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AN ANALYSIS OF NAVAL AIRCRAFT ENGINE CONTAINER MANAGEMENT

by

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December 1998

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Reusable aircraft engine and engine component containers serve a critical yet unglamorous role in the naval aviation logistics pipeline. Paradoxically, these items which provide shipping and storage protection to the most expensive aviation parts receive the least management attention and lowest budgetary prioritization. This thesis focuses on current funding and inventory management practices of those containers. The research revealed that container procurement and repair is chronically underfunded resulting in low supply availability and increasing wait times. Additionally, inventory management and budgetary decisions are complicated by poor asset visibility and accountability. The full impact of container shortages is obscured, as current logistics information gathering practices do not track this variable. The thesis identifies some alternative policies that could improve existing engine container support.

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AN ANALYSIS OF NAVAL AIRCRAFT ENGINE CONTAINER MANAGEMENT

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ABSTRACT

Reusable aircraft engine and engine component containers serve a critical yet unglamorous role in the naval aviation logistics pipeline. Paradoxically, these items which provide shipping and storage protection to the most expensive aviation parts receive the least management attention and lowest budgetary prioritization. This thesis focuses on current funding and inventory management practices of those containers. The research revealed that container procurement and repair is chronically underfunded resulting in low supply availability and increasing wait times. Additionally, inventory management and budgetary decisions are complicated by poor asset visibility and accountability. The full impact of container shortages is obscured, as current logistics information gathering practices do not track this variable. The thesis identifies some alternative policies that could improve existing engine container support.

TABLE OF CONTENTS

I. INTRODUCTION

A. PURPOSE

This thesis examines management policies and practices for naval aircraft engine containers. Improved utilization of scarce resources and decreased logistics response times are common themes of current management efforts throughout the Deaprtment of the Navy (DoN). Management of reusable engine containers may well be an area worthy of increased attention and revision to current procedures.

As a necessary component of the naval aircraft engine logistics pipeline, containers are as vital as any internal engine component in meeting the ultimate goal of providing working aviation engines when and where needed. They serve as both storage devices and as shipping vessels, protecting costly assets.

B. OBJECTIVES

The objective of this thesis is to assess current management policies and procedures for naval aircraft engine containers. It analyzes the funding environment and trends for container replacement and repair as well as funding mechanisms. Inventory control and accountability issues are explored, including requirements determination, asset visibility, and disposal procedures, in an effort to identify areas for possible improvement. While container management may be a relatively small budget item and appear trivial, it may play a sizeable role in the quality of aviation logistics support. The research will attempt to gauge that impact.

C. RESEARCH QUESTIONS

The primary research question to be answered in this thesis is:

- How might the Navy alter current inventory management and funding policies for aircraft engine containers to most efficiently support aviation logistics?

Subsidiary questions include the following:

- What is the source(s) of funding for engine container procurement?
- What is the source(s) of funding for engine container repair?
- How is funding for engine container repair allocated?
- What activity(s) is responsible for engine container inventory management?
- What procedural methods are used to obtain engine containers when needed for customer use?
- How are engine container assets accounted for?

- What criteria are employed to make repair or dispose decisions?
- What is the magnitude of engine container non-availability?
- What impact does engine container non-availability have on RFI engine availability and ultimately on aircraft readiness?
- What impact does engine container non-availability have on the risk of damage to unprotected engines?
- What incentives can be employed to improve accountability of engine container assets?
- What mechanisms might be used to increase asset visibility?
- What means of matching requirements to funding are likely to yield greatest benefit?

D. SCOPE OF THE THESIS

This study explores a variety of inventory management and funding policies regarding reusable naval aircraft engine containers. Naval Inventory Control Point, Philadelphia (NAVICP-P) has indicated a need for review of container management in light of continuing difficulties supporting requirements. The scope of this thesis is limited to specialized, reusable containers designed for aircraft engines, engine modules and major engine components under the control of DoN. General-purpose containers and specialized containers for other than aircraft engine components are beyond the scope of this thesis.

E. METHODOLOGY

Research included a review of documentation associated with aircraft engine container inventory management and funding. The literature search yielded numerous relevant naval instructions and publications.

Interviews were conducted with personnel involved in one or more facets of engine container management at Naval Air Systems Command, Naval Inventory Control Point-Philadelphia, and Naval Aviation Depot Jacksonville among others. These interviews concentrated on processes currently in use, difficulties encountered, and possible alternatives. Additionally, cognizant personnel provided pertinent funding and inventory data.

F. ORGANIZATION OF THE STUDY

Chapter II provides a brief description of engine containers followed by background information regarding organizational relationships of key activities. The chapter discusses funding approaches for the three facets affecting container population, initial provisioning, replenishment, and rework. Lastly, inventory management aspects are reviewed including an overview of the Uniform Inventory Control Program.

Chapter III presents data on recent funding levels for procurement and repair, supply measures of effectiveness, the customer base, container shortage workarounds, and the apparent impact on readiness.

Chapter IV analyzes the data with a goal of identifying areas for possible improvement. The chapter also explores current and proposed alternative systems.

Chapter V summarizes the findings and discusses conclusions drawn from the research and analysis. The chapter reviews both primary and subsidiary research questions.

II. BACKGROUND

A. INTRODUCTION

Although packaging is generally considered a peripheral element in the supply chain, and not worthy of serious discussion or top management attention, it is nonetheless costly and essential for moving and storing aircraft engines and components.

This chapter provides background information on aircraft engine container management. The chapter discusses basic characteristics of reusable containers, organizational roles and responsibilities of key activities, funding mechanisms, and inventory management policy.

B. CONTAINER CHARACTERISTICS

Naval aircraft engines may be shipped and stored as entire engine assemblies, or as modular subassemblies for some engine models. Collectively, they are referred to as engine/propulsion system modules (EPSMs). Additionally, some engine components below the module level are stored and shipped in reusable containers. Therefore, reusable aircraft engine containers come in three basic varieties: whole engine containers, module containers, and component containers. For purposes of this research, the term engine container will be inclusive of all types unless otherwise indicated. Engine containers are typically constructed from metal or fiberglass/plastic and are designed to fit snugly around contents, preventing potentially damaging vibra-tions and movement. Complete engine containers are designed as air tight assemblies. They can be filled with nitrogen in order to minimize corrosion to the engine while inside. EPSMs make up the single most expensive aircraft components, individually and collectively. Their protection while rapidly moving through the naval logistics pipeline is critical, as evidenced by the ship to ship transfer shown in Figure 2.1.

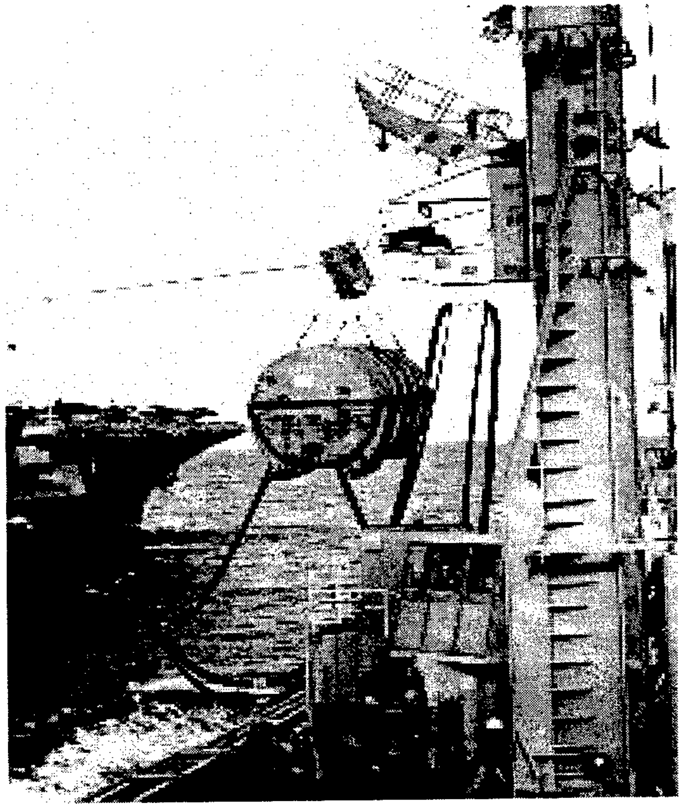

Figure 2.1.

