AFIT/GLM/LSM/92S-34

AN ANALYSIS OF THE FOREIGN MILITARY SALES PIPELINE OF REPAIR AND REPLACE REPARABLE ASSETS

THESIS

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THESIS

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Larry Orlando and George Rhame

Table of Contents

List of Figures

List of Tables

AFIT/GLM/LSM/92S-34

Abstract

This study examined the reparable logistics pipeline and identified characteristics and associated problems with the processing of Foreign Military Sales (FMS) repair and replace aircraft assets. Areas of investigation included examining the FMS logistics reparable pipeline and determining what section of the pipeline the USAF controls or can influence, identifying the individual problems within that section of pipeline, and collecting and analyzing data pertaining to FMS repair and replace requisitions. The methodology used in these areas, respectively, involved a literature review, personal interviews with Foreign Liaison Officers to obtain customer perspectives, and a statistical analysis of pipeline times for all FMS replacement requisitions for F-16 reparables filled within a specific six month period. Of primary concern to both the USAF and the customers was the time it took to fill replacement requisitions and especially the problems associated with H-coding requisitions. The research showed numerous possible causes for delays and indicated that many of the problems start before the USAF is even aware of the customer's demand, but that the USAF has been working hard to correct problems within its control and has attempted to improve the process overall.

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I. Introduction

General Issue

The United States is one of several nations which sell arms to foreign countries. This transfer or exchange of weapon systems to ally nations represents a significant portion of our nation's defense industrial base as well as having strong political overtones. Consequently, the U.S. Air Force (USAF) plays a vital role in providing logistical and technical support to these Foreign Military Sales (FMS) customers. The level of support provided by the USAF contributes to the political and economic success of each of these security assistance programs, which in turn affects our national security as a whole.

But the process of providing logistics support can be a slow one. Experience has indicated that FMS reparable assets may not be processed efficiently, taking an excessive amount of time to return serviceable assets to the customer's supply system. Furthermore, there is concern that many of the assets turned into the USAF repair cycle may be held for extended periods of time, in some cases longer than one year.

In an April 1991 letter to the Air Logistics Center (ALC) commanders, General Charles C. McDonald, Commander of the Air Force Logistics Command (AFLC), reminded each center commander of the substantial increase in support they have provided to our allies through FMS in recent years. General McDonald's letter went on to say that despite the increased support needs:

> . . .not all of our [USAF] policies and processes have kept pace, especially with respect to FMS repair. This has resulted in an increasing FMS repair backlog and dissatisfied customers. We must change our focus from top to bottom and commit to eliminating the FMS repair backlog, satisfying our FMS customers and using our capacity to best advantage. FMS FY90 case values were $26 billion and have the potential to continue to grow as our force structure decreases. Our first target in instituting this change in focus is to clear the FMS repair backlog (17).

This letter resulted in a heightened interest in FMS throughout the command and is considered by many to be the genesis of the current focus on improving logistical support.

Problem Statement

Since the USAF has only limited control over the FMS reparable pipeline, the specific research problem for this thesis was to examine the reparable logistics pipeline and identify characteristics and associated problems with the processing of FMS repair and replace aircraft assets. The research objectives were as follows: (1) examine the FMS logistics reparable pipeline and determine what section of the pipeline the USAF controls or can influence, (2) identify the individual problems within that section of pipeline, (3) determine what policy changes were put forth by USAF to address the problems, and (4) collect and analyze data pertaining to FMS repair and replace requisitions.

Research Questions

In consideration of the previously mentioned objectives, the following research questions were addressed:

1. At what point do FMS reparables fall under USAF control or influence in the pipeline?
2. What are the customer's views of the USAF reparable pipeline and what do they perceive to be the biggest problems?
3. What repair and replace program policy issues have been addressed as a result of the current heightened interest in FMS logistical support?
4. What can an FMS customer typically expect in terms of response times for the replacement requisition process?

Scope

To the maximum extent possible, this study focused on FMS aircraft assets returned to USAF ALCs for organic "repair and replace" type restoration. Repair and replace programs allow FMS customers to return unserviceable items to the repair activity and, if determined to be economically reparable, get replacement items issued from USAF stocks. The customer's unserviceable items are repaired and returned to USAF stocks. The country is then charged appropriately depending on the type of FMS case it is (7:353). Although much of the FMS reparable pipeline may also apply to "repair and return," this study did not specifically address those assets nor those repaired under contractual arrangements such as nonstandard item parts and repair support (NIPARS).

Definitions of Terms

A glossary of terms used in this thesis may be found in Appendix A. Unless otherwise noted, all definitions were taken from the FMS Glossary of Terms prepared by the AFLC International Logistics Center (ILC) policy branch, AFLC-ILC/XMXB (1).

Overview of Thesis

This first chapter introduced the general issue that there are concerns associated with the FMS reparable pipeline. A specific problem statement, research questions, scope of the research and definition of terms were also addressed.

The remainder of this thesis consists of a review of literature in chapter two, a methodology explanation and description in chapter three, a report on our research findings in chapter four, and an analysis of those findings with our conclusions and recommendations in chapter five.

II. Literature Review

Chapter Overview

The purpose of this chapter is to present information obtained through a search of the literature pertaining to Foreign Military Sales (FMS), support of reparable assets, the USAF-controlled section of the pipeline through which FMS reparables travel, and associated problems that foreign customers have with the reparable pipeline.

A literature search, or review, is an exploratory study of books, periodicals, and other writings used to familiarize researchers with their particular area of interest. Literature reviews help avoid the inefficiencies of discovering anew through original research what has been done by others already (12:145). A literature review was the primary method of determining what section of the reparable pipeline actually falls under USAF control.

Foreign Military Sales

There are two methods of conducting U.S. arms export sales, both designed to enhance the mutual security of the United States and friendly foreign nations. One acquisition method available to foreign countries is that of direct commercial sale. Direct commercial sales enable foreign governments, with U.S. government approval, to deal directly with a U.S. contractor in obtaining weapon systems. The other acquisition approach open to foreign governments is through Foreign Military Sales.

When purchasing countries select FMS, the Department of Defense (DOD) works as a middleman, basically serving as an executive agent for the foreign customer in negotiating contractual agreements with U.S. companies, integrating various system support activities, and providing essential administrative services. The buyer/seller relationship is defined by a DD Form 1513, the Letter of Offer and Acceptance (LOA), which is prepared by the Department of Defense. The LOA offers foreign governments or international organizations defense articles and services pursuant to the Arms Export Control Act (AECA) and projects the costs of the equipment, services, and authorized DOD charges (1:29). These extra charges are to cover the DOD's cost of doing business on behalf of the purchaser, that is, for such activities as material handling, contract administration, administrative overhead, logistics support, and non-recurring research and development (5:1-13).

FMS offers both initial support packages and follow-on support cases. Initial support packages provide support needed for the foreign customer to establish an in-country operational capability during the initial operating phase. This support is a consideration of FMS's "total package approach" and is provided either before or at the same time the system or major item is delivered (7:342).

Follow-on support cases begin with the initial operation of the system and include the material and services required for the operation of the system and equipment during its service life. Unlike initial support, follow-on support is not provided as a package but rather as individual cases for spares, support equipment, technical assistance, and so on. There are three types of support cases: defined order cases written for specific items and quantities with material normally leadtime away; blanket order cases written for a dollar value, which allows customers to requisition up to the dollar value of the case, again with material normally leadtime away; and, finally, cooperative logistics supply support arrangements (CLSSAs), which give participating countries a method to become a partner in the USAF and Defense Logistics Agency (DLA) supply systems for the purpose of reducing requisition leadtimes (2:1.1).

It was in this area of logistics support that we were primarily concerned and, in particular, how the U.S. Air Force fulfilled the DOD's responsibility under FMS agreements with the customer to provide that support related to reparable aircraft parts or components.

Reparable Support

AFLC (combined with the Air Force Systems Command in June 1992 becoming the Air Force Materiel Command as a result of USAF-wide restructuring) provides support to military forces around the world. "Each year, AFLC depot maintenance organizations overhaul or modify more than 1,200 aircraft and 6,400 aircraft engines or major engine components. In addition, over 1.1 million reparable assemblies. . .are overhauled or repaired" (8:8). Reparables are items that are not consumed in use, that is, they can be reconditioned or economically repaired when they become unserviceable. FMS provides foreign countries with a means of obtaining repair services without the necessity of establishing an in-country capability. In-country repair programs are not economically feasible in many cases, especially if the number of aircraft to be maintained and serviced is relatively small. However, a foreign customer with in-country repair capability may still want the FMS program to supplement its own. Most reparables sent back to the U.S. by FMS customers are for depot level repairs, overhauls, or rebuilds beyond the local capability of the foreign country. These repairs are accomplished through either "repair and replace" programs or through "repair and return" programs (15:80).

Repair and replace, simply put, is a process that results in replacement parts being issued from inventory whenever a broken part is turned in for repair. When the broken part enters the repair cycle it is sent back to the U.S. for repair in exchange for a serviceable part pulled from the U.S. government inventory. FMS customers with eligible CLSSAs, or blanket order cases, can use the repair and replace program (15:80). An advantage of the repair and replace method is that the customer does not need to wait for the repair cycle to run its course in order to receive a serviceable part. The FMS customer pays an average cost for repairing the broken part. For non-CLSSA cases, customers are charged replacement costs of the item issued from U.S. inventories (7:353). The replacement cost is the ALC current catalog price which is based on the assumed return of a reparable carcass.

On the other hand, repair and return programs enable FMS customers to send broken parts back to the U.S. for repair. Asset serial numbers are recorded in order to return the original asset to the country after repairs have been completed. The country is then billed for the actual repair costs (15:81).

Priority System

A major factor which determines how long it takes items to travel through the logistics pipeline is the degree of urgency associated with the requirement for the asset. The Uniform Material Movement and Issue Priority System (UMMIPS) helps satisfy the need to identify the relative importance of competing demands for resources within the logistics system. Furthermore, UMMIPS provides guidance for the ranking of material requirements as well as incremental time standards for requisition processing and material movement.

A series of two-digit numeric codes known as priority designators are used to assign their ranking of relative importance. The priority designator is determined by a combination of factors that relate to the mission of the requisitioning activity and the urgency of need. These factors are called the Force/Activity Designator (FAD) and the Urgency of Need Designator (UND), respectively. The FAD is represented by a Roman numeral from I through V and is assigned by the U.S. Joint Chiefs of Staff for all FMS customer countries. Usually, each customer has a FAD that is applicable to all requisitions for material destined for their country. However, different FADs may be assigned to a particular FMS case. Alphabetic characters A, B, or C are used to indicate the UND which is determined by the customer using the criteria established by UMMIPS directives. Basically, UND "A" means the customer has an extremely urgent requirement for the needed item in order to perform its mission. UND "B" is used to show that the mission of the force/activity is impaired, but not stopped. Finally, UND "C" indicates a routine requirement such as stock replenishment.

Table 1 provides an example of the UMMIPS matrix which is used to determine the priority designators for a given requisition. For example, an FMS customer assigned a FAD of "V" with a UND "C" would have a priority of 15 assigned to the requisition (7:335).

TABLE 1.

UMMIPS PRIORITY MATRIX (9:24.20)

Force/Activity Designators	Urgency of Need Designator		
	A	B	C
	Requisition Priority Designator		
I	01	04	11
II	02	05	12
III	03	06	13
IV	07	09	14
V	08	10	15

The Logistics Pipeline

Although the pipeline which carries FMS reparables actually starts and ends at the foreign customer's flightline, the U.S. Air Force influences the first part of the pipeline by dictating to the customer what shipping procedures must be followed when returning carcasses to ALCs for repair. Furthermore, the USAF can only control the section of that pipeline from where the asset enters the DOD distribution channels or arrives at the appropriate location for either depot maintenance or to be shipped on to a repair contractor, until the repaired item or a replacement is shipped back to the customer. This is illustrated in figure 1.

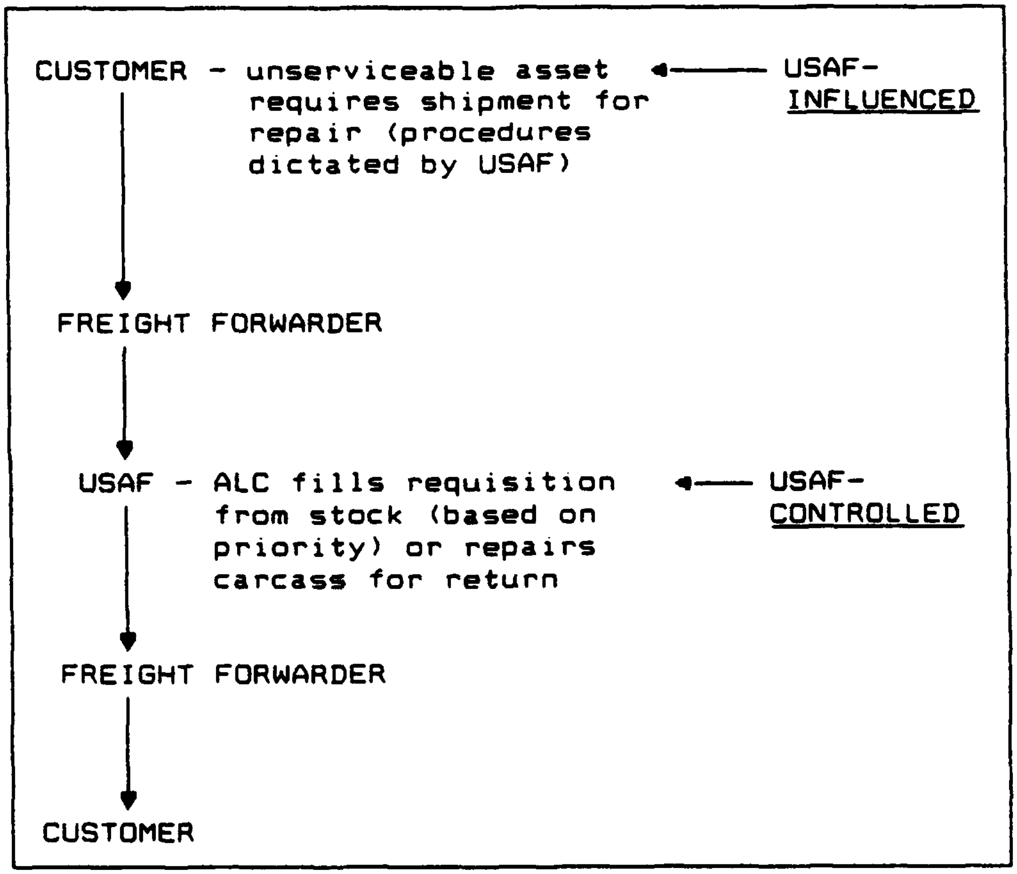

Figure 1. Pipeline Areas of USAF Responsibility

Depot Subsystem. The following description of the depot subsystem of the logistics pipeline does not reflect changes that were currently being brought about by the aforementioned USAF organizational restructuring, but is based upon an outline of the general ALC organizations and their responsibilities provided in a 1989 thesis by Bond and Ruth. In fact, responsibilities were shifted in some cases not only to different directorates but also to different agencies, such as the Defense Logistics Agency (DLA) now owns the distribution function. However, the outline by Bond and Ruth is sufficient for our needs here to understand the movement of assets internal to the Air Logistics Centers.

TABLE 2.

USAF AIR LOGISTICS CENTERS (10:14.71)

Center	Abbreviation	Location
Ogden	OO	Hill AFB, UT
Oklahoma City	OC	Tinker AFB, OK
Sacramento	SM	McClellen AFB, CA
San Antonio	SA	Kelly AFB, TX
Warner Robins	WR	Robins AFB, GA

The USAF depot subsystem of the logistics pipeline is managed by five separate depot organizations called Air Logistics Centers (ALCs) which are identified in table 2. The ALCs are divided into directorates which are responsible for distribution, maintenance, procurement, and material management, with each ALC providing similar overall functions (3:93).

When reparable items arrive at an ALC, they enter the depot subsystem of the pipeline where they are received by the Directorate of Distribution (DS). DS consists of five divisions: two that handle storage and issue functions and two that provide distribution management functions (these four divisions make up Depot Supply); and one division responsible for Depot Transportation (3:93).

After receiving a reparable item, DS processes and transports it to the Depot Maintenance section of the depot pipeline which is managed by the Directorate of Maintenance (MA). Depot Maintenance accounts for a large percentage of both the total assets held within the pipeline and actual pipeline time. The item is actually held by the DS Material Processing Division until requested by MA. Upon MA's request, the item moves from Depot Supply into the Maintenance Inventory Center (MIC) to be held until requested by the appropriate production shop for repair. Repaired items are later routed back through the MIC to be turned in to Depot Supply (3:98).

For the purposes of this thesis, this answered the first research question--the section of the pipeline controlled by the USAF is from the point assets arrive at an ALC for repair until the point where the customer's requisition is filled and shipped from the ALC. Also of interest was where the USAF influenced the pipeline;

therefore, since shipping procedures are dictated by USAF regulations, the shipment of unserviceable assets from the customer to the appropriate ALC was considered to be a part of the influenced pipeline. A full description of these shipment procedures is in AFM 67-1, volume IX, chapter 14, paragraph five.

Customer Concerns Toward FMS

Under the repair and replace program, part carcasses enter the repair cycle while replacements are issued out of the spares pool. The issuing of spares is determined by the Uniform Material Movement and Issue Priority System (UMMIPS), a priority system developed by DOD to establish the relative importance of competing requisitions. Priorities are based upon the importance of the mission of the requisitioning activity, as determined by the U.S. Joint Chiefs of Staff, and the urgency of need designator (9). A foreign country that has sent a part back to the U.S. for repair then loses that part if demand exceeds supply and other requisitions have higher priority. This can happen because the carcass reverts back to being USAF property upon its receipt at the ALC while the customer's requisition continues on as a separate entity. For instance, a USAF requisition might be filled with an FMS customer's part if no other items are available. To compound the problem for the FMS customer, U.S. defense budgets are forcing reductions in the number of spare parts (18:26). Customers feel that UMMIPS allows the USAF to usurp what could fairly be called foreign assets in order to fulfill U.S. requirements. But, from the U.S. point of view, the logistics system is performing an important function by allocating spares based on identified priorities (15:82).

A major problem with the repair and return process is unsatisfactory response times. Items requiring nonorganic (contractor) repair can take a year or more before being returned to the foreign customer. According to an interview Paul Lyons had with a General Dynamics repair manager, a May 1991 audit of General Dynamics was conducted to determine how long items stayed in holding areas awaiting actions to resolve repair problems. The audit, limited to F-16 repair actions for Egypt and Israel, found that 76 percent of the parts had been in a holding area for more than 50 days while 11 percent had been there between 400-500 days. The audit further revealed that much of the problem was due to production managers at Ogden ALC not being notified by the FMS customer that parts had been shipped to General Dynamics for repair. Since the contractor requires repair authorization from the ALC production manager, parts would sit in holding areas until General Dynamics identified them and contacted Ogden. The audit also identified contractual problems which were found to delay the process even more (15:84-85).

In his Air Force Institute of Technology Master's thesis entitled "An Evaluation of Logistics Support For F-16

Aircraft Owned by Foreign Countries," Lyons says that "timely, efficient logistics support of FMS customers of F-16 aircraft does not appear to be a principal concern of the USAF logistics system. Complexity of processes, untimely responses, and failure to consider customer needs are common failings on the part of the USAF" (15:90).

Conclusion

The U.S. Air Force is challenged to improve the repair backlog of its FMS customers. As drawdowns in the U.S. military take place and America relies more and more on the ability of its allies to protect themselves, it becomes critical that it provide FMS customers with the support pledged to them.

In summary, this literature review introduced and described Foreign Military Sales, reparable support, the logistics pipeline, and problems and customer concerns associated with the movement of FMS assets through the pipeline. The literature has shown that there are problems with returning reparable assets to our FMS customers in a timely manner. Senior Air Force leadership, aware of the important role played by foreign military sales, has initiated actions to help reduce the reparable backlog. However, this is only the start and much effort is needed to first identify the problem areas within the FMS pipeline and then work to resolve them.

III. Methodology

Chapter Overview

In this chapter, the research methodology will be addressed and a brief explanation of the three main areas of investigation is offered. The methods to be reviewed are literature search, judgment sampling, and personal interviewing. Last, a description of the population and sample is also provided.

Explanation

In order to perform a relatively thorough investigation of the repair and replace pipeline and identify characteristics and problems associated with it in the time available to us, we felt that our research needed to be both qualitative and quantitative in nature. To achieve the qualitative side of the research, we gathered information by reviewing literature, such as regulations, related to the subject and also by discussing the repair and replace program with people who work with it regularly. Quantitative analysis was done by collecting data related to general pipeline times, such as now long it took for the USAF to receive a customer's reparable carcass and the time it took to ship that customer a serviceable spare. Such a qualitative and quantitative approach had to be limited considering the time constraints we had to meet and so we decided that the research would include three main areas of investigation: (1) examining the USAF-controlled and influenced section of the reparable pipeline, (2) collecting data on common reparable parts, and (3) interviewing FMS customers (liaison officers). Corresponding to these areas were three different research methods: a literature search, nonprobability sampling, and personal interviews.

Identifying the section of the reparable pipeline that falls under USAF control was the first order of business because we wanted to know exactly what the USAF is responsible for before analyzing the pipeline to collect data on reparables or interviewing the liaison officers. This area of research included discussions with USAF logistics personnel to determine the recent history of USAF logistics pipelines and a review of current regulations related to this topic. Individual steps were explored and examined in the repair and replace requisition process for further insight.

Description of Population and Sample

A population, according to Emory and Cooper, "is the total collection of elements about which we wish to make some inferences" (12:242). For the purpose of this research, the population will be all FMS reparables controlled by USAF ALCs under a repair and replace program. The sample for this study consisted of a selection of F-16 reparable assets that shipped from the ALCs within a six-month period. Any inferences from the sample to the population can be supported only by logic. For example, the conclusions we came to based upon our research of F-16 requisitions may not necessarily hold true for FMS customers requisitioning F-4 parts. There are numerous differences between the two systems and so it should be expected that inferences made about the F-4, based on our F-16 research, must be logically reasoned out.

Data Collection. Probability sampling refers to the random selection of elements to reduce or eliminate sampling bias by assuring that each population element is given a known nonzero chance of selection (12:244). In contrast, nonprobability sampling is nonrandom. However, although it is considered to be technically inferior to probability sampling because of the increased opportunity for bias to enter into the sample selection and possibly distort the research findings, nonprobability sampling is still a practical alternative method of sampling. Practical considerations such as time requirements were the reason for selecting nonprobability sampling. The particular type of nonprobability sampling that was used to collect data on common reparable parts is called judgment sampling. Judgment sampling, a type of purposive sampling, occurs when sample members are handpicked to conform to some criteria (12:275).

By collecting data on common reparables, we were able to determine such information as average times spent in various phases of the pipeline and the variability the customer could expect in each of those phases. The first thing to do was to identify a common weapon system. The F-16 was chosen because it is a relatively young and popular weapon system acquired through FMS with fifteen foreign countries carrying them in their aircraft inventories as of 1991 (19). In this regard, we considered the F-16 to be a good aircraft to focus on to gather a sample of repair and replace requisitions, managed by Ogden ALC, within the population of all FMS reparable requisitions controlled by all USAF ALCs under a repair and replace program. Another reason the F-16 was selected was because of the availability of data associated with a popular weapon system and the convenience it afforded us when we needed to collect the sample of requisitions. To further narrow the sample and make it a more manageable size, we decided to collect data only on requisitions that shipped from ALCs within a six-month period (19 December 1991 through 19 June 1992).

The Security Assistance Management Information System (SAMIS) was used to collect the data. SAMIS is the computer system used for FMS management and requisition routing and control. A standard request for comprehensive requisition data was submitted at the International Logistics Center (ILC) SAMIS office. A specific materiel management aggregation code (MMAC) was used to identify F-16 requisitions only. The MMAC further served to identify requisitions of parts common to the USAF inventory. Data collected from the resulting SAMIS product included nomenclature, the original document number provided by the customer, the requisition number, status history, shipping dates from the ALCs, and information pertaining to whether the requisition was programmed or non-programmed.

Pipeline times calculated by taking the differences of the julian dates in the customer document numbers, the H-coded requisition number, and from the processing dates listed in the status history. The original customer document number date was used to approximate the time when the demand was initiated by the customer. By taking the difference between that document number julian date and the date the requisition was H-coded we could approximate how long it took the unserviceable part to get from the customer to the ALC. This was assuming that H-coding truly was an automatic occurrence that happened within a day or two of the carcass's arrival at the ALC and that problems rarely inhibited the process. This assumption was based on assurances from both ILC and Ogden ALC personnel that the requisitions that did not automatically get H-coded were a very small percentage of the total. Projected shipping times were determined by using the first requisition status provided. The SAMIS product listed the history of the requisition transaction status codes assigned and reflected the first status and processing time sent to the customer. The most common status was "BB" meaning that the item was backordered against a due-in to stock. However, many assets were immediately available and the status code was "BA" to show that the requisition item was being processed for release and shipment. Rarely did the status of the transaction reflect anything other than BB or BA dates (11:35). The SAMIS product also included shipping dates found on the "AS3" lines which indicated the shipping status to distribution. The first section of the pipeline, from the time the customer's demand is initiated until the carcass arrives at the ALC and the H-coded requisition enters the depot's computer, is similar to what is known as "order time" in the USAF's Recoverable Consumption Item Requirements System (D041). The other part of the pipeline we looked at, which was from the time the requisition was H-coded until the ALC shipped the asset back to the customer, is identical to the "depot processing time" in the D041. Order time, depot processing time, and "shipping time" (the time from when the ALC ships the part until the customer receives it) are the three components of what is called Order and Shipping Time or "O&ST" (21:19). We did not try to estimate the final pipeline component because we had no way to track most of the parts shipped from the ALC back to the consumer.

