NAVAL POSTGRADUATE SCHOOL
MONTEREY, CALIFORNIA

THESIS

CALIBRATION LABORATORIES AS A REGIONAL REPAIR CENTER: CONSOLIDATE OR COLLOCATE?

by

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December, 1996

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19970626 056

REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instruction, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington DC 20503.

1. AGENCY USE ONLY *(Leave blank)*	2. REPORT DATE December 1996	3. REPORT TYPE AND DATES COVERED Master's Thesis

4. TITLE AND SUBTITLE CALIBRATION LABORATORIES AS A REGIONAL REPAIR CENTER: CONSOLIDATE OR COLLOCATE?	5. FUNDING NUMBERS
6. AUTHOR(S) Marquita A. Mitchell and John E. Pasch	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School Monterey CA 93943-5000	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government.

12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.	12b. DISTRIBUTION CODE

13. ABSTRACT *(maximum 200 words)*

The purpose of this thesis is to examine the integration of AIMDs Miramar and North Island, and NADEP North Island calibration laboratories.. The expected benefits and weaknesses or problems resulting from integration are examined. The benefits analyzed include those in the areas of manpower, training, standards reduction, inventory reduction, streamlining facilities, and increased productivity. The problems analyzed include increased transportation costs, facilities modification costs, reduced military resiliency, potential negative impact on customer service, and issues related to sea/shore rotation, AIS, and the internal chain of command. The thesis also discusses Navy organizational structure and financial management policy, and the aspects of each that make it difficult to implement change. The thesis concludes that consolidation is feasible and there are scale economies to be achieved from consolidating the Intermediate and Depot level calibration laboratories at NAS North Island. However, the finanacial management and command and control issues must be solved before the benefits of Regional Maintenance can be realized.

14. SUBJECT TERMS Regional Maintenance, Consolidation, Aviation Maintenance, Regional Repair Center, Collocation	15. NUMBER OF PAGES 164
	16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. 239-18 298-102

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Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT
from the
NAVAL POSTGRADUATE SCHOOL
December 1996

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TABLE OF CONTENTS

I. INTRODUCTION 1
- A. HISTORY 1
- B. BACKGROUND 2
- C. OBJECTIVE 3
- D. RESEARCH QUESTIONS 4
- E. SCOPE 4
- F. METHODOLOGY 5
- G. ORGANIZATION 5

II. THE NAVAL AVIATION MAINTENANCE PROGRAM 7
- A. NAVAL AVIATION MAINTENANCE PHILOSOPHY 7
- B. THE THREE LEVEL MAINTENANCE CONCEPT 7
  - 1. System Maintenance Concept 7
  - 2. Organizational Level Maintenance 9
  - 3. Intermediate Level Maintenance 9
  - 4. Depot Level Maintenance 10

III. OVERVIEW OF THE AIRCRAFT INTERMEDIATE MAINTENANCE DEPARTMENT 13
- A. RESPONSIBILITIES 13
- B. ORGANIZATION 13
  - 1. Production Control 13
  - 2. Material Control 14
  - 3. Quality Assurance 14
  - 4. Avionics 15
  - 5. Power Plants 15
  - 6. Airframes 16
  - 7. Armament 16
  - 8. Aviation Life Support Systems 16
  - 9. Support Equipment 16
- C. PRECISION MEASURING EQUIPMENT (PME)/CALIBRATION LABORATORY 17
- D. TRAINING 18

IV. OVERVIEW OF DEPOT LEVEL MAINTENANCE 21
- A. SCOPE AND MANAGEMENT OF NADEP MAINTENANCE 21
- B. DON D-LEVEL INDUSTRIAL FACILITIES 23
- C. PRODUCTION PLANNING AND WORKLOAD 24
  - 1. Depot Level Industrial Workload Definition 24
- D. METROLOGY AND CALIBRATION PROGRAM 26
  - 1. Definition 26
  - 2. Calibration Workload Scheduling 27
- E. SUMMARY 28

V. THE REGIONAL MAINTENANCE CONCEPT 29
- A. BACKGROUND 29
- B. HISTORY 30
  - 1. Maintenance Support QMB 32

2. Development of the Regional Maintenance Concept 34
3. Implementation of Regional Maintenance 35
C. SOUTHWEST REGION DEFINED 36
1. Atlantic and Pacific Fleet Regions 36
2. The Southwest Region 37
3. The Regional Coordinator 38
D. REGIONAL MAINTENANCE CHALLENGES 41
1. Financial Management Policy 42
2. Organic Versus Commercial Capability 42
3. Cultural Issues 43
4. Manpower Capacity 43
E. REGIONAL REPAIR CENTERS 44
1. Regional Repair Center Candidates 44
2. Calibration Laboratories 45
F. SUMMARY 46
VI. EXPECTED BENEFITS OF CONSOLIDATED CALIBRATION ABORATORIES AS REGIONAL REPAIR CENTERS 49
A. CONSOLIDATION OF AIMD MIRAMAR AND NORTH ISLAND CALIBRATION LABORATORIES 50
1. Benefits 50
2. Weaknesses or Problems 58
B. COLLOCATION OF CONSOLIDATED I-LEVEL CALIBRATION LABORATORIES WITH NADEP NORTH ISLAND 62
1. Benefits 62
2. Weaknesses or Problems 63
C. CONSOLIDATION OF THE I-LEVEL CALIBRATION LABORATORY WITH THE NADEP NORTH ISLAND D-LEVEL CALIBRATION LABORATORY 65
1. Benefits 65
2. Weaknesses or Problems 66
D. SUMMARY 68
VII. IMPEDIMENTS TO PROGRESS 71
A. NAVY ORGANIZATIONAL ISSUES 72
1. Current Maintenance Strategies 73
2. Command and Control of Navy Maintenance 76
3. Structure and Restructuring 79
B. FINANCIAL MANAGEMENT ISSUES 89
1. Planning, Programming, and Budgeting 91
2. Appropriations 95
3. Unit Cost Concept 98
4. The Defense Business Operations Fund 103
C. SUMMARY 115
VIII. FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS 117
A. FINDINGS 117
1. Manpower Reductions 117
2. Training Enhanced 118

3. Calibration Standards Reduced 118
4. Facilities Not Streamlined 118
5. Unchanged Responsiveness 119
6. Automated Information System Inadequacies 119
7. Two Chains of Command 119
8. Two Funding Sources and Accounting Systems 119
B. CONCLUSIONS 120
1. The Environment of Regional Maintenance Implementation 120
2. Where Are The Savings? 120
3. Military Shore Billets Are Critical To The Navy Mission 121
4. Military Resiliency Is Decreased 121
5. Distinction Between I and D-levels Blurred 121
6. No Cost Visibility 122
7. Philosophical Differences and Parochialism Are Barriers 123
C. RECOMMENDATIONS 123
APPENDIX A. NADEP FUNCTIONAL ORGANIZATION AND RESPONSIBILITIES 127
APPENDIX B. NAVY MAINTENANCE AUTOMATED INFORMATION SYSTEMS 137
APPENDIX C. NADEP AND AIMD NORTH ISLAND CHAINS OF COMMAND 139
APPENDIX D. LIST OF ACRONYMS 141
LIST OF REFERENCES 147
BIBLIOGRAPHY 151
INITIAL DISTRIBUTION LIST 153

I. INTRODUCTION

A. HISTORY

In his 1992 State of the Union Address, President George Bush announced that his FY-93 budget submission would cut fifty billion dollars from the Department of Defense. In an effort to continue with decreasing spending, President Bill Clinton announced, during the National Performance Review (NPR), a six month review of the federal government and asked Vice President Gore to lead the effort. President Clinton stated, "Our goal is to make the entire federal government both less expensive and more efficient, and to change the culture of our national bureaucracy away from complacency and entitlements toward initiative and empowerment. We intend to redesign, to reinvent, and to reinvigorate the entire national government." Doing more with less is the primary goal.

In response to the NPR, the Navy commenced a major initiative to save money and become more efficient by streamlining its industrial infrastructure. One area which the Navy felt it could conserve funds is in the consolidation of duplicate maintenance capabilities. Consolidation is the process of combining these duplicate capabilities and placing them under the control of a single maintenance facility. If properly done, consolidation can result in cost savings by reducing manpower, equipment, and spares inventories, yet not have an adverse impact on fleet support.

B. BACKGROUND

Historically, Naval maintenance policy was formulated within platform lines and warfare areas. As each new weapons system was fielded, either new maintenance support would be introduced or the existing maintenance support infrastructure within the warfare area would be modified to meet the needs of the new systems. Existing maintenance capability and capacity in other warfare areas and whether they could act in support of common maintenance functions have not always been considered. Recognition of this area for potential improvement in the way the Navy does business led to a new vision for the future of Navy maintenance. This vision of the future includes optimization of maintenance processes. This vision is built upon the Battle Force Intermediate Maintenance Activity (BFIMA) concept, which has been used afloat. The BFIMA concept takes advantage of the significant maintenance capability and capacity resident within the aircraft carrier Engineering and Aviation Intermediate Maintenance Departments, to provide enhanced support to accompanying ships and their embarked aircraft. The Maintenance Support Quality Management Board (MS QMB) sought to duplicate this successful example of common maintenance process execution afloat with a mirrored process ashore to optimize maintenance support at lower cost and enhanced self-sufficiency at the same time. It was the success of this initiative that gave birth to the Regional Maintenance Concept ashore. This concept has led to the consolidation of repair

facilities into Regional Repair Centers (RRC) in order to minimize redundant maintenance capabilities and excess capacity.

At the inception of the Regional Maintenance effort there were over thirty calibration laboratories in the Southwest Region. Reductions in ships and aircraft requiring support resulted in all calibration laboratories having excess capacity. An analysis of the southwest region to determine the optimum calibration laboratory posture revealed potential savings in personnel reductions and acquisition and maintenance of calibration standards. The Calibration RRC Evaluation Process Action Team recommended consolidation from thirty-three to six calibration laboratories.

C. OBJECTIVE

Efforts to consolidate aviation intermediate and depot level calibration labs at North Island have been unsuccessful. Although they have been co-located they are not working as a unit thus not combined into an Regional Repair Center. One of the main barriers to their integration is the differences in accounting systems and funding sources; depot is a Defense Business Operation Fund (DBOF) activity and is funded by Naval Aviation Systems Command (NAVAIR) while Aircraft Intermediate Maintenance Department (AIMD) North Island is not a DBOF activity and receives funding from AIRPAC. Additionally, neither activity is willing to give-up any of their "turf".

The purpose of this thesis is to examine the integration of the AIMD Miramar and North Island, and Naval Aviation Depot (NADEP) North Island

calibration laboratories. In doing so the authors will identify any benefits, drawbacks, barriers and other issues involved with consolidation of the calibration laboratories.

D. RESEARCH QUESTIONS

Primary Research Question: Under the Regional Maintenance Concept, what are benefits and drawbacks currently realized by collocating versus consolidating the calibration laboratories in the Southwest United States Region?

Subsidiary Questions:

- Is consolidation beneficial or detrimental to mission readiness; responsiveness, quality and costs?
- What are the issues involved with the accounting system incompatibility and platform oriented programming and budget process.
- How do manpower requirements affect consolidation and collocation and of calibration laboratories?
- What affects does consolidation of Intermediate and Depot calibration laboratories have on other activities and facilities in the region?

E. SCOPE

This thesis will focus on the integration of Intermediate and Depot level calibration laboratories from Miramar and North Island, California. First, an overview of aviation maintenance, the regional maintenance concept and regional repair centers will be provided. Next, the affects of consolidation will be explored with an emphasis on risks, benefits, mission readiness, responsiveness, quality, and costs. Third, issues concerning full consolidation

the I- and D-level calibration laboratories and implementation of Regional Maintenance will be discussed.

F. METHODOLOGY

This thesis will rely on relevant published sources and personal interviews for historical and organizational data. Logistics, accounting data, and ramifications of consolidation will be assessed by analyzing quality analysis reports, interviews with key personnel to include: production control, quality analysis, regional maintenance working group (RM WG), calibration technicians, type commander comptrollers, and decision making personnel at NAVAIR and the Pentagon. Further analysis of the affects of consolidation in regards to responsiveness, mission readiness, quality and costs will be accomplished using a combination of linear programming, spreadsheets, and simulation models.

G. ORGANIZATION

The thesis is organized as follows:

- Chapter I is the Introduction.
- Chapter II provides a brief overview of the Naval Aviation Maintenance Program.
- Chapter III describes in detail the Aircraft Intermediate Level Maintenance.
- Chapter IV describes in detail Depot Level Maintenance.
- Chapter V gives the history and background of the Regional Maintenance Concept (RMS), and describes the Southwest Region as it applies to RMC.

- Chapter VI provides benefits and drawbacks of consolidating and collocating.

- Chapter VII discusses the issues that are making it difficult to establish the North Island calibration laboratories as a Regional Repair Center and the barriers to implementation of Regional Maintenance throughout the Navy.

- Chapter VIII discusses findings, conclusions and recommendations for further research.

II. THE NAVAL AVIATION MAINTENANCE PROGRAM

A. NAVAL AVIATION MAINTENANCE PHILOSOPHY

The Naval Aviation Maintenance Program (NAMP) is promulgated by the Chief of Naval Operations via the six volume series OPNAV Instruction 4790.2F. Set forth in this instruction is the CNO's policies, objectives, guidance and doctrine. The objective of the NAMP is to *"...achieve and continually upgrade the readiness and safety standards,...,with optimum use of manpower, facilities, material and funds."* The objective encompasses the maintenance, manufacture, and calibration of aeronautical equipment and material at the level of maintenance which will ensure optimal economic use of resources. [Ref. 1] The intent of the NAMP is to establish a program of "performance improvement" through teamwork, communication, and efficient use of resources focused to meet the needs of the customer.

B. THE THREE LEVEL MAINTENANCE CONCEPT

1. System Maintenance Concept

The maintenance concept describes the overall system support environment and sets the baseline for determining specific logistic support requirements. The main purposes of the maintenance concept is to provide (1) the basis for the establishment of supportability requirements in system design; (2) the total logistics support requirements; and (3) a basis for the maintenance plan [Ref. 2]. The Navy's aviation maintenance concept is defined in the Naval Aviation Maintenance Program Instruction, OPNAV Instruction 4790.2F.

The NAMP is established upon the three-level maintenance concept. The three levels of aeronautical repair are organizational (O-), intermediate (I-) and depot (D-) level and can be thought of as a pyramidal hierarchy. This concept of three level maintenance seeks to reduce total costs, increase operational readiness and availability, increase supply responsiveness, and improve mobilization, deployability, preparedness and sustainability. The division of maintenance into three levels allows management to: [Ref. 1]

- Classify maintenance functions by levels
- Assign responsibility for maintenance functions to a specific level
- Assign maintenance tasks consistent with the complexity, depth, scope, and range of work to be performed
- Accomplish any particular maintenance task or support service at a level which ensures optimum economic use of resources
- Collect, analyze, and use data to assist all levels of NAMP management.

Organizational level maintenance is at the base of the pyramidal hierarchy encompassing on-aircraft type work (generalized maintenance). Depot level maintenance is at the top of the pyramid with fewer sites performing specialized tasks. The top two levels of maintenance exists solely to support their customers, the organizations at the bottom of the pyramid. The three levels of maintenance are discussed in the following sections.

2. Organizational Level Maintenance

O-level aircraft maintenance is performed at the operational site and directly supports squadron operations. Their mission is to maintain assigned aircraft and aeronautical equipment in a full mission capable status while continually improving the local maintenance process. [Ref. 1] The organizational repair level is often thought of as the lowest and simplest level of aeronautical maintenance. The NAMP list the following as O-level maintenance functions:

- Inspections
- Servicing
- Handling
- Incorporation of technical directives (TDs)
- On-equipment corrective and preventive maintenance. (Including repair, removal, and replacement of defective components.)
- Age exploration (AE) of aircraft and equipment under reliability centered maintenance (RCM)
- Record keeping and reports preparation

3. Intermediate Level Maintenance

I-level maintenance is at the middle of the pyramidal hierarchy. It provides both direct and indirect (on and off equipment material) support for user activities at the O-level. The goal of I-level maintenance facilities is to provide high quality, timely support to enhance and sustain the mission

capability and readiness of supported units with the lowest practical expenditure of scarce resources. Maintenance personnel at the I-level usually have higher skills and are responsible for performing more detailed maintenance utilizing a more extensive range of specialized equipment than personnel at the O-level. I-level functions listed in the NAMP include:

- Performance of maintenance on aeronautical components and related support equipment
- Performance of calibration (Type IV), by field calibration activities which perform I-level calibration of designated equipment
- Incorporation of technical directives
- Processing aircraft components from stricken aircraft
- Manufacture of selected aeronautical components, liquids, and gases
- Performance of on-aircraft maintenance when required
- AE of aircraft and equipment under RCM
- Providing technical assistance to supported units

Aircraft Intermediate Maintenance Departments (AIMDs) ashore and afloat provide I-level maintenance support. AIMD calibration laboratories are part of the primary focus of this thesis and are discussed in greater detail in Chapter III.

4. Depot Level Maintenance

D-level maintenance is the highest level on the pyramidal hierarchy and supports the accomplishment of tasks above and beyond the capabilities available at the O- and I-levels. D-level's primary goal is to ensure the continued

flying integrity and safety of airframes and related flight systems throughout their service life. D-level maintenance supports O- and I-level activities by performing major rework /overhaul of parts, assemblies, subassemblies and end items, as well as manufacturing parts, making modifications, testing, inspecting, sampling, and reclamation. Although D-level maintenance is generally performed by Naval Aviation Depots (NADEPs) or on-site by NADEP field teams, an increasing amount of work is contracted out to other Department of Defense (DoD) services and private industry. D-level activities have far more higher skills and extensive facilities than activities at lower levels, and are not necessarily located near the activities they support. D-level maintenance functions listed may be grouped as follows: [Ref. 1]

- Technical and engineering assistance by field teams
- Standard D-level maintenance of aircraft
- Rework and repair of engines, components, and SE
- Calibration by Navy calibration laboratories (Type III) as well as standards laboratories (Types I and II)
- Incorporation of technical directives
- Modification of aircraft, engines, and SE
- Manufacture or modification of parts or kits
- AE of aircraft and equipment under RCM

NADEP calibration laboratories is the other area of primary focus in this thesis, and is discussed in greater detail in Chapter IV.

III. OVERVIEW OF THE AIRCRAFT INTERMEDIATE MAINTENANCE DEPARTMENT (AIMD)

A. RESPONSIBILITIES

The AIMD is responsible for performing I-level maintenance functions on the aircraft and the aeronautical equipment located at the host Naval Air Station. These functions consists of indirect support provided by repair of not-ready-for-issue (NRFI) items and direct support functions such as repair and return of components sent to an AIMD by a squadron. The I-level maintenance mission is to enhance and sustain the combat readiness and mission capability of supported activities by providing quality and timely material support at the nearest location with the lowest practical resource expenditure. [Ref. 1]

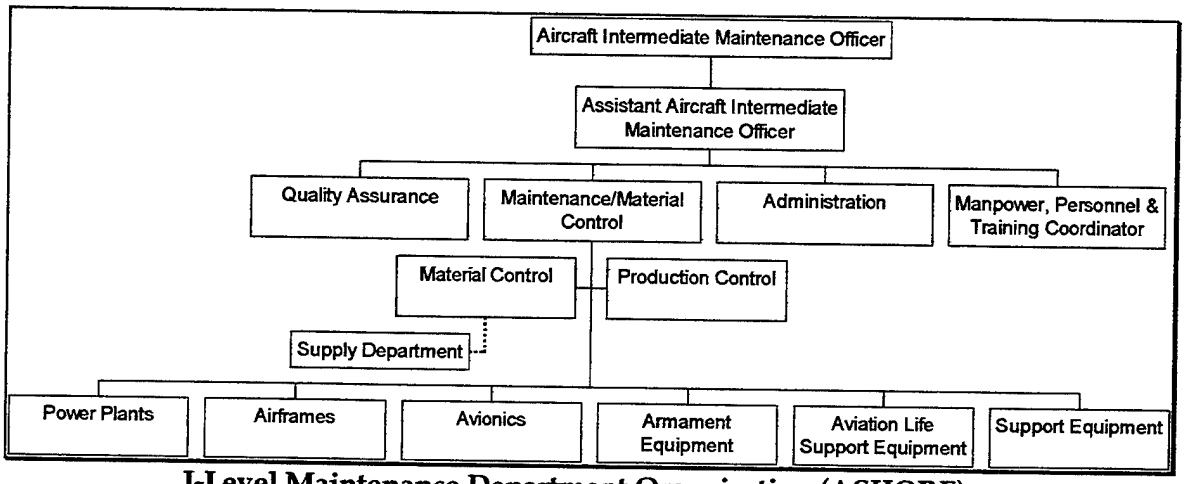
B. ORGANIZATION

The NAMP requires the same structure and organization for all AIMDs regardless of their location or the type(s) of aircraft they support. The goal for this standardization is effective management within a common framework of authority, functions and relationships. This allows achievement of improvements in performance, economy of operation, and quality of work. [Ref. 1] Figure 3.1 represents the standard AIMD organization as set forth in the NAMP.

1. Production Control

Production Control is a staff function that has as its purpose the effective and efficient management of AIMD resources. Production Control acts as the

main interface between the supported activities and the work centers. This is accomplished by Production Control scheduling the workload according to priorities. They also act as the interface between the AIMD and the Air Station's Supply Department.



I-Level Maintenance Department Organization (ASHORE)
Figure 3.1

2. Material Control

Material Control centers are contact points within AIMD organizations where requirements for material are coordinated with the Aviation Supply Department [Ref. 1]. This is achieved by forwarding requisitions for parts and material to supply in a timely manner. After receipt of these items from supply, Material Control expeditiously routes them to the applicable work centers.

3. Quality Assurance (QA)

Quality Assurance is a relatively small group of highly skilled personnel. Their primary goal is the prevention of the occurrence of defects. In addition,

QA provides a systematic and efficient method for gathering, analyzing, and maintaining information on the quality characteristics of products, the source and nature of defects, and their immediate impact on the current operation. The objective is to readily pinpoint problem areas [Ref. 1]. QA also maintains the Central Technical Publications Library (CTPL) for the department, which serves as the source for current technical information used for repairs and training. QA's Data Analyst is responsible for providing quantitative and qualitative analytical information to maintenance managers. The Data Analyst also collects and screens for accuracy of all Maintenance Data System (MDS) source documents.

4. Avionics

Avionics is comprised of numerous work centers and is typically the largest division in AIMD. Avionics is responsible for repairing aircraft communications, navigation, computer, electrical, radar, sonar, weapons control systems, and other aircraft electronic systems. Additionally, Avionics operates the Precision Measuring Equipment (PME) Calibration Branch, which calibrates and repairs test and measuring equipment, the area this thesis focuses on. [Ref. 1]

5. Power Plants

Power Plants is tasked with repairing and inspecting aircraft engines, auxiliary power units (APU), and engine accessories and components. Power

Plants is also responsible for maintaining and operating engine test facilities. [Ref. 1]

6. Airframes

Airframes consists of several interrelated work centers, each providing a different type of aircraft structural repair or maintenance. Airframes commonly have the following branches: Structures; Hydraulic/Pneumatic; Brakes; Tire/Wheel; Non-Destructive Inspection; Paint; and Machine Shop. [Ref. 1]

7. Armament

Armament maintains and repairs airborne weapon systems, such as guns, rocket launchers and bomb racks. Maintenance includes an active corrosion treatment and prevention program, performing periodic inspections, and preserving and storing weapons.

