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THESIS

THE FEASIBILITY OF USING ALTERNATIVE
MODELS FOR DETERMINING
RESERVE NAVAL MOBILE CONSTRUCTION FORCE
MATERIAL READINESS

by

Richard P. Manning III

December 1986

Thesis Advisor Thomas P. Moore
Co-Advisor O. Douglas Moses

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The Feasibility of Using Alternative Models for Determining Reserve Naval Mobile Construction Force Material Readiness

by

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

This thesis explores the feasibility of using alternative models for determining the material readiness of Reserve Naval Construction Force units. There is no system currently in place to measure and determine either the readiness contribution of the equipment and supplies on hand for these forces, or the material condition of the essential combat and major end items that will be used to carry out the wartime mission. Alternative models are explored to enable an accurate assessment of the individual unit's readiness posture and to portray this in appropriate format to the Joint Chiefs of Staff via the UNITREP system.

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I. INTRODUCTION

A. PURPOSE

The purpose of this thesis is to explore the feasibility of using alternative models to determine the material readiness of Reserve Naval Construction Force (RNCF) units. The RNCF presently reports unit readiness via the Unit Status and Reporting (UNITREP) System for personnel and training only. Material inventories are reported as not on hand but will be supplied from Prepositioned War Reserve Material Stock (PWRMS). Material condition is not reported.

The current system is inadequate and does not provide the information required to accurately assess the readiness of RNCF units. A greater understanding of what readiness is and how it is currently measured will help to suggest an approach which will satisfy the needs of the RNCF, its resource sponsors and the Joint Chiefs of Staff (JCS).

B. BACKGROUND

In 1983 a program was begun to improve the readiness of the RNCF by prepositioning war reserve material stock dedicated to these units. The dedicated assets were exempted from normal PWRMS reporting since they were to be containerized and configured to unit sets. This means that material will be packaged separately and dedicated to a specific unit. In a period of rapidly evolving hostilities the RNCF could not assemble, stage and deploy its units unless a significant quantity of material were prepositioned and configured in this manner.

Material has now begun to arrive in significant quantities. Continuing to report via the Unit Status and Reporting System, in the same manner as is currently done, does not reflect the real change in readiness. The Civil Engineer Support Office (CESO) in Port Hueneme, California has been tasked by the Naval Facilities Engineering Command (NAVFACENGCOM) to develop a system for determining the material readiness of RNCF units. These units will then use this system's outputs to reflect the changes in their readiness posture in their UNITREP submissions.

The goal of this system is to enable these units to accurately report their overall combat readiness rating and to show the annual incremental gains which have been experienced as funds have been expended on PWRMS. This thesis is designed to further the progress of reaching this goal and to suggest alternative approaches and models for inclusion in this system.

C. METHODOLOGY

The methodology used was a literature search of all relevant models and reports available from the Defense Technical Information Center (DTIC), the Defense Logistics Studies Information Exchange (DLSIE) and the Federal Depository. Personal interviews were conducted at the Army Concepts Analysis Agency, The Naval Facilities Engineering Command, the Headquarters of the Army Corps of Engineers, the Civil Engineer Support Office, the 31st Naval Construction Regiment and at various offices within the Pentagon.

D. ORGANIZATION

The body of this thesis is laid out in five chapters. Chapter II explores the background and development of readiness concepts and terminology, the Unit Status and Reporting System, and proxy readiness measures employed within the Department of Defense. Chapter III details the current RNCF status within the Department of Defense, the Navy and the Naval Construction force. It also outlines the development of the RNCF and the current initiative to upgrade its readiness. The present reporting system is examined in brief.

Chapter IV examines and compares the Active Duty Naval Construction Force readiness reporting system and the U.S. Army's readiness reporting system. The two systems are compared and contrasted for their applicability to the RNCF. Chapter V developes a proposed model for determining the expected readiness of an RNCF unit. It shows how the model may be used to determine the contribution to readiness gained by prepositioning war reserve material stock and it briefly explores and suggests a more refined model which weights RNCF Table of Allowance (TA) material based on criticality and mission contribution rather than on dollar value alone. Recommendations for further research are included at the end of the chapter.

E. CONCLUSIONS

The conclusions were placed in this chapter for the convenience of the reader. They are developed and explored in greater detail in the remainder of this thesis. The first set of conclusions is based upon observation, interviews and analysis of the current reporting systems of the Naval Construction Force and the U.S. Army.

The first conclusion is that any assessment of the readiness resource areas must be based on the actual material on hand. This is to say that readiness must be deterministic and can not rely on the probabilities of receiving material at some future point in time. There is a degree of leeway provided to the Services in that only critical material and equipment need be reported. All resource evaluations in Part I of a UNITREP must be made against the wartime requirements of a unit.

A second conclusion is that the RNCF will unnecessarily limit their readiness rating if they adopt the Naval Construction Force readiness reporting system. The active Naval Construction Force uses a rigorous approach to measuring readiness in that their system measures almost all of a unit's table of allowance. The table of allowance for Naval Mobile Construction Battalions (NMCBs) includes ninety days of sustainability for supplies and repair parts, and fifteen days of sustainability for subsistence and petroleum products. By adopting the active Naval Construction Force (NCF) system the RNCF will limit its overall combat readiness rating by including sustainability which is not needed to satisfy JCS requirements.

The Active Duty NCF readiness reporting system values supplies on hand based on their acquisition cost which is often a poor approximation for their true military worth. The Army's readiness reporting system has much to offer the RNCF in that it assigns essentiality codes to equipment that can then be used to determine where to invest the annual incremental funds available to have the greatest impact on readiness. Essentiality codes can also be used to select and measure the readiness of those items which are the most critical and without which a unit will not be able to perform its mission.

Another conclusion is that the Army's Mission Capable (MC) rate measure is better suited to the needs of the RNCF. The Active NCF reports equipment readiness based on a snapshot which shows equipment readiness as of the date of the UNITREP. The Army system reports historical readiness which means that Army Reserve and National Guard units report the average equipment availability for the previous ninety day period. Since the RNCF will be receiving the readiness figures from CESO and not developing them internally, a historical readiness based equipment readiness rate will be revealing to the units as well as to the UNITREP users.

When the RNCF adopts a base from which to compare equipment or supplies on hand to wartime requirements, it must remain constant or readiness trend data will be unreliable. This is to say that if the RNCF decides only to measure that equipment and material which is considered critical to a unit, it should not arbitrarily expand the quantities or types of equipment and supplies measured since readiness will fluctuate with whatever base is chosen. This also means that once equipment and supplies are configured to unit sets they can not be withdrawn and used for other purposes without causing fluctuations in their assigned unit's readiness.

Another conclusion is that Part II of an RNCF UNITREP should be used to report subjective estimates of unit capabilities and that the Army's Mission Accomplishment Estimate (MAE) should be adopted for RNCF use. The Mission Accomplishment estimate is a subjective assessment by a unit's commanding officer of the percent of the unit's mission it is able to accomplish. The MAE is a mandatory entry for Army units reporting a C-4 or C-5 overall combat readiness rating. This is expanded upon in Chapter IV.

The next set of conclusions are based on the work down in developing the model found in Chapter V. The first conclusion is that the proposed model which relies on the forecasted average Procurement leadtime (PCLT) and its Mean Absolute deviation (MAD) is an effective method for determining the expected percent of material on hand at a future point in time. It can be used to help determine how quickly deficiencies can be reduced in RNCF assets in the event of a mobilization.

Another conclusion is that the model can also provide an effective means of determining the contribution to readiness which is brought about by the prepositioning of war reserve Material stock. While resources reported to the JCS in Part I of a unitrep must be based on material physically on hand, a model which is capable of forecasting the expected readiness of a unit that does not have a full wartime allowance is better suited to the needs of resource sponsors and unit commanders.

At this point it is best to explore the entire issue of readiness further by examining the components of readiness and the historical development of its measurement within the Department of Defense. Chapter II will elaborate on this development.

II. WHY MEASURE READINESS?

A. HISTORICAL DEVELOPMENT

Shortly after the start of World War II, Great Britain was confronted with a series of complex problems in warfare which it desperately needed to solve. It created the first operations research groups which brought together teams of scientists and engineers to assist field commanders in answering perplexing tactical and strategic questions. The teams were composed of men and women who were asked to tackle intricate problems outside of their fields of expertise. Biologists, chemists and mathematicians studied questions which ranged from the best allocation of depth charges in antisubmarine warfare, to the evaluation of cost and effectiveness of complete military systems. [Ref. 1: p. 8] The success of these teams led the United States to adopt this approach by 1942.

Operations research continued in use within the Department of Defense (DOD) after the WWII but got its next boost with the elections in November of 1960 when Robert McNamara was selected by the Kennedy transition team to be the next Secretary of Defense (SECDEF). McNamara brought with him Charles J. Hitch and others from the RAND Corporation. It was Hitch, the author of *The Economics of Defense in the Nuclear Age* [Ref. 2], who organized and headed an operations research division within the Defense secretariat.

During the McNamara years, economy and efficiency became watchwords and the use of quantitative economic analysis became inexorably intertwined with determinations of resource allocation. The importance of proper allocation became especially pressing when the Kennedy Administration adopted a national strategy of *flexible response* and moved away from a then unrealistic strategic doctrine of *massive retaliation.*

Under the flexible response doctrine, the U.S. military was organized based on contingencies and commitments around the world. This doctrine called for a quick response to hostilities by a small task force, with follow-on augmentation of the proper size by units using sea and airlift capabilities [Ref. 3: p. 4]. Since the task forces were composed of joint service forces, a need existed to assure that resources were allocated properly among these services.

It was also during this period that the Planning, Programming and Budgeting System (PPBS) came into being. While the PPB system centralized budgeting power in the hands of the Secretary of Defense, it also provided a system to assist the Secretary in making rational choices about the allocation of resources among competing programs.

The initial PPB system provided a groundwork for implementing a national military strategy. For the first time within DOD, there was a linkage between the financial inputs and military outputs resulting from the budget process.[1]

The next development which occured was the recognition by the Joint Chiefs of Staff (JCS) and the services that a formalized system for reporting readiness was needed. After the Berlin crisis of 1961, when the Army was preparing to reinforce its European-based units, it found that its overall readiness posture was considerably worse than had been estimated. As a result of this, the Army developed their first central reporting system in 1963. [Ref. 4: p. 19] After the publication of the Army directive implementing this system, the JCS then required the other services to develop similar systems modeled after the Army's approach.

