The Boeing Company and the North American Rockwell Corporation. B-1/AGM-69 Interface Control Procedure. Boeing document number D220-10022-2 prepared under contract AF33657-71-C-0222. Seattle, Washington, 22 January 1971.
3. The Boeing Company and the North American Rockwell Corporation. B-1 Weapon System Program Associate Contractor Agreement between Los Angeles Division, North American Rockwell Corporation and Systems Division, The Boeing Company. Boeing document number D220-10022-1 prepared under contract AF33657-73-C-0257. Seattle, Washington, 6 December 1972.
4. U.S. Department of Defense. Military Standard Configuration Management Practices for Systems, Equipment, Munitions, and Computer Programs. MIL-STD-483. Washington, D.C., 31 December 1970.
5. U.S. Department of the Air Force. Air Force Systems Command. A Guide for Program Management. AFSCP 800-3. Washington, D.C., 9 April 1976.