8. Aviation Life Support Systems (ALSS)

ALSS maintains aircrew personal survival and life support equipment, and aircraft egress systems. ALSS maintenance includes equipment repair, treatment and prevention of corrosion and periodic inspections. [Ref. 1]

9. Support Equipment (SE)

Support Equipment is responsible for maintenance and inventory control of non-avionics support equipment primarily used by organizational activities. SE can be divided into two broad categories: 1) Common Support Equipment (CSE), which is general purpose support equipment such as towing or mobile power equipment used on a variety of different aircraft types; and 2) Peculiar

Support Equipment (PSE) specifically designed and developed for a particular weapons system. SE is also responsible for training and licensing personnel in the care and use of support equipment. [Ref. 1]

C. PRECISION MEASURING EQUIPMENT (PME) / CALIBRATION LABORATORY

The PME work center is responsible for managing and performing calibration and repair on selected test and monitoring systems (TAMS) [Ref. 1]. Calibration of all TAMS used for quantitative measurements is mandatory and shall be performed according to the intervals and procedures listed in the current issue of reference NAVSEA OD 45845, Metrology Requirements List or as otherwise specified. TAMS not used for quantitative measurements shall be specifically labeled "Calibration Not required." Calibration and TAMS repair support, beyond the intermediate level responsibility, should be obtained at the nearest calibration laboratory consistent with good management and fiscal practices [Ref. 3]. Approximately 100 I-level activities have been authorized to perform I-level calibration of SE/TAMS. IMAs are designated as a Type IV Field Calibration Activity (FCA). The Navy primary standards laboratory (Type I) and approximately 30 Type III Navy's calibration laboratories are considered to be D-level facilities. IMA Calibration Laboratory responsibilities include: [Ref. 1].

- Maintain an inventory of I-level calibration standards as prescribed by the MEASURE User's Manual. Special attention shall be given to new or recently received items which may not have been previously reported. Items shall be removed from an activity's inventory

whenever custodial responsibilities change and with TYCOM approval.

- Perform SE/TAMS calibration at established intervals and affix applicable labels and tags.
- Calibrate SE/TAMS using I-level calibration standards.
- Document all calibration and repair actions performed.
- Forward SE/TAMS scheduled for induction into Type III laboratories and above to the designated laboratory by the calibration coordinator.
- Ensure personnel performing calibrations are qualified and trained.
- Ensure I-level calibration standards are submitted for calibration per intervals established by NA 17-35MTL-1.

D. TRAINING

Maintenance training is a vital element in naval aviation. The quality and availability of technical training determines the functional capabilities of operating forces and support activities. The Maintenance Training Program is designed to ensure basic, intermediate, advanced, and in-depth levels of training are provided to all maintenance personnel to support existing, planned, and future weapon system acquisitions. Training is provided to all Department of the Navy (DON) personnel to operate, maintain, and support aircraft weapon systems and related equipment [Ref. 1].

Maintenance training is a continuum throughout an individual's career which begins with entry into service and continues through various training courses, including Practical Job Training (PJT) where feasible, with eventual

assignment to a particular job. The technical knowledge and skills required to perform in the assigned job determine course requirements. [Ref. 1]

Training is accomplished in a sequential process with basic courses providing requisites for following courses. Most aviation personnel receive initial training enroute to their first duty station [Ref. 1]. This initial training is conducted at Class A School ("A" School), and provides the basic technical knowledge and skill to prepare an individual for entry level performance on the job and for additional specialized training. Specialized training to qualify personnel for specific maintenance tasks is attained through Class C Schools ("C" School), PJT, the Maintenance Training Improvement Program (MTIP), formal instruction at local Fleet Readiness Aviation Personnel Departments (FRAMPS), Naval Aviation Training Group Detachments (NAMTRAGRUDETs), Fleet Aviation Specialized Training Groups (FASOTRGRUs), Naval Aviation Depots (NADEPs), and factory training.

Some training qualifies technicians for a Navy Enlisted Classification (NEC), which is a code to identify personnel qualified in specific areas/tasks. NAVPERS Manual 18068, Volume II lists all NECs and qualification requirements.

The Aviation Maintenance Training Program provides a tailored training sequence. Close liaison is established between the Maintenance Training Unit (MTU) coordinator and the ultimate duty station for enroute trainees to ensure the correct training is given for the billet to be filled. Standard billet training

requirements are provided by the MTU, with revised or exceptional requirements met on an as needed basis. The MTU sends a report of planned training to the member's ultimate duty station. The squadron/unit reviews the report to ensure planned training is consistent with requirements and unit's Activity Manpower Document (AMD). Concurrence/recommended changes are then immediately provided to the MTU, ensuring a carefully controlled training program, tailored to meet fleet requirements. [Ref. 1]

IV. OVERVIEW OF DEPOT LEVEL MAINTENANCE

The focus of this chapter will be on the Naval Aviation Depot Maintenance Organization (NADEP). The functional and program management structural composition will be discussed and the responsibilities of and upper management through lower level divisions will be described. Due to the breadth and depth of the organization, descriptions will be brief, focusing on only the main functional and program entities. Because calibration laboratories are the primary focus of this thesis, more attention will be given to describing how and where they fit into the Depot Organization.

A. SCOPE AND MANAGEMENT OF NADEP MAINTENANCE

NADEP maintenance consists of rework of existing aviation material, manufacture of items not available, and support services such as engineering, technology, and calibration. D-level supports organizational (O-) and intermediate (I-) levels by providing technical help and performing maintenance that are beyond the responsibility and capability of O- and I- level activities through the use of more extensive facilities, skills, and materials.

OPNAVINST 4790.2F, the NAMP, is the primary source of guidance for facilities performing depot level maintenance on naval aircraft, weapon systems and associated support equipment. The following is summarized from pertinent areas of the NAMP to provide a basic understanding of the mission and organizational structure of NADEPs.

The Office of the Secretary of Defense (OSD) has the overall responsibility

to establish the DoD D-level Industrial Program policy and to delegate to the DoD components. Within the Department of the Navy (DON) the Secretary of the Navy (SECNAV) has the responsibility to carry out the requirements of DoD policy under instructions issued by the OSD. The Chief of Naval Operations (CNO) implements the D-Level Industrial Program as directed by the SECNAV. The Commander Naval Aviation Systems Command (COMNAVAIRSYSCOM), an echelon two command, is responsible to the CNO for the overall management of the Aviation Depot Level Industrial Program. COMNAVAIRSYSCOM retains the authority to approve or disapprove recommendations for continuance, discontinuance, or conversion of depots in the areas of rework, manufacture, and extension of contract support for reasons other than cost reduction in those same areas.

Under the guidance of the Naval Sea Systems Command (NAVSEA), COMNAVAIRSYSCOM is responsible for the establishing the Metrology and Calibration Program (METCAL) policy. In doing so, they must budget for resource requirements and maintain the minimum number of calibration installations necessary to ensure adequate capability and capacity to meet operational requirements of the naval aviation community.

The Naval Aviation Depot Operations Center (NAVAVNDEPOTOPSCEN) is an echelon three command under COMNAVAIRSYSCOM and executes depot level programs, providing depot level resource management support to COMNAVAIRSYSCOM. The Naval

Aviation Maintenance Office (NAVAVNMAINTOFF) is an echelon three command responsible to COMNAVAIRSYSCOM. The mission of NAVAVNMAINTOFF is to ensure optimum aviation maintenance performance and fleet readiness by coordinating aviation fleet maintenance support and providing technical support in aviation life cycle logistics and maintenance planning. The last level in the responsibility hierarchy rests with the NADEPs. NADEPs are echelon 3 commands under COMNAVAIRSYSCOM, whose primary objective is to maintain and operate facilities for and perform a complete range of depot level support and rework operations on designated weapons systems, accessories, and equipment.

B. DON D-LEVEL INDUSTRIAL FACILITIES

The three **DoN D-Level Industrial Facilities** are the Naval Air Systems Command (NAVAIR) principal in-service logistic support activities. NADEPs fulfill Program Management and Cognizant Field Activity (CFA) responsibilities in addition to providing industrial maintenance and engineering functions in support of the operating fleet. Since 1989, as a result of the "right-sizing" initiative and tightening of the DoD budget, the **DoN D-Level Industrial Facilities** is striving to streamline production and management efforts to eliminate redundancies and reduce overhead costs. The three NADEPs that makeup Navy organic D-Level industrial base are located at North Island, California, Jacksonville, Florida, and Cherry Point, North Carolina.

The NADEP functional organization and responsibilities is described in

Appendix A.

C. PRODUCTION PLANNING AND WORKLOAD

1. Depot Level Industrial Workload Definition

Depot Level industrial workload consists primarily of industrial functions described in the Navy Industrial Fund (NIF) Handbook for Naval Air Rework Facilities, NAVSO P-3048, and other pertinent COMNAVAIRSYSCOM and NAVAVNDEPOTOPSCEN instructions. D-level maintenance is normally performed by naval organic, other military services, or commercial contractor aviation depots.

The industrial workload is composed of seven major programs primarily associated with the specific logistic support of naval aviation operating forces, and various minor workload programs of general to specific nature. The workload programs include but are not limited to the following:

- Rework of aircraft airframes and those systems not physically removed from the aircraft
- Rework of missile guidance and control systems
- Rework of power plants
- Rework of removed aviation components
- Aircraft support services which include the following major subprograms:
    - a) Salvage
    - b) Preservation and depreservation

c) Customer/operating forces training

d) Aircraft acceptance and transfer

e) Calibration

f) Customer service

g) COMNAVAIRSYSCOM shipboard work

h) Support equipment (SE)

i) Product Support Directorate (PSD) services

- Manufacture of designated items and particular modification change kits for aircraft and aeronautical equipment

- Aircraft modification

Workload requirements are generated within the framework of the Integrated Logistics Support Program Requirements for Aeronautical Systems and Equipment, the NAVAIR Maintenance Plan Program, and other associated COMNAVAIRSYSCOM instructions as the basis for the determination of overall logistic requirements. Current and projected approved force level and approved flying hour program for the Navy are the primary driving factors on the workload requirements. These account for peacetime requirements and do not include any national security contingency nor full scale mobilization (wartime) requirements.

D. METROLOGY AND CALIBRATION PROGRAM (METCAL)

1. Definition

Metrology is the science of measurement or determination of conformance to technical requirements, including the development of standards and systems for absolute and relative measurements. Calibration is the process by which calibration installations compare a calibration standard, precision measuring equipment (PME), or Test and Monitoring Systems (TAMS) with a standard of higher accuracy to ensure the former is within specified limits. A calibration facility is an installation that provides calibration services for PME, TAMS, and calibration standards used by activities engaged in research, development, test and evaluation, production, quality assurance, maintenance, supply, and operation of weapon systems, equipment and other DoD material. PME/TAMS used for quantitative measurement in the Navy METCAL Program, including calibration standards, must be periodically calibrated to be within specified accuracy limits required by supported systems and equipment.

Calibration laboratories are classified as Type I, II, III, or IV. Calibration lab type is determined by the accuracy level of calibration standards maintained and employed in the calibration or repair of equipment. For example, if a Type IV lab had a standard for the inch, the Type III standard would be accurate to 0.10 inch, the Type II standard would be accurate to 0.01 inch, and the master inch at the Primary Standards Lab (Type I) would have an accuracy of 0.001 inch.

2. Calibration Workload Scheduling

The primary objective of the METCAL Program is to accomplish the calibration and incidental repair of PME/TAMS used for O- and I-level maintenance functions by the operating forces. Metrology and calibration is budgeted, funded, and managed as a subprogram under the D-level Aircraft Support Services Program. The Metrology Automated System for Uniform Recall and Reporting (MEASURE) provides management information and data required to execute the COMNAVAIRSYSCOM METCAL Program.

The recall of equipment for calibration, at established intervals, is facilitated by the MEASURE. NAVAVNDEPOTOPSCEN publishes and monitors equipment recall schedules, and allocates resources required to execute the schedules. These schedules determine workload composition, authorizing MEASURE customers to forward specific equipment to the laboratories indicated for calibration.

Equipment scheduled into a laboratory for calibration and servicing is based on calibration intervals established by Metrology Engineering, the Metrology Requirements list (NA 17-35MTL-1), and the number of active metrology standards in the inventory at the various Type IV laboratories. A determination must also be made as to the number and the extent of on-site servicing required, as well as the hours required for lab servicing. The accomplishment of these requirements is subject to funding constraints and availability of laboratory man-hours to perform the work. The availability of

laboratory man-hours is determined during periodic fleet readiness support meetings.

E. SUMMARY

This chapter has described in general terms the organizational structure of the DoD and DON D-level Industrial Program. The main functional and operational players have been identified and their interaction within the depot maintenance environment are described. The METCAL Program was defined and the role of calibration laboratories in the depot maintenance scheme was conveyed. The chapter provides the basis for understanding specific material flows and production process that will be discussed in later chapters.

It is important to keep in mind that the information in this chapter is limited in that it only establishes a **framework** for authorities, responsibilities, functions, and relationships of organizations in the D-Level Industrial Program. Specifically, the three depots have evolved, in some respects, independently. Because of differences in equipment supported by each depot, each organization differs in their operations, processes, and structure at lower echelons. Specific attention to the organization and functional programs at NADEP, North Island will be described and analyzed in later chapters.

The following chapter describes the evolution of the Regional Maintenance Concept (RMC), and where the DoD/DON is today with respect to implementation of Regional Repair Centers.

V. THE REGIONAL MAINTENANCE CONCEPT

The information contained in this chapter is provided as background and current status of the Regional Maintenance Concept. It does not reflect the opinions or views of the authors and is derived from published briefs and documents as referenced.

A. BACKGROUND

Historically, naval maintenance policy was formulated within warfare areas (e.g., aviation, submarine, and surface) and platform lines (e.g., P-3 Orions, A-6 Intruders, frigates, destroyers, etc.). As each new weapons system was fielded, either existing maintenance support infrastructure within the warfare area would be modified to meet the needs of the new system or new maintenance support would be introduced. Navy maintenance managers in the past have given little regard to existing maintenance capability and capacity in other warfare areas, nor whether they could act in support of common maintenance functions. Recognition of this shortcoming in the way the Navy does business led to a new vision for the future of Navy maintenance. This vision of the future naval maintenance policy and programs includes the development of a *"...seamless functional support structure that optimizes the existing maintenance process commonality among all platforms."* [Ref. 3]

This vision is built upon the Battle Force Intermediate Maintenance Activity (BFIMA) concept, which has been used by aviation and surface repair

within the battle group afloat. The BFIMA concept takes advantage of the significant maintenance capability and capacity resident within the aircraft carrier Engineering and Aircraft Intermediate Maintenance Departments, to provide enhanced support to accompanying ships and their embarked aircraft. In an effort to simultaneously optimize maintenance support at lower cost and enhanced self-sufficiency, the Navy is attempting to duplicate the successful example of common maintenance process execution afloat with a mirrored process ashore. It was the success of the BFIMA that gave birth to the Regional Maintenance Concept (RMC) ashore. [Ref. 3]

B. HISTORY

President Clinton initiated a six month review of the federal government in the 1993 National Performance Review and tasked Vice President Gore with leading the effort. In remarks announcing the National Performance Review, President Clinton stated:

> *Our goal is to make the entire federal government both less expensive and more efficient, and to change the culture of our national bureaucracy away from complacency and entitlements toward initiative and empowerment. We intend to redesign, to reinvent, and to reinvigorate the entire national government.*

This ambitious initiative, "to do more with less" by the President has rippled through the entire federal government, especially the Department of Defense (DoD) and the Department of the Navy (DON). [Ref. 4]

In response to the Defense Management Report Decision (DMRD) 908 of 1989, and more recently the National Performance Review, the Navy has

commenced a major initiative to save money and become more efficient by streamlining its industrial infrastructure. Admiral Mike Boorda, then Chief of Naval Operations, stated the Navy's goal: [Ref. 5]

> *...to size regions' ashore industrial infrastructure to eliminate excess capacity. We* [Navy flag officers] *must continue from where the Base Realignment and Closure Commission (BRAC) decision has taken us. We must aggressively reduce the footprint and cost of our industrial capability,...,The integrated nature of our Naval Forces – ships, submarines, aviation, and the systems that support them – present us with a unique opportunity to demonstrate significant savings through this approach* (Regional Maintenance).

The CNO established an Executive Steering Committee (ESC) composed of his most senior deputies to address the issues of downsizing and mission readiness. The ESC's approach to this challenge included commissioning Quality Management Boards (QMB) charged with developing means of coping with budget reductions in specific areas of Navy operations and maintenance. [Ref. 3]

Seven QMBs were instituted in 1993 to focus on assigned areas impacting Navy readiness and affordability. The focus areas are: Budget, Environment, Fleet Support (FS), Information Systems, Jointness, Roles and Missions, and Quality of Life. The FS QMB, in turn, identified ten separate target areas for concentration, and chartered a subordinate QMB for each target area. The ten target areas are: information, management, maintenance, material, people, shore establishment, safety and environment, training, transportation, and weapon systems. As several of the FS QMB areas of interest crossed into other QMBs,

there was a concerted effort to develop an evaluation and management process capable of fully exchanging information and ideas that might be explored in the Maintenance Support QMB (MS QMB) and be of interest to one another. As a result of this process, the Regional Maintenance "Chain of Command" was established, as shown in Figure 5.1. [Ref. 3]

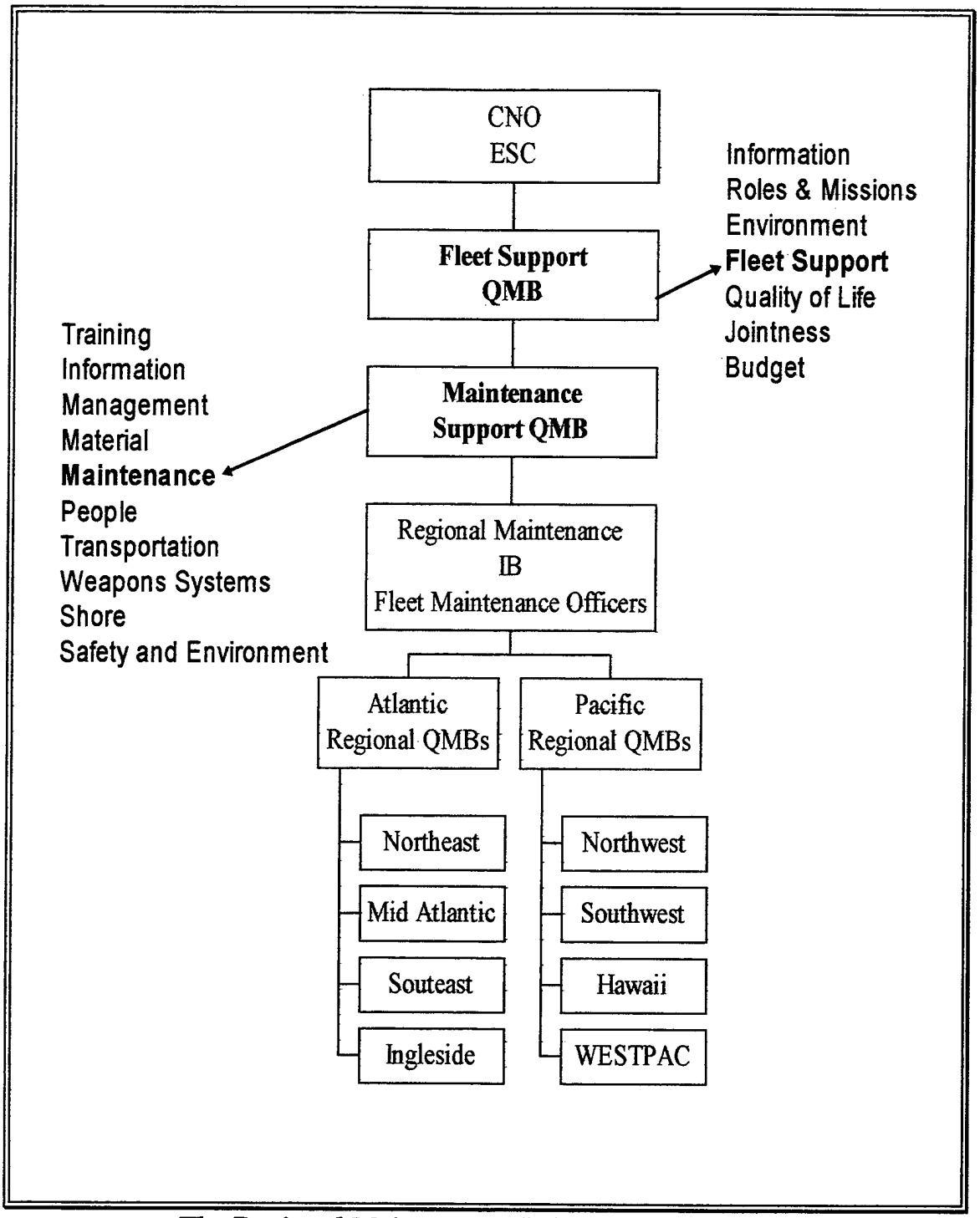
1. Maintenance Support QMB

The Maintenance Support QMB (MS QMB) was specifically chartered

> *...to improve the quality of fleet maintenance support and to define and develop a transition strategy for moving toward the minimum, most efficient, fleet maintenance support infrastructure which will satisfy the Navy's needs into the Twenty-first Century.* [Ref. 3]

The MS QMB is chaired by the Director of Maintenance under the Deputy Chief of Naval Operations for Logistics and is composed of members from the CNO staff, all Systems Commands and Fleet Commanders. The MS QMB is unique in that it united senior maintenance managers from aviation, submarine, and surface ship communities in an effort to jointly address issues that impact all parts of the Navy.

As the budget was reducing annually to reach a steady state at the end of this century when DoD manpower and force structure are expected to stabilize, the Comptroller of the Navy identified a fiscal target for each QMB. The MS QMB target was to reduce the cost of maintenance contribution to the Operations and Maintenance, Navy (O&MN) account by approximately 1.2 billion dollars over a six year period commencing with Fiscal Year 1995. [Ref. 6]



The Regional Maintenance "Chain of Command"
Figure 5.1

2. Development Of The Regional Maintenance Concept

Admiral Boorda stated the Navy goal,

> *...is to have our ship and aviation maintenance and logistics support processes become more similar by taking advantage of the best practices that we can identify. We must evolve to the same processes through smart planning when there is a clear benefit to the fleet in terms of lower costs and improved readiness.* [Ref. 5]

The RMC features a single maintenance management process, to standardize and enhance the battle forces intermediate maintenance capability afloat, and to adopt a regional maintenance support strategy for all naval maintenance ashore. The strategy envisions a single maintenance manager who would spearhead the right-sizing of all industrial facilities, and a single, accessible and responsible provider of maintenance support to the customer, with the primary focus on the material readiness of the deploying battle group.

For example, under the regional maintenance strategy, faulty black boxes from aircraft, ships, and submarines could be sent to the same shore repair facility known as a Regional Repair Center (RRC).

In developing their strategy for optimizing maintenance at reduced cost, the MS QMB identified six principal objectives: [Ref. 3]

- Eliminate excess maintenance infrastructure capacity and capability
- Improve maintenance processes
- Provide compatible Automated Data Processes (ADP) to serve all maintenance providers
- Better integrate supply support and maintenance requirements

- Provide management visibility of all maintenance related costs
- Preserve the technical control of the Systems Commands, life cycle support, responsiveness to the fleet, and readiness.

3. Implementation Of Regional Maintenance

In February 1994, the CNO ESC approved a phased execution plan for Regional Maintenance. The CNO issued the implementation order for the Regional Maintenance Concept in March 1994 [Ref. 7]. Due to the complexity of the undertaking and the scope of change, the concept is to be divided and implemented in three phases: Phase One FY 95-96, Phase Two FY 96-97, Phase Three 97-98.

During the preliminary phase, the primary task is for the maintenance managers to optimize intermediate level interoperability by minimizing redundant capability and capacity, by process improvement, and by resource sharing under the management of the Fleet Maintenance Officers (FMO). Fleet technical support for non-nuclear matters would be consolidated under the Fleet Technical Support Centers (FTSC), which would report directly to the FMO.

