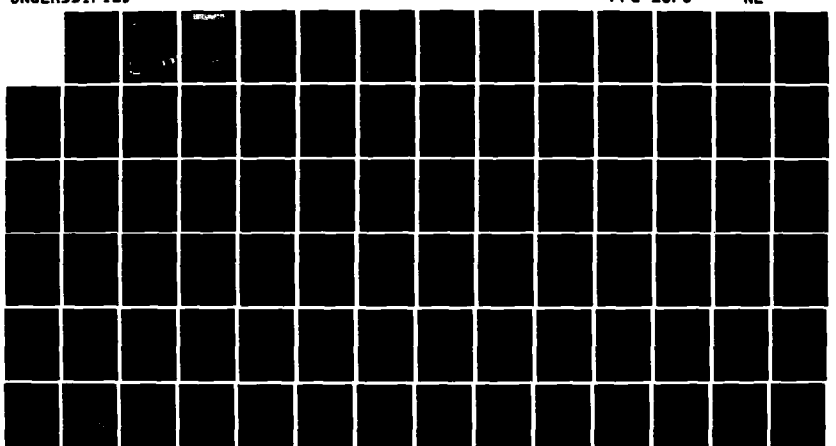
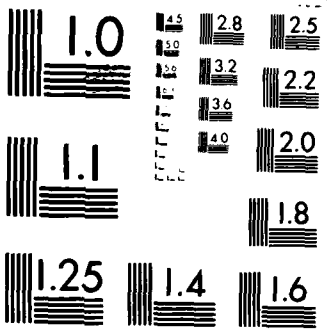
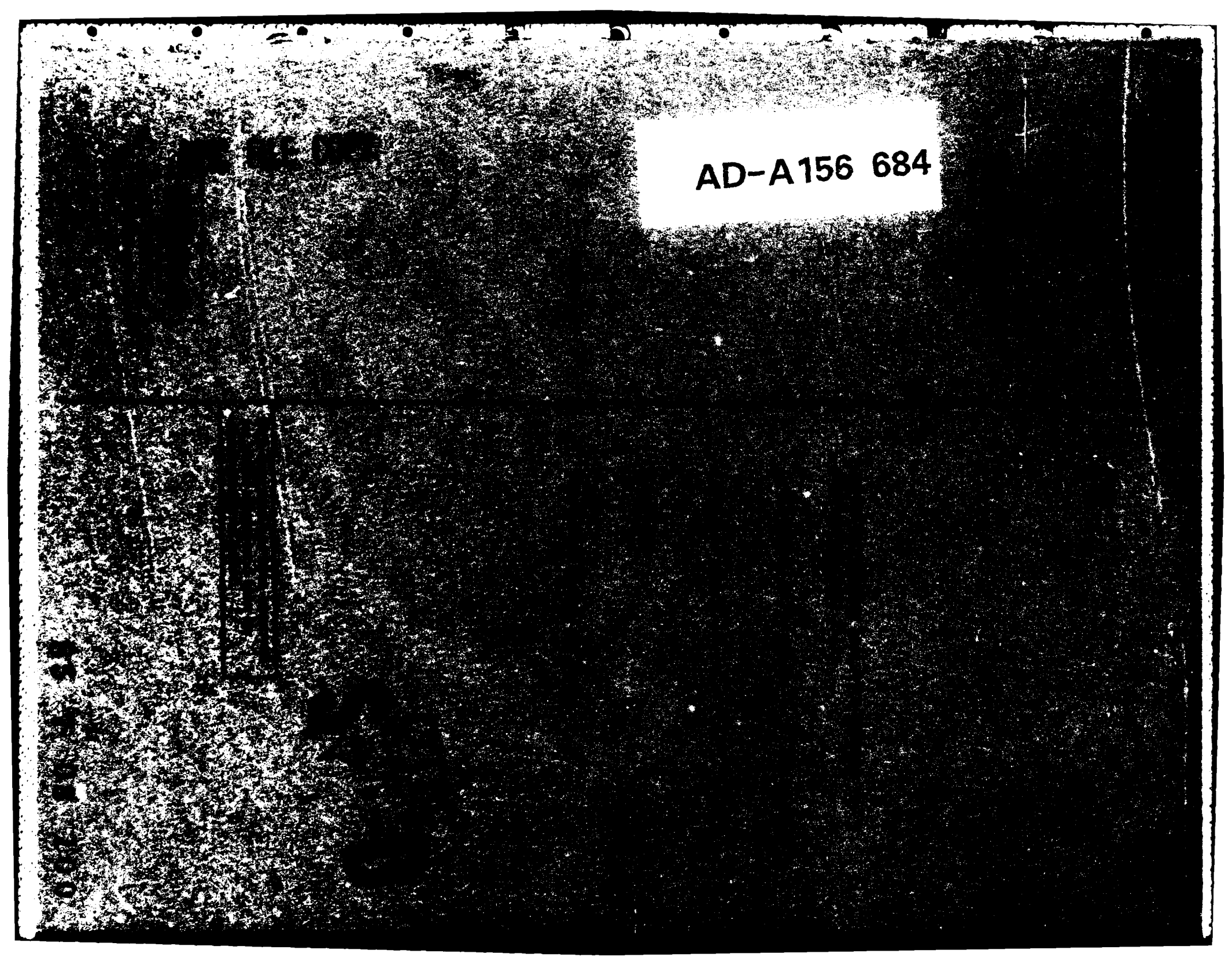
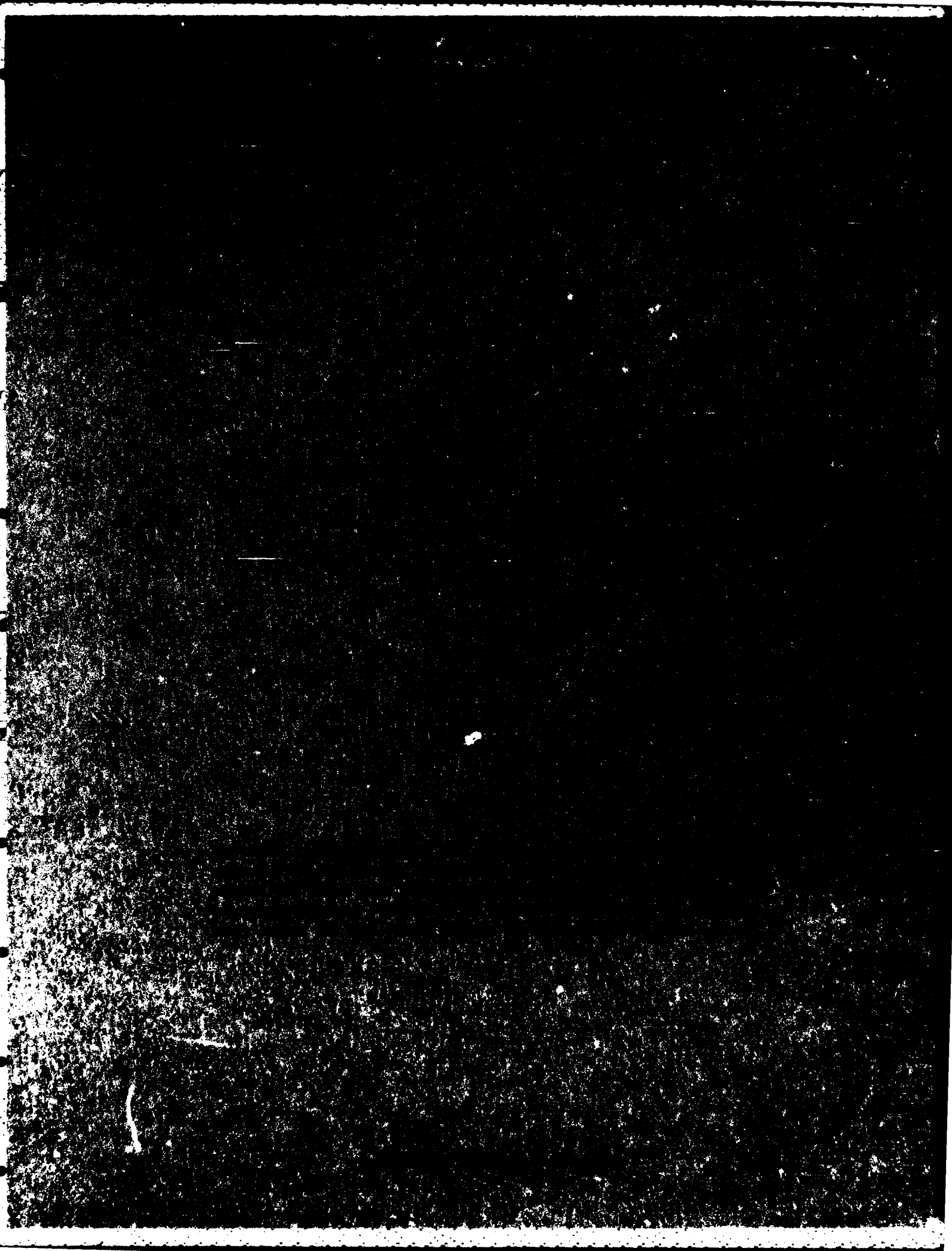
AD-A156 684 IMPROVING INITIAL LOGISTICS SUPPORT TO FOREIGN MILITARY 1/1
SALES(U) RAND CORP SANTA MONICA CA G K SMITH ET AL.
SEP 84 RAND/N-2189-AF F49620-82-C-0018

UNCLASSIFIED F/G 15/5 NL






AD-A156 684



UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER N-2189-AF	2. GOVT ACCESSION NO. AD-A156 684	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Improving Initial Logistics Support to Foreign Military Sales		5. TYPE OF REPORT & PERIOD COVERED Interim 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) G. K. Smith, N. Y. Moore, R. L. Petruschell		8. CONTRACT OR GRANT NUMBER(s) F49620-82-C-0018
9. PERFORMING ORGANIZATION NAME AND ADDRESS The Rand Corporation 1700 Main Street Santa Monica, CA. 90406		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Requirements, Programs & Studies Group (AF/RDQM) Ofc, DCS/R&D and Acquisition Hq USAF, Washingotn, DC 20330		12. REPORT DATE September 1984 13. NUMBER OF PAGES 63
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for Public Release: Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

No Restrictions

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Military Aircraft
Spare Parts
Logistics Support
Fighter Aircraft
Military Assistance

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

See reverse side

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

The primary objective of this study was to devise generalized procedures that would make it possible for the Air Force Logistics Command (AFLC) to provide initial spares support to a Foreign Military Sales (FMS) customer within two years of the Letter of Offer and Acceptance (LOA) without degrading USAF capabilities. The authors broke the overall acquisition process into three mutually exclusive phases: requirements phase, procurement phase, and production phase. They concluded that the requirements phase could be compressed into approximately one year if (1) some of the program manager's work could be completed while the LOA was being negotiated, and (2) the program manager was provided with an automated system for assembling, organizing, and editing the parts lists. To reduce leadtimes in the procurement phase, the authors recommend an interactive status reporting system that would highlight critical delays. Finally, the spares list should be rank ordered to ensure early delivery of the most important items.

A RAND NOTE

IMPROVING INITIAL LOGISTICS SUPPORT TO FOREIGN MILITARY SALES

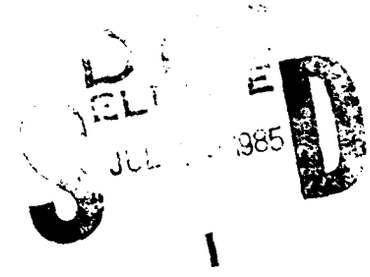
G. K. Smith, N. Y. Moore, R. L. Petruschell

September 1984

N-2189-AF

Prepared for

The United States Air Force



Rand
1700 MAIN STREET
P.O. BOX 2138
SANTA MONICA, CA 90406-2138

PREFACE

When foreign nations buy military aircraft from the United States, they typically also buy certain support equipment and an initial set of spare parts needed to operate the aircraft. USAF policy calls for such support equipment and the initial stock of spare parts to be delivered to the host country before the first aircraft arrives. Deliveries of such aircraft as the F-16 can start about two years after the Letter of Offer and Acceptance (LOA) has been signed, but experience shows that much more time may be needed for the Air Force to order and deliver the initial supply of spare parts and support equipment.

Rand was asked by the Director of International Programs in the Office of the Deputy Chief of Staff (Programs and Resources), Headquarters, United States Air Force (AF/PRI) to examine a variety of possible strategies for accelerating the delivery of those initial spares and support equipment. A briefing on the study results was presented to AF/PRI and other audiences in March and April 1984. This Note describes the study findings and recommendations, and provides supporting data.

This research was conducted under the Project AIR FORCE Resource Management Program study entitled "Methods for Reducing Lead Times in Delivery of Logistics Support to Foreign Military Sales."

SUMMARY

When the United States sells a major weapon system to a foreign customer, it is important to provide spare parts and other logistic support in a timely way. The prime contractor for the F-16 can begin delivering aircraft to a foreign customer within about two years after the Letter of Offer and Acceptance (LOA) is signed, without interfering with ongoing production for the USAF. However, the Air Force Logistics Command (AFLC), which is responsible for providing most Foreign Military Sales (FMS) cases with initial spares and ground support equipment, typically takes from three to four years to complete delivery of that materiel.

The primary objective of this study was to devise generalized procedures that would make it possible for AFLC to provide initial spares support to an FMS customer within two years of the LOA without degrading USAF capabilities (i.e., no diversion of critical USAF items) and without contractor support. The study focused on F-16 sales, but the results should be applicable to other weapon systems.

The analysis was based on a detailed examination of one actual FMS case, known as Peace Vector I, which called for the delivery of 40 F-16s to Egypt. The LOA was signed in June 1980 and the first aircraft was delivered 21 months later.

We focused on the following questions:

- How late were the deliveries of spares, and which items were late?

- o What are the main sources of delay?
- o What can be done to accelerate the process?

For analysis purposes we broke the overall acquisition process into three mutually exclusive phases:

1. Requirements Phase -- starting with LOA signing, through the definitization process, and ending when one or more requisitions are issued for each item.
2. Procurement Phase -- starting upon receipt of a requisition and ending when item is released from existing stocks or a contract is signed for new procurement.
3. Production Phase -- from contract date until delivery of the item from the vendor.

Although the variation from one item to another is large, each of these phases accounts for roughly one third of the total time required for the acquisition process.

We found that in Peace Vector I, delivery of initial spare parts fell well short of the two-year policy goal. Of the approximately 43,000 different stock numbers requisitioned during PV-I, only about 60 percent had at least one delivery within 24 months after LOA. This was true for high-value recoverable items and for low-value stock fund items.

We concluded that the requirements phase offers the most opportunity to reduce the overall time schedule. About 60,000 requisitions were issued during Peace Vector I, but only about 3/4 of them were issued within the first two years after LOA. If the overall

requirements phase in Peace Vector I could have been completed in about one year, with recoverable items mostly requisitioned within the first three months, nearly 90 percent of recoverable items and well over 90 percent of the stock fund items should have been delivered within 24 months after LOA. While not fully satisfying the goal of all initial spares and support equipment delivered in two years, delivery of 90 percent of the items would be an improvement over today's typical performance.