Even though the National Defense Act of 1947 had required the services to provide DOD with a current readiness report on all operational forces, no reporting procedure had been developed up to this time. It was in 1967 that the JCS incorporated each service's readiness reporting system into a comprehensive joint system called the Readiness Operations (REDOPS) Report. The Coast Guard was included as part of the Navy reporting system, since in time of war the Coast Guard transfers to the Department of Defense under Navy jurisdiction. Individual units reported up their chain of command using a Force Status and Identity (FORSTAT) Report. This system, however, suffered from a lack of uniformity across Service lines. By the late 1970s it was apparent that there was a need to further standardize and to better define what readiness was and how to measure it.

B. THE TAXONOMY AND DEFINITION OF READINESS

Readiness is an often spoken but little understood word when used in a military context. To many people within the Department of Defense and the Federal

---

[1]The 1986 Packard Commission report has sought to further strengthen the utility of PPBS by improving Defense strategy development and the Congressional Defense budget process.

government, as well as to the general populace, a state of readiness is thought of as implying:

> the capability, with a high degree of confidence, of winning any war, fought any place at any time. [Ref. 5: p. 2-1]

A military organization which is not capable of responding according to this definition is not ready.

Readiness, when used in this context, refers to the overall military capabilities of the nation. This definition however, presents difficulties to a military or civilian analyst when attempting to quantify readiness or to relate readiness to levels of funding.

All military units do not possess the same capabilities for countering the myriad of conceivable threats to the nation's security. Indeed, each unit is created to address specific aspects of a threat and is organized along the mission and task lines needed to counter the threat. This is done to facilitate an organized management of the nation's defense forces.

For purposes of quantification, readiness as it is defined above is too broad a term to be meaningfully applied down to a unit level. A further shortcoming of this definition is that the term is also used by logisticians and military planners to refer to two other concepts: material readiness and personnel readiness. Both of these concepts are the focus of their concerns. The general usage definition falls short of providing a meaningful basis for measuring and incorporating these other types of readiness.

Difficulties have arisen within DOD and the Congress over the imprecise use of the term *readiness*. These were highlighted in a 1980 General Accounting Office (GAO) report. This report [Ref. 6] stated that in both the 1980 House of Representatives Panel on Readiness and a U.S. Air Force-sponsored study, there was concern over the lack of uniformity in defining readiness. The Air Force study had uncovered forty-four definitions of readiness and related terms in use within DOD. [Ref. 6: p. 6]

As a result of the above concerns, DOD, the JCS, and the military Services developed a standardized taxonomy of definitions for readiness and related terms. These were incorporated into JCS Publication 1 in 1982 [Ref. 7]. The definitions follow.

Military Capability: The ability to achieve a specified wartime objective (win a war or battle, destroy a target set). It includes four major components:

- Force Structure - Numbers, size, and composition of the units that comprise our Defense forces; e.g., divisions, ships, airwings.
- Modernization - Technical sophistication of forces, units, weapon systems, and equipments.
- Readiness - The ability of forces, units, weapon systems, or equipments to deliver the outputs for which they were designed (includes the ability to deploy and employ without unacceptable delays).
- Sustainability - The "staying power" of our forces, units, weapon systems, and equipments, often measured in numbers of days.

As can be seen, readiness or force readiness is viewed as a component of military capability. It should also be noted that force readiness implies mobility and an integration and coordination of the units within a force. The hierarchical relationship for military capability is shown in Figure 2.1.

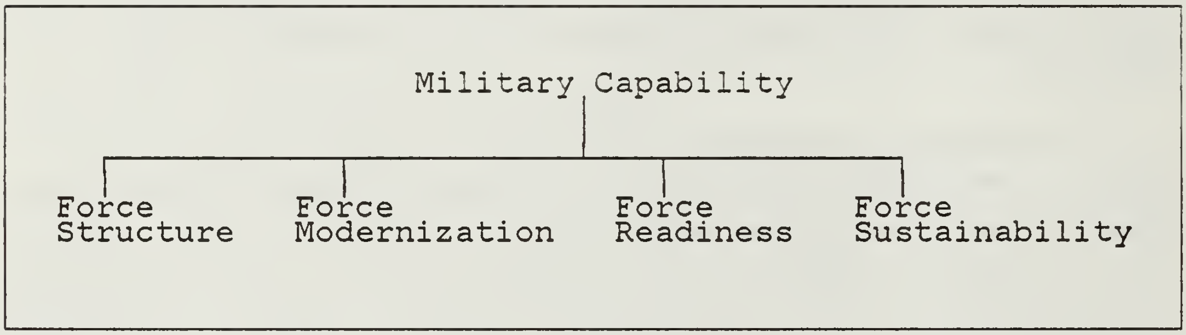

Figure 2.1 Relationship of Readiness to Associated Terms.

Force readiness is only one of the key components of the broader concept of military capability. It can be clearly seen that a military force, under this standard definition, might be 100% ready but still not provide an adequate degree of military capability due to a deficiency in either force structure, modernization or sustainability. It is also possible for a military force to be less than 100% ready and still perform adequately the mission for which it was intended.

Figure 2.2 shows the further breakdown of *force readiness* into its sub-components of *material* and *personnel* readiness.

Material readiness from the viewpoint of DOD [Ref. 8: p. 1831] and the JCS involves two further considerations:

- inventories of equipment and supplies on hand relative to the wartime requirement, and

- the condition of this hardware relative to its ability to perform the functions for which it was designed, procured or modified.

Personnel readiness from this same viewpoint involves two considerations also:

- inventories of personnel on hand relative to the wartime requirement, and
- the status of training for these personnel for the functions they must perform in wartime.

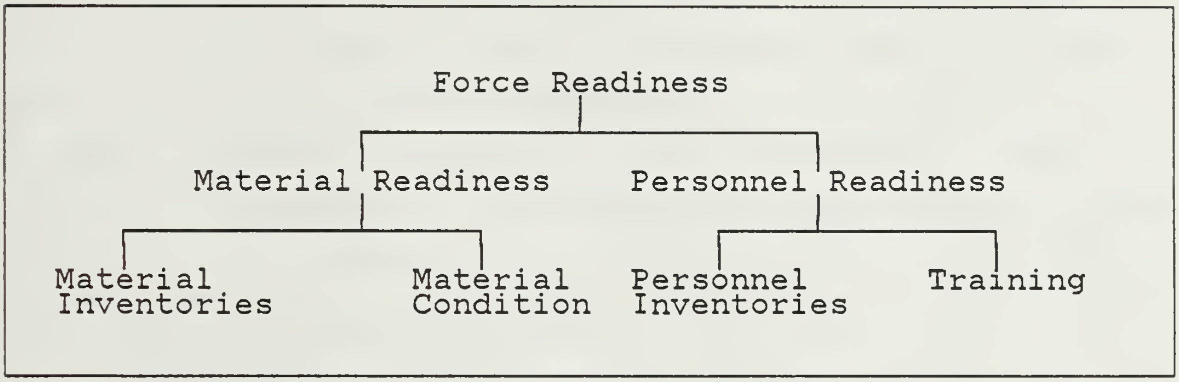

Figure 2.2 Taxonomy of Readiness.

This standardized set of definitions for readiness and related terms, as adopted by the JCS, makes the task of quantitatively measuring readiness more feasible. The four factors listed at the bottom of Figure 2.2 provide the basic measures used by the JCS to determine the readiness of all reporting units.

For material inventories, the readiness measure used is the percentage of critical material physically on hand versus the forecasted wartime requirements. For personnel inventories, it is the percent of people on hand versus the forecasted wartime requirements. For training, the measure is the percentage of training accomplished versus that which is required. For material condition, there are several measures. The one most often used is the Mission Capable (MC) rate.[2] This is essentially the average percentage of time a weapon system or piece of equipment is able to perform the functions for which it was designed, procured or modified. This measure can be aggregated across different types and quantities of equipment and weapon systems.

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[2]This is equivalent to Operational Availability (A_o) which is the term used to describe an individual system's state of functional readiness at any point in time. The only difference is that MC is expressed as a percentage whereas A_o is expressed as a probability: $MC = A_o * 100 = (\text{Uptime}/\text{Totaltime}) * 100$.

The readiness measures discussed thus far are reported through the chain of command to the JCS by the Unit Status and Reporting (UNITREP) System. The UNITREP replaced its predecessor, FORSTAT, in February of 1980. This provided for increased coverage of factors which affect the readiness of units. It incorporated personnel and logistics reports and changed the base of measurement to reflect actual wartime requirements instead of peacetime allowances.

C. UNIT STATUS AND REPORTING (UNITREP) SYSTEM

The UNITREP system is managed and controlled by the Office of the JCS (OJCS). Under this system unit reports are submitted up through the chain of command to the JCS, via the Unified and Specified Commanders-in-Chief (CINCs). The reports must be written according to broad guidelines established in JCS Publication 6 [Ref. 9: p. 2-1-3]. Service reporting rules tailor this information further and provide additional reporting guidance. At a minimum reports are required to be submitted whenever a change occurs which affects a unit's overall readiness rating.

The principal measure of unit readiness used within DOD and provided by the UNITREP is the C-rating, or combat readiness rating. The C-rating is used to determine the overall readiness of a reporting unit. The five categories of overall readiness are defined as follows in the order of decreasing readiness:

1) *C-1, Fully Combat Ready.* A unit possesses its prescribed levels of wartime resources and is trained so that it is capable of performing the wartime mission for which it is organized, designed, or tasked.

2) *C-2, Substantially Combat Ready.* A unit has only minor deficiencies in its prescribed levels of wartime resources or training which limit its capability to perform the wartime mission for which it is organized, designed, or tasked.

3) *C-3, Marginally Combat Ready.* A unit has major deficiencies in prescribed wartime resources or training which limit its capability to perform the wartime mission for which it is organized, designed, or tasked.

4) *C-4, Not Combat Ready.* A unit has major deficiencies in prescribed wartime resources or training and cannot effectively perform the mission for which it is organized, designed, or tasked.

5) *C-5, Service Programmed, Not Combat Ready.* Due to Service programs, a unit does not possess the prescribed wartime resources or cannot perform the wartime mission for which it is organized, designed, or tasked.[3]

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[3]Units which are rated C-5 are restricted to the following categories: ships in overhaul or restricted availability, units undergoing major equipment conversion or transition, units placed in a cadre status by the parent Service, units which are being activated, inactivated or reactivated, units which are not manned or equipped but are required in the wartime structure, and units with a primary task as training units that could be tasked to perform a wartime mission.