Intermediate and Depot Levels of maintenance will be integrated during the second phase and managed by the FMO and regional maintenance managers. During the third and final phase, Fleet maintenance is to be conducted using a single maintenance process supported by common business and production practices and by a common data foundation in both fleets. This

single manager approach will provide a clear process for ensuring technical authority and oversight by the Systems Commanders. [Ref. 3]

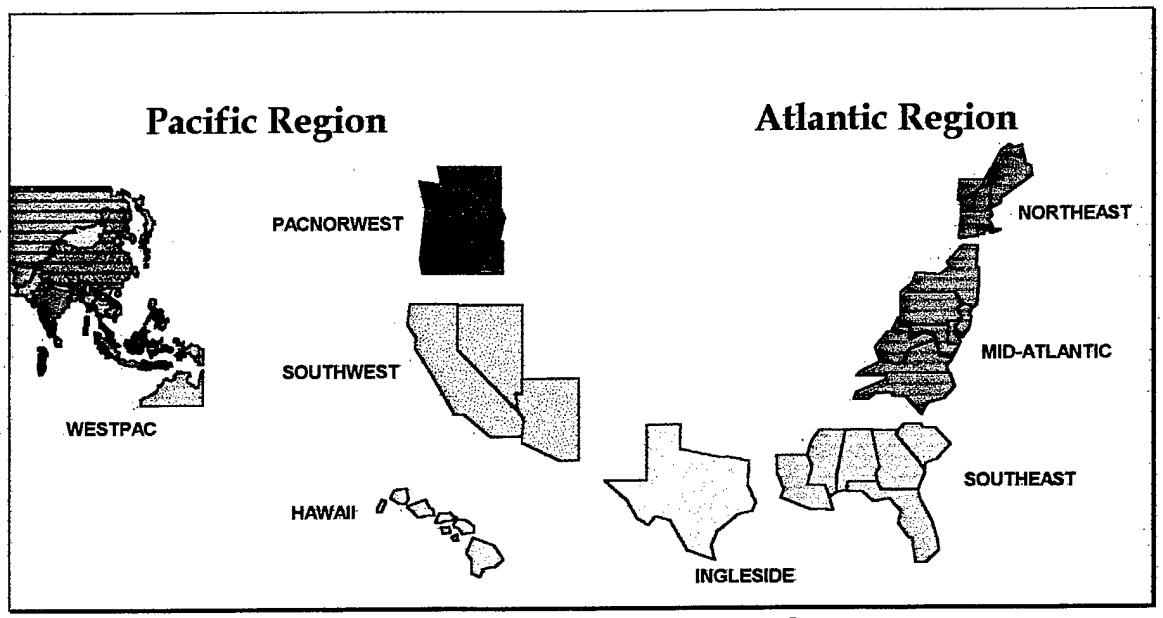
The transition to regional maintenance commenced with the issuance of the CNO directive and was anchored by seven pillars: policy, planning, production, automated information systems (AIS), human resources, finance, and supply.

C. SOUTHWEST REGION DEFINED

The Regional Naval Maintenance Plan commenced October 1, 1995 under the direction and leadership of the FMOs.

1. Atlantic and Pacific Fleet Regions

The Atlantic and Pacific FMOs divided the Navy geographically into eight regions (Figure 5.2). The Atlantic Fleet developed regions in the Northeast (New London-Portsmouth), Mid-Atlantic (Norfolk), Southeast (Jacksonville-Mayport-Kings Bay), and the Gulf Coast (Ingleside-Corpus Christi). In the Pacific Fleet, regions were created in the Southwest (San Diego), Pacific Northwest (Puget Sound), Hawaii (Pearl Harbor), and Western Pacific (Yokosuka, Japan). Within each region a regional maintenance infrastructure is being established to oversee implementation. [Ref. 6]



Eight Navy Regional Maintenance Centers
Figure 5.2

2. The Southwest Region

The Southwest Region encompasses all shore based Navy maintenance activities from San Francisco Bay Area to San Diego and then eastward to Naval Air Station, Fallon, NV. Principal maintenance providers within the region include:

- NADEP North Island, San Diego AIMD Naval Air Station North Island, CA
- AIMD Naval Air Station Miramar, CA—(ordered realigned to a U.S. Marine Air Station by BRAC 95[1])
- AIMD Naval Air Station Lemoore, CA
- AIMD Naval Air Station Fallon, NV

[1] AIMD Miramar and North Island planned to consolidate calibration laboratories regardless of the BRAC realignment. Although this may be true, this demonstrates that RMC is not occurring in a vacuum thus, there are other dynamics at play in reduction of Navy infrastructure.

- Naval Air Weapons Station Point Mugu, CA
- Naval Air Weapons Station China Lake, CA
- Long Beach Naval Shipyard—(ordered closed by BRAC 95)

3. The Regional Coordinator

At the onset of regional maintenance, the Pacific Fleet Type Commanders were responsible for implementation planning and execution within the Pacific Fleet regions as delineated by the Commander in Chief Pacific Fleet. Due to the size of the surface fleet homeported in the San Diego area, the Commander, Naval Surface Force Pacific Fleet was assigned oversight of regional maintenance in the Southwest region.

An executive level board known as the Regional Maintenance Working Group (RM WG) was chartered to act as a "board of directors" for management of the revolutionary new concept. Their primary responsibility is to set and implement policies that will lead to eventual full implementation of the RMC. The board is comprised of senior maintenance managers representing systems commands and fleet maintenance management activities within the southwest region. Among the members of the RM WG are the Commander Naval Surface Force Fleet, Commander Naval Air Force Assistant Chiefs of Staff for ship and aircraft maintenance, Naval Aviation Depot Commanding Officer, Surface Force Pacific Enhanced Readiness Support Group (ERSG) Commanding Officer,

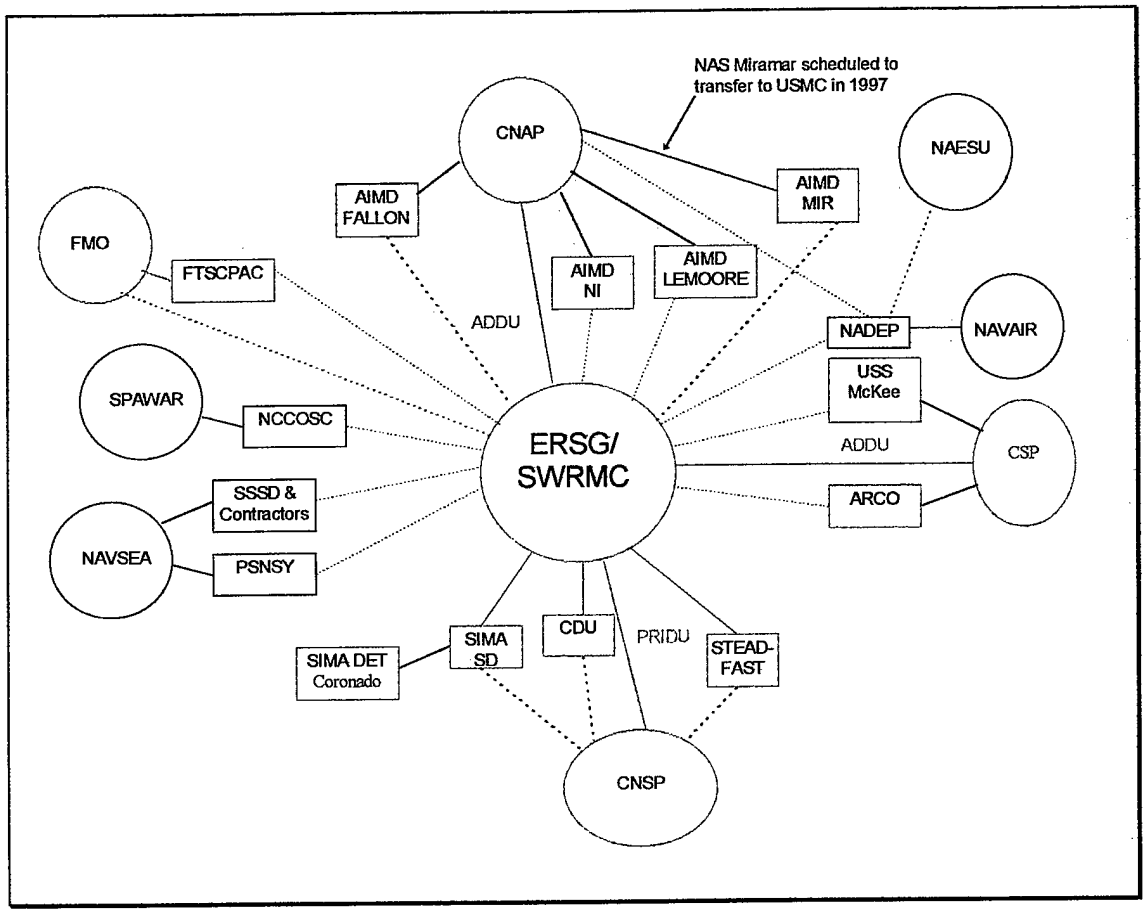
Supervisor of Shipbuilding Conversion and Repair, and the Commanding Officer Fleet Technical Support Center (FTSC) Pacific. [Ref. 6]

a. Enhanced Readiness Support Group

The Surface Force Pacific Readiness Support Group (RSG) was designated as the maintenance coordinator and principal agent for the implementation of regional maintenance in the Southwest Region. In this capacity they are responsible for near-term implementation actions and centralized maintenance job planning, brokering (assignment), and progressing. Consistent with the broadening of RSG roles and missions to include regional maintenance coordination, three specific enhancements to the RSG were made; thus they became the Enhanced Readiness Support Group (ERSG). Upon designation of the ERSG as the regional maintenance coordinating activity, the Commanding Officer of ERSG assumed chairmanship of the RM WG, relieving the Naval Surface Force Pacific Maintenance Officer. Figure 5.3 depicts ERSG within the "Regional Coordinator Concept". [Ref. 6]

To ensure accountability for all platforms, the Commanding Officer of ERSG reports to the Commander, Naval Surface Force Pacific (COMNAVSURFPAC), Commander, Naval Air Force Pacific (COMNAVAIRPAC), and Commander, Submarine Pacific (COMSUBPAC). Within the ERSG, a Regional Maintenance Development Group (RM DG) was chartered to support implementation of RMC. Personnel from the Type Commander staffs were provided to supplement the ERSG. These personnel

staff the RM DG and platform management positions within the ERSG. For example, the CV/CVN Maintenance Manager performs brokering for CV/CVN work through the ERSG to regional repair activities. The manager also serves as platform advocate for the CV/CVNs assigned in San Diego, ensuring a smooth transition from historic platform stovepipe support to sharing common regional maintenance resources. It is important to clarify that the ERSG does not have direct control over activities such as AIMD or NADEP, but rather performs

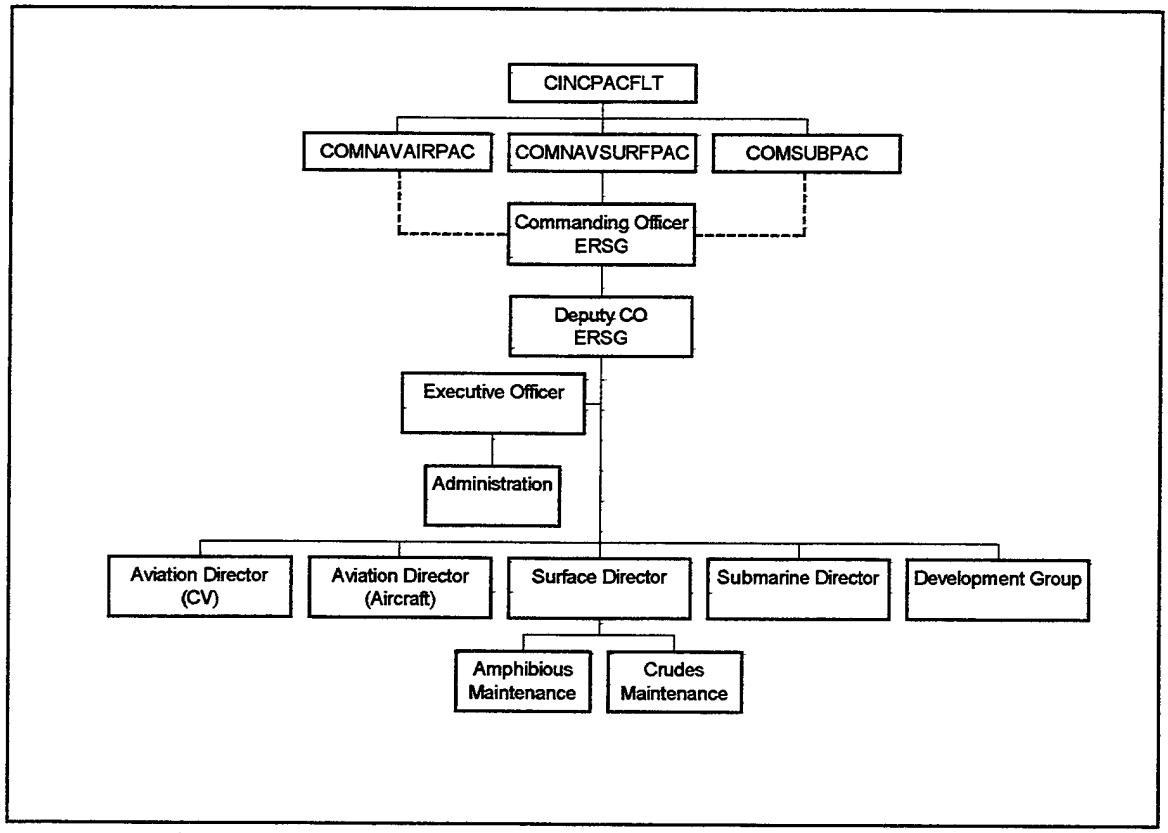


ERSG Today: "Regional Coordinator Concept"
Figure 5.3

brokering, tracking, and coordination functions between all of the maintenance repair facilities. The maintenance activities continue to report to their existing chains of commands for the foreseeable future. The ERSG organization structure is shown in Figure 5.4. [Ref. 6]

D. REGIONAL MAINTENANCE CHALLENGES

Four very important issues come to the forefront when analyzing RMC and integration of intermediate and depot level maintenance into a single level maintenance structure ashore.



Enhance Readiness Support Group Organizational Structure
Figure 5.4

1. Financial Management Policy

Currently some maintenance facilities operate under Defense Business Operating Funds (DBOF) while others receive funding from mission or Appropriated Funds. For example, NADEP North Island is a DBOF activity and AIMD North Island is funded through appropriations. A financial management policy is needed to standardize and simplify maintenance funding.

2. Organic Versus Commercial Capability

How will the Navy maintain its ships in the face of large reductions in organic capacity and capability? The Navy has adopted a well publicized policy resulting from a Department of Defense Roles and Missions study to limit organic repair capability to only a defined "core" of essential work and to contract more to the private sector [Ref. 8]. The number and types of aircraft homeported within each region, and the presence or lack of a robust commercial overhaul and repair base, significantly impact the manner in which regional maintenance will be implemented and function. Regional maintenance must find a way to provide the required maintenance with fewer resources while achieving Operations and Maintenance, Navy (O&MN) cost reductions and making the transition invisible to the Fleet. Readiness must not be traded-off for cost reductions.

3. Cultural Issues

The third challenge deals with resolving key organizational issues of who owns, who supports, and who controls the fleet maintenance process. Parochialism between the warfare areas is embedded deep in Navy culture and goes back to its roots. The Navy consists of many long-standing and powerful platform advocates that create an environment where each community/organization may be looking out for what is best for the Navy from a platform bias. The underlying causes of this competitive behavior have to be understood and corrected to establish a truly "seamless" maintenance support structure.

4. Manpower Capacity

Manpower capacity ashore plays a major role in maintenance support and overall mission readiness. The number of active duty personnel required at repair activities reflect three principal requirements. The first is the provision of sea-shore rotational assignments so that sea duty personnel can be assured adequate shore duty. This is a very important Quality of Life issue and impacts recruitment, training, and retention. Second is the retention and enhancement of technical skills required to repair platforms and installed systems at sea. For many Navy technical rates, there are limited ashore billets that allow for use of these skills. Maintaining perishable technical skills that are expensive to acquire requires continuous work within the respective trade specialties. Third, maintenance performed by sailors assigned ashore makes a large contribution to

fleet material readiness. Consolidation of maintenance capacity and capabilities inevitably involves reduction of shore billets which are critical to overall mission. Care must be exercised in identifying excess manpower capacity so as not to eliminate too many key shore billets.

E. REGIONAL REPAIR CENTERS

The first step in the process of optimizing regional capability and capacity is to identify redundant capabilities among all regional maintenance activities. Experience has shown that the more places a certain type of item is repaired, the more likely there is excess capacity. As each facility is manned to accommodate historical workload peaks, it is almost certain that consolidation to fewer locations will reveal excess capacity and be available for work that otherwise might not be done within Navy organic repair facilities. Under the RMC, these consolidated shops of redundant capabilities within a region are known as Regional Repair Centers (RRCs). [Ref. 6]

1. Regional Repair Center Candidates

Between FY 1995 and 1999 RRC candidates will be identified by the RM WG and then subjected to a rigorous evaluation process. [Ref. 3] Recommendations for RRCs comes in three forms: **consolidation** of all shops into a centrally located facility; **co-location**, wherein two or more shops will share common support resources such as planning, tech library, etc.; and

consolidated support with multiple repair locations served by a single management facility. [Ref. 6]

The RRC evaluation process is performed in four phases. Candidate capabilities and potential cost reducing options are evaluated and developed in the first two phases. In the third phase, a pilot RRC is developed, then submitted to a rigorous six-month evaluation in phase four. If the pilot RRC proves beneficial, the it becomes permanent. To date, over two dozen repair areas have been submitted to the RRC Development Process, one of which is Calibration Laboratories. [Ref. 6]

2. Calibration Laboratories

At the inception of the Regional Maintenance effort there were over thirty calibration laboratories in the Southwest Region. Reductions in ships and aircraft requiring support resulted in all calibration laboratories having excess capacity. The largest data gathering analysis effort to date in the Southwest Region was launched February 1994 to determine the optimum calibration laboratory posture for the region. [Ref. 6]

The Southwest Mechanical Calibration Process Action Team (PAT) identified potential savings in the areas of personnel reductions and acquisition and maintenance of calibration standards. The analysis identified over two hundred personnel in excess of workload requirements employed in the calibration facilities. Additionally, significant duplication of standards was

found throughout the region, each requiring on average about two thousand dollars annually in maintenance costs. [Ref. 6]

A Calibration RRC Evaluation Process Action Team, chartered to perform an in-depth study on the calibration laboratories in the Southwest region, recommended consolidation from thirty three laboratories to six. Two major multi-functional and multi-customer laboratories would exists in the San Diego area: one for ships at the Ship Intermediate Maintenance Activity (SIMA) and one for aviation at the NADEP. The Primary Standards Laboratory (Type I) would absorb the functions of the Metrology Engineering Center at Corona into a single laboratory at NADEP, North Island, CA. Finally, all the laboratories in each of the Point Mugu, China Lake, and Lemoore areas would consolidate into one facility at each location.

F. SUMMARY

Today, the financial reality is much different than during the Reagan military buildup of the 1980s when maintenance money was plenteous. In a political environment of shrinking defense dollars, the Navy needs to maintain a high level of readiness with fewer maintenance funds. Development of the Regional Maintenance Concept that focuses on consolidation, elimination of excess capacity, and the avoidance of redundant capabilities, is the strategy the Navy has selected to fulfill its fleet support requirements in the Twenty-first Century. The importance of Regional Maintenance is such that the program to develop it has been designated a National Performance Review Reinvention

Laboratory to continue, "...plans to build a coordinated and user friendly maintenance system at low cost to the operating forces [Ref. 9]."

Calibration Laboratories is an area where, potentially, millions of dollars may be saved annually. Streamlining of the calibration maintenance infrastructure is underway in the Southwest Region, but is experiencing problems with financial policy, cultural and manpower issues. The next two chapters will focus in-depth on the current challenge in consolidation of the calibration laboratories at NADEP North Island.

VI. EXPECTED BENEFITS OF CONSOLIDATED CALIBRATION LABORATORIES AS REGIONAL REPAIR CENTERS

The previous chapter explained that the more places a component is repaired, the more likely that excess repair capacity exists. Similarly , excess capacity may become apparent when redundant capabilities and capacity are consolidated and/or collocated. By identifying excess capacity and redundant capabilities, an organization can reduce costs and improve processes and operations, thus becoming more efficient, economical and effective. Efficiency is the relationship between actual and planned resources. It tells how well the resources were used. Economical is the ability to perform the assigned mission within allotted resources. And, effectiveness is defined by results, i.e., how well goals are achieved.

In February 1994, the Southwest Regional Maintenance Working Group (SWRM WG) directed the formation of the Southwest Region Electronic and Mechanical Calibration Consolidation Process Action Team (PAT). Primary goals were to examine calibration and repair infrastructure and potential for consolidation. Thirty-three site visits, data reductions, and data analyses were completed by the Southwest Region Electronic and Mechanical Calibration Consolidation PAT on 1 March 1995. Capabilities, capacities, operating expenses, man-hour rates, and workloads were determined for each facility. Nine consolidation options emerged as potential candidates. [Ref. 10] One of the options consisted of consolidating AIMDs at Miramar and North Island and

collocating the new, larger calibration lab with NADEP North Island. This was implemented November, 1995. This chapter and the remainder of this thesis will present findings from on-site visits to AIMDs Miramar and North Island, NADEP North Island, AIRPAC and the RMC Headquarters in the Southwest Region. Benefits of the consolidated I-Level laboratories and collocated I- and D-Level laboratories as well as any weaknesses or problems they are experiencing, will be described. Finally, the potential benefits of full consolidation will be analyzed and the barriers to implementation identified.

A. CONSOLIDATION OF AIMDs MIRAMAR AND NORTH ISLAND CALIBRATION LABORATORIES

1. Benefits

a. Manpower Benefits

It must be emphasized that accurate assessment of manpower utilization is crucial to realizing manpower savings. Regardless of the degree of consolidation, a manpower utilization analysis is needed to meet the manpower savings objective of consolidation. Manning requirements for the consolidated activity must be evaluated and excess personnel cut from manpower authorizations. There will be no manpower cost savings if the consolidated repair activity simply integrates all the personnel from the source AIMD into its operations. If one AIMD operation is run with two shifts and two supervisors, and the other AIMD operation is run with three shifts and three supervisors, there are five supervisors between the two AIMDs. If this repair function were

consolidated, it is not unreasonable to expect the consolidated operation to be run with no more than three shifts and three supervisors. Prior to the consolidation of AIMDs Miramar and North Island, Miramar had eleven military and eleven civilian calibration laboratory technicians, whereas North Island had 23 military and two civilian calibration laboratory technicians. After the consolidation of the two I-level calibration laboratories, nine military and eleven civilian billets were eliminated from Miramar, of which North Island gained one billet to increase to 24 technicians. This reduction of civilian personnel billets represents a potential annual savings of approximately $400,000 to $418,000.

b. Training Benefits

Training benefits could be substantial when the repair of entire functions or families of parts is consolidated. Calibration technicians at a consolidated maintenance site would be exposed to components from all the different aircraft types serviced by the consolidated site, rather than just the components peculiar to the aircraft serviced by an individual AIMD. Cross-training increases technician capabilities, which is especially beneficial for aircraft carrier (CV) operations. CV AIMDs are tasked with supporting many different types of aircraft from several functional wings. The broader the base of technician experience, the easier it is for the CV AIMD to service the embarked airwing. The greater degree of consolidation should provide for more mutual

support amongst technicians and allow a more active approach to training needs.

c. *Standards Reduction*

Laboratories are directed to maintain the minimum number of standards required to ensure adequate coverage for their customers. Standards inventories represent large costs savings or avoidance potential. Consolidation actions must address which standards will be retained and which ones will be placed in inactive or disposal status. NAVAIR controls standards through Naval Aviation Depot Operations Center (NADOC) for higher echelon laboratories and the TYCOM controls Field Calibration Activities (FCA) standards. Two areas of cost savings are anticipated from workload consolidation. Projected man-hour reductions will equate to less required billets for the same customer workload. A second savings is the reduction in overflow costs associated with sending some standards to a higher echelon laboratory for calibration. These costs can be significant due to the higher hourly rate usually charged by these laboratories. [Ref. 11] Before consolidation of the two I-level calibration laboratories, the total number of standards maintained was approximately 1940. Since the consolidation the total number of standards has been reduced to approximately 1044. With $2,000 established as the annual maintenance costs for each standard, this equates to a potential savings of approximately $1,592,000.

d. Inventory Reduction

Consolidating spare parts inventories also is affected by consolidation. The spare parts inventory is comprised of three elements: 1) material in the pipeline (in transit between stocking or production points because material transportation is not instantaneous); 2) regular or "cyclical" stock necessary to meet average demand between replenishments; and 3) safety stock, which is inventory over and above regular stock and kept as a hedge against variability in demand and replenishment lead time. [Ref. 12] Meeting aircraft component repair demand requires a high level of spare parts safety stock because the quantity and timing of demand (variability) is difficult to predict. Consolidating inventory can reduce the quantity of parts required for safety stock because as demand is concentrated at fewer stocking points, there is less uncertainty in demand to take into consideration and total safety stocks can be reduced. [Ref. 12] The following theoretical example illustrates the potential for inventory savings through consolidation: [Ref. 2]

> North Island AIMD's average lead time demand for consumable Part XYZ is four per week, and demand varies with a standard deviation of two. Assuming normally distributed demand, 90% protection against stock-out (i.e., a 10% probability of stock-out) is 1.28 standard deviations above the mean. Accordingly, to have 90% confidence that a Part XYZ will be available when needed, North Island will have to maintain safety stock of 1.28 x 2 = 2.56 parts. Miramar AIMD's average weekly demand for Part XYZ is eight with a standard deviation of three. To maintain the same 90% confidence factor, Miramar's safety stock will have to be 1.28 x 3 = 3.84. This means the Part XYZ safety stock held between the two AIMDs is 2.56 + 3.84 = 6.40 parts.