Statistical Analysis

In performing a statistical analysis on the data collected from SAMIS, the following calculation methods and tools were used: arithmetic means, standard deviations, confidence intervals, box and whisker plots, the Wilcoxon

Signed Rank Test, and the Two-Sample T Test. This section describes each of these topics separately and how they applied to the data.

Box and whiskers plots of the complete data set showed numerous probable outliers and extreme values which skewed the distribution. These plots are provided in figure 2 for the pipeline times from the time the customer initiated the requisition until it was H-coded and from H-coding until shipment from the ALC. Outliers are the most extreme measurements that stand out from the rest of the sample and may be faulty, either incorrectly recorded observations or belonging to a different population than the rest of the sample (16:126). Since our research question focused on what the customer could typically expect for response times, the population we were interested in was <u>typical</u> pipeline times; therefore, we assumed the outermost values to be atypical and probably represented data that had been either entered incorrectly into the computer system, incorrectly transcribed during data collection, or had actually suffered delays probably caused by problems we discuss in chapter four. A full description of box and whisker plots is provided later in this section.

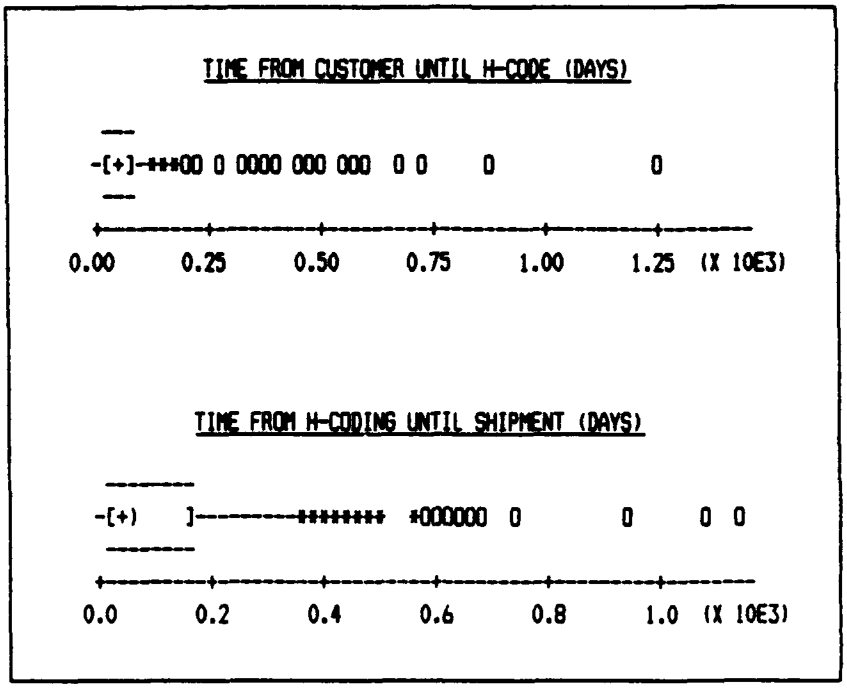

Figure 2. Box & Whisker Plots for Total Data Set

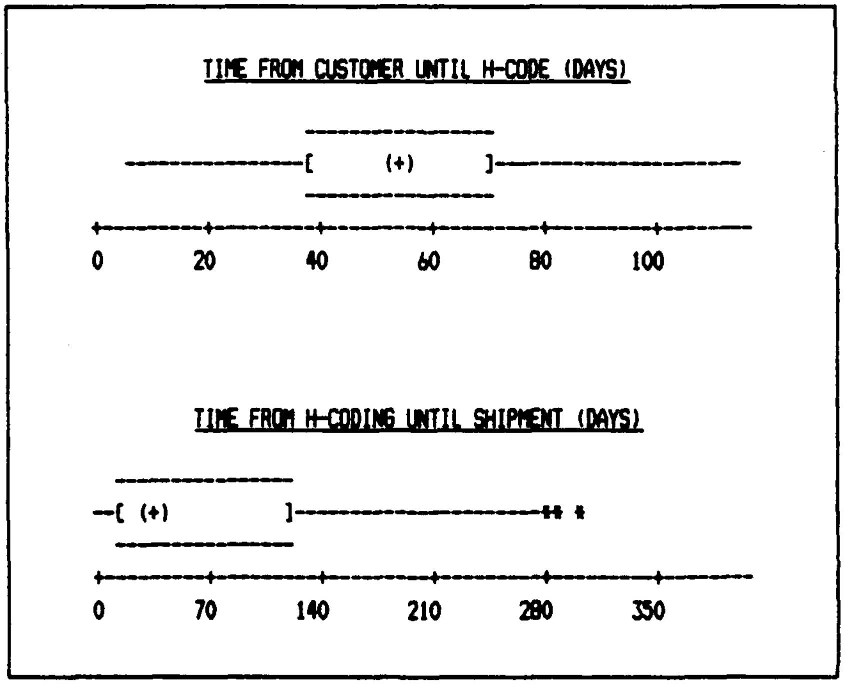

Figure 3. Box & Whisker Plots for Reduced Data Set

To ensure that the sample provided a highly acceptable, convincing representation of repair and replace requisitions, we consulted with Dr. Ben Williams, professor of statistics at AFIT. Dr. Williams reviewed our data and provided guidance to help us achieve that goal. He suggested removing the upper ten percent of the distribution tail in consideration of any random occurrences that would not depict normal flow of an asset through the pipeline. He further suggested taking confidence intervals based on the remaining data (25). For our analysis, we chose to use 90 percent confidence intervals. Box and whisker plots in figure 3 clearly show the effect of reducing the original data set by 10 percent. A full description of box and whisker plots is provided later in this section.

We looked at the individual distributions of the total reduced data set, the data relating to programmed requisitions only, and the data relating to non-programmed requisitions only. In each of these specific cases, separate evaluations were performed and ten percent of each of the distributions was removed. Since the distributions were almost always one-tailed this meant that the data removed came from the upper ten percent. The only exception to this was when we calculated the differences projected and actual shipping times and found a more normal distribution with two tails. We removed ten percent of this data by taking five percent from each tail. By normalizing the data in this manner, we could feel confident that our analysis would provide typical characteristics.

To perform all of these calculations, the data was entered into Statistix (version 3.5), an interactive statistical analysis program. This software was convenient to use and easily calculated descriptive statistics in addition to performing comparison tests such as the Wilcoxon Signed Rank Test and the Two-Sample T Test.

Arithmetic Mean. A popular and easily understood measure of central tendency for a quantitative data set is the arithmetic mean. "The mean of a set of quantitative data is the sum of the measurements divided by the number of measurements contained in the data set" (16:83). In nontechnical terms, this arithmetic mean is the average value of the data set. We used the arithmetic mean to provide a typical representation of the time for an asset to flow through the pipeline sections.

Standard Deviation. A method for determining the variability of the data is through the use of the standard deviation. The standard deviation is calculated as the "positive square root of the sample variance" (16:99). The variance is the sum of the squared distances from the mean divided by the number of measurements minus one. The standard deviation is a frequently used measure of spread because it improves interpretability by removing the variance's square and expressing the deviations in their original units (12:473). For example, the deviations were in "days" rather than "square days" when we viewed pipeline phase variability.

The Empirical Rule states that 68 percent of sample will fall within one standard deviation of the mean. Likewise, 95 percent will fall within two standard deviations and 98 percent will fall within three standard deviations of the mean.

Confidence Intervals. Unlike point estimators, such as the arithmetic mean, confidence intervals have some measure of reliability known as the confidence coefficient associated with them, and for that reason are generally preferred to point estimators (16:314). A confidence interval provides both an upper and lower boundary which could reasonably be expected to contain the mean within the confidence coefficient percent of times. For example, at a 90 percent confidence coefficient, we could expect the average time for a particular phase of the pipeline to average between the two boundaries 90 percent of the time.

Box and Whisker Plot. A box and whisker plot is based on the quartiles of a data set. Quartiles are values which partition the data into four groups, each containing 25 percent of the measurements. The lower quartile is the 25th percentile, the middle quartile is the median or 50th percentile, and the upper quartile is the 75th percentile. The box is determined by the interquartile range, the distance between the lower and upper quartiles, and represents 50 percent of the observations. The whiskers are constructed by establishing two sets of limits, the inner fences and the outer fences. The inner fences are located at a distance of one and a half times the interquartile range from the ends of the box and emanate from the box ends with lines referred to as whiskers. The two whiskers extend to the most extreme observations inside the inner fences. Values beyond the inner fences receive special attention because they are extreme values that represent relatively rare occurrences. These values are depicted on the plot with an "*". The outer fences are located at a distance of three times the interquartile range from each end of the box. Values beyond the outer fence are extremely rare and must be evaluated as potential outliers. These values are depicted on the plot with an "O" (16:125).

Parametric Versus Nonparametric Testing. As we mentioned at the beginning of this section, the Wilcoxon Signed Rank Test and the Two-Sample T Test were both used for performing the statistical analysis. To understand the reasoning for using both parametric and nonparametric testing in our methodology, a brief explanation is necessary to describe the relationship between the testing criteria and our data distributions.

Parametric testing requires the assumption that the data are normally distributed. When the data do not meet this criteria of normality, a nonparametric test is more appropriate. Using normality as the basic criteria, "parametric tests are generally more powerful [than] their nonparametric equivalents, although nonparametric tests often compare quite well in performance" (22:203). Figures 4a, 4b, and 4c show the dis ributions from the <u>reduced data set</u> that were evaluated and clearly indicate that a normal distribution is not evident in every phase of the pipeline being tested. For example, while the histograms for programmed and non-programmed H-coding times (PHCODE and NHCODE) present normally distributed data, the remainder of the histograms, which include programmed and non-programmed times for shipping (PSHIP and NSHIP) and total times from customer initiation until shipping from TRC (PTOTAL and NTOTAL) exhibit other than normal characteristics. Since the assumption of normality is not always met, the nonparametric Wilcoxon Signed Ranked Test was determined to be more appropriate. However, we chose to perform a parametric Two-Sample T Test as an additional measure of comparison and validation.

```
FREQUENCY (DAYS)        HISTOGRAM OF PHCODE
         :
         :      ******
   200   +      ******
         :      ******
         :      ******
   160   +      ******
         :      ******
         :      ******
   120   +      ******
         :      ******
         :      ******
    80   +      ******
         :      ************
         :      ************
    40   +      ************
         :      ******************
         :************************
     0   +-----+-----+-----+-----+-----+-----+
         0     30    60    90    120   150   180
            326 CASES PLOTTED    0 MISSING CASES

FREQUENCY (DAYS)        HISTOGRAM OF NHCODE
         :
   120   +      ******
         :      ******
         :      ******
   100   +      ******
         :      ************
         :      ************
    80   +      ************
         :      ************
         :      ************
    60   +      ************
         :      ************
         :      ************
    40   +      ************
         :      ************
         :******************
    20   +************************
         :************************
         :************************
     0   +-----+-----+-----+-----+-----+-----+
         0     30    60    90    120   150   180
            263 CASES PLOTTED    0 MISSING CASES
```

Figure 4a. Histograms

```
FREQUENCY (DAYS)        HISTOGRAM OF PSHIP
      |
180  +
     |*****
     |*****
150  +*****
     |*****
     |*****
120  +*****
     |*****
     |*****
 90  +*****
     |*****
     |*****
 60  +*****
     |**********
     |**********
 30  +**********
     |******************************
     |****************************************
  0  +----+----+----+----+----+----+----+----+----+----+-
     0   30   60   90  120  150  180  210  240  270  300
         325 CASES PLOTTED     0 MISSING CASES

FREQUENCY (DAYS)      HISTOGRAM OF NSHIP
     |
120  +
     |
     |
100  +*****
     |*****
     |*****
 80  +*****
     |*****
     |*****
 60  +*****
     |*****
     |**********
 40  +**********
     |**********
     |**********     *****
 20  +**********     **********
     |***********************************    *****
     |***********************************    ***************
  0  +----+----+----+----+----+----+----+----+----+----+----+
     0   30   60   90  120  150  180  210  240  270  300
         263 CASES PLOTTED     0 MISSING CASES
```

Figure 4b. Histograms

```
FREQUENCY (DAYS)          HISTOGRAM OF PTOTAL
    !
120 +
    !
    !
100 +
    !      ***
    !      ***
 80 +      ***
    !      ***
    !   ******
 60 +   ******
    !   ******
    !   *********
 40 +   *********
    !   *********
    !   ************
 20 +   ************   ******
    !   ************   *********
    !   ***************************   ***   ******
  0 +-----+-----+-----+-----+-----+-----+-----+-----+
    0     60   120   180   240   300   360   420   480
            324 CASES PLOTTED   0 MISSING CASES

FREQUENCY (DAYS)          HISTOGRAM OF NTOTAL
    !
 60 +
    !      ***
    !      ***
 50 +      ***
    !      ***
    !      ***
 40 +      ******
    !      ******
    !   *********
 30 +   *********
    !   *********
    !   *********      ***
 20 +   *********      ***
    !   *********      ******
    !   ************************   ***
 10 +   ************************   ***
    !   ************************   ***   *********
    !***************************************************
  0 +-----+-----+-----+-----+-----+-----+-----+-----+-----
    0     60   120   180   240   300   360   420   480
              263 CASES PLOTTED    0 MISSING CASES
```

Figure 4c. Histograms

Wilcoxon Signed Rank Test. This is a nonparametric procedure which tests the hypothesis that the frequency distributions for the two groups are identical. It is determined by ranking, or putting in order, each sample and summing the ranks. "If the rank sums are very different, the implication is that the two samples may have come from different populations" (16:954). This type of evaluation was also used to compare the pipeline times of programmed and non-programmed requisitions as a comparison to the parametric Two-Sample T Test. Because our data did not always meet the criteria of normality suggested for parametric testing, we decided to perform both types of evaluations. Although this nonparametric test is less accurate than a parametric test, the distributions and variances were probably better suited for it.

Two-Sample T Test. This parametric statistical procedure tests for the differences between the means of two independent samples. Two T Tests are computed, one assuming equal group variances and the other assuming different group variances (22:212). A test for equality of the variances is then performed, this is the F-statistic, and a P-value is calculated. The F-statistic is a statistical procedure to check the validity of equal variances in the means of two samples. The procedure for comparing sample variances makes an inference about the ratio of the sample variances with the larger sample variance being divided by the smaller sample variance (16:412-413). As the ratio nears one, the two samples are considered to have statistically equal distributions. This type of evaluation was also used to compare programmed and non-programmed requisition pipeline phases. The P-value, or the observed significance level, for a specific statistical test is "the probability of observing a value of the test statistic that is at least as contradictory to the null hypothesis (and as supportive of the alternative hypothesis) as the one computed from the sample data" (16:361).

Personal Interviews

Personal, face-to-face interviewing is a two-way conversation initiated by an interviewer to obtain information from a respondent. The greatest value of such an interview is the quality of information that can be secured in both depth and detail. The success of a personal interview is dependent upon three broad conditions: (1) availability of the needed information from the respondent, (2) an understanding by the respondent of his or her role, and (3) adequate motivation by the respondent to cooperate. Disadvantages associated with personal interviews include being time-consuming and also that the results can be adversely affected by inconsistent, untrained interviewers (12:320-321). Personal interviews were conducted with liaison officers to gather information pertaining to FMS reparable pipeline problems from the customer's viewpoint.

Interviewing FMS customers was accomplished by meeting with liaison officers from different countries. Many countries are represented by liaison officers working at the International Logistics Center located at Wright-Patterson AFB, Ohio. Officers from Israel, Egypt, and other countries were chosen to interview because of the number of F-16s their countries currently own. Rather than use a fixed set of questions to ask, a structured interview format was prepared to facilitate standardization. This format enabled us to guide the discussion and keep the FLOs talking about certain areas of interest related to the repair and replace pipeline. Our interview format is reproduced in Appendix B.

Effect-Cause-Effect Diagram

A tool popularized by Eliyahu Goldratt's "Theory of Constraints" was used to help illustrate how the problems are caused within the reparable return process. "In using the effect-cause-effect method we strive to explain the existence of many natural effects by postulating a minimum number of assumptions," according to Goldratt. The effect-cause-effect method identifies core problems (13:22-25). An effect-cause-effect diagram (or "current event tree") was developed to help understand how some of the basic assumptions about the repair/replace program can be violated and how problems result. This diagram was used to help us visualize how various problems effected other aspects of the repair/replace pipeline.

To read an effect-cause-effect (E-C-E) diagram, start at a block and read its contents. If the diagram has been built sufficiently, the statement should be clear and easy to understand. Assuming that the reader does not challenge the statement, it follows that "IF" the statement is true, "THEN" the following statement (at the end of the arrow) is the result. Multiple arrows leading to a statement and gathered together by an oval represent a situation where more than one event is required for the following statement to be true. In this case, the oval is read as a "logical and." For example, E-C-E number 1 in figure 5 reads, "if A and/or B, then C." When the arrows are linked, as in E-C-E number 2, it reads "if A and B, then C." The E-C-E diagram logically links undesirable effects (UDEs) together. The UDEs that were used to build the diagram (in figures 7a and 7b in chapter four) relate to the problems identified through discussions with Foreign Liaison Officers and USAF logistics specialists.

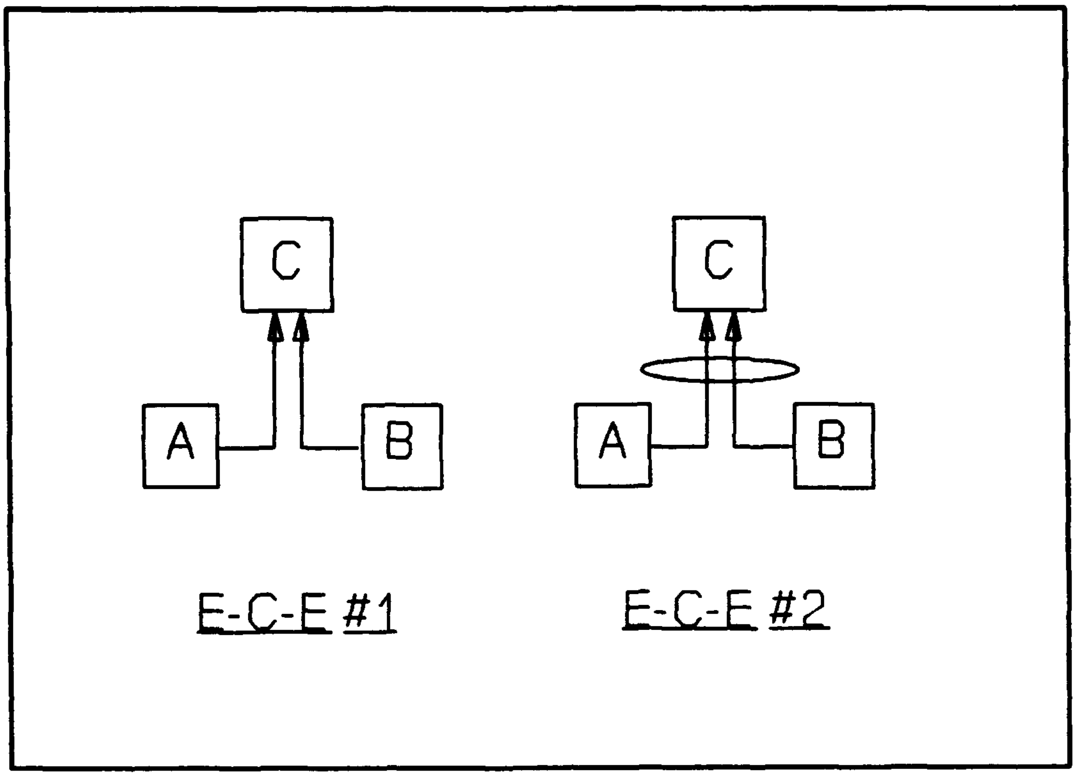

Figure 5. E-C-E Examples

Summary

This chapter presented the methodology we used to perform our research. Descriptions of the different areas of investigation were provided as well as an explanation justifying our choices of research procedures. Furthermore, we described selected methods of statistical evaluation which enabled us to analyze the data collected on repair and replace requisitions.

IV. Research Findings

Chapter Overview

The purpose of this chapter is to provide answers to the research questions posed in chapter one. As an introduction, there is a brief description of the repair and replace pipeline processes that are used to move assets requiring repair from the customer's operation to the point where replacement requisitions are filled and shipped back to the customer. Furthermore, problems discovered in the course of our research that are associated with the reparable pipeline will be illustrated and discussed.

Repair and Replace Processes

When an FMS customer needs to return an asset under the repair and replace program, the asset is shipped through a freight forwarder to a USAF repair facility or "technical repair center" (TRC) which is usually at one of the five ALCs. However, several things must occur in order for the customer to receive an asset in return. The customer must ensure that the asset in question is covered under an appropriate FMS case and is authorized to be sent for repair to a USAF repair facility. This may be accomplished in one of two ways. The asset may be pre-authorized for repair or the customer may request special permission for repair. The approval is then indicated on a Material Repair Requirements List (MRRL) as either "pre-authorized" or "manual." The country's MRRL indicates an "entry date" which reflects the date on which a particular national stock number (NSN) was first added to the list. There is also an "expiration date" on the MRRL, after which the ALC will no longer accept the item back for repair. This time frame from entry date to expiration date is usually 180 days (2:13.74). Once the carcass is received at a USAF repair facility, the requisition is transformed into an H-coded transaction indicating that it is an approved FMS requisition. The requisition is then processed along with other FMS requisitions and those of the USAF in accordance with priorities established by UMMIPS. Figure 6 illustrates the basic repair and replace process after the carcass arrives at the TRC.

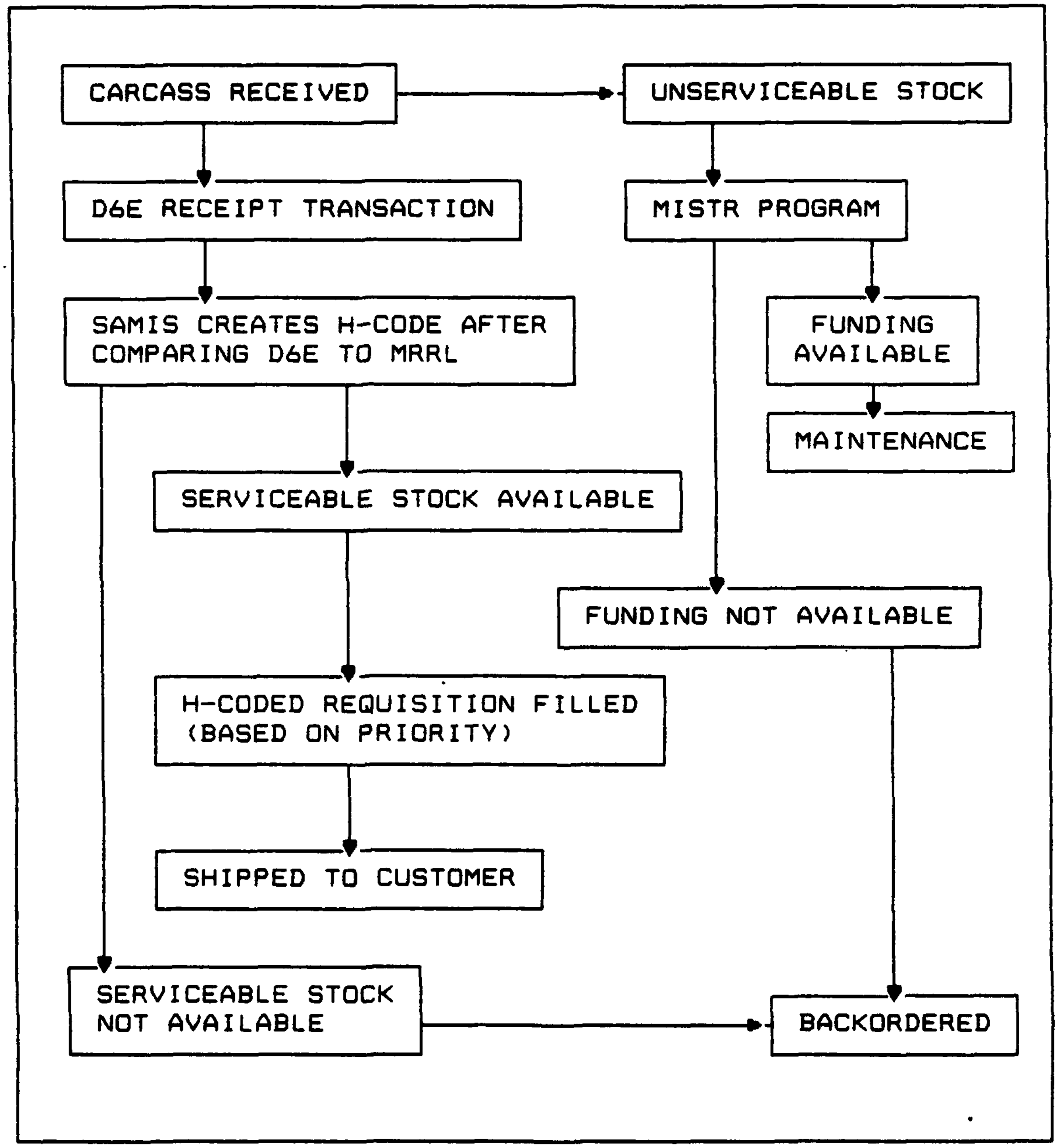

Figure 6. Basic Repair and Replace Process

MRRL Process. As mentioned above, an asset may be on the MRRL in one of two ways, preauthorized or manual. For preauthorization, items which are on the customer country's CLSSA stock level case (FMSO I) or which are members of an Interchangeability and Substitution (I&S) family whose master is on the stock level case may be preauthorized if they meet all eligibility criteria, including a valid USAF repair source. Repair of these items may then take place under the CLSSA requisition case (FMSO II). A monthly listing of preauthorized national stock numbers (NSNs) is provided to the country. This listing is the preauthorized MRRL. The manual MRRL is used for those items which are not preauthorized for repair. To obtain a manual MRRL, the customer must request repair of an asset not covered under their FMSO I and FMSO II cases (2:11-1).