Engine Transfer at Sea.

C. CONTAINER MANAGEMENT ORGANIZATIONAL RELATIONSHIPS

1. Naval Air Systems Command (NAVAIR)

NAVAIR is assigned overall technical cognizance for aircraft engine container research, design, development, test, evaluation, modification, and initial procurement. [Ref. 1,pg. 1] The Assistant Commander for Logistics and Fleet Support (AIR-3.0) is the corporate sponsor for the NAVAIR Packaging, Handling, Storage, and Transportation (PHS&T) Program, which includes reusable engine containers.

As the controlling activity and sponsor, AIR-3.0 has delegated the authority and responsibility for naval aviation PHS&T matters to the Naval Inventory Control Point, Philadelphia. [Ref. 2,para. 3.0]

2. Naval Air Warfare Center, Aircraft Division, Lakehurst (NAWCADLKE)

PHS&T requirements are developed to ensure weapon systems and components are adequately protected and ready for use throughout the DoD logistics cycle. The Naval Air Warfare Center, Aircraft Division, Lakehurst (NAWCADLKE), New Jersey, is the packaging specification and standardization activity for the Naval Air Systems Command and as such it has the lead in developing and modifying those specifications and standards. NAWCADLKE has cognizance over more than 100 military, federal and industry specifications and standards. [Ref. 2,para. 3.4]

3. Naval Inventory Control Point, Philadelphia (NAVICP-P)

NAVICP, Philadelphia, is the Navy's focal point for the purchase, distribution, and inventory control of aviation spare parts inventories as well as EPSM containers. The NAVICP-P serves as the NAVAIR Cognizant Field Activity (CFA) for management of aircraft engine and other component reusable containers. Functions included are:

- Logistics functions for containers.
- Engineering design functions.
- Performance of cost analyses.
- Design engineering analyses and technical evaluations of PHS&T matters.
- Promulgating technical guidance to Assistant Program Managers for Logistics (APMLs) and contractors. [Ref. 2,para. 3.1]

The role of the Naval Aviation Systems Team (NAST) PHS&T Program Office is also performed by NAVICP-P. Responsibilities involve providing support to the Naval Aviation Program Executive Offices (PEO) and Program Manager Air (PMA) organizations. This support includes:

- Interacting with industry concerning PHS&T matters.
- Formulating NAST PHS&T strategies and policies.
- Filling the role of the single point of contact for all aircraft and weapons programs. [Ref. 2,para. 3.1]

The Packaging Program Management Division of NAVICP-P serves as the NAVAIR PHS&T Logistics Element Manager (LEM). As the LEM, the Division has responsibility for:

- Providing overarching support and guidance to the Assistant Program Managers for Logistics (APMLs).

- Creating Integrated Logistics Support Documents (ILSDS, ILSP, etc.).
- Developing Planning, Programming and Budgeting System (PPBS) input.
- Participating in NAVAIR material source selections.
- Providing technical direction and assistance to field activities.
- Developing transportation requirements and management functions. [Ref. 2,para. 3.1]

Apart from its role as PHS&T LEM, the Packaging Program Management Division provides PHS&T requirements determination and ICP support consisting of:

- Reviewing packaging specifications to ensure compliance with Navy standards.
- Providing critical analysis and evaluating contract proposals to ensure they conform to the solicitation's PHS&T requirements.
- Developing preservation, packaging, marking, handling, storage, shelf-life and freight classification requirements for NAVICP-P controlled supply items. [Ref. 2,para. 3.1]

Additionally, the NAVICP assists the Naval Supply Systems Command (NAVSUP) in its role as the Navy lead for packaging.

4. Naval Aviation Depots (NADEPs)

The NADEPs provide support for the NAVAIR PHS&T competency and receive their PHS&T policy and procedural guidance from NAVICP. Areas of involvement include:

- Container rework. All NADEPs generally have reusable container repair capabilities.
- Containerization of material. NADEPs containerize major repairables such as aircraft engines, modules, and transmissions in their respective containers.
- Research and Development. NADEPs assist in research, development, and evaluation of preservation materials and processes. They participate with NAVICP-P in the developing and prototyping shipping containers for engines and components as well as alternate packaging methods for the wide range of material repaired at the depots.
- Evaluating contractor PHS&T demonstrations.
- Providing technical support toestablish preservation and storage policy.
- Performing first article evaluations on containers including packaging, form, fit and function.
- Establishing and implement local packaging guidelines and instructions concerning storage requirements for engines, components, modules, and aircraft. [Ref. 2,para. 3.3]

5. Fleet and Industrial Supply Centers (FISCs)

Fleet and Industrial Supply Centers provide storage facilities for NAVICP-P managed inventories including engine componenets, EPSMs and empty containers. FISCs also perform receiving, issuing, transaction reporting, packaging and handling functions for Navy owned material.

D. FUNDING

1. Funding methods

There are two basic methods of providing funding for materiel requirements; through appropriation accounts or through revolving fund accounts. Each will be discussed in turn.

a. Appropriation Purchases Account (APA)

Major equipment and repairable components being managed on an interim basis by a Hardware Systems Command (HSC) such as NAVAIR are procured using the APA. However, some Navy owned secondary items of APA principal end items and repairable assemblies are managed by NAVICP. This is the case with reusable engine containers. Generally, items managed by the HSC are reviewed periodically and transferred to NAVICP when there is no longer a need to manage them at the HSC or Program Manager level. APA materiel is purchased from contractors using one of three Navy procurement appropriations: Aircraft Procurement, Navy (APN); Weapons Procurement, Navy (WPN); or Other Procurement, Navy (OPN).

[Ref. 3,para. 3.2.1] Engine container purchases are funded by APN-6 (aircraft spares and repair parts.)

b. Revolving Funds

Items purchased by the Working Capital Fund (WCF) are held in stock until requisitioned by a customer. As items purchased using the WCF are issued to user activities, the user's financing appropriation reimburses the WCF for the items drawn, thereby providing financial resources which can be used by the fund to purchase new items or to replace inventory that has been sold. It is because of this last feature that the WCF is categorized as a revolving fund.

The WCF corpus consists of two elements, material carried in the account and cash. The WCF is designed to recover all costs associated with obtaining, storing, and issuing spare parts and other material to customers. Additionally, the revolving nature of the fund allows NAVICP greater flexibility in using funds to support future needs. [Ref. 3,para. 3.2.2] Currently, the aircraft engine component inventories, whether from replenishment procurement or rework, as well as other aviation repair parts are funded using the WCF.

2. Container Budget Process

The APA budget cycle starts with NAVICP performing a line item stratification of supply assets. Stratification identifies assets by their intended use and computes requirements through the budget year. The stratification program calculates funded and unfunded levels of requirements for these items and determines how much funding will be required to attain desired inventory levels. Stratification occurs bi-annually. The submission is based on the March stratification; the apportionment submission, when required, is based on the September stratification. [Ref. 3,para. 3.2.4-5]

The objective of the APA budget development process is to deliver a balanced budget to higher review levels which, if approved, will permit the NAVICP to fulfill supply system inventory policy and achieve supply system performance goals. The goal is to adequately support customer needs, as measured by a predetermined requisition fill rate or System Material Availability (SMA).