If repair capabilities were consolidated, the average consolidated demand for Part XYZ would be expected to be the sum of the demand of the individual AIMDs, which is 12 per week. The standard deviation of the consolidated demand would be the square root of the sum of the variances of the individual AIMDs, which is 3.6. Thus, to maintain a 90% confidence level of being able to fill requirements immediately upon demand, the consolidated activity would only have to maintain safety stock of 1.28 x 3.6 = 4.60 Part XYZs, which is a savings of 6.40 - 4.60 = 1.80 parts.

e. Streamlining Facilities

Facilities are required to support activities pertaining to the accomplishment of active maintenance tasks, providing warehousing functions for spares and repair parts, conducting training, and providing housing for related administrative functions. [Ref. 2] Savings can be realized by avoiding costs associated with the operation of facilities that are closed by consolidation. Planned building demolition and industrial consolidation reduces operation and maintenance costs, increases industrial efficiency in a more compact, tailored facility and reduces personnel overhead that seems to accompany large, under-utilized buildings. [Ref. 13] The consolidation of the two AIMDs and their collocation to NADEP North Island should have produced overhead savings in the elimination of the calibration laboratory facilities. But, with BRAC 95 NAS Miramar will become Marine Corps Air Station Miramar, meaning the Marines will be taking over the facilities, and the facility at AIMD North Island is being used as an office space. Unless the buildings are demolished, leased or sold

after they are vacated due to consolidation there will be no cost savings or cost avoidance.

f. Improved AIMD Productivity

Queuing theory supports the conclusion that consolidating duplicate AIMD capabilities can improve productivity. Queuing theory is the study of the arrival of customers to some type of process, the time customers spend waiting to be served, and the time they spend being served. Queues form as customers arrive and await service. Waiting lines for bank tellers, traffic toll booths and grocery check-outs are familiar queues. Queuing theory has developed a number of models that can be used to predict the average number of customers awaiting service, the average number of customers in the system, the average time spent awaiting service and the average total time in the system. These models are based on the three basic characteristics of queuing systems: 1) arrivals (customers or demand); 2) service mechanism (people and/or equipment); and 3) queue discipline (first-in/first-out, last-in/last-out, etc.). [Ref. 14]

The rate customers arrive for service (the number of customers that arrive during an interval of time) is one of the basic characteristics of a queuing system. For AIMDs, this characteristic is present in non-Ready For Issue (RFI) aircraft parts and equipment requiring I-level maintenance or repair. The non-RFI items (customers) begin queuing up when they arrive at AIMD Production Control for induction into the repair cycle. The components must wait

(Awaiting Maintenance (AWM)) in the repair cycle queue until a service channel (maintenance technician with required test/repair equipment), is available. The arrival rate of non-RFI items is based on the failure rate of the component and (for the vast majority of items) is independent of the failure rate of other items.

There is a finite population of potential AIMD "customers" (I-level repairable parts and equipment) at any one time. This population of customers is dependent on the number of supported activities and the number of components installed in supported weapons systems. The arrival rate of components ("customers") for AIMD repair is dependent on the failure rate, or reliability function, of the specific equipment. Non-RFI items could arrive in a fairly consistent pattern (as with parts on scheduled maintenance intervals) or the arrival pattern could be quite irregular (unscheduled maintenance actions). The difference in the arrival rates of non-RFI components into the AIMD repair cycle is based on differences in the distribution of failures. Failure rate distribution patterns include gamma, Weibull, and many others. [Ref. 2]

Another basic queuing theory characteristic is queue discipline, which concerns the order in which customers are taken from the queue. Queues can have a variety of disciplines. Common methods include; first-in/first-out, last-in/first-out, shortest processing time or longest processing time. Additionally, there can be differences in the manner of customer service within these basic methods. Some queue disciplines allow for "jumping," which is common at retail store check-outs where customers "jockey" for position in the

line with the fastest service. Other queues establish some type of priority system, like a hospital emergency room where the seriously injured patients are served first. [Ref. 15] As described in Chapter III, AIMDs have an established priority system for servicing customers. The first customers to be served are the Expeditious Repair, or "EXREP" components. Priority 2 (PRI 2) customers ("pool critical") are next in line, and Priority 3 customers are served last.

The variety of ways in which the three basic queuing characteristics can be combined is infinite. Consequently, much research has been devoted to the understanding and expansion of queuing theory, with emphasis on developing mathematical techniques to assist in the analysis of queuing models. A principal area of study in mathematical queuing analysis is the effects of combining two or more separate queues. This area of study has direct application to the analysis of consolidating AIMD workloads and repair capabilities. The process of combining queues is termed "pooling."

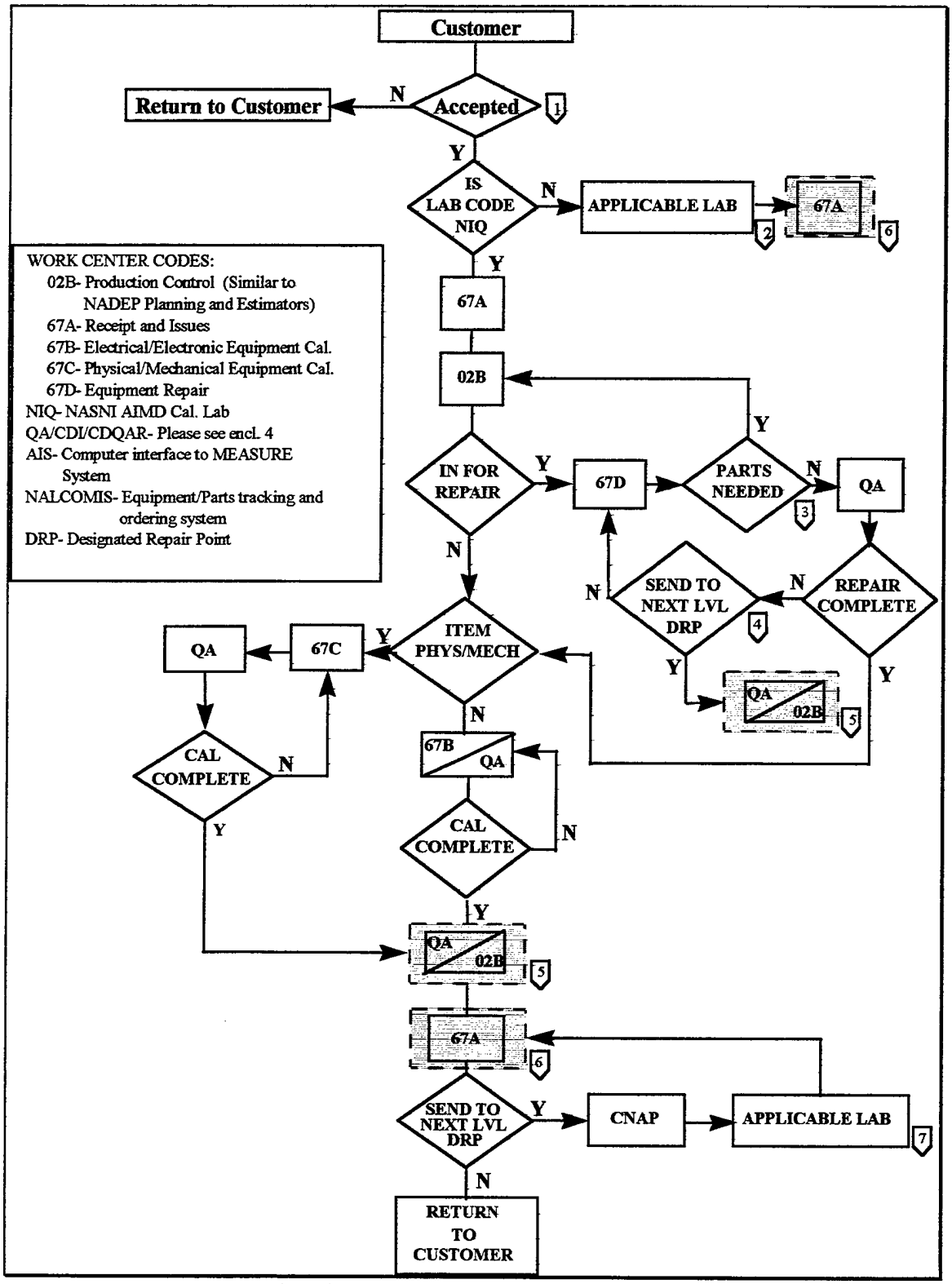
Pooling has been shown to increase the efficiency of a queuing system by lowering the total time a customer spends in the system, and decreasing the waiting time for service and the total number of customers in the system at any one time. These system improvements are independent of the arrival process and the distribution of service. In circumstances where the number of channels is very large, both good service and high utilization of assets is achieved. [Ref. 16]

Improvement through decreasing the time customers spend waiting is obtained by using idle resources. Separate systems are less efficient because a customer can be waiting for service in one system while the other system is idle. [Ref. 17] In separate systems, the next arriving customer may be blocked and have to wait until the customer being served departs the system. In a combined system, the probability of a customer having to wait for service is lower because the probability that an idle service channel is available is higher. Consequently, even when a customer must wait for service, the average waiting times should be much less when separate facilities that service separate streams of customers are combined to serve all the streams together. [Ref. 18] Figure 6.1 depicts the repair cycle that components ("customers") flow through at the consolidated AIMD Calibration Laboratory.

2. Weaknesses or Problems

a. Transportation

Transportation is an essential element of consolidation because it is necessary for transferring Test And Monitoring Systems (TAMS) instruments to/from different laboratories. Activities shipping or receiving TAMS or in receiving on-site calibration services from the consolidated site add transportation time and costs to calibration processes. Time added and additional costs incurred depend on the destination, transportation method selected and frequency of deliveries. [Ref. 10] Therefore, the additional



I-Level Calibration Component Repair Cycle
Figure 6.1

transportation costs incurred due to consolidation will offset savings and must be considered in consolidation decisions. Transportation costs from the consolidation of Miramar and North Island calibration laboratories are minimal. A satellite receipt/issue is maintained at Miramar for receiving and issuing equipment for sub-custodians located at Miramar. Miramar sub-custodians may deliver/pick-up equipment at the designated site or at NADEP North Island. Miramar is also providing a permanently assigned vehicle for transporting equipment to North Island, from the satellite receipt/issue. AIMD North Island sub-custodians now drop-off/pick-up equipment directly from the consolidated AIMD Calibration Laboratory at NADEP North Island. North Island is also providing a permanently assigned vehicle for on-site calibrations at North Island and Miramar.

b. Facilities Modification Costs

Facilities modification costs are directly related to the degree and type of consolidation and must be considered in the consolidation decision. Consolidation may require the modification of present facilities to accommodate the changes in workload. For example, if consolidation requires installation of additional test equipment and the present workspace is too small to allow expansion, an addition to the building or modification of its interior might be required. Another potential problem is that increases or changes in power requirements might call for the modification or utility services. Facility modification to AIMD North Island was unnecessary due to the fact that the

consolidated I-level calibration laboratories were collocated to NADEP North Island.

c. *Military Resiliency*

Military resiliency is the ability to recover from change or misfortune. Military resiliency is often thought of in terms of combat operations, i.e., the ability of an infantry company to reconstitute after sustaining combat losses. Consolidation will leave geographical areas more susceptible to a larger loss of its consolidated repair capability. For example, with both North Island AIMD and Miramar AIMD having calibration laboratories, there is an alternate site to continue work if one site should have to shut down as a result of fire or earthquake. However, if the calibration laboratories were consolidated at one or the other of these sites and there was a disaster such as fire or earthquake that destroyed the consolidated, site problems would arise.

d. *Customer Service Impact*

The objective of consolidation is cost reduction without degradation of customer service or operational readiness. It is essential to consider the impact consolidation will have on customer service before decisions are made regarding which capabilities to consolidate. The consolidation of AIMDs Miramar and North Island calibration laboratories has been transparent to their customers. Their customers are feeling no ill-affects from the consolidation [Ref. 19].

B. COLLOCATION OF CONSOLIDATED I-LEVEL CALIBRATION LABORATORY WITH NADEP NORTH ISLAND

1. Benefits

a. Training

Calibration and repair of Navy TAMS require unique skills beyond that of a general mechanical or electronic technician. Almost all measurements require a very high level of precision and attention to detail. With the military-manned laboratory being collocated with a higher echelon civilian laboratory, this provides Navy personnel with training advantages that otherwise would not be available. This is an opportunity for Navy personnel to receive a higher level of training through on-the-job-training (OJT) and formal/in-classroom sessions on calibration and repair on Navy TAMS. This new level of knowledge could benefit the Navy as well as its personnel in that the experience gained can be used when the personnel transfer to sea duty or to another shore based activity. Military technicians could be working on a piece of equipment and come across a discrepancy that would normally stop maintenance production. Because of their extensive knowledge and experience, the artisans would provide OJT and/or possibly some formal/in-classroom training on what to look for and how to look for it as well as how to correct the discrepancy. Therefore, if the Navy technicians are presented with this discrepancy again they can correct it with the knowledge gained from the artisans, saving time and money. The military technicians collocated at NADEP North Island are

receiving some OJT from the artisans but, no formal/in-classroom training is present. The artisans will not provide formal/in-classroom training unless it is specifically stated in their Position Descriptions (PDs). Interaction with career civilian technicians could provide relevant training to Navy personnel and could result in higher performance levels throughout Navy personnel careers.

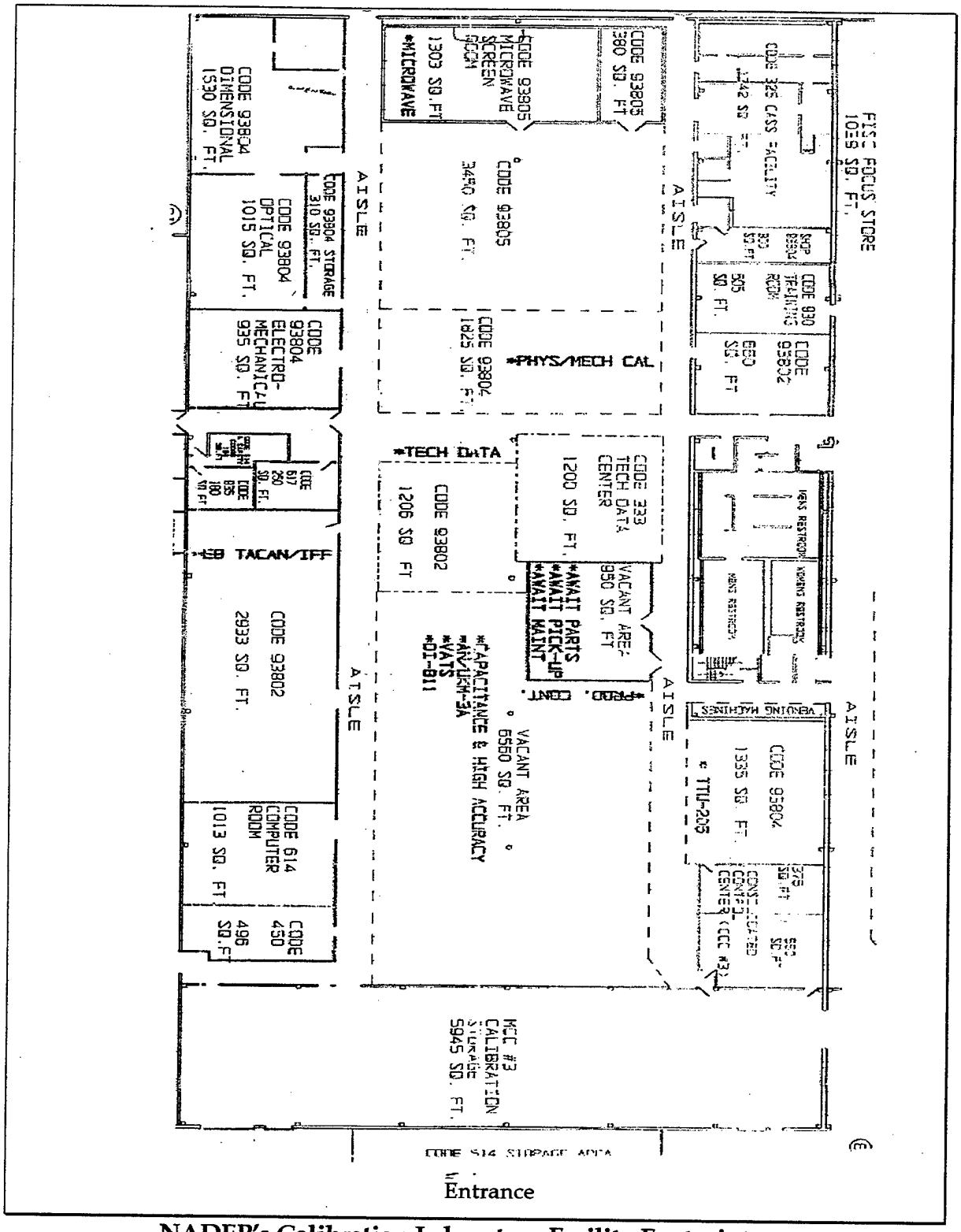
b. Flexibility of Collocated versus Consolidated

Collocation provides more flexibility than consolidation. The I-level calibration laboratories at NADEP North Island are collocated, i.e., combined (centralized) but separate. Resources, manpower, chains of command and funding systems continue to be separate, which makes the activities easy to disconnect if the need arises.

2. Weaknesses or Problems

a. Facilities Modification Costs

As discussed in Section A.2.b of this chapter, consolidation as well as collocation may require modifications of the present facility to accommodate the changes of integrating another unit into the process. The collocation of the I-level calibration laboratory with NADEP North Island required no modifications to the NADEP facility. Figure 6.2 illustrates the NADEP Calibration Laboratory facility footprint. The vacant areas on the footprint are those which the I-level Calibration Laboratory now occupies. NADEP is paying all costs associated with the operations of the facility at this time due to the inability to define exactly how to share all the costs. For example, electricity is not metered;



NADEP's Calibration Laboratory Facility Footprint
Figure 6.2

therefore NADEP cannot determine the exact amount used by the different units operating in the facility and thus cannot separate usage costs by units. They are considering a prorated costing model based on square footage utilized by each unit to solve such problems [Ref. 20].

C. CONSOLIDATION OF THE I- LEVEL CALIBRATION LABORATORY WITH THE NADEP NORTH ISLAND D-LEVEL CALIBRATION LABORATORY

1. Benefits

a. Training Benefits

As stated earlier in the chapter, consolidated facilities can provide unique and beneficial opportunities for Navy personnel. Future cost avoidance or savings can be realized if Navy personnel were to interact with career civilian technicians of higher echelon laboratories.

b. Standards Reduction

As addressed in Section A.1.c. of this chapter, standards inventories represent large costs savings or avoidance potentials. The first savings is the projected man-hour reductions that will require fewer billets for the same customer workload. A second savings is the reduction in overflow costs associated with sending some standards to a higher echelon laboratory for calibration. [Ref. 11]

2. Weaknesses or Problems

a. Sea/Shore Rotation

Sea maintenance ratings must be supported by meaningful shore duty to sustain a robust battle force repair capability. Shore maintenance billets are needed to provide continuing skill training (in some cases qualification training) and current experience for those personnel that will return to sea in a maintenance capacity. Also, shore maintenance billets can be used to support the necessary sea/shore rotation for required sea billets and the home basing initiative. Military billets within regional maintenance activities should not exceed the sea/shore rotation needs of the afloat Navy. Where workload exceeds the capacity of military maintenance personnel rotated ashore (with training requirements considered), civilian personnel could be assigned or the maintenance contracted out. [Ref. 21]

b. Automated Information Systems (AIS)

Regional Maintenance relies on the efficient sharing of data generated by requesting activities and service providers. The establishment of an AIS and communications infrastructure that enables exchange of technical and management data is critical. The current maintenance information infrastructure is too fragmented to provide optimum support to accomplish the Navy's maintenance and repair mission. [Ref. 22] The programs most widely used and critical to carrying out Navy maintenance and repair missions are shown in Appendix B.

The existing maintenance management systems have historically, not needed to communicate outside their associated vertical community. Also, communication within the same "stovepipe" is sometimes discontinuous. For example, depot maintenance data is not currently included in the Naval Aviation Maintenance and Material Management Data System (AV-3M). The primary objective of the AV-3M is to provide for managing maintenance and maintenance support in a manner which will ensure maximum equipment operational readiness. Moreover, a number of different maintenance philosophies and business processes have evolved numerous unique information systems that compound the problem of sharing data across community boundaries. Maintenance of numerous, special purpose information management systems is program driven and expensive. The real cost to the Navy of so many systems is hard to determine since costs are embedded in many different budget lines. Regional maintenance seeks to adopt a common business approach where possible, and eventually converge the numerous information systems to a set of systems that have the connectivity necessary to facilitate the complete exchange of maintenance business and technical data within and among the various regions and in support of life cycle cost reduction. [Ref. 21]

c. *Internal Chain of Command*

Presently there are two chains of command, one for I-level and one for D-level. Appendix C illustrates the two chains of command for the I-level and D-level. If consolidation of the two is an option, then one chain of command would be appropriate. The purpose of the consolidated chain of command would be to support the management and administrative functions of the calibrated/repair mission. An example of a consolidated chain of command could be the use of the Southwest Regional Maintenance Center Headquarters in San Diego, CA. If the NADEP North Island calibration laboratory and the I-level calibration laboratory were to consolidate, then the Southwest Regional Maintenance Center Headquarters would be its chain of command. Neither NADEP North Island nor AIMD North Island would have control of the consolidated calibration laboratory.

D. SUMMARY

This chapter, has summarized the benefits and problems associated with consolidating two I-level calibration laboratories and then collocating them with a D-level calibration laboratory. The potential benefits of full consolidation were analyzed.