The overall C-rating is based upon input from each of the four resource categories shown in Figure 2.2. These categories are equivalent to the following: Equipment and Supplies on Hand, Equipment Readiness, Personnel, and Training. Each of these are then converted into C-ratings by criteria shown in Tables 1 through 4 The overall C-rating for a unit is the lowest C-rating for any of the four categories.

TABLE 1

PERSONNEL C-RATING CONVERSION TABLE

CRITERIA	RESOURCE AREA COMBAT RATING				
	C-1	C-2	C-3	C-4	C-5
a. Total available strength divided by structured strength.	>90%	>80%	>70%	<70%	N. A.
b. Service selected critical MOS qualification of available strength divided by structured strength of critical MOS.	>85%	>75%	>65%	<65%	N. A.
c. (Optional by Service) Grade fill of Service selected critical E-5s and above available divided by structured strength of critical E-5s and above.	>85%	>75%	>65%	<65%	N. A.

The UNITREP system was designed to provide a picture of force readiness to the National Command Authorities. It was not intended to provide a mechanism for developing budgets or for evaluating a commanding officer's performance. The UNITREP system was designed expressly to let the JCS and Services know which units are ready to go to war on short notice. For those units that are not ready, the UNITREP indicates what resources constrain them.

The UNITREP format can be and is used by each Service to collect additional detailed information. The Navy, Air Force and Coast Guard require mission areas and capabilities to be assessed. The Army requires mission accomplishment estimates for units reporting C-4 or C-5 overall ratings. (For a further discussion of the definitions of mission area assessments and mission accomplishment estimates, see chapter IV.) This supplemental reporting data is intended to provide a more complete assessment of Service specific readiness and to identify in greater detail the resource categories that

TABLE 2

EQUIPMENT AND SUPPLIES ON HAND
C-RATING CONVERSION TABLE

CRITERIA	RESOURCE AREA COMBAT RATING				
	C-1	C-2	C-3	C-4	C-5
a. Total Service selected combat essential equipment possessed divided by prescribed wartime requirement.	>90%	>80%	>65%	<65%	N.A.
b. Total Service selected end items, support equipment and supplies possessed divided by prescribed wartime requirement.	>90%	>80%	>65%	<65%	N.A.

TABLE 3

EQUIPMENT READINESS
C-RATING CONVERSION TABLE

CRITERIA	RESOURCE AREA COMBAT RATING				
	C-1	C-2	C-3	C-4	C-5
a. Total Service selected combat essential equipment possessed and combat ready divided by total wartime requirement.	>90%	>70%	>60%	<60%	N.A.
b. Major Service selected end items of equipment possessed and combat ready divided by prescribed wartime requirement.	>90%	>70%	>60%	<60%	N.A.

are constraining the overall C-rating. With the greater level of information provided by Service reporting requirements, resources can be reallocated to eliminate deficiencies on either a macro or micro level of management.

TABLE 4

TRAINING
C-READINESS CONVERSION TABLE

CRITERIA	RESOURCE AREA COMBAT RATING				
	C-1	C-2	C-3	C-4	C-5
a. Weeks of training required.	<2	>2<4	>4<6	>6	N. A.
b. Or, percent of unit training completed.	>85%	>70%	>55%	<55%	N. A.

D. PROXY READINESS MEASURES

Before leaving the discussion of readiness, there are several additional indicators of readiness that should be examined. These indicators are used by DOD and the Services as *proxy* measures. These are substitute measures which are used to show whether or not the basic measures accurately reflect the readiness posture of reporting units. The proxy measures also indicate the health of various logistics systems.

The basic measures are reiterated in Table 5 and some, but not all, of the proxies which are used within DOD are shown in Table 6.

TABLE 5

BASIC READINESS MEASURES

% Equipment versus Requirements

% Personnel Inventories versus Requirements

% Training versus Requirements

Mission Capable (MC) Rates

As would be expected, proxy measures are directly related to the basic measures of readiness and provide insight into factors that contribute to increases or decreases in these basic measures. For example, it is reasonable to expect that as reenlistments

TABLE 6

PROXY READINESS MEASURES

- Maintenance Backlogs
- Supply Fill Rates
- Supply Backorders
- Cannibalization Rates
- War Reserve Withdrawals
- Flying Hours/Steaming Days/or Battalion Training Days
- Exercises
- Reenlistment Rates
- Mental Categories of Enlistees
- Match of Skills and Grades versus Jobs
- Personnel Turbulence/Stability

increase and the match of skills and grades versus jobs improves, the percent of personnel inventories versus requirements will also improve. It is also reasonable to assume that the training resource area will show improvement as the number of exercises and battalion training days increase.

While all proxy readiness measures are not collected in the UNITREP, they are monitored by various agencies within the Services and DOD. For example, the Navy Enlisted Personnel Management Center (EPMAC) in New Orleans collects information on unit manpower shortages by quantity, paygrade, occupational specialty (Rating or MOS), and educational training (NEC).

Deficiencies which degrade unit readiness are filled on a priority basis. The ability to fill these deficiencies however, is directly related to the mix of personnel assets available.

This raises the next key point. There is an interaction between the variables which affect readiness and which, in turn, affect military capability. The proper mix of personnel assets may not be available, at a given time, because of manpower ceilings imposed on DOD by the Congress or because recruitment or retention have decreased.

If the personnel are not available due to a decrease in recruitment or retention then this decrease, in turn, may have been brought about by a higher operating tempo which created longer periods of family separation. It could also have been caused by an improved national economy and a relative decrease in the perceived value of military compensation.

Trends in proxy indicators may call attention to problems but they also point the way to possible solutions such as: increasing salaries and benefits, stepping up recruiting efforts, or both. As actual personnel skill and grade levels decrease in relation to a unit's wartime requirements; there will be an effect on the quality of training and possibly (depending on the mix of personnel assets affected) on the maintenance of the unit's equipment or its ability to obtain the necessary support from the logistics system.

There is a direct correlation and interaction between each of the basic measures of readiness. While it is proper to aggregate them on the basis of a measure such as a unit's overall C-rating, it is also important to realize that each resource category represents a decision variable which involves a question of economic choice that must be answered to provide balance to the total system.

Charles Hitch expressed this idea as follows:

> An economically efficient solution to military problems does not imply a cheap force or a small military budget. It simply implies that whatever the military budget . . ., the greatest military capabilities are developed. Since military capabilities are plural and not easily commensurate, an efficient military establishment, in the technical sense, would merely be one in which no single capability - antisubmarine warfare, ground warfare, offensive air, an so on - could be increased without decreasing another. [Ref. 2: p. 123-124]

This economically efficient solution applies equally well to the basic measures of readiness and the resources that they represent. The choices that are made to maximize force readiness given a fixed budget are the same choices that must be made to minimize the cost per unit of readiness attained.

It should be apparent why readiness is measured within the National Defense establishment. What may not be apparent is that readiness is a perishable commodity that requires the constant application of resources. These resources must be managed efficiently to maximize their contribution to the military capability of the Nation. Suitable systems must be put in place to assure that this is accomplished.

III. THE CURRENT SYSTEM

A. BACKGROUND

National objectives are first developed by the president and are then translated into strategic concepts and military objectives. Various groups within the executive branch including the Departments of State and Defense as well as the National Security Council (NSC) provide inputs. With the aid of the Office of Management and Budget (OMB), the president also provides guidance for the annual budget process and preparation of the president's budget for submission to the congress.

The JCS has responsibility for the part of the PPB system which generates the DOD portion of the president's budget. An annual Joint Strategic Objectives Plan (JSOP) is prepared which states the JCS position on the forces required to meet military objectives for the current and future years of the Five Year Defense Plan (FYDP). The JSOP is then forwarded to the Secretary of Defense for planning purposes. While the JSOP in the past was of little worth, since the JCS did not constrain their planning to realizable level of funding, this has changed recently and the JSOP now provides a valuable planning tool [Ref. 10: p. 263].

Decisions concerning threat assessment, force levels, and force mix are reflected in the strategic, logistic and programming guidance provided by the Office of the Secretary of Defense (OSD) to the military Services and to the CINCs. This programming guidance takes into account the budget totals which the Secretary believes will be eventually approved and appropriated by the congress. Based upon the military objectives outlined and the funding constraints imposed, a national military strategy is formed.

1. Operation Plans

Operation Plans (OPLANs) are developed by the CINCs in line with national military objectives. Input is obtained from each of the Services in order to formulate plans on how best to meet a specified threat. An OPLAN is a document which lays out in detail the plan for military operations over a large geographic area and cover considerable periods of time. For instance, an OPLAN which covers the Pacific theater, is under the cognizance of the Commander-in-Chief Pacific (CINCPAC). The Service input for the Navy portion of a Pacific theater OPLAN would come from the

Navy Service component commander who is the Commander-in-Chief of the Pacific Fleet (CINCPACFLT). Each Service component commander identifies the support that they consider necessary to accomplish the strategic mission identified by the unified commander. Plans are then laid out in sufficient detail to identify the force levels and logistics materials that will be necessary to accomplish the mission.

2. Joint Operations Planning System

To provide uniformity among the Services and CINCs in developing operation plans, the Joint Operations Planning System (JOPS) was created under the direction of the JCS. It provides a mandatory set of detailed procedures for the development, review and eventual execution of OPLANs. JOPS provides both a system and a set of computer-based software aids to assist in force, logistics and transportation planning. The system includes the capability to integrate the required personnel, equipment, supplies and support facilities needed to successfully execute any operations plan. It also specifies the planning, and review procedures for each logistics element and provides a Time-Phased Force and Deployment List (TPFDL) to promote efficient use of the logistics pipeline.

Within an appendix to the logistics annex of an OPLAN can be found the Civil Engineer Support Plan (CESP). The CESP identifies the facilities that will be required and the units needed to assemble and maintain those facilities in support of the Navy's mission. The CESP is developed by processing information in a data base known as the Civil Engineering File (CEF). The CEF is composed of data elements which contain information on Advanced Base Functional Components (ABFC).

3. Advanced Base Functional Components

The Advanced Base Functional Component System is a tool of Naval logistics:

> It is the quantitative expression and measurement of planning, procurement, assembly and shipping of material and personnel needed to satisfy emergency facility support requirements overseas. An ABFC is a grouping of personnel, facilities, equipment and material designed to perform one of the special functions or accomplish a particular mission of an advance base. [Ref. 11: p. 1]

While this rather dry statement sums up the nature of an ABFC, it is lacking somewhat in color and depth.

