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BY THE COMPTROLLER GENERAL

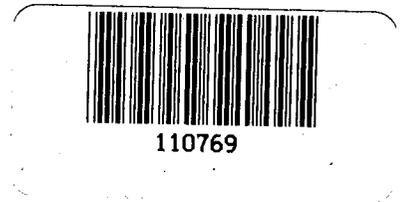
Report To The Congress

OF THE UNITED STATES

The Navy Does Not Know If It Has Too Much Electronic/Electrical Depot Maintenance Capability, Too Little, Or The Right Kind

The Navy does not know if its maintenance depot resources are adequate to satisfy mobilization requirements. It has identified these requirements in broad terms and can identify specific needs under projected wartime usage. However, the Navy has not translated the requirements into specific maintenance resources (facilities, equipment, and skills). As a result, it has no basis for measuring if existing capacity is too much, too little, or the right kind.

Recent studies have shown that the Navy's gross in-house capacity for depot electronic/electrical maintenance far exceeds that needed to accomplish current peacetime requirements. Because of the large excesses and the availability of multishift operations, current capacity likely exceeds that needed to accomplish mobilization requirements.



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COMPTROLLER GENERAL OF THE UNITED STATES

WASHINGTON, D.C. 20548

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To the President of the Senate and the
Speaker of the House of Representatives

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This report presents the results of our review on how the Navy manages depot maintenance of electronic/electrical items. It identifies the need to properly size these repair facilities through defining mobilization needs, determining the in-house capacity necessary to fill these needs, and matching existing facilities to this requirement.

Copies of this report are being sent to the Director Office of Management and Budget, and the Secretaries of Defense and the Navy.

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James B. Starks
Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

THE NAVY DOES NOT KNOW IF IT
HAS TOO MUCH ELECTRONIC/
ELECTRICAL DEPOT MAINTENANCE
CAPABILITY, TOO LITTLE, OR
THE RIGHT KIND

D I G E S T

Determining mobilization requirements in relation to depot maintenance capacity and capability is essential for properly assessing the adequacy of available depot resources and for planning future changes. Even more important, determining the requirements is critical for making sure that vital naval weapon systems are operational and ready to support wartime demands. The Navy has failed to make such determinations to support its electronic/electrical equipment. GAO found numerous examples of costly excess and under-used depot capability. (See chs. 4 and 5.)

The Navy's in-house depot maintenance of electronic/electrical equipment costs in excess of \$275 million per year. Sixteen activities under three Navy commands directly perform this maintenance work.

Although the Navy has made broad wartime planning assumptions which identify projected gross operating levels for its industrial complex, it has not determined what its mobilization requirements will be in terms of specific resources needed. Failure to equate projected wartime usage with the need for specific facilities, equipment, and skills has resulted in the Navy developing electronic/electrical capacity far in excess of peacetime requirements. (See app. II.) Such large excesses and the availability of multishift operations indicate that current gross capacity may also exceed future mobilization requirements.

The Navy must identify the depot maintenance resources needed to meet mobilization requirements and optimally size its depot

capabilities to meet these requirements. If the Navy does not do this, it cannot have any assurance that it will be able to support a wartime posture. Further, unnecessary expenditures to support excess and underused capacity will continue.

Insufficient information concerning requirements and resources, inadequate long-range planning, and an inclination towards self-sufficiency and autonomy at the installation level have hindered proper depot sizing. As a result, the following situations have occurred:

--The electronic/electrical shops at the eight shipyards and two electronic systems engineering centers are being used only 45 and 47 percent, respectively. (See app. II.)

--The North Island Naval Air Rework Facility's Computer Automatic Tester III-D, a \$400,000 system installed in 1978, has been used infrequently. Other major automatic test equipment systems are only used about 2 hours a day. (See p. 19.)

--The Philadelphia Naval Shipyard plans to spend about \$13 million to increase its electronic/electrical maintenance capacity, when current capacity use is only about 45 percent. (See p. 25.)

--The Alameda Naval Air Rework Facility plans, upon approval, to establish a limited printed circuit board manufacturing capability despite there already being four west coast Navy activities with this capability--one of which is not being used and two of which are underused. (See p. 30.)

--In 1975 Mare Island spent about \$140,000 to construct a facility for repairing and testing surface gunfire control systems. The facility has not been, and probably never will be, used for its intended purpose. (See p. 31.)

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- Two naval electronic systems engineering centers were established which duplicated existing underused electronic repair facilities at nearby Navy shipyards. (See p. 43.)
- The Navy unnecessarily spent about \$300,000 to consolidate the air launched missile program at the Alameda Naval Air Rework Facility. Less than 1 year after the decision to consolidate, the Navy decided to turn the program over to private contractors. (See pp. 36 to 38.)
- The Alameda Naval Air Rework Facility retained more than \$2 million of low-use test equipment to work components available through the supply system despite the need of another installation for this test equipment. (See pp. 38 to 43.)

RECOMMENDATIONS

The Navy has the challenging task of properly sizing its depots in a manner which will meet wartime contingencies as well as optimizing scarce depot maintenance funds during peacetime. To accomplish this task, GAO recommends that the Secretary of the Navy:

- Identify mobilization maintenance workload requirements and translate them into specific maintenance resources, such as facilities, equipment, and skills.
- Distribute this workload between Navy, commercial, and other military service facilities.
- Develop a master plan to properly size the available resources. This plan should include a timetable for phasing out excesses, consolidating underused capabilities, and spending available funds to alleviate shortages and to renovate or upgrade those facilities which are needed.

GAO made several other recommendations involving underused automatic test equipment and the Navy's plans to create additional in-house capacity. (See pp. 23, 33, and 45.)

AGENCY COMMENTS

Navy officials reviewed this report and said that they concurred with the conclusions and recommendations. Their comments were incorporated into the report where appropriate.

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ABBREVIATIONS

AIMS	see footnote on page 34
ATE	automatic test equipment
DOD	Department of Defense
GAO	General Accounting Office
NAVAIR	Naval Air Systems Command
NAVELEX	Naval Electronic Systems Command
NAVSEA	Naval Sea Systems Command
NTDS	Navy Tactical Data System
OMB	Office of Management and Budget

CHAPTER 1

INTRODUCTION

Equipment is maintained at depots or contractor plants 1/ when it needs maintenance which requires more extensive facilities and equipment and higher skilled personnel than are available at lower maintenance levels. The primary objective of depot maintenance is to sustain weapon and end item systems in a state of operational readiness, consistent with the mission requirements of the operating or tactical elements and at the least cost.

We estimate that the Navy's organic (in-house) depot-level maintenance of electronic items costs in excess of \$275 million per year. (See app. I.)

MAINTENANCE ORGANIZATIONS

The chart on page 2 shows the many organizations involved in managing depot maintenance of electronic/electrical items.

As regards electronic/electrical depot maintenance:

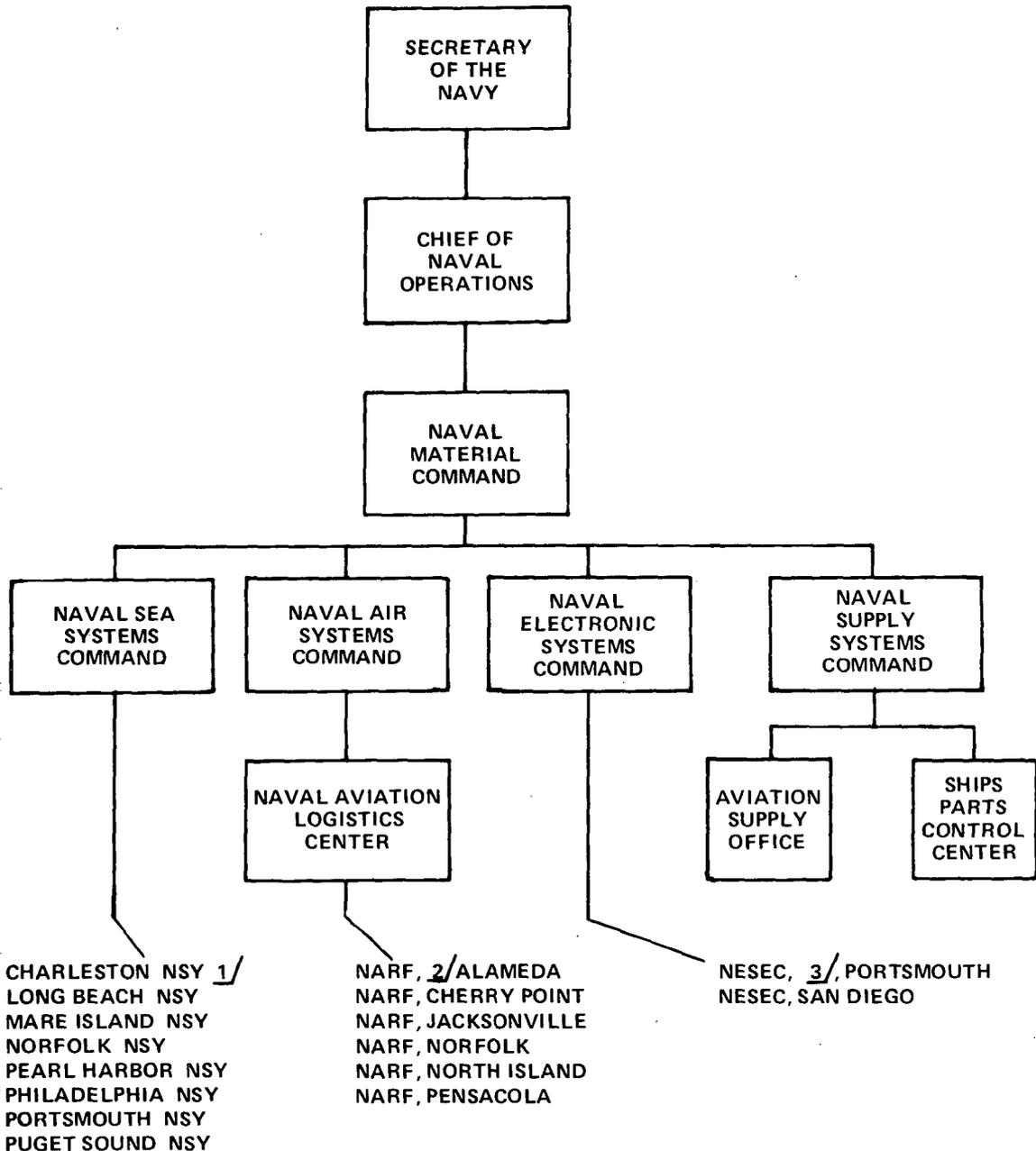
- Shipyards repair ship-related and some land-based systems and components.
- Naval air rework facilities primarily work on aircraft-related systems and components.
- Naval electronic systems engineering centers repair land-based and ship-related systems and components.

We observed that the electronic shops at the shipyards, air rework facilities, and electronic systems engineering centers were basically the same in terms of facilities, equipment, and skills.

The map on page 3 shows the location of the 16 naval activities performing depot maintenance on electronic/electrical items.

1/ Depot maintenance normally consists of inspection, test, repair, modification, alteration, modernization, conversion, overhaul, reclamation, or rebuilding parts, assemblies, subassemblies, components, equipment and equipment items, and weapon systems.