Collocation of the I-level Calibration Laboratory appears to be a step in the right direction but the full benefits of a consolidated Regional Repair Center have not been achieved. The two major problems remain to be resolved 1) the current stovepiped organizational structure and culture of the Navy and 2) the

existence of two funding systems, with mission and DBOF funding, continue to be problems. These issues will need to be resolved in the future for complete and successful regionalization to occur. The following chapter will discuss in detail these two issues.

VII. IMPEDIMENTS TO PROGRESS

As a result of the Regional Maintenance initiative, the intermediate level calibration laboratories at Miramar and North Island have been consolidated while simultaneously being collocated with the NADEP North Island calibration laboratory. Streamlining of the calibration function in the North Island area has taken place with minimum difficulty due to the flexibility and "can do" attitude of the technicians and maintenance managers involved. Collocation of the calibration laboratories, although a step in the right direction, has not achieved the full benefits of a consolidated Regional Repair Center as intended under the Regional Maintenance Concept based upon the data gathered through interviews with Navy personnel participating in this reorganization.

In general, the personnel interviewed held the common view that they have done as much as they could, within the limits of their authority and regulations, toward consolidating the calibration laboratories at North Island. Before they could take the next step toward full consolidation, top management in the Navy needs to make decisions about two major issues that are inhibiting the implementation of Regional Maintenance.

The two major issues that repeatedly surfaced in almost every interview were: (1) the "stovepipe" organizational structure and culture of the Navy do not "fit" the RMC model; (2) although it is possible to operate and manage with both mission and DBOF funding, it is inefficient and cumbersome to do so. One

financial management policy and method would simplify the existing, overly complex process.

This chapter examines current Navy maintenance organizational structure and financial management policy, and the aspects of each that make it difficult to fully implement the Regional Maintenance Concept.

A. NAVY ORGANIZATIONAL ISSUES

Regional maintenance requires "best business practices", benchmarking, and executive level consensus decisions to reach "smart" consolidations and reductions. A variety of tough organizational issues exist such as sharing of resources, resource ownership and priority, need for extensive communication and coordination, job enlargement, job enrichment/cross skill development, integrated skill training, command/promotion opportunity and community considerations, integration and mix of military and civilian workers, technical control in a multi-platform shop, job responsibility and mission redefinition. Any one of these issues may be offered as an excuse <u>not</u> to change. All, however, are symptomatic of a narrow perspective that has traditionally been applied in a singular, platform-based maintenance approach to organization. Consequently, lessons have been learned the hard way with controls applied accordingly. For example, problems associated with "split job responsibility" have been resolved in favor of avoiding the split entirely rather than determining how to manage a job with more than one participating activity.

Regional maintenance requires managers to reconsider traditional approaches to maintenance in favor of a more cost efficient and, potentially, effective model.

1. Current Maintenance Strategies

a. Aviation

As described in previous chapters, Naval aircraft are maintained in accordance with OPNAV Instruction 4790.2 (Series). Organizational level technicians perform on-aircraft work, including removal of and replacement of components, both consumable and repairable. Field and depot level repairables removed are forwarded through supply to the supporting AIMD, both ashore and afloat. When a component is repaired, it is returned to the supply department as ready-for-issue stock. Field level repairables that cannot be repaired are discarded by the AIMD. Depot level repairables that are beyond the capability of the AIMD are forwarded to a depot, Navy or commercial, for final disposition.

b. Aircraft Carriers

Aircraft carriers are maintained under three different philosophies; the Engineered Operating Cycle (EOC) for conventionally powered carriers (CVs), the Incremental Maintenance and Modernization Program (IMMP) for a forward deployed CV, and the CVN 68 Class Incremental Maintenance Plan (IMP). The CV EOC is based on a series of short availabilities coupled with complex overhauls. The notional overhaul interval is six years with an overhaul

duration of twelve months. Between overhauls, material readiness is maintained during a three to five month Selected Restricted Availability (SRA) following each deployment. The CV IMMP provides for a continuous, incremental, selected and restricted availability for accomplishment of phased repairs and alteration installation. A minimum of thirty days is spent in upkeep each quarter with a maximum sixty day availability accomplished once per year. Docking for major rework is scheduled every five to eight years. The CVN IMP provides for phased repairs and alteration installations through a six month planned, incremental availability following each deployment. Every third availability is an eleven month docking availability. A notional thirty-two month complex overhaul for refueling is accomplished at the mid-life of each CVN class aircraft carrier.

c. Surface Ships

The surface ship maintenance plan rests on a condition based strategy with short depot availabilities between deployments and major modernization availabilities, if required, every ten years. Between these availabilities (formally scheduled and budgeted) are shorter availabilities of intermediate and some depot level activities to accomplish emergent requirements. The port engineer is the key maintenance manager in the process and is responsible for identification and prioritization of maintenance requirements utilizing ship input, technical agent input, Systems Command maintenance plan and Type Commander direction and resources.

d. Submarines

Submarines are maintained through the requirements of the Class Maintenance Plans (CMP). Submarine CMP includes all levels of required maintenance; organizational, intermediate and depot. While CMP vary between TRIDENT class SSBNs and fast attack submarine classes, the basic philosophy of uncompromising adherence to operationally proven and technically based CMP is a major factor in submarine high mission readiness and submarine safety. The Attack Submarine CMP is a compendium of O, I & D level maintenance requirements and periodicities. The Submarine Extended Operating Cycle (SEOC) program is the basis of the attack submarines CMP. The SEOC program includes the following elements: maintenance requirements and standards, class maintenance plans and schedules, integrated maintenance and modernization planning, material condition feedback, and technical support.

The 688-class submarine approved operating cycle (OPCYCLE) is one hundred and twenty months long. Each OPCYCLE contains three operating intervals (OPINTERVAL) that are periods of Fleet operations (including O & I level maintenance periods) followed by homeport dry-docking selected, restricted availabilities (DSRA). The OPCYCLE is restarted by accomplishment of a Major Depot Availability (MDA), such as a refueling or overhaul, conducted at a shipyard.

The TRIDENT maintenance concept includes a CMP that supports incremental overhaul, dedicated refit facilities (TRFs), a rotatable equipment

pool, and a continuous material condition assessment (MCA) program. The TRIDENT submarine design has fully integrated life cycle support to facilitate integrated maintenance and modernization. The CMP provides for incremental overhaul and modernization at the TRF supported by enhanced I-level capability and the TRIDENT Planned Equipment Replacement Program (TRIPER) with rotatable pool equipment.

2. Command and Control of Navy Maintenance

Ship and aircraft maintenance is currently controlled at several levels and within separate chains of command depending primarily upon the location of maintenance accomplishment; i.e., on-platform, at an Intermediate Maintenance Activity (IMA) or in a depot. Differences exist between aviation and ship maintenance control as well as among the various platform systems involved. For example, strategic, nuclear, Aegis and aviation safety of flight systems have an extremely close linkage to their associated technical authority regardless of the location or level of maintenance accomplishment. The following provides a brief description of the principal controlling authority for maintenance depending upon who does the work and where the work is accomplished.

a. Organizational maintenance

Organizational maintenance is controlled by the ship or aircraft squadron commanding officer. Work is identified by the unit, by scheduled planned maintenance programs or by hardware Systems Command approval of minor configuration changes within the capability of unit military personnel.

The commanding officer determines whether the work can be accomplished immediately or whether it must be deferred. Work is accomplished in accordance with published technical specifications and platform documentation provided by the Systems Commands. Funding is provided by the Fleets through the Type Commanders in an O&MN operating target for supplies and equipage made available from the Type Commander. Labor is provided by qualified military personnel assigned to the individual unit under Fleet claimancy. Quality assurance is performed in accordance with the applicable QA manuals. The unit commanding officer is responsible for the proper identification, accomplishment and retesting of work on their assigned ship or aircraft.

b. Intermediate level maintenance

Intermediate level maintenance is controlled by the IMA commanding officer or department head. Ship IMAs exist within the chain of command of the Type Commander. An immediate senior in command may exist between the IMA commanding officer and the Type Commander. Afloat aviation intermediate maintenance departments (AIMD) work for the ship commanding officer. However, ashore AIMDs work for the naval air station commanding officer who is outside of the Type Commander direct chain of command. Work is identified by the units being supported and validated by the associated squadron material/port engineer organization. Work is accomplished in accordance with technical specifications and platform documentation provided by the hardware Systems Commands. Funding is

provided by Fleets through the Type Commanders in O&MN operating targets for material and, in some cases, civilian salaries supporting the repair of vessels and aircraft. Some funding is provided by activities outside of the Type Commander chain of command for special manufacturing projects or for calibration managed by Systems Commands. Labor is provided by qualified military and civilian personnel assigned to the intermediate maintenance activities under Fleet claimancy; a significant civilian workforce exists at some IMAs. Quality assurance is performed in accordance with the applicable QA manuals. The IMA commanding officer or department head is responsible to the maintained unit commanding officer for the proper accomplishment of assigned work.

c. Depot maintenance

Depot work accomplishment is controlled by the depot commander or, for private sector work, an administrative contracting officer. The depots report to the hardware Systems Commands. Work is identified by the individual units, the Type Commander material staffs and the Systems Commander platform logistic manager. A platform-specific maintenance protocol or strategy is prepared and maintained by the Systems Command platform manager in coordination with the Type Commanders. Funding is provided from a variety of sources. Aviation depot funding is provided by the Naval Air Systems Command for repairs and overhauls (O&MN) and for modifications (APN). The aviation Inventory Control Point (ICP) also funds

depots using fleet provided funding for aviation depot level repairables (AV-DLR) and stock funds for manufacturing. Shipyards are funded by the Fleet for repairs (O&MN) and some alterations, and by the Naval Sea Systems Command OPN for major ("K") alterations. Labor is mostly civilian, and for public depots is costed at a rate developed under the Defense Business Operation Fund (DBOF). Rates are set to provide for recovery or appropriate rebate of accumulated operating results from year to year. Quality assurance is performed in accordance with applicable specifications promulgated by the Systems Commands. Specifications may be more rigorous than those applicable to the organizational or intermediate levels since depot repairs can involve a restoration of systems and components to a pre-established maintenance cycle condition. Quality assurance is in accordance with Systems Command quality standards and programs. In some cases, the Type Commander may specify that the Type Commander quality assurance standards be applied if depot work is done by a depot work force at the IMA location. The depot commander (or the supervising authority for private sector work) is responsible to the maintained unit commanding officer and the appropriate Systems Command for the proper accomplishment of assigned work.

3. Structure and Restructuring

Issues involving community boundaries tend to come up due to the inherent differences in the repair processes used by the ship, air, and submarine communities. The ship community in the Southwest depends heavily on the

private sector and is generally not equipped to easily handle the local workload. The aviation repair process is closely aligned with the supply system that provides repair services for many of the components removed from aircraft for repair. Aviation Integrated Logistics Support resources (trained technicians, technical publications and data, support equipment, spare and repair parts, etc.) are specifically tailored to the workload anticipated at each activity, and are pre-positioned only at the designed activities in accordance with the Naval Aviation Maintenance Program (NAMP) and Integrated Logistics Support Plans. This is call workload "pre-brokering". Aviation maintenance workload is overwhelmingly "pre-brokered", ship maintenance workload is not. This puts aviation maintenance at odds with one of the primary thrusts of RMC: emergent workload planning and real-time brokering decisions at a single waterfront location for each region [Ref. 23]. Any regional maintenance initiatives that may disrupt this well developed relationship, including the "pre-brokering" of work generates concern within the aviation community. The submarine community closely controls the maintenance performed on the boats, either through ownership of the maintenance activities or by using organic (shipyard) resources. Again, any initiatives that may affect this close control generate concern. Regionalization of maintenance will proceed only when these communities can be assured of the level of support that they now enjoy.

The chain of command for decisions and control on regional maintenance issues is often clouded with guidance and tasking coming from outside the

traditional chain of command. It is particularly difficult when tasking is given without a reference such as a message or letter, if the tasking involves action in which all commands are not ready or able to participate. Regional maintenance also involves organizations outside the fleet claimancy that may or may not be willing to be full participants in the new process. Without clear guidance from their chain of command, it is difficult to get cooperation and participation on regional maintenance initiatives.

The involvement and full participation of non-Fleet activities, such as weapon centers or other SYSCOM activities, is now based on individuals being "good citizens" rather than due to any formal tasking or direction. Generally, cooperation is forthcoming when "flag poles" are not at risk. However, the barriers go up if organizational authority, autonomy, or survival is threatened.

Finding a workable arrangement of roles and relationships is an ongoing struggle in all organizations. Miller and Friesen have characterized many corporations and public bureaucracies as "stagnant or machine bureaucracies". [Ref. 24] Stagnant bureaucracies are described as older organizations controlled by past traditions and turning out obsolete product lines. [Ref. 24] A predictable and placid environment has lulled the organization to sleep, and top management is heavily committed to old ways. Information systems are not sophisticated enough to detect the need for change. The organizational culture resists change. Lower-level managers feel ignored and alienated. [Ref. 24]

a. Overcentralization

Management literature teaches that two basic rules govern organizational design. First, strategy should determine structure. Strategy is defined as a pattern of purposes, policies, programs, actions, decisions, or resource allocations that define organization mission, what it does, why it does it and how it relates to its external environment. The second basic rule is that the organization should be as decentralized as possible. Contemporary management philosophy supports the concept that the effectiveness of large, complex organizations improves when authority and responsibility are delegated down into the organization. Of course, authority should not be arbitrarily or capriciously delegated. Decentralization requires prior clarification of the purpose or function of each administrative unit and responsibility center, procedures for setting objectives and for monitoring and rewarding performance, and a control structure that links each responsibility center to the goals of the organization as a whole. [Ref. 25]

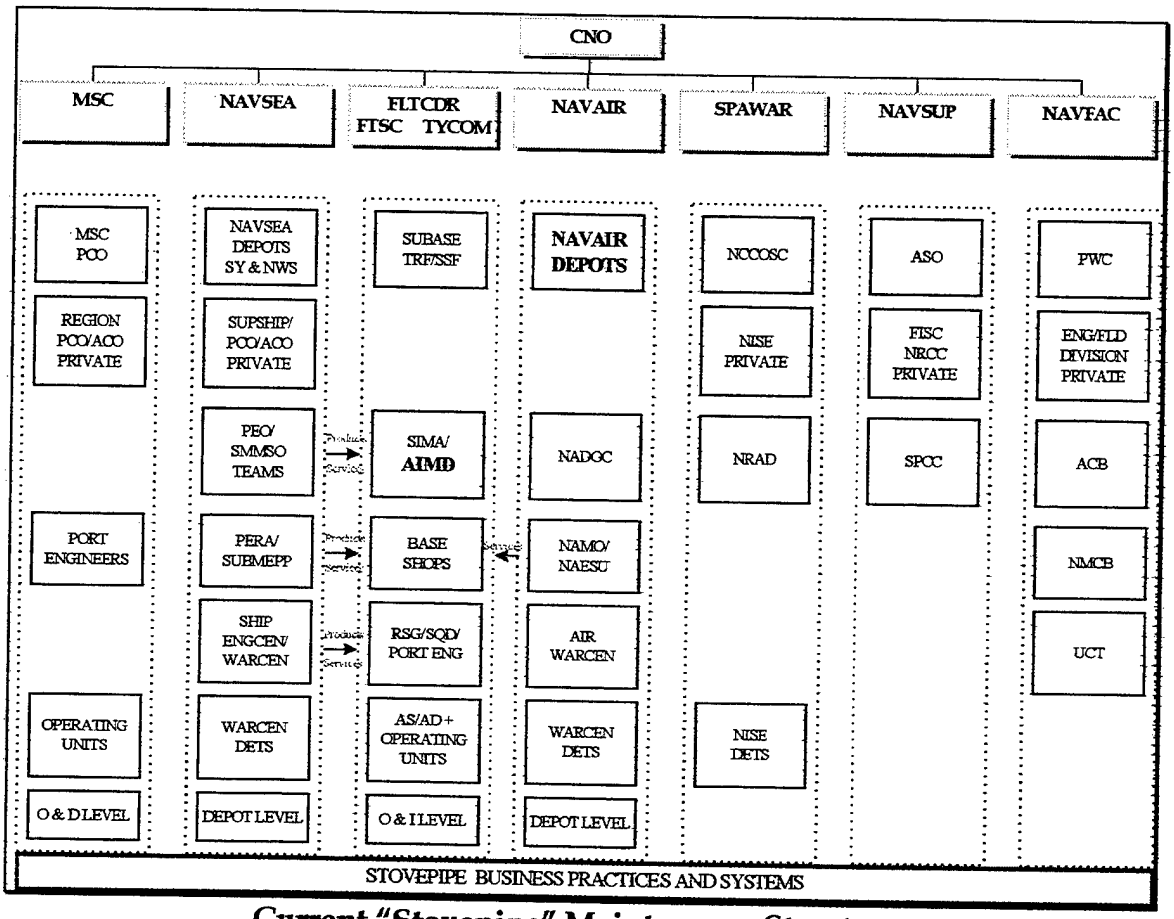
According to Robert N. Anthony and David Young, a responsibility center is an administrative unit headed by a manager who is responsible for its actions. Responsibility centers have purposes or objectives, and they use inputs (resources) to produce outputs (goods and services). The outputs of a well-designed responsibility center is closely related to its objectives. [Ref. 25]

Centralization is not to be confused with unity of command—that is, policy direction from the top, using hierarchically established goals and central control procedures. Unity of command characterizes all well-managed organizations. Rather, centralization is characterized by the use of before-the-fact controls, by rules and regulations that specify what must be done as well as how, when, where, and by whom. Decentralization is characterized by after-the-fact controls, by rewards and performance targets that are high enough to elicit the best efforts from organization personnel. [Ref. 25]

Multiple layers of formal authority remove decisions far from their source so that decision making becomes both slow and inaccurate. In what is termed "machine bureaucracy" decisions are made at the strategic apex of the organization. Machine bureaucracies have a large support staff and techno-structure; there are many layers between the apex and the operating levels. Authority and responsibility should, but do not go together. The primary structural issue is around motivating workers and initiating creativity at the operating core. [Ref. 26]

Each warfare area within the Navy organization can be viewed as a functional bureaucracy within the overall Navy machine bureaucracy. No one office (Systems Command) is responsible for overall maintenance, but each has numerous sponsors that compound the complexity of the maintenance management program. Sponsorship is uncoordinated and often represents different agendas. This complexity is shown in Figure 7.1 depicting the parallel

"stovepipes" of each Systems Command within the Navy "machine bureaucracy."



Current "Stovepipe" Maintenance Structure
Figure 7.1

The Navy has not agreed upon what the RMC end-state will look like and thus, is evolving as individual issues are debated and decided. Under the current structure the CNO owns the shipyards and the NADEPS. The CINCs own the O- and I-levels. It would seem that either the CNO or the CINCs should control Fleet maintenance and support. It is evident that the Navy does not have

an organization that yet embraces the concept of seamless three level of maintenance [Ref. 27].

b. Pressures for restructuring, reinventing, and realignment

It is important to be clear about the meaning of terms used when discussing organizational change. For the sake of this discussion, three types of changes are involved: restructuring, reinvention, and realignment. *Restructuring* is cutting everything in the organization that does not contribute value to the services delivered to customers. *Reinvention* is strategic planning and market research to move the organization toward new service delivery modes and markets; reinvent the service market strategy. *Realignment* refers to changing the organizational structure at all levels to match the new market and service delivery strategy as a means for motivating management and employees. [Ref. 28]

Why do organizations restructure, reinvent, and realign themselves? In the last thirty years organizations typically have gone for fairly long periods of time with relatively little structural change but, then have experienced intervals of major restructuring. Organizations try to retain their existing form as long as possible to maintain internal consistency and to avoid upsetting the existing equilibrium and productivity. But, if the environment changes while the organization remains static, the structure gets more and more out of touch with the environment. Eventually, the gap becomes so wide that the organization is forced to do a major overhaul. Restructuring, reinventing,

and realignment in this view, is like spring cleaning: we accumulate debris over months or years, and finally we have to face the mess. The stimulus or combination of stimuli that lead to restructuring, reinvention, and realignment include environmental changes, technology changes, significant resource reduction, organizational downsizing or "rightsizing", political changes, and leadership changes. [Ref. 26]

c. Current trends

The Cold War is over. The DoD and DoN budget is being reduced. Military bases are being closed as a result of the Commission on Base Realignment And Closure. The Bottom-Up Review calls for reduced force structure and manpower. Also, the industrial age has given way to the age of Information technology. [Ref. 25]

The dynamic changes in the world order have significant impact on the DoD and the U.S. Navy. The threat has changed, and the development of the Naval strategy "From the Sea" reflects tactical and operational changes. Infrastructure realignment has just begun. The task is very dynamic and requires a thorough understanding of numerous factors. The most influential, and probably the least understood change factors, are the current and pending changes in federal legislation by Congress. The removal of the Full Time Equivalent (FTE) is intended to allow better and more appropriate personnel actions at Naval industrial activities. The work assignment issue is still hampered by the statutory requirement to retain sixty percent of the industrial

workload in public depots. Ongoing studies such as the Quadrennial Defense Review (QDR)—mandated by Congress in the 1997 Defense Authorization Act—of "roles and missions" and the development of "core" workload requirements with associated, accurate workload levels are still in progress.

Workload assignment obviously has major impact for Naval maintenance organizations. To compound the issue, a movement towards privatization and commercialization is gaining momentum. Maintenance transition cannot wait for legislation either to be rescinded or enacted. Rather, a degree of flexibility must be maintained so that congressional decisions can be better accommodated or guided by DoD policy. A proactive strategy is needed. In DoD, strategy and policy are constantly being evaluated. The most important resource, skilled personnel, is being downsized. Labor unions, through the President's Executive Order, are in receipt of pre-decisional information from the leaders of recognized bargaining units. DoD and the Office of Personnel Management have responded to identify needs regarding performance management and appraisal. Within the Navy, the skills, knowledge and abilities of our civilian work force are being recognized by integrating depot and ship artisans with sailors so that, through training and mentorship, a world class, integrated, high performance team of civilians and sailors can be developed to best serve the needs of the Fleet.

Technology will have a significant impact on the maintenance of current systems and the design of future systems. Closing the gap on the cycle

time of technology introduction is extremely important. Studies must be initiated and brought to closure, with analysis of alternatives resulting in decisions so that production can provide for timely benefit of technology before it becomes obsolete. Applications and processes appear to be in a state of constant change to meet and support improvements in weapon systems.

Maintenance managers must better implement Reliability Centered Maintenance (RCM) and Engineering for reduced maintenance through focused engineering support organizations (SHAPEC & CFA), shop floor control and just-in-time material management. Identification of cumbersome work practices, review of the technical authority process, continuous maintenance and integrated maintenance strategies, closer customer/provider relationships, improved platform diagnostics, material initiatives, regional transportation and supply partnerships, and better repair versus replace analysis are some of the many ways to aide in solving the Navy recapitalization problem.

A new industrial management structure will require customers and suppliers to be focused on Fleet support to insure no sacrifice of quality or schedule, while reducing costs. Regional maintenance requires a close review of current maintenance processes and business rules. Privatization and commercialization must be considered as alternatives to maintaining organic skills supporting key products. The recent military personnel homebasing initiative—an effort to assign E-4 to E-9 Sailors the maximum number of tours possible in the same geographic location to improve Sailors' quality of life, add

stability and increased expertise to the regions, improve retention, and reduce permanent change of station (PCS) funding requirements—impacts ashore military industrial support. Competition may have a significant impact as other organizations, services or private sector companies challenge the maintenance system of the past. Regionalization of maintenance provides the opportunity to assess new ways of providing products and services to the Fleet.