The Navy has built advance bases ever since the War of 1812 when the first one was constructed on Nukihiva Island in the Marquesas by the commanding officer of the USS ESSEX in October of 1813. The base, Fort Madison, located in what is now French Polynesia, was needed as a safe harbor to allow refurbishment of the ESSEX and some captured ships before engaging a British Naval squadron which was actively searching for ESSEX. While the base was later overrun by hostile natives and the ESSEX was eventually captured by the British, it points out that a need existed early in the nation's history for the Navy to have the ability to build, maintain and defend advance bases in support of the fleet.

It was not until World War II, when the SeaBees were constructing a series of advance bases throughout the South Pacific, that a need to standardize facilities became apparent. Standardization meant pre-engineering the facilities in order to more efficiently utilize the personnel, material, supplies and equipment available for the war effort. It also meant prepackaging the facilities to save time and reduce wastage of assets. This in effect was the precursor of the Navy's ABFC system of today.

A grouping of material and personnel that make up an ABFC represents preplanning of the material and personnel needed to perform a specific function. Examples of ABFCs are shown in Table 7. The Navy's ABFC system is managed under the control of the Chief of Naval Operations (OP-44). OPNAV publication 41P3A [Ref. 11] is the definitive table of advance base functional components. In order to assure that material planning for ABFCs is maintained, the CNO has assigned each ABFC to a hardware or systems command (SYSCOM). Examples of dominant commands responsible for various ABFCs can also be seen in Table 7.

Each command assigned responsibility for an ABFC maintains a detailed Advanced Base Initial Outfitting List (ABIOL). This is an itemized line-item list of the material in each ABFC. Other commands may be assigned responsibility for a part of the material in an ABFC and are then responsible for maintaining their portion of the ABIOL.

There is a third set of documents, besides OPNAV P-41P3A and the ABIOL, needed to complete the picture of the ABFC system. This third set is the Advance Base Functional Components Planning Guide, NAVFAC P-437 [Ref. 12]. The ABFC Planning Guide is a two volume document. Volume I contains reproducible engineering drawings and networks, and volume II contains detailed lists of facilities, assemblies and line items required for the construction of the components of an advance base. A member of a Navy planning staff must use at least the information

TABLE 7

EXAMPLES OF ADVANCE BASE FUNCTIONAL COMPONENTS[4]

TITLE	DOMINANT COMMAND
Mobile Facility - Small Craft Base	NAVFACENGCOM
Inshore Undersea Warfare Patrol (Heavy)	NAVSEASYSCOM
Underwater Demolition Team	NAVSEASYSCOM
Military Sealift Command Office (Small)	NAVFACENGCOM
Naval Base Communications (Large)	SPAWARS
Fleet Issue Load List (Afloat Resupply)	NAVSUPSYSCOM
Ships Store Facilities (5000 to 7000 men)	NAVSUPSYSCOM
Naval Overseas Air Cargo Terminal (Large)	NAVAIRSYSCOM
Refrigerated Storage Facilities (4000 men)	NAVSUPSYSCOM
Ship Repair (Medium)	NAVSEASYSCOM
Decontamination of Ships Exposed to NBC Warfare	NAVSEASYSCOM
Hospital (1000 Bed)	NAVMEDCOM
Ophthalmic Lens Laboratory	NAVMEDCOM
Dental Clinic (Medium)	NAVMEDCOM
P-3C Squadron Augmentation	NAVAIRSYSCOM
Photographic Laboratory Mobile Aerial Reconnaissance	NAVAIRSYSCOM
Chapel (Small)	NMPC
Fleet Recreation Center	NMPC
Naval Mobile Construction Battalion	NAVFACENGCOM
Fire Protection-Waterfront and Harbor	NAVSEASYSCOM

contained in P-41P3A and P-437 to determine which components are needed when tailoring an advance base to an OPLAN.

[4]NAVSEASYSCOM is the Naval Sea Systems Command. SPAWARS is the Space and Naval Warfare Systems Command. NAVSUPSYSCOM is the Naval Supply Systems Command. NAVAIRSYSCOM is the Naval Air Systems Command. NAVMEDCOM is the Naval Medical Command. NMPC is the Naval Military Personnel Command.

There is one other item that must be understood before moving on in this discussion. Some of the components in the ABFC system are operational as is, i.e. they contain all of the necessary personnel, structures and material needed to perform their mission. Other components contain facilities or material only and must be applied to other components for integration into an advance base plan.

An example of a component that is self-contained is the P25 which is a Naval Mobile Construction Battalion (NMCB). A NMCB has a wartime complement of 24 officers and 738 enlisted personnel. It also has 239 pieces of Civil Engineer Support Equipment (CESE) which range from 1/4 ton utility trucks to 35 ton cranes. The mission statement of an NMCB as stated in P-41P3A reads as follows:

> This is an integral component in personnel, administration, housing, subsistence and equipment consisting of one Headquarters Company, one Equipment Company and three Construction Companies. It is technically and basically equipped to prosecute the general construction work of an advance base, such as housing, buildings, airfield, roads and bridges, waterfront, utilities, fuel installations, ect. Supplemental equipment and supplies required for exceptional tasks or terrain conditions are provided by a Naval Construction Force Support Unit (NCFSU), P31. This component is equipped and supplied to service and provide organizational and field maintenance for its own automotive and construction equipment. Component is trained and infantry equipped for defensive warfare.
>
> A tent camp is included as an integral part of the component.
>
> Disaster Control is a function of this component and the personnel are trained accordingly. Equipment and materials are included for disaster recovery with the personnel and equipment of this component. The equipment and material required for base recovery must be provided through the P6 series components. [Ref. 11: p. P25-1]

To construct many of the major ABFCs, a full NMCB is required and must be included in an OPLAN.

4. **Prepositioned War Reserve Material Requirements**

Only some of the approximately 200 components, 800 facilities, 1700 assemblies and tens of thousands of ABIOL material line-items in the ABFC system have been procured and warehoused for use in a contingency. The ABFC system does not by itself provide any material, equipment or personnel. By specifying a requirement for a specific component or set of components in an OPLAN though, a Navy planning staff signals that a need for the material exists. The material requirement becomes part of the Navy Prepositioned War Reserve Material

Requirements (PWRMR) when it is incorporated into a CNO Special Project within the Navy Support and Mobilization Plan (NSMP).

PWRMR is that portion of the War Reserve Material Requirement (WRMR) which approved plans dictate be positioned prior to the outbreak of hostilities. The material is to be positioned at or near the point of planned use or issue to the user. When an ABFC is included in a CNO Special Project, this provides authorization for the material to be acquired and maintained in a specified state of readiness. The dominant commands shown in Table 7 take action to procure and preposition this material subject to limitations in funding and budgetary constraints.

Once material has been procured and prepositioned, it is then referred to as Prepositioned War Reserve Material Stock (PWRMS). Material, which is related to the construction phase of a CNO Special Project, is stockpiled at one of the three Construction Battalion Centers (CBCs) which are located at Davisville, Rhode Island; Port Hueneme, California; and Gulfport, Mississippi.

War Material Requirements (WMR) are by nature always greater than the war material stock available to fill these requirements. As in any organization, the military attempts to invest its next available dollar where it is likely to provide the greatest return. For the armed forces, this return is measured in terms of increased military capability. Since all OPLAN contingencies are neither equally likely, nor of the same strategic significance to national interests nor have the same time constraints applied to them, some stated requirements go unfilled until after mobilization. Figure 3.1 shows the relationship of War Requirements (WR) to prepositioned war reserve material stock.

B. THE RESERVE NAVAL CONSTRUCTION FORCE

The Reserve Naval Construction Force (RNCF) has never had sufficient equipment and supplies on-hand to perform its wartime mission. This is because its organizational units were considered to be ABFCs which, it was assumed, could be assembled prior to the onset of hostilities. Additionally, the perception was not firmly established that the upfront investment in equipment, supplies and material to support these units was warranted given competing demands on the limited funds available to the Navy.

Figure 3.2 shows the current allowance of RNCF units approved by congress. The RNCF is composed of one Reserve Naval Construction Brigade (RNCB), nine

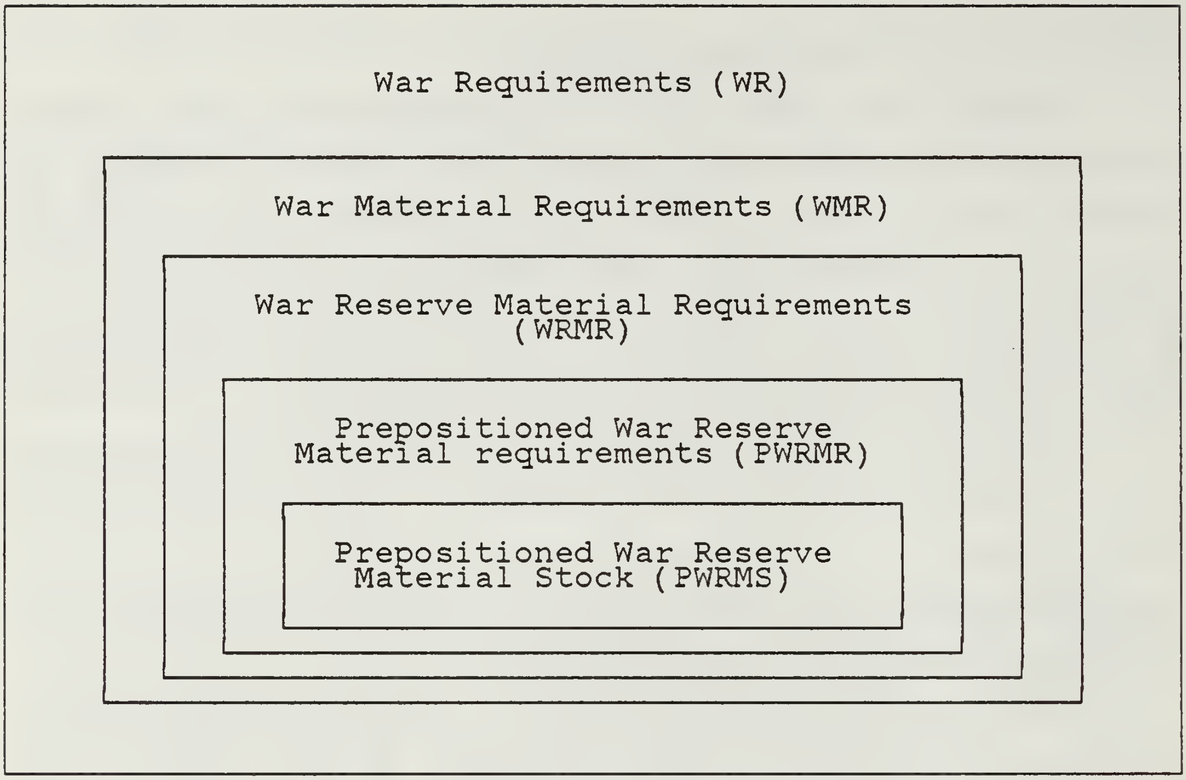

Figure 3.1 PWRMS as a Subset of War Requirements[5].