**NAVY ORGANIZATION
FOR MANAGING DEPOT
MAINTENANCE OF
ELECTRONIC/ELECTRICAL ITEMS**

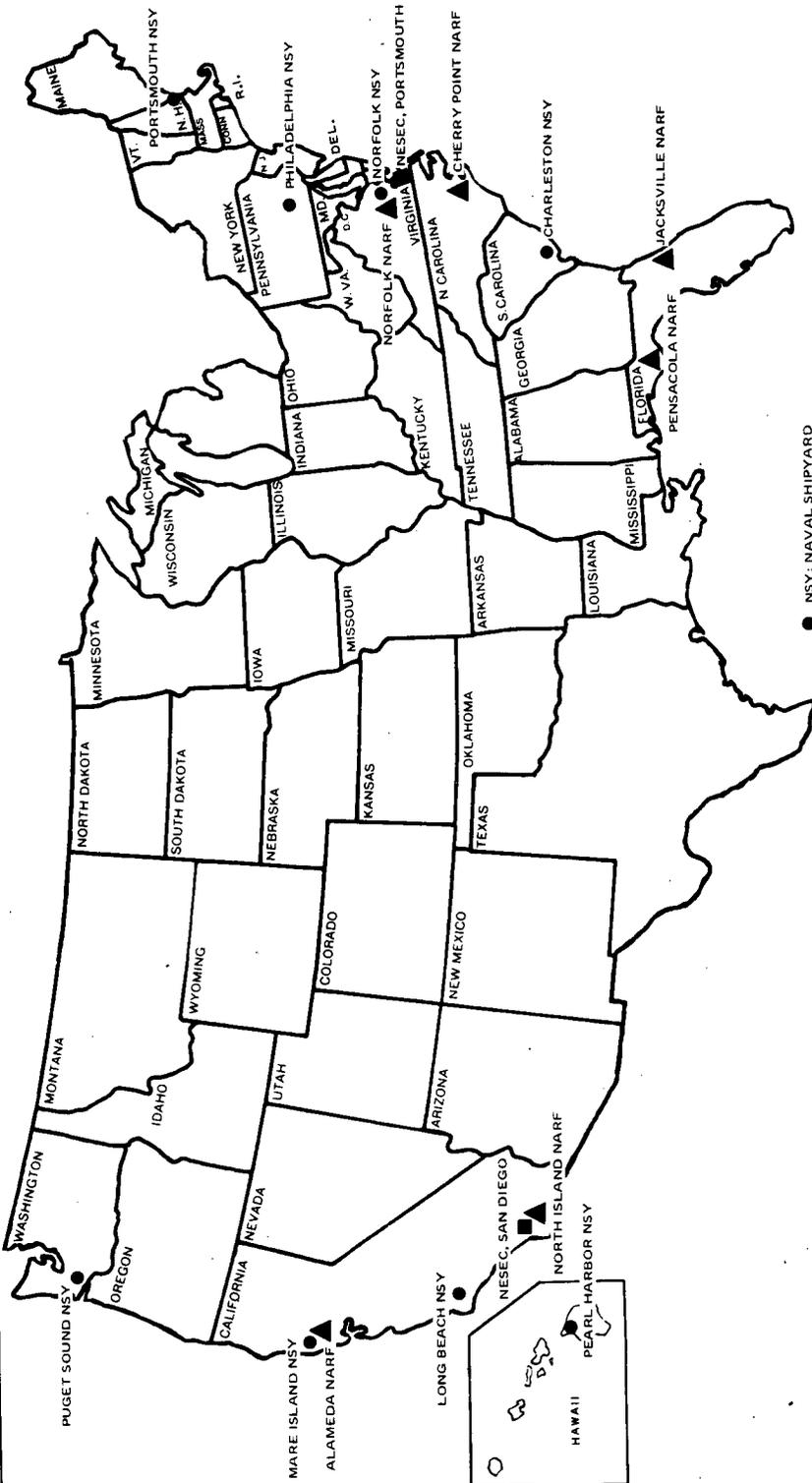
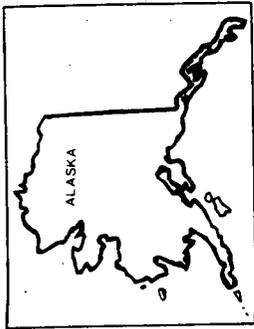


1/ NAVAL SHIPYARD (NSY).

2/ NAVAL AIR REWORK FACILITY (NARF):

3/ NAVAL ELECTRONIC SYSTEMS ENGINEERING CENTER (NESEC).

**NAVY INSTALLATIONS WITH
ELECTRONIC/ELECTRICAL
DEPOT CAPABILITY**



- NSY: NAVAL SHIPYARD
- NARF: NAVAL AIR REWORK FACILITY
- ▲ NESEC: NAVAL ELECTRONIC SYSTEMS ENGINEERING CENTER

SCOPE OF REVIEW

This review covered the management of depot maintenance of electronic/electrical items at Navy shipyards, naval air rework facilities, and naval electronic systems engineering centers.

Our review was made at the following locations:

- Headquarters, the Department of Defense (DOD), the Pentagon.
- Office of the Chief of Naval Operations.
- Naval Material Command.
- Naval Sea Systems Command (NAVSEA).
- Naval Air Systems Command (NAVAIR).
- Naval Electronic Systems Command (NAVELEX).
- Naval Supply Systems Command.
- Naval Aviation Logistics Center.
- Aviation Supply Office.
- Ships Parts Control Center.
- Long Beach Naval Shipyard.
- Mare Island Naval Island.
- Philadelphia Naval Shipyard.
- Naval Air Rework Facility, Alameda.
- Naval Air Rework Facility, Norfolk.
- Naval Air Rework Facility, North Island.
- Naval Air Rework Facility, Pensacola.
- Naval Electronic Systems Engineering Center, San Diego.

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AGENCY COMMENTS

Navy officials reviewed this report and said that they concurred with the conclusions and recommendations. Their comments were incorporated into the report where appropriate.

CHAPTER 2

SIZING DEPOT CAPACITY AND CAPABILITIES

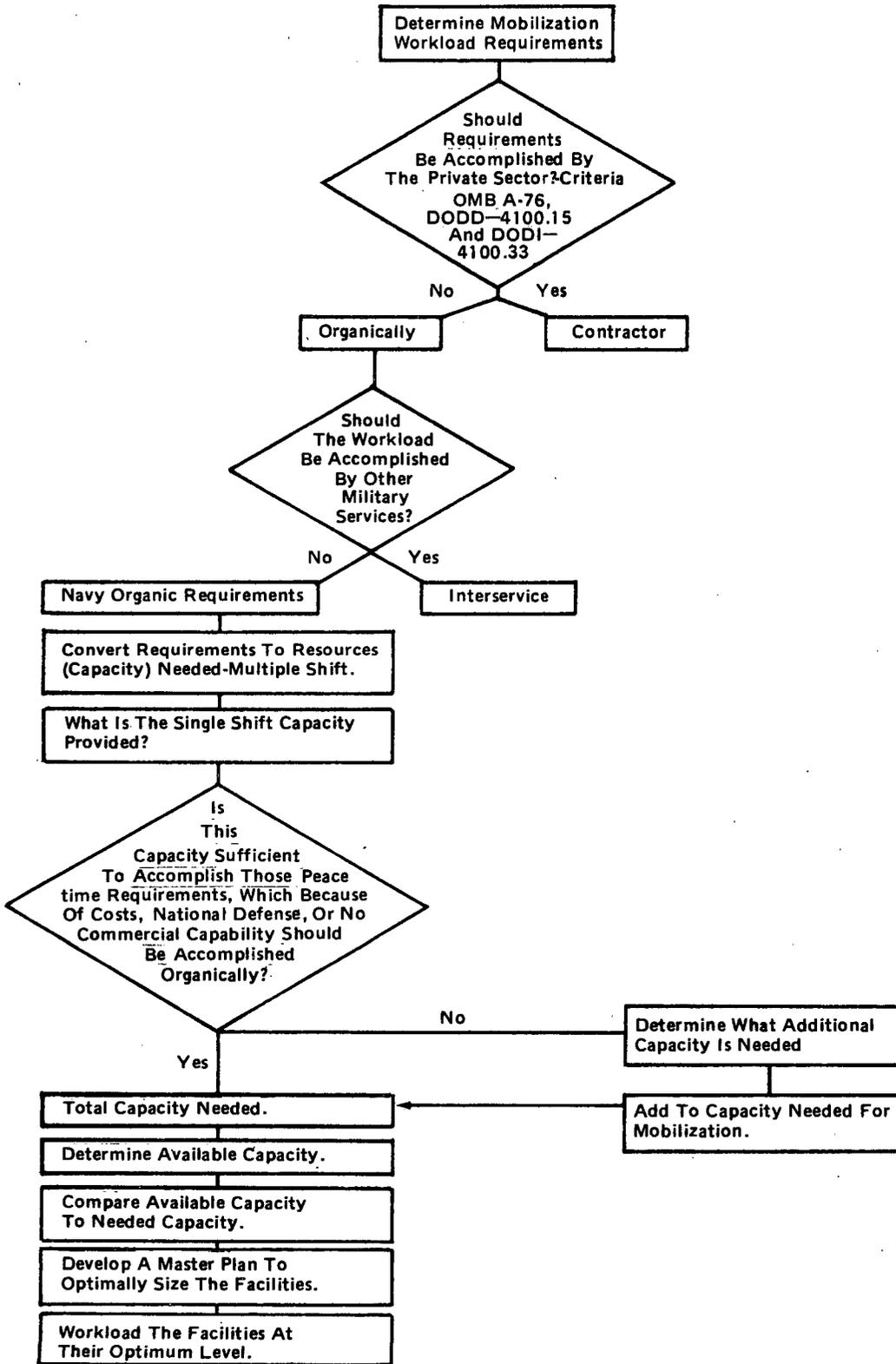
The Navy is responsible for ensuring that its essential weapon systems are operational and ready to support contingency situations. Much of the maintenance work required to keep these systems operational can only be accomplished at depot facilities. Thus, the Navy must know what depot capacity and capability it requires so that it can make sufficient resources available.

Unfortunately, the Navy does not know if existing depot resources are adequate to satisfy mobilization requirements. It has identified these requirements in broad terms and can identify specific line item needs under projected wartime usage. However, the Navy has not translated the requirements into specific maintenance resources (facilities, equipment, and skills). As a result, it has no basis for measuring if existing capacity is too much, too little, or the right kind.

Recent studies have shown that the Navy's gross organic capacity for depot electronic/electrical maintenance far exceeds that needed to accomplish current peacetime requirements (see app. II). Because of the large excesses and the availability of multishift operations, we believe that current capacity likely exceeds that needed to accomplish mobilization requirements.

In the following sections, we will discuss a methodology which would allow the Navy to reach optimum facility sizing and workloading. This methodology is set forth in the following decision tree.

SIZING METHODOLOGY DECISION TREE



DETERMINING WARTIME REQUIREMENTS

Wartime requirements are determined through (1) mathematical modeling and computer simulation using historical failure rates and (2) estimated usage based on planning data provided by the Chief of Naval Operations. These requirements are based on the number of each specific line item needed to support a given level of operation. They do not, however, reflect the maintenance resources (facilities, equipment, and skills) needed for this support. Further, the worst case scenarios, from an operations point of view, may not be the worst case scenarios from a maintenance or logistics point of view. This factor must be borne in mind when determining wartime requirements.

WHO WILL FILL THE REQUIREMENTS?

Once requirements are identified, the Navy must determine how the workload will be distributed between organic (Navy and other military services) and commercial sources.

In this respect, it has been, and continues to be, the Government's policy to rely, to the extent possible, on the private sector to provide necessary products and services. This policy, originally stated in the Bureau of the Budget (now the Office of Management and Budget (OMB)) Circular A-76 dated March 3, 1966, evolved from a longstanding recognition that the Government unnecessarily competing with the private sector would not be in the best interest of the free enterprise system. Reissuance of OMB Circular A-76 on March 29, 1979, has added new emphasis to this position. According to OMB Circular A-76, organic capacity can only be justified under three conditions: no satisfactory commercial source available, national defense, or least cost to the Government.

DOD's implementation of OMB Circular A-76 is contained in DOD Directive 4100.15 and DOD Instruction 4100.33. These documents confirm DOD's dedication to the principle of reliance on the private sector.

Other DOD publications are more specific in discussing the need to develop depot maintenance capabilities in the private sector. DOD Directive 4005.1 on Industrial Preparedness Production Planning stresses:

"In planning for the production of selected items preference shall be given to privately-owned facilities, so as to minimize the need for Government-financed facilities."

This need for reliance on the private sector is further explained in DOD Directive 4151.1:

"Indirect (depot) Maintenance support of military weapons and equipment will be planned and accomplished by the combined use of contractual sources and organic military capability, in order to establish and sustain a flexible maintenance production base capable of expansion to accommodate emergency military needs within a limited time frame."

DOD Directive 4151.1 states further that only mission-essential work should be performed in-house, and minimum organic capabilities necessary to perform a portion of this wartime workload on a multishift basis will be the baseline for sizing facilities and equipment. However, the directive also states that the need for organic capabilities for depot support of mission-essential equipment need not be total, but that at least 30 percent of the mission-essential workload be performed by contract. It states:

"The extent of facility capability and capacity within the Military Departments for depot support of mission-essential equipment will be kept to the minimum required to insure a ready and controlled source of technical competence and resources necessary to meet military contingencies. Generally, organic depot maintenance capacity will be planned to accomplish no more than 70% of the gross mission-essential depot maintenance workload requirements with a facility capacity loading at a minimum rate of 85%, on a 40-hour week, 1-shift basis. The Services will attempt in the implementation of this Directive to utilize the DOD-wide industrial organization in a manner that will insure the most advantageous and economic benefits to the DOD."

DOD is updating Directive 4151.1. The Navy said that this update is expected to clarify the policy for determining the necessary minimum organic capacity and enhance the Navy's ability to appropriately distribute future workload.

While the Navy generally knows what capabilities exist in the private sector, it has not identified specific capacity available. Further, as will be discussed later, it has only recently begun to identify its own organic capability.

In a 1976 report 1/ to the Secretary of Defense, we took exception to the current DOD workload distribution policy because it did not foster a cost-effective approach. The services tended to adhere to the 70-percent organic figure as the quantity of mission-essential workload that should be retained for military depots, rather than to identify the actual minimum amount necessary for retention. We recommended that the Secretary of Defense develop and apply criteria for

- assessing needs for surge to meet wartime requirements,
- planning the minimum organic and contractor capacity to meet those requirements, and
- relating the status of this capacity to peacetime workloads.

Once the Navy has identified the quantity and type of organic resources needed for wartime support of the mission-essential workload on a multishift basis, it must determine if these resources are sufficient to also meet peacetime requirements. The organic peacetime mission-essential workload is to be accomplished with an 85-percent, one-shift loading of the mobilization capacity. Consequently, proper sizing of organic depots will include any necessary allowance for peacetime requirements exceeding this workloading level, providing commercial sources cannot economically meet this additional work.