To compress the requirements phase into approximately one year, we believe that two actions would be necessary:

1. Modify certain administrative and funding procedures so that some of the ALC program manager's work could be completed while the LOA was being negotiated, instead of waiting until LOA signature. Such advance work would include assignment of staff for the ALC Program Manager, assembly of parts lists, and preparation for a definitization conference. Such actions should not require a large investment but could save several months during the subsequent requisition phase.[1]
2. Provide the ALC Program Manager with an automated system for assembling the parts lists, organizing them for the definitization conference, editing them during the conference, and issuing the subsequent requisitions.

---

[1] The Defense Security Assistance Agency would have to review such a system before it could provide approval for the in-house, front-loaded administrative concept. This review would also focus on the funding source(s).

The procurement phase of the acquisition process begins when a requisition is issued for an item and ends when the item is either on contract or delivered from stock. Procurement of FMS spares is handled in the standard USAF system and represents less than 10 percent of the total throughput of that system.

There are several paths through the procurement process. In Peace Vector I, over 80 percent of the items (most stock fund items and a few recoverable items) were drawn from inventory or stock. The Item Manager took an average of three months to issue a release from stock although a few items took as long as 27 months to deliver from inventory.

The remaining items requisitioned in Peace Vector I were procured from a vendor. We found that it took from two to eight months from requisition until a contract was signed, although a few items took as long as two years.

We concluded that FMS managers have little opportunity to substantially change the standard AFLC procurement process. However, the waiting time many AFLC items experience for batching and efficiency reasons may not be justified in an FMS case, especially for critical items. The ALC Program Manager could expedite this process and reduce average waiting if made aware of an item's delayed progress. Therefore, to reduce leadtimes in the procurement phase, we recommend:

3. An advanced, interactive status reporting system for the ALC Program Manager that could highlight problem requisitions.

Even with full implementation of the above recommendations, a few items (less than 10 percent) will experience deliveries more than two years after LOA. Aircraft design changes and list revisions will contribute to this problem. Fortunately, most of these late items will have little effect on the host country's initial flying programs. We therefore recommend that:

4. The formal policy goal for delivery of initial spares should be modified, calling for all critical items to be delivered within two years but recognizing that some items might be delayed for another year or so.

Implementation of recommendations 3 and 4 above requires that some rank ordering be made of the parts list in terms of how likely it is that those parts might be needed early in the host country's flying program. Such ranking would be needed by the ALC Program Manager to guide him in selecting the parts for early attention during the definitization and requisition process, and in deciding which parts justify some intervening action if they are delayed during the procurement and production phases. We therefore recommend that:

5. A process should be developed to rank order the initial spares and other items provided by AFLC in a typical FMS case. The ranking should be in terms of the probability that the lack of a particular item would hinder the flying program of the host country during the first year after delivery of the first aircraft.

ACKNOWLEDGMENTS

This study could not have been completed without the generous assistance of numerous people throughout the Air Force Logistics Command. The authors are especially indebted to Mr. Jerry Wilson, Peace Vector I Program Manager, and Mr. Don Leavitt, both of the Logistics Management Branch, Directorate of Materiel Management, at the Ogden Air Logistics Center. Throughout the early phases of the study, Maj. James L. Vick, then assigned to the Directorate of Materiel Management at Ogden, provided invaluable assistance by explaining the detailed operating procedures of the various ALC organizations involved in processing a FMS requisition. Ms. Darlene Talbot, Logistics Management Specialist in the Directorate of Materiel Management at Ogden, helped us understand the H051 data system. Mr. Richard Kirk, then Assistant Deputy for Operations at the International Logistics Center, and Mr. Steve Garrett in the Directorate of International Programs, Hq USAF, provided guidance and assistance throughout the study.

The interpretations and recommendations described in this Note are, of course, the sole responsibility of the authors.

CONTENTS

FIGURES

TABLES

I. INTRODUCTION

When a new major weapon system is procured, it frequently requires three to four years from the time development is started until delivery of the first operational unit and the initial set of spares and support equipment. During normal peacetime procurement, various elements of the program can be planned and programmed several years in advance so that their schedules are consistent with the overall program schedule. However, there are some instances when all phases of a program cannot be planned that far in advance. One such instance, of course, is response to combat needs by the USAF. Another is response to an order from a foreign customer, who is sometimes responding to his own urgent, combat-driven needs. Such instances may impose procurement leadtime demands that are substantially more stringent than those of normal peacetime procurement.

Not all foreign military sales (FMS) orders are that urgent, but they still impose a transient on an acquisition program that has normally been scheduled to run smoothly to supply the programmed USAF needs. In the F-16 program, one of the most popular systems now being purchased by foreign nations, the prime contractor has found it possible to begin delivery of aircraft approximately two years after receipt of an FMS order without disrupting concurrent production for the USAF. However, a fully functional weapon system requires not only the flight vehicle, but also a number of logistic support elements (ground support equipment, spare parts, test equipment, manuals, etc.), training of both support and operating personnel, and a supply of fuel and ordnance.

These components of the overall system are generally supplied through different administrative organizations and have different lead times. In most FMS cases, the Air Force Logistics Command (AFLC) is assigned responsibility for supplying the initial spares and ground support equipment. Using routine planning and procurement procedures, it typically takes AFLC between three and four years to complete delivery of initial spares and support equipment in support of a foreign military sale. The United States could be more responsive to foreign buyers if AFLC could provide initial logistic support within the same two-year time span required for delivery of the basic flight vehicles.[1]

STUDY OBJECTIVES AND SCOPE

The primary objective of this study was to devise generalized procedures that would make it possible for AFLC to routinely provide initial logistic support to a foreign buyer within approximately two years after the Letter of Offer and Acceptance (LOA) had been signed. Further, those procedures should achieve the two-year response time without causing any degradation in USAF capabilities (i.e., without diverting critical items from USAF stock). Schedules much longer than two years pose little problem, and schedules much shorter than that inevitably involve shifting assets from present or programmed USAF inventory.

It seems likely that procedures designed to reduce FMS initial logistic support lead times might also provide collateral benefits to the USAF, in terms of improved readiness or reduced cost of spare parts stockage. Therefore, a secondary objective of the study was to

---

[1] It should also be noted that formal Air Force policy, as stated in AFR 400-3, sets the goal of all spares and support equipment being in place 30 days before delivery of the first aircraft.

highlight those AFLC methods for supporting future FMS cases that would also yield collateral benefits to the USAF.

Two important limitations were placed on the scope of the study. First, we were to examine only situations where the foreign buyer deals with the U.S. government rather than buying directly from a contractor, and where the item being purchased is currently in production for the USAF. Second, we developed detailed data on only one such system, F-16 fighter aircraft, although the results are believed to be sufficiently general so that they could be applied to other systems in the future.

The study was also limited to an examination of initial logistic support provided by AFLC. We did not examine follow-on or replenishment support, nor certain items such as specialized support equipment that are normally provided by the Air Force Systems Command (AFSC). The exact definition of initial logistic support provided by AFLC will vary slightly from one FMS case to another, depending on the needs of the host country, but it usually includes nearly all the items needed to operate the weapon system. Because a host country frequently will not possess the industrial infrastructure and existing stock of supplies that is common in the U.S., an FMS order for initial support equipment usually includes many more items than would be provided to a USAF base upon delivery of a new system type. Initial logistic support provided to a foreign buyer of an F-16 weapon system can involve over 40,000 different stock numbers, including both recoverable and consumable items, with a value of tens of millions of dollars. The identification and procurement of such a collection of items in a timely way obviously represents a sizeable management task.

STUDY APPROACH

The provision of initial logistic support to a foreign buyer involves a number of agencies within the USAF. The "front end" of the process is managed by organizations largely dedicated to FMS, but much of the process of actually acquiring the necessary items is conducted by the same organizations that routinely supply those items to the USAF. A rough initial survey suggested that important time delays were involved throughout the entire process, rather than being concentrated in one discrete function. We therefore organized the research program into three separate issues:

1. How does the actual schedule of deliveries in a representative case compare with the nominal goal of two years? How late are the deliveries, and which items tend to be delivered later than others?
2. What are the main sources of delay in the overall process, starting with LOA signature and ending with delivery of a full set of initial logistic support equipment to the host country?
3. What can be done to improve timeliness?

To address those issues it was necessary to examine at least one FMS case in considerable detail. We needed to understand what was being done by each of the various organizations involved in the process, how long each step of the process was taking, and what the underlying technical and institutional factors were that affected the time delays. We needed to examine a case that most nearly matched the nominal goal of first delivery in two years, and that had proceeded far enough through

the process to provide substantial empirical data on processes and time lags.

The case that most nearly satisfied those criteria was Peace Vector I, an order for 40 F-16 aircraft by Egypt. The LOA was signed in June 1980, and the first aircraft was delivered in March 1982.[2] We obtained the International Logistics Management Information System (H051) data file containing a record of all transactions conducted in Peace Vector I and used that file to reconstruct a detailed history of what actually happened in that case. Almost all of the quantitative data and analysis provided in this Note were drawn from that case.

Figure 1 shows the cumulative delivery history for spares and support items in Peace Vector I. It can be seen that by 24 months after LOA, only about 60 percent of the stock numbers had been delivered. This does not mean that full delivery of each of those stock numbers had occurred, only that at least one delivery had been made for 60 percent of the stock numbers. Furthermore, some parts had not been delivered three years after LOA.

Unfortunately, each FMS case is unique, with many differences between cases depending on the needs and capabilities of the host country and on the desired delivery schedule. Use of a single case study as the main basis for the analysis raises questions about how applicable the conclusions are to other cases. Without attempting to show that Peace Vector I is typical or representative of all FMS cases, it can be argued that it is a suitable basis for this analysis because it includes a complete set of spares, equipment and materiel needed to

[2] In this case the first aircraft was delivered 21 months after LOA, a slightly faster pace than called for in the nominal goal of 24 months adopted for this study. The difference was not important to the study results.

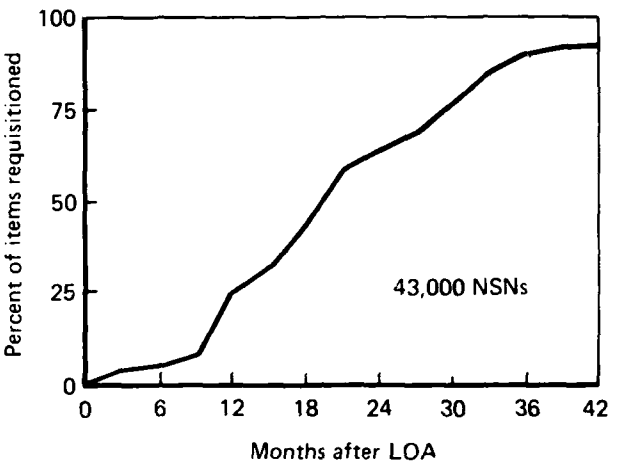


Fig. 1 -- Delivery History
Peace Vector I

support the F-16 weapon system. Egypt has only a small aircraft industry or supporting infrastructure, so nearly every kind of item, ranging from major aircraft components to minor supplies such as windshield cleaning fluid, had to be supplied as part of the initial spares and support provisions. Table 1 summarizes the distribution of item types and values supplied in Peace Vector I (as of January 1984). Thus it seems reasonable to expect that procedures which would have provided timely delivery of initial support to Peace Vector I should also prove sufficient in most other FMS cases with similar overall schedule objectives.

Table 1

PEACE VECTOR I INITIAL SPARES AND SUPPLIES

Spares Type	Stock Numbers (43,000)	Ordered Value ($70 million)
Support equipment	2%	1%
AF recoverable	4%	72%
Stock fund	77%	19%
Other[a]	17%	8%
Total	100%	100%

[a] "Other" includes contracted services, documentation, and all items supplied through AFLC that do not fit into the three main categories.

REPORT ORGANIZATION

This Note comprises five main sections. Section II provides an overview of the organizations and procedures used to identify and procure spares and support equipment for an FMS case, and briefly describes the overall delivery schedule performance achieved by those organizations and procedures in the Peace Vector I case. Sections III, IV, and V then describe in some detail the three main phases of the overall process, showing the time typically required to complete each phase, why that much time is required, and what actions might be taken to reduce each element of delay. Section VI summarizes the study's conclusions and recommendations. The appendixes present additional details about the spares procurement process at the Air Logistic Centers and the associated data systems.

II. FMS SPARES ACQUISITION PROCESS

The process of supplying a set of initial spares and support material for a foreign military sale formally begins with the signing of the Letter of Offer and Acceptance (LOA).[1] At that time the U.S. Government has a binding contract with the host country. In the case of aircraft and certain other kinds of weapon systems, the Air Force is appointed to serve as the executive agent for the procurement and delivery of the materiel and services specified in the LOA. Hq USAF typically issues the necessary management directives and associated funding authority to the Air Force Systems Command (AFSC) to supply the prime items, and separate management directives and funding authority to the Air Force Logistics Command (AFLC) to supply the initial spares and other materiel and services needed to support the aircraft. In this study we are concerned only with the consequent activities of AFLC in providing initial spares and support equipment.

The task of identifying and supplying the initial spares and support equipment is delegated by Hq AFLC to the Air Logistics Center (ALC) that is responsible for managing that particular weapon system.[2] There an ALC Program Manager is appointed to be responsible for that particular FMS case.[3]

---

[1]Both formal and informal discussions begin well before this and lead up to the LOA signature. Some preplanning and even spares procurement may also begin before LOA signature.

[2] The F-16 weapon system is supported through the Ogden Air Logistics Center at Hill AFB, Ogden, Utah.

[3] For every USAF weapon system there is an AFLC System Manager located at the appropriate ALC. For systems being sold to foreign buyers, the AFLC System Manager creates within his organization an FMS office that is supported by FMS funds. The ALC Program Manager and his staff are organizationally attached to that FMS office.

To start things in motion, the ALC Program Manager must be authorized to begin work on the case, funds must be certified, and staff acquired. The process ends with the delivery of the spares to a freight forwarder for shipment to the host country.

THREE MAJOR PHASES

For analysis purposes, we have found it convenient to break the overall process into three separate phases: the Requirements Phase, the Procurement Phase, and the Production Phase (see Fig. 2).[4] Although the variation from one item to another is large, each of these phases accounts for roughly one third of the total time required for the acquisition process. Each phase is briefly described below, with a more thorough description contained in the following sections.

The Requirements Phase

The requirements phase comprises three main elements. First, it is necessary for the ALC Program Manager to obtain a list of all of the parts represented by the weapon system. That list must include not only the appropriate stock number but also the quantity that is believed to be needed by the host country, the lead time that is expected to be required to purchase and deliver that part, and the likely price of the part.

---

[4] We recognize that the nomenclature used to describe the second phase is slightly contrary to standard Air Force usage. The Item Manager is not normally considered a part of the procurement organization at an ALC. In this study it was more convenient to include the Item Manager in the procurement process because that allowed us to make the distinction between the first two phases coincide with an important organizational division, that between the FMS organization and the standard ALC elements that manage and procure spare parts for USAF as well as FMS.