Shipping. Once a customer has verified repair authority through the MRRL, it is the customer's responsibility to arrange for shipment of the reparable to the USAF within the designated time frame. The customer may not substitute the items with NSNs different than the ones approved. Furthermore, the customer may not return items to any TRC other than the one listed on the MRRL for that NSN. If the customer is returning more than one item to the same TRC, it is the customer's responsibility to mark the container appropriately, i.e. "MULTIPACK". It is also the customer's responsibility to arrange for the freight forwarding and to make necessary coordination efforts to allow for the clearance of the assets through U.S. customs. All FMS returns will be allowed to enter the U.S. duty free provided a customs declaration form accompanies each reparable shipment. When the asset is received by the ALC, DS will verify the NSN, quantity, and condition of the asset and create a D6E computerized receipt transaction for what is actually received, not on what is documented by the customer as having been sent (10:14.71-72).

Replacement Requisition (H-Code) Processing. After DS enters the D6E receipt transaction, the H-coding process is as follows:

1. SAMIS receives the D6E receipt transaction and attempts to match it to either a preauthorized or manual Material Repair Requirements List (MRRL) suspense transaction. This suspense refers to the time frame in which repair and replace transactions are available according to the current MRRL.

2. If a match occurs, SAMIS:

a. Automatically creates a replacement requisition known as an H-code (an "H" is placed in position 40 of the new requisition number).

b. Assigns the priority shown in the MRRL. If the priority is blank, as is the case for preauthorized suspenses, priority 15 is assigned. (Recent policy changes, which will be explained in more detail later, authorized case managers to elevate this priority to the highest level possible within the country's FAD.)

c. Automatically creates a status transaction that cross references the return carcass document number (position 8 through 22) with the replacement requisition document number.

d. Commits case funds in the appropriate amount to cover average repair costs (ARC); the stock list price (SLP); packing, crating, and handling (PCH); and condemnations.

e. Codes the requisition as either programmed or non-programmed. A requisition is programmed when the returned material is on the FMSO I and the requisition is less than or equal to the eligible-to-be-programmed quantity (EPQ). The EPQ is then reduced by the quantity of the programmed requisition (equal to the quantity returned) for 90 days, after which the EPQ reverts to its original level. An H-coded requisition is non-programmed when the returned material is not on the FMSO I or the requisition quantity is greater than the available EPQ.

At this point, if serviceable stock is available, the H-coded requisition is filled based on priority restrictions and shipped to the customer. Otherwise the requisition is backordered (2:11.5-11.6).

Research Questions

The remainder of this chapter addresses our four research questions. The first question was: "At what point do FMS reparables fall under USAF control or influence in the pipeline?" As previously mentioned, this question was answered during our literature review. We considered the section of the pipeline from the point that the assets arrive at an ALC for repair until the point where the customer's requisition is filled and shipped from the ALC to be under the direct control of the USAF. Furthermore, we considered the shipment of unserviceable assets from the customer to the appropriate TRCs to be influenced by the USAF because shipping procedures are dictated by USAF regulations.

Customer's General Perceptions of FMS

Our second research question was: "What are the customer's views of the USAF reparable pipeline and what do they perceive to be the biggest problems?" To answer this research question, personal interviews were conducted with foreign liaison officers stationed at Wright-Patterson AFB, Ohio. Since each FLO represented a country with unique FMS requirements, the interviews were only structured enough to get each FLO to share their individual perceptions, both good and bad. The basic format used for guiding the interviews in this way can be found in Appendix B.

While each FLO was very helpful, there was often a feeling that they were holding back a little in their criticism of the system and, conversely, that they were too generous in their praise. This can be explained by the political and diplomatic nature of the FLOs' jobs, and so it is important to note that their responses may not have been the most accurate for the purpose of gathering information related to FMS customer satisfaction. To compound this problem further, FLOs are often sensitive to what other countries may find out about the particulars of their FMS involvement with the USAF. Not knowing us and what we may tell other FLOs during our interviews, they may have been reluctant to divulge information (4). Therefore, the data collected from the foreign liaison officers may be considered inaccurate due to what Emory and Cooper called "response error." Response error occurs when data reported differ from the actual data for a variety of reasons including when the interview respondent fails to report fully and accurately. Respondents may find it difficult to report fully and accurately on topics that they regard as sensitive in nature (12:328). With this in mind, it would be understandable if the FLOs felt the interview topics were sensitive considering their positions as representatives of their countries. Although the information could have been considered inaccurate, we found that many of the FLO's perceptions were similar and verifiable through contacts with logistics specialists working in ILC, and therefore it was still of interest to us.

Foreign liaisons from Turkey, Venezuela, Israel, Greece, Indonesia, Singapore, Spain, and Egypt were interviewed. Most of the respondents expressed that FMS did a good job providing the systems and support their countries needed. When the FLOs were asked to describe the problems they saw, many indicated that there were no real problems with the system and that most problems that did occur were their own (the customer's) fault. For example, problems were often the result of not properly following procedures which often indicated a need for more training or experience on the part of the customer. Another problem beyond the control of the USAF was that most customers lacked an adequate tracking system to provide them with visibility of their assets in the pipeline.

An overview of the FLOs' reported perceptions of FMS problems in general, and the repair and replace program in particular, follows:

a. Item managers did not adequately update shipping information.

b. Problems were caused by the lack of long-range logistical planning on the part of the customers who had not learned how to provide proper support for complicated and sophisticated weapon systems.

c. Some believed that the USAF was not customer-oriented.

d. In general, customers had fewer problems working with a particular ALC when another FLO was stationed at that ALC. When the FLOs were asked whether or not they perceived one ALC to be better than the rest, they did not indicate a favorite ALC; however, in most cases FLOs thought that they had the most problems with San Antonio ALC. (The upcoming section which discusses policy changes involving FMS repair and replace will include an explanation of possible contributing factors that could lead to such customer perceptions about San Antonio ALC in addition to a brief description of ongoing efforts to improve the support provided there.)

e. Many stated that ALCs needed to track incoming parts. Item managers did not know when parts were on the way or when they were received.

f. USAF work capacity was not being used to full potential to provide customer support.

g. Practically all FLOs agreed that the H-coding process took too long.

h. Some did not see the advantage to buying into CLSSA because they could not tell much difference between the treatment of programmed and non-programmed requisitions.

i. SAMIS tracking ability was not good enough.

j. There was no feedback from ALC or ILC to indicate immediate receipt of assets. Therefore, if problems came up after the carcass arrived at the ALC and H-coding did not automatically occur, the customer had no way of knowing.

k. No real visibility of items in the pipeline made it difficult to tell when something was lost or missing.

l. The quality of repair work at ALCs needed to improve. Broken items were sometimes received from ALC.

m. The priority system did not treat customers right.

Process Problems and Causes. In order to for us to comprehend "the big picture" better, we also talked to logistics specialists at the International Logistics Center and asked them to explain to us the problems involved in the replacement requisition process. Their insights enabled us to understand some of the causes of the problems mentioned by the FLOs.

To start with, customers felt that H-coding was far from being the "automatic" process it was meant to be. However, typical problems which slow down the replacement requisition process and add to the time it takes to get a requisition H-coded are associated with improper requisitioning practices on the part of the customer, i.e. the customer not following USAF regulated guidance. For example, if parts are returned under a repair and replace program without ensuring that they are covered by either a preauthorized or manual MRRL (that is, establishing whether or not the items are currently authorized to be returned for repair) then there will not be a match when the D6E is compared to the MRRLs if the item is not listed. Another typical problem is due to improper shipping practices such as sending multiple assets in a container to a single ALC, even though some of the items need to go to other ALCs for repair. When this occurs, the first receiving ALC will frequently forward parts to the correct technical repair center without notifying either the customer or the ILC. As a result, since the parts have not been "received" yet, the parts lose their identify as an FMS asset. Hence, the TRC receives parts that are believed to belong to the USAF and the FMS asset appears to be lost because of the misrouting. However, in spite of these problems, only a very small percentage of customer requisitions fail to get H-coded automatically (6).

Aside from these issues, other USAF policies or practices were also found to contribute further to customer difficulties with the repair procedures. Some of these were:

1. The requirement that USAF funds had to be available to do the repair, in spite of the fact that the FMS requisition was fully funded. Depot purchased equipment maintenance (DPEM) money was needed to cover the repair expense before customer funds were used. Therefore, if the USAF did not have funds available to cover repairs, the customer's requisitions could not be filled even though the customer had already paid.

2. The requirement that reparable carcasses had to be in the USAF's possession before replacement assets could be shipped to fill a requisition.

3. Item managers could use FMS carcasses to support condemnations and other USAF requirements rather than purchasing more assets. While it was understood how the UMMIPS priority system would result in the USAF having priority over FMS customers, the requisition system was not

designed to encourage item managers to plan for FMS requirements and buy assets accordingly.

4. There were opportunities to discriminate against FMS customers. For example, if two countries submitted similar requisitions with identical priorities at different times, favoritism could be practiced by filling the more recent requisition first.

Effect-Cause-Effect Diagram. To illustrate the different kinds of problems within the repair and replace process, an effect-cause-effect diagram was developed. The E-C-E diagram helped to visualize how problems occur by stringing together a sequence of possible events and describing the ensuing effects. This diagram is by no means intended to reflect all of the possible problems within the repair and replace requisition process, but rather it is meant to highlight the most common problems we learned about in the course of our research.

An item manager review (IMR) conducted from 23 March to 17 April 1992, that included a review of all ALCs except Warner-Robins over the previous year, identified problem areas very similar to those we mentioned here. The IMR investigation was not limited to the repair and replace pipeline the way our research was and therefore represented a much broader range of support. However, it was interesting to note that the IMR findings showed that approximately ten percent of the problems found were related to supporting Desert Shield and Desert Storm and the materiel shortages that resulted, particularly involving parts for C-130 transport aircraft (6). The accompanying E-C-E diagram does not include problems associated with any shortages generated by the Persian Gulf War.

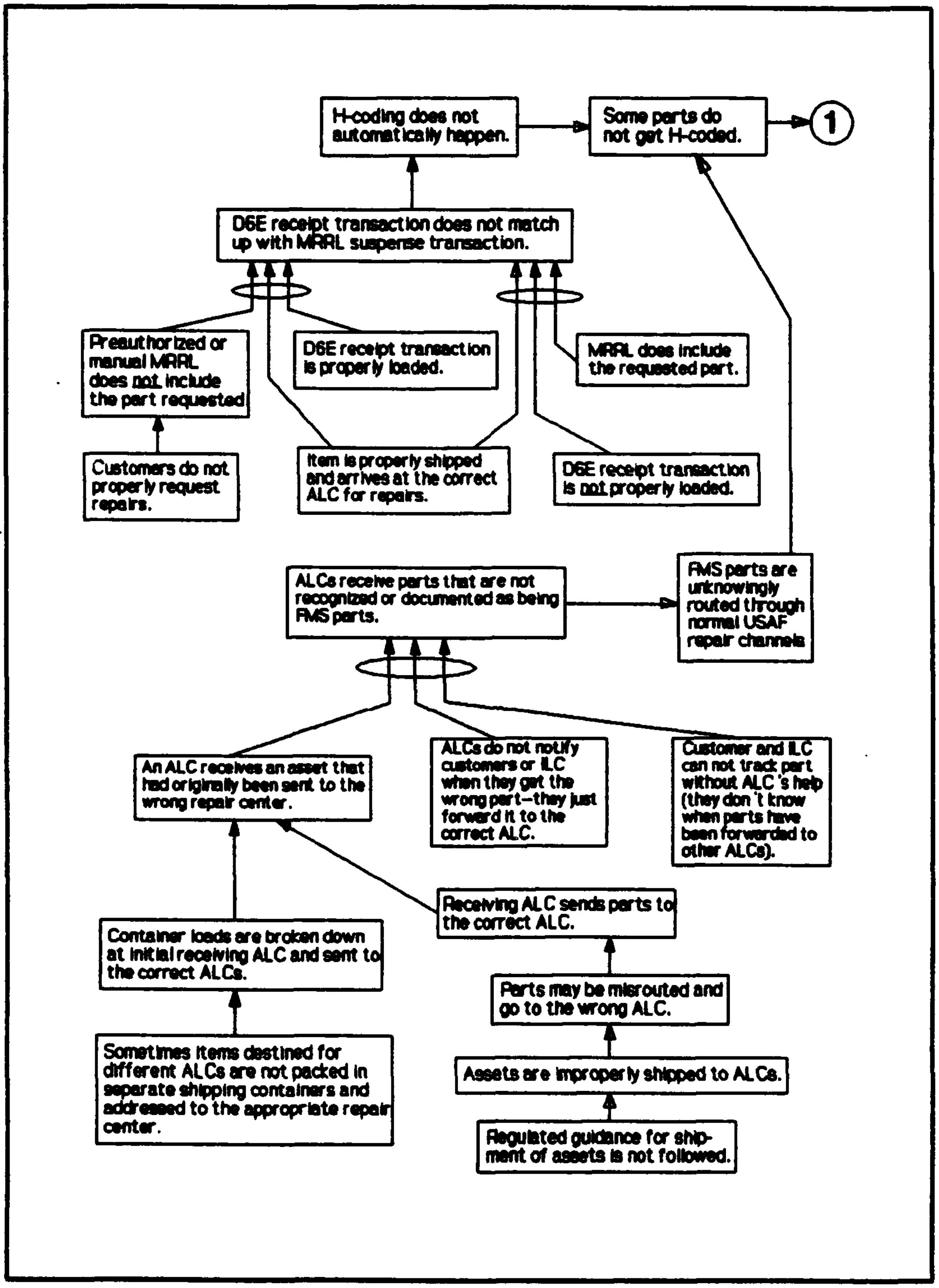

Figure 7a. Effect-Cause-Effect Diagram (Part 1)

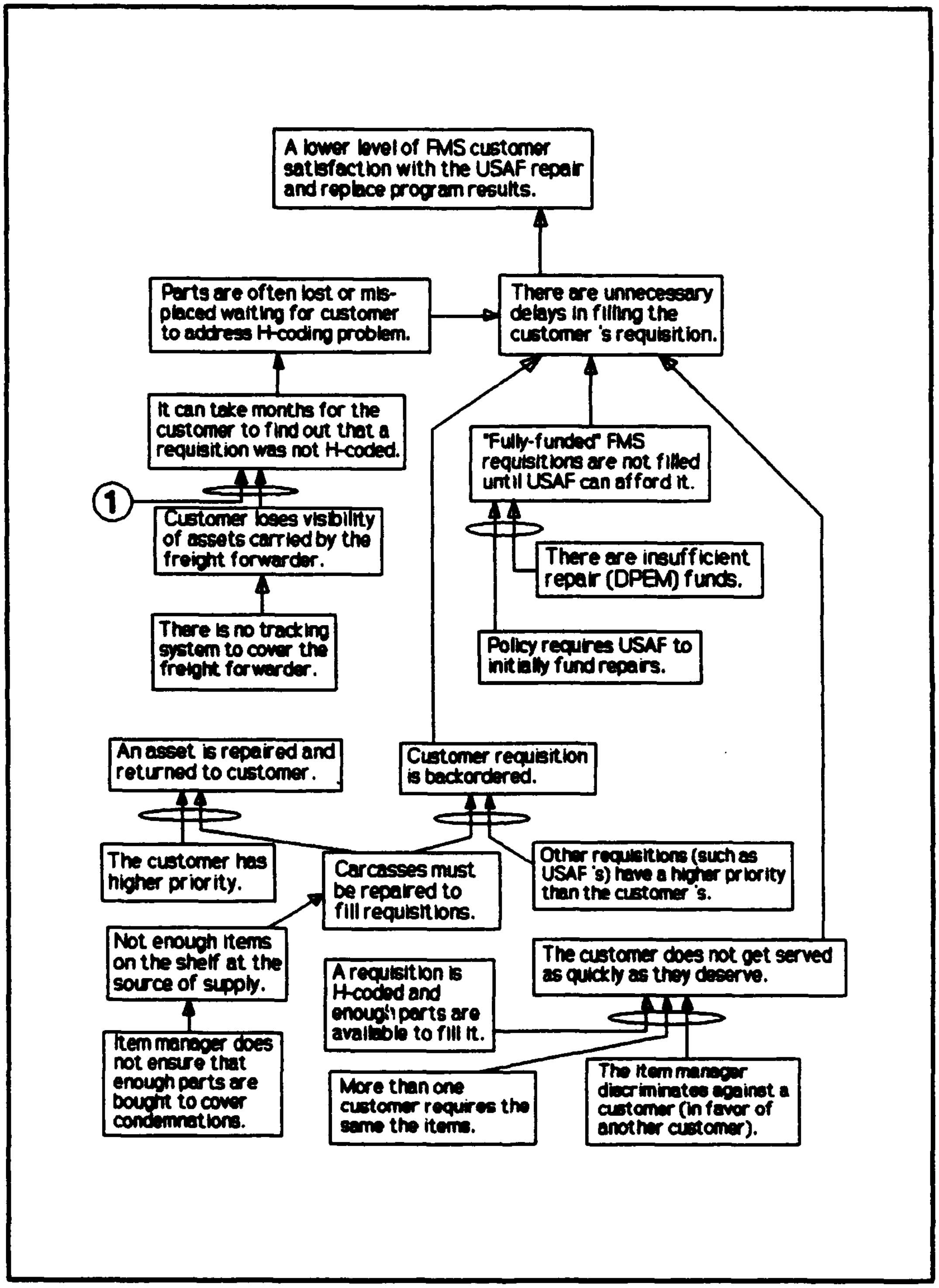

Figure 7b. Effect-Cause-Effect Diagram (Part 2)

Policy Issues

Our third research question was: "What repair and replace program policy issues have been addressed as a result of the current heightened interest in FMS logistical support?" We researched these policy issues primarily through personal interviews with ILC Policy Office (XMXB) personnel. In the course of our discussions we found that during a tour of the ALCs by the AFLC commander, General McDonald, a presentation at Oklahoma City ALC brought to his attention various difficulties in supporting foreign reparables. As a result, General McDonald elevated management attention at all levels initially by sending each ALC commander the previously mentioned letter that stressed the importance of improving the level of support offered to our FMS customers and stating that new policy would be forthcoming. Here we address the policy issues by reviewing suggested policy changes and discussing their current status.

In May, 1991, shortly after General McDonald's letter, a message from AFLC/XR (Items Requirements Directorate) to all appropriate ALC organizations outlined policy changes either implemented or being considered (20). Following is a brief description of each new policy mentioned in that message including current status updates as of June 1992.

1. Policy: Increase the priorities of existing and newly created H-coded requisitions to the highest priority allowable within the country/case FAD. It was the intention

of this policy to let FMS repair and replace requisitions compete more effectively with USAF and other requisitions for both repair negotiations and asset allocation.

Status: This policy was implemented by ILC/XMX (Policy Office) with a letter to each case manager on 26 April 91. All requisitions were manually upgraded by the case managers and FLOs indicated that the action was visible to the customer and was effective. A change to the SAMIS case records was implemented which allowed for an automated capability to establish the appropriate priority when the H-coded requisition is created. The change allows the case manager to enter into the case record the priority to be assigned for that case. ILC/XMX recommends that the case managers use the highest priority allowed but the final priority is set by the case manager. One possible exception to the use of this priority is for preauthorized MRRLs which have a higher priority. In this case the highest priority takes precedence and is assigned for that requisition.

2. Policy: H-coded requisitions will be treated as fully funded repair requirements.

Explanation: In the past, ALC item managers used the overall shortage of depot purchased equipment maintenance (DPEM) program funds as a reason for not providing timely support. It was perceived to be advantageous to obligate the FMS funds as soon as possible since reimbursable authority for FMS repair requirements was projected and authorized each fiscal year based on historical data. For this reason, the implementation of such a policy eliminated USAF funding shortages as an excuse for untimely support.

Status: The AFLC/CC letter to each ALC directed that the FMS repair backlog be cleared up and emphasized that, since FMS repairs were fully funded, timely repairs were appropriate. Representatives from the ILC visited each ALC and performed item management reviews to evaluate the various causes for delays in supporting older FMS repair requirements and reported the findings to AFLC requirements and item management directorates. Their findings could not adequately support the idea that funding practices were a concern. The long range goal of this policy was to create alternate funding methodologies for FMS reparables. However, Defense Security Assistance Agency (DSAA) rejected this proposal and as late as June 1992, General McDonald stated that funding was not an appropriate reason for untimely support and that this was no longer an issue for consideration (24). However, ILC policy personnel continued to pursue changes in funding practices. ILC felt that a more appropriate way to address this problem was to "fence" FMS repair money. Their proposed change to the repair and replace funding process would provide money for the repair of FMS assets even when USAF DPEM funding priorities are placed elsewhere. This would keep the FMS customers from having to wait for the USAF to fund repairs that the customer has already paid for.

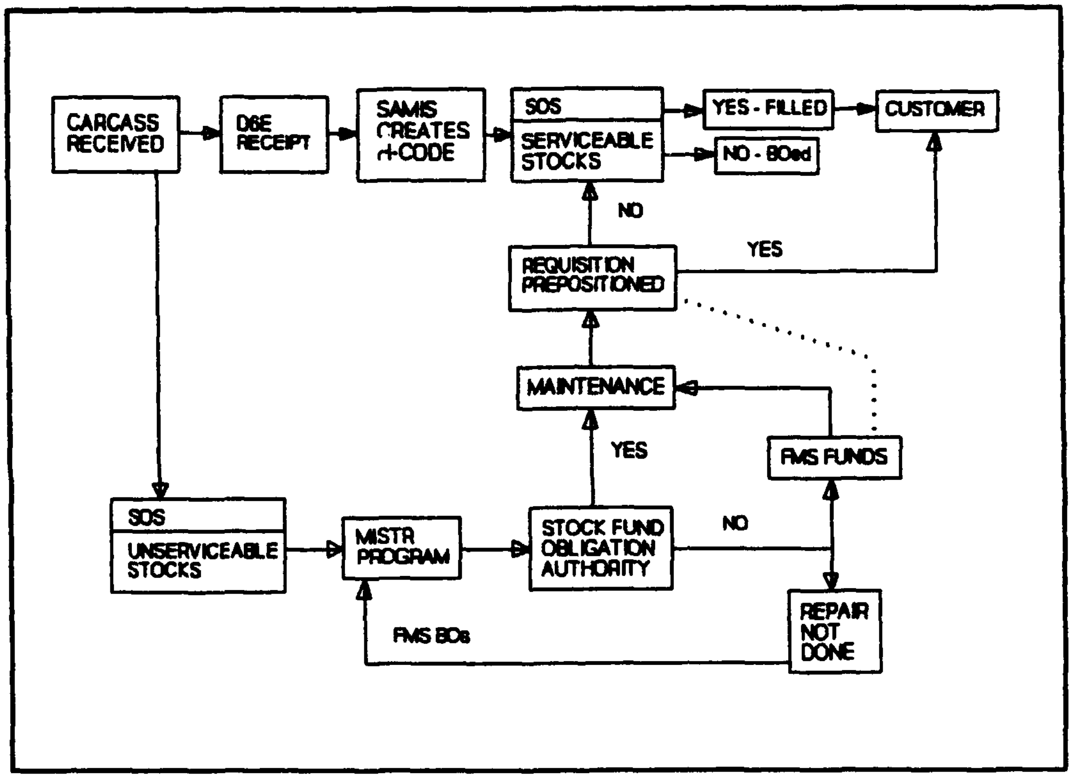

Figure 8. Improved Support Repair and Replace Process (14)

A diagram of the proposed change can be found in figure 8 and is supplied to provide a contrast to the basic repair and replace process previously diagrammed in figure 6. This chart of the proposal to improve support for the repair and replace process clearly shows the link between the fenced "FMS FUNDS" and "REQUISITION PREPOSITIONED" to indicate that those funds would be available to cover the costs if DPEM funds were not.

3. Policy: H-coded requisitions will be considered and treated as a request for a service rather than as a requisition. (Note: The standard requisition format is used only because it is identifiable within all of the affected data systems.)

Explanation: The intent of this policy was to change the philosophy used by the USAF to improve the support provided to FMS customers. Unlike regular requisitions, in these cases the USAF had already received a reparable carcass from the customer and funding was obligated for the repair of the item only. We could not buy to fill the requirement but had to fill the requisition with assets on hand, due-in, or through repair since new procurement is not authorized for the repair and replace program (10:8.103).

Status: Action was taken at all ALCs, the ILC, and HQ AFLC to help create this change in philosophy. These changes consisted of such things as the introduction of an HQ AFLC FMS Repair Replace Tiger Team and ALC Process Action Teams (PAT). Also, ILC developed and presented item manager short courses. The goal was to educate USAF personnel so that they may better understand the impact of improved support for America's allies. Nowhere was the need for improved support more noticeable than during Desert Shield/Storm when it became obvious that U.S. allies combat capabilities in the Persian Gulf were directly linked to FMS support. Therefore, the Persian Gulf War provided further emphasis and helped change the old mind set.