B. FINANCIAL MANAGEMENT ISSUES

In FY 1996 Fleet maintenance funds were distributed to more than 120 activities to accomplish depot and intermediate maintenance of ships and aircraft. From a critical point of view the current financial system does not appear to support informed decision making by Navy maintenance commanders. In some cases, the financial system actually motivates inefficient and costly near-term decisions; e.g., buying more capacity from the private sector when public capacity is available and must be paid for. The problem is not an issue of industrial funding versus mission funding. Industrial funding (DBOF) provides the necessary flexibility to handle contingencies associated with Fleet operations. Unfortunately, the DBOF also provides a mechanism for absorbing the cost of a variety of initiatives at the expense of current or future programs. Alternatively, managers of mission funded activities are not cost accountable for all of the resources they "manage". Military personnel, facilities, utilities and plant equipment can be viewed as "free," and therefore, are to be accumulated rather than efficiently managed. Such "in-kind" resources conceal

the true cost of products and services. In addition, the hardware commands and program managers make decisions that consume Fleet resources, either in the near-term or long-term, but frequently without coordination with the Fleet or the understanding that decisions impacting Fleet resources. Conversely, Fleet maintenance execution decisions may impact life cycle costs.

Extraordinary effort is required to collect activity costs given the existing financial structure and accounting system capability. Most costs are retrospective. Individual maintenance managers and their chains of command do not have managerial accounting systems available to them that can address the "should cost" or "is costing" questions that arise in assessing alternative courses of action. Some change is occurring in this regard. For example, AIRPAC is moving towards a managerial accounting system to provide the capability to identify, compare and better manage the cost of Fleet products. The regional maintenance initiative provides a means to prototype the managerial accounting system that is needed to provide responsive and flexible decision making for a smaller and more austere Navy.

The Bottom-Up Review, completed in September 1993, calls for a smaller, less expensive, and more efficient defense force structure. Because of the high priority placed on "rightsizing" military structure and budget, the enormous defense support organization is also being proportionately re-aligned. Efficient financial management in both areas, force operations and force support is critical. Due to the large share of Navy funds going to force support, it is

incumbent upon maintenance managers to identify actions that can be taken to reduce the cost of supporting today's weapons to make more money available for recapitalization of Navy weapon systems.

Each dollar spent on maintenance and support competes with requirements of operating forces. It is therefore imperative that financial management in support activities emphasize efficiency and cost control to maximize the resources available to the operating forces.

AIMD North island receives funding for its maintenance support operations through the annual appropriations for Operations and Maintenance, Navy. This funding is a result of a complicated resource decision process: the Planning, Programming and Budgeting System (PPBS).

1. Planning, Programming, and Budgeting

Planning, Programming and Budgeting (PPBS) had its birth in the DoD in 1962 under Secretary of Defense Robert McNamara. In the simplest of terms, PPBS is a system designed to assist the Secretary of Defense (SECDEF) in making choices about the allocation of resources among a number of competing or possible programs and alternatives to accomplish specific objectives in our national defense. In other words, the ultimate objective of PPBS is to provide operational commanders with the best mix of forces, equipment and support attainable within fiscal constraints.

PPBS can be summarized in a few words. Based on the anticipated **threat**, a **strategy** is developed. **Requirements** of the strategy are then estimated

and **programs** are developed to package and execute the strategy. Finally, the costs of approved programs are **budgeted** in the sequence shown in Figure 7.2. [Ref. 29]

THREAT→ STRATEGY→ REQUIREMENTS→ PROGRAMS→ BUDGET

PPBS Formulation Steps
Figure 7.2

The PPBS concept was developed and installed by Charles J. Hitch, the Assistant Secretary of Defense (Comptroller) under SECDEF McNamara, in the FY 1963 DoD budget. It was a revolutionary change, and introduced the concept of programming as a bridge between the already established functions of military planning and budgeting. [Ref. 30]

PPBS differs from the traditional budgeting process which preceded it in two significant ways. First, in planning and programming PPBS tends to focus less on the existing base and more on the annual increments to it. Also, it focuses more on objectives and purposes, and long-term alternative means for achieving them. Planning assesses the threat environment in the short and long term. Secondly, PPBS brings together planning and budgeting by means of programming, a process that essentially defines a procedure for distributing available resources among the many competing programs.

The PPBS has three distinct phases.

a. Planning

The first phase of PPBS begins with a review of the U. S. national security objectives, consideration of broad strategies for dealing with the threats to national security, and development of force structures and levels that will support those strategies. Following these steps is the development of defense-wide policies with respect to manpower, logistics, acquisitions and functional areas. [Ref. 29]

Planning elements are brought together under the general direction of the Under Secretary of Defense for Policy. They represent the views of all the senior defense staff offices, including the various elements of the Office of the Secretary of Defense (OSD), the Joint Chiefs of Staff (JCS), the unified and specified commanders (CINCs) and affected staff elements of the military services and defense agencies. The broad elements of national security policy guidance are also derived in coordination with the National Security Council and the Office of Management and Budget. [Ref. 29]

The planning guidance that arises from this process is reviewed by the Defense Resources Board (DRB) to ensure that guidance represents realistic and executable direction. Upon completing the review, the Defense Planning Guidance (DPG) is signed out by the SECDEF to the military departments and defense agencies, with instructions to prepare and submit their Program Objectives Memorandum (POM) consistent with that guidance. [Ref. 29]

b. Programming

Programming is the process by which information in the Defense Planning Guidance is translated into a financial plan of effective and achievable packages (programs). Programming produces a six-year program for each service component through development of a POM and a DoD data base called the Future Years Defense Program (FYDP). The FYDP is a publication of decisions approved by SECDEF on DoD programs for a six-year period. It is an integrated and coordinated program document that displays forces, costs, manpower, procurement and construction in the approved programs. [Ref. 29]

The POM is each Service's annual recommendation to SECDEF for the integrated application of their resources (forces, personnel, material, and dollars) over a six-year period. The most recent two years of the POM become part of the President's Budget submitted to Congress. [Ref. 29]

c. Budgeting

Budgeting is the final phase in the PPBS process. The budget expresses the financial requirements necessary to support approved programs developed during the planning and programming phases. It is through the budget that planning and programming are translated into annual funding requirements. The budgeting phase is completed when the President sends his budget (with DoD) input to Congress no later than the first Monday in February. [Ref. 29]

With the submission of the President's budget to Congress the next cycle of budget negotiation and enactment begins. The objective of budget negotiation and enactment is to authorize programs and appropriate funds.

2. Appropriations

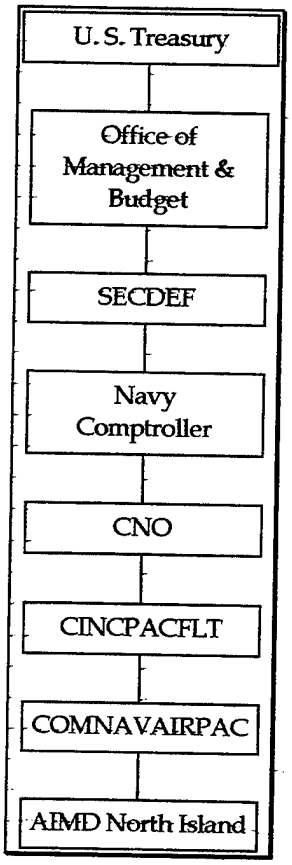
Government operations are funded by the Congress by means of annual legislation known as Appropriation Acts. Each Appropriation Act must be accompanied by an Authorization Act. The Authorization Act identifies and authorizes the purpose of programs. Appropriation provides the funding for programs. Once funding has been appropriated, budgets are executed by DoD and the Navy.

The DoD Appropriation is one of thirteen government appropriations. The appropriations that provide funding to AIMD North Island are Operations and Maintenance Navy (O&MN), and Military Personnel, Navy (MPN). Figure 7.3 shows the appropriation funding chain for AIMD North Island.

a. Operations and Maintenance, Navy

Operations and Maintenance, Navy (O&MN) provides the day-to-day operations and maintenance funds for such varied areas as flight operations, ship and aircraft maintenance, and base operations support costs. In execution, funds are distributed to major claimants (i.e., CINCPACFLT).

The O&MN appropriation is sub-divided into Budget Activities (BA) including Mission Forces, Depot Maintenance, and Other Support. CINCPACFLT has funding responsibilities in Mission Forces and Other Support



Appropriation Funding Chain for AIMD North Island
Figure 7.3

including both air and surface force requirements for the activities under its cognizance. Depot maintenance is executed in total by Naval Aviation Systems Command (NAVAIR). Funding for aviation is passed by CINCPACFLT to COMNAVAIRPAC to administer and execute.

Funding for Naval air forces support flight training, aircraft operations and aircraft maintenance. Funds provide for fuel, oil, lubricants, consumable and depot level repair parts, replacement of flight clothing and emergency equipment, active duty military mission travel, miscellaneous

supplies for squadron operation, and operations of simulators and instrumented ranges used for crew training.

Other Support funds base operations for both air and surface commands. This includes costs incurred for administration of all command departments, maintenance and repair of real property, utilities, communications, galley and bachelor quarters operations, automatic data processing, travel, minor and plant property equipment, civilian labor, transportation equipment operation and maintenance, airfield operations, recruiting, advertising, management headquarters. The Activity Group (AG), Other Base Operations Support, within the Other Support BA includes funding for AIMDs.

An Annual Planning Figure (APF) represents the target level of total funding a command may plan to receive for the fiscal year within its operating budget. An Operating Budget (OB) for CINCPACFLT is composed of funding for Mission Forces and Other Support. Separate APFs are issued for each BA within the OB. APFs may be issued by CINCPACFLT either before or after the beginning of the fiscal year, depending on many variables including the nature of the BA and whether the Appropriations Act is approved by Congress before the start of the fiscal year.

OB holders are responsible for execution of a viable financial plan, not dependent on additional funding from their major claimant, and maintained within their assigned APFs.

3. Unit Cost Concept

a. Principles

Unit cost is the foundation upon which the revolving fund concept operates. The primary goal of the unit cost process is to give managers the ability to determine and evaluate all the business costs of producing an output. In principle, reduced costs and increased productivity can be achieved through cost visibility and a focus on the mission. [Ref. 29]

First, an output must be identified to be able to assign costs. The unit cost system emphasizes using an objective measurement of the output by relating it directly to the primary mission of the activity. Although this system emphasizes a measurable output, it also recognizes that some outputs cannot be easily measured and must be treated as a level of effort. [Ref. 29]

The term unit cost per output is based on the concept that each cost incurred by a unit cost activity will find its way into some output. The goal is to have a cost identified for each output as accurately as possible so that as workload fluctuates, the revenue and costs remain in balance. [Ref. 29]

b. Terms

Outputs are subcategorized into primary and other outputs. A **primary output** reflects the primary mission of a unit cost activity. It is importune to have as few primary outputs identified as possible to avoid fragmenting the organization and defeating the purpose of managing total costs.

Outputs that have no workload measure, or outputs that do no relate to the primary output measure, are considered **other outputs.** [Ref. 29]

The cost of every product or service output consists of direct, indirect, and general and administrative (G&A) costs. **Direct costs** are those that are clearly associated with a product or output such as parts or direct labor. **Indirect costs**, such as shop supervisors, are those mission costs that cannot be identified to a single output, thus are allocated over a select number of outputs. **G&A expenses** are overhead costs that cannot readily be associated to any particular output and are arbitrarily allocated to all outputs or products. G&A costs usually include such functions as local command and control personnel, comptroller, installation security, facilities engineering, custodial services, entomology services, or other common support functions provided as part of the base operations. [Ref. 29]

All costs required to make a product or give a service are totaled and then divided by workload units produced to determine actual unit cost or cost per unit. This approach includes all direct costs of production and costs associated with the infrastructure that supports an activity in the unit cost. The objective is to highlight the cost drivers, or those activities that result in costs being incurred. Cost drivers are then evaluated to determine whether they add value to an output or result in improved customer support. [Ref. 29]

c. *Implementation*

Customer demand is the factor that determines output quantity. The DoD Comptroller sets the unit cost targets at the service level based on recommendations of the service components. The manager's primary function is to ensure that the DBOF activity provides goods and services at or below the stipulated unit cost. This ties funding levels directly to outputs. Instead of a guaranteed budget level, obligations are limited to a predetermined unit cost target times a defined output. [Refs. 29]

All of an activity's costs are allocated to primary output(s) through the cost accounting system. From this information, the activity can establish a **unit cost** per selected output. Through the budget formulation process, activities propose and are issued a **unit cost goal** or several unit cost goals for activities with multiple outputs. The unit cost goal is determined by dividing total budgeted costs by budgeted workload (outputs). The unit cost goal is what the activity tries to meet during actual execution. Rates or prices for customers are also set based on the unit cost goal. The unit cost goal times the budgeted workload gives the unit cost activity its **earned authority** or cost authority. At the end of the year, the earned authority is compared to actual total costs. If the earned authority is more than actual costs, the activity has made a profit. If earned authority is less than actual costs, they incurred a loss. The profit or loss will be taken into account when establishing next year's unit cost goal. [Ref. 29]

Unit costing is based on the relationship of resources consumed to output produced. The system seeks to have each product or output bear the cost as accurately as possible. Savings can only happen if processes are changed or eliminated and the effects of these changes result in a lower actual cost per output. [Ref. 29]

Unit cost can apply to appropriated activities. Future budgets are derived by applying a unit cost allocation to future output levels for appropriated activities. Instead of receiving a fixed operating budget, appropriated funded activities are resourced based on a unit cost goal times a budgeted level of outputs. This resource allocation method is known as **unit cost resourcing**. A baseline unit cost is determined at a fixed level of output and applied to a future output level. The future output level, whether expressed as budget or workload, may or may not be the same as in previous years. Under unit cost resourcing, appropriated activities "earn" their budgets based on the level of outputs produced. [Ref. 29]

Unit cost and unit cost resourcing embody sound management principles, consistent with modern business practices. Managing with unit cost information empowers managers, but does not make management decisions. Using unit cost is not a substitute for informed management. However, enlightened managers understand the usefulness of unit cost information.

d. Disadvantages

As with any new way of doing business, implementing and using a unit cost system has some potential pitfalls. The following are three problem areas of the unit cost system in the DoD: [Refs. 25, 29, and 30]

- **The "Death Spiral" of Demand.** Under a unit cost system, budgets and corresponding unit cost goals are based on a projected number of outputs or work units. If the projection is not realized, it could cause the activity to exceed its unit cost goal and result in a negative Net Operating Result (NOR). Since operating losses must be recovered in future year rates, the unit prices that the activity charge its customers will increase. As prices increase, customers will economize and seek out alternate sources or reduce the number of units purchased. If units produced continues to decline, the activity will have to spread fixed costs and overhead costs over fewer units driving up the prices even more. Theoretically, this spiral continues until the activity is no longer viable and goes out of business or an external financing source makes up the operating losses, eliminating the spiraling price effect. Accurately predicting workload and production units is essential to making a unit cost system work. Even then, workload sometimes does not materialize due to factors beyond the control of the activity;

- **All costs are variable costs.** Unit cost systems have a tendency to treat all costs as variable with no distinction made between the fixed and variable portions of total costs. Mangers should be aware of the level of fixed costs within their activities, because the percentage of fixed costs could have a large impact upon future funding levels. For example, under a unit cost resourcing scheme, an activity with relatively large fixed costs would generally receive excess funding as output increased. However, as output is decreased, that same activity may find it difficult to meet mission requirements when those large fixed costs are unitized over a smaller output. Likewise, an activity with a relatively smaller portion of total costs being fixed, should no expect to see as much variation in funding levels. This is provided that the output is in some relevant range where variable costs are not changing significantly.

- **Disregarding marginal costs.** Unit cost pricing may make costs higher than commercial alternatives. This can happen because commercial activities operate on a contribution margin, not solely on

average unit cost. Information regarding the change in marginal cost at different levels of output is required to make efficient management decisions. Without the appropriate marginal cost information, decisions could be made that could lead to higher rather than lower total program costs. The ultimate objective of unit cost is achievement of economic efficiency through minimizing total program costs. In an environment of declining resources, managerial efficiency is an important factor in how resources are allocated in a unit cost system.

4. The Defense Business Operations Fund

a. Introduction

The Defense Business Operations Fund (DBOF) is a revolving fund authorized by specific provision of law to finance a continuing cycle of operations. This fund concept fulfills the needs of management in regards to timely, accurate, and reliable information concerning costs and accomplishments.

Properly designed and implemented cost accounting systems are of great value to management to control costs. The complexities of modern production techniques and the large volume of transactions involved in maintaining sophisticated weapon systems have made high-speed and high-capacity automatic data processing systems absolutely essential for providing timely and accurate management information.

The cyclical concept inherent in the DBOF operation provides for the return of capital investment through billing of customers. Costs for services are identified to the specific ordering activities and are subsequently billed against the funds provided. During the time that work is in process on a given

project or job, the customer is billed (termed 'progress billing") for actual direct costs plus an estimated (applied) overhead expense recovery amount. Upon completion of the project or job, the customer is billed (termed "final billing") the previously negotiated fixed price amount or, in the case of cost reimbursable orders, the value of the actual hours multiplied by the negotiated direct and indirect rates. The variance between the final billing and the actual cost incurred is taken as a gain or loss to accumulated operating results.

The intent of industrial fund financing and accounting is to introduce, to a large extent, many of the incentives and practices prevalent in private enterprise. The DBOF System provides a wealth of information upon which to base judgements and from which can be derived data necessary for effective review and control of costs and operations. In times of austere funding and increased demand for economy and efficiency of operations, the industrial fund system is intended to afford managers the means for attaining optimum results and achieving realistic goals through the application of proven business techniques. The inherent flexibility of the fiscal structure facilitates the financing of peak loads and permits controlled retrenchment during slack periods.

In summary, the DBOF utilizes commercial accounting techniques to provide a service to management which permits the Commanding Officer to control internal operations through the medium of the accounting system.

b. Background

The Navy had a revolving fund as early as 1878. Modern day revolving fund authority is provided by the National Security Act of 1947, as amended (Title 10 U.S.C. section 2208) that allows the Secretary of Defense to establish revolving funds as a means of more effectively controlling the cost of the work performed by the DoD. The Navy Industrial Fund was established at the Naval Aviation Depots in 1962. DoD established the DBOF or Fund, on October 1, 1991. It encompasses all branches of DoD. In the Navy, the Fund includes shipyards, aviation depots, ordnance plants, ammunition depots, weapons facilities, research and development laboratories, printing plants, public works centers, missile facilities, test centers, and others. The Depot Fund consists of an initial allocation of cash from the United States Treasury; accounts receivable; inventories of materials and supplies, work-in-process, and other current assets; subject to liabilities assumed at inception plus those subsequently incurred in support of current operations.

Many of the basic tools of dynamic management are included in the DBOF System. It employs the commercial-type system of accounting, with production and overhead-type job orders for accumulating labor and material costs by performing or benefiting cost centers, and use of standards of performance and cost. DBOF uses accrual accounting, i.e., a system that records transactions in the same period in which they occur. It has a commercial-type balance sheet and income and expense statement for reporting current status of

the fund and results of operations. The budgetary system is linked to the accounting system to enable plant managers to follow the course of operations and provide a logical and reliable means of measuring progress against plans.

c. *Objectives of the Fund*

The DBOF concept has three important features that are intended to encourage better management and stimulate efficiency similar to private industry:

- **Contractual Relationship.**

  a) A contractual relationship is created between the customer and the producer (NADEP), causing the producer to accurately define all tasks to be accomplished, to accurately forecast all costs associated with these tasks, and to quote the customer a fixed price in most cases.

  b) The customer must provide funds for the cost of their requirements just as when they buy from commercial firms. As a result, the customer is motivated to order only those items and services for which there is a real need.

- **Identifying Costs for Specific Jobs.** Cost accounting employed by DBOF activities enables management to identify costs to a particular job. This identification is essential to:

  a) Establishing management control of costs

  b) Developing standards for pricing

  c) Providing a means of projecting realistic budgets based on expected future workloads

  d) Providing a means of measuring efficiency since all work performed is expressed in one common denominator—dollars.

- **Flexibility of Revolving Fund.** A revolving fund provides flexibility to utilize dollars as operationally required. Money is centralized under local jurisdiction.

    a) While the reason for adopting a DBOF System was to create an environment conducive to more responsible and efficient management, the DBOF System is no more effective than the manager's ability to use the tools it provides. Therefore, it is very important that the Depot manager be familiar with the financial operation and accounting employed in the DBOF.

The desired benefit is that the DBOF reimbursable concept will increase cost visibility to both the customer and provider, and that both are better able to make informed decisions as a consequence. The goal of DBOF is to produce a management structure that provides incentives to managers and employees of DoD business organizations to provide products and services at the lowest cost. For the customer, reduced production costs translate to reduced prices. This enables the customer to more effectively accomplish assigned missions within the resources available.

d. Concept

DBOF is a revolving cash management fund and not a physical entity or corporation. It functions as an accounting and financing mechanism, much like appropriated funds are a financing mechanism. However, unlike the allocation of funding in the Resource Management System driven by appropriations, activities financed by the DBOF do not receive an annual appropriation. Instead, they receive unit cost goals and earn cost authority for the amount of every customer order accepted. As DBOF activities accept these

orders and perform work for their customers, they use cash in the DBOF to pay for their costs. Customers are then billed based on stabilized rates and the customers reimburse the DBOF. This revolving cycle continues, hence the DBOF is considered a revolving fund.

The DBOF combines individual revolving funds into a single revolving working capital fund. This initial capital funding was started by Congress with a funding corpus. When a customer needs a service performed, they submit a customer order to the activity to perform the services. The activity finances the cost of the material, personnel, and any other costs to start the work. The customer is billed when the work is completed or as it is being completed. The customer then pays the bill by reimbursing the working capital fund. Prices for goods and services produced set on a break-even basis over the long-term. [Ref. 29]

Each DBOF activity submits an operating budget and a capital budget. Separation of capital investments and operating costs provides management with increased visibility and identification of operating and capital costs and identifies total cost of the business area.

DBOF activities incur costs differently than appropriation funded activities. Instead of receiving a funding document that provides fixed budget authority for a specified period of time, the amount of orders from customers determines the earned cost authority of each DBOF provider. Each DBOF activity manager is expected to hold costs within the product of the approved

unit cost goals times the actual work load or number of work units produced. DBOF managers can make trade-off decisions to minimize costs and maximize output.

The DBOF is composed of the business areas that were included with the old industrial funds, stock funds and some additional Defense Agency functions determined to be to utilize the DBOF business management approach. Navy related business areas absorbed in the Fund through FY95 included:

- Base Support
- Depot Maintenance
- Distribution Depots
- Information Services
- Logistics Support
- Printing
- Research and Development
- Supply Management
- Transportation

e. Link to customer budgets

During budget formulation, Components are responsible for balancing DBOF business area budgets with the customers' appropriated budget requirements. Components develop proposed budgets for both appropriated fund activities and DBOF business areas and submit them to the Under Secretary

of Defense, Comptroller (USD (C)) for review. Customers determine and justify their anticipated requirements for goods and services and levels of performance they require from the DBOF business areas to fulfill mission objectives. Customer budgets are developed using projected rates and prices published by the DBOF business areas. Because the customer-financing mechanism exerts a controlling influence on the size of the DBOF business areas, it is essential that customers identify and submit accurate budget requests to their component headquarters. If customers inaccurately state their requirements for DBOF-financed goods and services, they may receive insufficient appropriated funds to meet mission requirements.

On the DBOF side, inaccurate customer requirements data could cause managers to inappropriately "size" the DBOF's business area operations (e.g., personnel, overhead, material, operating and capital budgets). Because DBOF business areas cannot "resize" their infrastructures "overnight" to accommodate significant changes in customer orders, having good projections of requirements enables business operations to successfully meet their customers' needs in a timely manner.

f. Budgeting at depot maintenance activities

Annual operating budgets are submitted as mandated by OMB Circular A-11. Depot maintenance activity budgets are developed in accordance with USD (C) guidance, as perpetuated in DoD 7000.14R (Financial Management Regulation) volumes 2A and 2B and NAVCOMPT NOTE 7111. The DBOF

budget contains both an operating budget section and a capital budget section. The operating budget section contains the unit cost and all operating expenses. The capital budget contains the amounts for depreciable capital investments. Depreciation expenses are factored into the rates charged to DBOF customers and are reflected in the operating budget section of the annual operating budget.