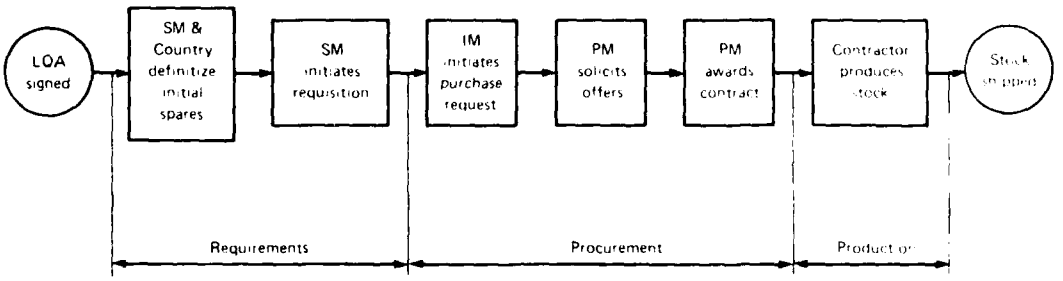


Fig. 2 -- FMS Initial Spares Acquisition Process

Given that list of potential spare parts and other supplies, a definitization conference is held in which the ALC Program Manager and the host country representative go over the list and decide which, and how many, of each shall be ordered, and establish a required availability date (RAD) which tells the item managers and buyers when the item is needed.

Finally, the ALC Program Manager issues one or more requisitions for each of the stock numbers that is to be procured. With some 43,000 items to definitize and requisition, it is not surprising that the process is not completed in a few days.

The Procurement Phase

The procurement phase of the Acquisition Process begins when a requisition is issued for an item and ends when the item is either on contract for procurement or delivered from stock. Unlike the requirements phase, which is largely the province of the FMS organization at the ALC, procurement of FMS spares and materiel is handled in the standard USAF system. FMS orders are processed right along with USAF orders. Frequently, spares for an FMS customer and for a USAF customer will be bought on the same contract. The FMS order will be identified as a separate contract line item and will be separately funded but, other than that, will usually receive no special treatment. FMS items generate only a small fraction of the procurement workload at an ALC--5 to 10 percent of the requisitions processed.

The Production Phase

The Production Phase starts when a contract to manufacture the item is awarded and ends when the item is delivered to the Freight Forwarder for shipment to the FMS country. Basically, this is the time required to manufacture the particular part.

ITEM CLASSIFICATION

The initial spares for any FMS case consist mostly of two distinctly different kinds of items: high-value, small-quantity items, and low-value, large-quantity items.

Order quantities of one or two units and unit costs ranging from $100,000 to $1 million are typical for the high-value, low-quantity items. While there may be exceptions, these items are generally

included in D041, the AFLC Recoverable Consumption Item Requirements data system. These items generate a large fraction of the total initial spares dollars (perhaps as much as 75 percent) but a small fraction of the total acquisition workload (less than 10 percent of the requisitions). These items also have the longest acquisition lead times--sometimes as much as 3 years or more.

The low-value, high-quantity items, on the other hand, typically have unit costs of less than $10, although some have unit costs of a few thousand dollars. Except for the most expensive items, these may be ordered in lots of several hundred or more. These are the Economic Order Quantity (EOQ) items managed by the AFLC EOQ requirements system (D062) and procured through use of the Air Force Stock Fund. The notion of a stock fund is that the fund will buy in quantity to maintain an inventory of items that can be drawn down by the user when he needs the item. In this way, the fund obtains the price benefits of quantity purchases. Users pay the fund for the items they use when they obtain them and the fund uses these revenues to replenish its inventories. Typically, stock fund items have rather short lead times--months or sometimes even days--because they are usually delivered directly from the fund's inventory.

The Air Force Stock Fund, in turn, frequently obtains its stock from the Defense Logistics Agency (DLA), the General Services Administration (GSA), and other service stock funds. The items procured directly by the Air Force tend to be more specialized and higher value than the nuts and bolts typically supplied through DLA and GSA. Although all such items are technically part of the Air Force Stock Fund, in this analysis we will often separately identify those items obtained by other agencies as "non-AF stock fund."

Many different items will be obtained from the stock fund to provide initial spares for a typical FMS customer-- typically, about three fourths of the requisitions for spares are for these items. On the other hand, the total value of the stock fund items is small--on the order of one fourth of the total. Thus, a significant part of the FMS workload involves ordering large numbers of relatively low-value items.

KEY INFORMATION SYSTEMS

The primary data system for Foreign Military Sales is H051, the International Logistics Management Information System. It provides central control for management of security assistance programs assigned to AFLC. As a management information system for FMS cases, H051 provides case financial tracking as well as requisition validation, routing, and tracking. H051 interfaces with many other data systems including J041 (the Acquisition and Due In System), D032 (the Item Management Stock Control and Distribution System), D043 (the Master Item Identification and Control system), and H075E (the Foreign Military Sales, Grant Aid Centralized Delivery Reporting Systems). As a result of its interfaces, H051 is a rich source of detailed information on requisition status and deliveries, as well as money spent.

H051 produces a number of reports, some automatically and others by special request. We used the Consolidated Status Report (R058) "history" format that lists all open and closed requisitions against a particular FMS case. It contains supply status, shipment status, and delivery reports.

III. THE REQUIREMENTS PHASE

After the LOA has been signed and funds have been allocated for procurement of initial spares and support equipment, the first task is to identify which items are to be supplied, how many of each, and when they should be delivered. We refer to this portion of the overall process as the requirements phase. This phase is performed largely by the ALC Case Manager and his staff, together with representatives of the host country.

PHASE DESCRIPTION

The ALC Program Manager must first assemble a small staff of people who will normally be assigned to that particular FMS case throughout the requirements phase. This requires not only that funds be available, but also that manning authorizations be obtained and people with the necessary skills be transferred to the case staff.

Parts Lists

After assembling a staff, the next step is to obtain a "shopping" list of all of the parts represented by the weapon system. One would think that such a list would be readily available--particularly for an existing Air Force weapon system such as the F-16 that is well established in the USAF inventory and has already had a number of FMS sales. However, this is not the case. AFLC is organized according to broad categories of equipment (e.g., engines, landing gear, radar systems) and not according to weapon systems. Therefore, a list of all parts for a particular weapon system must be drawn from many different

elements of the AFLC organization. Furthermore, because the detailed configuration of a weapon system is continually changing, any list of system parts has to be updated periodically, and aircraft supplied to an FMS customer are usually configured slightly different from models being concurrently produced for the USAF. Another reason is that a foreign buyer frequently lacks the industrial infrastructure that exists in the U.S., and the list of parts and suplies provided to such a buyer may contain many items that a USAF F-16 base would obtain locally rather than through the USAF supply system. Consequently, a parts and supplies list must be created for each FMS case.

Because different kinds of parts and supplies are provided through a number of different USAF and other government organizations, several separate lists must be obtained and amalgamated by the ALC Program Manager. Each list must contain item identification, expected unit price, and suggested quantity for the particular FMS application. The quantity should reflect the FMS customer's particular needs based on his own operating environment, aircraft inventory, and expected flying program. The ALC Program Manager is responsible for supplying programmatic information of this kind to the preparer of the individual lists. Because it takes so long to obtain all of the necessary lists, final definitization is usually accomplished in several steps corresponding to the availability of the individual lists.

In Peace Vector I the ALC Program Manager purchased lists of Contractor Furnished Equipment (CFE) and aircraft and engine spares from the prime contractors. Lists of parts for Government Furnished Aerospace Equipment (GFAE) posed a much different problem. Subsystems must first be identified and, from them, lists of relevant parts must be

developed. The ALC Program Manager pulls together the list of subsystems, drawing on whatever help is available to him locally. Different ALCs have item management responsibility for different subsystems, so the Case Manager must request lists of probable GFAE spares requirements from several ALCs.

One of the more difficult and time-consuming lists to obtain is the Common/Bulk Items List (CBIL). The CBIL identifies the many "hardware store" items such as nuts and bolts, springs, washers, paints, lubricants, cleaners, etc., that will be needed to provide initial support for the FMS aircraft in the host country. Included in this list are literally thousands of typically low-value stock fund items. Each item must be separately identified, definitized, and requisitioned. At present, the practice is to prepare a USAF CBIL, based on the number of aircraft to be supported, to obtain relevant items and then to scale the quantities to suit the needs of the specific FMS customer.

The Standard Support Equipment Spares list poses still another kind of problem. "Standard" support equipment consists of relatively common tools, meters, and other measuring devices, basic test instruments, etc. Most of this equipment is available on the open market in the U.S. and when replacement parts are needed they are either purchased locally or ordered directly from the manufacturer of the equipment. The Air Force does not maintain any inventory of spares or records of consumption data from which to estimate the requirements of an FMS customer for these items. However, the typical FMS customer does not have ready access to the suppliers of this equipment and so must be provided with inventories of the necessary spare or replacement parts for the standard support equipment ordered.

To obtain a list of spares for standard support equipment, the ALC Program Manager first determines what items of standard support equipment will be ordered by the FMS customer. Because standard support equipment consists of generic items (i.e., same specifications but several manufacturers), the case manager must wait until the items are on contract (or delivered, if released from stock) to identify them more specifically before asking the item manager to assemble a list of parts. On receipt of these requests from the ALC Program Manager, the equipment specialists at the various ALCs not only must prepare lists of which parts should be stocked by the FMS country, but also must estimate how many of each part to stock. With no formal records of USAF experience to consult, this task is formidable at best.

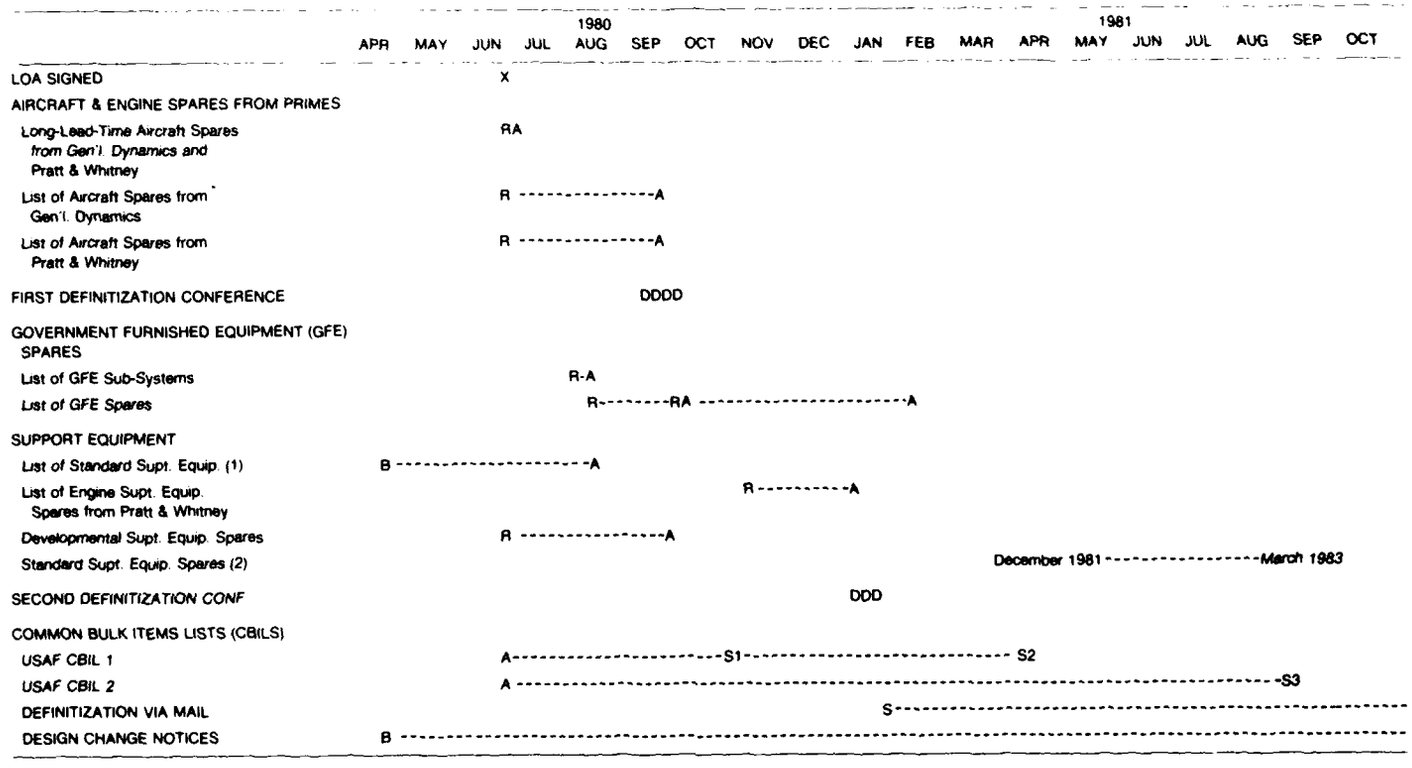
The ALC Program Manager is further hampered because the process of pulling all of these lists together is quite informal. Coming from so many different sources and at such different points in time, lists are rarely obtained in the same format. Some are received in computer readable form, others are hard copy computer output, and some are even handwritten. Format and content vary widely from list to list. The ALC Program Manager must pull all of these diverse data together, check for omissions, evaluate recommended quantities and prices, edit for correctness of stock numbers, etc., to prepare a final list or lists that are suitable for use at a formal definitization conference.

The problem of preparing aircraft spares lists is further complicated by the fact that the aircraft configuration is dynamic. Given the time required to obtain the lists, it is certain that between the time a list is requested and the time it is used in the

definitization conference, some of the items on the list will have become obsolete and other items not on the list will be required to replace them. An extension of this problem comes from the fact that the FMS customer frequently receives aircraft in several different configurations. For example, of the 40 F-16 aircraft delivered in PV-I, no more than three had exactly the same configuration. The ALC Program Manager must continuously interact with the prime contractors and the FMS customer to keep the lists current and to advise the customer of required changes. The bookkeeping task alone is enormous.

Figure 3 shows the time-phasing of the major elements in PV-I's definitization and requisitioning process. The length of each bar represents the time required to prepare the parts list. Note that preparation of the list of Standard Support Equipment spares began some two months prior to the signing of the LOA. These spares were identified as long-leadtime items based on the experience of previous FMS cases.

Upon signing of the LOA, the ALC Program Manager for Peace Vector I obtained lists of aircraft (F-16A/B) and developmental support equipment spares and engine (F-100) spares from General Dynamics and Pratt & Whitney, respectively. Each manufacturer responded within several weeks with a list of long-leadtime items. The remainder of the lists, comprising some several thousand items, took over two months to assemble. At that time the first definitization conference was held, resulting in a flow of requisitions for high-value, long-leadtime items soon thereafter.



NOTES: A – Available on this date.
B – Started preparation on this date.
D – *Definitization conference* on this date.
R – Requested on this date.
S – Started definitization through mail.
S1 – Sent updated list to Eqypt for review.
S2 – Hand carried another list to Eqypt. First one lost in Eqypt.
S3 – Sent factored USAF CBIL 2 to Eqypt.