4. Policy: H-coded non-programmed requisitions will be treated as programmed 90 days after receipt at the ALC.

Explanation: Under regulatory guidance, non-programmed requisitions suspense computations were based on 180 days after receipt in the D035 system. By reducing this period to 90 days allowed assets to be released to lower support levels sooner. The waiting period would not be reduced further in order to continue the incentives inherent in the CLSSA buy-in concept, such as requisitions being filled much faster, and ensure that projected requirements are included in the USAF total computations.

Status: Item managers were given the authority to manually treat non-programmed H-coded requisitions over 90 days old as programmed with the receipt of the message which outlined these policy issues, May 1991 (20:4). The reduced waiting period was automated in the D035 system in January 1992, relieving the item managers of the responsibility of having to manually input the change. Interviews with FLOs indicated that the action was visible to the customer and was effective.

5. Policy: Change the distribution logic in the USAF computer network to put H-coded requirements higher in the pecking order for serviceable asset release.

Explanation: This "distribution logic" basically referred to the way that an asset could be diverted to any requisition as long as it was still under the ALC's control and had not actually been shipped. Therefore, even though FMS funds were obligated for repair of assets and an item was destined to fill an H-coded requisition, the asset could still be pulled at any time to fill higher priority requisitions. Since H-coded requirements were not "normal" requisitions, they should not have been constrained by the normal distribution pecking order.

Status: An initial six month test program was planned in early 1991 but due to Desert Storm and the amount of increased workload to do manually, the test was placed on hold pending automation and subsequently was dropped as a possible policy change.

6. Policy: Establish a method to ensure that assets are released to those customers for whom funds were obligated.

Explanation: Implementation of this policy would ensure that a customer's funded requisition is filled, regardless of priority, prior to that of a non-funded requisition. If alternate methods of funding were to be developed, this type of accounting would be mandatory.

Furthermore, if such a policy were to lead to an automated procedure, it would enhance the system ability to distribute assets properly.

Status: To coincide with ILC's suggested funding change described in paragraph two above, the ILC developed a proposal in which FMS items at the point of entering repair receive a "mark-for" designation and once the repairs are completed, the asset is shipped to that destination through normal shipping channels rather than entering back into the normal supply stock. In other words, once a customer provided the funds for a particular asset to be repaired, that asset would not be re-routed to another activity with a higher priority. At the time of this writing, the Tiger Team was continuing to examine possible procedures and impacts.

Observations. In researching these policy issues, several items were observed worth noting. First, as a result of the efforts to achieve a change in philosophy toward FMS support, representatives from the ILC personally trained approximately 890 item managers. Interestingly, after ILC announced visits to each ALC to conduct item manager reviews on older H-coded requisitions, many of the older requisitions were released by the item managers. Additionally, the efforts of the HQ AFLC Tiger Team and ALC PAT teams resulted in lowered H-coded service orders over one year old at all ALCs. The reductions ranged from a low of five percent at Sacramento ALC to a high of 31 percent at

Warner-Robins ALC for the period from May 1991 to April 1991 (23). Table 3 shows the progress made by all of the ALCs over that period of time.

TABLE 3.

PERCENTAGES OF OPEN H-CODED REQUISITIONS OVER ONE YEAR OLD BY ALC (23)

ALC	May 91	Sep 91	Dec 91	Apr 92
OC	30	25	23	23
OO	18	13	12	11
SA	26	23	15	17
SM	34	20	29	29
WR	51	26	21	20

As previously noted, many of the Foreign Liaison Officers indicated that the ALC they had the most problems with was San Antonio. A possible explanation for this could have been that recent changes in organizational structure moved many of Sacramento ALC's assets to responsibility centers at San Antonio. It was reasonable to expect that the additional workload on San Antonio, particularly when many of the transferred systems (and their historical problems) were older, could cause difficulties until adjustments could be made to the new work requirements. These problems were recognized and addressed by suggesting additional manpower be added to the San Antonio ALC FMS focal point office staff to better handle the workload of FMS problems. Furthermore, as of June 1992, a test program was implemented at San Antonio which gave item managers the authority to work outside normal UMMIPS priorities and procedures. Once immediate USAF requirements and MICAPs were taken care of, item managers were allowed to use their own discretion and best judgement to determine what H-coded requisitions to release, regardless of the age of the requisition.

Statistical Analysis

A standard comprehensive requisition data product from SAMIS that reflected those F-16 repair and replace requisitions that had shipped in a six month period provided the data used in our analysis. To approximate the times when the customer initiated the requisition, we used the julian date from the original customer document number. It is also important to note that while the exact dates that the carcasses arrived at the ALCs were not available, they could be approximated by the dates of the H-coded requisition numbers, assuming that most requisitions arrived and were H-coded automatically within a few days and without any problems. Projected shipping times were determined by using the first requisition status provided. The SAMIS product showed the history of the requisition transaction status codes assigned and reflected the first status that the customer would have received. The most common status was "BB" meaning that the item was backordered against a due-in to stock. Sometimes assets were immediately available and the status code was "BA" meaning that the requisition item was being processed for release and shipment. In only a few cases did the status of the transaction reflect other than BB or BA dates (11:35). The SAMIS product also included shipping dates found on the "AS3" lines (shipping status to distribution) and programmed source codes which told us whether the requisition was programmed or non-programmed.

The data consisted of 656 actual H-coded requisitions from Venezuela, Turkey, Thailand, Netherlands, South Korea, Indonesia, Greece, Egypt, Denmark, Belgium, and Bahrain which were shipped between 19 December 1991 and 19 June 1992. The breakdown of requisitions by country is presented in figure 9. The data consisted of 293 requisitions that were non-programmed and 363 that were programmed and was loaded into a spreadsheet for sorting and initial evaluation. The subsequent statistical study was performed using the analytical software package Statistix (version 3.5). Calculations were performed to determine the means, standard deviations, and confidence intervals for each of the different areas of interest. The Wilcoxon Signed Rank Test and the Two-Sample T Test were also used to compare programmed and non-programmed requisitions.

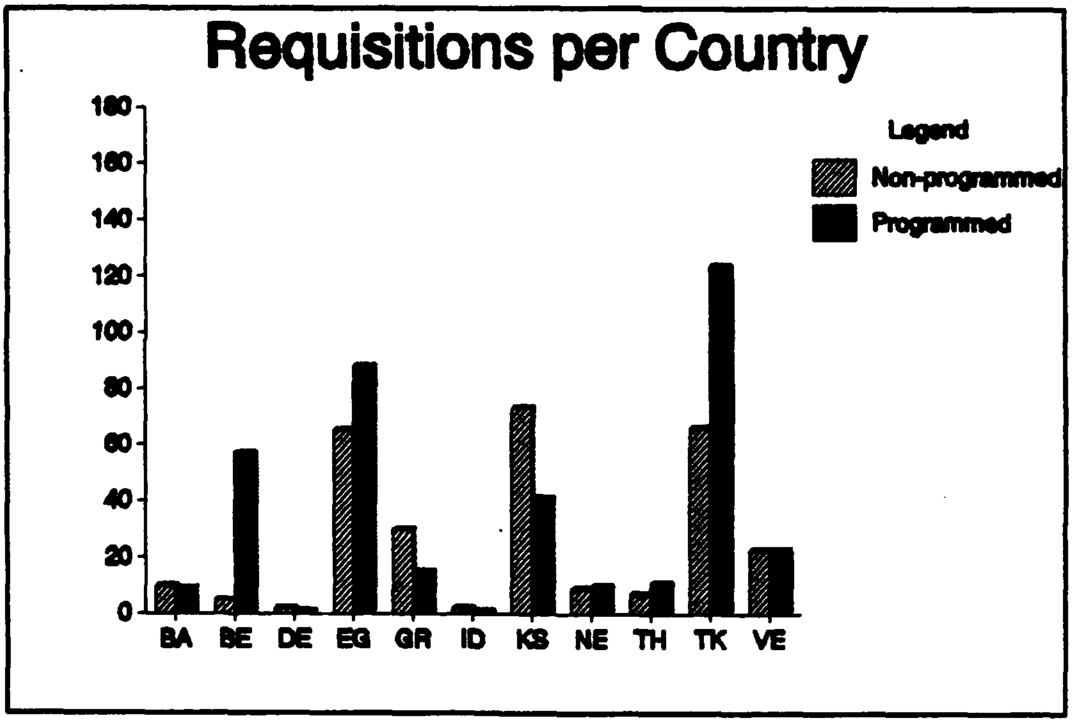

Figure 9. Number of Requisitions By Country

Findings. Our final research question was: "What can an FMS customer typically expect in terms of response times for the replacement requisition process?" The remainder of this section answers this question as the findings that resulted from the statistical analysis are presented.

Total Data Set. To keep our results in perspective, general information pertaining to the entire data sample (before it was reduced by ten percent) indicated the following:

a. On average, it took approximately 86 days from the time a customer started a requisition until it was received and H-coded in the USAF system.

b. On average, the USAF shipped an asset to fill the requisition 112 days after H-coding.

c. Overall, from the time a customer initiated a repair and replace requisition until that requisition was filled (shipped from the TRC) took an average of 198 days.

d. The requisitions were filled an average of 306 days prior to the first projected shipping date. In other words, the initial projections, on average, exceeded the actual time an ALC took to ship a requisition by 306 days.

e. In only 13 percent of the programmed cases examined did requisitions take longer to fill than what was originally projected by the USAF, and less than 16 percent of the cases for non-programmed. The projected dates had been indicated normally by the initial BB status. A possible explanation for the ALCs beating the projected time by such a large margin is that BB status is typically a very rough estimate based on a worst case scenario. (Note: Statistix was not used to determine these percentages. They were calculated by counting the number of requisitions exceeding their projected ship dates and dividing by the total number of requisitions in the sample.)

Reduced Data Set. As we mentioned in the methodology chapter, we decided to remove ten percent of the data to ensure that our statistical analysis provided typical pipeline characteristics. The remainder of the statistical information presented in this chapter was based upon that reduced sample.

a. It took an average of approximately 55 days from the time a customer started a requisition until it was received and H-coded.

b. On average, the USAF shipped an asset to fill the requisition about 72 days after H-coding.

c. From the time a customer initiated a repair and replace requisition until that requisition was shipped from the TRC took an average of around 148 days.

d. The reduced data showed that requisitions were filled an average of 299 days prior to the first projected shipping date.

Programmed Versus Non-programmed. The following information was obtained by differentiating between programmed and non-programmed requisitions:

a. Programmed requisitions were H-coded, on average, 53 days after initiation of the requisition while non-programmed requisitions took an average of 57 days. For programmed requisitions, the 90 percent confidence interval was from 51 to 55 days with a standard deviation of 21 days with a range of 20 to 107 days. For non-programmed requisitions, the 90 percent confidence interval was from 55 to 59 days with a standard deviation of 23 days with a range of 5 to 121 days.

b. Requisitions were filled and shipped, on average, 60 days and 85 days after H-coding for programmed and non-programmed respectively. The 90 percent confidence intervals were 54 to 66 days for programmed, with a standard deviation of 67 days and a range from 3 to 248 days, and 76 to 94 for non-programmed, with a standard deviation of 88 days and a range from 2 to 328 days.

c. Overall, from the time a customer initiated a repair and replace requisition until the requisition was filled (shipped from the TRC) the average was 132 days for programmed and 167 days for non-programmed. The 90 percent confidence intervals were 123 to 141 and 155 to 180 days respectively. Programmed requisitions had a standard deviation of 97 days and a range of 27 to 439 days and non-programmed had a standard deviation of 121 days with a range of 25 to 495 days.

d. Programmed requisitions were typically filled 251 days prior to the first projected shipping date provided to the customer and non-programmed items were usually shipped an average of 397 days earlier than the first projected shipping date. The 90 percent confidence intervals were 240 to 266 for programmed and 366 to 427 for non-programmed. The standard deviation was 119 for programmed with a range of 356 days early to 39 days past the projected date. The standard deviation was 299 for non-programmed with a range of 990 days early to 49 days past the projected date.

e. In only 8 percent of the programmed cases examined did requisitions take longer to fill than what was originally projected by the USAF, and less than 12 percent of the cases for non-programmed.

f. Using the Wilcoxon Signed Rank Test and the Two-Sample T Test to evaluate both the total data set and 90 percent of the data after removing outliers, the programmed and non-programmed requisitions statistically proved to be significantly different in the way they were treated for shipping times after H-coding. The ranked sums of the Wilcoxon Signed Rank Test for both the total data set (Appendix D) and the reduced data set (Appendix E) were clearly different. The Two-Sample T Test validated this with a probability of less than one percent for the total data and a probability of zero for the reduced data set that these two distributions would be the same. For the size of sample used, at any probability, in order for the two samples to be considered equal the F statistic must be less than 1.00. This was not the case, in fact, the F statistics for both total and reduced data sets were substantially greater than 1.00 showing significant difference between the samples. Table 4 provides both the Wilcoxon Signed Rank Test differences and the Two-Sample T Test probabilities extracted from the appendixes.

TABLE 4.

STATISTICAL COMPARISON OF PROGRAMMED AND NON-PROGRAMMED REQUISITIONS

	Total Data	Reduced Data
Wilcoxon Signed Rank Sums	-2332 1945	-1529 1221
Two-Sample T Test	P = 0.0089 F = 1.30	P = 0.0000 F = 1.69

This significance should be looked at from the perspective that in 90 percent of the cases the average time to fill a requisition took only 22 days longer for a non-programmed requisition than it did to fill a programmed one. Both the parametric Two-Sample T Test and the nonparametric Wilcoxon Signed Rank Test yielded practically identical results which gives added support to these findings.

Interesting to note was the difference between the time it took programmed and non-programmed requisitions to get H-coded. We expected to find no difference between the two, however this was not the case. As shown previously, times for programmed requisitions averaged 53 days in 90 percent of the cases whereas non-programmed averaged 57 days, four days longer to receive an H-coded requisition number and begin processing through the USAF channels.

Table 5 summarizes the pipeline times determined from the reduced data set for more convenient reference. Also, figure 10 presents a side-by-side comparison of programmed and non-programmed requisitions in the repair and replace pipeline and shows very clearly that FMS requirements were filled quicker when they were programmed. Sets of calculations performed on both the complete data sample and the reduced sample are presented in the form of Statistix outputs in Appendix D and Appendix E respectively.

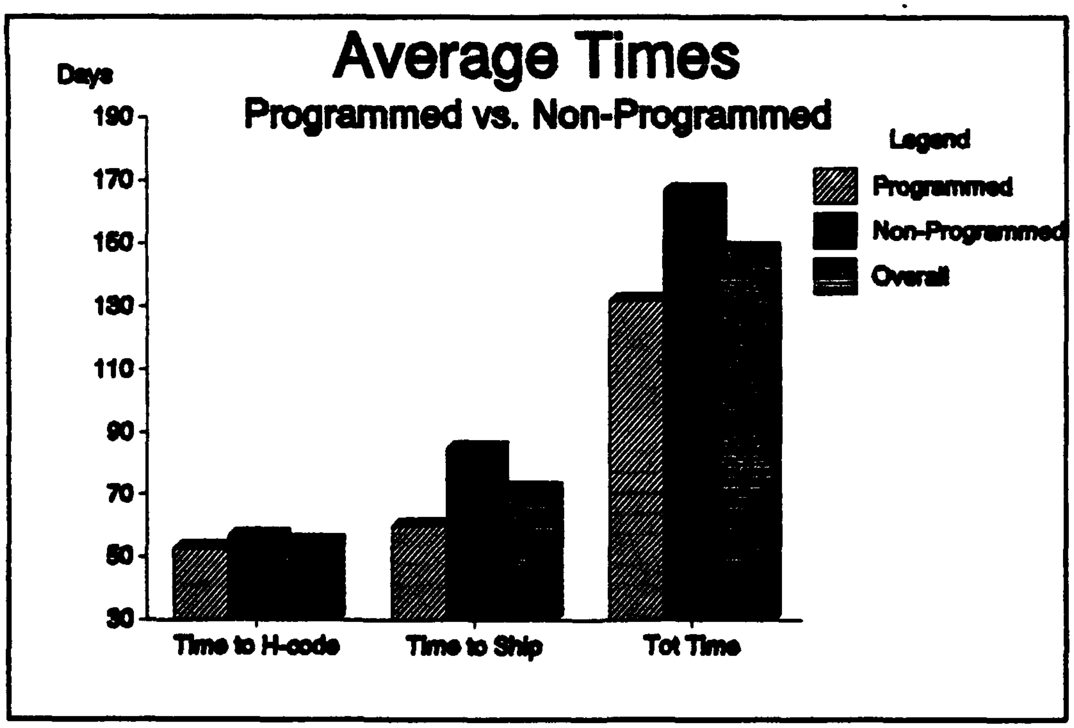

Figure 10. Average Pipeline Times

TABLE 5.

PIPELINE TIMES IN DAYS
FOR REDUCED DATA SET (90%)

Pipeline Segment		Prog	Non-prog	Total
Customer to H-Code	AVG	52.75	57.07	55.04
	90% CI	50.86-54.63	54.74-59.41	53.54-56.54
H-Code to Return Shipping	AVG	59.94	85.32	71.53
	90% CI	53.85-66.04	76.37-94.27	66.29-76.77
Customer to Return Shipping	AVG	132.0	167.2	147.7
	90% CI	123.1-140.9	154.9-179.5	140.4-155.1
Diff Between Proj & Actual Return Ship	AVG	251.1	396.6	299.1
	90% CI	240.2-266.0	366.1-427.0	285.3-312.8

Summary

In this chapter we answered the research questions originally posed in chapter one. To briefly summarize, our findings were as follows:

1. We considered the section of the pipeline from the point that the assets arrive at an ALC for repair until the point where the customer's requisition is filled and shipped from the ALC to be under the direct control of the USAF. Furthermore, since the reparable return procedures are guided by AFM 67-1, the first part of the pipeline between the customer and the ALC was considered to be influenced, or under the indirect control, of the USAF.

2. Although the FLOs shared many opinions about the repair and replace program, the greatest concerns voiced most often pertained to H-coding taking too long, inability to adequately track carcasses from the time the customer sends them until the time they get H-coded, and an overall feeling that FMS is not very customer-oriented.

3. Policy changes that resulted since the AFLC commander announced the immediate need to improve reparable support focused a great deal on the customer concerns of H-coding. Some of those policy changes were to increase the priorities of existing and newly created H-coded requisitions to the highest priority allowable within the country/case FAD and to treat H-coded requisitions as fully funded repair requirements.

4. Finally, our statistical analysis revealed that an FMS customer can expect it to take between 54 and 58 days for a carcass to arrive at the ALC and receive an H-coded requisition number 90 percent of the time. Similarly, it took between 66 and 77 days after H-coding for the requisition to be filled and shipped from the ALC back to the customer. Further analysis differentiated between treatment of programmed and non-programmed requisitions.

V. Conclusions and Recommendations

Chapter Overview

The purpose of this chapter is to briefly summarize what we set out to accomplish with this thesis and to provide the conclusions we reached after researching the repair and replace pipeline and analyzing the findings presented in chapter four. Additionally, we will offer recommendations for improving the FMS reparable pipeline and suggest further areas of research we feel would be useful to gain a better understanding of the replacement requisition process.

Summary of Research

Our specific research problem was to examine the reparable logistics pipeline and identify characteristics and associated problems with the processing of FMS repair and replace aircraft assets. The subsequent research involved three main areas of investigation: (1) examining the section of the reparable pipeline under USAF control or influence, (2) collecting data on common reparable parts for analysis, and (3) interviewing FMS customers to determine their perceptions of the replacement requisition process. The pipeline characteristics and problems were explored by reviewing pertinent literature and by talking with specialists at the International Logistics Center. The customers' perceptions were obtained by meeting with many foreign liaison officers working at ILC. Data was also collected on FMS customer requisitions of F-16 reparables that shipped from the ALCs within a specific time period and a statistical analysis was performed to identify additional pipeline characteristics. A summary of our findings was presented in chapter four.

Conclusions

In spite of the many concerns that customers expressed regarding replacement requisition H-coding, we found that it usually took from five to 117 days, averaging about 55 days from the date of the customer's original document number. We thought that this was a reasonable time frame considering that the returned carcasses went through freight forwarders and most probably traveled by sea. Some of the requisitions we gathered were from countries as far away as Egypt, Korea, and Indonesia which would have added significantly to the travel time. Furthermore, remember that freight forwarders are required to clear customs when both leaving the customer's country and when entering the United States which would have added even more to the pipeline time. Customers should generally expect it to take about two or three months for their requisitions to be H-coded unless they choose to ship the carcasses by priority air.

Our research showed that there are many things that can delay H-coding and practically all of them result from the customer not properly following the requisitioning and shipping procedures prescribed in AFM 67-1. When shipping procedures are not followed, carcasses can easily be misrouted or even lost because of the lack of visibility of the reparable assets from the time the customer ships them until they are H-coded. Also, when a carcass arrives at the wrong TRC, the ALCs do not help matters by forwarding the parts to the correct repair center without ensuring that they are identifiable as FMS returns. Delays could be caused by not properly requesting repairs, too. For example, if a customer initiated a requisition for an item that was not included on the MRRL, then when the carcass arrived and a receipt transaction was entered into the computer, there would not be a match between the D6E and the MRRL and, therefore, SAMIS would not H-code that requisition.

Although there are many reasons for possible delays, there was some indication that such problems did not occur very often in our data sample. Considering the full data set, 25 out of 656 requisitions, less than four percent, took over a year to get H-coded. Taking a year or more to get a requisition H-coded is excessive by any standards but, since we could not tell how long it took after arrival of the carcass at the correct repair center, those requisitions were presumably problem cases such as we have discussed that may have been misrouted or lost. However, only 106 requisitions (16 percent) took more than three months. Whereas these numbers may not have reflected a severe problem with getting requisitions H-coded, they did show that problems exist even though the general feeling among USAF personnel has been that H-coding was accomplished automatically except in rare cases. A possible explanation for this misperception is that, it may be an automatic process once SAMIS verifies the match between the D6E receipt transaction and the MRRL suspense transaction, but there are many opportunities for problems to occur that are not obvious to USAF personnel before the carcass arrives at the ALC and falls under the direct control of the USAF. The effect-cause-effect diagram in chapter four illustrated this point.

While the data clearly indicated a difference between the way programmed and non-programmed requisitions are treated, this difference was statistically significant only and each customer must weigh for themselves how valid the differences are for their individual concerns. While the data showed clearly that programmed requisitions were filled more quickly, the average time saved was 35 days compared to a non-programmed demand. It may not be worth it for some customers to pay for the difference, even though they may want to invest in greater in-country inventories. For example, some customers may be perfectly willing to wait longer for requisitions to be returned as a trade off of not having to invest heavily into the CLSSA programs. This benefit of added financial resources could far offset a country's need for rapid response times.

This thesis was not meant to focus on the quality of customer service provided by FMS. However, while examining the various aspects of the replacement requisition process, it became obvious that some of the difficulties typically experienced by FMS clients were directly related to procedures in the system that were designed to protect U.S. interests with little regard for the ensuing effect on customer support. For example, customers are required to return their reparable carcasses and have them formally documented as having been "received" at the appropriate technical repair center before their requisitions are recognized by the USAF. This is not the case for USAF requisitions. A USAF requisition is initiated by the customer who informs the supply activity of the requirement. Supply, in turn, either fills the requisition from assets on hand or passes the demand requirement on to be worked by the appropriate logistics agency. While Supply addresses the customer's demand, the unserviceable part is simply considered to be owed to Supply or "due-in from maintenance." It is a case of Supply coming to the USAF and of FMS having to go to Supply.

Similarly, it may be difficult for a customer to understand why the money they paid into a CLSSA case is not good enough to cover the initial maintenance costs involved in repairing spares. How could they be adequately convinced that, although their money is already under the control of the Security Assistance Accounting Center to cover the maintenance, they should wait for DPEM funds to become available to cover the costs? It is understandable why the customer does not always perceive the USAF to be very customer oriented!

However, since April 1991, there has been a major effort on the part of the USAF to improve the support for FMS customers. Many of the policy changes specifically targeted problems associated with getting requisitions H-coded. Proposed changes in funding would also make the process move along more smoothly for the customer while providing the added benefit for the USAF of having more DPEM funds available for its own use. The USAF saw the importance of having well-supported allies during the Persian Gulf War and the extra attention given to FMS programs is an indication of this. A more recent consideration may also be that, if the U.S. wants to continue to reduce its weapon system production costs by improving economies of scale through FMS sales, it will have to be more competitive with the military hardware being made available by other countries, most notably those emerging nations from the former Soviet Union.

Ultimately, our research has statistically proven what we knew all along--the FMS reparable pipeline is not a perfect system. Customers that use the repair and replace program find that it can take a long time to obtain the serviceable assets they need, but the pipeline times are reasonable considering the process involved. Although some customers feel there are problems inherent in the system, the USAF has recognized many of the problems and is actively pursuing solutions which would benefit all parties.