Reserve Naval Construction Regiments (RNCR), four Reserve Naval Construction Force Support Units (RNCFSU) and seventeen Reserve Naval Mobile Construction Battalions (RNMCB).

All told, there are over five hundred officers and almost fourteen thousand enlisted personnel represented in the brigade organization. In addition to the substantial investment in personnel and training that the RNCF represents, each unit also requires its own Table of Allowance (TA). The TA is that material and CESE needed to provide the facilities and assemblies to make these units self-sustaining and capable of carrying out their missions.

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[5]What is not apparent from the figure is that WMR = WRMR + Peacetime Operating Stock (POS). Peacetime operating stocks are those stocks other than PWRMS that are carried in the logistics system to support the operating requirements of a peacetime military force. It is also the case that WRMR = PWRMR + OWRMR. OWRMR is Other War Reserve Material Requirements and represents additional requirements to support a second prescribed period of time following mobilization.

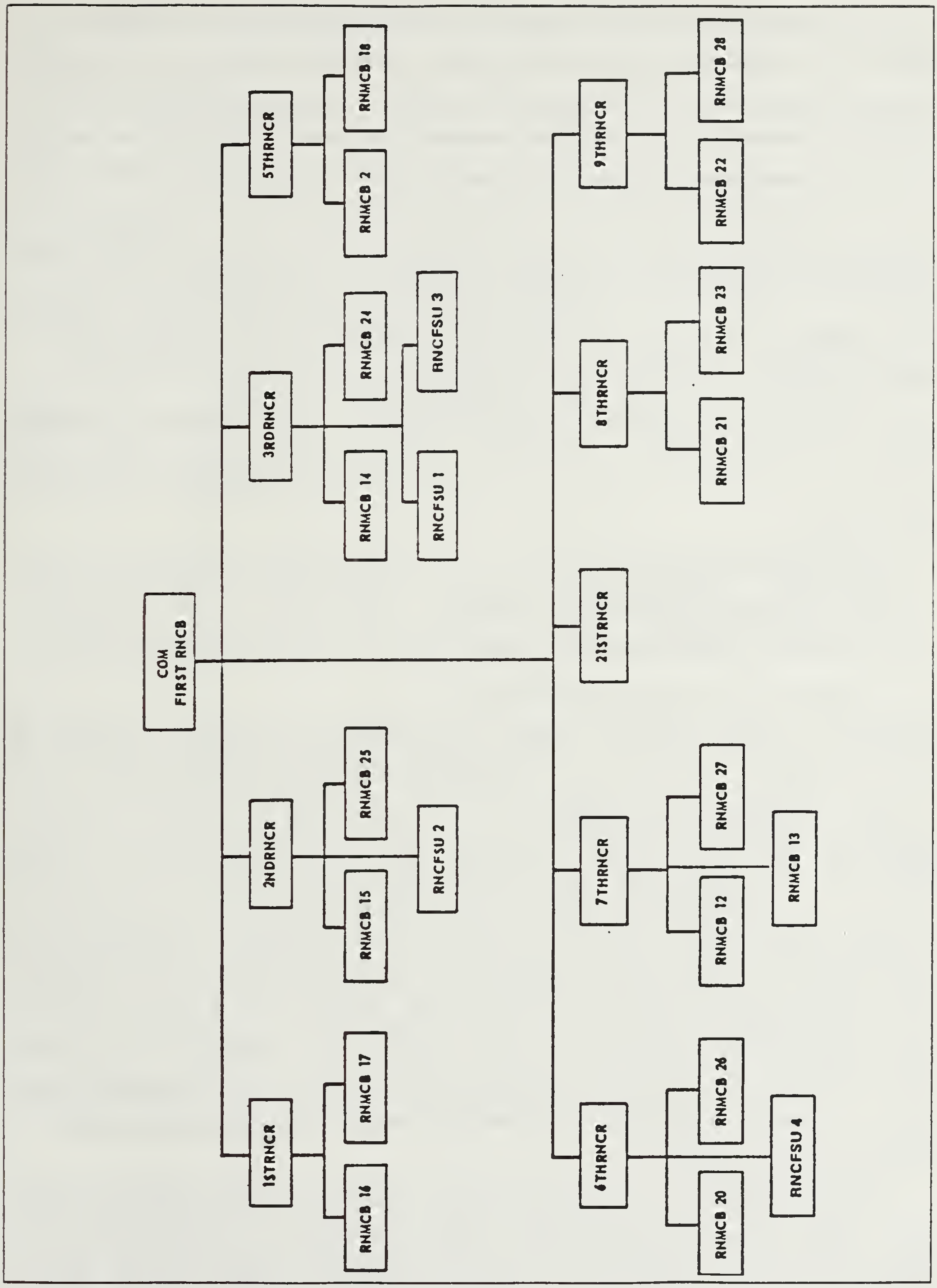

Figure 3.2 Brigade Organization of the RNCF.

In 1983 the Chief of Naval Operations (OP-44) placed renewed emphasis on the RNCF. It was realized that these forces did not have the capability for mobilization and rapid deployment that was needed by the fleet. Contingency planning called for the NCF to possess the ability to repair, construct, maintain and operate shore, inshore and deep ocean facilities in support of the Navy, Marine Corps and other Services and agencies of the federal government. More importantly the RNCF has specific early and critical missions in a war effort which include War Damage Repair (WDR), Rapid Runway Repair (RRR) and fleet hospital construction. OP-44 recognized that the RNCF could not be capable of carrying out its mission, when required, unless a significant portion of its needed material was identified and procured as PWRMS.

In 1983 the total deficiency in material, based on the outfitting of seventeen battalions, was $253 million. A plan was therefore set into action based on an identified need to improve readiness by outfitting the RNCF. The plan contained the following steps:

- solidify the requirements
- reduce non-essential material in the TA
- examine alternative equipment sources
- obtain funds to eliminate the deficiency

In addition, a proper format to display the problem was needed to increase the RNCF's credibility when requesting funding for the shortfall in the PPB process.

The requirement for the current NCF was confirmed by the Naval Facilities Engineering Command based upon liaison with the CINCs and the Service component commanders. The next step was the reduction of non-essential material in the tables of allowance for each type of unit within the RNCF. An important consideration was that the RNCF represents two-thirds of the total Naval Construction Force after mobilization, but both the dollar value and gross weight of the TAs were excessive when examined from the perspective of a comptroller or logistician. The Naval Facilities Engineering Command decided that both the active and reserve forces should maintain the same, but a somewhat reduced, allowance from what was then authorized in P-41P3A and the ABIOLs.

After the reduction of non-essential material in the TA, which eliminated such items as barber chairs and communion wafers, and deferred other purchases until mobilization, the total of RNCF deficiencies was reduced to $207 million in April of 1985.

Alternative equipment procurements were also examined concurrently with this reduction of non-essential material. Methods such as obtaining loans of equipment from state and local municipal highway departments as well as lease and buy arrangements with construction contractors were explored. The lease with purchase option was finally selected and is currently undergoing contract negotiations.

C. FUNDING

The final portion of the plan called for funding of the identified and validated shortfalls in material and equipment. This was pursued.

In a prepared statement given to the Senate Armed Services Committee on 15 March 1984 for the FY 1985 deliberations on the authorization of DOD appropriations, Rear Admiral William D. Daniels, USNR, Deputy Commander of the Naval Reserve Force stated:

> Major equipment shortfalls still remain in many areas of the Surface Reserve. The most significant areas are in the Naval Mobile Construction Forces, Cargo Handling Battalions and Beach Groups. These shortages include major equipments such as earth moving equipment, trucks, trailers, weight handling equipment and a sizable shortage of tools, clothing, bedding, tents, ect. The Navy has an aggressive plan to address these shortages throughout the Five Year Defense Plan (FYDP). [Ref. 8: p. 2061]

This and other testimony before congress helped to identify the Navy's need for funding to increase the readiness of the RNCF.

At this point it should be easy to see how direct the relationship is between funding, military capability and force readiness. Table 8 shows the key budget accounts which affect the RNCF and have a direct effect on its readiness.
Each appropriation shown in Table 8 represents a separate authorization by Act of Congress to incur obligations and to make payments from the U.S. Treasury. Since the RNCF is technically a set of ABFCs whose material and equipment have been approved for PWRMS, it has been necessary to obtain funds from various appropriations and sources in order to assemble and maintain these assets.

Under OP-44's plan the Naval Facilities Engineering Command, as the RNCF Program Technical Manager, took a more aggressive role in programming for the material to outfit the force. The RNCF has also submitted programming issues to the Chief of Naval Reserve for improving administration and training. As a result of these and other efforts, a shift in perception regarding the importance of improving RNCF

TABLE 8

KEY BUDGET ACCOUNTS AND APPROPRIATIONS AFFECTING RNCF READINESS[6]

PROCUREMENT (OP,N/WP,N/P,NG&R)	MILITARY PERSONNEL (MP,NR)
-CESE	-Pay
-Support equipment	-Bonuses
-2C Cog material (non USN)	-Incentives
-Materials Handling Equipment	
-Weapons	

OPERATIONS & MAINTENANCE (O&M,N/O&M,NR)	NAVY STOCK FUND
-Depot Repairs	-War reserve material stock
-Consumable items	-Peacetime operating stock
-Force operations	
-Battalion training days	

readiness has taken place and increased funding has become available. Some funds have come from Procurement, National Guard and Reserve, some from the Navy Stock Fund, some from the SYSCOMs for ABIOL material support and some from DOD approved programs such as the containerization of the TAs to improve force mobilization capability. The following is a breakdown of funds received in fiscal years 1983 to 1986:

- FY 1983: $8.4 million in O&M,N for NSF material.
- FY 1985: $20.0 million in P,NG&R for CESE, Materials Handling Equipment (MHE), TA-41s, containers, RADIAC and photographic gear. $3.8 million in O&M,N for NSF material.
- FY 1986: $19.0 million in P,NG&R. $59 million in NSF to complete requirements. $8.3 million for CESE and containers.