(1) Long lead time items ordered during June and July.
(2) Not normally included in a FMS. Waited until end item shipped before ordering spares.

Fig. 3 -- Assembly of Support Items Shopping Lists
Peace Vector I

Assembling the lists for the remainder of the spares took considerably longer. Figure 3 shows that lists for government-furnished equipment and support equipment, and for support equipment spares, were not ready until late in 1980--about five months after LOA signature. A second definitization conference for those items was held in January 1981.

The Common/Bulk Item Lists (CBIL), primarily for stock fund items, took until the middle of 1981 to fully prepare. Definitization of those lists with Egypt was still ongoing nearly three and a half years after the LOA was signed. Standard support equipment spares, which are not typically stocked by the USAF, were also still being definitized at that late date. Because these spare parts are very dependent on the make and model of the support equipment, the case manager waited until the equipment was delivered before ordering spares.

Definitization Conference

After at least a portion of the overall parts list has been assembled, the ALC Program Manager conducts a definitization conference. This conference includes representatives of the FMS country, contractor personnel, people from relevant USAF operating commands, and anybody else that can contribute to the decision on exactly how many of which items the country will order.

Because of the long lead times necessary to obtain the requisite lists and to pull them into shape for definitization, the actual definitization with the country representatives is usually conducted in phases. For example, the case manager may receive both approval and funding from the host country to go ahead and issue requisitions for

high-value, long-leadtime aircraft and engine spares prior to any formal definitization. The first formal definitization conference for Peace Vector I was held soon after receipt of the CFE aircraft and engine spares list from the prime contractors. Later, when the standard support equipment spares lists were obtained, another formal conference was called to definitize those spares. Still later, the CBILs were definitized--largely through the mail and without any formal conference.

Requisitions

After the definitization process has yielded agreement on a particular item to be ordered, the next step is for the ALC Program Manger to issue a requisition for that item. Each requisition contains the stock number, the quantity required, a required availability date (RAD), and a priority. The requisitions are entered into HO51, the FMS data system. HO51 forwards each requisition to the Item Manager at the appropriate ALC. This completes the requirements phase and thereafter the ALC Program Manger's role becomes primarily that of a monitor.

TIME DELAYS

How long did the requirements phase take in Peace Vector I? A time history of cumulative requisitions issued is shown in Fig. 4. It can be seen that only about 3/4 of the 60,000 requisitions were issued within the first two years after LOA.

As noted earlier, several distinct kinds of items are included in a set of FMS spares: high-value recoverable items, support equipment, stock fund items, etc. The recoverable items constitute only a small fraction of the total, but those items generally require a relatively long production leadtime. Conversely, stock fund items normally have no

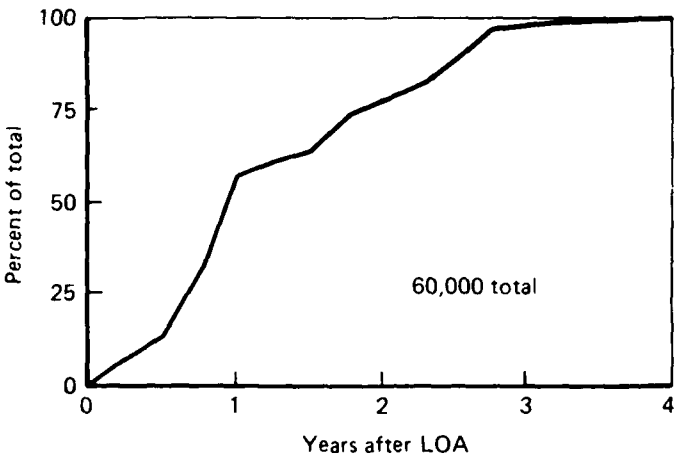


Fig. 4 -- Requisitions Issued
Peace Vector I

"production" time, and the total time to delivery after a requisition is issued is relatively short. Is there any opportunity to shorten the overall delivery schedule by more optimally phasing the requisition work load?

Figure 5 shows the stream of requisitions in Peace Vector I for three kinds of items: recoverable, Air Force stock fund, and stock fund obtained from other agencies (DLS, GSA, etc.). It can be seen that the recoverable items were requisitioned first, with half the total being issued within seven months after LOA. Requisitions for the lowest-value items (stock fund items from other agencies) did not begin to build up in appreciable quantities until about eight months after LOA, and it was not until 19 months after LOA that half of them had been

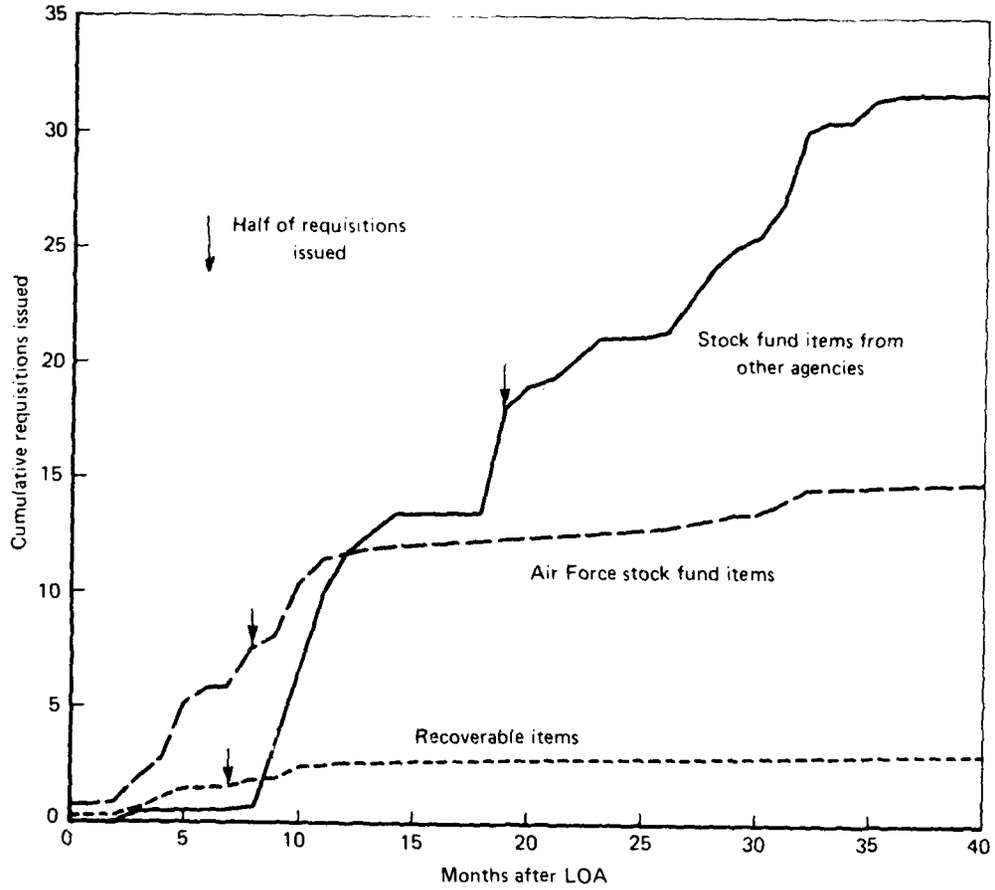


Fig. 5 -- Requisitions Issued
By Class Of Item

issued. The items drawn from the Air Force stock fund tend to be intermediate between the two extremes in overall production and delivery lead time, and half the requisitions for those items had been issued eight months after LOA.

Three things are apparent from Fig. 5. First, the ALC Program Manager appears to have distributed his effort across the different kinds of items in a reasonable manner, and little time could be saved by merely revising that phasing.

Second, the requisition activity in the later months was dominated by the non-Air Force stock fund items. Requisitions for all other items were largely completed within the first year after LOA, but a substantial stream of requisitions for non-AF stock fund items was still being issued a full three years after LOA. Furthermore, this display again calls our attention to the degree by which those non-AF stock fund items dominated the requisition phase work load, involving as they did slightly over half of the total requisitions issued.

Third, all of the requisition schedules have a "tail." Even three years after LOA, several dozen requisitions were being issued each month for recoverable items, and over a hundred per month for all stock fund items. This continuing requisition workload stems from several sources, including changes in aircraft configuration, correction of errors, and response to new requests from the host country. We will return to this characteristic of the process in Sec. VI.

One thing stands out from our examination of the definitization and requisition process during Peace Vector I. The assembly of a definitive, comprehensive, and up-to-date list of parts covering an

entire FMS case, the definitization process, and the issuance of the consequent requisitions needs to be significantly accelerated in order to ensure a more rapid delivery. In Peace Vector I that process was still going on 3-1/2 years after LOA signature.

OPPORTUNITIES FOR ACCELERATING THE PROCESS

We observed that the requirements phase begins slowly. AFLC cannot assign manpower to a case until funds are available, and such funds are rarely available until after the LOA is signed. Once manpower is assigned, the staff begins the laborious tasks of purchasing and assembling many lists from many sources, editing the lists during definitization, writing the requisitions, and canceling and reordering items with design changes. We further observe that this complex process is largely manual, at least for the F-16. Even the process of writing the nearly 60,000 requisitions was performed mostly by hand during Peace Vector I. It is to AFLC's credit that they perform as well as they do given the conditions going into a case.

We see no opportunity to eliminate any of the functional steps accomplished in the requirements phase: up-to-date lists of items must be assembled, definitization must be performed, and requisitions must be issued. However, the process can be accelerated. First, manpower and funding authorizations should be provided earlier in each case so that the case manager can initiate the list processing even before LOA signature, and start the definitization process immediately after the LOA signature.

Second, the preparation of lists and the issuance of requisitions should be standardized and automated in order to speed the process and to eliminate costly and time consuming errors. A set of computer

programs should be prepared to bring those lists into a common format. Another set of computer programs is needed to summarize and manipulate the lists for use during the definitization conference. Lastly, the computer should be used to automatically prepare and issue the requisitions.

To accelerate future FMS cases we recommend that manpower and funds be authorized earlier, before final LOA signature, so that the definitization conferences can be held earlier. Furthermore, both the list management system and requisitions issuance should be automated. The IWIPS program being used at the San Antonio ALC is a step in this direction. The Ogden Air Logistics Center has also initiated some modest steps in the same direction. However, the task is relatively large. Some investment over a period of years, and initiative by the Air Force Headquarters FMS staff, will be required. Lastly, even relatively short-leadtime spares, like stock fund items, should be requisitioned earlier to ensure timely delivery.

IV. THE PROCUREMENT PHASE

The procurement phase of the acquisition process begins when a requisition is issued for an item and ends when the item is either on contract or delivered from stock. As noted earlier, procurement of FMS spares is handled in the standard USAF system and represents less than ten percent of the total throughput of that system.

PHASE DESCRIPTION

There are three distinctly different paths through the Procurement Phase, as illustrated in Fig. 6. The actual distribution by type of procurement action for Peace Vector I is shown in Table 2. Each of

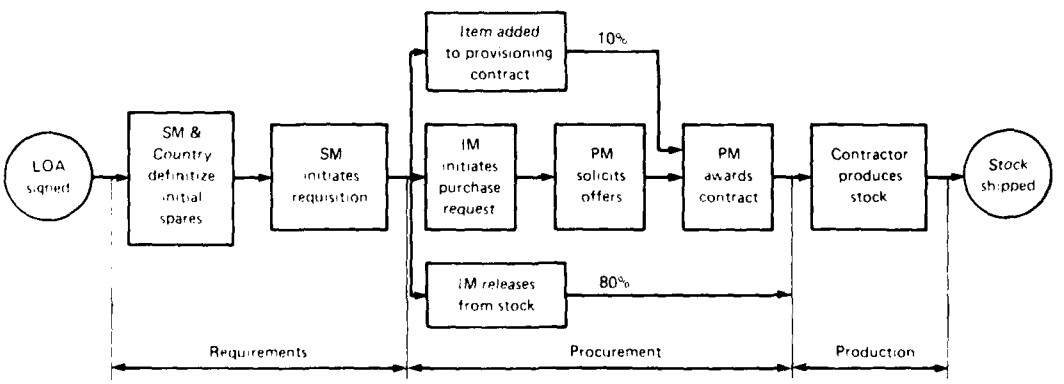


Fig. 6 -- Procurement path options

Table 2

DISTRIBUTION OF PROCUREMENT PHASE PATH:
PEACE VECTOR I

Path	Number of Requisitions	Percent of Total Sample
Draw from stock or release from inventory	35,288	84.0
Breakout Procurement	2,677	6.4
Provisioned Item Order	4,028	9.6
Total	41,993	100.0

NOTE: These data represent the sample (70% of total) where the necessary process dates were included in the H051 record.

these three paths is described below.

Delivery From Inventory or Stock

Each Item Manager is responsible for managing the Air Force inventory of a class of items. When a requisition is issued, the Item Manager checks to see if the required quantity is in long supply in the USAF inventory. Long supply means that USAF has a surplus either in inventory or due into inventory. If in long supply, the item manager will issue a release from inventory and the required quantity, when it is actually available, will be sent to the freight forwarder as illustrated by the bottom path in Fig. 6. Not surprisingly, this is the shortest path through the procurement phase if sufficient items are in or due into the Item Manager's inventory. About one fourth of the high-

value recoverable items and support equipment spares were supplied in this manner during Peace Vector I.

By their very nature, most stock fund items end up being delivered from stock. The USAF policy and other government agencies' policy on stock fund items is to buy them in economic order quantities and to reorder so that the next shipment should arrive before the remaining stock is depleted. About 90 percent of the stock fund items delivered during Peace Vector 1 were drawn directly from stock. Consequently, only about 16 percent of the items delivered during Peace Vector I had to be procured directly for that case.

Breakout Procurement

If the item is not in long supply, the Item Manager will verify that funds are available from the FMS customer's account, have the necessary funds earmarked, and issue a Purchase Request (PR) for the specified quantity of the item. This path is referred to as "breakout" contracting because it involves going through the normal competitive bidding processes. For other than stock fund items, this is considered the normal process, and about 6 percent of the items in Peace Vector I were obtained via this route.

Following the breakout path can be relatively time-consuming. On receipt of an FMS requisition, the Item Manager may wait and batch the FMS order with an Air Force order for the same item. This is usually done to increase the quantity ordered and thereby obtain a lower unit price. On receipt of the PR, the buyer prepares solicitations, which are sent to qualified contractors. The interested contractor or contractors respond to the solicitations by submitting bids. The buyer evaluates the bids for price, leadtime, performance capability, etc.,

and selects a contractor. The buyer then negotiates a firm price with the selected contractor. When agreement is obtained, a formal contract is awarded. Like the Item Manager, the buyer may also hold individual PRs to batch orders and thus receive a better contract price.

Provisioned Item Order

In the "breakout" process described above, it usually takes the buyer several months to negotiate a contract. For urgently needed items, or items that are expected to require a long production time, it is sometimes possible to reduce the procurement phase process time by resorting to a provisioned item order (PIO). This is an open-ended contract, normally placed with the prime system contractor during the development phase for the purpose of procuring spare parts that have not yet been fully identified and therefore are not suitable for breakout contracting. Once such a contract is available, additional items can be added in only a few days time, but with the disadvantage that the order is placed, and sometimes the item is delivered, before a price is agreed to. Thus the provisioning method largely bypasses the procurement step, and the order is essentially passed directly from the ALC Program Manager to the contractor, as shown by the top path in Fig. 6. Although the prime is responsible for delivering the items, they may be manufactured by either the prime or a subcontractor.