Recommendations

Although the data evaluated indicated that the majority of FMS customer assets move from the customer's country into a USAF repair facility and receive an H-code in an acceptable time period, this phase of the pipeline still has vast room for improvement. When a USAF unit needs a part repaired, the unit initiates a requisition and the ALCs begin processing the request before the carcass leaves base. This is not the case for our FMS customers. When an FMS customer needs a replacement part, the customer sends the ALC an advanced copy of the requisition but the ALC does not initiate processing the requisition until the carcass actually arrives at the ALC. In this day of electronic media, such as Fax machines and computer modems which are readily accessible to customers who can afford weapon systems such as the F-16, there is no reason that an FMS customer cannot notify an ALC of a requisition virtually immediately upon the identification of a need, much the same way that the USAF units operate now. If the ALCs would begin processing these requests when received rather than requiring the carcass to be on hand first, this alone would reduce the pipeline greatly. Our data by itself indicates such a policy could remove two to three months from the pipeline for most requisitions. Our research has not uncovered any reason to prevent such a policy from being enacted. Furthermore, in our discussions of this concept with ILC logistics specialists, no one could provide any justification of why the USAF had to have a carcass in hand before beginning to process a repair and replace requisition for an FMS customer. Some possible reasons provided were that not every country had the technology to process the requisitions electronically or that this concept may result in the USAF being placed in a position to credit an FMS case because if the USAF were to ship an asset before receiving a carcass it would charge full value and then have to credit the customer when the carcass was received. This credit idea was not well received in the ILC, but again we are not aware of any reason why this could not be made to work effectively.

Another recommendation would be for the USAF to emphasize the importance of customer training and familiarization with applicable regulations, particularly those involving the detailed requisitioning, packaging, and shipping procedures. Since many of the worst problems such as lost or misrouted carcasses could be avoided by properly following USAF procedures, this recommendation would probably best be considered as teaching the customer preventive maintenance.

To validate our findings and recommendations, we suggest that further research be conducted involving other weapon systems' pipelines in which FMS customers extensively use the repair and replace program. One particular area of interest would involve a contrast of our data, or similar data, on FMS replacement requisitions to comparable requisitions from the USAF to determine any differences. Continued research in this area could enhance the future level of support provided to U.S. allies.

APPENDIX A: GLOSSARY OF TERMS (1)

AIR LOGISTICS CENTER (ALC) - One of five Air Force inventory control points which normally will fill FMS requisitions.

BLANKET ORDER CASE - A case established for a category of items or services with no definitive listing of specific items or quantities. The case specifies a dollar ceiling against which the purchaser may place orders.

CASE - A contractual sales agreement between the U.S. and an eligible foreign country or international organization documented by a DD Form 1513. One FMS case designator is assigned, for the purpose of identification, accounting, and data processing for each accepted offer (DD Form 1513).

COMMERCIAL SALE - Sale made by U.S. industry directly to a foreign buyer which is not administered by the DOD through FMS procedures.

COOPERATIVE LOGISTICS SUPPLY SUPPORT ARRANGEMENTS (CLSSA) - Peacetime military logistics support arrangements designed to provide responsive and continuous supply support at the depot level for U.S.- made military material possessed by foreign countries and international organizations. The CLSSA is normally the most effective means for providing common repair parts and secondary item support for equipment of U.S. origin which is in allied and friendly country inventories.

DEFINED ORDER CASE - A case used to purchase specific quantities of individually defined goods or services.

ELIGIBLE RECIPIENT (FMS) - Any friendly foreign country or international organization determined by the President to be eligible to purchase defense articles and defense services, unless otherwise ineligible due to statutory restrictions.

ELIGIBLE-TO-BE-PROGRAMMED-QUANTITY (EPQ) - That portion of a FMSO I investment item stock level quantity that is available for coding a FMSO II requisition as a programmed demand. If the FMSO II requisition quantity is greater than the EPQ, the requisition is coded as non-programmed.

FMS CASE - A DD Form 1513, "United States Department of Defense Offer and Acceptance," which has been accepted by a foreign country.

FOREIGN LIAISON OFFICER (FLO) - An official representative, either military or civilian, of a foreign government or international organization, stationed in the U.S. normally for the purpose of managing or monitoring security assistance programs.

FOREIGN MILITARY SALES (FMS) - that portion of U.S. security assistance authorized by the Arms Export Control Act, as amended, and conducted on the basis of formal contracts or agreements between the USG and an authorized recipient government or international organization. FMS includes government-to-government sale of defense articles or defense services, from DOD stocks or through purchase under DOD-managed contracts,m regardless of the source of financing.

FOREIGN MILITARY SALES ORDER NO. I (FMSO I) - Provides for pipeline capitalization of a cooperative logistics support arrangement, which consists of stocks on hand and replenishment of stocks on order in which the participating country buys equity in the U.S. supply system for support of a specific weapon system. Even though stocks are not moved to a foreign country, delivery (equity) does in effect take place when the country pays for the case.

FOREIGN MILITARY SALES ORDER NO. II (FMSO II) - The CLSSA case used for requisitioning spares (2:viii).

FREIGHT FORWARDER (FF) - The agent designated by the purchaser to complete or control FMS material shipment from CONUS or third countries to the purchaser's designation. This is usually a licensed international broker or freight forwarding agent.

H-CODE - A replacement requisition with an "H" in position 40 automatically generated by SAMIS when the D6E transaction matches up with a MRRL suspense transaction. Identifies requisition to belong to an FMS customer (1:11.5).

INTERNATIONAL LOGISTICS CENTER (ILC) - The AFLC organization responsible for providing logistics support to FMS customers through the USAF SA program.

LEAD TIME (FMS) - Generally refers to the amount of time required to negotiate an agreement, place an item on contract and deliver the item to the customer.

LETTER OF OFFER AND ACCEPTANCE (LOA) - U.S. DOD Form 1513 offer and Acceptance by which the USG offers to sell to a foreign government or international organization defense articles and defense services pursuant to the Arms Export Control Act, as amended. The DD Form 1513 lists the items and/or services, estimated costs, the terms and conditions of sale, and provides for the foreign government's signature to indicate acceptance.

MATERIAL REPAIR/REQUIREMENTS LIST (MRRL) - An FMS customers' list of repair requirements for assets covered under a current CLSSA FMSO II case. Requires approval for repair by USAF based on availability of a valid repair source (7:14.70).

MILITARY EXPORT SALES - All sales of defense articles and defense services made from U.S. sources to foreign governments, foreign private firms and international organizations, whether made by DOD or by U.S. industry directly to a foreign buyer. Such sales fall into two major categories: Foreign Military Sales and Commercial Sales.

NON-PROGRAMMED DEMAND - A status assigned to a FMSO II requisition to indicate that on-hand/on-order depot assets will not normally be used to fill the requisition. Unless the asset position is above the control level, the requisition quantity will be backordered lead time away.

NONSTANDARD ITEM PARTS AND REPAIR SUPPORT (NIPARS) - A contractual arrangement between the ILC and a contractor wherein the contractor provides a purchasing system to fill nonstandard item supply and repair/return requisitions. Items covered under this contract include those never used by DOD (i.e., a country-unique configuration), those no longer used by DOD (i.e., a deactivated system), and commercial items with military application.

PROGRAMMED DEMAND - Demand (requisition) for an item for which a CLSSA stock level forecast has been incorporated into the applicable requirements computation for a sufficient period of time that depot stocks have been increased in anticipation of the demand. Programmed demands are given access to on-hand/on-order depot stocks.

REPARABLES - Items not consumed in use; that is, they can be reconditioned or economically repaired when they become unserviceable (9:80).

SECURITY ASSISTANCE (SA) - A group of programs authorized by the Foreign Assistance Act of 1961, as amended, and the Arms Export Control Act of 1976, as amended, or other related statutes by which the U.S. provides defense articles, military training, and other defense-related services, by grant loan, credit, or cash sales in furtherance of national policies and objectives.

SECURITY ASSISTANCE MANAGEMENT INFORMATION SYSTEM (SAMIS) - The computer system used for FMS management and requisition routing and control.

SPARES - Those support items that are an integral part of the end item or system which are coded as reparable.

WEAPON SYSTEM - A delivery vehicle and weapon combination including all related equipment, materials, services and personnel required so that the system becomes self-sufficient in its intended operational environment.

APPENDIX B: FLO INTERVIEW PROCESS

Give FLO a quick briefing on what we're doing and why their opinions are important to us.

Get a general background of what the FLO's military experience is.

1. What are your perceptions of the FMS program in general as a customer?

   As an FMS customer, do you feel you are treated fairly by the program?

2. Does your country use the repair/replace program?

3. Are you satisfied with the way in which the repair/replace program operates?

4. Are there cases that you are aware of involving parts that were delayed excessively or lost?

   What was the explanation for the delay/loss?

   Details and part numbers if available...?

5. Are there particular aircraft that receive better service than others through FMS?

6. Are there some depots (ALCs) that provide better service than others?

   Why do you think so?

7. If you could make any changes, what would you change about FMS and the repair/replace program in particular?

APPENDIX C: REPAIR AND REPLACE DATA FOR FMS F-16

line	Nomenclature	Country	Shipped to USAF	H-coded	Proj. Ship date	Shipped to Cust	Prog	Cust to H-code	H-coded till ship	Cust till proj ship	Cust till actual ship	Diff btwn proj & actual
1		BA	1272	1325	2323	2016	N	53	56	416	109	307
2	CIRCUIT CARD AS	BA	1315	2028	2029	2031	N	78	3	79	81	-2
3	CIRCUIT CARD AS	BA	1092	1303	2151	2121	N	211	183	424	394	30
4	CONTROL UNIT, F	BA	2060	2099	3095	2122	N	39	23	400	62	338
5	CONTROLLER, FLI	BA	1315	2027	3023	2034	N	77	7	438	84	354
6	CONVERTER, SIGN	BA	1198	1276	5032	2016	N	78	105	1294	183	1111
7	NOISE REGULATOR	BA	1315	2027	4240	2031	N	77	4	1020	81	939
8	POWER SUPPLY	BA	1294	2035	4309	2041	N	106	6	1110	112	998
9	POWER SUPPLY	BA	1272	1325	4082	1361	N	53	36	905	89	816
10	TRANSMITTER, AN	BA	2004	2050	3293	2139	N	46	89	654	135	519
11	CIRCUIT CARD AS	BE	1212	1275	4031	2107	N	63	197	914	260	654
12	CIRCUIT CARD AS	BE	9299	1179	3271	2091	N	610	277	1432	887	545
13	CIRCUIT CARD AS	BE	1051	1086	3206	2037	N	35	316	885	351	534
14	CIRCUIT CARD AS	BE	1002	2098	4191	2129	N	461	31	1284	492	792
15	TRANSDUCER, MOT	BE	2106	2155	2156	2160	N	49	5	50	54	-4
16	CONTROLLER BOAR	DE	1311	1331	5056	2062	N	20	96	1205	116	1089
17	UNIT, RATE SENS	DE	1350	2027	3342	2093	N	42	66	722	108	614
18		EG	1309	2027	3023	2031	N	83	4	444	87	357
19	ACTUATOR, ELECT	EG	1004	1101	4166	2017	N	97	281	1257	378	879
20	ANTENNA	EG	1076	1211	2332	2036	N	135	190	621	325	296
21	ASYMMETRYBRAKE,	EG	1338	2070	4161	2072	N	97	2	918	99	184
22	ASYMMETRYBRAKE,	EG	1308	2027	4118	2031	N	84	4	905	88	817
23	CIRCUIT CARD AS	EG	2104	2154	3150	2157	N	50	3	411	53	358
24	CIRCUIT CARD AS	EG	2054	2113	4117	2121	N	59	8	793	67	726
25	CIRCUIT CARD AS	EG	2021	2078	3075	2112	N	57	34	419	91	328
26	CIRCUIT CARD AS	EG	2025	2078	2125	2127	N	53	49	100	102	-2
27	CIRCUIT CARD AS	EG	2001	2070	2364	2121	N	69	51	363	120	243
28	CIRCUIT CARD AS	EG	2001	2070	4161	2084	N	69	14	890	83	807
29	CIRCUIT CARD AS	EG	2001	2070	3252	2121	N	69	51	616	120	496
30	CIRCUIT CARD AS	EG	1317	2055	4146	2098	N	103	43	924	146	778
31	CIRCUIT CARD AS	EG	1317	2055	4146	2098	N	103	43	924	146	778
32	CIRCUIT CARD AS	EG	1317	2055	4146	2098	N	103	43	924	146	778
33	CIRCUIT CARD AS	EG	1317	2055	4146	2097	N	103	42	924	145	779
34	CIRCUIT CARD AS	EG	1329	2041	3037	2043	N	77	2	438	79	359
35	CIRCUIT CARD AS	EG	1310	2027	3023	2057	N	82	30	443	112	331
36	CIRCUIT CARD AS	EG	1217	1295	2293	2002	N	78	72	441	150	291
37	CIRCUIT CARD AS	EG	9119	1261	3352	2065	N	872	169	1693	1041	652
38	CIRCUIT CARD AS	EG	9119	1261	3352	2065	N	872	169	1693	1041	652
39	CIRCUIT CARD AS	EG	1142	1235	4113	2045	N	93	175	1066	268	798
40	CIRCUIT CARD AS	EG	1113	1210	3026	2045	N	97	200	643	297	346
41	COMPUTER, AIR D	EG	1335	2041	3037	2045	N	71	4	432	75	357
42	CONTROL UNIT, F	EG	203	304	1301	2008	N	101	434	463	535	-72
43	DISPLAY UNIT, H	EG	1142	1263	2354	2034	N	121	136	577	257	320

REPAIR AND REPLACE DATA FOR FMS F-16

line	Nomenclature	Country	Shipped to USAF	H-coded	Proj. Ship date	Shipped to Cust	Prog	Cust to H-code	H-coded till ship	Cust till proj ship	Cust till actual ship	Diff btwn proj & actual
44	ELECTRONIC COMP	EG	1309	2027	4179	2038	N	83	11	965	94	871
45	EPROM BOARD	EG	1322	2042	4073	2121	N	85	79	846	164	682
46	INTERFACE UNIT,	EG	2042	2113	4144	2139	N	71	26	832	97	735
47	INTERFACE UNIT,	EG	2042	2111	4141	2139	N	69	28	829	97	732
48	INTERFACE UNIT,	EG	2042	2111	4141	2141	N	69	30	829	99	730
49	INTERFACE UNIT,	EG	2042	2111	4141	2141	N	69	30	829	99	730
50	INTERFACE UNIT,	EG	2042	2097	4127	2141	N	55	44	815	99	716
51	INTERFACE UNIT,	EG	2042	2097	4127	2141	N	55	44	815	99	716
52	INTERFACE UNIT,	EG	2042	2097	4127	2140	N	55	43	815	98	717
53	INTERFACE UNIT,	EG	2042	2097	4127	2140	N	55	43	815	98	717
54	INTERFACE UNIT,	EG	2042	2097	4127	2140	N	55	43	815	98	717
55	MULTIPLIER, ELE	EG	1329	2041	3345	2055	N	77	14	746	91	655
56	PANEL, POWER DI	EG	64	243	2213	2113	N	179	600	879	779	100
57	PANEL, POWERDIS	EG	1239	1325	4236	2082	N	86	122	1092	208	884
58	POWER SUPPLY	EG	1335	2041	3037	2154	N	71	113	432	184	248
59	POWER SUPPLY	EG	1295	2027	3023	2143	N	97	116	458	213	245
60	POWER SUPPLY	EG	1308	2013	3009	2154	N	70	141	431	211	220
61	POWER SUPPLY	EG	1167	1266	2269	2153	N	99	252	467	351	116
62	POWER SUPPLY	EG	1127	1210	2208	2154	N	83	309	446	392	54
63	POWER SUPPLY	EG	1070	1200	2205	2154	N	130	319	500	449	51
64	POWER SUPPLY	EG	1062	1172	2177	2126	N	110	319	480	429	51
65	PRINTED CIRCUIT	EG	1338	2070	3066	2098	N	97	28	458	125	-302
66	SIGHT, HUD	EG	2105	2154	4184	2157	N	49	3	809	52	757
67	TRANSFER UNIT	EG	2021	2078	2111	2113	N	57	35	90	92	-2
68	TUBE UNIT ASSY	EG	1222	1295	2293	2002	N	73	72	436	145	291
69	TUBE UNIT ASSY	EG	1222	1295	2293	2013	N	73	83	436	156	280
70	TUBE UNIT ASSY	EG	1218	1268	2271	2001	N	50	98	418	148	270
71	TUBE UNIT ASSY	EG	1189	1266	2269	2013	N	77	112	445	189	256
72	TUBE UNIT ASSY	EG	1189	1266	2269	2002	N	77	101	445	178	267
73	TUBE UNIT ASSY	EG	1189	1266	2269	1361	N	77	95	445	172	273
74	TUBE UNIT ASSY	EG	1189	1266	2269	2014	N	77	113	445	190	255
75	TUBE UNIT ASSY	EG	1118	1235	2238	2010	N	117	140	485	257	228
76	TUBE UNIT ASSY	EG	1118	1235	2238	2010	N	117	140	485	257	228
77	TUBE UNIT ASSY	EG	1118	1235	2238	2010	N	117	140	485	257	228
78	TUBE UNIT ASSY	EG	1118	1235	2238	2010	N	117	140	485	257	228
79	VALVE ASSY	EG	2103	2149	5240	2155	N	46	6	1232	52	1180
80	VALVE ASSY	EG	2001	2070	5161	2077	N	69	7	1255	76	1179
81	VALVE, REGULATI	EG	253	1268	4054	2044	N	380	141	1261	521	740
82	VALVE, REGULATI	EG	1197	1267	2271	2343	N	70	441	439	511	-72
83		GR	1162	1191	1273	1281	N	29	90	111	119	-8
84		GR	1128	1159	1339	2072	N	31	278	211	309	-98
85	ACTUATOR, ELECT	GR	1296	1331	2329	2162	N	35	196	398	231	167
86	ACTUATOR, ELECT	GR	1296	1331	2329	2070	N	35	104	398	139	259

REPAIR AND REPLACE DATA FOR FMS F-16

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87	CARD ASSEMBLY,	GR	1115	1140	2293	2018	N	25	243	543	268	275
88	CIRCUIT CARD AS	GR	2049	2078	4048	2112	N	29	34	729	63	666
89	CIRCUIT CARD AS	GR	2049	2078	4048	2112	N	29	34	729	63	666
90	CIRCUIT CARD AS	GR	2010	2063	4215	2101	N	53	38	935	91	844
91	CIRCUIT CARD AS	GR	2035	2057	3363	2091	N	22	34	693	56	637
92	CIRCUIT CARD AS	GR	2024	2057	3363	2091	N	33	34	704	67	637
93	CIRCUIT CARD AS	GR	2010	2036	3033	2062	N	26	26	388	52	336
94	CIRCUIT CARD AS	GR	2010	2036	4090	2112	N	26	76	810	102	708
95	CIRCUIT CARD AS	GR	1308	1361	2358	2127	N	53	131	415	184	231
96	CIRCUIT CARD AS	GR	1260	1296	3266	1361	N	36	65	736	101	635
97	CIRCUIT CARD AS	GR	1189	1210	2207	1362	N	21	152	383	173	210
98	CIRCUIT CARD AS	GR	1189	1210	2362	2084	N	21	239	538	260	278
99	CIRCUIT CARD AS	GR	1189	1210	4149	2045	N	21	200	1055	221	834
100	CIRCUIT CARD AS	GR.	1128	1162	2160	2162	N	34	365	397	399	-2
101	CIRCUIT CARD AS	GR	1025	1050	2048	2044	N	25	359	388	384	4
102	COMPENSATOR	GR	2016	2036	4250	2043	N	20	7	964	27	937
103	CONTROL UNIT, F	GR	2031	2057	3055	2065	N	26	8	389	34	355
104	DISPLAY HEAD AS	GR	1092	1168	3170	1361	N	76	193	808	269	539
105	ELECTRONIC COMP	GR	2066	2086	4241	2094	N	20	8	905	28	877
106	ELECTRONIC COMP	GR	1179	1210	2208	2002	N	31	157	394	188	206
107	POWER SUPPLY	GR	1176	1281	4037	1361	N	105	80	956	185	771
108	POWER SUPPLY	GR	1128	1159	2158	2126	N	31	332	395	363	32
109	POWER SUPPLY	GR	1085	1130	2130	2119	N	45	354	410	399	11
110	POWER SUPPLY	GR	1085	1130	2130	2120	N	45	355	410	400	10
111	PRINTED CIRCUIT	GR	2134	2160	3157	2167	N	26	7	388	33	355
112	PRINTED CIRCUIT	GR	2134	2160	3157	2167	N	26	7	388	33	355
113	PRINTED CIRCUIT	GR	2134	2160	3157	2167	N	26	7	388	33	355
114	PLATFORM, INERT	ID	1284	2064	2156	2094	N	145	30	237	175	62
115	PLATFORM, INERT	ID	1284	2064	2156	2070	N	145	6	237	151	86
116	ACTUATOR INSTAL	KS	1086	1155	2152	2052	N	69	262	431	331	100
117	ACTUATOR INSTAL	KS	1086	1155	2152	2050	N	69	260	431	329	102
118	ACTUATOR INSTAL	KS	1086	1155	2152	2050	N	69	260	431	329	102
119	ACTUATOR, ELECT	KS	1281	1345	2342	2162	N	64	182	426	246	180
120	ACTUATOR, ELECT	KS	1094	1155	2152	2050	N	61	260	423	321	102
121	ANTENNA	KS	1199	1259	3045	2042	N	60	148	576	208	368
122	ANTENNA	KS	1066	1122	2243	2030	N	56	273	542	329	213
123	CABLE ASSEMBLY,	KS	8349	9003	9017	2051	N	19	1143	33	1162	-2129
124	CARD ASSY, PROG	KS	299	1011	2166	2133	N	77	487	597	564	33
125	CARD ASSY, PROG	KS	299	1011	2166	2133	N	77	487	597	564	33
126	CARD ASSY, PROG	KS	299	1011	2166	2133	N	77	487	597	564	33
127	CARD ASSY, PROG	KS	320	1011	2166	2139	N	56	493	576	549	27
128	CENTRAL PROCESS	KS	2048	2113	3110	2121	N	65	8	427	73	354
129	CIRCUIT CARD AS	KS	2048	2114	2119	2121	N	66	7	71	73	-2

REPAIR AND REPLACE DATA FOR FMS F-16

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130	CIRCUIT CARD AS	KS	2048	2114	2119	2121	N	66	7	71	73	-2
131	CIRCUIT CARD AS	KS	2048	2114	2119	2121	N	66	7	71	73	-2
132	CIRCUIT CARD AS	KS	2048	2114	2119	2121	N	66	7	71	73	-2
133	CIRCUIT CARD AS	KS	2048	2114	5057	2154	N	66	40	1104	106	998
134	CIRCUIT CARD AS	KS	166	2099	4192	2111	N	663	12	1486	675	811
135	CIRCUIT CARD AS	KS	2027	2097	2104	2105	N	70	8	77	78	-1
136	CIRCUIT CARD AS	KS	2041	2097	2105	2111	N	56	14	64	70	-6
137	CIRCUIT CARD AS	KS	2027	2093	3090	2147	N	66	54	428	120	308
138	CIRCUIT CARD AS	KS	2021	2086	3085	2114	N	65	28	429	93	336
139	CIRCUIT CARD AS	KS	1253	1350	3319	2087	N	97	102	796	199	597
140	CIRCUIT CARD AS	KS	1199	1259	3228	1360	N	60	101	759	161	598
141	CIRCUIT CARD AS	KS	1169	1246	1247	2029	N	77	148	78	225	-147
142	CIRCUIT CARD AS	KS	1169	1246	4185	2017	N	77	136	1111	213	898
143	CIRCUIT CARD AS	KS	1169	1246	4185	2017	N	77	136	1111	213	898
144	CIRCUIT CARD AS	KS	1169	1246	4276	2045	N	77	164	1202	241	961
145	CIRCUIT CARD AS	KS	1182	1246	4154	2034	N	64	153	1067	217	850
146	CIRCUIT CARD AS	KS	1169	1246	1365	2105	N	77	224	196	301	-105
147	CIRCUIT CARD AS	KS	1086	1155	2152	1354	N	69	199	431	268	163
148	CIRCUIT CARD AS	KS	303	1032	2336	1360	N	94	328	763	422	341
149	CIRCUIT CARD AS	KS	295	1011	4014	2045	N	81	399	1179	480	699
150	CONVERTER, PRES	KS	2048	2114	5057	2129	N	66	15	1104	81	1023
151	CORE MEMORY UNI	KS	2037	2093	2094	2098	N	56	5	57	61	-4
152	CORE MEMORY UNI	KS	233	1311	2308	2065	N	443	119	805	562	243
153	CORE MEMORY UNI	KS	233	1311	2308	2065	N	443	119	805	562	243
154	CORE MEMORY UNI	KS	233	1311	2308	2002	N	443	56	805	499	306
155	CORE MEMORY UNI	KS	1231	1304	2302	2008	N	73	69	436	142	294
156	CORE MEMORY UNI	KS	1231	1284	2281	2065	N	53	146	415	199	216
157	CORE MEMORY UNI	KS	1231	1284	2281	2065	N	53	146	415	199	216
158	DIGITAL MODULE	KS	2048	2113	5083	2120	N	65	7	1130	72	1058
159	DUPLEXER AND WA	KS	2037	2093	4157	2111	N	56	18	850	74	776
160	ELECTRONIC COMP	KS	2048	2114	2119	2121	N	66	7	71	73	-2
161	ELECTRONIC COMP	KS	1152	1276	2279	2153	N	124	242	492	366	126
162	ELECTRONIC COMP	KS	261	330	2026	2052	N	69	452	495	521	-26
163	PANEL, POWERDIS	KS	1152	1276	4032	2080	N	124	169	975	293	682
164	POWER SUPPLY	KS	2048	2133	2134	2142	N	85	9	86	94	-8
165	POWER SUPPLY	KS	2048	2114	2119	2121	N	66	7	71	73	-2
166	POWER SUPPLY	KS	2048	2114	2119	2125	N	66	11	71	77	-6
167	POWER SUPPLY	KS	2048	2114	2119	2125	N	66	11	71	77	-6
168	POWER SUPPLY	KS	2048	2114	2119	2121	N	66	7	71	73	-2
169	POWER SUPPLY	KS	2048	2114	2119	2125	N	66	11	71	77	-6
170	POWER SUPPLY	KS	2048	2114	2119	2121	N	66	7	71	73	-2
171	POWER SUPPLY	KS	2048	2114	4209	2129	N	66	15	891	81	810
172	POWER SUPPLY	KS	2027	2093	5036	2107	N	66	14	1104	80	1024