[6]The appropriations shown are: OP,N which is Other Procurement,Navy, WP,N is Weapons Procurement,Navy, P,NG&R is Procurement,National Guard and Reserve, O&M,N is Operations and Maintenance,Navy, O&M,NR is Operations and Maintenance,Naval Reserve and MP,NR is Military Personnel,Naval Reserve. The Navy Stock Fund is a revolving fund established for the purpose of providing working capital to finance the procurement of all stores and supplies carried in stock in the Navy stock account. It is not an appropriation but it must be funded to increase the quantity of stores and supplies available in the supply system.

As this money has been made available, and equipment and material were procured, the RNCF technical managers needed a format to graphically display the progress which was being made. A format was developed in the autumn of 1985 and is used in presentations given to resource sponsors who figure prominently in the PPB process. Figures 3.3 and 3.4 show the format used to identify the deficiencies.

As can be seen, the vertical axis represents RNCF units in the order of their priority. The horizontal axis shows the breakout of component equipment by appropriation and type of material. The dollar values, expressed in thousands, represent the remaining deficiencies and show a breakout between material which could be purchased now, if funds were available, and that which will be deferred until mobilization. This format is shown in black and white but has been previously color coded for ease of visual reference. Because of this color coding, it has been commonly known as the *Sherwin-Williams chart.*

Figures 3.3 and 3.4 represent more than just visual aides to identify dollar value deficiencies in RNCF equipment and material. By prioritizing the various types of units based on a compilation of all the CINC OPLAN requirements, the units with the most urgent missions could be outfitted first. In order to do this though, a change in the management philosophy of RNCF PWRMS had to take place. Previously, PWRMS was treated as a single pool of assets which were owned by the resource sponsor. Segregation of the material was required to identify portions of material stored in lots as belonging to specific units.

After balancing the alternatives and obtaining the necessary approvals, a doctrine was adopted to outfit and configure the material to unit sets. This essentially means that material will be packaged separately for each unit. To accomplish this segregation and, in addition, to realign the NCF with the transitioning of the merchant fleet to containerships, a containerization program was developed. A contract was awarded in June of 1986 and the first deliveries were scheduled for December. This containerization program applies to over 95% of the line items but less than 50% of the weight of an RNMCB because it does not include oversized items or CESE [Ref. 13: p. 4].

By stratifying PWRMS material to unit sets and containerizing it, the RNCF will have significantly increased their material readiness and mobilization capability. A negative aspect, though, is that containerization also means these assets will loose visibility in the supply system and can not be easily rotated to prevent expitation of

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RNCF DEFICIENCY AS OF 1 OCTOBER 1986
EXPRESSED IN THOUSANDS OF DOLLARS (K)

15 Oct 86 (Corrected)

PRI/UNIT		OPN								WPN	O&MN	NIF				TOTAL
		CESE			2C											
		TOT DEF	DEFER	NET DEF	NON USN	CONTAINER	M/E	COMM	RADIAC/ PHOTO	WEPS	CBR MASKS	CBR MASKS	TOT DEF	DEFER	NET DEF	
19 AIR DETS #1-17		172.4		172.4						1507.7	306.0					1986.1
20 NCR #1								121.9		21.4		11.0	35.9	35.2	.7	155.0
21 NCR #2								121.9		21.4		11.0	35.9	35.2	.7	155.0
23 NMCB #1	B	114.9		114.9		497.5		451.6		541.7		142.0	636.7	590.5	46.2	1793.9
24 NMCB #2	A	114.9		114.9		497.5		451.6		541.7		142.0	651.3	590.5	60.8	1808.5
25 NMCB #3	S	114.9		114.9		* 471.0 26.5		451.6		541.7		142.0	645.6	590.5	55.1	1802.8
26 NCR #3	E							121.9		21.4		11.0	39.1	35.2	3.9	158.2
29 NMCB #4		114.9		114.9		x 238.8 258.7		451.6		* 303.0 238.7		142.0	636.7	590.5	46.2	1793.9
30 NMCB #5	L	114.9		114.9		497.5		451.6		541.7		142.0	651.3	590.5	60.8	1808.5
31 NMCB #6	I	114.9		114.9		497.5		451.6		541.7		142.0	636.7	590.5	46.2	1793.9
32 NCFSU #1	N	973.9	973.9			z 571.0 76.9		203.7		197.2		46.0	1340.7	1309.5	31.2	1126.0
33 NCR #4	E							121.9		21.4		11.0	35.9	35.2	.7	155.0
36 NCFSU #2		3886.1	2688.8	1197.3		647.9		203.7		197.2		46.0	1375.1	1309.5	65.6	2357.7
37 NCR #5								121.9		21.4		11.0	36.1	35.2	.9	155.2
39 NCFSU #3		5831.2	2834.9	*1110.9 x1885.4		647.9		203.7		197.2		46.0	1340.1	1309.5	31.2	4122.3
40 NMCB #7		659.2		659.2		497.5	45.5	451.6		541.7		142.0	645.6	590.5	55.1	2392.6
41 NMCB #8		2006.4		z 719.7 1286.7	17.0	497.5	182.1	451.6		541.7		142.0	651.3	590.5	60.8	3899.1
42 NMCB #9		2887.2		2887.2	61.9	497.5	182.1	451.6		x 341.1 200.6		142.0	636.7	590.5	46.2	4810.2
43 NCB								53.8		17.9		10.4	33.0	32.8	.2	82.3

Figure 3.3 RNCF Deficiencies by Priority of Units and Appropriation[7].

shelf life. Most of the material which will be procured at mobilization has a short shelf life or is composed of Special Material Identification Coded (SMIC) items, which means hazardous or flammable. This material is scheduled to be bought or included in the packup of the TAs. Other items in this deferred category were selected by the Fleet Material Support Office (FMSO) on their review of line-item listings submitted for PWRMS buys with Navy Stock Funds. A prominent group included in this category is lumber and wood products.

With the advent of the drive to improve RNCF capability has come the requirement to exercise responsible management control over these assets and to maximize the capability of the RNCF with the annual incremental funds that become available.

D. RESERVE READINESS MATERIAL REPORTING SYSTEM

In September of 1986 the Civil Engineer Support Office (CESO), a component of CBC Port Hueneme which performs decentralized NAVFAC management functions, put forward a draft Mission Element Needs Statement (MENS) to be used in final form to justify the funding for the development of a Reserve Readiness Material Reporting System (RRMRS). The RRMRS, as proposed, will be developed under contract in the private sector. The system is needed to provide information support to the CNO via OP-44 and to enable a rapid mobilization of RNCF assets by tracking the status of equipment and material assets which are in procurement, maintenance and stock. The RRMRS will interface with existing systems and re-establish the asset visibility which will be lost after containerization.

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[7] 1) Priorities are established in accordance with FAC 062A memorandum of 18 Jul 1986. The CHBs interspersed throughout the RNCF priority list are not shown. 2) All figures are expressed in 1987 dollars and have been adjusted to reflect 17 battalions. 3) All FYDP dollars are based on best information available as of 1 Oct 1986, prior to OSD mark and FY87 DOD appropriation. 4) CESE: FY87 FYDP of $3.17M applied. FY88 FYDP of $.886M applied. FY89 FYDP of $2.665M applied. 5) 2C Non USN: Deficiencies shown are based on stratification of 1 Oct 86 by priority. No FYDP $ through FY89. 6) CONTAINERS: FY87 FYDP of $1.466M applied. FY88 FYDP of $.283M applied. FY89 FYDP of $1.998M applied. 7) MHE: FY87 FYDP of $.934M applied. FY88 FYDP of $1.927M applied. FY89 FYDP of $1.271M applied. 8) COMM: No FYDP $ through FY89. 9) RAD/PHOTO: No FYDP $ through FY89. 10) WEAPONS: FY87 FYDP of $3.5M applied. FY88 FYDP of $3.5M applied. FY89 FYDP of $3.5M applied. 11) CBR MASKS: Procurement rejected by Air Force Sep 86 - NSF recouped by FMSO. Shortages exist in O&M,N for the 17 Air Dets and in NSF for the 17 RNMCBs (TA01-TA41). 12) NAVY STOCK FUND: Net deficiency reflects NSF items non-procurable because of known system cancellations and local procurements. Net deficiency expected to increase as further system cancellations and TA changes occur.

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RNCF DEFICIENCY AS OF 1 OCTOBER 1986
EXPRESSED IN THOUSANDS OF DOLLARS (K)

PRI/UNIT	OPN: CESE TOT DEF	OPN: CESE DEFER	OPN: CESE NET DEFT	OPN: 2C NON USN	OPN: CONTAINER	OPN: MHE	OPN: COMM	OPN: RADIAC/PHOTO	WPN: WEPS	O&MN: CBR MASKS	NSF: CBR MASKS	NSF: TOT DEF	NSF: DEFER	NSF: NETDEF	TOTAL
44 NMCB #10	3223.1		3223.1	112.9	497.5	182.1	451.6		541.7		142.0	636.7	590.5	46.2	5197.1
45 NMCB #11	3703.1		3703.1	112.9	497.5	182.1	451.6		541.7		142.0	645.6	590.5	55.1	5686.0
46 NMCB #12	4134.0		4134.0	112.9	497.5	*160.1 274.1	451.6		541.7		142.0	651.3	590.5	60.8	6374.7
47 NCR #6	10.1		10.1	9.4			121.9		21.4		11.0	36.1	35.2	.9	174.7
48 NMCB #13	4619.7		4619.7	119.3	497.5	602.3	451.6		541.7		142.0	636.7	590.5	46.2	7020.3
49 NMCB #14	4991.6		4991.6	119.3	497.5	602.3	451.6		541.7		142.0	651.3	590.5	60.8	7406.8
50 NMCB #15	5522.8		5522.8	150.9	584.6	x327.6 274.7	451.6		z 332.5 209.2		142.0	636.7	590.5	46.2	8042.1
51 NCFSU #4	13630.2	6050.6	7579.6	100.7	834.6	511.3	203.7		197.2		46.0	1375.1	1309.5	65.6	9538.7
52 NCR #7	73.1		73.1	10.6	10.1		121.9		21.4		11.0	39.1	35.2	3.9	252.0
53 NMCB #16	8415.9		8415.9	164.3	668.4	z374.7 227.6	451.6	18.3	541.7		142.0	636.7	590.5	46.2	11050.7
54 NMCB #17	8686.5		8686.5	164.3	668.4	602.3	451.6	37.1	541.7		142.0	645.6	590.5	55.1	11349.0
55 NCR #8	136.2		136.2	10.6	10.1		121.9		21.4		11.0	35.9	35.2	.7	311.9
TOTAL FY87 DEF	74252.1	(12548.2)	61703.9	1267.0	11684.9	4730.9	9521.0	55.4	11694.5	306.0	2696.4	16691.1	(15590.9)	1100.2	104760.2

* - Indicates end of FY87
x - Indicates end of FY88
z - Indicates end of FY89

Figure 3.3 RNCF Deficiencies by Priority of Units and Appropriation . (cont'd.)