While provisioning contracts have been used to purchase FMS spares in the past, their use is currently frowned on and future use for FMS is discouraged primarily because placing an order on a provisioning contract is tantamount to awarding an unpriced contract. In an FMS case, this process is typically resorted to only for a few high-value parts that have long procurement leadtimes and when USAF stock levels

are not adequate to permit diversion from existing supply. In Peace Vector I nearly ten percent of all items were procured via a PIO. The selection of which items are to be procured via a PIO is made by the ALC Program Manager and the country representatives after consulting with the appropriate Item Managers to determine which items are likely to be delivered late if normal methods are used.

TIME DELAYS

The time required to move through these various steps varies widely from item to item and depends, in part, on the path taken. An overall summary of average time lags, and the maximum time lag for each segment, experienced in Peace Vector I are shown in Fig. 7.

The shortest path through the overall process is obviously to draw from stock because that obviates the need for a subsequent production phase. On average it took about 3 months for the Item Manager to order a release from stock, although a maximum of 27 months was observed in Peace Vector I.

For the relatively few items procured through a conventional breakout contract, it took an average of 3 months for the Item Manager to issue a purchase request and another 5 months for the buyer to negotiate a contract. The overall procurement phase delay was thus an average of 8 months, although a maximum of 24 months was observed in Peace Vector I. For the items procured on a PIO it took an average of 2 months to add the item to an existing PIO, but a maximum of 22 months was observed in Peace Vector I.

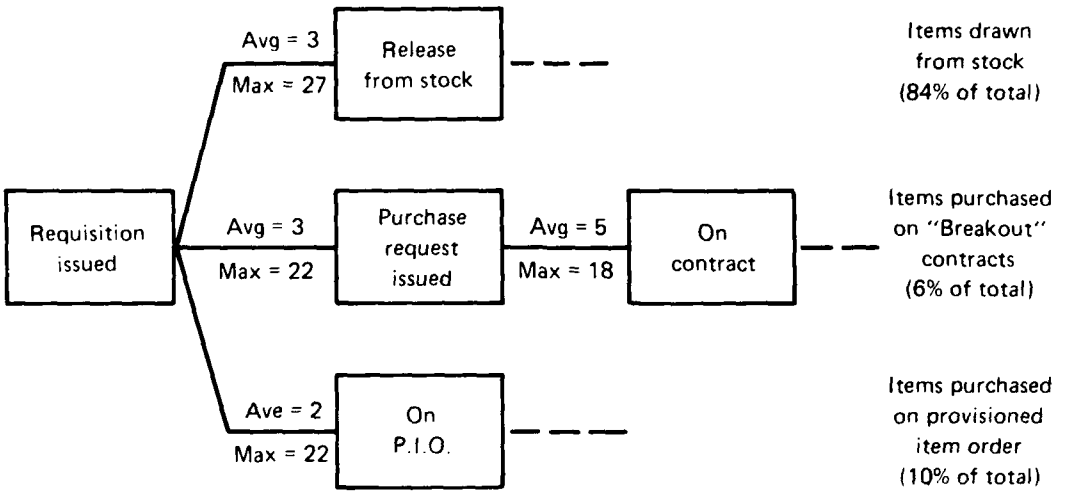


Fig. 7 -- Time delays during procurement phase

OPPORTUNITIES FOR ACCELERATING THE PROCESS

Because FMS requisitions are a rather small part of the overall AFLC procurement workload, FMS managers have very little opportunity to substantially change the process. Furthermore, most of the requisitions are processed through this phase in an average of 2 to 3 months (except for the relatively few items procured on a breakout contract, and those typically took a total of about 8 months). However, sometimes the process seems to bog down and large time delays are incurred.[1] The overall problem of time delays during the procurement phase can thus be localized to that of identifying the relatively few requisitions that are not being promptly processed, so that the ALC case manager can then take corrective action.

To perform such a monitoring and problem identification task, the case manager needs more visibility into the progress of each requisition as it works its way through the procurement phase. Currently, the procurement phase has no automated information feedback system. H051 does track the status of a requisition, but its reports are not stratified or timely enough to flag problem requisitions at each step of the process. For example, a few requisitions in Peace Vector I required two years to be processed through the procurement phase. If the case manager had a better mechanism to automatically monitor the progress of requisitions and flag problems (e.g., requisitions with no PR after 4

[1] There is no intent here to imply that procurement personnel are performing inadequately or improperly. A brief review of some item histories suggested that there is usually a logical reason why each action was taken. However, the objectives and decision criteria applied by the personnel throughout the process vary from time to time and from organization to organization, and are not necessarily the ones that would be applied by the ALC Program Manager.

months) he could rely on ad hoc work-arounds to solve the problems. Some may be as simple as changing the item's priority or calling the Item Manager and requesting that the PR be issued immediately. Other solutions may be more complex, such as diverting from Air Force stock.

It is theoretically possible to obtain such information from H051, but the current process is too cumbersome (e.g., searching through thousands of lines of detailed output) for the case manager to use on more than a very few items. The case manager needs an online interrogative capability to ask very specific questions, such as, What requisitions have a revised required availability date (RAD) that is after first aircraft delivery?[2]

We recommend that a more useful reporting system be devised which the case managers could tailor to their own particular needs. Existing data systems could be extended to provide this capability. The new SAMIS system should include at least some of the capability and report formats that we believe are necessary, but in its present form it will almost certainly be inadequate to fully satisfy the ALC Program Manager's needs.

---

[2] It is important to note that a Required Availability Date is specified by the ALC Program Manager when he issues a requisition, but that date can be changed by the Item Manager without approval, or even awareness, of the ALC Program Manager.

V. THE PRODUCTION PHASE

The Production Phase starts when a contract to manufacture the item is awarded, and ends when the item is delivered to the freight forwarder for shipment to the FMS country. Requisitions that require purchasing items either via a provisioned item order (PIO) or a breakout contract must go through this production phase. Almost all of the high-value parts are obtained in this manner, and those parts tend to have a relatively long production leadtime, so this phase has traditionally received major attention during any attempt to accelerate the spares procurement process.

TIME DELAY

The production leadtime of any particular part may vary considerably, depending on how busy the contractor is with other work, how many vendors are involved and how busy they are, how long it has been since that particular item was last manufactured, etc. However, the aggregate distribution of leadtimes over a wide variety of items does not change much from year to year.

A typical distribution for the production leadtime of recoverable items from the D041 data system is shown in Fig. 8. It can be seen that roughly 10 percent have lead times of 18 months or greater. This obviously poses a serious problem if one is trying to deliver the parts in two years or less, while allowing some realistic time for the requisition and procurement phases.

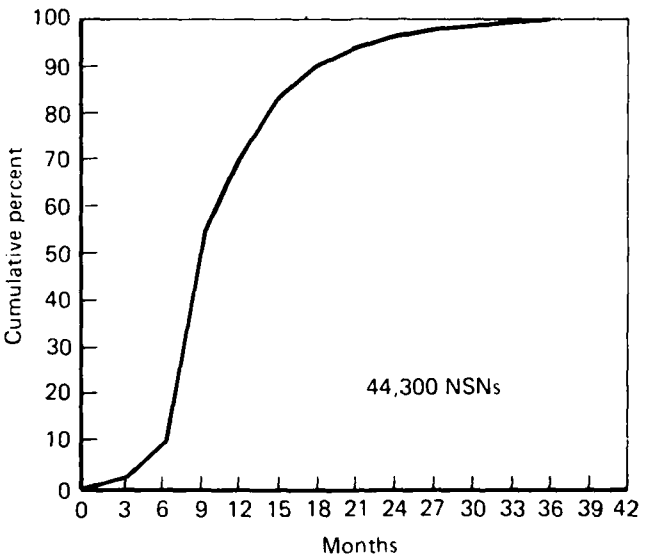


Fig. 8 -- Distribution of production leadtimes

OPPORTUNITIES FOR ACCELERATING THE PROCESS

During the past few years there has been considerable research on and debate over the general topic of industry responsiveness to military production needs. Much of that debate has focused on strategies for ensuring that key industry members remain economically healthy and that adequate tooling and other process capacity exist for meeting anticipated military production needs. Those strategies are considerably beyond the scope of this study, leaving only one remaining class of "solution" that might be effective in reducing FMS production leadtimes: the creation of inventories that could be drawn from when necessary to meet FMS needs.

We examined in some detail several different approaches to the idea of establishing a special inventory of certain long-leadtime items so that they would be available when necessary in response to an FMS order. Such an inventory might be established by simply increasing the nominal stock level maintained for USAF needs, or a special inventory might be established which would consist only of FMS items.[1]

One problem with such an inventory of finished items is that there is a turnover of some stock numbers as the airplane configuration evolves, and every year some of the items stocked would become obsolete. We therefore examined the possibility of creating an inventory of only the early work-in-progress at a vendor's plant, such as the procurement of long-leadtime castings. Such a strategy is theoretically possible and it would somewhat reduce the dollar loss due to obsolescence, since only part of the product would have been manufactured. Furthermore, a design change would not always affect that portion of the product that had been processed and held pending a future FMS order.

However, all such inventory strategies share one common characteristic. It is necessary to predict the identity of the long-leadtime items, and to initiate some stockpiling actions, possibly years in advance of actual need. As we worked with this general strategy, it became more and more apparent that such predictions cannot be made with the necessary degree of precision. One reason is that engineering design changes are constantly being made in the weapon system, even a system as mature as the F-16A/B. For example, anecdotal evidence from

---

[1] Congress has provided a Special Defense Acquisition Fund for the express purpose of creating a revolving inventory of items that would then be available for sale to foreign governments. However, that fund has typically been used to buy end items rather than spare parts.

[illegible] estimates that for one set of 5,000 F-16 parts there were [illegible] changes over a two-year period. It is clear that any [illegible] policy would have been seriously troubled by that kind of [illegible] escalation.

A second problem resides in our ability to predict the production leadtime of a particular item. The curve shown in Fig. 8 represents the distribution of leadtime at any particular date. But the content of the long-leadtime tail of that distribution changes over time.

To get some idea of how much uncertainty there is in predicted procurement leadtimes, we compared the actual lead times of recoverable parts in Peace Vector I with the leadtimes for those same parts that were listed in D041 in mid-1980 when the procurement was initiated. The results of that comparison are shown in Fig. 9. It can be seen that there is essentially no correlation between the actual lead time and that shown in the D041 data system.

We reluctantly concluded that there is no practical way to identify the particular parts that would have to be procured in some sort of special inventory scheme to reduce production leadtimes. We also have observed from the Peace Vector I experience that there is a relatively small number of parts that actually turn out to be troublesome in that regard, and that if the ALC Program Manager can identify those parts early enough in the procurement process, he has a very good chance of finding some way of solving the problem.

We therefore recommend that no investments be made in any special inventory of long-leadtime items, but we also note that this again places an additional demand on the need for better information systems for use by the ALC Program Manager.

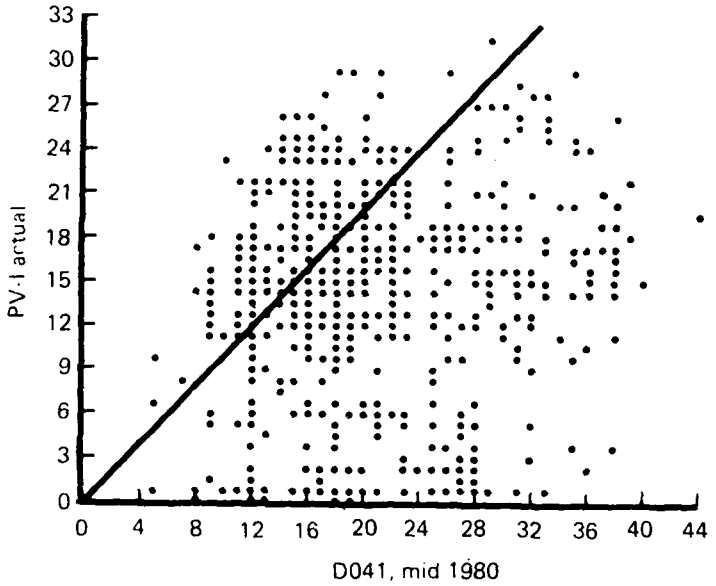


Fig. 9 – Production leadtime predictability

VI. OVERVIEW AND RECOMMENDATIONS

The process of identifying, procuring, and manufacturing an initial set of spares for an FMS case is organizationally and procedurally complex. Many steps are involved, each with the potential for introducing a time delay. While there is no single change in the process that could be implemented within practical resource constraints and that would, with high confidence, permit achieving the proposed goal of two-year response time, there are opportunities for making significant reductions in at least some of the time delays typical of recent programs.

In the previous sections we discussed time delays in each of the three major phases of the spares requirements and acquisition process. We can now assemble that information into an overall view of the time delays. To highlight the important results of this analysis, we will focus on two contrasting classes of items: the relatively small number of recoverable items, and the much larger number of non-AF stock fund items. These two classes of items represent the extremes in the distribution of time lags among the various phases of the process. Furthermore, for this discussion we will combine the procurement and production phases because our recommendations for future improvements are the same for those two phases.