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173	POWER SUPPLY	KS	2037	2056	2058	2062	N	19	6	21	25	-4
174	POWER SUPPLY	KS	1268	1340	2337	2016	N	72	41	434	113	321
175	POWER SUPPLY	KS	1268	1340	2337	2016	N	72	41	434	113	321
176	POWER SUPPLY	KS	233	1339	4095	1361	N	471	22	1322	493	829
177	POWER SUPPLY	KS	1268	1319	2316	2017	N	51	63	413	114	299
178	POWER SUPPLY	KS	1169	1247	3338	1364	N	78	117	899	195	704
179	POWER SUPPLY	KS	1169	1246	3337	1364	N	77	118	898	195	703
180	POWER SUPPLY	KS	1053	1115	2112	2125	N	62	375	424	437	-13
181	POWER SUPPLY	KS	1028	1100	2101	2121	N	72	386	438	458	-20
182	POWER SUPPLY	KS	1028	1098	2101	2126	N	70	393	438	463	-25
183	PRINTED CIRCUIT	KS	2055	2113	2118	2120	N	58	7	63	65	-2
184	RACK, ELCETRICA	KS	1196	1266	3144	2101	N	70	200	678	270	408
185	RECEIVER, RADAR	KS	2027	2097	2105	2106	N	70	9	78	79	-1
186	TUBE UNIT ASSY	KS	1018	2127	4158	2139	N	474	12	1235	486	749
187	TUBE UNIT ASSY	KS	74	133	1135	2139	N	59	736	426	795	-369
188	TUBE UNIT ASSY	KS	74	133	1135	2133	N	59	730	426	789	-363
189		NE	52	201	3110	2098	N	149	627	1153	776	377
190		NE	52	201	3110	2114	N	149	643	1153	792	361
191	CIRCUIT CARD AS	NE	175	180	2031	2073	N	5	623	586	628	-42
192	CIRCUIT CARD AS	NE	62	87	1301	2009	N	25	652	604	677	-73
193	CONVERTER, PRES	NE	2065	2090	4364	2099	N	25	9	1029	34	995
194	MESSAGE UNIT, V	NE	329	1011	3014	2065	N	47	419	780	466	314
195	VALVE, REGULATI	NE	328	1107	3229	2009	N	144	267	996	411	585
196	VIN FIN ASSY	NE	1230	1284	3074	2008	N	54	89	574	143	431
197	CONVERTER, PRES	SR	2049	2084	4085	2098	N	35	14	766	49	717
198	SIGHT, HUD	SR	1298	1350	4289	2029	N	52	44	1086	96	990
199	ACTUATOR, ELECT	TH	1193	1238	2237	2058	N	45	185	409	230	179
200	CIRCUIT CARD AS	TH	2009	2093	2106	2114	N	84	21	97	105	-8
201	CIRCUIT CARD AS	TH	1213	2027	2279	2043	N	179	16	431	195	236
202	CIRCUIT CARD AS	TH	1213	1268	1294	1298	N	55	30	81	85	-4
203	CIRCUIT CARD AS	TH	1213	1268	2271	2011	N	55	108	423	163	260
204	POWER SUPPLY	TH	1063	1133	2131	2030	N	70	262	433	332	101
205	VALVE, SOLENOID	TH	1276	2142	3264	2149	N	231	7	718	238	480
206	BACKPLANE ASSY	TK	1304	1358	4032	2017	N	54	24	823	78	745
207	BLANKER, INTERF	TK	2029	2071	3067	2108	N	42	37	403	79	324
208	BLANKER, INTERF	TK	1304	1358	2364	2038	N	54	45	425	99	326
209	BLANKER, INTERF	TK	1304	1358	2364	2021	N	54	28	425	82	343
210	CIRCUIT CARD AS	TK	2058	2100	3096	2108	N	42	8	403	50	353
211	CIRCUIT CARD AS	TK	2029	2078	3075	2134	N	49	56	411	105	306
212	CIRCUIT CARD AS	TK	2029	2071	4162	2084	N	42	13	863	55	808
213	CIRCUIT CARD AS	TK	2008	2065	3065	2084	N	57	19	422	76	346
214	CIRCUIT CARD AS	TK	2008	2041	4285	2057	N	33	16	1007	49	958
215	CIRCUIT CARD AS	TK	2008	2041	3365	2108	N	33	67	722	100	622

REPAIR AND REPLACE DATA FOR FMS F-16

line	Nomenclature	Country	Shipped to USAF	H-coded	Proj. Ship date	Shipped to Cust	Prog	Cust to H-code	H-coded till ship	Cust till proj ship	Cust till actual ship	Diff btwn proj & actual
216	CIRCUIT CARD AS	TK	1338	2027	3024	2031	N	54	4	416	58	358
217	CIRCUIT CARD AS	TK	1304	1358	2220	2010	N	54	17	281	71	210
218	CIRCUIT CARD AS	TK	1304	1358	3304	2057	N	54	64	730	118	612
219	CIRCUIT CARD AS	TK	1304	1358	3304	2108	N	54	115	730	169	561
220	CIRCUIT CARD AS	TK	307	1347	4228	2017	N	405	35	1381	440	941
221	CIRCUIT CARD AS	TK	1035	1095	1149	1364	N	60	269	114	329	-215
222	CIRCUIT CARD AS	TK	1188	1225	2074	2142	N	37	282	251	319	-68
223	CIRCUIT CARD AS	TK	2120	2155	4033	2170	N	35	15	643	50	593
224	COMPUTER, FIRE	TK	2029	2090	3086	2142	N	61	52	422	113	309
225	COMPUTER, FIRE	TK	1338	2066	3062	2080	N	93	14	454	107	347
226	COMPUTER, FIRE	TK	1151	1303	2300	2014	N	152	76	514	228	286
227	COMPUTER, FIRE	TK	1188	1260	1261	2009	N	72	114	73	186	-113
228	CONTROL, UNIT-G	TK	1338	2027	4119	2041	N	54	14	876	68	808
229	CONTROLLER, FLT	TK	2029	2070	3066	2107	N	41	37	402	78	324
230	CONTROLLER, FLT	TK	2008	2041	3038	2062	N	33	21	395	54	341
231	CONTROLLER, FLT	TK	1304	2006	3003	2034	N	67	28	429	95	334
232	CONTROLLER, FLT	TK	1304	2006	3003	2037	N	67	31	429	98	331
233	CONVERTER, SIGN	TK	307	1281	5037	2038	N	339	122	1555	461	1094
234	CORE MEMORY UNI	TK	2029	2071	3067	2084	N	42	13	403	55	348
235	CORE MEMORY UNI	TK	2008	2055	3051	2062	N	47	7	408	54	354
236	DATA ENTRY DISP	TK	1245	1284	4289	2031	N	39	112	1139	151	988
237	DATA ENTRY DISP	TK	1245	1284	4289	2098	N	39	179	1139	218	921
238	ELECTRONIC COMP	TK	1151	1210	2207	2153	N	59	308	421	367	54
239	ELECTRONIC COMP	TK	1151	1182	2186	2006	N	31	189	400	220	180
240	ELECTRONIC COMP	TK	2008	2041	5133	2056	N	33	15	1220	48	1172
241	ELECTRONIC COMP	TK	205	304	4030	2034	N	99	460	1285	559	726
242	ELECTRONIC COMP	TK	1211	1246	2252	2006	N	35	125	406	160	246
243	HOLDER, PRINTED	TK	1338	2027	2060	2031	N	54	4	87	58	29
244	INTERCONNECTING	TK	38	92	1090	2043	N	54	681	417	735	-318
245	INTERFACE UNIT,	TK	307	1269	1337	2021	N	327	117	395	444	-49
246	MESSAGE UNIT, V	TK	347	1039	3039	2043	N	57	369	787	426	361
247	NOISE REGULATOR	TK	155	1352	4235	2024	N	562	37	1540	599	941
248	NOISE REGULATOR	TK	1188	1226	4074	2050	N	38	189	981	227	754
249	NOISE REGULATOR	TK	1188	1225	2074	2050	N	37	190	251	227	24
250	PANEL, POWER DI	TK	2008	2041	2243	2082	N	33	41	235	74	161
251	POWER SUPPLY	TK	2058	2090	4364	2194	N	32	104	1036	136	900
252	POWER SUPPLY	TK	1304	1358	4093	2008	N	54	15	884	69	815
253	POWER SUPPLY	TK	1188	1225	2074	2006	N	37	146	251	183	68
254	POWER SUPPLY	TK	1178	1225	2261	2024	N	47	164	448	211	237
255	POWER SUPPLY	TK	1122	1155	2158	2118	N	33	328	401	361	40
256	POWER SUPPLY S-	TK	1304	1358	2364	2014	N	54	21	425	75	350
257	POWER SUPPLY-RE	TK	1211	1233	4172	2028	N	22	160	1056	182	874
258	PRESSURIZING SE	TK	2008	2041	3038	2085	N	33	44	395	77	318

REPAIR AND REPLACE DATA FOR FMS F-16

line	Nomenclature	Country	Shipped to USAF	H-coded	Proj. Ship date	Shipped to Cust	Prog	Cust to H-code	H-coded till ship	Cust till proj ship	Cust till actual ship	Diff btwn proj & actual
259	PRINTED CIRCUIT	TK	2008	2041	3038	2091	N	33	50	395	83	312
260	PWR SUPPLY, S-A	TK	2088	2125	3121	2128	N	37	3	398	40	358
261	PWR SUPPLY, S-A	TK	1338	2027	3024	2035	N	54	8	416	62	354
262	SIGHT, HUD	TK	2088	2125	5064	2128	N	37	3	1071	40	1031
263	SIGHT, HUD	TK	1338	2027	4302	2042	N	54	15	1059	69	990
264	SIGHT, HUD	TK	1338	2027	4302	2038	N	54	11	1059	65	994
265	SIGHT, HUD	TK	1188	1225	2074	2065	N	37	205	251	242	9
266	TRANSMITTER, AN	TK	2008	2041	3285	2139	N	33	98	642	131	511
267	TUBE UNIT ASSY	TK	2008	2057	4088	2107	N	49	50	810	99	711
268	TUBE UNIT ASSY	TK	1188	1225	2261	2017	N	37	157	438	194	244
269	VIN FIN ASSY	TK	1123	1155	2276	2059	N	32	269	518	301	217
270	ACTUATOR, ELECT	VE	8312	2108	4321	2113	N	1256	5	2199	1261	938
271	ACTUATOR, ELECT	VE	1134	1163	2166	2077	N	29	279	397	308	89
272	ACTUATOR, ELECT	VE	1134	1163	2166	2073	N	29	275	397	304	93
273	CIRCUIT CARD AS	VE	2120	2156	4247	2167	N	36	11	857	47	810
274	CIRCUIT CARD AS	VE	2120	2156	4096	2162	N	36	6	706	42	664
275	CIRCUIT CARD AS	VE	2120	2156	3247	2162	N	36	6	492	42	450
276	CIRCUIT CARD AS	VE	2120	2156	3247	2163	N	36	7	492	43	449
277	CIRCUIT CARD AS	VE	2097	2134	3347	2149	N	37	15	615	52	563
278	CIRCUIT CARD AS	VE	2097	2134	3347	2149	N	37	15	615	52	563
279	CIRCUIT CARD AS	VE	2097	2134	3130	2163	N	37	29	398	66	332
280	CIRCUIT CARD AS	VE	2097	2134	5103	2148	N	37	14	1101	51	1050
281	CIRCUIT CARD AS	VE	2064	2099	3095	2140	N	35	41	396	76	320
282	CIRCUIT CARD AS	VE	2064	2099	3312	2142	N	35	43	613	78	535
283	CIRCUIT CARD AS	VE	2014	2034	3338	2062	N	20	28	689	48	641
284	CIRCUIT CARD AS	VE	1225	1266	2264	2041	N	41	140	404	181	223
285	CIRCUIT CARD AS	VE	1225	1266	4175	2045	N	41	144	1045	185	860
286	CIRCUIT CARD AS	VE	227	284	1281	2017	N	57	463	419	520	-101
287	CONTROL, UNIT-G	VE	2120	2156	4247	2163	N	36	7	857	43	814
288	CRT ASSY	VE	1092	1112	2265	2022	N	20	275	538	295	243
289	FRONT PANEL ASS	VE	1225	1266	2264	2065	N	41	164	404	205	199
290	INPUT-OUTPUT	VE	2097	2134	3316	2156	N	37	22	584	59	525
291	PRESSURE VESSEL	VE	1326	1350	4229	2080	N	24	95	998	119	879
292	PROTECTION AND	VE	2064	2099	3095	2108	N	35	9	396	44	352
293	MESSAGE UNIT, V	NE	245	284	2285	2010	N	39	456	770	495	275
294	ACTUATOR, ELECT	BA	2060	2092	2193	2120	P	32	28	133	60	73
295	ACTUATOR, ELECT	BA	324	1032	2088	2043	P	73	376	494	449	45
296	BLANKER, INTERF	BA	2004	2050	3047	2100	P	46	50	408	96	312
297	CIRCUIT CARD AS	BA	2060	2099	3095	2108	P	39	9	400	48	352
298	CIRCUIT CARD AS	BA	1294	2035	3031	2153	P	106	118	467	224	243
299	CIRCUIT CARD AS	BA	1071	1291	2292	2043	P	220	117	586	337	249
300	CIRCUIT CARD AS	BA	1160	1238	2243	2034	P	78	161	448	239	209
301	TRANSMITTER, AN	BA	1071	1291	2292	2112	P	220	186	586	406	180

REPAIR AND REPLACE DATA FOR FMS F-16

line	Nomenclature	Country	Shipped to USAF	H-coded	Proj. Ship date	Shipped to Cust	Prog	Cust to H-code	H-coded till ship	Cust till proj ship	Cust till actual ship	Diff btwn proj & actual
302	TRANSMITTER, AN	BA	1272	1325	2323	2101	P	53	141	416	194	222
303	CONVERTER, PRES	BE	1303	1340	2337	2015	P	37	40	399	77	322
304	CONVERTER, PRES	BE	1303	1340	2337	2015	P	37	40	399	77	322
305	CONVERTER, PRES	BE	1260	1295	2300	2015	P	35	85	405	120	285
306	CONVERTER, PRES	BE	1260	1295	2300	2015	P	35	85	405	120	285
307	CONVERTER, PRES	BE	1260	1295	2300	2015	P	35	85	405	120	285
308	CONVERTER, PRES	BE	1238	1290	2299	2015	P	52	90	426	142	284
309	CONVERTER, PRES	BE	1238	1284	2291	2015	P	46	96	418	142	276
310	CONVERTER, PRES	BE	2108	2135	3131	2150	P	27	15	388	42	346
311	CONVERTER, PRES	BE	2108	2135	3131	2150	P	27	15	388	42	346
312	CONVERTER, PRES	BE	2063	2113	3110	2121	P	50	8	412	58	354
313	DETECTOR, PEAK	BE	1303	1340	2337	1360	P	37	20	399	57	342
314	DETECTOR, PEAK	BE	1256	1295	2300	1360	P	39	65	409	104	305
315	DETECTOR, PEAK	BE	1256	1295	2300	1360	P	39	65	409	104	305
316	DETECTOR, PEAK	BE	2015	2064	3060	2084	P	49	20	410	69	341
317	DIGIBUS INTERFA	BE	2086	2121	3117	2128	P	35	7	396	42	354
318	MULTIPLIER ASSY	BE	2008	2050	3046	2107	P	42	57	403	99	304
319	PHASE LOCK LOOP	BE	2098	2155	3151	2169	P	57	14	418	71	347
320	PHASE LOCK LOOP	BE	2044	2084	3081	2128	P	40	44	402	84	318
321	PHASE LOCK LOOP	BE	2037	2078	3075	2169	P	41	91	403	132	271
322	PRESSURE VESSEL	BE	1330	1364	2361	2150	P	34	151	396	185	211
323	PRESSURE VESSEL	BE	1296	1340	2337	2150	P	44	175	406	219	187
324	PRESSURE VESSEL	BE	1296	1340	2337	2150	P	44	175	406	219	187
325	PRESSURE VESSEL	BE	1303	1340	2337	2118	P	37	143	399	180	219
326	PRESSURE VESSEL	BE	1303	1340	2337	2111	P	37	136	399	173	226
327	PRESSURE VESSEL	BE	1255	1294	2300	2111	P	39	182	410	221	189
328	PRESSURE VESSEL	BE	1255	1294	2300	2101	P	39	172	410	211	199
329	PRESSURE VESSEL	BE	1255	1294	2300	2101	P	39	172	410	211	199
330	PRESSURE VESSEL	BE	1255	1294	2300	2104	P	39	175	410	214	196
331	PRESSURE VESSEL	BE	1255	1294	2300	2104	P	39	175	410	214	196
332	PRESSURE VESSEL	BE	1255	1294	2300	2080	P	39	151	410	190	220
333	PRESSURE VESSEL	BE	1221	1275	2278	2078	P	54	168	422	222	200
334	PRESSURE VESSEL	BE	1221	1275	2278	2077	P	54	167	422	221	201
335	PRESSURE VESSEL	BE	1221	1275	2278	2057	P	54	147	422	201	221
336	PRESSURE VESSEL	BE	1210	1275	2278	2072	P	65	162	433	227	206
337	PRESSURE VESSEL	BE	1156	1275	2278	2045	P	119	135	487	254	233
338	PRESSURE VESSEL	BE	1219	1275	2278	2045	P	56	135	424	191	233
339	PRESSURE VESSEL	BE	1219	1275	2278	2044	P	56	134	424	190	234
340	PRESSURE VESSEL	BE	1226	1266	2269	2034	P	40	133	408	173	235
341	PRESSURE VESSEL	BE	1177	1226	2229	1361	P	49	135	417	184	233
342	PRESSURE VESSEL	BE	1011	1121	2119	2035	P	110	279	473	389	84
343	PRESSURE VESSEL	BE	274	2013	3011	2167	P	469	154	832	623	209
344	PRESSURE VESSEL	BE	175	2009	3006	2150	P	564	141	926	705	221

REPAIR AND REPLACE DATA FOR FMS F-16

line	Nomenclature	Country	Shipped to USAF	H-coded	Proj. Ship date	Shipped to Cust	Prog	Cust to H-code	H-coded till ship	Cust till proj ship	Cust till actual ship	Diff btwn proj & actual
345	RECEIVER ASSY	BE	1330	2002	2364	2007	P	37	5	399	42	357
346	RECEIVER ASSY	BE	1330	2002	2364	2007	P	37	5	399	42	357
347	RECEIVER ASSY	BE	1330	2002	2364	2007	P	37	5	399	42	357
348	RECEIVER ASSY	BE	1330	2002	2364	2007	P	37	5	399	42	357
349	RECEIVER ASSY	BE	2009	2050	3046	2055	P	41	5	402	46	356
350	RECEIVER ASSY	BE	2009	2050	3046	2055	P	41	5	402	46	356
351	RECEIVER ASSY	BE	2009	2050	3046	2055	P	41	5	402	46	356
352	RECEIVER ASSY	BE	253	2008	3004	2015	P	485	7	846	492	354
353	REFERENCE SOURC	BE	2107	2155	3151	2168	P	48	13	409	61	348
354	REFERENCE SOURC	BE	2107	2155	3151	2168	P	48	13	409	61	348
355	REFERENCE SOURC	BE	2024	2072	3068	2091	P	48	19	409	67	342
356	TRANSDUCER, MOT	BE	2085	2126	2127	2129	P	41	3	42	44	-2
357	TRANSDUCER, MOT	BE	2085	2126	3122	2170	P	41	44	402	85	317
358	TRANSDUCER, MOT	BE	2085	2121	2122	2126	P	36	5	37	41	-4
359	MULTIPLIER ASSY	DE	2015	2037	3034	2097	P	22	60	384	82	302
360	ACTUATOR INSTAL	EG	240	1011	1016	2041	P	136	395	141	531	-390
361	ACTUATOR, ELECT	EG	1230	1322	2323	2087	P	92	130	458	222	236
362	ACTUATOR, ELECT	EG	1232	1322	2323	2059	P	90	102	456	192	264
363	ACTUATOR, ELECT	EG	1231	1301	2299	2156	P	70	220	433	290	143
364	ACTUATOR, ELECT	EG	241	1024	2021	2024	P	148	365	510	513	-3
365	ACTUATOR, ELECT	EG	2104	2148	3144	2157	P	44	9	405	53	352
366	ACTUATOR, ELECT	EG	2049	2107	3103	2122	P	58	15	419	73	346
367	ACTUATOR, ELECT	EG	1230	1295	2293	2070	P	65	140	428	205	223
368	ACTUATOR, ELECT	EG	1231	1295	2293	2065	P	64	135	427	199	228
369	ACTUATOR, ELECT	EG	1183	1266	2269	2053	P	83	152	451	235	216
370	ACTUATOR, ELECT	EG	1163	1266	2269	2017	P	103	116	471	219	252
371	ACTUATOR, ELECT	EG	1139	1248	2245	2044	P	109	161	471	270	201
372	ACTUATOR, ELECT	EG	1153	1246	2249	2044	P	93	163	461	256	205
373	ACTUATOR, ELECT	EG	1072	1176	2179	2065	P	104	254	472	358	114
374	ACTUATOR, ELECT	EG	297	1043	2046	2050	P	111	372	479	483	-4
375	ACTUATOR, ELECT	EG	274	1011	2011	2051	P	102	405	467	507	-40
376	CIRCUIT CARD AS	EG	2077	2135	2137	2143	P	58	8	60	66	-6
377	CIRCUIT CARD AS	EG	2077	2135	3132	2153	P	58	18	420	76	344
378	CIRCUIT CARD AS	EG	2055	2113	3110	2163	P	58	50	420	108	312
379	CIRCUIT CARD AS	EG	2055	2113	3110	2163	P	58	50	420	108	312
380	CIRCUIT CARD AS	EG	2040	2113	3110	2121	P	73	8	435	81	354
381	CIRCUIT CARD AS	EG	2039	2113	3110	2133	P	74	20	436	94	342
382	CIRCUIT CARD AS	EG	2042	2113	3110	2129	P	71	16	433	87	346
383	CIRCUIT CARD AS	EG	2004	2070	3066	2077	P	66	7	427	73	354
384	CIRCUIT CARD AS	EG	2055	2113	3110	2163	P	58	50	420	108	312
385	CIRCUIT CARD AS	EG	2055	2113	3110	2163	P	58	50	420	108	312
386	CIRCUIT CARD AS	EG	1336	2041	3037	2045	P	70	4	431	74	357
387	CIRCUIT CARD AS	EG	1329	2041	3037	2077	P	77	36	438	113	325