The NAVICP must collect and analyze a large volume of data in preparation of the APA procurement and rework budgets. NAVSUP establishes supply and budget policies and procedures. HSCs, such as NAVAIR, provide program and planning information and the data collection systems. The flow of data through the APA budget process is equivalent to that of other DoD appropriations. The APA budget is segmented into three different categories: (a) initial provisioning, (b) replenishment, and (c) component rework (repair) funding. Initial provisioning and replenishment draw from the Aircraft Procurement, Navy appropriation (APN), while repair uses Operations and Maintenance, Navy funds (O&M,N). [Ref. 3,para. 3.2.1]

a. Initial Provisioning

Funding requirements for APA item initial provisioning levels are developed in accordance with DoDI 4140.42. Program and planning data required for development of the initial provisioning requirement is provided to the NAVICP by the HSC; NAVAIR in the case of engine containers. This program and planning data includes end item procurement plans and delivery schedules. The NAVICP must maintain open communications with the end item program manager at the HSC to ensure that all required information is available to determine the initial provisioning requirement. The overall amount budgeted for initial provisioning includes outfitting and beginning system stock requirements for an initial support period. [Ref. 3,para. 3.2.1.1]

b. Replenishment

APA replenishment funding requirements are determined on the basis of NAVICP line item stratification results. The requirement includes projected issues of material to end user customers through the appropriate fiscal periods plus required end of period levels (safety level, lead time requirements, repair cycle, procurement cycle, etc.). Offsetting assets that are applied to the requirements include on-hand Ready For Issue (RFI), recoverable on-hand NRFI material, on order material, serviceable returns and projected recoverable unserviceable returns. The resulting asset shortfall becomes the basic funding requirement. However, owing to the numerous conditions and events which cannot be incorporated into the stratification process, certain adjustments and special program additions are typically required to determine the final budget figure. These additions or new initiatives are priced out on a gross basis after they are offset by available assets. These additions are included in the Budget Transition Statement. [Ref. 3,para. 3.2.1.2]

c. Container Rework (Repair) Funding

The container rework funding requirement is derived from NAVICP's repair stratification process. Requirements included in calculations consist of expected customer orders plus end of period repair levels requirements. Assets applied to the requirements include on-hand RFI assets, serviceable returns, receipts from procurement, NRFI scheduled for repair, NRFI not currently scheduled for repair, and unserviceable returns. [Ref. 3,para. 3.2.1.3] Rework of APA items is accomplished using the Operation & Maintenance, Navy (O&M,N) appropriation.

E. INVENTORY MANAGEMENT

NAVICP, Philadelphia is designated as the cognizant inventory manager for engine containers. Within this responsibility reside such functions as requirements determination, materiel distribution, procurement of replenishment stock, and disposal of excess and obsolete items. For ease of management, material is segregated into groups identified by cognizance symbols known as cogs. Cog is a two character numeric-alphabetic code that identifies the type of funds that are used to purchase an item and the activity that has inventory management responsibility for it. These codes are used internally by the Navy and not by other services. An odd number in the first position indicates that the material is funded by the Working Capital Fund (WCF) and is paid for, or reimbursed by the customer, typically with O&M,N funds. An even number in the first position indicates that the item was paid for with Appropriation Purchase Account (APA) funds such as APN, and is issued to the customer free of charge. Reusable aircraft engine containers are assigned the cog 6K and are funded by the APN appropriation. As such they are free of charge to customers.

Groups of items in the supply system are assigned to individual Item Managers (IMs) who oversee the various inventory management functions for their items. IMs are located not only at NAVICP but at HSCs and other services, as well as at Defense Logistics Agency (DLA). The IM exercises control over and visibility of assigned material assets through daily transaction reporting from stock points around the world. These transaction reports include issues, receipts, and changes in material condition, such as changes from Ready For Issue (RFI) to Not Ready For Issue (NRFI), and back to RFI via repair. Also included are disposal actions and losses due to damage, obsolescence, or other cause.

As material is issued to customers, the total on-hand balance of RFI material decreases to a point where additional quantities of material are needed to meet anticipated requirements. The IM initiates a replenishment procurement for new material or directs the repair of NRFI retrograde units returned by user activities. Forecasts of future demand are derived from historical data, including the number of requisitions per unit of time and the average quantity of material ordered on those requisitions. Known or planned future requirements, other than simple replacement of failed items, are also taken into account. The IM's decision of when to replenish and how much to replenish are subject to considerations used in most inventory models such as economic order quantity and safety level. [Refs. 3,para. 1.12 & 4,pg. 3-8,9]

1. NAVICP Inventory Program

To manage the hundreds of thousands of items in the Navy wholesale supply inventory, NAVICP uses a system of computer files and programs under an ADP umbrella called Uniform Inventory Control Program (UICP). UICP extends to every major supply function performed by NAVICP. UICP allows inventory requirement parameters to be adjusted by cognizance symbol and even among groupings within a cog. This approach avoids the one size fits all dilemma by providing tailored parameters for various items. [Ref. 4,pg. 3-8,9]

2. Requisition Processing

Customer requisitions for material are first passed to a point of entry stocking location, such as a FISC. Ideally all demands would be filled from the local stock point and the issue transaction reported to the ICP. However, stock nonavailability may require the requisition to be passed electronically to the ICP for further action. Requisition referrals are input to the UICP requisition processing application designated B01. The B01 application then attempts to refer the request to another stock point holding ICP assets. If no assets are available throughout the supply system, the requisition will be placed on backorder pending availability or a spot procurement will be initiated. Action taken in B01 is then relayed to the customer as status. [Ref. 4,pg. 3-15 - 3-17]

3. Requirements Determination

UICP uses five major data files in the requirements determination process: the Master Data File, the Reapirables Management File, the Planned Program File, the Due-in/Due-out file, and the Inventory History File.

The Master Data File (MDF) consists of hundreds of data elements for each of the ICP managed inventory items. Almost all of the important characteristics for the items, both technical and management, are incorporated into the file. Technical data includes dimensions, method of procurement, unit of issue, and weight. Pertinent management information includes on-hand assets, due-in assets, demand observations, unit costs, repair turnaround time, and procurement lead times. [Ref. 4,pg. 3-12]

The Repairables Management File (RMF) is an offshoot of the MDF containing Depot Level Repairable (DLR) specific data. Organic and commercial repair information regarding inductions, repair times, repair completions, disposals, etc. resides in the RMF. [Ref. 4,pg. 3-12]

The Planned Program Requirements (PPR) File is designed as the repository for requirements known in advance. These requirements are not a part of the demand generated by random failure and replacement, but nonetheless need to be factored into the requirements determination process. PPRs are typically communicated to the ICP from the field activities and HSCs based on specific program needs. [Ref. 4,pg. 3-13]

The Due-in/Due-out File (DDF) consists of pending actions that affect supply system material. These pending actions range from outstanding requisitions and procurements to disposal directives and stock point to stock point material movement orders as well as movement of DLRs in and out of the repair cycle. [Ref. 4.pg. 3-14]

The last of the five files is the Inventory History File (IHF). As the name implies, this is a historical record for each item. Data elements in the file are updated quarterly during the UICP Cycle Levels and Forecasting (D01) application. System activities including demands, backorders, lead times, and carcass returns are recorded in the file. [Ref. 4,pg. 3-14]

Data from all the files are brought together in the Cycle Levels and Forecasting (D01) application process and run through various inventory models to calculate new system order quantities, reorder levels, repair quantities, forecasts, and establish stock points as shippers or receivers. [Ref. 4,pg. 3-28 - 3-34]

4. Depot Repair Scheduling

Two programs are utilized by NAVICP-P to manage the organic repair requirements of aviation DLRs under its control. They are: the Level Schedule Program and the B08 Cyclic Repairables Management Program. Items with historically high volumes of customer demand and annual repair expenditure may be chosen for the Level Schedule Program. The remaining 7R, which are WCF items, and 6K cognizance aeronautical repairables, are managed through the B08 program in UICP. B08 item repair requirements are calculated weekly. The program places items into the production requirement category when RFI assets are below the required level. Repair directives are then transmitted to the various Designated Overhaul Points (DOPs) for action.