An important part of this proposed system will be its ability to handle and process asset data to provide the following information:

1) Acceptable materials for the RNCF. This includes information on suitable substitutes. (Currently the military supply system generates suitable substitute listings but these are often at odds with the particular requirements of the RNCF.)
2) Replacement, cost and budgetary data.
3) Prepositioned War Reserve Material Requirements versus stock on-hand.
4) Identification of deferred items in PWRMR, their availability and the procurement leadtime for these items.

In addition to satisfying various interface requirements, the system must also be capable of generating the equipment and supplies on hand information used by individual RNCF units when computing and reporting their combat readiness rating via the UNITREP system.

When completed this ambitious system development effort will provide a valuable management control tool and planning aide. The information needs of senior commands responsible for resource ownership and assessment as well as those of the reserve operating forces will be met if the system is implemented and designed with forethought.

E. THE CURRENT RNCF UNITREP SYSTEM

Commissioned RNCF units, (those shown in Figure 3.2), transitioned from the Reserve Training and Support System (RTSS) and began reporting their readiness via the UNITREP system in August of 1986 [Ref. 14: p. 1]. At present, however, only the actual readiness of personnel and training is reflected in the reserve's UNITREPs. A C-4 condition is reported for the equipment and supplies on hand portion and a notation is added that these assets will be supplied from PWRMS. The C-4 condition, as shown in Chapter II, Section C, indicates that a unit is not combat ready and has major deficiencies in wartime resources which prevent the unit from performing its mission. An overall C-5 or *no count* rating is also assigned to each UNITREP.

The problem with the current system is that it does not reflect the significant gains which are being made in force material readiness. The Naval Facilities Engineering Command and the RNCF are justifiably concerned that if the incremental gains are not properly reflected in the UNITREP system, the JCS will write the RNCF out of any contingency plans which call for a rapid mobilization and deployment capability. Without adequate feedback to resource sponsors on the effect that their investments have made, continued support for additional funding in the FYDP is in jeopardy.

The RRMR system will be designed to provide the information needed to properly assess the material readiness of RNCF units as currently measured by the UNITREP system. The purpose of this thesis, as previously stated, is to examine alternative models to enable an accurate assessment of the individual unit's readiness posture and to portray this in an appropriate format to the Joint Chiefs of Staff via the UNITREP system.

IV. OTHER DOD READINESS REPORTING SYSTEMS

A. THE ACTIVE NAVAL CONSTRUCTION FORCE

After having examined the nature of readiness and the current methodology for readiness reporting by the RNCF, it is appropriate to examine alternative systems now in effect as candidates for RNCF use.

The active Naval Construction Forces report their readiness by UNITREP to the CINC under whose operating control (OPCON) they are assigned. This is done in accordance with the procedures detailed in COMCBPAC/COMCBLANT[8] Instruction 3501.1 [Ref. 15: p. 1]. This instruction also applies to RNCF units upon mobilization.

The Navy annex to JCS Publication 6 [Ref. 9: p. 2-6-B-1] states that Naval operating units will report the four resource categories and their overall C-rating after a determination is made of each unit's primary mission area capabilities. These Primary Mission Areas (PRMARs) are assigned to Naval forces based on the purpose for which they were organized, designed or tasked. The primary mission areas for all Naval forces are contained in OPNAV Instruction 3501.2. They are further defined for the Naval Construction Force in OPNAV Instruction 3501.115A [Ref. 16]. This latter instruction describes the primary mission areas, Projected Operational Environment (POE) and the Required Operational Capabilities (ROC) for each type of unit in the NCF, and RNCF brigade organization.

1. Projected Operational Capabilities and Required Operational Environment

Table 9 shows the projected operational environment of NCF and RNCF units. Table 10 shows the required operational capabilities of an NMCB or RNMCB in the primary mission area of Construction (CON). The primary mission areas which involve NCF units are: Mobility (MOB), Command, Control and Communications (CCC), Special Warfare (SPW), Fleet Support Operations (FSO), Construction (CON)

[8]COMCBPAC is the Commander, Construction Battalions, U.S. Pacific Fleet. COMCBLANT is the Commander, Construction Battalions, U.S. Atlantic Fleet. CBPAC and CBLANT are both Type Commanders (TYCOMs). This means that they are responsible for the operational and administrative control of units under their respective Service component commander's OPCON. Under CINCLANTFLT, for example, there are four TYCOMs: SURFLANT, SUBLANT, AIRLANT and CBLANT.

and Noncombat Operations (NCO). Each of these PRMARs are reported by active NCF units with the exception of FSO and NCO, since these involve service capabilities which are measured indirectly by the other PRMARs.

TABLE 9

PROJECTED OPERATIONAL ENVIRONMENT
FOR NMCB AND RNMCB UNITS

1. In foreign country in wartime.
2. Capable of performing horizontal and vertical construction simultaneously.
3. Capable of staffing jobs for two ten-hour shifts, seven days per week.
4. Capable of performing all defensive functions simultaneously.
5. Capable of performing intermediate maintenance on own equipment simultaneously with construction effort.
6. Construction and maintenance capabilities decrease as defensive requirements increase.
7. Operate in climate extremes ranging from cold weather to tropical to desert environments.
8. Operate independently or as part of an NCF Module consisting of two or more NMCBs, one NCFSU, and one NCR, with UTC support.
9. Capable of over the beach operations in support of Fleet Marine Force amphibious assault.

The required operational capabilities and projected operational environment vary between types of units. The degree of capability for each subset of the required operational capabilities also varies from full to partial. Some capabilities such as conducting dredging operations or performing railroad construction, (CON 4.8 and 4.9: see Table 10), are required of one RNMCB unit only.

The Navy assigns missions to each unit and determines where the unit can be employed by use of the projected operating environment statement. This then helps to determine the durability and operating characteristics of the unit's equipment, its facilities and the additional support items that will be required. An example of

TABLE 10

REQUIRED OPERATIONAL CAPABILITIES FOR NMCB AND RNMCB UNITS

Primary Mission Area: Construction (CON)

CON 1 - Perform tactical Construction.

CON 1.1 Perform vertical construction including prefab buildings, bunkers and towers.

CON 1.2 Perform horizontal construction including unpaved roads, airstrips, mat runways and helo landing areas.

CON 1.3 Construct utilities including power generation and water purification systems.

CON 1.4 Construct beach improvements, beach exits, helopads, minor roads and camps.

CON 2 - Perform base construction.

CON 2.1 Perform vertical construction including prefab buildings, masonry and concrete buildings, and steel and concrete bridging.

CON 2.2 Perform horizontal construction including asphalt roads, asphalt and concrete runways, and paved storage, staging and parking areas.

CON 2.3 Construct utilities including central base power plant, sewage and water systems, water purification and desalination systems, and wire communication systems.

CON 3 - Perform construction engineering.

CON 3.1 Conduct surveying and drafting operations.

CON 3.2 Conduct materials testing.

CON 3.3 Perform planning and estimating.

CON 3.4 Perform design for local expedient projects.

CON 4 - Perform specialized construction.

CON 4.1 Conduct well drilling operations.

CON 4.2 Conduct concrete batch plant operations.

CON 4.3 Conduct concrete batch plant operations.

CON 4.4 Conduct asphalt batch plant operations.

CON 4.5 Conduct quarry operations.

CON 4.6 Conduct rock crusher operations.

CON 4.7 Conduct SeaBee team operations.

TABLE 10

REQUIRED OPERATIONAL CAPABILITIES FOR NMCB AND RNMCB UNITS (CONT'D.)

Primary Mission Area: Construction (CON) continued

CON 4.8	Conduct dredging operations.
CON 4.9	Perform railroad construction.
CON 4.10	Conduct concrete block plant operations.
CON 4.11	Conduct saw mill operations.
CON 4.12	Conduct pile driving operations.
CON 4.13	Perform pier and wharf construction.

additional support items is protective and special clothing. The projected operating environment statement may also indicate the need for training which is related to the possible operating environment of the unit, such as horizontal construction during extreme cold weather conditions. The degree of independence and interoperability with other forces is also indicated in the POE.

The required operational capabilities determine the types of equipment, supplies, personnel and training needed to perform the mission. Taken together, the POE and ROC detail the needed capabilities of a unit. Knowing the needed capabilities can then help to determine the necessary investment in capital and human assets. This is an appropriate methodology for linking desired outputs to the assets which can produce them and to the budget dollars needed to procure those assets. By decreasing or increasing a unit's required capabilities, the investment in that unit will also vary although unlikely in the same proportion.

The degree to which a unit has attained its required operational capabilities is determined by measuring the primary mission area's four resource categories. Thus for the PRMAR of construction, only the equipment and supplies on hand, their condition, the personnel and the training needed to perform construction are measured. Once measured, a Mission Area Specific Resource rating (M-rating) is assigned to each resource category. After all mission areas are evaluated and M-ratings are assigned, a set of criteria is applied which determine the resource C-rating values. The resource C-ratings in turn will determine the overall C-rating for the unit. The logic flow in worksheet format can be seen in Figure 4.1.