By identifying any justifiable additional resources needed to cover peacetime workloads and combining them with resources needed to cover mobilization, the Navy can determine the total organic resources which can be justified under current Government policy. This is the baseline, the organic capacity towards which the Navy should be working. Any excess to this baseline should be identified and not be upgraded or renovated. Money should only be spent to create, improve, or perpetuate that capacity which is justified. The next section discusses the identification process in more detail.

1/"Should Aircraft Depot Maintenance Be In-House or Contracted? Controls and Revised Criteria Needed" (FPCD-76-49, Oct. 20, 1976).

IDENTIFYING AVAILABLE NAVY RESOURCES

In 1976 DOD issued its "Depot Maintenance Production Shop Capacity Measurement Handbook"--DOD 4151.15H--and instructed the military services to perform capacity studies. (For a discussion of capacity see app. III.) The air rework facilities completed their preliminary capacity studies in 1977. In 1976 the Navy performed nonengineered capacity studies 1/ at its shipyards, ordnance depots, and electronic systems engineering centers. Further, at the time of our review, NAVSEA was in the process of performing capacity studies in accordance with 4151.15H. Preliminary figures for one shipyard showed capacity greater than the 1976 study.

The results of the 1976 Repairables Rework and Air Rework Facility studies are detailed by installation in appendix II and summarized below:

<u>Type of installation</u>	<u>Capacity (staff years)</u>	<u>Capacity utilization</u> (percent)
Shipyards	4,662	45
Naval air rework facilities	2,882	67
Naval electronic systems engineering centers	<u>561</u>	47
Total	<u>8,105</u>	53

To staff a mobilization effort, the military services plan to initially use extended shifts until they can hire and train sufficient staff to cover multishift operations. During a mobilization, the Navy will be competing with contractors, uniformed military needs, and the other services' industrial complexes for available staff. Additionally, the Navy may find itself losing staff to active military duty.

1/The capacity utilization studies were performed as part of NAVSEA's and NAVELEX's 1976 Repairables Rework Study.

It does no good to have sufficient capacity and to optimally size the facilities if the needed skills are not available in the right quantities and locations. Accordingly, it behooves the Navy to identify specific staffing needs and to take the necessary actions to assure their availability when needed.

PROVIDING RESOURCES TO ACCOMPLISH REQUIREMENTS

Once the Navy has determined what organic resources are needed and what resources are available, it should match them to identify excesses and shortages. The Navy should then develop a master plan to balance the available resources with required resources. Such a master plan should include a timetable for phasing out excesses, consolidating under-used capabilities, and spending available funds to alleviate shortages and to renovate or upgrade those facilities which are needed.

Further, any decisions regarding facility construction, retention, renovation, expansion, reduction, or elimination should be based upon mobilization needs. In general, we found that the Navy's justification for these type of actions was based on the specific peacetime needs of individual installations. While these actions often appeared justified, based on local conditions, frequently they were not justifiable based on total Navy needs and/or wartime surge needs. (See chs. 4 and 5.)

Why facilities should be properly sized and staffed

Although existing capacity is a past cost to the Government, there are current costs associated with excess and underused capacity and benefits associated with properly sized and staffed facilities.

Cost of excess and underused facilities

The cost of excess or underused capacity will be discussed in chapter 3. Generally, however, these costs fall into the following areas: maintenance, repairs, and technological improvements, and increased personnel-related costs.

Benefits of properly sized facilities

Moneys spread too thin, to keep more capacity than needed, could better be spent on keeping that which is needed, technologically current.

In a technical area, such as electronic/electrical, automation and staff specialization can be cost effective. Fewer employees can frequently accomplish more work faster and with improved quality. This productivity is especially beneficial during a mobilization when workload may increase faster than the work force can be increased.

Currently, to support ship overhaul, the shipyards maintain capabilities to perform all levels of electronic/electrical component repair. In such instances, not enough workload is available to economically use specialized personnel or automatic test equipment. With long leadtimes for ship overhaul, centralized repair of components at specialized functional work centers can be more efficient. For example, in 1977 we reported 1/ that the Sea Systems Command should evaluate the capability and relative cost of using existing naval shipyards to perform needed repair work on the Navy Tactical Data System (NTDS), rather than contract the work solely to the Hughes Aircraft Company. In this regard, we specified that the Navy should determine its minimum needs for in-house maintenance capability. Currently, the Philadelphia and Puget Sound naval shipyards and the Hughes Aircraft Company are designated overhaul points which do concurrent 2/ restorations of NTDS display equipment for other shipyards. Neither Philadelphia nor Puget Sound have sufficient capability to absorb the entire in-house workload. As of January 1979 nine ships have had their NTDS equipment refurbished at an average cost of \$1.1 million. Navy officials stated that the NTDS refurbishments done by Philadelphia and Puget Sound are equal in quality and cost to refurbishments performed by Hughes Aircraft.

1/Letter report to Representative Morris K. Udall, B-146889, Aug. 11, 1977.

2/Concurrent work as used in the example refers to work performed on equipment which came off a ship regardless of the location of the work. The equipment will be overhauled and returned to the ship during the course of the ship's normal overhaul.

We believe this concept could not only be extended to other class A 1/ overhauls, but also to class B 2/ repair work as well.

The concept of performing all electronic work at designated overhaul points fits into the Navy's new maintenance concepts. The FFG-7 frigate class support program is designed around a logistics support concept that emphasizes component removal and replacement, increased intermediate support, and less depot level ship overhaul. Rather than the lengthy overhauls regularly performed at 3- to 4-year intervals, the ship is brought into the depot every 24 months for about 4 weeks. Success of this program depends largely upon an accurate statement of maintenance requirements and a responsive supply system which makes available the parts, modules, and reparable components to achieve the short turnaround times.

The concept of lengthening depot cycle times is also being applied to existing surface ships. The Engineered Operating Cycle program is one of the approaches to achieve these goals for about 50 percent of the surface fleet by 1984.

We believe that implementing these concepts deemphasizes the need for total capabilities at each shipyard to support ship overhaul and places a premium on the type of electronic component repair responsiveness possible through specialized functional work centers.

What problems or attitudes have hindered proper facility sizing?

Although proper sizing of facilities would benefit the Navy, many internal Navy problems or attitudes have hindered this effort. While this subject is discussed in detail in chapters 4 and 5, briefly the impediments are

- insufficient information on Navy-wide requirements (peacetime and mobilization) and capabilities,
- concurrent rework,

1/Work which will sustain or improve the operating and performance characteristics of the item. It is intended that the end product will be brought to a "like new" condition.

2/Work which will restore the operating and performance characteristics of the items to its "original" design and technical specifications.

- a tendency towards self-sufficiency and autonomy,
and
- overall planning deficiencies.

CONCLUSIONS

The Navy has made broad wartime planning assumptions which identify projected gross operating levels for its industrial complex. It has not, however, quantified its mobilization requirements in terms of specific resources, such as facilities, equipment, skills, and technologies. As a result, it has no basis for determining if existing capacity is too much, too little, or the right kind to meet mobilization needs.

Additionally, the Navy has not systematically identified the organic and contractor capacity available to accomplish these workloads. Nor has it identified the specific workload which should be accomplished organically.

In gross terms, existing organic capacity has been extremely underused for peacetime workload. Since the Navy has not identified specific mobilization needs, it has no choice but to assume the excess will provide adequate room to fulfill mobilization needs. We believe, however, that maintaining an unspecified excess for this purpose is too costly.

Although the Navy has not determined what resources are needed to meet mobilization needs, it has invested substantially in facilities and equipment and additional expenditures are planned. (See chs. 4 and 5.) We believe such expenditures should only be made where they meet a demonstrated urgent deficiency or a specific mobilization requirement.

Moreover, planning for these investments should be coordinated with mobilization plans to ensure the right facilities, equipment, and skills are acquired in the right quantities and existing and potential production bottlenecks are identified and alleviated.

RECOMMENDATIONS

- Accordingly, we recommend that the Secretary of the Navy:
- Identify mobilization maintenance workload requirements and translate them into specific maintenance resources, such as facilities, equipment, and skills.

- Distribute this workload between Navy, commercial, and other military service facilities.
- Develop a master plan to properly size the available resources. This plan should include a timetable for phasing out excesses, consolidating underused capabilities, and spending available funds to alleviate shortages and to renovate or upgrade those facilities which are needed.

AGENCY COMMENTS

Navy officials concurred in the need to strengthen their planning effort for identifying mobilization maintenance workload requirements. They mentioned several recent Navy initiatives aimed at improving this area:

- NAVAIR has been developing an annual depot maintenance mobilization plan for avionics equipment since 1976. The plan assesses the capability of NAVAIR's resources to support mobilization contingencies. The plan also details total depot requirements in terms of direct labor hours and identifies shortfalls in staffing, equipment, and facilities to the productive shop level.
- The Joint Logistics Commanders panel has chartered a Tri-Service group to analyze aeronautical depot maintenance capacity to meet mobilization needs and to recommend depot configuration and maintenance management alternatives. The study results are due April 1981.
- NAVSEA is currently working on identifying mobilization requirements for nonaviation commodities required to be serviced in the shipyards.

Navy officials also said that their actions are constrained by differences in resources necessary to overhaul a ship from those needed to overhaul an aircraft. Because of this, aviation requirements, as a general method of planning, are separated from nonaviation requirements.

We believe that the cited actions are steps in the right direction. However, as discussed on page 1, we observed that the technology to maintain electronic/electrical equipment is similar for aviation and surface equipment. We believe that there is potential for merging the underutilized capabilities of both communities. However, without accurately identified mobilization needs, it is difficult to determine what resources are necessary. An accurate statement of minimum organic needs and, where possible, combining of capabilities

Navy-wide, would ease the impact of underused capacity both on peacetime workload and on the ability to meet mobilization needs.

CHAPTER 3

EFFECT OF IMPROPERLY SIZED DEPOTS

The Navy's failure to determine its depot maintenance requirements and properly size its electronic/electrical shops to meet these requirements has resulted in excess and underused capability. Developing and maintaining excess and underused capability is costly. In addition to the initial investment in facilities, there are recurring costs. Although past expenditures cannot be reversed, the Navy can avoid further investment and reduce operating costs by consolidating and better distributing the electronic/electrical workload.

UNDERUSED CAPABILITY

DOD Directive 4151.1 states that military in-house maintenance capability should be sufficient to accomplish 70 percent of the mission-essential work at 85-percent minimum capacity loading based on a single-shift, 40-hour week. Numerous studies, including our review, indicate that the Navy electronic/electrical shops' workload is far below the 85-percent DOD guideline.

A 1976 Repairables Rework Study prepared by NAVSEA and NAVLEX concluded that the electronic/electrical shops of all eight shipyards were only used 45 percent of a single shift. Separately, the electronic shops were used even less, about 42 percent. The study also concluded that the naval electronic systems engineering centers were only used about 47 percent.

Our visit with officials at the shipyard depots and our observation of the shops indicate that the study results are conservative. For example:

--Mare Island shop superintendents estimate that the electronic shop is used at about 30 percent of its capacity. The missile electronic section of the ordnance shop is used at about 20 percent of its capacity.

--Long Beach Naval Shipyard officials estimate that their electronic shop is used less than 40 percent of capacity.

In early 1979 naval air rework facilities officials estimated that their avionics divisions were used about 67 percent of capacity.

As shown by the following photographs, taken during duty hours, the unused capacity at the electronics depots we visited is obvious. We noted that a great deal of shop floor space is used for storage, many work benches are not used, and many pieces of equipment are idle.

Automatic test systems underused

Automatic test equipment (ATE) is underused at the North Island Naval Air Rework Facility and, despite declining workload, additional equipment has been approved or planned for procurement. Since 1970 North Island has received ATE valued at about \$1.2 million.