The quantity inducted for repair is constrained by several factors, including availability of NRFI assets, DOP capacity, DOP capability, and funding. [Ref. 5,para. 4,5]

5. **Disposal of Containers**

As a depot level repairable item, container disposal authority is limited to the DOP and NAVICP-P. Containers at a NADEP may be surveyed and disposed of when they are no longer economical to repair, or Beyond Economic repair (BER). Disposal of excess and obsolete material is authorized by NAVICP and is accomplished through disposal directives, which are transmitted to applicable fleet sites. All fleet activities having NAVICP-P cognizance material they are considering for disposal are to request disposition instructions from NAVICP-P prior to action. [Ref. 6,para. 3,4]

III. RESEARCH FINDINGS

A. INTRODUCTION

This chapter presents quantitative and qualitative information. Quantitative information comes from data obtained by the researcher from multiple sources including UICP, NAVICP-P, NAVAIR, and NADEP Jacksonville personnel. Qualitative information comes from notes taken during interviews with key activity personnel. Much of the data presented is reflects engine, module, and component containers in general. Other portions are restricted to F-404 engine and component container information to facilitate research efforts.

B. CURRENT FUNDING

As described in the preceding chapter funding of new purchases and funding of repairs progresses along two separate paths. Each will be detailed below.

1. Procurement Funding

The stratification process is conducted twice annually at NAVICP-P. An IM review of the difference between projected demand and projected assets yields the basis for replenishment procurement budget submissions. These budget submissions are initiated by responsible container IMs, and passed up to NAVICP-P's budget office. There they are scrubbed and consolidated before being forwarded to NAVAIR. At AIR 3.8.2, these 6K cognizance symbol requirements (reusable aviation container) are reviewed again and rolled into a budget line, along with items such as HQ replenishment, covering executive helicopters, and the Aviation Outfitting Account (AOA), which constitutes the largest portion. The 6K component being the smallest of these budget items is easily obscured and therefore often ignored. [Ref. 7] Figure 3.1 indicates just how small a portion of the APN-6 budget 6K is, less than one percent of the total. [Refs. 8 & 9]

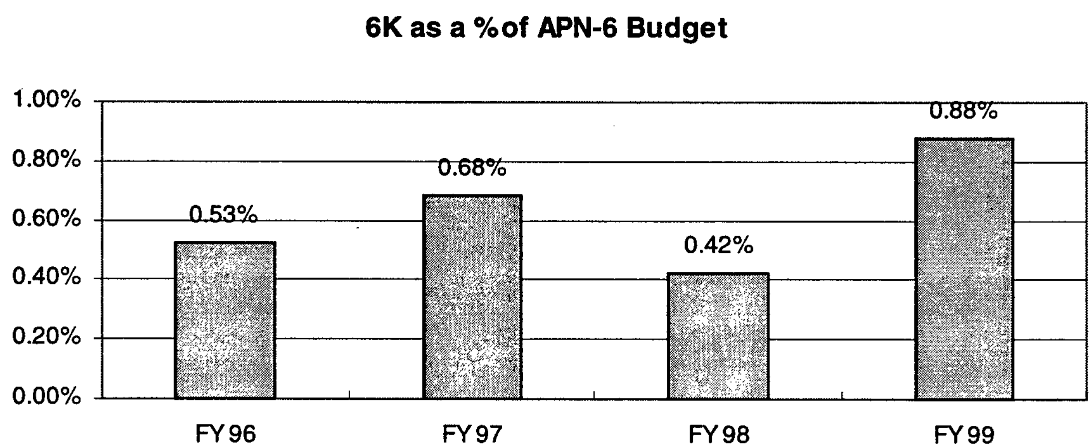

Figure 3.1. 6K as a Percentage of APN-6 Budget.

The 6K budget fluctuated over the past three fiscal years; it increased significantly in FY99, in part to accommodate introduction of new engine types into the fleet. Figure 3.2 portrays recent 6K procurement budget requests versus actual funding. [Refs 8 & 9]

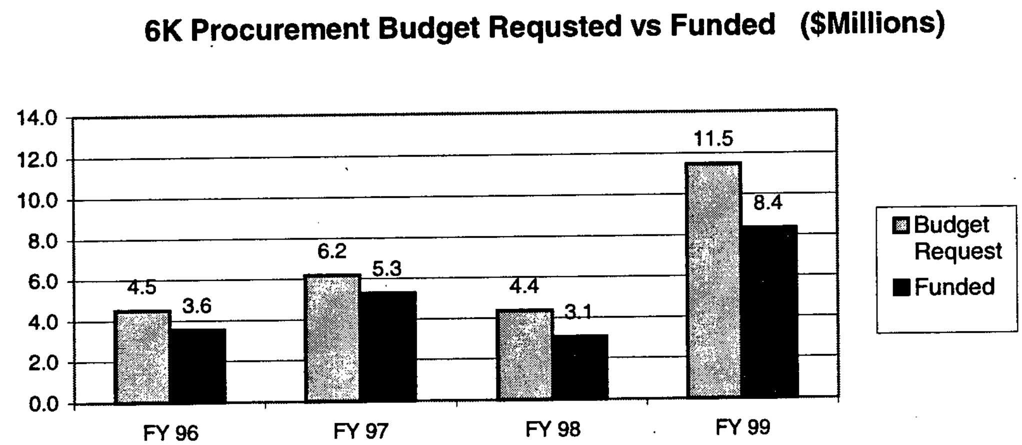

Figure 3.2. 6K Procurement Budget Requested vs. Funded.

2. Repair Funding

Repair funding requirements are also generated through the stratification process at NAVICP-P and transmitted to NAVAIR for inclusion in budget submissions. O&M,N funding was provided to AIR-3.8 through the flying hour program. AIR-3.8 passed it to AIR-6.0 (Industrial Liaison) who then distributed it to the three NADEPs. Recently, AIR-6.0 has been eliminated from this chain and rework funds now flow directly from AIR-3.8 to the NADEPs. [Ref. 10] The funding split among the three NADEPs is: NADEP Jacksonville 65%, NADEP Cherry Point 30%, and NADEP North Island 5%. [Ref. 8]

Once funded the NADEP inducts containers for repair in accordance with a quarterly induction schedule worked out between the NADEP and cognizant IMs. [Ref. 11] This is contrary to the B08 Repairables Management Program policy. This policy calls for weekly computations to identify RFI deficiencies and generation of repair directives to be transmitted to the DOP. Generally, all funding is obligated before all identified requirements are filled. Unlike WCF items for which the IM has funding status information resident within NAVICP-P, repair orders for these APA containers must be approved by the NADEP in terms of financial availability. This requires a level of coordination between NADEP personnel and the various engine IMs not otherwise called for.

Funded 6K repair budgets have generally been on the rise over the most recent four-year period as shown in Figure 3.3. [Refs. 8 & 10] Most notable is the narrowing gap between requested and actual funding. As FY99 is not complete, so the $700,000 funding is tentative; it began as low as $331,000 before efforts were undertaken to increase it.

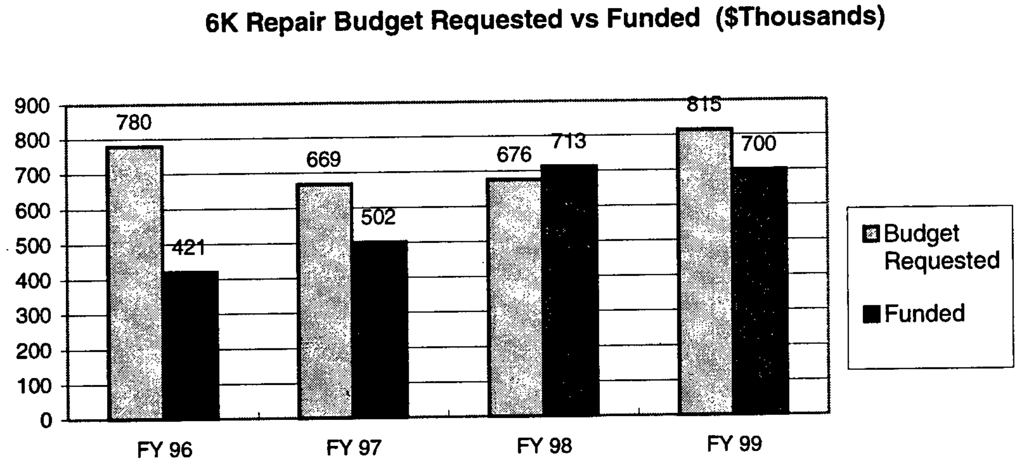

Figure 3.3. 6K Repair Budget Requested vs. Funded.