Depot maintenance activities electronically transmit their budgets directly to the Assistant Secretary of the Navy (Financial Management and Comptroller) (ASN (FM&C)) into the Navy Industrial Fund Reporting System (NIFRS). ASN (FM&C) operates the NIFRS and maintains a budget and execution data base for use by management commands, ASN (FM&C) evaluations, and DoN and USD (C) budget formulation and reporting.

g. Billing for customer work

NADEP employs two methods for billing customers for work accomplished: cost reimbursable and fixed price. Both are used to recover total costs incurred in support of a customer orders. Differences between the two methods hinge on the activity's ability to adhere to previously budgeted estimates and on the degree of risk it is will to accept.

The **cost reimbursable** approach essentially involves accumulating direct, indirect, and G&A costs in such a manner as to allow progressive charging of costs to a customer as work is accomplished. Work in support of nonfederal government entities, such as local governments and foreign military sales, all charges are calculated based on actual costs.

The **fixed price** customer order approach involves an agreement between an activity and its customer to perform specific work for a specific fixed price. These customer orders normally evolve from negotiations between the customer and the activity.

Under both cost reimbursable and fixed price, the charge to the customer is intended to be based on a stabilized rate per unit plus actual costs incurred for items like direct contracts and materials. Charges to customers by either approach are either based on inputs to or outputs of the process. Inputs would include such factors as hours worked or materials consumed while outputs would include products or services produced.

It is worth noting that for non-supply DBOF activities there is no national output pricing system. The price charged for a standard productive process in a Depot Maintenance activity on the East Coast is not the same as charged on the West Coast. Given similar efficiencies for inputs and similar sizes for two activities, their charges to customers vary based upon the cost of inputs including regional wage scales, regional raw material costs, and regional utility costs. Each activity seeks to recover its own costs independently.

h. Stabilized rates

The OSD performs the vital functions of controlling the DBOF, approving unit cost rates and establishing the "stabilized rate." The stabilized rate is the rate that customers must pay for services acquired from DBOF activities. This brings the full cost of providing a service in view of the customer

and provides an incentive to procure services only when needed and at the best rate possible.

The stabilized rate is a compilation of a charge for services plus or minus a surcharge to bring the DBOF back to a break-even status. For example, if the Fund has collected profits and is over its desired level, OSD will reduce the stabilized rate so that customers enjoy the return of the profits. Similarly, if the Fund is under the desired level then the stabilized rate is increased to make up the losses through increased customer payments.

The principle objective of stabilized rates is to shelter DoD customers from wide price variances due to cost escalation (inflation) as compared to budgeted prices. This allows DoD and the Navy to better manage execution of its programs. DBOF rates charged for services are based upon the DBOF portion of the President's Budget.

Individual activities construct their budget submissions during early spring and submit these budgets together with proposed rates to their Management Commands (i.e., NAVAIR). The budgets are reviewed and adjusted by the Management Commands during May and June, then submitted to ASN (FM&C) before going to DoD in September. DoD reviews these budgets and makes adjustments right up to the end of December at which point they are incorporated into the President's budget for submission to Congress in January. Original rates proposed by the activities, during the April time frame, have to be modified to incorporate changes made by Management Commands, ASN

(FM&C), and USD (C). This update is normally accomplished in early spring of the following year. Consequently, stabilized rates are not announced to customers until the April/May timeframe, which hinders the budget planning process.

Since Navy customer budgets are priced from the "bottom up," it is important to note that the DBOF rates for the President's Budget are not available to customers when the President's Budget is being prepared. Rather, they become available a year later, in time for the construction of the apportionment year column of the next year's President's Budget.

While ASN (FM&C) tries to balance customer and DBOF activity funding in the President's Budget, the process in reality is managed at a level much further beyond that of the local customer budget. The imbalances that inevitably occur come to light in apportionment. In effect, although the program stabilizes rates almost two years ahead of time, stabilization for the local activity level customer happens a year later than is needed to program its goal efficiently.

The essence of rate stabilization is that annual rates are set for the entire fiscal year. The result of combining rate stabilization and activity budgeting has created a situation wherein the rates ultimately charged reflect modifications by the Management Commands, ASN (FM&C), and USD (C). As a consequence, individual DBOF activity commanders have lost the ability to directly determine or change rates once an error has been observed in execution.

In fact, DBOF activities are told what factors to employ during budget construction and subsequently modify rates prior to execution.

C. SUMMARY

This chapter has examined the Navy maintenance organizational structure and financial management policy, and aspects of each that are impeding progress in the effort to consolidate the calibration laboratories at NAS North Island. The traditional platform-based organizational structure and maintenance strategies were analyzed. It was shown how the "split job responsibility" approach does not fit the decentralized RMC model consisting of RRCs that provide repair service to multiple platforms. Additionally, the two funding and accounting systems were described and how cumbersome and inefficient it is to operate and manage maintenance with both mission and DBOF funding at a consolidated RRC. It is important to note that the current accounting systems make it nearly impossible to provide an accurate cost benefit analysis regarding consolidation thus, the current financial system does not appear to support informed decision making.

The final chapter will summarize the findings of this thesis, present conclusions based on the findings, and give recommendations in regard to consolidation of the calibration laboratories at NAS North Island and further research required to realize the full benefits of Regional Maintenance.

VIII. FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This thesis has analyzed the present state of the consolidation effort between the Naval Aviation Depot and Aircraft Intermediate Maintenance Department calibration laboratories at North Island, CA. In doing so, the benefits, actual and potential, as well as the drawbacks, of collocation and consolidation have been compared. The analysis has centered on the two primary issues impeding full integration of the calibration laboratories into a Regional Repair Center: the Navy maintenance culture and organizational command structure; and the differences in funding sources and accounting systems. The following is a summary of our findings, conclusions, and recommendations for follow-on research.

A. FINDINGS

1. Manpower Reductions

The total number of military and civilian calibration technicians has decreased as a result of consolidating AIMD Miramar and North Island calibration laboratories. Nine military and eleven civilian billets were eliminated from Miramar, of which North Island gained one billet to increase to 24 technicians. Although not in the calibration laboratory, the eleven civilians were rehired at NADEP North Island. There were no personnel reductions as a result of the collocating AIMD and NADEP North Island calibration laboratories.

2. Training Enhanced

The consolidated I-level site exposes technicians to components from a larger variety of aircraft since a single, larger calibration laboratory is servicing aircraft from more than one Naval Air Station, rather than just the components peculiar to the aircraft serviced by an individual AIMD. NADEP artisans are providing informal on-the-job training to the military technicians. This "cross-training" better prepares the military technicians to accomplish the mission at sea. If formal training is desired, the requirement must be included in the depot artisans' position description (PD).

3. Calibration Standards Reduced

The number of calibration standards between AIMD Miramar and North Island was reduced approximately five percent as a result of their consolidation. The disposition of the standards is not known, therefore actual dollar savings from their inactivation or disposal could not be identified. The number of standards did not change as a result of the collocation of AIMD and NADEP North Island.

4. Facilities Not Streamlined

As a result of BRAC 1995, the Navy is moving out of NAS Miramar and the Marines are moving into Marine Corp Air Station Miramar. The facility that housed the calibration laboratory at AIMD North Island is being used by other divisions within AIMD. The NADEP calibration facility floor space is more

efficiently utilized as a result of collocating the I and D-level calibration laboratories; facility modifications were not required to accommodate the I-level calibration laboratory.

5. Unchanged Responsiveness

The consolidation of AIMD Miramar and North Island and collocation to NADEP North Island has been transparent to their customers. There is a single indication of productivity improvement, as the AIMD backlog of TTU-205s has been reduced. Turn-around-times have neither increased nor decreased.

6. Automated Information System Inadequacies

AIMD and NADEP each utilize various and different data bases and information systems, therefore it is difficult for them to share technical and management data. This fragmentation of data and information systems is inefficient and inadequate to support Regional Maintenance.

7. Two Chains of Command

Although the I- and D-level calibration laboratories have collocated, each has maintained a distinct and separate internal chain of command. In this respect, no change (streamlining) has occurred in maintenance management as a result of Regional Maintenance.

8. Two Funding Sources and Accounting Systems

NADEP North Island is a DBOF activity and is funded by NAVAIR. AIMD North Island is mission funded and receives appropriated funding from

CINCPACFLT. All personnel interviewed said they would prefer one type of funding. Extraordinary effort is required to collect activity costs given the existing financial structure and accounting system capability.

B. CONCLUSIONS

1. The Environment of Regional Maintenance Implementation

Regional Maintenance is not occurring in a vacuum. Other dynamics such as BRAC and Fleet reductions makes it difficult to state, with any precision, how much of the reductions are due to regional maintenance. It is very difficult to isolate benefits and costs of regional maintenance because, in terms of infrastructure and billets, there are several related dynamics at play including Base Realignment and Closure, in which fifty percent of the Navy shipyards and NADEPs will be closed, as well as tender drawdown, and Regional Maintenance.

2. Where are the Savings?

Unless buildings are leased, sold, or demolished after they are vacated due to RMC there will be no significant cost savings or avoidances. Similarly, true savings cannot be realized if personnel are redistributed throughout the Navy and DoD. Billets (military and civilian) must be cut and personnel discharged. Excess equipment must be deactivated or disposed if savings are to be realized from consolidation of maintenance capacity. If the Navy takes the

savings and redistributes them during the PPBS process, then there is no reduction in the Navy Total Obligation Authority, and hence no true savings.

3. Military Shore billets are Critical to the Navy Mission

Maintaining sufficient shore billets to support sea-shore rotation is critical to the retention and enhancement of sailor technical skills, quality of life, and contribution to fleet material readiness. Military billets within a region should not exceed the sea-shore rotation needs of the afloat Navy. All things considered, where workload exceeds the capacity of military maintenance personnel ashore, civilian personnel could be assigned or the maintenance outsourced. However, extreme care must be exercised in identifying excess manpower capacity so as not to eliminate too many key shore billets.

4. Military Resiliency is Decreased

Collocation and consolidation of maintenance facilities will leave geographical areas more susceptible to a larger loss in the event of a disaster (i.e., fire, earthquake). Although this should not halt implementation of regional maintenance, it should be considered and contingency planning should take place accordingly.

5. Distinction between I and D-levels Blurred

Under a consolidated management structure, the distinction between I- and D-levels become blurred. While this may be intended by the Regional Maintenance Concept, it could cause problems. The Naval Aviation

Maintenance Program (NAMP) is based on three distinct levels of maintenance, each with a different level of capability. Of which, I-level is key to Navy forward deployment and sustainment. RMC decisions may, inadvertently, violate NAMP business rules. Each platform has a different maintenance strategy and operates under a specific set of rules. Regionalization of maintenance will proceed only when these communities can be assured of the level of support that they currently enjoy.

6. No Cost Visibility

The current financial system does not appear to support informed decision making by Navy maintenance commanders. DBOF provides the necessary flexibility to handle contingencies associated with Fleet operations, but unfortunately, it also provides a mechanism for absorbing the cost of a variety of initiatives at the expense of current or future programs. Individual maintenance managers and their chains of command do not have managerial accounting systems available to them that can address the "should cost" or "is costing" questions that arise in assessing alternative courses of action. The lack of cost visibility, can, and does, lead to some choices that appear to be good for the customer, but are actually the more expensive option for the Navy and the taxpayer. The existing system does not provide sufficient cast and decision accountability.

7. Philosophical Differences and Parochialism

Philosophical differences among the warfighting communities and organizational parochialism are complicating efforts to implement Regional Maintenance, and hence the end-state continues to evolve. The participants in Regional Maintenance have been identified (i.e., aviation, ship, and submarine communities) but, the exact nature and level of participation of each has not. The chain of command for decision and control on regional maintenance issues is often clouded with guidance and tasking coming from outside the traditional chain of command. Without clear guidance from their chains of command, it is difficult to get cooperation and participation on regional maintenance initiatives.

C. RECOMMENDATIONS

Theoretically, there are scale economies to be achieved from consolidating the I and D-level calibration laboratories into a Regional Repair Center at NAS North Island. Although the previously listed findings may project a "glass half empty" viewpoint, calibration laboratories are an area where Navy Maintenance can be more effective, efficient, and economical. Consolidating redundant calibration laboratories can provide benefits and savings to the Navy if vacated facilities are leased, sold, or demolished, billets are cut based on workload requirements, excess calibration standards are deactivated or salvaged, and by process improvements. However, before successful consolidation can be achieved and benefits realized, a consistent budgetary process is necessary and the issue of command and control should be resolved.

Following is a list of areas requiring further research to assist in determining the advisability of changing the existing system of Naval Maintenance and resolving the impediments to implementation of RMC.

- **RMC and Title 10 issues:**

  a) Section 2464 requires that DoD maintain logistics capability—including personnel, equipment, and facilities—to ensure a ready and controlled source of technical competence and resources necessary for an effective and timely response to mobilization, national defense contingency situations, and other emergency requirements;

  b) Section 2466 (60/40 law) requires no more than forty percent of the funds made available in a fiscal year to a military department or Defense Agency may be used to contract for the performance by non-Federal Government personnel. The blurring of the distinction between maintenance levels associated with regional maintenance could make this provision problematic. Similarly, changing current funding structures could amplify this problem;

  c) Section 2469 requires public/private competition if depot-level workload, valued in excess of 3 million dollars is to be moved from a public to a private source of repair and merit based procedures if workload is to be moved between Navy organic depots. Blurring of the levels of maintenance could lead to problems if I-level workload, performed at a depot, is really I-level and not subject to these provisions;

  d) Section 2216 requires SECDEF to maintain the separate identity of each fund and activity managed through DBOF that was managed as a separate fund or activity before the establishment of the Fund.

Research is required in these areas to assess the impact Title 10 has on RMC.

- **Unit Costs and Mission Funding:** A core management requirement for any business is the ability to know the costs associated with producing a product or service. It is very difficult and labor intensive to extrapolate cost data at mission funded activities and is one of the

reasons for moving toward DBOF. The current initiatives to improve cost visibility at mission funded activities should be studied and the feasibility of using only mission funding for RRCs.

- **Accounting System Compatibility:** Mission funding verses DBOF—which is right for RMC? It is inefficient and cumbersome to operate and manage RRCs under two financial systems. Are either of the two current systems better suited for Regional Maintenance or should both be maintained? If one is, what types of changes would be necessary to migrate to the single financial system.

- **Automated Information Systems:** Study the current maintenance management data systems and feasibility of migration to a fully compatible system with common data elements.

- **Management of Regional Maintenance:** Management of Navy maintenance is currently accomplished within the several platform "stovepipes", relying heavily on the Systems Commands to provide support, control and maintenance strategies with which to articulate and control basic platform modernization, configuration and maintenance requirements. RMC calls for Systems Commands to realign and interface the requisite support and control mechanisms at all stages and levels of the integrated Fleet maintenance management model. What are the possible end states for command and control of Navy Maintenance under RMC and which best meets the current requirements from each platform area.

- **RMC and Life Cycle Costs:** How does RMC affect life cycle costs of Navy weapon systems? The NAMP employs three levels of maintenance, each with a different level of capability. Whereas, surface ship maintenance capitalizes upon multiple alternative repair sites, each capable of meeting fleet requirements. Aviation maintenance policy is designed to minimize life-cycle weapon system support costs. Although it appears that the surface fleet can reduce support costs through RMC, what is the impact on aviation life cycle support costs where rules currently exists to reduce redundancy between the different levels of maintenance?

- **RMC and Level of Repair Analysis:** How does RMC affect the current Level of Repair Analysis (LORA) in the weapon acquisition process? In aviation maintenance, it is decided during the Logistic Support Analysis and Maintenance Planning early in the weapons system acquisition cycle, where an item is going to be sent when it

needs repair based on numerous factors including capability, turn-around-time, and costs. Resources are specifically tailored to the workload anticipated at each I- and D-level maintenance activity, and are prepositioned only at the designated activities according to the approved Integrated Logistic Support Plans. Regional Maintenance blurs the boundaries between I- and D-level repair. How does the notion of "one level of maintenance ashore" affect "pre-brokering" of aviation maintenance?

- **Potential Regional Repair Centers:** the following repair areas should be studied to determine the feasibility of consolidating redundant and excess capacity and the potential benefits that can be realized by establishing a RRC for each under RMC.

  a) Diesel engine and small boat repair
  b) Air Conditioning and Refrigeration CFC Removal
  c) Antennae Repair
  d) Avionics/Micro-miniature Repair
  e) Automated Test Equipment
  f) Corrosion Control
  g) Cryptographic Equipment Repair
  h) Electro-plating
  i) Electric Motor Rewind
  j) Flexible Hose Repair and Fabrication
  k) Machine Shops
  l) Hoist Repair, Weight Testing and Re-Certification

APPENDIX A

NADEP FUNCTIONAL ORGANIZATION AND RESPONSIBILITIES

Generally, NADEPs are organized as matrix organizations. Functions can be thought of as imposed across the horizontal axis while the Program Management Team responsibilities cut through the organization across the vertical axis. Each functional manager provides services (manpower) to the program managers. Figure A.1 shows NADEP as a matrix organization.

	Functional Areas						
Programs	Production & Support MNGT	Industrial Planning	Operations Planning	Industrial Technology	Corporate Operations	Logistics	Engineering
S-3							
E2/C2							
Components							
F-14							
F/A-18							
Field Service Voyager Repair Calibration							
Manufacturing							
Aircraft Services							

NADEP North Island as a Matrix Organization
Figure A.1

NADEPs operate with both military and civilian personnel. The military billets are at the management level above the department level and report

directly to the Commanding Officer (CO) and Executive Officer (XO).

The command level is the first major element of organization followed by the departments. Each department is subdivided into divisions, branches, sections (if necessary), units (known as service departments) or shops (production department) in descending order. The organization structure is shown in Figure A.2.

1. Commanding Officer (CO)

The Commanding Officer (CO) is charged by COMNAVAIRSYSCOM to accomplish the mission and directing the operations of the NADEP.

2. Executive Officer (XO)

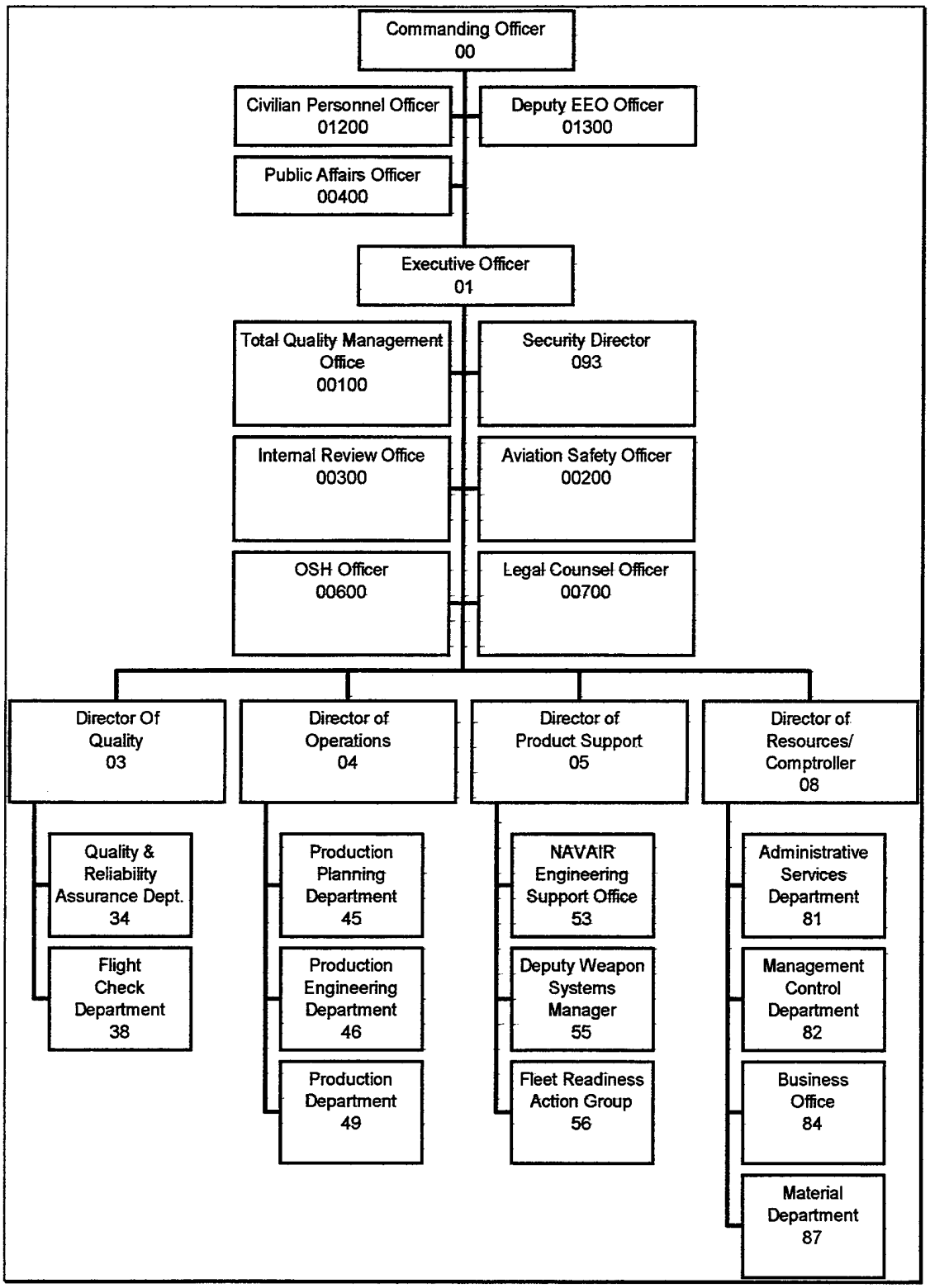
The Executive Officer (XO) assists the CO in performing command duties and supervises the overall functions of the depot through subordinate positions. The XO also determines apportionment of military billet allowances and is responsible for supervising efforts and promoting harmony and cooperation throughout the organization.

3. Legal Counsel Office (00700)

The Legal Counsel Office provides legal services, including business and commercial law, to the command and its field activities.

4. Occupational Safety and Health Officer (00600)

The Occupational Safety and Health Officer acts as special assistant and advisor to the CO with the responsibility for developing and directing a



Naval Aviation Depot Organization Chart
Figure A.2

comprehensive Occupational Safety and Health (OSH) Program (excluding aviation safety). The program includes, but is not limited to, interpretation of safety standards, ensure safe work methods, perform safety inspections on equipment, accident prevention, investigation, and analysis, education and training programs, liaise with the aviation safety officer, and manage the Navy Occupational Safety and Health Deficiency Abatement Program and Hazardous Materials Control Programs.

5. Internal Review Office (00300)

The Internal Review Office administers the internal audit service for the command to ensure integrity of existing systems, methods, and procedures. They are responsible for analyzing the cost accounting system to assure proper classification, presentation and processing cost control information into the Financial Management Program for the facility.

6. Aviation Safety Officer (00200)

The Aviation Safety Officer serves as staff advisor to the CO and is charged with developing and implementing a comprehensive aviation safety program within the depot.

7. Total Quality Management Program Office (00100)

The Total Quality Management Program Office coordinates and manages the implementation of the total quality management (TQM) throughout the depot.

8. Deputy Equal Employment Opportunity Officer (01300)

The DEEOO advises and educates management on methods of addressing system barriers, identifying potential problems, analyzing the impact of agency policy, and applying motivational techniques which improve EEO attainment through job structuring, promotions, training, etc.

9. Public Affairs Officer (00400)

The Public Affairs Officer serves as advisor to the CO in relationships with civic groups and external industrial professional and government organizations. They coordinate both an internal and external communication systems to keep employees and outside organizations informed of activities and special events.