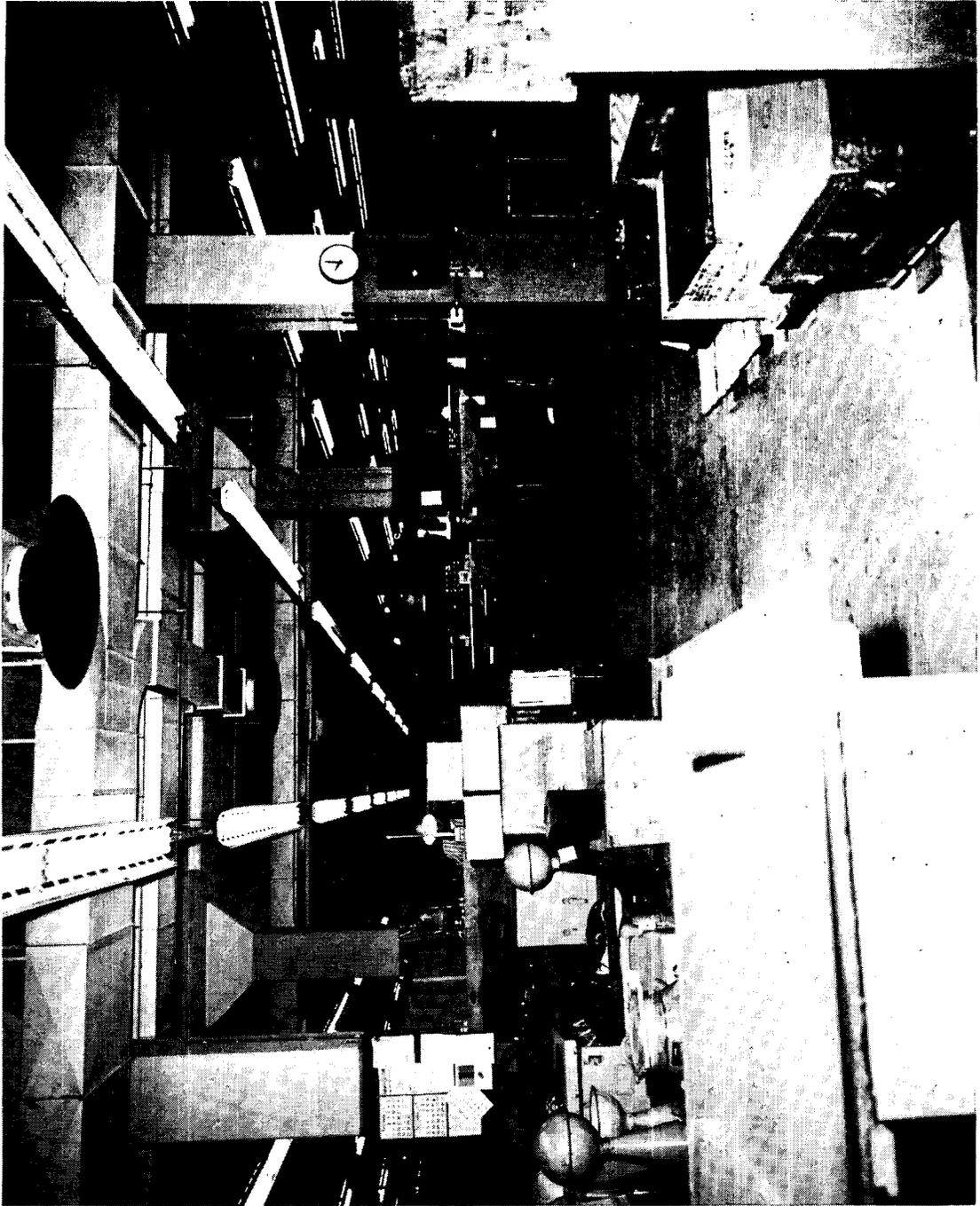
According to North Island officials, ATE systems should be fully used in a multishift basis. North Island has fallen far short of this goal, as shown below:

- The primary testing system (the AAI-5500 which is 10 years old) is used an average of 1.6 hours per day.
- Other major systems are used just under 2 hours per day.
- The Computer Automatic Tester III-D, a \$400,000 system installed in 1978, has been used infrequently.

North Island officials attribute the low use to

- management and shop personnel viewing the systems as being undependable,
- the declining workload,
- shop personnel preferring to do the testing at their test bench rather than on the automatic systems,
- automatic systems not being easily accessible to shop personnel, and
- the systems not being mandatory.

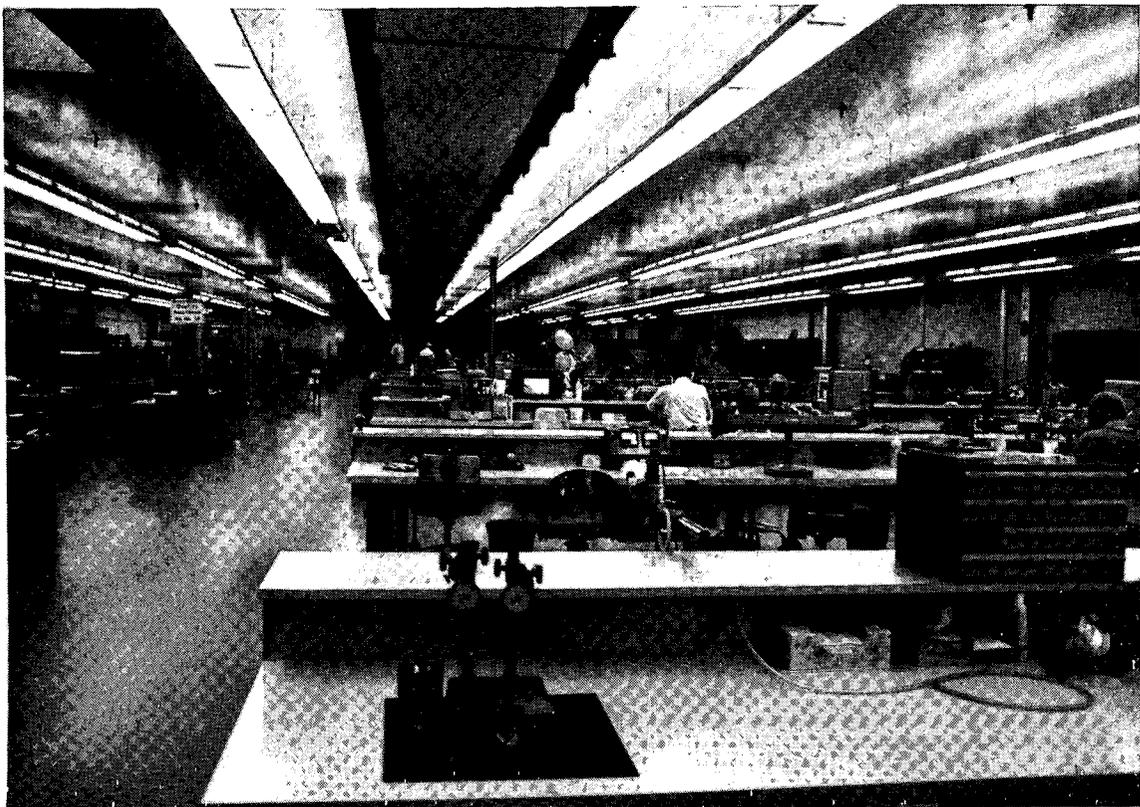
Despite low use, additional systems have been approved and planned. For example, the Navy has approved a \$1.9 million automatic system (Digital/Analog Automatic Test System) for North Island. One additional system is being considered for procurement in fiscal year 1982. Estimated cost for this system is \$1.9 million.



ELECTRONIC SHOP MARE ISLAND NAVAL SHIPYARD



AVIONICS DIVISION ALAMEDA NAVAL AIR REWORK FACILITY



INSTRUMENT SHOP PENSACOLA NAVAL AIR REWORK FACILITY

UNDERUSED CAPABILITY IS COSTLY

Although costs to maintain underused capability are not easily segregated from the total operating costs, they can be substantial. These costs include expenditures for maintenance, repairs, and technological improvements, and increased personnel-related costs. Since funds are limited, the more money spent on maintaining excess and underused capabilities, the less is available for more immediate Navy-wide requirements.

Repair, maintenance, and modernization costs

Whether a depot is used to its full or much lesser capacity, shops must be lighted, cleaned, and heated; equipment must be maintained and calibrated; buildings and equipment must be repaired; and facilities and equipment must be technologically current. To the extent facilities and equipment are excess or underused, the Navy does not receive maximum benefits for these overhead expenditures.

Facility and equipment maintenance, repair, alteration, and modification can be costly. For example, the avionics division at the North Island Naval Air Rework Facility spent \$1 million and \$1.6 million in fiscal years 1977 and 1978, respectively, for this purpose.

Overhead operating costs are high. At Mare Island, for example, the cost of utilities for the electronic/electrical shops alone is approaching \$1 million per year.

Nonrecurring major maintenance is substantial. For example:

- Mare Island has spent over \$1 million for non-recurring maintenance of the electronic/electrical/ordnance building in the last 4 years.
- Over the last 2 years, NAVAIR has authorized Alameda to spend about \$700,000 on renovating the lighting and other environmental equipment at its main avionics building.
- Both Navy air rework facilities, Alameda and North Island, have been authorized to repair the roofs of their avionics buildings. Each project will cost in excess of \$100,000.

In addition to maintenance and repairs, specialized

equipment must be available at the various installations. This equipment must be technologically updated and replaced, even though it is not used to its full capacity. Modern equipment is costly. For example:

--In the last several years, Alameda received \$2 million to \$3 million each year to purchase new, highly technical, often state-of-the-art equipment. Much of this equipment is for electronic/electrical shops.

--Mare Island received about \$1.2 million for electronic/electrical equipment in 3 fiscal years ending in 1978.

Despite substantial investments in updated equipment and additional spending to alter buildings to meet changing needs, not all facilities are modern. Because funds are limited, investments in plant and equipment are approved according to a priority system. Installations with low workload often cannot justify modernization.

Personnel-related costs

Overhead personnel support direct labor personnel. To get the most from such overhead personnel, the relationships between direct and indirect labor must be optimized. This requires workloading facilities to optimize the fixed portion of overhead. The higher the ratio of direct-to-indirect personnel the more economical operations are. In recent years, this ratio of direct-to-indirect labor has generally been declining. For example, direct labor hours decreased from 74 percent to 68 percent of total hours between 1972 and 1979 at the avionics division of the Naval Air Rework Facility, Alameda. Direct labor hours also decreased from 70 to 64 percent of total hours between 1972 and 1979 at the avionics division of the Naval Rework Facility, North Island.

CONCLUSIONS

Although the Navy has much underused ATE at North Island, it has approved procurement of equipment costing \$1.9 million and is considering acquiring additional equipment costing \$1.9 million in fiscal year 1982.

RECOMMENDATIONS

Naval Air Systems Command

The Secretary of the Navy should instruct (NAVAIR) to

--examine the justification for the already approved \$1.9 million worth of equipment and

--consider existing equipment at North Island and other DOD depots when evaluating future procurement of equipment at North Island.

CHAPTER 4

IMPEDIMENTS TO OPTIMUM SIZING OF DEPOTS

Although the Navy recognizes it has excess and underused capacity, it has been slow in acting to correct the situation. Some of the problems or constraints the Navy faces in trying to properly size its capabilities are

- insufficient information on which to base decisions,
- concurrent rework, and
- tendencies toward self-sufficiency and autonomy.

LACK OF INFORMATION

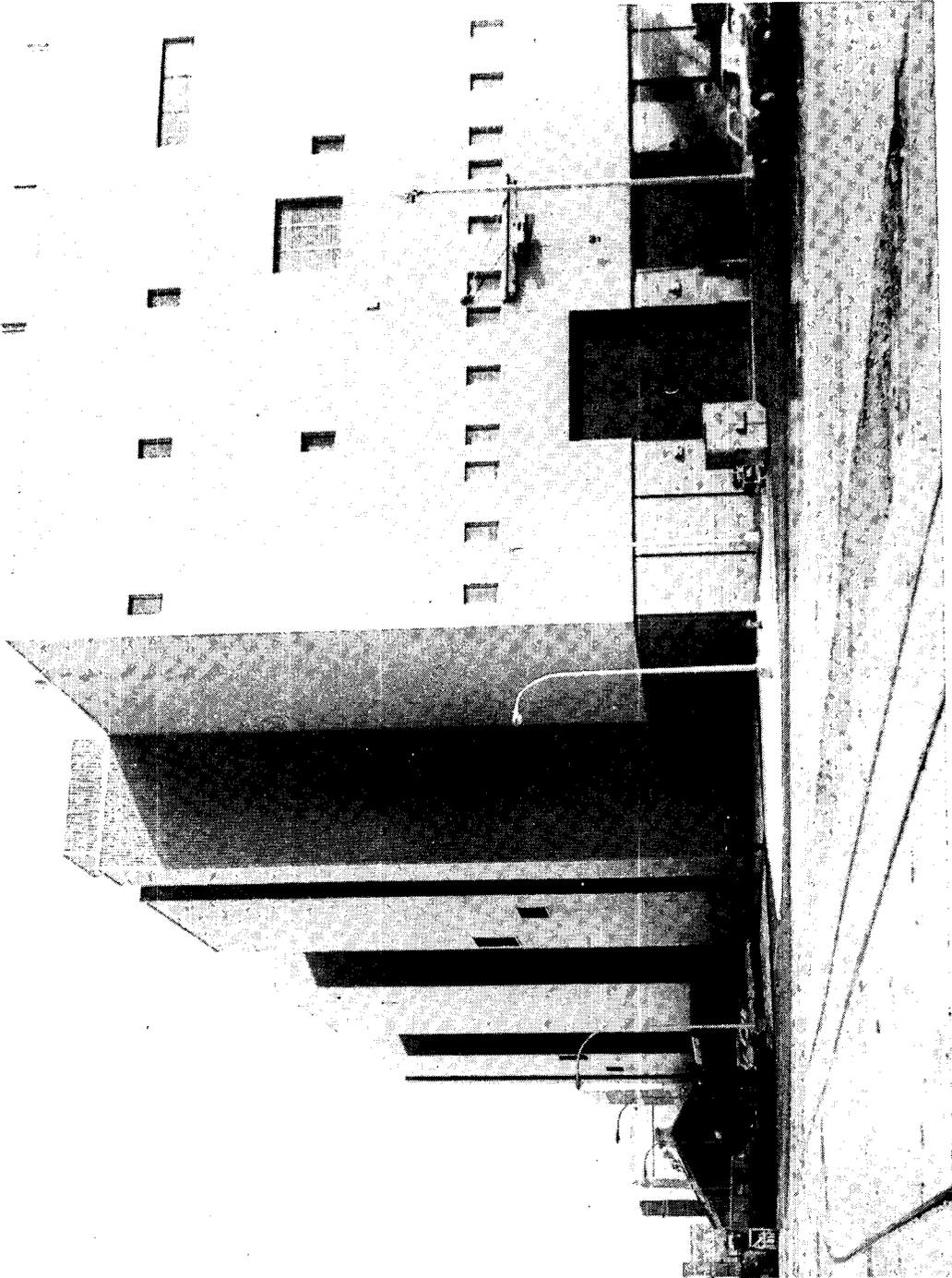
Military construction and projects involving relocating, altering, and repairing facilities generally originate at installations, and the justification packages are prepared at this level. Unfortunately, personnel at the installation level do not have a comprehensive view of Navy-wide workload and mobilization requirements or of the excess capacities at other DOD or civilian facilities. Further, the systems commands, which must evaluate and approve these projects, also have insufficient information in many of these areas. As a result, systems commands are forced to rely too heavily on installation-prepared justifications in making their decisions. As shown in the following example, this situation has led to creating excess and underused capacity.