C. CUSTOMER BASE

The customer base for engine containers consists of various intermediate and depot level maintenance activities such as NADEPs, aircraft carriers, naval air stations, Marine Aviation Logistics Squadrons (MALS), and others including Naval Air Warfare Centers and contractors. [Ref. 12] Figure 3.4 depicts the distribution of NAVICP-P's engine container issues to customers over a three-year period. [Ref. 13] These percentages only include issues made of empty containers in response to customer requisitions. The vast majority of container transactions go unrecorded and are not reflected in Figure 3.4. For example, the transaction is not recorded when an RFI item is removed from a container and immediately replaced with a NRFI item in the course of aircraft maintenance actions. Under this scenario no requisition is processed and no demand is registered.

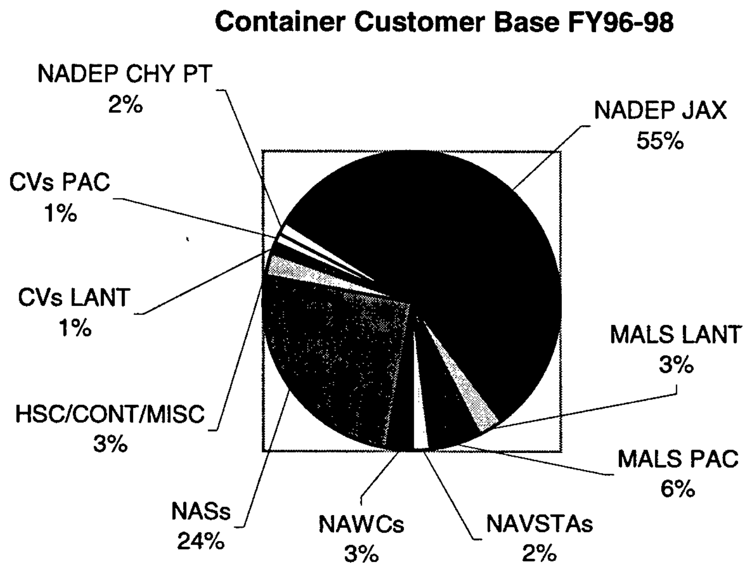

Figure 3.4. Container Customer Base FY96-98.

D. SYSTEM DEMAND AND MEASURES OF EFFECTIVENESS

As mentioned previously, the vast majority of container requirements, defined as instances of packaging an EPSM or component, are not recorded by the supply system. Ideally, there would be no requisitions for containers; all needs would be met with locally available assets. Requisitions for empty containers across all Navy engine types for the fiscal years 96 through 98 are displayed in Figure 3.5. [Ref. 13] The numbers are hardly of a significant magnitude except that each one means that an item could not be moved when required in as protected a fashion as intended.

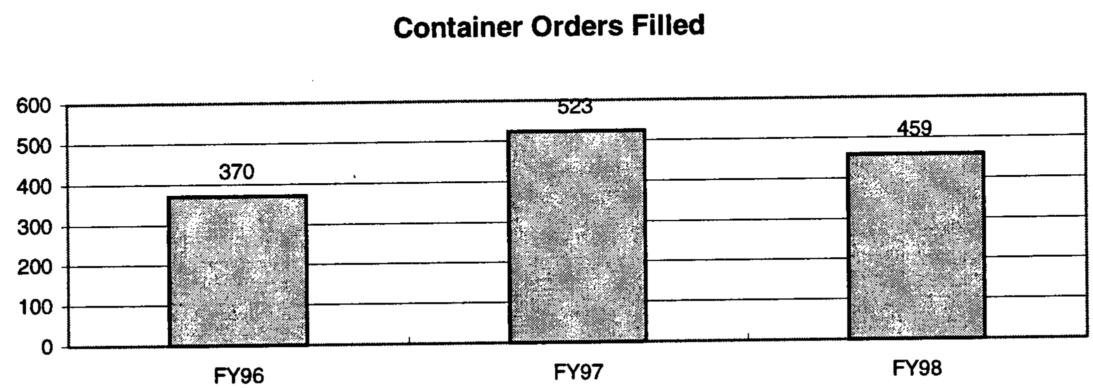

Figure 3.5. Container Orders Filled

Supply system effectiveness, as measured by System Material Availability (SMA), is calculated as follows: SMA= 1 - {(BO+DVD)/Demand} where BO = backorders and DVD = direct vendor deliveries. The SMA for 6K containers has remained considerably below goal over the past three years. Figure 3.6 portrays the relative inability of the supply system to respond to customer demands as they are received. [Ref. 14]

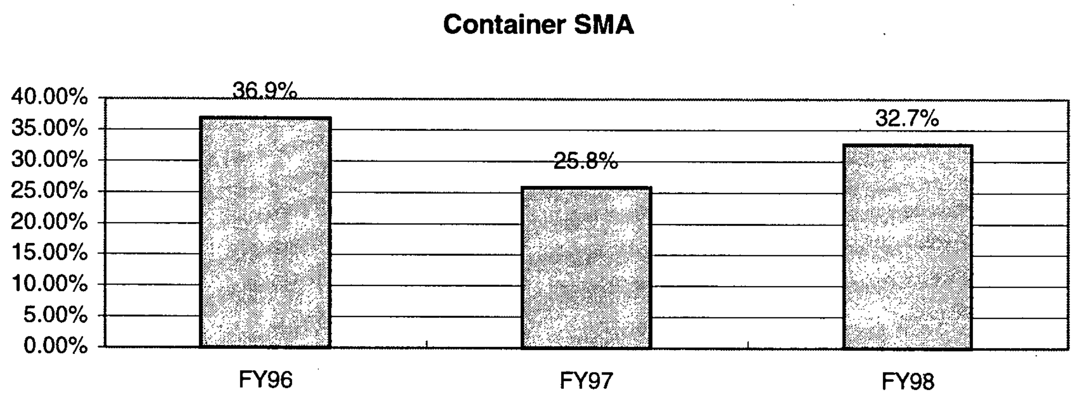

Figure 3.6. Container SMA.

Another measure of effectiveness that helps to highlight the current state of container availability is average customer wait time (ACWT). While a true ACWT was not obtainable, data was gathered for the time from requisition reaching the ICP until the requested material was released for shipment from the storage facility. Excluded from this information is the time material took to reach the customer once released. Figure 3.7 provides a picture of increasing customer wait times over the past three fiscal years. [Ref. 13]

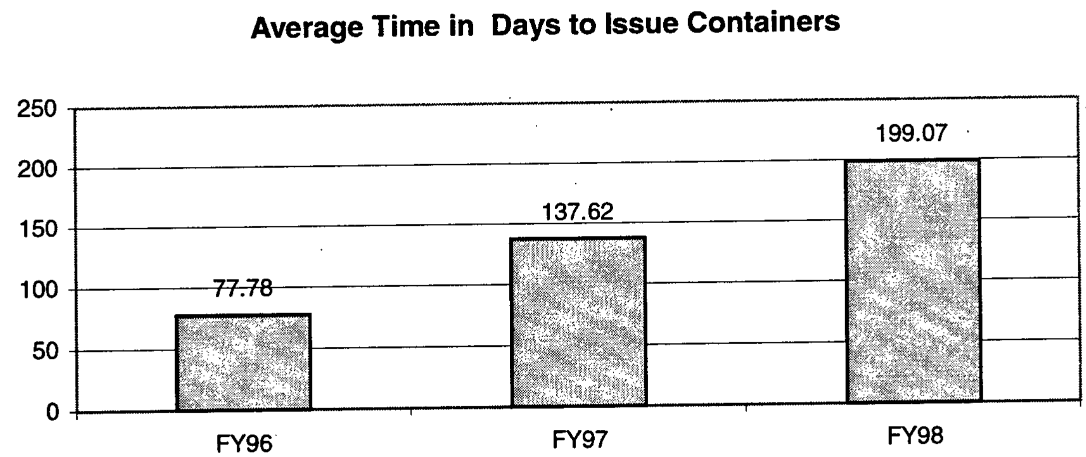

Figure 3.7. Average Time in Days to Issue Containers.