REPAIR AND REPLACE DATA FOR FMS F-16

line	Nomenclature	Country	Shipped to USAF	H-coded	Proj. Ship date	Shipped to Cust	Prog	Cust to H-code	H-coded till ship	Cust till proj ship	Cust till actual ship	Diff btwn proj & actual
388	CIRCUIT CARD AS	EG	1294	2028	3024	2042	P	99	14	460	113	347
389	CIRCUIT CARD AS	EG	1299	2027	3023	2042	P	93	15	454	108	346
390	CIRCUIT CARD AS	EG	1310	2027	3023	2127	P	82	100	443	182	261
391	CIRCUIT CARD AS	EG	1310	2013	3009	2057	P	68	44	429	112	317
392	CIRCUIT CARD AS	EG	1310	2013	3009	2112	P	68	99	429	167	262
393	CIRCUIT CARD AS	EG	1126	1210	2208	2045	P	84	200	447	284	163
394	CIRCUIT CARD AS	EG	1040	1122	2125	2017	P	82	260	450	342	108
395	CIRCUIT CARD AS	EG	1003	1098	2119	2017	P	95	284	481	379	102
396	COMPUTER, AIR D	EG	1335	2041	3037	2052	P	71	11	432	82	350
397	CRT ASSY	EG	252	1254	2260	2037	P	367	148	738	515	223
398	ELECTRONIC COMP	EG	1328	2041	3037	2066	P	78	25	439	103	336
399	ELECTRONIC COMP	EG	1299	2027	3023	2038	P	93	11	454	104	350
400	EPROM BOARD	EG	1286	2027	3023	2038	P	106	11	467	117	350
401	FIN, VENTRAL AS	EG	2006	2065	3061	2125	P	59	60	420	119	301
402	PANEL ASSY	EG	1230	1294	2291	2001	P	64	72	426	136	290
403	PANEL ASSY, FLI	EG	2034	2097	3093	2112	P	63	15	424	78	346
404	PANEL ASSY, FLI	EG	1308	2036	3032	2112	P	93	76	454	169	285
405	PANEL ASSY, FLI	EG	1231	1301	2300	2339	P	70	403	434	473	-39
406	PANEL, INDICATI	EG	1294	2027	3023	2031	P	98	4	459	102	357
407	PHASE LOCK LOOP	EG	1286	2027	3023	2042	P	106	15	467	121	346
408	PLATFORM ELECTR	EG	2039	2113	3110	2127	P	74	14	436	88	348
409	PLATFORM ELECTR	EG	1294	2027	3023	2042	P	98	15	459	113	346
410	PLATFORM ELECTR	EG	1299	2027	3023	2038	P	93	11	454	104	350
411	POWER SUPPLY	EG	2070	2132	3129	2143	P	62	11	424	73	351
412	POWER SUPPLY	EG	2041	2097	2159	2105	P	56	8	118	64	54
413	POWER SUPPLY	EG	2040	2097	2159	2105	P	57	8	119	65	54
414	POWER SUPPLY	EG	1049	1172	1272	2038	P	123	231	223	354	-131
415	POWER SUPPLY S-	EG	2040	2113	3110	2127	P	73	14	435	87	348
416	POWER SUPPLY S-	EG	1293	2027	3023	2101	P	99	74	460	173	287
417	RECEIVER ASSY	EG	2041	2097	3093	2106	P	56	9	417	65	352
418	RECEIVER ASSY	EG	1286	2027	3023	2031	P	106	4	467	110	357
419	RECEIVER ASSY	EG	1286	2027	3023	2031	P	106	4	467	110	357
420	RECEIVER ASSY	EG	1285	2027	3023	2031	P	107	4	468	111	357
421	REFERENCE SOURC	EG	2067	2132	3129	2143	P	65	11	427	76	351
422	REFERENCE SOURC	EG	2039	2113	3110	2121	P	74	8	436	82	354
423	REFERENCE SOURC	EG	1343	2070	3066	2091	P	92	21	453	113	340
424	REFERENCE SOURC	EG	1286	2027	3023	2031	P	106	4	467	110	357
425	REFERENCE SOURC	EG	1286	2027	3023	2031	P	106	4	467	110	357
426	TANK, FUEL, AIR	EG	297	1056	2059	1360	P	124	304	492	428	64
427	TRANSMITTER, AN	EG	2034	2097	3093	2105	P	63	8	424	71	353
428	TRANSMITTER, AN	EG	2012	2070	2071	2073	P	58	3	59	61	-2
429	TUBE UNIT ASSY	EG	2001	2070	3066	2098	P	69	28	430	97	333
430	TUBE UNIT ASSY	EG	1307	2013	3009	2016	P	71	3	432	74	358

REPAIR AND REPLACE DATA FOR FMS F-16

line	Nomenclature	Country	Shipped to USAF	H-coded	Proj. Ship date	Shipped to Cust	Prog	Cust to H-code	H-coded till ship	Cust till proj ship	Cust till actual ship	Diff btwn proj & actual
431		GR	2023	2057	3055	2065	P	34	8	397	42	355
432	ACTUATOR, ELECT	GR	1179	2128	3128	2150	P	314	22	679	336	343
433	CARD ASSEMBLY,	GR	1115	1140	2138	2018	P	25	243	388	268	120
434	CARD ASSEMBLY,	GR	1039	1067	2067	2018	P	28	316	393	344	49
435	COMPENSATOR	GR	2016	2036	3033	2043	P	20	7	382	27	355
436	COMPENSATOR	GR	1296	1331	2332	2043	P	35	77	401	112	289
437	ELECTRONIC COMP	GR	1092	1130	2130	2051	P	38	286	403	324	79
438	MEMORY, MAGNETI	GR	1234	1268	2270	2115	P	34	212	401	246	155
439	MEMORY, MAGNETI	GR	1177	1210	2208	2079	P	33	234	396	267	129
440	MEMORY, MAGNETI	GR	1133	1163	2161	2079	P	30	281	393	311	82
441	MEMORY, MAGNETI	GR	306	351	1349	2079	P	45	458	408	503	-95
442	POWER SUPPLY	GR	1039	1095	2101	2114	P	56	384	427	440	-13
443	TRANSMITTER, AN	GR	2077	2104	2106	2107	P	27	3	29	30	-1
444	TUBE UNIT ASSY	GR	2049	2078	3075	2092	P	29	14	391	43	348
445	TUBE UNIT ASSY	GR	2049	2078	3075	2092	P	29	14	391	43	348
446	INERTIAL NAVIGA	ID	1326	2034	3032	2042	P	73	8	436	81	355
447		KS	2027	2097	2101	2101	P	70	4	74	74	0
448	ACTUATOR INSTAL	KS	47	110	1107	2039	P	63	659	425	722	-297
449	ACTUATOR INSTAL	KS	47	108	1105	2025	P	61	647	423	708	-285
450	ACTUATOR, ELECT	KS	1281	1345	2342	2070	P	64	90	426	154	272
451	ACTUATOR, ELECT	KS	1239	1289	2286	2065	P	50	141	412	191	221
452	ACTUATOR, ELECT	KS	1239	1287	2285	2017	P	48	95	411	143	268
453	ACTUATOR, ELECT	KS	1220	1284	2281	2086	P	64	167	426	231	195
454	ACTUATOR, ELECT	KS	47	1182	2179	2065	P	500	248	862	748	114
455	ACTUATOR, ELECT	KS	326	1043	2040	2050	P	82	372	444	454	-10
456	ACTUATOR, ELECT	KS	296	324	1321	2050	P	28	456	390	484	-94
457	CIRCUIT CARD AS	KS	2055	2113	3113	2142	P	58	29	423	87	336
458	CIRCUIT CARD AS	KS	2027	2097	2101	2101	P	70	4	74	74	0
459	CIRCUIT CARD AS	KS	2027	2093	3090	2147	P	66	54	428	120	308
460	CIRCUIT CARD AS	KS	2027	2093	3090	2108	P	66	15	428	81	347
461	CIRCUIT CARD AS	KS	2027	2093	3090	2120	P	66	27	428	93	335
462	CIRCUIT CARD AS	KS	2027	2093	3090	2108	P	66	15	428	81	347
463	CIRCUIT CARD AS	KS	2027	2092	2094	2098	P	65	6	67	71	-4
464	CIRCUIT CARD AS	KS	2027	2078	3075	2119	P	51	41	413	92	321
465	CIRCUIT CARD AS	KS	1253	1353	2350	2038	P	100	50	462	150	312
466	CIRCUIT CARD AS	KS	1253	1345	2343	2017	P	92	37	455	129	326
467	CIRCUIT CARD AS	KS	1253	1345	2343	2101	P	92	121	455	213	242
468	CIRCUIT CARD AS	KS	267	1309	2308	2013	P	407	69	771	476	295
469	CIRCUIT CARD AS	KS	1120	1171	2171	2045	P	51	239	416	290	126
470	ELECTRONIC COMP	KS	2048	2114	2119	2121	P	66	7	71	73	-2
471	NOISE REGULATOR	KS	2037	2078	3075	2086	P	41	8	403	49	354
472	NOISE REGULATOR	KS	1253	1354	2351	2022	P	101	33	463	134	329
473	POWER SUPPLY	KS	2048	2114	2119	2121	P	66	7	71	73	-2

REPAIR AND REPLACE DATA FOR FMS F-16

line	Nomenclature	Country	Shipped to USAF	H-coded	Proj. Ship date	Shipped to Cust	Prog	Cust to H-code	H-coded till ship	Cust till proj ship	Cust till actual ship	Diff btwn proj & actual
474	POWER SUPPLY	KS	2055	2114	2121	2126	P	59	12	66	71	-5
475	POWER SUPPLY	KS	2027	2093	3090	2099	P	66	6	428	72	356
476	POWER SUPPLY	KS	1268	1319	2316	2017	P	51	63	413	114	299
477	POWER SUPPLY S-	KS	1253	1345	2243	1364	P	92	19	355	111	244
478	RECEIVER S-ASSY	KS	267	1309	2308	2013	P	407	69	771	476	295
479	RECEIVER, RADAR	KS	2027	2097	2101	2101	P	70	4	74	74	0
480	RECEIVER, RADAR	KS	2027	2092	3089	2099	P	65	7	427	72	355
481	TANK, FUEL, AIR	KS	1259	1345	2343	1361	P	86	16	449	102	347
482	TUBE UNIT ASSY	KS	2027	2093	3090	2114	P	66	21	428	87	341
483	TUBE UNIT ASSY	KS	2027	2093	3090	2114	P	66	21	428	87	341
484	TUBE UNIT ASSY	KS	2027	2093	3090	2114	P	66	21	428	87	341
485	TUBE UNIT ASSY	KS	1149	1200	2200	2142	P	51	307	416	358	58
486	VALVE, REGULATI	KS	1281	1345	2343	2038	P	64	58	427	122	305
487	VIN FIN ASSY	KS	1308	2009	3009	2057	P	66	48	431	114	317
488	CIRCUIT CARD AS	NE	1118	1168	2174	1361	P	50	193	421	243	178
489	CIRCUIT CARD AS	NE	225	253	1251	2073	P	28	550	391	578	-187
490	CONVERTER, PRES	NE	2077	2113	3110	2121	P	36	8	398	44	354
491	FIN, VENTRAL	NE	1159	1284	2281	2125	P	125	206	487	331	156
492	RACK, ELECTRICA	NE	9042	9075	119	2065	P	33	1085	442	1118	-676
493	RACK, ELECTRICA	NE	1188	1231	2229	2065	P	43	199	406	242	164
494	RACK, ELECTRICA	NE	329	1011	2011	2065	P	47	419	412	466	-54
495	TRANSDUCER ASSY	NE	9232	1221	2218	2013	P	719	157	1081	876	205
496	VIN FIN ASSY	NE	2056	2091	3087	2121	P	35	30	396	65	331
497	WAVEGUIDE ASSY	NE	1292	1340	2350	2002	P	48	27	423	75	348
498		TH	2044	2076	3080	2115	P	32	39	401	71	330
499	ACTUATOR, ELECT	TH	1276	2022	3024	2162	P	111	140	478	251	227
500	CIRCUIT CARD AS	TH	2044	2076	3080	2108	P	32	32	401	64	337
501	CIRCUIT CARD AS	TH	2044	2076	3080	2094	P	32	18	401	50	351
502	CIRCUIT CARD AS	TH	2044	2076	3080	2112	P	32	36	401	68	333
503	CIRCUIT CARD AS	TH	2044	2076	3080	2100	P	32	24	401	56	345
504	MULTIPLEX	TH	2044	2076	3080	2128	P	32	52	401	84	317
505	PHASE SHIFTER	TH	2044	2076	3080	2143	P	32	67	401	99	302
506	SIGHT, HUD	TH	2044	2076	3080	2115	P	32	39	401	71	330
507	TRANSMITTER, AN	TH	2041	2076	2106	2107	P	35	31	65	66	-1
508	VALVE, REGULATI	TH	1276	2025	3025	2050	P	114	25	479	139	340
509		TK	2088	2125	3121	2133	P	37	8	398	45	353
510		TK	2088	2121	3117	2133	P	33	12	394	45	349
511		TK	2058	2100	3096	2108	P	42	8	403	50	353
512		TK	2008	2041	3038	2082	P	33	41	395	74	321
513		TK	1338	2027	3024	2082	P	54	55	416	109	307
514		TK	2088	2136	3132	2154	P	48	18	409	66	343
515	ACTUATOR INSTAL	TK	9282	190	1187	2041	P	273	581	635	854	-219
516	ACTUATOR, ELECT	TK	1035	1073	2076	2106	P	38	398	406	436	-30

REPAIR AND REPLACE DATA FOR FMS F-16

line	Nomenclature	Country	Shipped to USAF	H-coded	Proj. Ship date	Shipped to Cust	Prog	Cust to H-code	H-coded till ship	Cust till proj ship	Cust till actual ship	Diff btwn proj & actual
517	ACTUATOR, ELECT	TK	1188	1224	2228	2080	P	36	221	405	257	148
518	ACTUATOR, ELECT	TK	1064	1102	2108	2052	P	38	315	409	353	56
519	ACTUATOR, ELECT	TK	1064	1098	2107	2051	P	34	318	408	352	56
520	ACTUATOR, ELECT	TK	347	1060	2057	2164	P	78	469	440	547	-107
521	ACTUATOR, ELECT	TK	239	304	1301	2051	P	65	477	427	542	-115
522	ACTUATOR, ELECT	TK	239	288	1280	2052	P	49	494	406	543	-137
523	ACTUATOR, ELECT	TK	1245	1296	2294	2017	P	51	86	414	137	277
524	ACTUATOR, ELECT	TK	1245	1289	2287	2069	P	44	145	407	189	218
525	ACTUATOR, ELECT	TK	1151	1203	2200	2070	P	52	232	414	284	130
526	ACTUATOR, ELECT	TK	2088	2135	3131	2149	P	47	14	408	61	347
527	ANTENNA	TK	1188	1225	2074	2050	P	37	190	251	227	24
528	ANTENNA	TK	1151	1182	2186	2050	P	31	233	400	264	136
529	BACKPLANE ASSY	TK	2088	2125	3121	2128	P	37	3	398	40	358
530	BLANKER, INTERF	TK	1338	2009	3006	2100	P	36	91	398	127	271
531	BLANKER, INTERF	TK	1338	2009	3006	2038	P	36	29	398	65	333
532	CARD ASSEMBLY,	TK	1064	1098	2107	2133	P	34	400	408	434	-26
533	CARD ASSEMBLY,	TK	347	1039	2042	2133	P	57	459	425	516	-91
534	CENTRAL PROCESS	TK	2008	2085	3081	2140	P	77	55	438	132	306
535	CIRCUIT CARD AS	TK	2088	2125	3121	2133	P	37	8	398	45	353
536	CIRCUIT CARD AS	TK	2058	2122	2143	2154	P	64	32	85	96	-11
537	CIRCUIT CARD AS	TK	2088	2121	3117	2133	P	33	12	394	45	349
538	CIRCUIT CARD AS	TK	2058	2092	3088	2097	P	34	5	395	39	356
539	CIRCUIT CARD AS	TK	2029	2071	3067	2091	P	42	20	403	62	341
540	CIRCUIT CARD AS	TK	2029	2071	3067	2084	P	42	13	403	55	348
541	CIRCUIT CARD AS	TK	2029	2071	3067	2112	P	42	41	403	83	320
542	CIRCUIT CARD AS	TK	2008	2057	2059	2062	P	49	5	51	54	-3
543	CIRCUIT CARD AS	TK	2008	2057	3054	2066	P	49	9	411	58	353
544	CIRCUIT CARD AS	TK	2008	2041	3038	2084	P	33	43	395	76	319
545	CIRCUIT CARD AS	TK	2008	2041	3038	2125	P	33	84	395	117	278
546	CIRCUIT CARD AS	TK	2008	2041	3038	2051	P	33	10	395	43	352
547	CIRCUIT CARD AS	TK	1338	2027	3024	2112	P	54	85	416	139	277
548	CIRCUIT CARD AS	TK	1338	2027	3024	2031	P	54	4	416	58	358
549	CIRCUIT CARD AS	TK	1338	2027	3024	2084	P	54	57	416	111	305
550	CIRCUIT CARD AS	TK	1338	2027	3024	2031	P	54	4	416	58	358
551	CIRCUIT CARD AS	TK	1338	2027	3024	2031	P	54	4	416	58	358
552	CIRCUIT CARD AS	TK	1304	2015	3011	2051	P	76	36	437	112	325
553	CIRCUIT CARD AS	TK	1338	2009	3006	2016	P	36	7	398	43	355
554	CIRCUIT CARD AS	TK	1304	1358	2364	2087	P	54	94	425	148	277
555	CIRCUIT CARD AS	TK	1304	1358	2364	2031	P	54	38	425	92	333
556	CIRCUIT CARD AS	TK	1304	1358	2364	2082	P	54	89	425	143	282
557	CIRCUIT CARD AS	TK	1304	1358	2364	2007	P	54	14	425	68	357
558	CIRCUIT CARD AS	TK	1304	1358	2364	2008	P	54	15	425	69	356
559	CIRCUIT CARD AS	TK	1304	1358	2364	2016	P	54	23	425	77	348

REPAIR AND REPLACE DATA FOR FMS F-16

line	Nomenclature	Country	Shipped to USAF	H-coded	Proj. Ship date	Shipped to Cust	Prog	Cust to H-code	H-coded till ship	Cust till proj ship	Cust till actual ship	Diff btwn proj & actual
560	CIRCUIT CARD AS	TK	307	1347	2347	2017	P	405	35	770	440	330
561	CIRCUIT CARD AS	TK	307	1347	2347	2121	P	405	139	770	544	226
562	CIRCUIT CARD AS	TK	307	1338	2336	2084	P	396	111	759	507	252
563	CIRCUIT CARD AS	TK	307	1338	2336	1353	P	396	15	759	411	348
564	CIRCUIT CARD AS	TK	307	1338	2336	2028	P	396	55	759	451	308
565	CIRCUIT CARD AS	TK	307	1338	1340	1364	P	396	26	398	422	-24
566	CIRCUIT CARD AS	TK	1211	1246	2252	2050	P	35	169	406	204	202
567	CIRCUIT CARD AS	TK	1188	1224	2228	2050	P	36	191	405	227	178
568	CIRCUIT CARD AS	TK	1188	1224	1365	2105	P	36	246	177	282	-105
569	CIRCUIT CARD AS	TK	1085	1130	2133	1354	P	45	224	413	269	144
570	CIRCUIT CARD AS	TK	1035	1106	2103	1354	P	71	248	433	319	114
571	CIRCUIT CARD AS	TK	2120	2155	3151	2162	P	35	7	396	42	354
572	CIRCUIT CARD AS	TK	2088	2135	3131	2154	P	47	19	408	66	342
573	COMPENSATOR	TK	205	2021	3018	2045	P	546	24	908	570	338
574	COMPUTER, FIRE	TK	1338	2066	3062	2080	P	93	14	454	107	347
575	CONTROL S-ASSY	TK	1188	1224	2228	2094	P	36	235	405	271	134
576	CONVERTER, PRES	TK	1304	1358	2364	2015	P	54	22	425	76	349
577	CONVERTER, PRES	TK	1188	1225	2074	2022	P	37	162	251	199	52
578	CONVERTER, PRES	TK	2120	2155	2156	2164	P	35	9	36	44	-8
579	CONVERTER, SIGN	TK	1211	1283	2280	2017	P	72	99	434	171	263
580	CYLINDER ASSY,	TK	1338	2030	3037	2044	P	57	14	429	71	358
581	Core Memory Uni	TK	2088	2135	3131	2148	P	47	13	408	60	348
582	Core Memory Uni	TK	1304	2015	3011	2021	P	76	6	437	82	355
583	ELECTRONIC COMP	TK	1151	1182	2186	2006	P	31	189	400	220	180
584	ELECTRONIC COMP	TK	2058	2105	3102	2112	P	47	7	409	54	355
585	ELECTRONIC COMP	TK	1338	2027	3024	2041	P	54	14	416	68	348
586	ELECTRONIC COMP	TK	1338	2027	3024	2036	P	54	9	416	63	353
587	ELECTRONIC COMP	TK	1304	2015	2016	2021	P	76	6	77	82	-5
588	ELECTRONIC COMP	TK	307	1338	2336	1353	P	396	15	759	411	348
589	PANEL, INDICATI	TK	1304	1358	2364	2010	P	54	17	425	71	354
590	PANEL, POWERDIS	TK	2008	2041	3038	2097	P	33	56	395	89	306
591	PANEL, POWERDIS	TK	307	1338	2336	2097	P	396	124	759	520	239
592	PANEL, POWERDIS	TK	1151	1182	2186	2157	P	31	340	400	371	29
593	PANEL, POWERDIS	TK	9220	9255	258	2097	P	35	937	403	972	-569
594	PANEL, POWERDIS	TK	2120	2155	3151	2163	P	35	8	396	43	353
595	POWER SUPPLY	TK	2088	2121	3117	2157	P	33	36	394	69	325
596	POWER SUPPLY	TK	2029	2085	3081	2094	P	56	9	417	65	352
597	POWER SUPPLY	TK	2029	2071	3067	2082	P	42	11	403	53	350
598	POWER SUPPLY	TK	2008	2041	2043	2051	P	33	10	35	43	-8
599	POWER SUPPLY	TK	1338	2036	3032	2094	P	63	58	424	121	303
600	POWER SUPPLY	TK	1338	2027	3024	2031	P	54	4	416	58	358
601	POWER SUPPLY	TK	1304	1358	2364	2136	P	54	143	425	197	228
602	POWER SUPPLY	TK	307	1347	2347	2021	P	405	39	770	444	326

REPAIR AND REPLACE DATA FOR FMS F-16

line	Nomenclature	Country	Shipped to USAF	H-coded	Proj. Ship date	Shipped to Cust	Prog	Cust to H-code	H-coded till ship	Cust till proj ship	Cust till actual ship	Diff btwn proj & actual
603	POWER SUPPLY	TK	2120	2155	2156	2164	P	35	9	36	44	-8
604	PRESSURIZING SE	TK	2058	2086	3082	2101	P	28	15	389	43	346
605	PRESSURIZING SE	TK	1338	2030	3037	2087	P	57	57	429	114	315
606	PRINTED CIRCUIT	TK	2058	2090	3086	2094	P	32	4	393	36	357
607	PRINTED CIRCUIT	TK	1304	1358	2064	2014	P	54	21	125	75	50
608	PROCESSOR, SIGN	TK	2029	2085	3081	2094	P	56	9	417	65	352
609	RECEIVER, RADAR	TK	2029	2071	3067	2078	P	42	7	403	49	354
610	SENSOR, PNEUMAT	TK	2008	2041	3038	2062	P	33	21	395	54	341
611	TANK, FUEL, AIR	TK	1304	2006	3003	2079	P	67	73	429	140	289
612	TANK, FUEL, AIR	TK	1245	1340	2340	1361	P	95	21	460	116	344
613	TRANSDUCER ASSY	TK	1304	1358	2364	2013	P	54	20	425	74	351
614	TRANSDUCER ASSY	TK	307	1338	2336	2016	P	396	43	759	439	320
615	TRANSDUCER ASSY	TK	1085	1130	2133	2013	P	45	248	413	293	120
616	TRANSMITTER S-A	TK	2029	2072	2073	2080	P	43	8	44	51	-7
617	TRANSMITTER S-A	TK	1338	2036	2037	2045	P	63	9	64	72	-8
618	TRANSPARENCEY,	TK	2008	2041	3038	2072	P	33	31	395	64	331
619	TRANSPARENCY, C	TK	1304	1357	2356	2016	P	53	24	417	77	340
620	TRANSPARENCY, C	TK	307	1338	2036	1353	P	396	15	459	411	48
621	TUBE UNIT ASSY	TK	2088	2125	3121	2139	P	37	14	398	51	347
622	TUBE UNIT ASSY	TK	2058	2090	3086	2107	P	32	17	393	49	344
623	TUBE UNIT ASSY	TK	1338	2009	3006	2016	P	36	7	398	43	355
624	TUBE UNIT ASSY	TK	1151	1182	2186	2017	P	31	200	400	231	169
625	TUBE UNIT ASSY	TK	2120	2155	3151	2164	P	35	9	396	44	352
626	UNIT, RATE SENS	TK	2008	2041	3038	2065	P	33	24	395	57	338
627	VALVE, REGULATI	TK	1304	1358	2364	2057	P	54	64	425	118	307
628	VALVE, SOLENOID	TK	2029	2074	2075	2078	P	45	4	46	49	-3
629	VALVE, SOLENOID	TK	1304	1364	2003	2006	P	60	7	64	67	-3
630	VIDEO INTERFACE	TK	307	1347	2347	2017	P	405	35	770	440	330
631	VIN FIN ASSY	TK	1338	2009	3006	2080	P	36	71	398	107	291
632	VIN FIN ASSY	TK	1304	1358	2364	2045	P	54	52	425	106	319
633	ACTUATOR, ELECT	VE	2076	2113	3110	2121	P	37	8	399	45	354
634	ACTUATOR, ELECT	VE	8312	2108	3104	2112	P	1256	4	1617	1260	357
635	CIRCUIT CARD AS	VE	2076	2126	3122	2140	P	50	14	411	64	347
636	CIRCUIT CARD AS	VE	2076	2126	3122	2140	P	50	14	411	64	347
637	CIRCUIT CARD AS	VE	2076	2113	3110	2140	P	37	27	399	64	335
638	CIRCUIT CARD AS	VE	2076	2113	3110	2153	P	37	40	399	77	322
639	CIRCUIT CARD AS	VE	2061	2099	3095	2140	P	38	41	399	79	320
640	CIRCUIT CARD AS	VE	2014	2034	3030	2056	P	20	22	381	42	339
641	CIRCUIT CARD AS	VE	2014	2034	3030	2156	P	20	122	381	142	239
642	CIRCUIT CARD AS	VE	1304	1331	2333	2101	P	27	135	394	162	232
643	CIRCUIT CARD AS	VE	1134	1163	2166	2052	P	29	254	397	283	114
644	CIRCUIT CARD AS	VE	1084	1115	2118	2148	P	31	398	399	429	-30
645	CONVERTER, POWE	VE	2076	2113	3110	2140	P	37	27	399	64	335