Philadelphia Naval Shipyard Building 1000

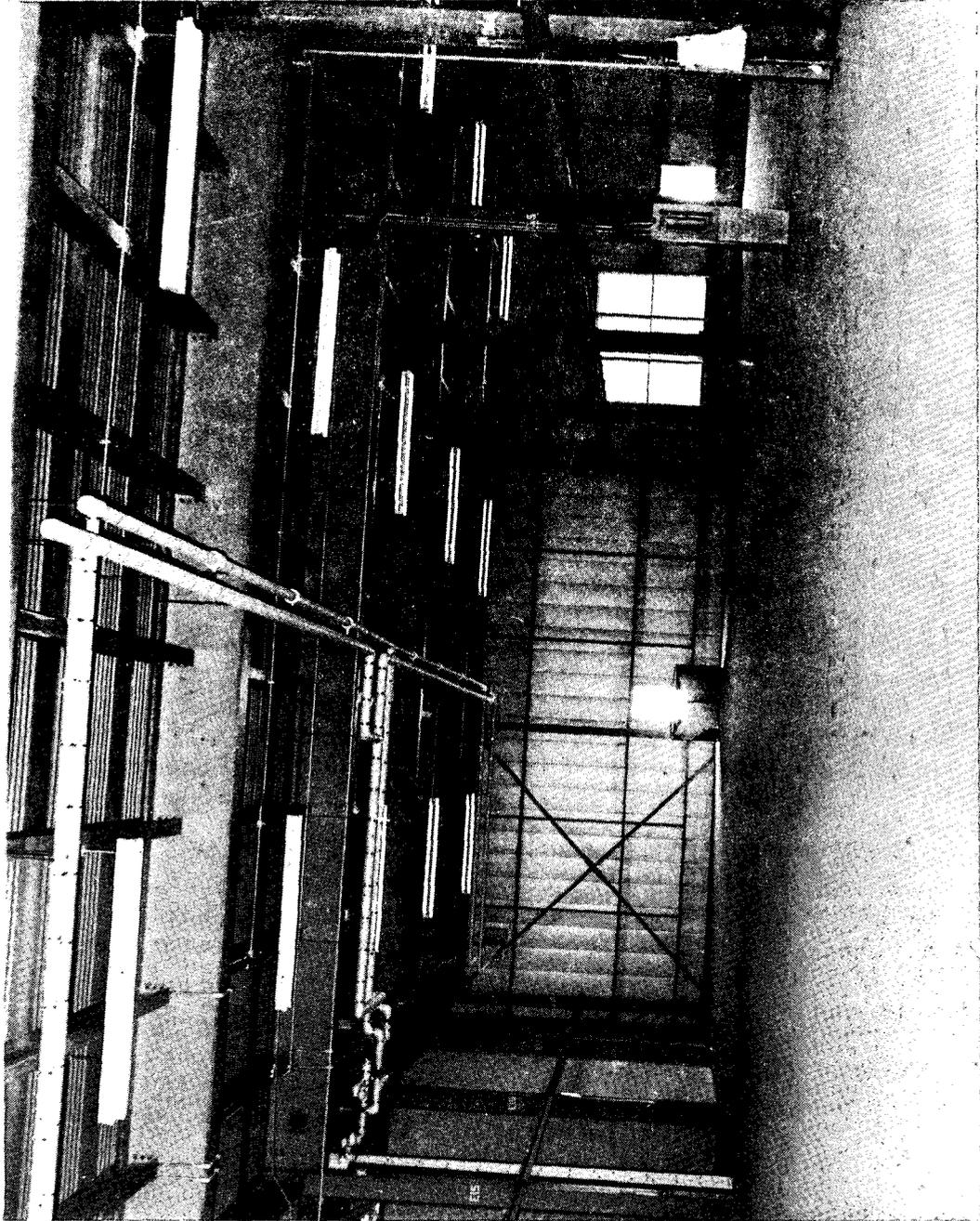
Building 1000 is a four-story, 384,000-square foot electronic/electrical maintenance facility constructed in two phases. Phase one, completed in 1973 at a cost of about \$12 million, consisted of constructing the building itself and completing the first two floors. Phase two is planned for fiscal year 1981 and consists of completing the top two floors at an estimated cost of \$13 million.

The building was justified based on a 1968 study and locally perceived needs. Electronic/electrical work was located in old, inadequate, and separated facilities. The building was and is meant to bring all electronic/electrical work under one roof.

Since 1973, when the building was completed, all shop-related electronic/electrical work has been accomplished on the first two floors (about 191,000 square feet of available



PHILADELPHIA NAVAL SHIPYARD BUILDING 1000 EXTERIOR



PHILADELPHIA NAVAL SHIPYARD BUILDING 1000 4TH FLOOR

space) and in other older buildings (about 95,000 square feet dedicated to electronic/electrical maintenance).

A 1976 study 1/ showed that the Philadelphia Naval Shipyard was using only about 45 percent of its electronic/electrical maintenance capacity (exclusive of the two unfinished floors--nearly 190,000 square feet--in Building 1000). Preliminary figures from a later study made by the shipyard, showed that the 1976 study underestimated the available capacity by about 7 percent, making the underused capacity even greater. Further, the 1976 Navy study showed that Navy-wide electronic/electrical capacity at shipyards was only 45 percent used.

Recently, a final decision to perform a service life extension on the aircraft carrier Saratoga at the Philadelphia Naval Shipyard was made. Shipyard officials told us that they were not sure what impact the Saratoga workload would have on the total electronic/electrical workload at the shipyard. Since the use figures for Philadelphia, as well as Navy-wide, have been less than 50 percent and the impact of the Saratoga workload on the total Philadelphia workload is yet unknown, we believe the Navy should take a very close look at whether the top two floors should be completed. Alternatives available to the Navy are to (1) increase use of the first two floors or (2) transfer some of Philadelphia's workload to other underused installations which have adequate facilities.

CONCURRENT REWORK

Shipyard management has emphasized ship overhaul work over supply-oriented work. To ensure the timeliness of ship work, the shipyards have created and retained wide capabilities rather than rely on the supply system. In many instances, they have performed concurrent rework 2/ rather than use existing supplies. This practice encourages shipyards to retain the capabilities even when the workload volume does not justify it. Further, such practices are detrimental to an effective and economical supply system.

1/NAVSEA's and NAVLEX's 1976 Repairables Rework Study.

2/Concurrent rework refers to removing, repairing, and replacing components during an end item overhaul cycle, as opposed to using supply system-generated items.

Navy Instruction 4400.9 establishes policy pertaining to the management and control of reparable components and limits concurrent rework. It states:

"Overhaul programs for ships, aircraft and major systems at industrial facilities will utilize supply system stocks in lieu of equipment/component overhaul of repairables to the extent system assets and overhaul schedules permit."

In addition, the instruction requires the Chief of Naval Material to develop and implement, with assistance from operating and support commands, procedures and parameters for use of supply system assets in place of concurrent rework of repairables in overhaul programs.

We found, however, that the Navy is doing concurrent rework on supply item components, rather than using available assets. At the Philadelphia Naval Shipyard, we inquired into the inventory status of nine items which were reworked concurrently. The results of this inquiry are detailed in appendix V and summarized below.

For four of the nine items selected, ready-for-issue assets exceeded current requirements. Thus, the items definitely could have been used in place of concurrent rework. For example, a multiplier had current requirements of 182 units and serviceable stock of 682 units.

In the remaining five cases, current requirements exceeded available serviceable assets. However, even in these cases, the requisition priority system should decide who gets these assets, not shipyard management.

The problem of concurrent rework is not unique to the shipyards. We previously reported 1/ on concurrent rework being performed at the naval air rework facilities. The Navy Audit Agency has also reported on this problem.

Relying on concurrent rework rather than supply adversely affects the supply system because the system does not pick up those requirements. As a result, stock level requirements are computed on incomplete data and are therefore sometimes lower than true requirements would dictate. Further, it results in fewer opportunities for batch processing supply items and increases maintenance costs. As the supply

1/"Navy Aircraft Overhaul Depots Could Be More Productive" (LCD-75-432, Dec. 23, 1975).

system's adequacy deteriorates, it becomes more and more difficult to rely on it and encourages installations to retain the capabilities which allow them to concurrently rework components. Thus, a vicious circle results.

Shipyard officials believe they are operating in accordance with Navy policy. Defective components or modules are repaired in the shops if possible. If not possible, the items are returned to stock and serviceable assets drawn from supply. In their opinion, this procedure is more effective and economical.

The Navy recognizes that stronger enforcement of policy preventing concurrent rework is required. In this regard, the Navy has a pilot program at the Norfolk Naval Air Rework Facility to eliminate concurrent rework on F-14 and A-6 aircraft and determine its effect on fleet readiness.

SELF-SUFFICIENCY AND AUTONOMY

The Navy's practice is to allow each installation commander to be as autonomous and self-sufficient as possible. As shown in the following examples, this policy has resulted in excess, underused, and duplicate capabilities.

Manufacturing capability for printed circuit boards

The Mare Island Naval Shipyard developed printed circuit board manufacturing capability in 1973. Mare Island personnel sent messages to all west coast Navy shipyards and naval air rework facilities informing them that it had this capability and would like to do work for them.

The Alameda Naval Air Rework Facility began giving Mare Island its circuit board business in 1974. Over the years, Mare Island performed Alameda's work economically and with satisfactory quality. Despite Mare Island's satisfactory performance, Alameda personnel decided they would like to have their own capability. As a result, Alameda plans to establish a limited manufacturing capability. Alameda estimates the project will cost about \$45,000. Alameda's justifications for wanting to have its own printed circuit board manufacturing capability are a desire for greater flexibility and a hope that having the capability will attract workload from other activities. Meanwhile, Mare Island's capability is underused, even with the workload from Alameda.

In 1978 the North Island Naval Air Rework Facility established printed circuit board repair capability at a cost

of about \$75,000. North Island's purpose was to produce printed circuit boards no longer manufactured, thereby minimizing reliance on outside sources. North Island personnel said they were unaware of Mare Island's capabilities.

The North Island shop is used infrequently because North Island does not have the funding or personnel to operate the shop and, more important, because outside contractors can produce printed circuit boards at a lower cost.