E. DISPOSAL ACTIONS

Containers in "F" condition (NRFI) are held by FISC pending examination and evaluation for possible induction to rework. During the examination and evaluation, NADEP production personnel make a determination as to the container's potential for return to RFI condition. Repair estimates in excess of 80% of replacement value are deemed uneconomical, placing the container in a BER status. Containers inducted may similarly be condemned as rework estimates are revised. After IM notification and approval condemned containers are sent to disposal. [Ref. 11]

A comparison was made between F-404 IM disposal records and NADEP Jacksonville records to ascertain their congruence. The comparison suggests that notice of disposal actions is being conveyed to the IM. Experienced production personnel also confirmed as reasonable disposal rates reflected in the records. [Ref. 15]

F. WORKAROUNDS

Faced with insufficient RFI containers, IMs and depot personnel have found a couple of not so terribly efficient workarounds to meet fleet requirements.

1. Foraging

NADEP personnel report it is not uncommon to have to scour the local area and poll nearby commands for empty containers.

The IM for F-404 engine containers routinely moves an average of three whole engine containers from one coast to the other each month to satisfy urgent requests. The IM uses worldwide screening messages to track down available assets, however response is generally less than spectacular. Contacting using commands and Type Commanders (TYCOMs) via phone is also standard procedure in attempting to locate empty and unreported containers. [Ref. 12]

2. Alternative Packaging

Alternative packaging instructions can be provided by NAVICP-P after attempts to locate the proper reusable container have failed. The construction of wooden containers has become prevalent, particularly for some engine components and occasionally for modules, however whole engines are not shipped without the appropriate reusable container. As items are returned to RFI condition they normally pass through packaging and preservation as a final step. However, when containers are not on-hand items are sent to the local FISC for packaging. There wooden crates are built for the RFI asset. [Ref. 11]

Cost estimates range from $250 to $473 per item for construction of these containers. In the fourth quarter of 1997 components from one NADEP for one engine program alone consumed over $112,000 for temporary wooden crate construction. [Ref. 11] The fabrication of crates is not limited to items coming out of depot level rework. Naval air station Aviation Intermediate Maintenance Departments

(AIMDs) are also resorting to constructing crates. The total magnitude of expenditures on wooden crate is unclear.

G. IMPACT ON READINESS

Two aspects of container non-availability need to be examined. The first is the delay caused in moving material to and from repair and the second is damage caused by suboptimal packaging.

1. Delay of Engine/Component Movements

Research was conducted in an effort to determine the extent to which container shortages cause delays in moving items either as RFI material from repair or as NRFI to the depot. Contact with several NAVAIR, NADEP, AIMD, and NAVIP-P personnel revealed that data on such time delays are not maintained. Questions regarding movement delays elicited various responses from engine container availability not being a significant problem at the intermediate level to engines are waiting on the loading dock without containers. The Aircraft Engine Management System (AEMS) is used to track and manage all naval EPSMs. All EPSM movements and changes in status are recorded in this system yet data regarding shipment delays due to lack of containers was not readily available. [Refs. 16 & 17]

2. Damage Due to Use of Alternative Packaging

Attempts to obtain meaningful quantitative data pertaining to material damage due to alternative packaging proved less than successful. NAVICP-P is the responsible activity for fielding Reports of Discrepancies (RODs) for engine components, however personnel there report RODs are infrequent, perhaps twenty-five a year for all engine related material not just items with specialized reusable containers. Additionally, personnel at fleet activities and at NAVAIR familiar with AEMS indicated that it is not practice to classify damage in such a discrete category as damage due to container non-availability related packaging inadequacies. [Refs. 17 & 18]

In an Air Force study conducted between 1989 and 1990 at Wright-Patterson Air Force Base, 1287 F100 and T56 engine components experienced damage due to improper packaging amounting to $4,001,820. These damages occurred during on-base transportation. While the wooden crates are built to meet packaging specification and do not constitute improper packaging, they do not offer the level of protection afforded by specialized reusable containers either. The Air Force study was included in a NAVICP-P study, which came to the conclusion that improper packaging contributes a minimum of 6-8% increase in repair cost and increases in TAT of aviation DLRs in the retrograde cycle. [Ref. 19]

H. SUMMARY

6K container funding constitutes a small portion of the APN-6 procurement budget and even a smaller portion of the O&M,N repair budget. Recent data suggests an increase in funding to both categories. The customer base for empty containers is dominated by NADEP Jacksonville, and total requisitions per year range from 350 to 550. Supply measures of effectiveness such as SMA and Time to Issue indicate poor response to customer requirements. Shortages have led to time consuming efforts to track down containers as well as construction of wooden crates as substitutes. Possibly the most important aspect of container shortfalls is the impact it has on fleet aviation readiness, however data other than anecdotal has been difficult to obtain.

IV. ANALYSIS

A. INTRODUCTION

The purpose of this chapter is to analyze data presented in the previous chapter as well as introduce some alternative methods of engine container management. Analysis will include current funding issues, asset visibility concerns, readiness metrics, and alternative packaging.

B. FUNDING DIFICULTIES

Engine container funding levels belie the importance of the function they perform. Because funding amounts for procurement and repair of these items is relatively insignificant, it is treated more as a nuisance than a serious subject. Indeed several inventory, financial, and production managers expressed their frustration with getting container budget requirements addressed properly. [Refs. 10,11,12]

The inclusion of 6K container procurement within a budget line containing executive helicopter support is bound the relegate it to the position of perennial loser in any funding shortfall adjustments. The juxtaposing of these two budget items in a group only further obscures engine container requirements.

Funding decisions for both procurement and repair are made by NAVAIR while management responsibility rests with NAVICP-P. Although this separation of authority and responsibility is not insurmountable, it is not a beneficial feature of the current management arrangement either. Invariably such divisions foster a lessening of accountability and an increase in a "it's beyond my control" mentality.

Perhaps of greater significance is the existing arrangement of using an inventory control system intended to operate in a revolving fund environment to manage items supported through the appropriated fund budget process. IMs place procurement orders and repair directives for WCF items of supply based on anticipated demand. Due to the WCF's revolving nature, funding is an inherent element in the forecasting process for these items whereas APA items such as engine containers are subject to appropriated fund annual undulations regardless of forecasted requirements. This raises the question: should appropriated fund end items be managed under a WCF oriented inventory supply system?

NAVICP-P budget personnel related a timing issue as well. WCF items of supply are stratified twice annually with the resultant forecasts and outputs being acted upon almost immediately. Stratification information for 6K containers is used to formulate budget submissions for funding two years downstream. The responsive funding nature of the WCF is lost under these conditions. [Refs. 10 & 20]

C. ASSET VISIBILITY

Proper requirements determination methodology necessarily calls for knowledge of current on-hand assets. As described earlier in the background on the replenishment funding process, assets that are applied toward requirements include on-hand RFI and on-hand serviceable NRFI containers, on order, and projected returns of serviceable assets from using activities. IM's have visibility over all these areas except projected returns. For WCF DLRs there is a strong financial incentive to return carcasses to supply; that is, the incentive is avoidance of paying full or standard price for the item. This makes forecasting of anticipated returns a more stable and accurate endeavor.