Figure 10 shows two elements of leadtime, and the overall delivery schedule, for the 1708 different recoverable items ordered in Peace Vector I. The top display shows the rate at which requisitions were issued, and the middle display shows the distribution of leadtimes for

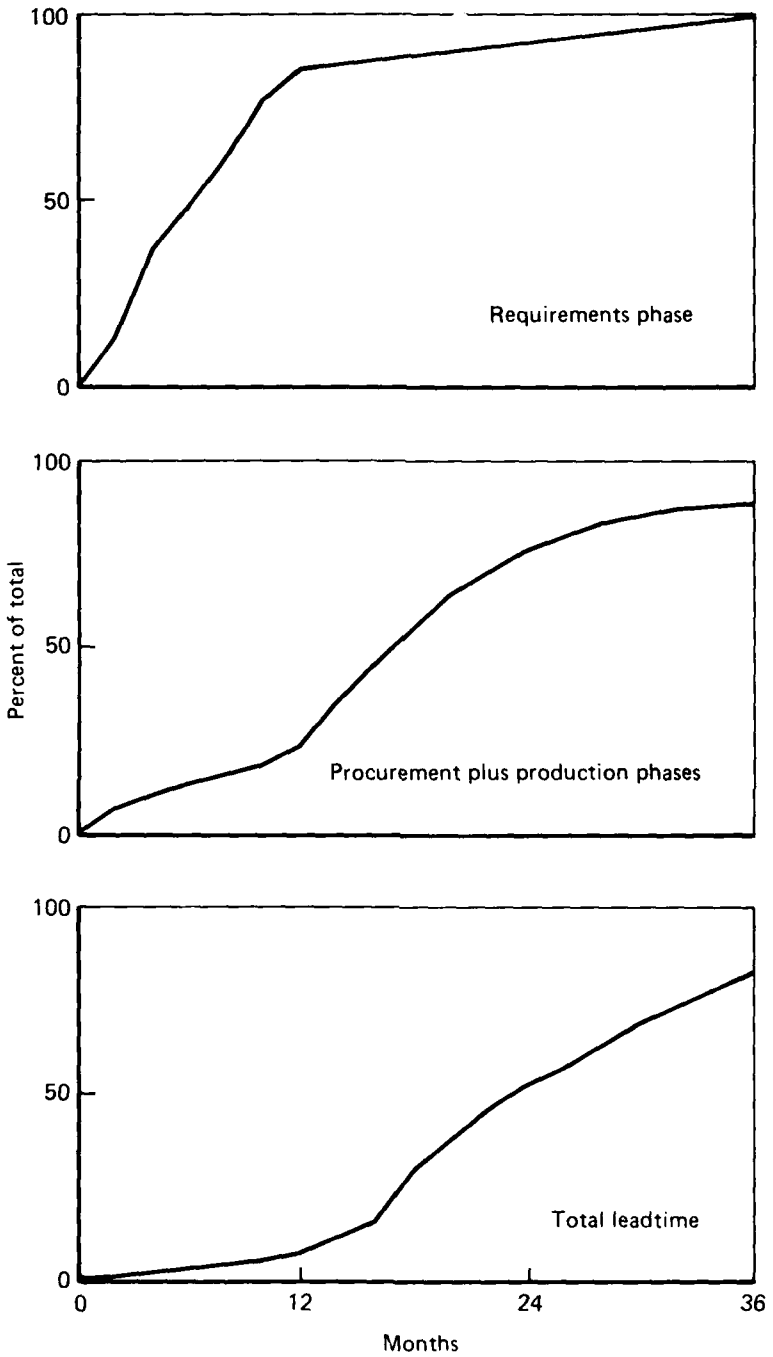


Fig. 10 -- Lead Times
Recoverable Items

those items as they passed through the procurement and the production phases. These two elements of leadtime combine to yield the accumulation of final deliveries, shown at the bottom of the figure. In each case, results are shown in terms of percentage of the total number of requisitions issued.[1]

For this class of items, the time delays are mostly in the procurement and production phases. Requisitions had been issued for over half of the items within six months after LOA, and most of the remainder were issued within the next six months. The remaining requisitions largely reflect design changes and are an inevitable part of the process, regardless of how quickly the initial set of requisitions are issued.

The distribution of leadtimes in the middle of Fig. 10 shows that only slightly over half of the items were delivered within 18 months after the requisition date, and 15 percent required more than two years. Thus the overall leadtime for recoverable items is dominated by the procurement and production phases. However, we concluded (see Secs. IV and V) that there was little opportunity for the FMS community to make systematic reductions in those leadtimes, and that most of the reductions in leadtime could probably be made in the requirement phase. We must therefore ask, How much improvement in overall delivery schedule might be possible for this class of item?

---

[1] Note that the display of total lead time is slightly different than that shown earlier in Fig. 1, where the ordinate was percent of stock numbers ordered.

We performed a rudimentary simulation of the overall process, assuming no change in the leadtimes for the procurement and production phase and assuming various degrees of compression in the requisition schedule (but retaining the shape of the requisition schedule). Results are shown in Table 3. It can be seen that some improvement in overall delivery schedule could be achieved, but that even in the limit case, assuming that 85 percent of the requisitions were issued within one month after LOA, only about 87 percent of the orders would have been filled within two years after LOA. Thus, it seems unrealistic to believe that any compression of the requisition phase would yield full compliance with the policy goal of all items delivered within two years after LOA.

At the opposite extreme in terms of leadtime distribution are the stock fund items drawn from sources outside the Air Force. In Fig. 11 we show the same kinds of information as were presented in Fig. 10: the

Table 3

POTENTIAL IMPROVEMENTS IN DELIVERY RATE FOR RECOVERABLE ITEMS

Requisition Schedule (Months After LOA)			Item Delivery Schedule (Percent Delivered)	
85 % Issued	100% Issued		24 Months After LOA	36 Months After LOA
12	36	<PV-I Experience>	53	82
6	18		75	95
1	3		87	99

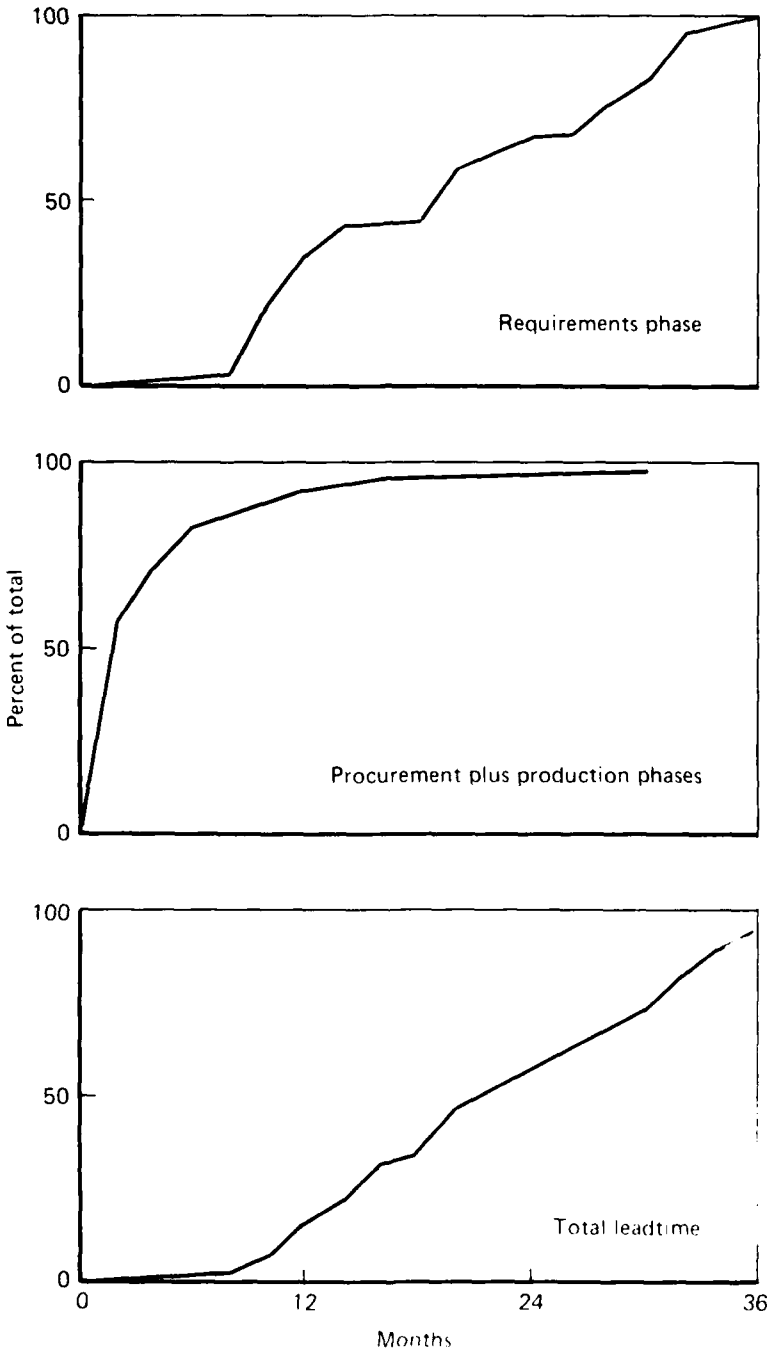


Fig. 11 -- Lead Times
Non-AF Stock Fund Items

rate at which requisitions were issued, the distribution of lead times for those items as they passed through the procurement and the production phases, and the accumulation of final deliveries. It can be seen that for these items the leadtime for procurement and production was relatively short, but that a long time was required to issue the 31,587 requisitions needed for the ultimate delivery of 23,520 different kinds of items. Again we performed a rudimentary simulation of the overall process, assuming no change in the leadtimes for the procurement and production phase and assuming various degrees of compression in the requisition schedule (but retaining the shape of the requisition schedule). Results are shown in Table 4. It can be seen that a large improvement in overall delivery schedule could be achieved if the requirement process could be reduced from three to two years, which seems like a modest goal. If all requisitions could be issued in one year, virtually all of the stock fund items should be delivered within two years after LOA. Thus it seems reasonable to expect that even some

Table 4

POTENTIAL IMPROVEMENTS IN DELIVERY RATE FOR STOCK FUND ITEMS

Requisition Schedule (Months After LOA)	Item Delivery Schedule (Percent Delivered)	
100% Issued	24 Months After LOA	36 Months After LOA
36 <PV-I Experience>	58	95
24	90	99
12	98	99

modest improvements in the rate at which requisitions are issued could bring the delivery of stock fund items largely into compliance with the two-year policy goal.

If the overall requirements phase in Peace Vector I could have been completed in about one year, with recoverable items mostly requisitioned within the first three months, nearly 90 percent of recoverable items and well over 90 percent of the stock fund items would have been delivered within 24 months after LOA. That contrasts with about 60 percent of each class of item that was actually delivered within the first two years during Peace Victor I. While not fully satisfying the goal of all initial spares and support equipment delivered in two years, delivery of 90 percent of the items would be an improvement over todays' typical performance.

What would be required to compress the requirements phase into approximately one year? We believe that two actions would be necessary to achieve that goal.

1. Modify certain administrative and funding procedures so that some of the ALC Program Manager's work could be completed while the LOA was being negotiated, instead of waiting until LOA signature. Such advance work would include assignment of staff for the ALC Program Manager, assembly of parts lists, and preparation for a definitization conference. Such actions should not require a large investment but chould save several months during the subsequent requisition phase.[2]

[2] The Defense Security Assistance Agency would have to review such a system before it could provide approval of the in-house front-loaded administrative concept. This review would also focus on the funding source(s).

2. Provide the ALC Program Manager with an automated system for assembling the parts lists, organizing them for the definitization conference, editing them during the conference, and issuing the subsequent requisitions.

In this study it was not possible to examine how, or to what extent, those recommendations might be implemented and it is therefore not possible to estimate the actual time savings that might be achieved. The goal of all requisitions issued in one year does not seem unreasonable.[3]

While acknowledging that major functional changes in the procurement and production phases are not likely to occur on the basis of FMS stimulus, the ALC Program Manager can have some influence over events during those phases. Some of the leadtime experienced in the procurement phase stems from the practice of "batching" several small requisitions and purchase order to achieve a more efficient procurement action. Furthermore, in any organization that processes so many procurement actions it is inevitable that some steps are delayed for what may be locally proper reasons but that, from the FMS manager's viewpoint, are inappropriate. Some reduction in overall leadtime in this phase could be achieved if the ALC case manger had a ready means of monitoring progress of each requisition so that he could take appropriate action on the occasional items that were experiencing unusual delays and where timely delivery was considered critical. We

[3] Because of continuing design changes and refinement of the host country's plans, there will inevitably be a more or less continuing stream of requisitions after the basic set has been issued. Those are largely beyond the control of the ALC Program Manager and will vary from case to case.

therefore recommend one action that should lead to modest reductions in leadtime associated with the procurement phase:

3. Provide the ALC Program Manager with the ability to create status reports that would highlight any requisitions that were experiencing unusual delays in the procurement phase.

The basic data needed for such monitoring are available from existing management systems, and certain standard report formats can be generated from those systems. However, those existing formats are not responsive to the needs of the ALC Program Manager, and indeed the variety of FMS case situations makes it unlikely that any standardized format would be fully satisfactory. The ALC Program Manager needs the ability to interrogate the data systems and to create report formats responsive to his needs of the moment. This is another aspect of the improved level of automation needed by the ALC Program Manager.

Even full implementation of the three recommendations described above is unlikely to result in all parts and supplies being delivered within two years after LOA. We estimate that about 90 percent of the basic initial spares and support equipment could probably be delivered within two years, but inevitably some items will be delayed. Furthermore, there will almost always be a continuing stream of system design changes that require new requisitions, and in at least some cases the host country will revise its list of needs as it gains experience with the system. It is therefore difficult to measure the "end" of the initial spares set in other than budgetary terms, and equally difficult to measure when "all" such items have been delivered.

Fortunately, experience strongly suggests that some shortfall could be tolerated with little or no effect on the host country's flying program, because many parts are not needed within the first year or so of active operations. We therefore recommend that:

4. The formal policy goal for delivery of initial spares should be modified, calling for all critical items to be delivered within two years but recognizing that some items might be delayed for another year or so.

Implementation of recommendations 3 and 4 above requires that some rank-ordering be made of the parts list in terms of how likely it is that those parts *might* be needed early in the host country's flying program. Such ranking would be needed by the ALC Program Manager to guide him in selecting the parts for early attention during the definitization and requisition process, and in deciding which parts justify some intervening action if they are delayed during the procurement and production phases. We therefore recommend that:

5. A process should be developed to rank-order the initial spares and other items provided by AFLC in a typical FMS case. The ranking should be in terms of the probability that the lack of a particular item would hinder the flying program of the host country during the first year after delivery of the first aircraft.

One of the secondary goals of the study was to seek policies that would improve the readiness of the USAF as well as improve response time in providing initial spares to FMS customers. Since all of the recommendations outlined above pertain only to the FMS management system, it is unlikely that implementation of those recommendations would have any effect on the ability of the USAF to respond to unexpected demands for logistic support of their own aircraft. Conversely, implementation of those recommendations should minimize the need to draw critical items from USAF stock in order to provide initial spares to a FMS customer in a timely way.

Appendix A

THE FMS INITIAL SPARES ACQUISITION PROCESS

A flow chart of the FMS initial spares acquisition process is shown in Fig. 12. Carrying out this process is the responsibility of the Directorate of Material Management (MM) and the Deputy for Contracting and Manufacturing (PM) at the AFLC Air Logistics Centers. The Comptroller organization (AC) manages the funds of the FMS country.

The process begins with the signing of the Letter of Offer and Acceptance (LOA). At that time the U.S. Government and the Air Force have a binding contract with the FMS country to provide initial spares support for FMS aircraft. The process ends with the delivery of the spares to a freight forwarder for shipment to the FMS country. Several organizations and many people are involved and it typically takes months to several years to completely process a single item. It will be helpful in describing the process to have the reader think of procuring a single item while, at the same time, recognizing that items are most often processed in groups.