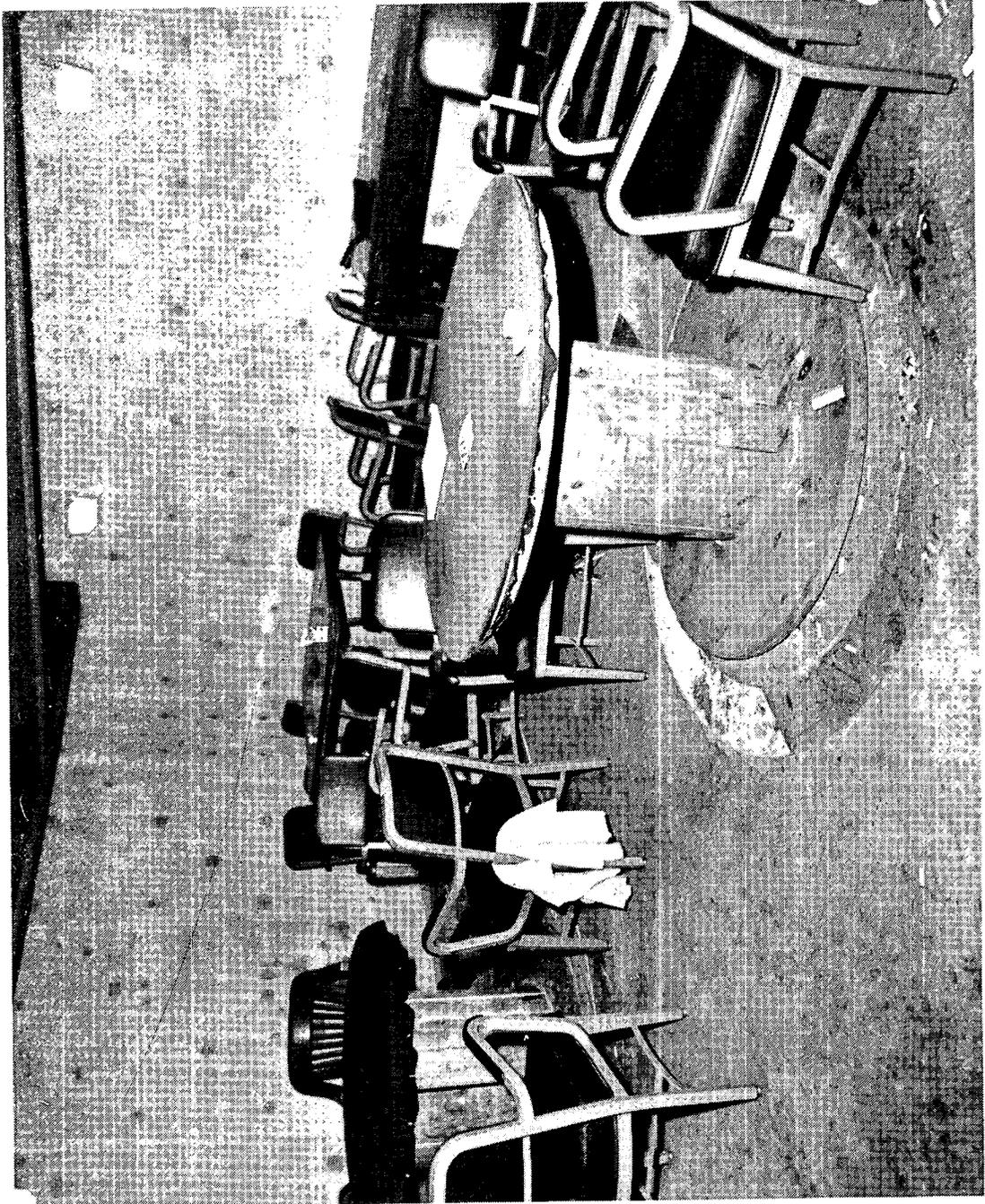
The Long Beach Naval Shipyard established an extensive printed circuit board manufacturing capability for new equipment and modifications in 1974 at a cost of \$83,000. A Long Beach official who was familiar with both Mare Island and Long Beach told us that Long Beach's capability was greater than Mare Island's and also underused.

During the review, we learned that Puget Sound also has printed circuit board manufacturing capability.

Gun and director repair and testing pit

In 1975 Mare Island's gun and director repair and testing pit was rendered useless when the building it was located in was converted to a "deep submergence" facility. Although the pit had not been used for about 1 year and there was no projected workload, Mare Island decided to construct a new pit in its electronic/electrical building. The project was completed in 1975 at a cost of about \$140,000.

The new pit has not been used as intended since completion. As the facility is specifically designed for the repair and testing of surface fire control systems and Mare Island is a submarine yard, it is unlikely that the facility will be used for its intended purpose in the foreseeable future. The facility is currently being used as an employee lounge.



THIS \$140,000 GUN REPAIR PIT AT MARE ISLAND NAVAL SHIPYARD HAS BEEN USED AS AN EMPLOYEE LOUNGE SINCE IT WAS BUILT IN 1975.

CONCLUSIONS

Since the capacity use at Philadelphia, as well as all Navy shipyards, has been less than 50 percent and the impact of the Saratoga workload on the total Philadelphia workload is yet unknown, we do not believe completing the top two floors of Building 1000, at a cost of \$13 million, is appropriate.

Also, because the Alameda Naval Air Rework Facility is near other organic facilities with underused printed circuit board manufacturing capabilities and competitive outside contractors are available, we do not believe that a need exists for establishing this type of capacity at the Alameda facility.

RECOMMENDATIONS

The Secretary of the Navy should direct NAVSEA to evaluate alternatives to completing the top two floors of Philadelphia's Building 1000. NAVSEA should consider

- better utilizing the completed two floors and
- transferring component work to other underused DOD or civilian facilities.

The Secretary of the Navy should direct the Commander, Alameda Naval Air Rework Facility, to disapprove creating any printed circuit board manufacturing capability at Alameda unless Alameda can demonstrate that the other capabilities (in-house and contractor) cannot satisfy Alameda's requirements.

*Naval Sea
Department
Command*

CHAPTER 5

CASE STUDIES IN REACTIONARY PLANNING

The Navy defines planning as a detailed scheme, program, or method worked out beforehand to accomplish an objective or goal. In terms of depot maintenance, long-range planning is the process of providing for the efficient, orderly development of naval facilities. This process includes matching facility requirements with existing depot resources and logically planning facility improvements where warranted.

Unfortunately, all too often the Navy has failed to do such forward planning. This chapter presents three such cases: air launched missiles, AIMS 1/, and naval electronic systems engineering centers. These studies illustrate how the Navy reacted to problems or events resulting in costly expenditures that could have been avoided with proper long-range planning.

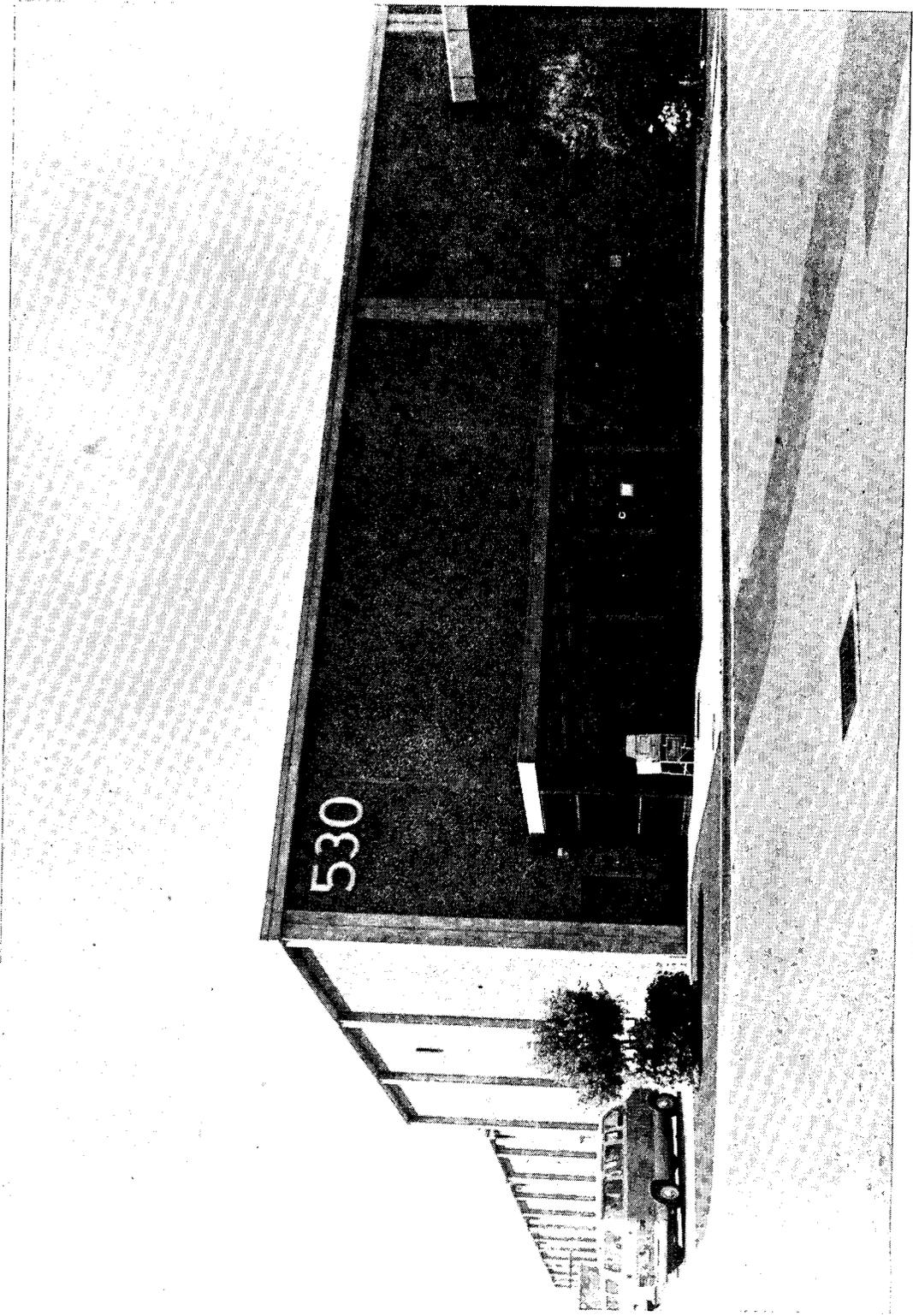
AIR LAUNCHED MISSILES

A \$3 million building was constructed even though prior to ground breaking it became apparent that a project of this size was not justified. Further, neither existing facilities at nearby Navy installations nor the underused capacity at another missile depot were considered. Five years later, realizing that two depots were unnecessary and uneconomical, the Navy decided to consolidate the program at one of them. However, subsequent decisions resulted in the unnecessary expenditure of about \$300,000.

Facility construction

The naval air rework facilities at Alameda and Norfolk have performed depot maintenance on the guidance and control sections of missiles since before the Vietnam buildup. In 1966 Alameda planned a new 80,000-square foot, single-story building specifically designed for missile maintenance. Construction was programed for fiscal year 1970. The project justification included annual facilities consolidation economies of \$1.2 million and anticipated workload

1/AIMS--Air Traffic Control Radar Beacon System (ATCRBS), Identification Friend or Foe (IFF), and Mark XII Identification System--System. We previously reported on the military services' AIMS program in "Aircraft Depot Maintenance: A Single Manager Is Needed to Stop Waste" (LCD-78-406, July 12, 1978).



MISSILE BUILDING ALAMEDA NAVAL AIR REWORK FACILITY

increases through fiscal year 1971 of about 200 percent. However, by 1969 the Navy knew that Alameda would be losing the Terrier missile workload which was part of the project's justification. Alameda officials, concerned about the then apparent decreasing workload, considered moving something else into the building to justify the original size. They decided, however, that it would not be necessary since construction funds were plentiful because other military bases with authorized projects were scheduled to close. In November 1969 the Congress approved funds for the project.

Alameda only considered the facilities available at their own installation. Neither existing facilities at nearby Mare Island Naval Shipyard nor the possibility of expanding Norfolk's program was adequately evaluated.

Even before construction started in May 1971, Alameda officials were aware of decreasing missile workload. For example, in June 1970 Alameda's long-range plans projected a steadily decreasing workload through fiscal year 1975. The decreases in direct hours worked materialized, and by fiscal year 1979 the workload had decreased about 60 percent from the level it was at prior to the start of construction. Nevertheless, the Navy spent about \$3.4 million at Alameda to construct and move into a new missile building.

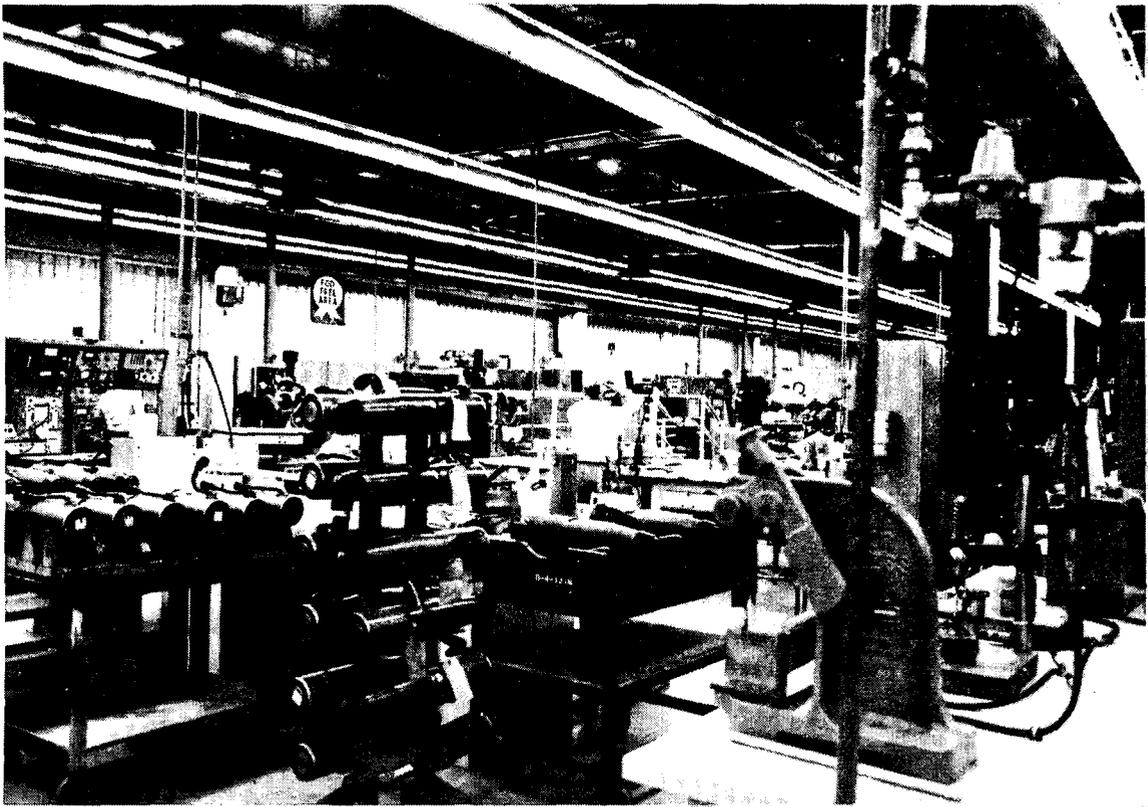
In-house consolidation

In August 1978, after conducting various studies and monitoring the decreasing workload for about 5 years, the Navy decided that the missile maintenance program had deteriorated to a point where the short- and long-range forecast for requirements, including mobilization considerations, indicated that two depots were not economically sound. Accordingly, both depots began making plans to consolidate the workload at Alameda. The decision came only days after the last of five automatic test systems, costing \$1.5 million each, had arrived at Norfolk.