Because 6K containers are issued free of charge there is no financial incentive for activities to return them to supply. This makes projecting returns less predictable and as one IM put it, "a big swag."[Ref. 12] The effect on container requirements determination is to remove it from a methodical process under UICP and place it in the realm of guesswork. An additional effect of these soft estimates is that budget requests become less credible.

The lack of asset visibility also promotes inefficient utilization of container resources. If all existing assets were known to the IM, it is likely that ferrying empty containers cross country would become less frequent and management effort expended in meeting urgent requirements less intense.[Ref. 12]

D. METRICS FOR IMPACT ON READINESS

Increased funding levels for engine container procurement and repair could most easily be obtained if compelling justification were presented. Two areas potentially impacted by insufficient container availability stand out; they are delayed movement of engines and components, and damage due to inferior packaging. As indicated in chapter III meaningful quantitative data in this area was not readily available.

Naval Inventory Control Point Instruction 4030.4H of 15 July 1996 provides packaging guidance for retrograde DLRs. This instruction calls for NAVICP to review and evaluate Reports of Discrepancy (RODs) and when appropriate advise cognizant activities of the adverse effects that improper packaging has on item turnaround times, recovery rates, and fleet readiness. So a system does exist to report and evaluate inadequate packaging occurrences. The information gathered from NAVICP indicated that approximately twenty-five RODs might be received annually for aircraft engine related items, hardy a significant impact if correct.[Ref. 18]

On the other hand NADEP personnel indicated that it is often difficult to determine the source of damage, packaging or other, for components received in wooden crates.[Ref. 21] If the Air Force portion of the NAVICP study cited in chapter III is given weight, then substantial unreported damage may be occurring. Further investigation into this area might be warranted to validate the need for increased container funding.

Likewise, data gathering efforts concerning EPSM and component movement delays proved inconclusive. AEMS tracks all EPSM movements and changes in status. Data is maintained on time awaiting maintenance, time awaiting parts, and transit times. Time awaiting a container or alternative packaging is rolled up into the time awaiting maintenance (AWM) category. There is no discrete recording of delays due to lack of containers.

Personnel queried as to the possibility of retrieving this data from AEMS were uniform in their unfamiliarity with a need for such information. Again, this may mean that there is no significant impact on readiness, hence the lack of interest, or as with other underlying logistics problems it is simply masked. Establishment of a metric for container induced movement delays is a possible area of further research. The additional administrative actions necessary to document this pipeline element may or may not be worth the potential benefit.

E. UTILITY OF ALTERNATIVE PACKAGING

The full scope of alternative packaging costs was not determined during the course of this research. Preliminary data on wooden crate construction for F-404 rotors indicates that as much as $443.00 is being spent per crate in materials and labor.[Ref. 22] Expenditures for alternative packaging of RFI F-404 rotors coming out of NADEP Jacksonville were in excess of $81,000 and $79,000 in the third and fourth quarters of FY98 respectively.[Refs. 21 & 22] With these figures in mind expenditures across all Navy activities may be significant. Two west coast AIMDs servicing F-404 engines confirmed that rotor crate building occurs at their activities as well.

The utility of crate building is questionable. Their use is restricted to shipments within CONUS and their life expectancy is quite limited. One NADEP packaging representative estimates a rotor crate is probably good for one round trip, RFI leaving the depot and NRFI returning to the depot.[Ref. 21] In areas where the availability of covered storage is limited crated items are exposed to weather causing accelerated deterioration of the crate and potential damage to the contents.[Ref. 18]

For the price of fabricating eight crates a new rotor container costing about $3320 could be procured. With an expected service life of five years before requiring rework and the ability to offer greater component protection, reusable containers may represent the best value for the Navy. Funds currently being spent on crates are a cost to the WCF and as such are being passed on to all customers.

F. ALTERNATIVE CONTAINER MANAGEMENT PRACTICES

The Army, Navy, and Air Force all manage reusable engine containers somewhat differently. Comparing the different approaches suggests possible improvements the Navy might consider.

Under the Navy system a DLR is assigned two prices, standard if no carcass turn-in is made, and net if the failed unit is turned into the supply system. The standard price tends to be considerably more than the net price. When a Navy customer orders a DLR, the net price is billed unless the customer declares no turn-in will be made, in which case the standard price is charged at the outset. Customers that are charged the net price have a set amount of time in which a turn-in must be made. Notifications are sent and replied to and ultimately if no carcass is received the difference between net and standard price is charged to the customer resulting in a full price billing.

1. U.S. Army M1A1 Abrams Tank Engine Container

Perhaps the simplest, most straightforward approach to overcoming the tendency of using units to delay or avoid turn-in of empty engine containers is exemplified by the Army method. Customers are initially charged the standard price when placing a requisition. Subsequently, if and when the ordering activity turns in a carcass a credit is granted, effectively reducing the overall charge to that of a net price.[Ref. 23] The clear difference between the Army and Navy systems is that the Army places an immediate financial burden upon the customer and the Navy places a delayed financial burden on the requisitioning activity.

With these differences in DLR billing procedures as background, a more significant matter can be addressed. Unlike the Navy which issues engine containers free of charge to customers, the Army treats engine containers like other DLRs in their WCF and charges the requisitioning activity for issues. Additionally, the Army uses a system whereby a National Stock Number (NSN) is assigned to the engine, one to the container, and a third to the combination of engine and container. A requesting unit would order an engine with container at full price. If the unit turned in only an engine carcass without a container, a credit for the engine alone would be granted. The turn-in would then be accounted for under the engine without container NSN. By charging customers for containers and charging them full price up front a strong financial incentive is established that encourages good stewardship of containers and their timely return to supply. The incentive is such that expensive tracking of individual containers is unwarranted.[Ref. 23]

2. U.S. Air Force Container Management

The Air Force faces some of the same challenges as the Navy with regard to container management. Like the Navy, the Air Force treats engine containers as free issue items. And like the Navy the Air Force is faced with a less than optimal supply support posture for containers. Contributing issues include: container management governing policy, asset visibility, and requirements forecasting.

Air Force Manual (AFM) 67-1 which governs management and reuse of Air Force containers calls for the organization managing the item stored in a particular container to shoulder responsibility for funding procurement and repair, repair being authorized up to 75% of the item stock list price. AFM 67-1 authorizes the retention of empty containers by bases for future return of failed items to the repair activity. The engine containers are not serialized and are not tracked through any Air Force data system. The pooling of assets at any specific location is therefore undocumented and unreported.

Requirements forecasting methodology for Air Force containers is nonexistent. A reactive management method is employed. Requirements are passed from field organizations to the container manager as the need arises, whether for retrograde going to repair or RFI leaving the DOP. The Navy differs in that demand is recorded in UICP and along with planned requirements, forecasts are made. Several aspects of the Air Force system hinder the introduction of a proactive forecasting methodology. The first among these is the AFM 67-1 policy mentioned previously, that allows bases to retain spare containers without any accountability reporting. Second, since containers are neither serialized nor tracked the container manager is unable to determine on-hand quantities at each location. Lastly, alterations in container configuration resulting from internal adapter, fixture, and rail changes distort the identity and utility of the container.[Ref. 24] For the Navy this last issue has not been raised in the course of this research. However, the issues of customer asset retention and uncertainty of asset posture have surfaced as concerns during interviews.

Solutions offered by a commercial firm studying the topic for the Air Force will be described next. Forecasting of engine container requirements could be performed through actuarial forecasting of scheduled and unscheduled engine and module removals by activity. This would be akin to dependent demand inventory modeling and would provide a baseline of container requirements by activity over a given time period.

The study foresees the need to have on-hand asset information available to container managers as a necessary component of requirements determination. One possible means of accomplishment would be to contact holding activities at the beginning of the forecast period for on-hand figures. Another, and more ambitious method would be to serialize all engine containers and track their location and movement with a database. Serialization could be performed using an attrition method in which serial numbers are applied only as containers pass through the depot. This might take several years to complete. Alternatively, tiger teams might be formed at specific activities to shorten task duration.