Three major branches or paths are indicated on the flow chart: the breakout path, the provisioning path, and the funds path. Items may be processed through the breakout path or through the provisioning path--though usually not both. The funds path applies to either. The breakout and provisioning paths each indicate the sequence of steps required to decide what item to procure, how many to procure, and whether the item can be made available from Air Force stock or if it must be procured from a vendor. Decisions about what items to procure (and how many) are largely the responsibility of the System Manager

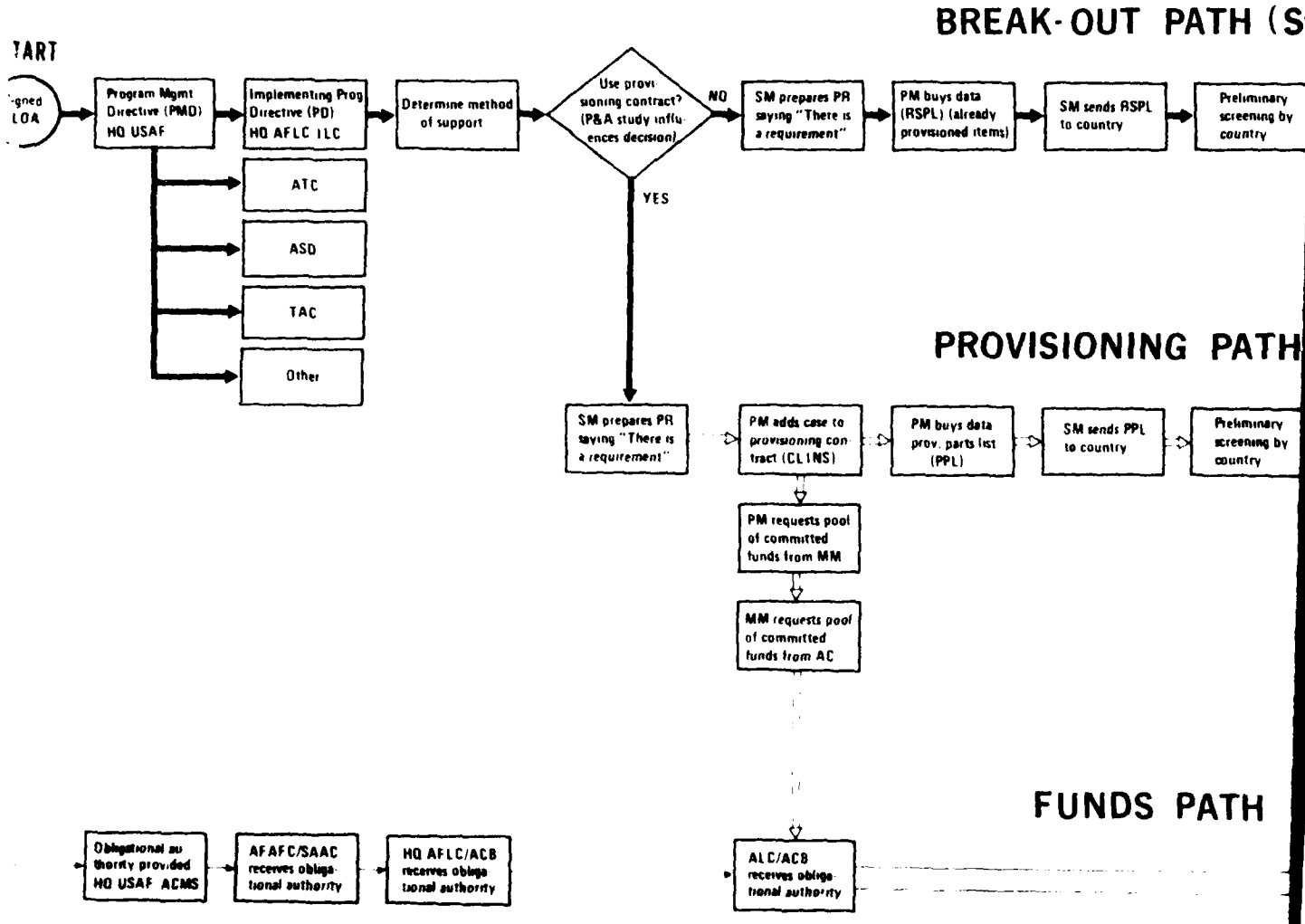
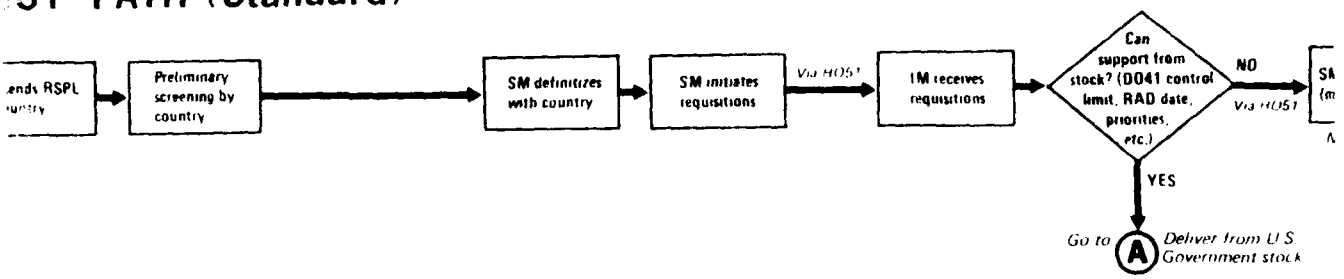
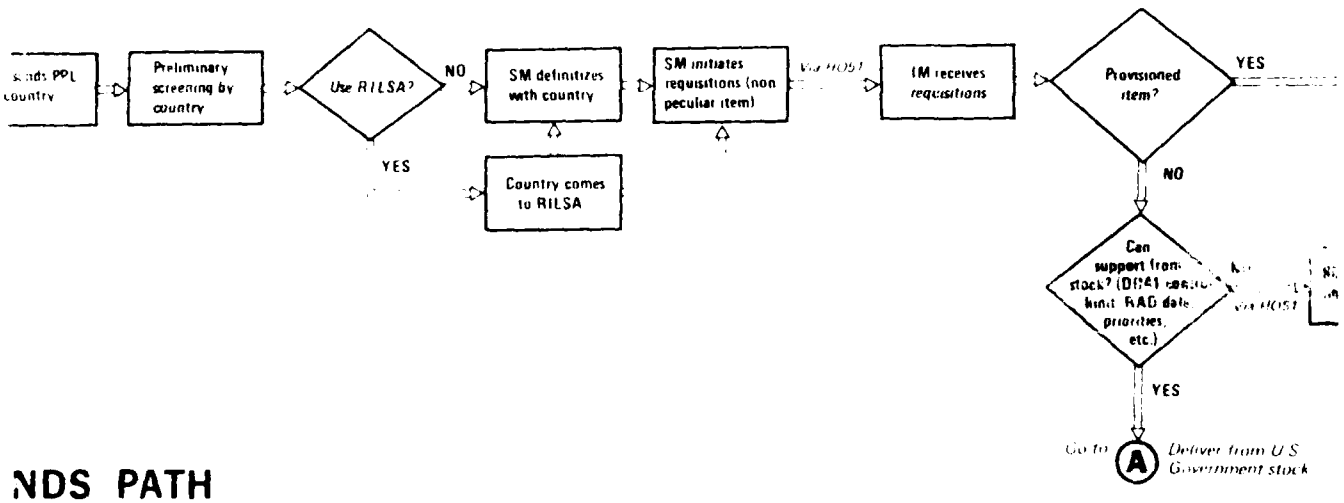


Fig. 12 -- FMS Initial Spares Procurement Process

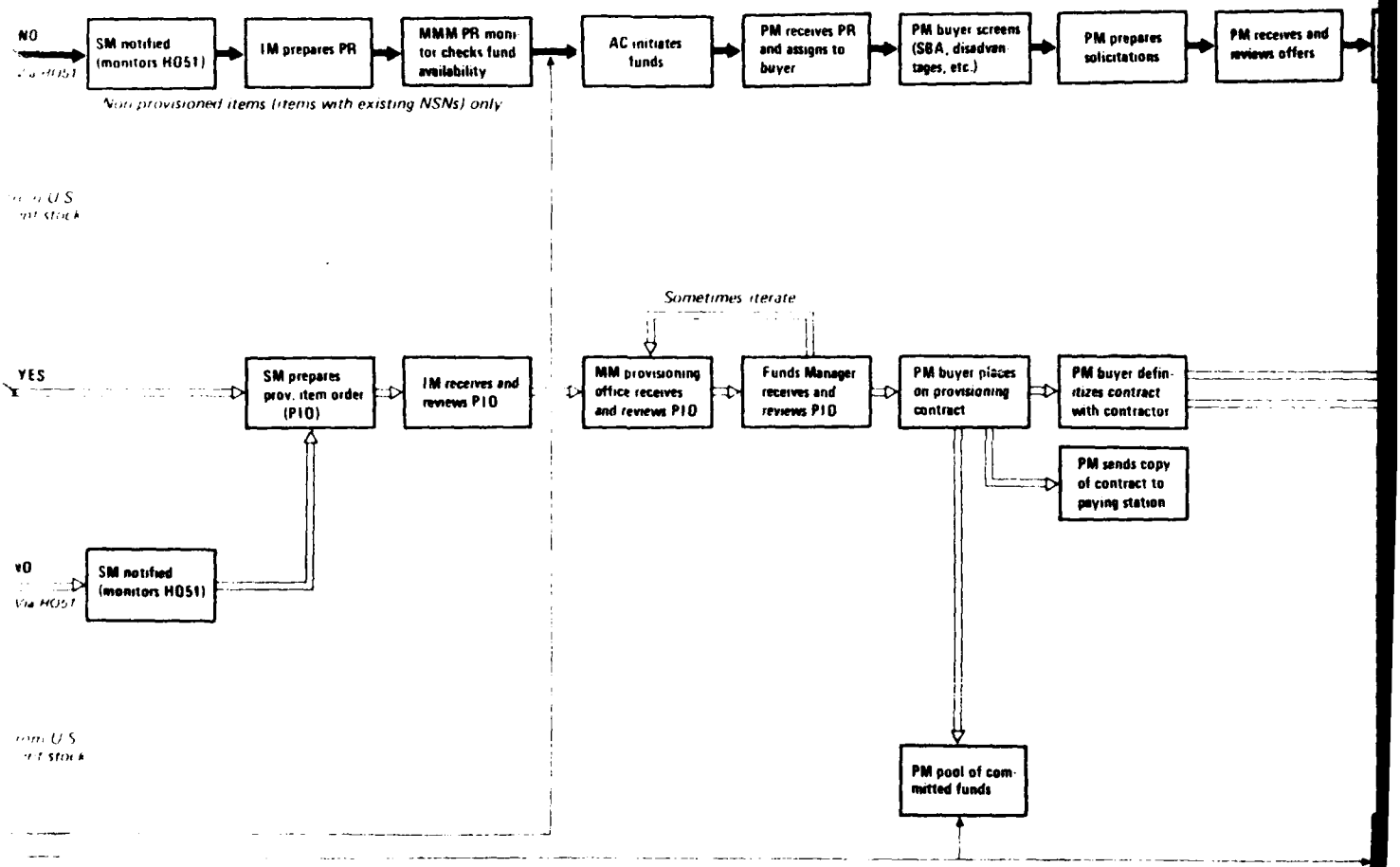
UT PATH (Standard)

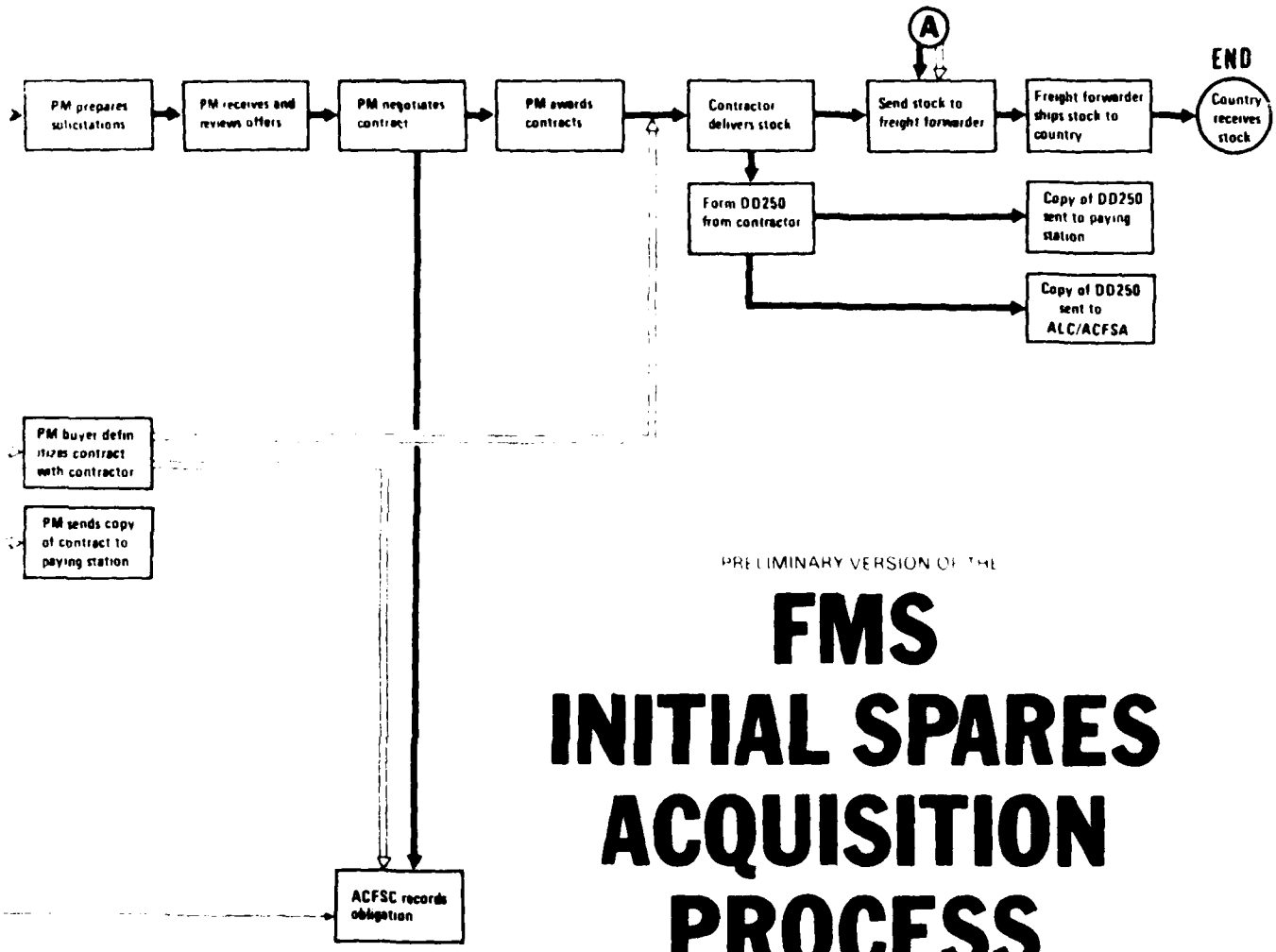


ONING PATH (Alternate)



NDS PATH





PRELIMINARY VERSION OF THE

FMS INITIAL SPARES ACQUISITION PROCESS

PREPARED BY R. L. PETRUSCHELL, Rand Corporation
Major LARRY VICK, Ogden ALC

JUNE 1983

organization within MM and the foreign country. Determining whether or not the item can be supplied from Air Force stock and, if not, issuing the necessary Purchase Request, is the responsibility of the Item Managers within MM. The buyers in PM place the item on contract.

A detailed walk through the flow chart is provided below.