Missile program to go out-of-house

Two decisions resulted in the unnecessary expenditure of about \$300,000 for the air launched missile program.

In March 1979 the Navy decided to temporarily retain part of the missile program (Sidewinder) at Norfolk. By then, Alameda had spent about \$200,000 preparing for this workload that never materialized. Costs included



SIDEWINDER REWORK AREA NORFOLK NAVAL SHIPYARD

- \$132,550 for an engineering documentation update,
- \$50,000 for training and travel,
- \$16,000 for workload consolidation renovation to Alameda's missile building, and
- \$7,000 for nonrefundable equipment.

Additionally, much staff time was wasted and production was disrupted at both depots. For example, over 1 staff year of engineering time and about 200 hours of clerical support were spent at Alameda. Meanwhile, Norfolk, anticipating the pending consolidation, allowed its repair supplies to deplete to the point where they are now considered a potential production bottleneck.

Finally, after spending about \$300,000 consolidating the majority of the air launched missile depot maintenance program at Alameda, NAVAIR, in April 1979, announced that to accommodate increasing staff ceiling constraints and to improve Navy surge capability, the entire program, including the Sidewinder, will be turned over to private contractors by fiscal year 1981.

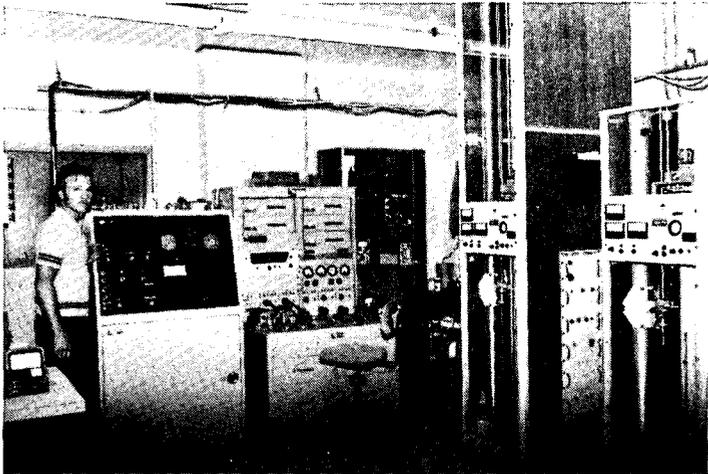
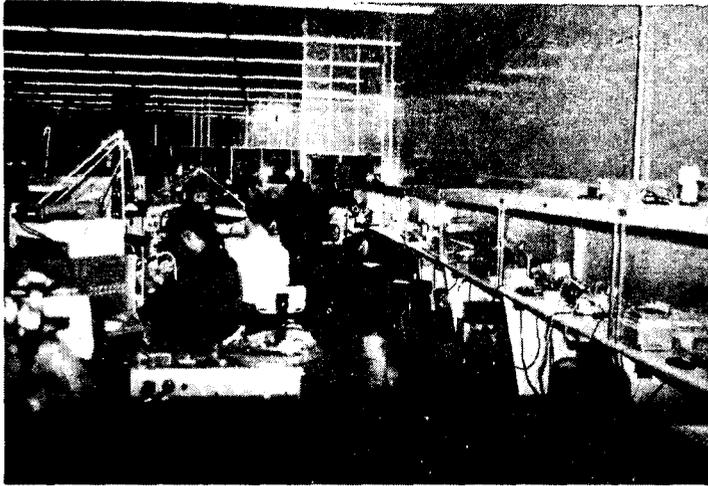
AIMS

Similar to the missile case study, the Navy established excess AIMS capability in anticipation of workload increases which never materialized. Moreover, when the Navy finally decided to consolidate AIMS' capabilities, it failed to consolidate the entire program. As a result, an installation retained very costly, poorly utilized equipment when the equipment was needed elsewhere.

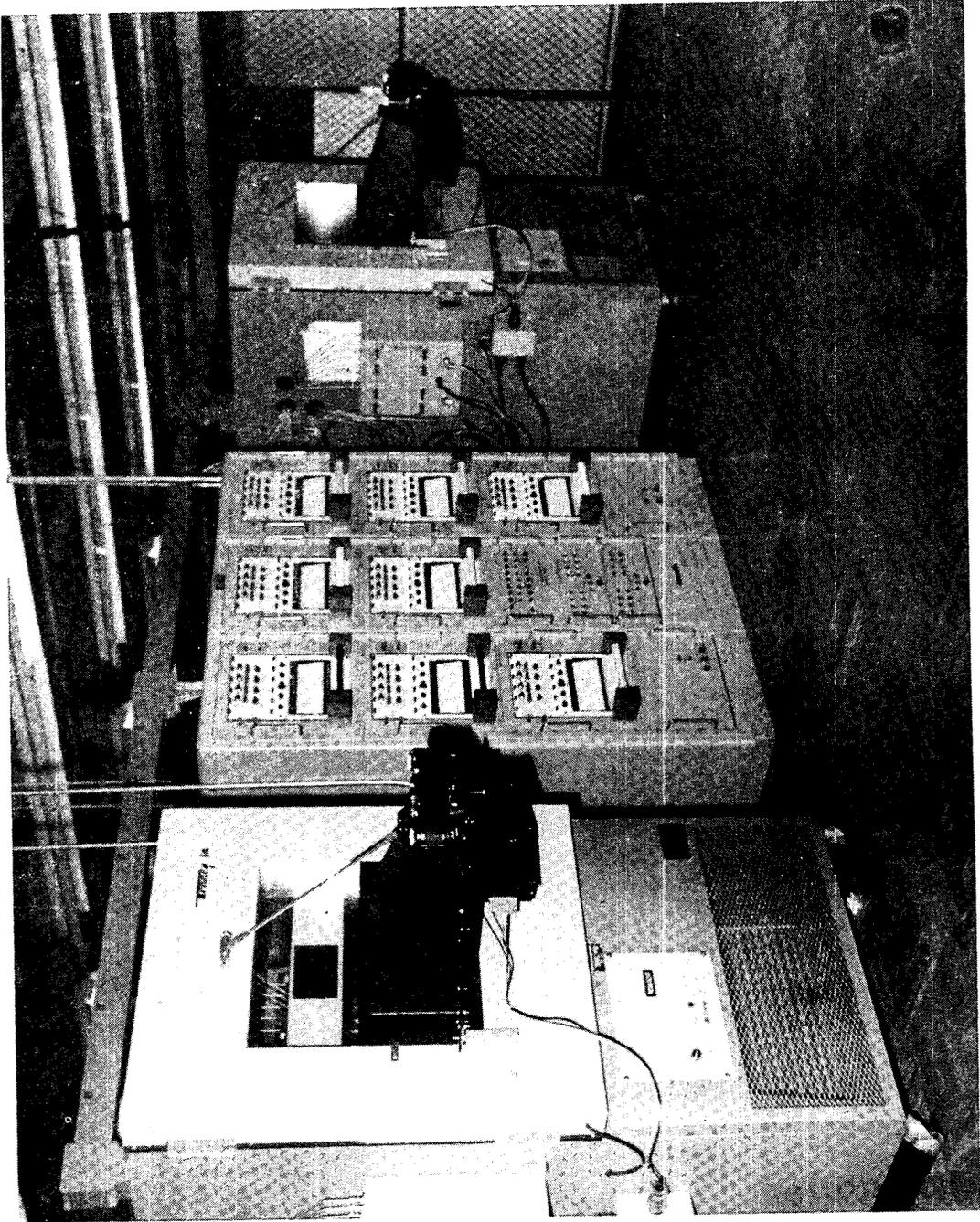
Two AIMS depots established

In 1971 the Navy, anticipating a heavy maintenance workload, and in keeping with its policy of having a depot on each coast, designated the naval air rework facilities at Alameda and Pensacola as AIMS rework points.

Low utilization was evident at both facilities almost from the start. For example, in January 1974 an Alameda official stated "it would appear then that through fiscal year 1975 our \$1.4 million installation will be utilized at about 30 percent of its capacity." Since 1976 the Navy's AIMS requirements have been steadily declining.



AIMS REWORK SHOP ALAMEDA NAVAL AIR REWORK FACILITY



AIMS AUTOMATIC TEST STAND ALAMEDA NAVAL AIR REWORK FACILITY



AIMS REWORK AREA PENSACOLA NAVAL AIR REWORK FACILITY

In November 1977 a joint service study recommended that Alameda's AAU-19 altimeter (a major AIMS component) workload be transferred to Pensacola. Accordingly, in January 1978 NAVAIR designated Pensacola a sole depot for the AAU-19. Subsequently, the majority of Alameda's CPU-66 AIMS computer workload was also transferred to Pensacola. However, a small part (about 16 percent) of the AIMS supply system program was still left at Alameda.

We were told that decreased flying hours, since the 1978 consolidation, have resulted in an AIMS workload which is about 30 percent less than the Navy projected in 1977. Consequently, as of March 1979, Pensacola's AIMS shop was still only 50 percent utilized on a single shift.

AIMS costly fragmentation

Alameda retained all its AIMS equipment, which cost in excess of \$2 million, to rework the remaining AIMS related components and to concurrently rework AIMS instruments removed from aircraft in for overhaul.

We were told that one of the primary reasons why concurrent AIMS rework is being performed at Alameda is because an insufficient number of components were available in the supply system to assure satisfactory turnaround time. However, as shown in the example below, AIMS components were generally available to satisfy Alameda's requirements.

Alameda's Quarterly AIMS Requirements and Their Availability Through the Supply System

	<u>Alameda's quarterly requirements (note a)</u>	<u>Available (note b)</u>
AAU-19 altimeters	43	357
AAU-24 & 31 encoders	57	226
AAU-21 encoders	74	25
CPU-66 computers	10	94

a/Based on 3d quarter, fiscal year 1979 requirements as of May 23, 1979.

b/Supply system components in ready-for-issue condition as of March 20, 1979.

Pensacola AIMS shop officials have expressed a need for much of Alameda's AIMS equipment. For example, a test system costing \$518,000 is on Pensacola's general procurement equipment list. A comparable system arrived at Alameda in October 1978 after the majority of Alameda's AIMS supply program had already transferred to Pensacola. Although this automatic test system has the capacity to test 16 altimeters of the same kind simultaneously, we found that Alameda's average weekly workload was only about 3 or 4 altimeters of the same kind. Thus, during the first 3 weeks of operation (May 1979) this system had only been used about 5 percent of its single shift capacity. While Alameda officials anticipate better usage in the future, Pensacola officials said that they could use Alameda's system at a rate of 50 percent or better.

An Alameda official estimated that it costs them about \$8,000 a quarter to maintain and calibrate their AIMS equipment. Further, in a sample of 13 types of test equipment valued at more than \$1.5 million, we found the average utilization was only about 6.6 percent of single shift capacity.

NAVAL ELECTRONIC SYSTEMS ENGINEERING CENTERS

Two NAVELEX depots 1/ have developed, and consequently, duplicated electronic repair facilities in shipyards in response to inadequate shipyard repair of supply system electronic equipment. NAVELEX established one depot and expanded the other to provide alternate sites dedicated strictly to electronic equipment repair. In each instance, shipyard electronic facilities already existed nearby with adequate repair resources. These facilities, however, did not respond timely enough or cheaply enough to the equipment managers and users because the repair of supply system electronic equipment was subordinated to the removal, repair, and installation of electronic equipment from ships undergoing overhaul. Consequently, both NAVELEX repair facilities continue to operate near underused shipyard repair facilities capable of doing similar work.

The San Diego facility has grown from a small repair operation in the mid-1960s to a large equipment and module repair center currently employing about 250 people (155 Government and 95 contractor employees). At its peak

1/The naval electronic systems engineering centers at San Diego, Calif., and Portsmouth, Va.

employment in 1974, it had about 370 Government employees. The center is located about 100 miles from the Long Beach Naval Shipyard which, since 1970, has had an electronic/electrical capability of 800 to 1,000 staff years and has been at least 60 percent underused.

The Portsmouth depot, a few miles from the Norfolk Naval Shipyard, is a smaller operation than the San Diego facility. It was established in 1975 with Government employees but was converted to contractor employees in 1976. The Norfolk Naval Shipyard has had similar electronic repair capacity and underutilization, as has the Long Beach Naval Shipyard.

The two depots did not develop from long-range planning but instead, were a response to NAVELEX's self-sufficiency attitude and shipyards' inadequate repair of supply system electronic equipment.