REPAIR AND REPLACE DATA FOR FMS F-16

line	Nomenclature	Country	Shipped to USAF	H-coded	Proj. Ship date	Shipped to Cust	Prog	Cust to H-code	H-coded till ship	Cust till proj ship	Cust till actual ship	Diff btwn proj & actual
646	POWER AMPLIFIER	VE	2076	2113	3110	2119	P	37	6	399	43	356
647	POWER SUPPLY S-	VE	2076	2113	3110	2140	P	37	27	399	64	335
648	RADIO FREQUENCY	VE	2014	2034	3030	2142	P	20	108	381	128	253
649	RADIO FREQUENCY	VE	2014	2034	3030	2142	P	20	108	381	128	253
650	RECEIVER ASSY	VE	2014	2034	3030	2051	P	20	17	381	37	344
651	RECEIVER ASSY	VE	1304	1331	2333	2002	P	27	36	394	63	331
652	REFERENCE SOURC	VE	2064	2099	3095	2108	P	35	9	396	44	352
653	REFERENCE SOURC	VE	2064	2099	3101	2114	P	35	15	402	50	352
654	TRANSMITTER S-A	VE	65	108	1110	2016	P	43	638	410	681	-271
655	TRANSMITTER, AN	VE	2097	2134	3130	2153	P	37	19	398	56	342
656	CONVERTER, PRES	BE	1312	1350	2347	2015	P	38	30	400	68	332

APPENDIX D: STATISTIX OUTPUTS FOR TOTAL DATA SET

Legend

HCODE--------	Number of days from customer initiated requisition until requisition is H-coded
PHCODE-------	Same as HCODE but for programmed requisitions only
NHCODE-------	Same as HCODE but for non-programmed requisitions only
SHIP---------	Number of days from H-coding until shipped from the TRC
PSHIP--------	Same as SHIP but for programmed requisitions only
NSHIP--------	Same as SHIP but for non-programmed requisitions only
TOTAL--------	Total number of days from customer initiation until shipped from TRC
PTOTAL-------	Same as TOTAL but for programmed requisitions only
NTOTAL-------	Same as TOTAL but for non-programmed requisitions only
DIFF---------	Number of days difference between USAF's first projected ship date and actual ship date
PDIFF--------	Same as DIFF but for programmed requisitions only
NDIFF--------	Same as DIFF but for non-programmed requisitions only

STATISTIX 3.5
DESCRIPTIVE STATISTICS

	HCODE	SHIP	TOTAL	DIFF
CASES	656	656	656	656
LOWER 90.0% C.I.	77.94	102.3	185.5	287.4
MEAN	85.80	112.1	197.9	306.0
UPPER 90.0% C.I.	93.67	121.8	210.3	324.6
S.D.	122.3	151.7	192.9	289.0
S.E. (MEAN)	4.775	5.922	7.531	11.28
C.V.	142.54	135.34	97.48	94.43
MINIMUM	5.000	2.000	25.00	-2.129E+03
MEDIAN	54.00	43.50	113.0	317.5
MAXIMUM	1.256E+03	1.143E+03	1.261E+03	1.180E+03

STATISTIX 3.5

```
FREQUENCY                    HISTOGRAM OF HCODE
     ¦
 240 +
     ¦
     ¦
 200 +
     ¦    **
     ¦    **
 160 +    **
     ¦    ****
     ¦    ****
 120 +    ****
     ¦    ******
     ¦    ******
  80 +    ******
     ¦    ******
     ¦  ********
  40 +  ************
     ¦  **************
     ¦  ******************
   0 +---+---+---+---+---+---+---+---+---+---+---+---+
     0  30  60  90 120 150 180 210 240 270 300 330 360
          620 CASES PLOTTED   36 CASES OUTSIDE SCALE
```

```
FREQUENCY                    HISTOGRAM OF SHIP
     ¦
 180 +**
     ¦**
     ¦**
 150 +**
     ¦**
     ¦**
 120 +**
     ¦**
     ¦**
  90 +****
     ¦****
     ¦******
  60 +******
     ¦******
     ¦******
  30 +********          **
     ¦****************  ******
     ¦****************************  ********    **
   0 +---+---+---+---+---+---+---+---+---+---+---+---+
     0  30  60  90 120 150 180 210 240 270 300 330 360
          605 CASES PLOTTED   51 CASES OUTSIDE SCALE
```

```
FREQUENCY                      HISTOGRAM OF TOTAL
     :
 120 +
     :
     :
 100 +
     :
     :        **
  80 +        **
     :        **
     :        **
  60 +      ******
     :      ******
     :      ******  **
  40 +    ************
     :    ************
     :    ************        **
  20 +    ****************    **  **    **
     :    ****************************  **
     :  **********************************************
   0 +---+---+---+---+---+---+---+---+---+---+---+---+
     0  30  60  90 120 150 180 210 240 270 300 330 360
         548 CASES PLOTTED   108 CASES OUTSIDE SCALE
```

```
STATISTIX 3.5
FREQUENCY                      HISTOGRAM OF HCODE
     :
 360 +
     :
     :  **
 300 +  **
     :  **
     :  **
 240 +  **
     :  **
     :  **
 180 +  **
     :  ****
     :  ****
 120 +  ****
     :  ****
     :  ****
  60 +  ******
     :********
     :**********                **
   0 +---+---+---+---+---+---+---+---+---+---+---+---+
     0  60 120 180 240 300 360 420 480 540 600 660 720
          652 CASES PLOTTED   4 CASES OUTSIDE SCALE
```

```
FREQUENCY                    HISTOGRAM OF SHIP
     |
 300 +
     |
     |**
 250 +**
     |**
     |**
 200 +**
     |**
     |**
 150 +**
     |**
     |**
 100 +****
     |****
     |****
  50 +****  ****
     |************
     |**********************  ****  **
   0 +---+---+---+---+---+---+---+---+---+---+---+---+
     0  60 120 180 240 300 360 420 480 540 600 660 720
          651 CASES PLOTTED   5 CASES OUTSIDE SCALE
```

```
FREQUENCY                    HISTOGRAM OF TOTAL
     |
 180 +
     |
     |
 150 +    **
     |    **
     |    **
 120 +    **
     |    **
     |  ****
  90 +  ******
     |  ******
     |  ******
  60 +  ******
     |  ******
     |  ********  ****
  30 +  ********  ****
     |  ****************  **      **
     |  ************************************
   0 +---+---+---+---+---+---+---+---+---+---+---+---+
     0  60 120 180 240 300 360 420 480 540 600 660 720
          638 CASES PLOTTED   18 CASES OUTSIDE SCALE
```

DESCRIPTIVE STATISTICS

	PHCODE	NHCODE	PSHIP	NSHIP
CASES	363	293	363	293
LOWER 90.0% C.I.	72.86	76.89	86.56	112.9
MEAN	82.81	89.52	98.83	128.5
UPPER 90.0% C.I.	92.76	102.1	111.1	144.1
S.D.	114.9	131.0	141.9	161.8
S.E. (MEAN)	6.032	7.651	7.446	9.451
C.V.	138.79	146.31	143.53	125.93
MINIMUM	20.00	5.000	3.000	2.000
MEDIAN	54.00	59.00	36.00	56.00
MAXIMUM	1.256E+03	1.256E+03	1.085E+03	1.143E+03

	PTOTAL	NTOTAL	PDIFF	NDIFF
CASES	363	293	363	293
LOWER 90.0% C.I.	166.0	203.4	220.4	358.8
MEAN	181.6	225.7	234.2	395.0
UPPER 90.0% C.I.	197.3	248.1	247.9	431.3
S.D.	181.3	231.6	159.0	376.3
S.E. (MEAN)	9.514	13.53	8.345	21.98
C.V.	99.79	102.62	67.90	95.26
MINIMUM	27.00	25.00	-676.0	-2.129E+03
MEDIAN	108.0	146.0	307.0	336.0
MAXIMUM	1.260E+03	2.162E+03	358.0	1.180E+03

STATISTIX 3.5

```
FREQUENCY                        HISTOGRAM OF PHCODE
       |
   240 +
       |
       |   ***
   200 +   ***
       |   ***
       |   ***
   160 +   ***
       |   ***
       |   ***
   120 +   ***
       |   ***
       |   ***
    80 +   ***
       |   ******
       |   ******
    40 +   *********
       |   *********
       |************                           ***
     0 +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
       0     60    120   180   240   300   360   420   480   540   600
               361 CASES PLOTTED   2 CASES OUTSIDE SCALE
```

```
FREQUENCY                    HISTOGRAM OF NHCODE
     :
 120 +   ***
     :   ***
     :   ***
 100 +   ***
     :   ******
     :   ******
  80 +   ******
     :   ******
     :   ******
  60 +   ******
     :   ******
     :   ******
  40 +   ******
     :   ******
     :*********
  20 +************
     :************
     :***************
   0 +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
     0    60    120   180   240   300   360   420   480   540   600
               288 CASES PLOTTED    5 CASES OUTSIDE SCALE
```

```
FREQUENCY                    HISTOGRAM OF PSHIP
     :
 180 +
     :***
     :***
 150 +***
     :***
     :***
 120 +***
     :***
     :***
  90 +***
     :***
     :***
  60 +***
     :******
     :******
  30 +******
     :******************
     :***************************            ***
   0 +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
     0    60    120   180   240   300   360   420   480   540   600
               358 CASES PLOTTED    5 CASES OUTSIDE SCALE
```

```
FREQUENCY                         HISTOGRAM OF NSHIP
     |
 120 +
     |
     |
 100 +***
     |***
     |***
  80 +***
     |***
     |***
  60 +***
     |***
     |******
  40 +******
     |******
     |******   ***
  20 +******   ******
     |**********************  ***
     |**********************  ***************      ******
   0 +-----+-----+-----+-----+-----+-----+-----+-----+-----+-----+
     0     60   120   180   240   300   360   420   480   540   600
                 285 CASES PLOTTED    8 CASES OUTS.DE SCALE
```

STATISTIX 3.5

```
FREQUENCY                         HISTOGRAM OF PTOTAL
     |
 120 +
     |
     |
 100 +
     |    **
     |    **
  80 +    **
     |    **
     |  ****
  60 +  ****
     |  ****
     |  ******
  40 +  ******
     |  ******
     |  ********
  20 +  ********  ****
     |  ********  ******          **
     |  ******************  **  ************
   0 +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
     0  60 120 180 240 300 360 420 480 540 600 660 720 780 840 900
                 360 CASES PLOTTED    3 CASES OUTSIDE SCALE
```

```
FREQUENCY                          HISTOGRAM OF NTOTAL
    :
 60 +
    :    **
    :    **
 50 +    **
    :    **
    :    **
 40 +    ****
    :    ****
    :  ******
 30 +  ******
    :  ******
    :  ******    **
 20 +  ******    **
    :  ******    ****
    :  ****************  **
 10 +  ****************  **
    :  ****************  **  ******  **  **
    :**************************************      **  ******
  0 +---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
    0  60 120 180 240 300 360 420 480 540 600 660 720 780 840 900
              289 CASES PLOTTED    4 CASES OUTSIDE SCALE
```

STATISTIX 3.5

TWO SAMPLE T TESTS FOR PHCODE VS NHCODE

VARIABLE	MEAN	SAMPLE SIZE	S.D.	S.E.
PHCODE	82.81	363	114.9	6.032
NHCODE	89.52	293	131.0	7.651

	T	DF	P
EQUAL VARIANCES	-0.70	654	0.4855
UNEQUAL VARIANCES	-0.69	585.4	0.4988

	F	NUM DF	DEN DF	P
TESTS FOR EQUALITY OF VARIANCES	1.30	292	362	0.0092

CASES INCLUDED 656

STATISTIX 3.5

WILCOXON SIGNED RANK TEST FOR PHCODE - NHCODE

SUM OF NEGATIVE RANKS	-2.024E+04
SUM OF POSITIVE RANKS	1.882E+04
NORMAL APPROXIMATION WITH CONTINUITY CORRECTION	0.529
TWO TAILED P VALUE FOR NORMAL APPROXIMATION	0.5971

TOTAL NUMBER OF VALUES WHICH WERE TIED	224
NUMBER OF ZERO DIFFERENCES DROPPED	14
MAX. DIFF. ALLOWED BETWEEN TIES	1.0E-0005

CASES INCLUDED 279

STATISTIX 3.5

TWO SAMPLE T TESTS FOR PSHIP VS NSHIP

VARIABLE	MEAN	SAMPLE SIZE	S.D.	S.E.
PSHIP	98.83	363	141.9	7.446
NSHIP	128.5	293	161.8	9.451

	T	DF	P
EQUAL VARIANCES	-2.50	654	0.0128
UNEQUAL VARIANCES	-2.46	585.1	0.0135

	F	NUM DF	DEN DF	P
TESTS FOR EQUALITY OF VARIANCES	1.30	292	362	0.0089

CASES INCLUDED 656

STATISTIX 3.5

WILCOXON SIGNED RANK TEST FOR PSHIP - NSHIP

SUM OF NEGATIVE RANKS	-2.332E+04
SUM OF POSITIVE RANKS	1.945E+04
NORMAL APPROXIMATION WITH CONTINUITY CORRECTION	1.339
TWO TAILED P VALUE FOR NORMAL APPROXIMATION	0.1805

TOTAL NUMBER OF VALUES WHICH WERE TIED 183
NUMBER OF ZERO DIFFERENCES DROPPED 1
MAX. DIFF. ALLOWED BETWEEN TIES 1.0E-0005

CASES INCLUDED 292

APPENDIX E: STATISTIX OUTPUTS FOR REDUCED DATA SET

(90% OF TOTAL DATA SET)

Legend

HCODE-------- Number of days from customer initiated requisition until requisition is H-coded
PHCODE------- Same as HCODE but for programmed requisitions only
NHCODE------- Same as HCODE but for non-programmed requisitions only
SHIP--------- Number of days from H-coding until shipped from the TRC
PSHIP-------- Same as SHIP but for programmed requisitions only
NSHIP-------- Same as SHIP but for non-programmed requisitions only
TOTAL-------- Total number of days from customer initiation until shipped from TRC
PTOTAL------- Same as TOTAL but for programmed requisitions only
NTOTAL------- Same as TOTAL but for non-programmed requisitions only
DIFF--------- Number of days difference between USAF's first projected ship date and actual ship date
PDIFF-------- Same as DIFF but for programmed requisitions only
NDIFF-------- Same as DIFF but for non-programmed equisitions only

STATISTIX 3.5
DESCRIPTIVE STATISTICS

	HCODE	SHIP	TOTAL	DIFF
CASES	593	590	590	590
LOWER 90.0% C.I.	53.54	66.29	140.4	285.3
MEAN	55.04	71.53	147.7	299.1
UPPER 90.0% C.I.	56.54	76.77	155.1	312.8
S.D.	22.17	77.27	108.9	202.7
S.E. (MEAN)	9.103E-01	3.181	4.484	8.344
C.V.	40.28	108.03	73.72	67.77
MINIMUM	5.000	2.000	25.00	-42.00
MEDIAN	54.00	36.00	104.5	317.5
MAXIMUM	117.0	307.0	463.0	874.0

STATISTIX 3.5
DESCRIPTIVE STATISTICS

	PHCODE
CASES	326
LOWER 90.0% C.I.	50.86
MEAN	52.75
UPPER 90.0% C.I.	54.63
S.D.	20.68
S.E. (MEAN)	1.145
C.V.	39.21
MINIMUM	20.00
MEDIAN	49.00
MAXIMUM	107.0

```
STATISTIX 3.5
FREQUENCY            HISTOGRAM OF PHCODE
      |
  240 +
      |
      |      ******
  200 +      ******
      |      ******
      |      ******
  160 +      ******
      |      ******
      |      ******
  120 +      ******
      |      ******
      |      ******
   80 +      ******
      |      ************
      |      ************
   40 +      ************
      |      ******************
      |************************
    0 +-----+-----+-----+-----+-----+-----+
      0    30    60    90   120   150   180
        326 CASES PLOTTED    0 MISSING CASES
```

```
STATISTIX 3.5
DESCRIPTIVE STATISTICS

                      NHCODE
CASES                   263
LOWER 90.0% C.I.      54.74
MEAN                  57.07
UPPER 90.0% C.I.      59.41
S.D.                  22.93
S.E. (MEAN)           1.414
C.V.                  40.18
MINIMUM               5.000
MEDIAN                55.00
MAXIMUM               121.0
```

```
STATISTIX 3.5
FREQUENCY             HISTOGRAM OF NHCODE
         |
    120  +      ******
         |      ******
         |      ******
    100  +      ******
         |      ************
         |      ************
     80  +      ************
         |      ************
         |      ************
     60  +      ************
         |      ************
         |      ************
     40  +      ************
         |      ************
         |******************
     20  +************************
         |************************
         |************************
      0  +-----+-----+-----+-----+-----+-----+
         0    30    60    90   120   150   180
           263 CASES PLOTTED     0 MISSING CASES
```

STATISTIX 3.5
DESCRIPTIVE STATISTICS

	PSHIP
CASES	325
LOWER 90.0% C.I.	53.85
MEAN	59.94
UPPER 90.0% C.I.	66.04
S.D.	66.57
S.E. (MEAN)	3.693
C.V.	111.05
MINIMUM	3.000
MEDIAN	27.00
MAXIMUM	248.0

```
STATISTIX 3.5
FREQUENCY                          HISTOGRAM OF PSHIP
     ¦
 180 +
     ¦*****
     ¦*****
 150 +*****
     ¦*****
     ¦*****
 120 +*****
     ¦*****
     ¦*****
  90 +*****
     ¦*****
     ¦*****
  60 +*****
     ¦**********
     ¦**********
  30 +**********
     ¦******************************
     ¦****************************************
   0 +----+----+----+----+----+----+----+----+----+----+---
     0   30   60   90  120  150  180  210  240  270  300
                  325 CASES PLOTTED    0 MISSING CASES
```

STATISTIX 3.5
DESCRIPTIVE STATISTICS

	NSHIP
CASES	263
LOWER 90.0% C.I.	76.37
MEAN	85.32
UPPER 90.0% C.I.	94.27
S.D.	87.89
S.E. (MEAN)	5.419
C.V.	103.01
MINIMUM	2.000
MEDIAN	43.00
MAXIMUM	328.0

```
STATISTIX 3.5
FREQUENCY                              HISTOGRAM OF NSHIP
      |
  120 +
      |
      |
  100 +*****
      |*****
      |*****
   80 +*****
      |*****
      |*****
   60 +*****
      |*****
      |**********
   40 +**********
      |**********
      |**********    *****
   20 +**********    **********
      |***********************************     *****
      |***********************************     ***************
    0 +----+----+----+----+----+----+----+- --+----+----+----+----
      0   30   60   90  120  150  180  210  240  270  300
                263 CASES PLOTTED    0 MISSING CASES
```

STATISTIX 3.5
DESCRIPTIVE STATISTICS

	PTOTAL
CASES	324
LOWER 90.0% C.I.	123.1
MEAN	132.0
UPPER 90.0% C.I.	140.9
S.D.	97.45
S.E. (MEAN)	5.414
C.V.	73.83
MINIMUM	27.00
MEDIAN	93.50
MAXIMUM	439.0

STATISTIX 3.5

```
FREQUENCY                          HISTOGRAM OF PTOTAL
      :
  120 +
      :
      :
  100 +
      :      ***
      :      ***
   80 +      ***
      :      ***
      :   ******
   60 +   ******
      :   ******
      :   *********
   40 +   *********
      :   *********
      :   ************
   20 +   ************   ******
      :   ************   *********
      :   ***************************   ***   ******
    0 +-----+-----+-----+-----+-----+-----+-----+-----+
      0     60   120   180   240   300   360   420   480
                  324 CASES PLOTTED    0 MISSING CASES
```

```
STATISTIX 3.5
DESCRIPTIVE STATISTICS

                    NTOTAL
CASES                 263
LOWER 90.0% C.I.    154.9
MEAN                167.2
UPPER 90.0% C.I.    179.5
S.D.                120.5
S.E. (MEAN)         7.428
C.V.                72.04
MINIMUM             25.00
MEDIAN              116.0
MAXIMUM             495.0
```

```
STATISTIX 3.5
FREQUENCY                    HISTOGRAM OF NTOTAL
      :
   60 +
      :      ***
      :      ***
   50 +      ***
      :      ***
      :      ***
   40 +      ******
      :      ******
      :   *********
   30 +   *********
      :   *********
      :   *********      ***
   20 +   *********      ***
      :   *********      ******
      :   ************************   ***
   10 +   ************************   ***
      :   ************************   ***   *********
      :***************************************************
    0 +-----+-----+-----+-----+-----+-----+-----+-----+-----
      0    60   120   180   240   300   360   420   480
                 263 CASES PLOTTED    0 MISSING CASES
```

STATISTIX 3.5
TWO SAMPLE T TESTS FOR PHCODE VS NHCODE

VARIABLE	MEAN	SAMPLE SIZE	S.D.	S.E.
PHCODE	53.00	299	20.90	1.209
NHCODE	56.49	236	22.78	1.483

	T	DF	P
EQUAL VARIANCES	-1.84	533	0.0658
UNEQUAL VARIANCES	-1.82	482.9	0.0652

	F	NUM DF	DEN DF	P
TESTS FOR EQUALITY OF VARIANCES	1.19	235	298	0.0803

STATISTIX 3.5
WILCOXON SIGNED RANK TEST FOR PHCODE - NHCODE

SUM OF NEGATIVE RANKS	-1.270E+04
SUM OF POSITIVE RANKS	1.205E+04
NORMAL APPROXIMATION WITH CONTINUITY CORRECTION	0.337
TWO TAILED P VALUE FOR NORMAL APPROXIMATION	0.7360

TOTAL NUMBER OF VALUES WHICH WERE TIED 202
NUMBER OF ZERO DIFFERENCES DROPPED 14
MAX. DIFF. ALLOWED BETWEEN TIES 1.0E-0005

STATISTIX 3.5

TWO SAMPLE T TESTS FOR PSHIP VS NSHIP

VARIABLE	MEAN	SAMPLE SIZE	S.D.	S.E.
PSHIP	61.78	300	67.56	3.901
NSHIP	84.20	235	87.86	5.732

	T	DF	P
EQUAL VARIANCES	-3.34	533	0.0009
UNEQUAL VARIANCES	-3.23	428.9	0.0015

	F	NUM DF	DEN DF	P
TESTS FOR EQUALITY OF VARIANCES	1.69	234	299	0.0000

STATISTIX 3.5

WILCOXON SIGNED RANK TEST FOR PSHIP - NSHIP

SUM OF NEGATIVE RANKS	-1.529E+04
SUM OF POSITIVE RANKS	1.221E+04
NORMAL APPROXIMATION WITH CONTINUITY CORRECTION	1.487
TWO TAILED P VALUE FOR NORMAL APPROXIMATION	0.1371

TOTAL NUMBER OF VALUES WHICH WERE TIED 167

NUMBER OF ZERO DIFFERENCES DROPPED 1

MAX. DIFF. ALLOWED BETWEEN TIES 1.0E-0005

STATISTIX 3.5
DESCRIPTIVE STATISTICS

	PDIFF
CASES	324
LOWER 90.0% C.I.	240.2
MEAN	251.1
UPPER 90.0% C.I.	262.0
S.D.	119.1
S.E. (MEAN)	6.617
C.V.	47.43
MINIMUM	-39.00
MEDIAN	306.5
MAXIMUM	356.0

STATISTIX 3.5

```
FREQUENCY                      HISTOGRAM OF PDIFF
     |
 120 +
     |
     |                                       ***
 100 +                                       ***
     |                                       ***
     |                                       ***
  80 +                                       ***
     |                                       ***
     |                                       ***
  60 +                                       ***
     |                                       ***
     |                                    ******
  40 +                                    ******
     |                                    ******
     |   ***                     ***   *********
  20 +   ***                  ******************
     |   ***   ***            ******************
     |******   *********************************
   0 +-----+-----+-----+-----+-----+-----+-----+-----+----
   -50    10    70   130   190   250   310   370   430
                 324 CASES PLOTTED    0 MISSING CASES
```

STATISTIX 3.5
DESCRIPTIVE STATISTICS

	NDIFF
CASES	263
LOWER 90.0% C.I.	366.1
MEAN	396.6
UPPER 90.0% C.I.	427.0
S.D.	299.3
S.E. (MEAN)	18.46
C.V.	75.47
MINIMUM	-49.00
MEDIAN	336.0
MAXIMUM	990.0

```
STATISTIX 3.5
FREQUENCY                     HISTOGRAM OF NDIFF
     :
  48 +
     :                  ***
     :                  ***
  40 +                  ***
     :                  ***
     :***               ***
  32 +***               ***
     :***               ***
     :***               ***
  24 +***         ***   ***
     :***         *********
     :***         *********
  16 +******      *********               *********
     :******      *********           ************
     :*********   *********           ***************
   8 +*********************      ************************
     :*********************   ***************************
     :******************************************************
   0 +--------+--------+--------+--------+--------+--------+
   -50.0    130.0    310.0    490.0    670.0    850.0   1030
              263 CASES PLOTTED    0 MISSING CASES
```

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Vita

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13. ABSTRACT (*Maximum 200 words*)

This study examined the reparable logistics pipeline and identified characteristics and associated problems with the processing of Foreign Military Sales (FMS) repair and replace aircraft assets. Areas of investigation included examining the FMS logistics reparable pipeline and determining what section of the pipeline the USAF controls or can influence, identifying the individual problems within that section of pipeline, and collecting and analyzing data pertaining to FMS repair and replace requisitions. The methodology used in these areas involved a literature review, personal interviews with Foreign Liaison Officers to obtain customer perspectives, and a statistical analysis of pipeline times for all FMS replacement requisitions for F-16 reparables filled within a specific six month period. Of primary concern to both the USAF and the customers was the time it took to fill replacement requisitions and especially the problems associated with H-coding requisitions. The research showed numerous possible causes for delays and indicated that many of the problems start before the USAF is even aware of the customer's demand, but that the USAF has been working hard to correct problems within its control and has attempted to improve the process overall.

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