10. Security Director (093)

The Security Director manages the security programs for the depot including classification management, coordinating physical security with the host air station, personnel and ADP security, and education and training of employees on security matters.

11. Civilian Personnel Officer (01200)

The Civilian Personnel Officer (CPO) of the air station is designated as CPO for the depot on a collateral basis. The CPO provides comprehensive civilian personnel staff services to all elements of the depot and serves as consultant to top management on matters affecting civilian personnel

administration.

12. Director of Quality (03)

The Director of Quality oversees and coordinates the efforts of the Quality and Reliability Assurance (Q&RA) Department (34) and the Flight Check Department (38).

a. Q&RA Department

The Q&RA Department is the focal point for technology advances and continual improvement in quality. They assure low variability in production of quality products and service by evaluating and determining the capability of systems and processes.

b. Flight Check Department (38)

The Flight Check Department coordinates all aspects of the functional check flight program.

13. Director of Operations (04)

The Director of Operations advises the CO on production management issues and exercises operational oversight of the Production Planning Department (45), Production Engineering Department (46), and the Production Department (49). The operations director recommends changes in policy and procedures which will improve the effectiveness of production operations.

a. *Production Planning Department (45)*

The Production Planning Department carries out the production

planning, schedule and control program encompassing the total production assignments of the depot. In addition to their daily relations with the production department's operations, the production planning department plays a significant role in improving systems and management controls.

b. Production Engineering Department (46)

The Production Engineering Department determines processing batch sizes to achieve optimum sequence of operations and any special tooling and equipment requirements then provides the Production Planning Department the necessary data for use in establishing workload commitments and production schedules.

c. Production Department (49)

The Production Department controls the daily workload and schedule assigned to the depot. All other departments exist to support the production effort in producing products of acceptable quality on schedule at minimum cost.

14. Director of Product Support (05)

The Director of Product Support oversees the efforts of the Product Support Directorate (PSD) (53), the Deputy Weapons System Manager (WSM) (55), and the Fleet Readiness Action Group (56).

a. Product Support Directorate (53)

The Product Support Directorate keeps the entire maintenance,

logistics, and modification program in balance so as to maximize readiness and achieve the most efficient use of resources. They have design and maintenance engineering cognizance of assigned weapon systems and equipment and provide worldwide engineering support for designated systems, components, and equipment.

b. Deputy Weapon Systems Manager (55)

The WSM performs management and integration of the material acquisition and logistics support functions for the total aircraft or weapons systems. The WSM has a direct channel to COMNAVAIRSYSCOM and other commands to accomplish orderly and timely weapons systems management functions.

c. Fleet Readiness Action Group (56)

The FRAG is a functional unit within the DEPOT that assists in resolving COMNAVAIRSYSCOM, Navy Supply, and fleet operating squadrons support problems relating to maintenance and supply.

15. Director of Resources/Comptroller (08)

The Director of Resources/Comptroller advises the CO on matters concerning material management and administrative services and recommends changes in policy and procedures which will improve its effectiveness. The Director of Resources/Comptroller manages the operations of the Administrative Services Department, the Management Control Department, the

Business Office, and the Material Department.

a. Administrative Services Department (81)

The Administrative Services Department serves as an integrating force throughout the depot by providing administrative office and personnel support services and other functions not performed or provided by the host air station.

b. Management Control Department (82)

The Management Control Department aides the CO and his staff in planning for and use of money, manpower, material and facilities in support of assigned programs and tasks. They provide the needed training, coordination, and project execution for documentation of all realized cost reductions.

c. Business Office (84)

Strategic and Business Planning are the two predominate functions of the Business Office. They are the primary focal point in assessing the future shape of depot maintenance, developing business strategies and instituting tactical plans to achieve long range strategic objectives.

d. Material Department (87)

The Material Department is responsible for the acquisition, receipt, distribution, storage, issuing, inventory control and analysis, excessing, and quality assurance of material support throughout all departments in the depot.

APPENDIX B

NAVY MAINTENANCE AUTOMATED INFORMATION SYSTEMS

SYSTEM	ACRONYM	PROGRAM SPONSOR	RESOURCE SPONSOR
Automated Technical Information Support System	ATIS	SEA 04	N865, N871, N885
AUTOSPEC Users System	AUS	SEA 071 AIR 3.0	N43, N881, N87
Baseline Advanced Industrial Management	BAIM	N43	DUSD(L)
Calibration Recall Information System	CRIS	SEA 04	N43
Computer Aided Design 2	CAD-2	SEA 071 AIR 3.0	
Executive Information System	EIS	JLSC	DUSD(L)
Facilities Equipment Maintenance	FEM	JLSC	DUSD(L)
Fleet Modernization Program Management Information System	FMPMIS	SEA 04	N43
Hazardous Material Management System	HMMS	JLSC	DUSD(L)
Interservice Material Accounting Computer System	IMACS	JLSC	DUSD(L)
Integrated Condition Assessment System	ICAS	N43	N88, N86, N853
Joint Computer-aided Acquisition and Logistics Support	JCALS	N43	N43, DUSD(L)
Joint Engineering Data Management Information and Control System	JEDMICS	N43	N43, DUSD(L)
Laboratory Information Management System	LIMS	JLSC	DUSD(L)
Maintenance Resource Management System IMA	MRMS-IMA	N43	N62
Maintenance Resource Management System TYCOM Representative Component	MRMS-TRC	N43	N62
Manufacturing Resource Planning II	MRP II	JLSC	DUSD (L)

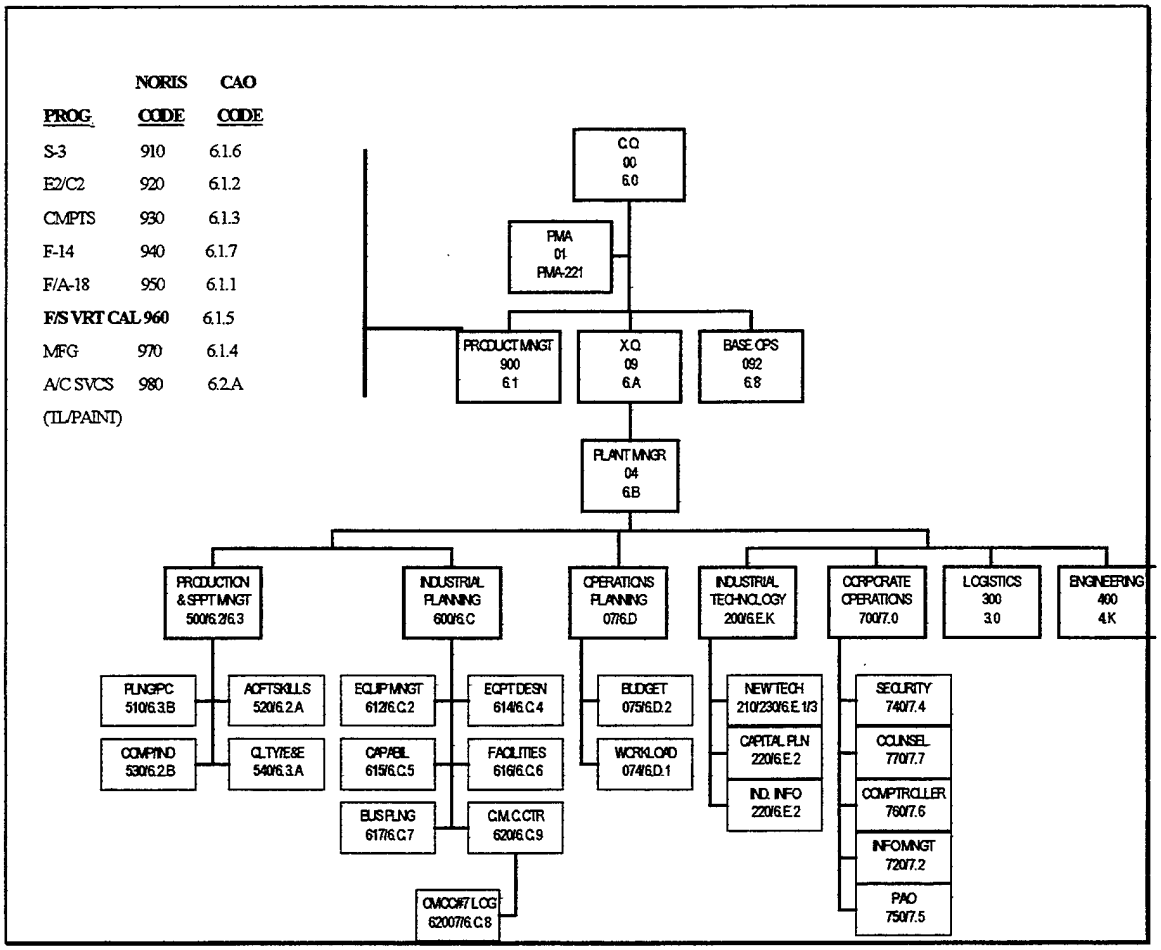
Naval Aviation Logistics Management Information System	NALCOMIS	N881	N62
Open Architectural Retrieval System	OARS	SEA 04	N43
Organizational Maintenance Management System	OMMS	N43	N62
Programmed Depot Maintenance Scheduling System	PDMSS	N43	DUSD(L)
Shipboard Uniform Automated Data Processing System	SUADPS	N41	N62
Ship Configuration and Logistics Support Information System	SCLSIS	SEA 04	N43
Shipboard Non-Tactical ADP Program	SNAP	SEA 04	N62
Total Availability Management System	TAMS	SEA 04, SEA 07, AIR 6.0	N43, N881, N87
Trident Logistics Data System-Planned Maintenance Management System	Trident LDS-PMMS	N87	N87
Trident Logistics Data System-Refit Maintenance Management System	Trident LDS-RMMS	N87	N87
Uniform Automated Data Processing System	UADPS	N41	N41

APPENDIX C

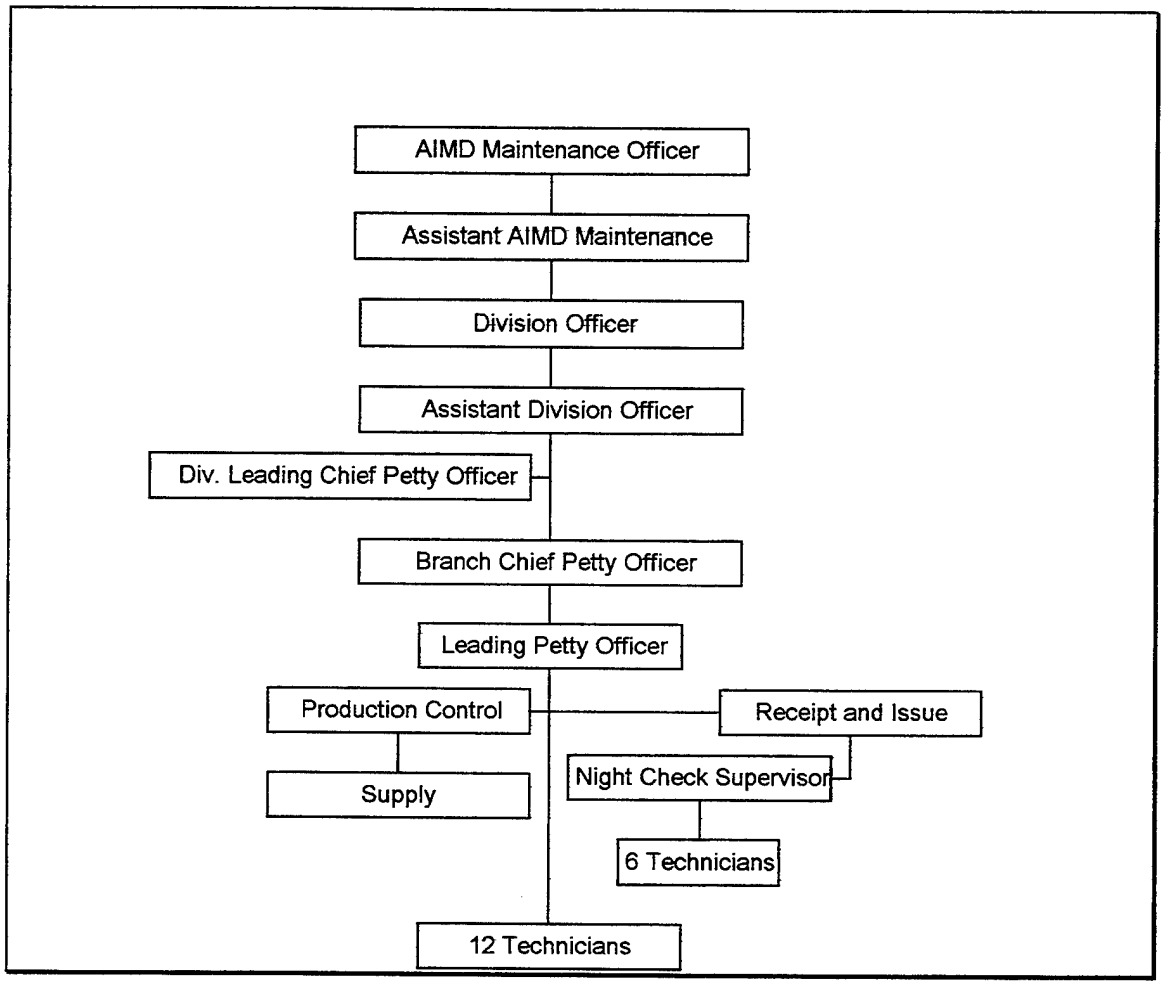
NADEP AND AIMD NORTH ISLAND CHAINS OF COMMAND

NADEP NORTH ISLAND CALIBRATION LABORATORY CHAIN OF COMMAND

PROG	NORIS CODE	CAO CODE
S-3	910	6.1.6
E2/C2	920	6.1.2
CMPTS	930	6.1.3
F-14	940	6.1.7
F/A-18	950	6.1.1
F/S VRT CAL	960	6.1.5
MFG	970	6.1.4
A/C SVCS (TL/PAINT)	980	6.2.A



AIMD NORTH ISLAND CALIBRATION LABORATORY CHAIN OF COMMAND



APPENDIX D

LIST OF ACRONYMS

A/A	Authorized Allowance
A/C	Aircraft
AAA	Authorized Accounting Activity
ACC	Aircraft Controlling Custodian
ACFT	Aircraft
ACLS	All-Weather Carrier Landing System
ACR	Allowance Change Request
ADB	Aircraft Discrepancy Book
ADP	Automated Data Processing
AEMS	Aircraft Engine Management System
AESR	Aeronautical Equipment Service Record
AFB	Airframe Bulletin
AFC	Airframe Change
AFM	Aviation Fleet Maintenance
AIMD	Aircraft Intermediate Maintenance Department
AIR	Aircraft Inventory Record
AIRPAC	Air Force Pacific
AIRS	Aircraft Inventory Reporting System
AIS	Automated Information System
ALRE	Aircraft Launch and Recovery Equipment
AMRR	Aircraft Material Readiness Report
AMMRL	Aircraft Maintenance Material Readiness List
AMSU	Aeronautical Material Screening Unit
ANSI	American National Standards Institute
AT	Aviation Electronics Technician
ATC	Action Taken Code
ATCS	Activity Tool Control System
ATE	Automated Test Equipment
ATSS	Aviation Training Support System
AVCAL	Aviation Consolidated Allowance List
AVDLR	Aviation Depot Level Repairable
AWM	Awaiting Maintenance
AWP	Awaiting Parts
BCM	Beyond Capability of Maintenance
BUNO	Bureau Number
CAG	Carrier Air Group
CALSTAR	Calibration Standards Allowance Requirements
CDI	Collateral Duty Inspector
CFA	Cognizant Field Activity
CINCPACFLT	Commander in Chief Pacific Fleet

CNAL	Commander, Naval Air Force, U.S. Atlantic Fleet
CNAP	Commander, Naval Air Force, U.S. Pacific Fleet
CNARF	Commander, Naval Reserve Force
CNATRA	Commander, Naval Air Training
CNET	Chief of Naval Education and Training
CNO	Chief of Naval Operations
COD	Carrier Onboard Delivery
COMSEC	Communications Security
COMSTA	Communications Station
COMSUBPAC	Commander Submarine Force Pacific
CONUS	Continental United States
CRIPL	Consolidated Remain-In-Place List
CPR	Calibration Problem Reports
CRIS	Computer Resources Integrated Support
CSM	Combat Systems Manager
DOD	Department of Defense
DLR	Depot Level Repairable
DOP	Designated Overhaul Point
DSF	Data Services Facility
DSP	Designated Support Point
ECP	Engineering Change Proposal
ESD	Electrostatic Discharge
EST	Estimated
ETR	Engine Transaction Report
ETS	Engineering and Technical Services
EXREP	Expeditious Repair
FCA	Field Calibration Activities
FCF	Functional Check Flight
FGC	Family Group Code
FLR	Field Level Repairable
FMC	Full Mission Capable
FMF	Fleet Marine Force
FMO	Fleet Maintenance Officer
FOD	Foreign Object Damage
FRAMP	Fleet Readiness Aviation Maintenance Personnel
FRS	Fleet Readiness Training
FSCM	Federal Supply Code for Manufactures
FTSCLANT	Fleet Technical Support Center Atlantic
FTSCPAC	Fleet Technical Support Center Pacific
FY	Fiscal Year
GPETE	General Purpose Electronic Test Equipment
HM	Hazardous Material
HMR	Hazardous Material Report
HW	Hazardous Waste

ICRL	Individual Component Repair List
ILS	Integrated Logistic Support
ILSP	Integrated Logistic Support Plan
ILSMT	Integrated Logistic Support Management Team
IMA	Intermediate Maintenance
IMACC	Intermediate Maintenance Activity Coordination Center
IMRL	Individual Material Readiness List
IPB	Illustrated Parts Breakdown
IRAC	Interim Rapid Action Change
JBD	Jet Blast Deflector
JCN	Job Control Number
JOAP	Joint Oil Analysis Program
LAMPS	Light Airborne Multi-purpose System
LCM	Life Cycle Management
LCP	Local Calibration Procedure
LIRSH	List of Items Requiring Special Handling
LOX	Liquid Oxygen
LRCA	Local Repair Cycle Asset
MAF	Maintenance Action Form
MAG	Marine Aircraft Group
MALS	Marine Aviation Logistics Squadron
MAM	Maintenance Assist Module
MAP	Measure Assurance Program
MAW	Marine Aircraft Wing
MDR	Maintenance Data Report(ing)
MDS	Maintenance Data System
MEASURE	Metrology Automated System for Uniform Recall and Reporting
MESM	Mission Essential Subsystem Matrix
METCAL	Metrology and Calibration
METRL	Metrology Equipment List
	Metrology Requirements List
MI	Maintenance Instruction
MIRCS	Mechanical Instrument Repair and Calibration Shop
MIS	Management Information System
MMCO	Maintenance Material Control Officer
MO	Maintenance Officer
MOA	Memorandum of Agreement
MOCC	MEASURE Operational Control Center
MRIL	Master Repairable Item List
MTIP	Maintenance Training Improvement Program
MWSG	Marine Wing Support Group
NADEP	Naval Aviation Depot

NADOC	Naval Aviation Depot Operations Center
NAESU	Naval Aviation Engineering Service
NALCOMIS	Naval Aviation Logistic Command Management Information System
NAMDRP	Naval Aviation Maintenance Discrepancy Reporting Program
NAS	Naval Air Station
NAVAIR	Naval Air Systems Command
NAVCOMSTA	Naval Communications Station
NAVFAC	Naval Facility
NAVRADSTA	Naval Radio Station
NAVSEA	Naval Sea Systems Command
NAVSHIPYDPUGET	Naval Shipyard Puget Sound
NAVSTA	Naval Station
NAVTELCOM	Naval Telecommunications
NCL	Navy Calibration Laboratory
NDI	Nondestructive Inspection
NEC	Navy Enlisted Classification
NETS	Navy Engineering Technical Services
NIIN	National Item Identification Number
NMC	Not Mission Capable
NMCM	Not Mission Capable Maintenance
NMCS	Not Mission Capable Supply
NOAP	Navy Oil Analysis Program
NORS	Not Operationally Ready Supply
NSB	Naval Submarine Base
NSWC	Naval Surface Warfare Center
NTP	Navy Training Plan
NTRF	Naval Transmitter Radio Facility
NUWCDIVKPT	Naval Undersea Warfare Center Division, Keyport
NWAD	Naval Warfare Assessment Division
NWS	Naval Weapons Station
OE	Ocean Engineering
OJT	On-the-Job Training
OMA	Organizational Maintenance Activity
OMD	Operations Maintenance Division
OOT	Out-of-Tolerance
OPNAV	Office of the Chief of Naval Operations
OPTAR	Operating Target
ORG	Organizational Code
OSH	Occupational, Safety, and Health
OT	Overtime
OTN	Out-of-Tolerance Notice
PACNORWEST	Pacific Northwest

PAT	Process Action Team
PC	Personal Computer
PC	Production Control
PEB	Pre-expended Bin
PGSCOL	Naval Post Graduate School
PIMA	Prime Intermediate Maintenance Activity
PMC	Partial Mission Capable
PMCM	Partial Mission Capable Maintenance
PMCS	Partial Mission Capable Supply
PME	Precision Measuring Equipment
POA&M	Plan of Action and Milestones
POC	Point of Contact
PPB	Power Plants Bulletin
PQS	Personnel Qualification Standard
PRE-X	Pre-expended Bin
PRI	Priority
QA	Quality Assurance
QAR	Quality Assurance Representative
QDR	Quality Deficiency Report
QEC	Quick Engine Change
QECA	Quick Engine Change Assembly
QECK	Quick Engine Change Kit
QECS	Quick Engine Change Stand
RADCON	Radiation Control
RADIAC	Radiation Detection, Indication, and Computation
R&R	Repair and Return
RAG	Replacement Air Group
RAM	Random Access Memory
RAMEC	Rapid Action Maintenance Engineering Change
RFI	Ready For Issue
RFU	Ready For Use
RIP	Remain In Place
RMC	Regional Maintenance Center
RRC	Regional Repair Center
SCIR	Subsystem Capability and Impact
SCLSIS	Ships Configuration and Logistics Support Information System
SDLM	Standard Depot Level Maintenance
SE	Support Equipment
SECA	Support Equipment Controlling Activity
SERMIS	Support Equipment Resources Management Information System
SERNO	Serial Number
SHORCAL	Shore Based Consolidated Allowance List

SIMA	Shore Intermediate Maintenance Activity
SMD	Ship Manning Document
SM&R	Source, Maintenance and Recoverability Code
SMIC	Special Material Identification Code
SQDN	Squadron
SQMD	Squadron Manning Document
SRA	Shop Replaceable Assembly
SRC	Scheduled Removal Component
SSC	Supply Support Center
SSP	Strategic Systems Programs
SUBASE	Submarine Base
SUBPAC	Submarine Force, U.S. Pacific Fleet
SUBSAFE	Submarine Safe
SURFPAC	Naval Surface Force, U.S. Pacific Fleet
SWFPAC	Strategic Weapons Facility, Pacific
SY	Ship Yard
SYSCOM	Systems Command
T&ME	Test & Measuring Equipment
TAMS	Test and Monitoring Systems
TAP	Technical Awareness Program
TAT	Turn Around Time
TBI	Test Bench Installation
TD	Technical Directive
TDC	Technical Directive Change
TEC	Type Equipment Code
TOL	Tailored Outfitting Listing
TPDR	Technical Publications Deficiency Report
TPL	Technical Publications Library
TRF	Trident Refit Facility
TRIPER	Trident Planned Equipment Replacement
TRITRAFAC	Trident Training Facility
TSB	Technical Services Building
TYCOM	Type Commander
UMMIPS	Uniform Material Movement and Issue Priority System
VAST	Versatile Avionics Shop Test
VIDS	Visual Information Display System
WPNSTA	Weapons Station
WRA	Weapons Replaceable Assembly
WUC	Work Unit Code
3M	Aviation Maintenance Material Management (NAMP)

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