In August 1973 NAVELEX's policy stated that its

"objective can best be achieved through self-sufficiency--minimum reliance on external organizations to perform NAVELEX responsibilities. * * * Repair, restoration, and calibration of electronic systems and equipments under NAVELEX cognizance * * * must be minimized in favor of self-sufficiency."

Users of supply-generated equipment have considered shipyard repair inadequate for several reasons. As one 1969 Navy study stated:

"To get the maximum repair from a limited number of repair dollars, [the user] must have a competitive price and a fast turnaround time. * * * Currently, the naval shipyards do not meet these requirements because of overhead costs, the interference with the [repair] by waterfront demands, and inadequate administrative procedures for repairables programs * * * Where alternate choices have been available, the [users] have tended to place the repair work outside the shipyards."

The Navy recognized these problems in 1969. However, rather than correcting the problems, it allowed NAVELEX to develop its depots as alternative repair sites despite shipyard underutilization.

Not until 1975 when NAVFLEX wanted to consolidate even more shipyard work into an expanded east coast repair facility, did the Navy, in its repairables rework study, recognize that NAVFLEX repair facility development may be unnecessary. As a result of the study, NAVFLEX did not develop the east coast facility, and the Long Beach and Norfolk shipyards instituted improved techniques for electronic equipment repair.

CONCLUSION

As discussed in the AIMS case study, it would be economical for the Navy to finish consolidating the AIMS rework program at a single depot and make greater use of available assets in the supply system.

RECOMMENDATIONS

We recommend that the Secretary of the Navy direct the Commander of NAVAIR, to the extent consistent with mission requirements, to:

- Air Traffic Control
Identification Marks System*
- Transfer the balance of the AIMS program from Alameda to Pensacola and require that Alameda obtain its AIMS instruments through the supply system.
 - Require Alameda to transfer its AIMS equipment to Pensacola.
 - Require that Pensacola delete the \$518,000 AIMS automatic test system from its requirements list and use Alameda's.

ELECTRONIC/ELECTRICAL DEPOTESTIMATED DIRECT AND INDIRECT COSTS

<u>Installation</u>	<u>Direct</u>	<u>Indirect</u>	<u>Total</u>
	----- (thousands) -----		
Shipyards (note a):			
Charleston	\$ 8,293.6	\$ 3,541.4	\$ 11,835.0
Long Beach	15,188.7	6,568.5	21,757.2
Mare Island	23,037.2	9,209.2	32,246.4
Norfolk	15,190.1	7,258.1	22,448.2
Pearl Harbor	11,692.2	3,843.5	15,535.7
Philadelphia	10,834.5	4,348.2	15,182.7
Portsmouth, N.H.	6,934.5	2,795.7	9,730.2
Puget Sound	<u>13,298.9</u>	<u>4,949.2</u>	<u>18,248.1</u>
Total	<u>\$104,469.7</u>	<u>\$42,513.8</u>	<u>\$146,983.5</u>
Naval electronic systems engineering centers (note b):			
San Diego	\$ 4,343.9	\$ 3,825.0	\$ 8,168.9
Portsmouth, Va.	<u>3,043.1</u>	<u>1,794.1</u>	<u>4,837.2</u>
Total	<u>\$ 7,387.0</u>	<u>\$ 5,619.1</u>	<u>\$ 13,006.1</u>
Naval air rework facilities (note c):			
Alameda	\$ 14,148.7	\$10,490.8	\$ 24,639.5
Cherry Point	10,805.7	6,022.6	16,828.3
Jacksonville	7,503.0	6,239.7	13,742.7
Norfolk	9,497.0	6,399.3	15,896.3
North Island	15,699.8	8,846.4	24,546.2
Pensacola	<u>12,891.0</u>	<u>7,931.5</u>	<u>20,822.5</u>
Total	<u>\$ 70,545.2</u>	<u>\$45,930.3</u>	<u>\$116,475.5</u>
Total	<u>\$182,401.9</u>	<u>\$94,063.2</u>	<u>\$276,465.1</u>

a/Data from shipyards' financial and operating statements--
Sept. 30, 1978.

b/Fiscal year 1978 figures not available. The figures for
the naval electronic systems engineering centers are esti-
mated on the first two quarters of fiscal year 1979.

c/This is an estimated figure based on 40.5 percent of the
total naval air rework facilities component program. This
percentage was obtained from NAVSEA's and NAVLEX's
"Repairables Rework Study Phase II Report" dated Sept. 1976.

EXCESS ELECTRONIC/ELECTRICAL
DEPOT MAINTENANCE CAPACITY AT NAVY SHIPYARDS,
ELECTRONIC SYSTEMS ENGINEERING CENTERS,
AND AIR REWORK FACILITIES

<u>Installation</u>	<u>Capacity (staff years)</u>	<u>Capacity utilization</u>	
		<u>Staff years</u>	<u>Percent</u>
Shipyards (note a):			
Charleston	405	161	40
Long Beach	859	389	45
Mare Island	709	304	43
Norfolk	959	468	49
Pearl Harbor	233	135	58
Philadelphia	600	271	45
Portsmouth, N.H.	309	176	57
Puget Sound	588	206	35
Total	<u>4,662</u>	<u>2,110</u>	45
Naval electronic systems engineering centers (note a):			
San Diego	433	212	49
Portsmouth, Va.	<u>128</u>	<u>51</u>	<u>40</u>
Total	<u>561</u>	<u>263</u>	47
Naval air rework facilities:			
Alameda	641	404	63
Cherry Point	96	72	75
Jacksonville	303	185	61
Norfolk	586	408	70
North Island	960	601	63
Pensacola	296	259	87
Total	<u>2,882</u>	<u>1,929</u>	67
Total	<u>8,105</u>	<u>4,302</u>	53

a/Facility capacity and utilization obtained from NAVSEA's and NAVLEX's "Repairables Rework Study Phase I Report" dated June 1976.

CAPACITY DETERMINATION

To measure a shop's capacity, an industrial engineer views the facility and equipment layout, discusses workflow with shop personnel, and identifies work positions. ^{1/} Under ideal conditions, each work position can produce 40 direct labor hours a week, or about 2,000 direct labor hours a year. A shop's capacity is the total of these direct labor hours.

In measuring capacity, usage patterns will likely differ between peacetime and mobilization. During peacetime, capacity may be reduced or constrained by personnel unavailable due to leave, training, and other nonproductive activities. During mobilization, however, staffing may be kept at a sufficient level so that all positions could be staffed at all times. This difference was recognized in DOD's "Depot Maintenance Production Shop Capacity Measurement Handbook," DOD 4151.15H. DOD refers to the constrained capacity as "peacetime" capacity and the unconstrained as "physical" capacity.

Also affecting capacity is the reduced efficiency of second and third shifts and worker overlap between the second and third shifts. DOD 4151.15H indicated that multi-shift capacity calculations should include a 15- to 20-percent efficiency reduction for the second and third shifts and a 25-percent shift overlap reduction for the third shift.

The following hypothetical example shows the effect of these views of capacity on a shop with one work position.

^{1/}A work position is the physical area and equipment which would be controlled and operated by one worker. It could be a workbench, one or more pieces of equipment, or whatever the engineer subjectively determines it to be.

	<u>Direct Labor Hours</u>		
	<u>Unconstrained capacity</u>	<u>Constrained capacity</u>	<u>Constraint</u>
<u>Peacetime shifts</u>			
Day	2,000	<u>1,600</u>	20-percent re- duction for staff unavailability (400 direct labor hours)
<u>Mobilization shifts</u>			
Day	2,000	2,000	Fully staffed
Swing	2,000	1,600	20-percent ef- ficiency reduction (400 direct labor hours)
Graveyard	2,000	<u>1,200</u>	20-percent ef- ficiency reduction and 25 percent shift overlap (800 direct labor hours)
Total		<u>4,800</u>	

HIGHLIGHTS OF OUR PREVIOUS REPORTS ON DEPOT MAINTENANCE"Navy Aircraft Overhaul Depots
Could Be More Productive"(LCD-75-432, Dec. 23, 1975)

- Capabilities to meet mobilization contingencies should be the primary factor used to determine the amount of depot capacity retained.
- The Navy does not routinely determine mobilization requirements and has no basis for knowing if existing depot capacity is too much or too little.
- Identifying opportunities for consolidation depends largely on the ability to predict mobilization requirements.
- Based on our model to analyze capacity and mobilization requirements, substantial consolidation potential exists at the six naval air rework facilities.
- The Navy's concept of self-sufficient aircraft depots has led to redundancies in technology capabilities.
- Each depot independently justifies its modernization and equipment projects with no overall plan to recognize the redundancies and to plan overall capacity to meet mobilization needs.
- Modernization funds should be tailored to definite long-range plans.
- Potential exists under DOD regulation for greater use of contracts and interservice support for the Navy's depot needs.
- Organizing depots by technology or functional work group has not been fully exploited.

"Should Aircraft Depot Maintenance
Be In-House or Contracted?
Controls and Revised Criteria Needed"
(FPCD-76-49, Oct. 20, 1976)

- DOD policy to distribute depot workload between organic and commercial sources is unclear and could result in inefficient and uneconomical use of existing organic capabilities.

- No specific criteria is available to determine which weapon system and equipment should be supported in-house, and minimum organic capabilities to meet mobilization requirements have not been determined.
- The objective of DOD's policy is to establish a depot maintenance base consisting of both organic and commercial sources. The Navy, however, plans to accomplish essentially all its mobilization workload in-house.

"The Navy Depot Level Aircraft Maintenance Program--Is There A Serious Backlog?"
(LCD-77-432, Sept. 1, 1977)

- The Navy is not using its component rework funding effectively, which has contributed to a backlog of ready-for-issue components.
- Components are routinely reworked concurrently with aircraft undergoing depot overhaul, while higher priority systemwide components are backlogged.

"Naval Shipyards--Better Definition of Mobilization Requirements and Improved Peacetime Operations Are Needed"
(LCD-77-450, Mar. 31, 1978)

- The primary justification for organic depot maintenance capacity is to meet emergency requirements.
- Through computer simulations, mathematical modeling, and carefully engineered analysis of past, present, and future work, requirements can be identified and shipyard needs established.
- The Navy has not projected probable mobilization workloads and manpower requirements, although NAVSEA assumes mobilization needs will exceed peacetime requirements.
- The Navy has made broad planning assumptions, such as the type of work each shipyard is to perform. However, the assumptions are too broad to translate into specific equipment, facility, and skill needs. The Navy has no basis to measure if existing capacity is too little or too great.

- Although the Navy has not established mobilization needs to assure that the right facilities, equipment, and skills are acquired in the right quantities, substantial investments are being made in facilities and equipment.
- When determining mobilization requirements, the Navy must appraise private capabilities and capacities which could successfully meet increases in depot workloads.

"Aircraft Depot Maintenance:
A Single Manager Is Needed
To Stop Waste"
(LCD-78-406, July 12, 1978)

- DOD-wide aircraft depots have as much as 130-percent excess gross capacity, much of which represents duplicate capabilities, equipment, facilities, and skills between the services.
- Decisions to increase or decrease the depot maintenance resource base are made by the individual services without regard for DOD-wide requirements or capabilities.
- DOD is uncertain about the capabilities and capacities needed to effectively match mobilization and peacetime requirements.
- Despite excess capacity and uncertainty as to what is needed, the services invest as much as \$65 million yearly to modernize facilities and equipment.
- The services have not properly identified what capabilities and capacity private industry can and should provide in peacetime and wartime. More effective use of contractors could reduce the requirements for organic capability.
- A management alternative is assigning functional activities, i.e., electronic, engines, or hydraulics, to specific depots to be responsible for all work in their specific area.

"The Navy's Ship Support
Improvement Project"
(LCD-78-433, Sept. 12, 1978)

- This program is to develop new maintenance concepts for surface ships. The concepts emphasize modular

replacement-type repairs, more intermediate support, and less depot-type work.

- Reliance on supply stocks is essential due to the short availabilities for depot maintenance.
- These new concepts, including increased reliance on intermediate support, will have an effect on the capacity and capabilities needed at the depots, and it is important that these needs be adequately identified.
- The Navy has not adequately considered the capabilities of private shipyards or naval air rework facilities for special needs.
- Success of the new maintenance policy depends on accurate statements of maintenance requirements, which in the past have not been routinely available.

AN EXAMPLE OF SYSTEMWIDE STATUS FOR ITEMSWORKED CONCURRENTLY AT THE PHILADELPHIA NAVAL SHIPYARD

<u>Items</u>	<u>Price</u>	<u>Current requirements</u>	<u>Ready for issue</u>	<u>Total onhand</u>
Calibrator 6625-078-4718	\$ 689	552	684	3,354
Multiplier 5820-760-8922	301	182	682	2,350
Translator 5820-879-7577	1,730	61	120	1,791
Converter 5820-179-8081	1,760	92	155	782
Amplifier 5820-167-7675	1,580	491	97	513
Coupler 5820-078-4717	157	10	3	297
Tuner 5820-836-2985	2,860	190	3	134
Transmitter 5820-078-4726	76	189	60	132
Driver 5820-836-9140	288	109	13	102

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