GETTING THE PROCESS STARTED

The initial step is, of course, to obtain a signed LOA. However, certain other actions are necessary to really get the ball rolling.

The Deputy Chief of Staff for Air Force Programs, Hq USAF (AF/PRI) must see that a Program Management Directive (PMD) is prepared and distributed to all Air Force agencies who will be called on to help implement the program. The PMD is the basic management document for the program. It defines program objectives and assigns broad responsibilities. Examples of relevant agencies are:

- The International Logistics Center (ILC) at Hq AFLC is given the overall responsibility for implementing the program.
- The Air Training Command (see Fig. 1) would be called on for information about the country's training needs and the training equipment and training equipment spares to support those needs.
- The Aeronautical Systems Division (ASD) of the Air Force Systems Command, particularly the System Project Office (SPO), will be involved in managing the weapon system configuration and hence will play a major role in determining exactly what spares are required. Furthermore, the SPO is, by and large, the source of knowledge regarding technical characteristics of

the system and so will be called on to provide many different kinds of inputs.

- o The Tactical Air Command (TAC) will be called upon for information relating to the day-to-day operation of the weapon system. Maintenance concepts and related spares requirements, item failure rates, and any other operational inputs and insights helpful in configuring the country's spares program would be provided by TAC, which is also responsible for ferrying the aircraft to the host country.
- o Any other agency that might be called upon to contribute special knowledge or data or to help carry out the program in any way.

With the PMD in hand, the ILC prepares the implementing Program Directive (PD). The PD defines the objectives and ground rules within which AFLC will carry out the FMS initial spares support program. The PD passes the operational responsibility for carrying out the program to the Air Logistics Center (ALC). The ILC, of course, maintains responsibility for the overall management of the program.

Funds in terms of Obligational Authority must also be made available to get the program started. Within the Air Force, Obligational Authority is made available to the Air Force Comptroller, where the Directorate of Management Analysis (ACMS) certifies that funds are available to the Security Assistance Accounting Center (SAAC) at the Air Force Accounting & Finance Center (AFAFC) in Denver. SAAC, in turn, certifies fund availability to the Directorate of Budget (ACB), Hq AFLC.

The last step required to get the process going is the determination of the method of procurement. The required decision is whether to follow the breakout or the provisioning path. This decision is usually made by the ALC Program Manager and the country representative.

The remainder of the discussion will be split into two parts. The first will describe the steps in the breakout path, and the second the steps in the provisioning path.

When the provisioning path is selected, much of the work normally required of the ALC staff, particularly that of the PM people, is performed by the prime contractor. However, the use of this path is generally frowned upon for anything but the purchase of items that are really being provisioned, because a provisioning contract is essentially an unpriced contract. The terms of the contract are that prices will be determined within 120 days after the agreement to go ahead.

THE BREAKOUT PATH

The breakout path may only be used for items that have already been provisioned, i.e., for items that have been purchased before and hence have National Stock Numbers (NSNs) assigned. This is the standard path used by the Air Force for its own purchases of replenishment spares, etc. It requires soliciting offers from several contractors, competitive bidding where possible, and choosing the contractor with the lowest bid. The competitive bidding requirement does not apply for items which must be procured sole-source.

At the outset, a Program Manager is designated in the ALC System Manager's office, and his first task is to prepare a Purchase Request (PR) to buy a "list" of candidate spares from the aircraft and engine prime contractors. The PR is passed on to a buyer in PM who contacts the relevant prime contractors to order a Recommended Spares List (RSPL). The RSPL is simply a list of already provisioned items that the contractors recommend for consideration.

On receipt of the RSPL, the ALC Program Manager sends a copy of it to the host country for their review and preliminary screening. When the country is ready, a formal Definitization Conference is convened--usually at the responsible Air Logistics Center. At this conference, the ALC Program Manager, representatives from the relevant Air Force agencies, and representatives from the contractors get together with country representatives to decide exactly which items and how many of each will be purchased. Once definitization has been completed, the ALC Program Manager in the System Manager's office writes up a requisition for each definitized item.

The requisitions are passed on to the appropriate item managers through the International Logistics Management Information System (H051). H051 records all requisitions and subsequently reports all actions against those requisitions to the ALC Program Manager.

On receipt of the requisition, the Item manager determines whether or not he can provide the requested items from Air Force stock within the Required Availability Date (RAD). His decision will be influenced by stock available, or scheduled to become available, relative to projected Air Force demands for it, and the priority assigned to the

item by the ALC Program Manager. If sufficient stock is on hand or scheduled to be on hand in time, the Item Manager will prepare a release from stock and the item will be delivered to the Freight Forwarder for shipment to the country. At this point the process for items delivered from Air Force stock is completed. If the item is not available from stock, the process continues. In either instance, the ALC Program Manager receives notice of what has happened by monitoring H051.

The Item Manager initiates the purchase of an item by issuing a Purchase Request (PR). Typically, requisitions are for one or two items, and the Item Manager may be able to obtain a better price for a larger quantity. He may therefore choose to hold the requisition for a time so that it can be combined with one or more additional requisitions for the same item. After a PR is issued, a PR monitor in the Resources Management Division (MMM) of the Directorate of Material Management (MM) checks to see that funds are available to support the PR and if so notifies the ALC comptroller to earmark funds for that purpose, i.e., funds are initiated. These actions are recorded in H051.

The PR is passed on to the Contracting and Manufacturing Division (PM) where it is entered into the AFLC Procurement Data System (J041) and assigned to a buyer. The buyer has many restrictions placed on him which govern from whom he may purchase stock and much of his time is spent coping with these restrictions. For example, he must demonstrate that small businesses, businesses in the local area, businesses run by minorities or the disadvantaged, etc., were each provided an opportunity to bid on the item. These firms are seldom both capable and qualified to supply the required items, but only after they have been considered, and the appropriate paperwork processed, can the buyer prepare and

transmit solicitations to qualified contractors. Frequently, there is only one qualified contractor. Sometimes there are two or three but seldom more than that.

With the solicitations out, the buyer waits until offers are received from the interested contractors. If there is more than one offer, the buyer screens them to weed out the obviously unacceptable ones and then gets together with the remaining contractors either formally or informally to negotiate the terms of a contract. AC records the obligation of funds. The buyer's job is essentially finished when a contract is awarded. The J041 system records procurement actions against PRs and reports relevant status to the ALC Program Manager through the H051 system (i.e., J041 talks to H051).

After production is completed, the contractor delivers the item or items to the Air Force, which, in turn sends the item or items to the freight forwarder for shipment to the country. The DD250 forms indicated on the flow chart are accounting forms used to notify the various organizations and data systems that the transaction has been completed.

THE PROVISIONING PATH

At this point we return to the diamond on the flow chart that asks whether to use a provisioning contract or not.

"Provisioning" is a term used to describe the process of defining requirements for, and purchasing a spares item for the first time. The item is then assigned a National Stock Number and other necessary data, and entered into the appropriate requirements computation system (D041 for recoverable items, D039 for equipment items, and D062 for EOQ items). Subsequent procurements will take place routinely through these

systems. The provisioning process is necessary to establish things like the maintenance concept and to make initial estimates of demand rates, etc. Later, as the item is actually used, these data will be based on experience, which will automatically be entered into the appropriate requirements system.

To facilitate initial provisioning, a Provisioned Item Order (PIO) is typically negotiated with the weapon system prime contractor while the major equipment is first being procured. For the F-16, the weapon system prime contractor is General Dynamics. A single provisioning contract may be used to purchase all items initially provisioned for a weapon system. As items are identified, orders are accumulated on a PIO and that substitutes for the PR used to request the purchase of breakout items. Orders for a few or hundreds of different items may be combined on a single PIO. With no prior purchase, determining a price for provisioned items is very difficult, so generally orders against provisioning contracts are placed with only an estimate of the aggregate cost of all the items on a PIO. The terms of the contract are that the actual price is to be determined within 120 days. Frequently a firm price is not forthcoming until well after the start of production.

Using a provisioning contract for purchasing FMS spares, if one is available, is attractive because many time-consuming steps in the procurement process can be short-circuited. The buyer in PM can usually get a PIO on contract within a few days while it would require months to place the same items on contract following the breakout path. However, while AFLC has used provisioning contracts to purchase non-provisioned items for FMS, future use is frowned upon. Because FMS spares normally have been procured before, data for negotiating a firm fixed price should be

available. Furthermore, putting them on a provisioning contract is tantamount to awarding a cost-plus contract.

Given a decision to use a provisioning contract, the first step in the process is for the ALC Program Manager in the System Manager's office to notify the PM people that there is a requirement. The provisioning contract person in PM will then add a Contract Line Item to an existing provisioning contract and, based on an aggregate estimate of the probable cost, request that MM obtain obligational authority to cover the expected cost. MM reviews the amount and passes the request along to the ALC budget people in AC. The budget people check to see that sufficient obligational authority has been made available from the budget people at Hq AFLC (the ILC), and if so, make the obligational authority available.

With funds available, PM immediately purchases an RSPL from the contractor, and on receipt of the RSPL, the ALC Program Manager sends a copy to the FMS country for review and preliminary screening.

The next step is to formally definitize the list of spares that will be ordered by the country. In the process, the country frequently makes use of the Resident Integrated Logistics Support Agency (RILSA) in residence at the prime contractor's plant to help them decide. When all are ready, a formal definitization conference is held. Some of the items definitized will be for purchase via a provisioning contract, but not all.

After definitization, the ALC Program Manager prepares requisitions for all definitized items and passes these to the Item Manager in MM through the H051 system. The Item Manager reviews the requisitions to determine if any of them can be supported from Air Force stock. If the

item is to be procured on a provisioning contract, the next step is for the ALC Program Manager to place the item on a PIO.

The ALC Program Manager proceeds by preparing the necessary PIO and passes the PIO back to the Item Manager for his review. The PIO is also reviewed by the Provisioning Office and the funds manager, both in MM. With their approval, the PIO is passed to the appropriate buyer in PM.

The buyer checks the estimated cost on the PIO against his pool of committed funds and, if sufficient funds are available, he definitizes a contract with contractor and sends a copy of the contract to the appropriate paying agent. PM can usually place a PIO on an existing provisioning contract in a few days. The AC people record the obligation of funds and things proceed as described earlier for the breakout path.

Appendix B

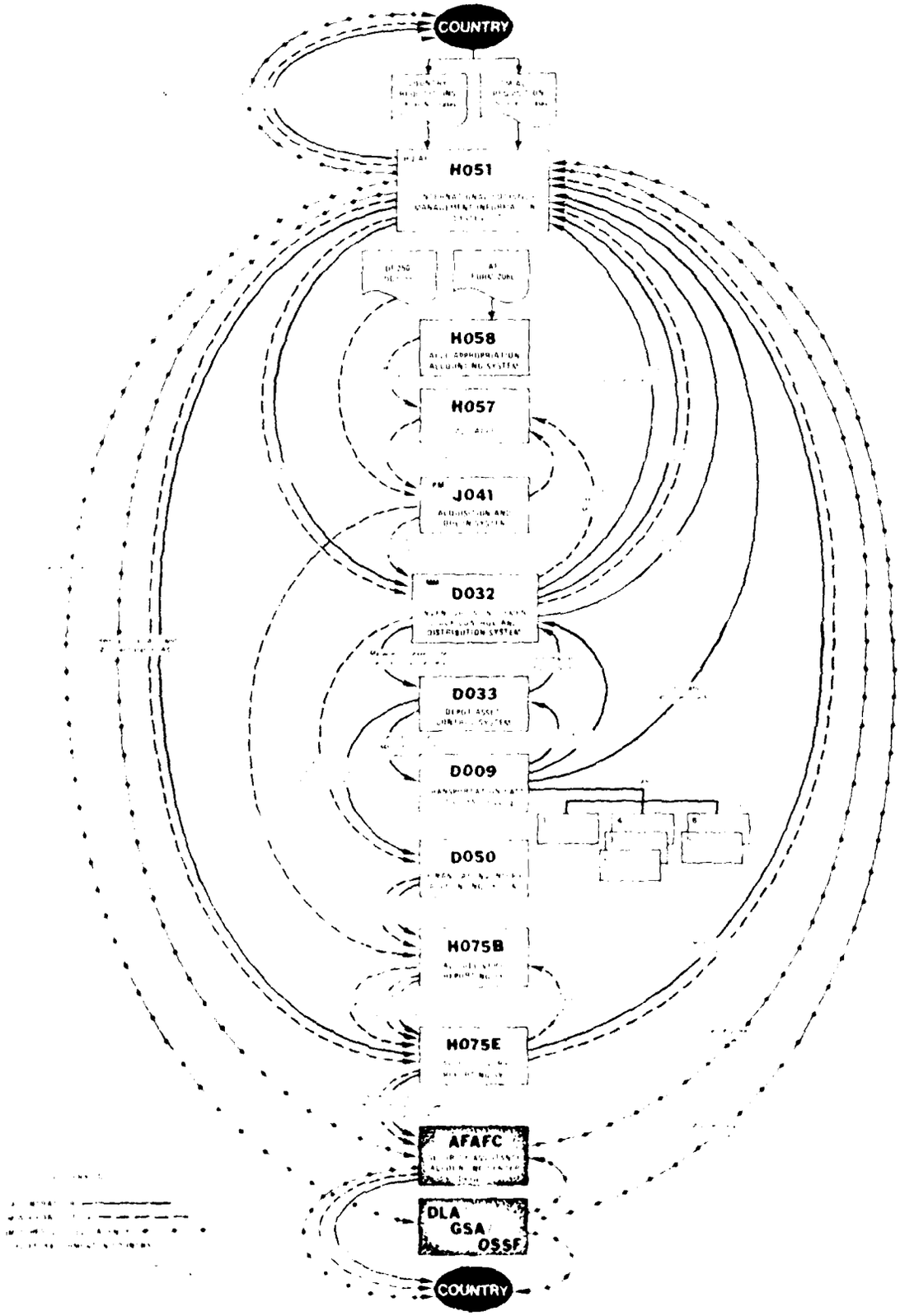
B051 BASIC INPUTS AND OUTPUTS

B051, the International Logistics Management Information System, is the central financial and information management system for FMS cases. A case is implemented in B051 after the LOA is signed and when Obligation Authority is approved. At that time both a total sales value and fiscal-year spending-limit are set, so that B051 can prevent overcommitment.

Because B051 interfaces with a number of Air Force and Department of Defense data systems as well as the country customer, it is a valuable source of detailed information on the order, delivery, and financial status of a case. Figure 15 shows the information flows between B051, the country, and other data systems.

B051's Consolidated Status Report (RCS) "History" format contains a history of all transactions between B051 and the data systems shown in Fig. 15. For each requisition B051 keeps detailed records for 120 days after delivery. At that time the detailed records are collapsed to a financial status and delivery record.

For more detailed information on B051 see B051 User's Guide, AFLC [illegible] September 1[illegible]. For more information on how the item managers use B051 see Information for Logistics Program--Student Study Guide, [illegible].


COUNTRY
H051
H058
H057
J041
D032
D033
D009
D050
H075B
H075E
AFAFC
DLA
GSA
OSSF
COUNTRY

END

FILMED

8-85

DTIC