The study suggests two tracking methods for the serialized containers. The first involves adding containers to the Air Force's Comprehensive Engine Management System (CEMS) and the second developing and using an E-mail based system. The study considers the E-mail based system the simpler approach, pointing out that modification to CEMS would be a lengthy process and might be overkill for this particular function.[Ref. 24]

CEMS is comparable to the Navy's AEMS. Since AEMS is used to track all movements of EPSMs it is not illogical to consider incorporation of container tracking into the system. One shortcoming not noted in the Air Force study regarding the use of an E-mail based system is that of compliance. A separate administrative requirement to track and record container transactions in all likelihood would meet with something less than full compliance. AEMS transaction recording on the other hand is mandatory and well established; piggy-backing container transactions onto the process of recording EPSM movements may well achieve greater compliance.[Ref. 24]

G. SUMMARY

Chapter IV began by presenting funding difficulties faced under the current container management structure. The analysis then moved to effects of poor asset visibility and metrics for impact on readiness that might support increased funding levels. The utility of wooden crate fabrication as alternative packaging was reviewed and finally a discussion on other service container management practices was presented.

V. CONCLUSIONS AND RECOMMENDATIONS

A. INTRODUCTION

The focus of this thesis has been to examine funding and inventory management policies and procedures pertaining to naval aircraft engine, engine module, and engine component reusable containers. In that vane research efforts were directed at determining the current state of affairs and areas which may hinder effective logistics support. This chapter presents the researcher's conclusions and recommendations regarding the research effort. Included are answers to the primary and subsidiary research questions.

B. CONCLUSIONS

A report by the General Accounting Office (GAO) studying DoD reusable containers conducted in 1978 concluded; managers do not have an accounting and reporting system that indicates what containers are available or where they are located, costly building of substitute containers is occurring, valuable containers are lost or underutilized because they are not treated as accountable assets, requirements determination is confused by poor visibility, and components sustained damage that they otherwise would not if they were packaged in their designated container.[Ref. 25] It appears as though not much has changed in the intervening twenty years.

Container management and funding is an ancillary priority, but one with potentially significant, although not yet quantified, consequences for aviation logistics. Divisions in funding authority and inventory management responsibility underlie the difficulty in adequately meeting customer requirements.

C. RECOMMENDATIONS

1. Conversion to WCF

Serious consideration should be given to conversion of reusable engine containers from 6K APA items to 7R WCF items. The flexibility and funding responsiveness inherent in WCF operations would benefit container support. Incentives would be established that lead to timely return of unused containers which in turn raises the level of asset visibility and control, and therefore utilization.

2. Tracking and Accountability

Development and implementation of a container tracking system should be studied. A means of accounting for these investment items is needed as opposed the current reality of treating them like consumable items. Perhaps modification of AEMS to include entry of container movement transactions along with the contents would serve this function. This may be the best solution if containers remain as NAVICP-P controlled, APA funded items.

3. Readiness Impact

NAVICP-P as the CFA should conduct in-depth analysis of both damage to material and delay of item movements resulting from non-availability of designated containers. From this further research it will become more apparent what level of management attention and investment in containers is warranted.

4. Funding Level

NAVICP-P should obtain adquate repair and procurement funding levels to eliminate construction of substitute containers. There is no indication that this is a good value for the Navy. Alternatively, investigate the possibility of directing WCF preservation and packaging resources currently being used to build wooden crates toward reusable container repair or replacement.

D. ANSWERS TO RESEARCH QUESTIONS

1. Primary Research Question

The primary research question for this thesis is: How might the Navy alter current inventory management and funding polices for aircraft engine containers to most efficiently support aviation logistics?

Based on the information collected and the analysis presented in Chapter IV there are a variety of changes which can be contemplated to effect improvements in container support. Simply matching procurement and repair funding to requirements would be the most straightforward, least cumbersome solution to rectify container shortages. This would not, however, ensure an efficient use of container assets. Visibility and accountability issues remain. A tracking system to monitor asset location would provide the benefits of improving IMs' ability to efficiently distribute resources and it would greatly aid in more accurate determination of requirements. The AEMS program is one potential vehicle for a tracking program. Visibility may also be improved through economic incentives. Conversion of containers from APA items to WCF material would induce customers to promptly return unused containers and thereby cause a higher percentage of assets to be visible to the IM at any given time.

2. Subsidiary Research Questions

- **What is the source(s) of funding for engine container procurement?**

Procurement funding is provided by NAVAIR to NAVICP-P where it is held for IMs' use in placing procurement orders.

- **What is the source(s) of funding for engine container repair?**

Repair funding also originates at NAVAIR and is sent quarterly to the three NADEPs. Funding is derived from the O&M,N appropriation annually.

- **How is funding for engine container repair allocated?**

NADEP Jacksonville receives the majority of funds, approximately sixty-five percent. NADEP Cherry Point receives thirty percent and NADEP North Island is sent the remaining five percent.

- **What activity(s) is responsible for engine container inventory management?**

NAVAIR has designated NAVICP-P as the cognizant field activity (CFA) for aircraft engine container inventory management.

- **What procedural methods are used to obtain engine containers when needed for customer use?**

Fleet activities as well as the depots will first seek any available ready-for-use (RFU) container within their command or from a neighboring command. The most common scenario being the use of a container recently emptied of its cargo. For requirements not satisfied locally, the normal supply requisitioning system is used to transmit requests to the ICP which in turn directs an issue to be made or backorders the container.

- **How are engine container assets accounted for?**

Containers while in the custody of NAVICP-P through a FISC or NADEP are accounted for in the UICP system. Other than those located at a FISC or in the rework process at a depot, containers are unaccounted for. At any given time the majority of assets falls into this category.

- **What criteria are employed to make repair versus disposal decisions?**

Containers undergo an examination and evaluation process by NADEP production personnel while located at the

FISC to determine suitability for rework. An 80% of replacement cost rule is used as an upper limit on containers that will be inducted for rework.

- **What is the magnitude of engine container non-availability?**

The SMA rate for all 6K engine containers has ranged from 26% to 37% over the most recent three fiscal years. Average customer wait time measured from requisition receipt at ICP to material release has increased over the past three years from 78 days to 199 days.

- **What impact does engine container non-availability have on RFI engine availability and ultimately on aircraft readiness?**

The significance of container shortages in the logistics pipeline was not determinable in the course of this research. Delays in moving engines and components due to non-availability of containers are not recorded as discrete events within the aviation maintenance system. Anecdotal evidence suggests that movements are delayed for lack of readily available containers. Resources are diverted to fabricate wooden crates as substitutes as well.

- **What impact does engine container non-availability have on the risk of damage to unprotected engines?**

No clear evidence was obtained that would conclusively show non-availability of containers is having a significant impact on engine, module, or component shipping and storage related damages. However, this may be more reflective of reporting tendencies rather than actual occurrence.

- **What incentives can be employed to increase asset visibility?**

As described previously, a tracking system for containers or financial incentives, such as carcass charges, would encourage a higher level of asset turn-in and lead to greater visibility.

- **What means of matching requirements to funding are likely to yield greatest benefit?**

A main area of difficulty in the requirements determination process stems from poor asset visibility. Improvements in this area would contribute to the requirements determination accuracy needed for the budget process. Capitalization of assets into the WCF would provide a more responsive funding source than currently exists under appropriated funding.

E. SUMMARY

Through personal interviews and a review of relevant literature, the research provided beneficial insight into the existing management practices and difficulties currently experienced by avaition logisticians regarding aircraft engine containers. Quantitative data collected indicates that customer support is weak as measured by SMA and customer wait time. Container item managers related an inability to obtain adequate procurement or repair funds through the appropriated budget process. Also raised as issues of concern were asset visibility and accountability. An effort was made to determine the extent to which container non-availability impacts aircraft readiness and engine item shipping damage. No strong conclusions were drawn in either of these areas. Finally, Army and Air Force container management policies were briefly reviewed that brought to light some possible alternative practices.

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