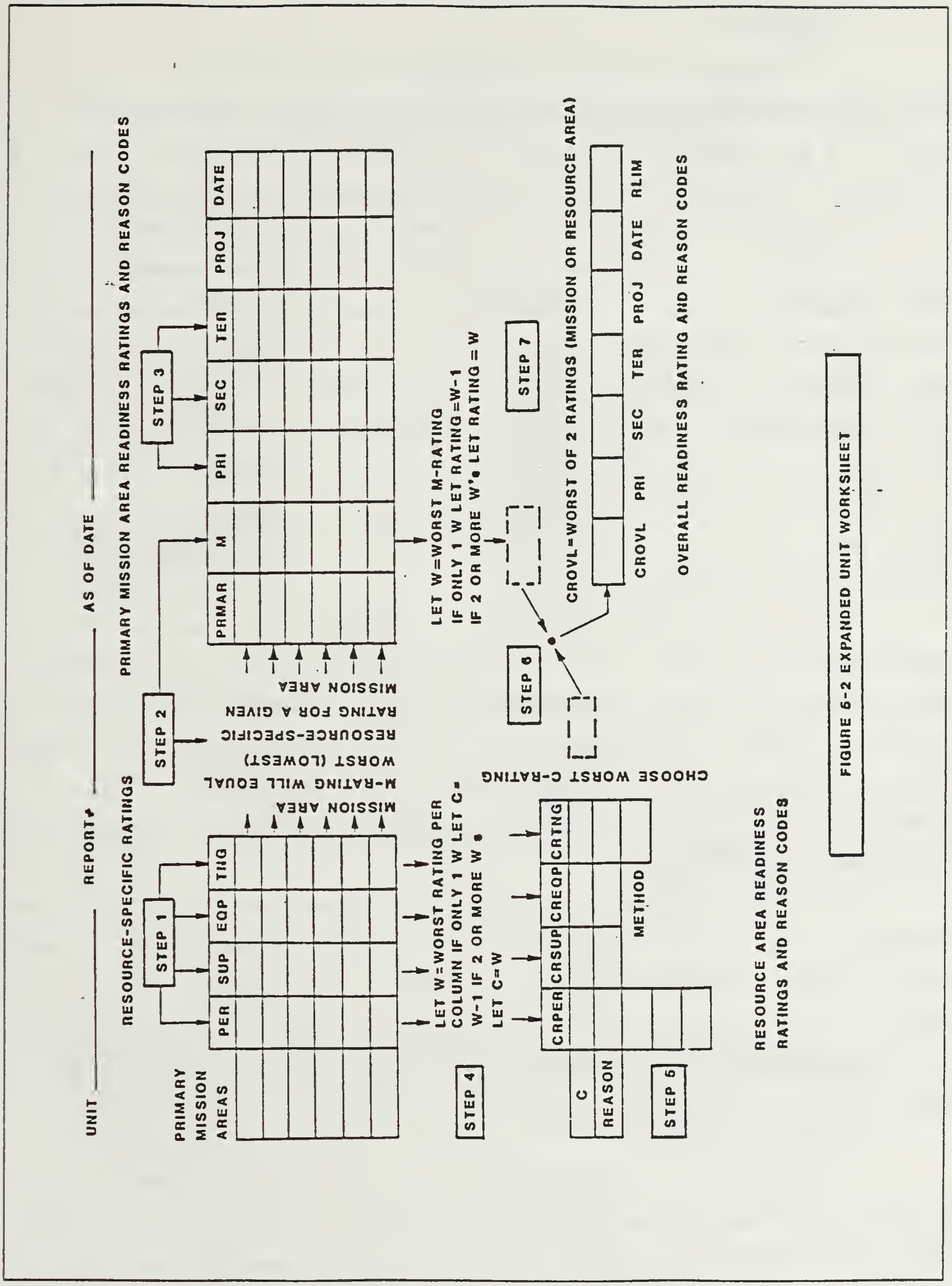

Figure 4.1 UNITREP Preparation Worksheet for C-ratings.

2. Mission Area Specific Resource Ratings

a. Equipment

To determine the mission area specific resource rating for the equipment portion of the equipment and supplies on hand, only major end items, (i.e., CESE), are counted. To be included in the count the end items must be physically held by a reporting unit or its parent unit. If an item is to be shipped for overhaul or disposal, it must be counted until it physically leaves the unit site. If the responsible TYCOM, (CBPAC or CBLANT), sends notification that an end item has been shipped to a unit, it will be counted as on hand. End items assigned to another unit will not be counted. A determination of the percent of equipment on hand is made by adding up the number of items on hand of specific equipment needed to perform a particular PRMAR, and dividing by the total number specified by the wartime requirement. The specific equipment, the cut off points and the associated M-ratings are obtained from COMCBPAC/COMCBLANT Instruction 3501.1. Table 11 displays the PRMAR of mobility and shows the required equipment as well as the conversion table for determining the M-rating.

The primary mission areas of mobility, command, control and communications, and special warfare use this methodology. For the primary mission area of construction, there is an additional step required. The equipment identified for construction is further segregated into four critical groups: transportation, MHE, compressors/pumps/generators and earth moving. The criteria shown in Table 12 is applied in order to obtain the equipment portion of the equipment and supplies on hand resource for this PRMAR.

All other equipment and supplies in a unit's table of allowance are considered to be the supplies on hand portion of the equipment and supplies on hand resource. Supplies are considered to be on hand if they are physically held by a unit or if they are on order and will be received within 90 days. Material which will take more than 90 days before receipt is considered to have a long leadtime and is not included as being on hand.

b. Supplies On Hand

A determination of the percent of supplies on hand is made by obtaining the dollar value of material considered to be on hand and dividing by the total dollar value of the wartime requirement. This wartime requirement can be found by examining the appropriate sections of a unit's table of allowance. The applicable

TABLE 11

ESTABLISHED CRITERIA FOR DETERMINING MISSION AREA SPECIFIC RESOURCE RATINGS

Primary Mission Area: Mobility (MOB)

EQUIPMENT/SUPPLIES ON HAND:

1. Equipment:

Equipment Description:	ECCs:	No:
TRK 3/4T UTILITY	030731, 010701	12
TRK 11/4T CARGO	036031, 034812	16
TRK STAKE	064301, 053901	20
TRK TRACTOR	064512, 060712 060701	10
TRK WRECKER	073021, 073011	2
SEMITRLR LB 40T	082512, 082600 082601, 082611 084201	13
TRLR 15T BOLST	084201	1
LOADER SCOOP WH	453109	4
LOADER SCOOP WH	453133, 453123	4
TRFK 4LB	133000, 130400 130600	5
TRFK 10LB	182000, 182600	7
TOTAL:		94

ON HAND:	RATING:
85-94	M/C1
66-84	M/C2
57-65	M/C3
0-56	M/C4

2. Supplies: Compute rating based upon percent of TA-01 Sections 3, 4, 8, 9, 10, 12, 21, 22 and 25 on hand.

PERCENT ON HAND:	RATING:
90-100	M/C1
80-89	M/C2
65-79	M/C3
0-64	M/C4

EQUIPMENT READINESS: Reevaluate rating determined in the equipment portion of the Equipment and Supplies On Hand resource above. Items will be totaled after being counted and weighed by their condition codes below. Items on deadline or otherwise not available will not be counted.

CONDITION CODE:	VALUE:
A4	1.00
A5	.75
A6	.45

TABLE 12

EQUIPMENT M-RATING CRITERIA FOR PRIMARY MISSION AREA OF CONSTRUCTION

A. The total P25 quantity is obtained from the basic NMCB TA-01 dated 12 April 1985. The four critical groups below can be found in greater detail in COMCBPAC/COMCBLANT Instruction 3501.1:

GROUP:	QUANTITY:
1. Transportation	72
2. MHE, WHE	16
3. Compressors, pumps and generators	28
4. Earth moving	69

B. RATINGS:

UNITS ON HAND:					RATING:
TA-01	GRP-1	GRP-2	GRP-3	GRP-4	
216-239	65-72	14-16	25-28	63-69	M/C1
168-215	51-64	11-13	20-24	48-62	M/C2
144-167	44-50	9-10	17-19	41-61	M/C3
0-143	0-43	0- 8	0-16	0-40	M/C4

C. DETERMINATION OF EQUIPMENT ON HAND RATING:

1) Use total on hand rating if it equals or exceeds any or all critical group ratings.

2) Use the worst critical group rating minus one if only one critical group rating exceeds the total on hand rating, or if two or more critical groups have worse ratings than the P25 rating but do not satisfy part C below.

3) Use the worst critical group rating if two or more critical group ratings exceed the total on hand rating and each of the worst critical groups have the same rating.

sections of the TA, which are assigned to each PRMAR, are also specified by COMCBPAC/COMCBLANT Instruction 3501.1. An example of this can also be seen in Table 11. For further explanation of the composition and contents of a TA, a portion of the 1985 NMCB Table of Allowance [Ref. 17] is included as an Appendix. While equipment is evaluated independently of the supplies on hand, the worst rating of either equipment or supplies is used to determine the mission area specific resource rating for a PRMAR.

c. Equipment Readiness

The mission area specific resource rating for the equipment readiness resource is determined by computing a Mission Capable (MC) rate. The MC rate calculation used by the NCF differs from that discussed in chapter II. Table 11 shows the weights applied to equipment and the calculation required to determine this *weighted* Mission Capable rate. Only the types and quantities of equipment specified in the TA are used in the computation. Augment equipment, which is not part of the basic allowance, may be counted for substitution purposes if it does not misrepresent the actual state of readiness.

d. Unit Commander's Assessment

In addition to the direction received from higher authority, a commanding officer of a unit has the prerogative to reduce a readiness rating if he feels that a PRMAR has been degraded due to a deficiency not addressed in published criteria. If this is done, an explanation must be included in part II of the UNITREP. Senior commands are not authorized to change a subordinate unit's reported rating or to change the criteria on which the report is based. These senior commands are, however, authorized and required to evaluate subordinate commands on their adherence to the published UNITREP reporting requirements.

By measuring the four primary missions of an NMCB, nearly all of the TA is included in the calculations required to determine readiness. The exceptions are: tent camp facilities, petroleum (POL), provisions (subsistence) and container requirements. While POL and subsistence are not insignificant omissions, they are excluded because each TYCOM has standby arrangements to obtain these requirements from prepositioned stock located at supply depots and fuel farms. The tent camp facilities are not considered a part of the active unit's allowance and these assets are held by TYCOM representatives in warehouses located at unit deployment sites in Okinawa, Guam, Porto Rico and Spain. Container requirements are not measured at present, since operating units are capable of packing their supplies into battalion made wooden mount out boxes. These units have not yet converted to ISO containers which are being procured under contract.

This active NCF readiness reporting system was discussed first since it is the most likely candidate for RNCF use. There are some drawbacks to using this system without modification. These will be discussed in the next section while examining another readiness reporting system that may prove useful.

B. THE ARMY'S READINESS REPORTING SYSTEM

Since the Army was the first Service to develop a readiness reporting system, the other services tended to pattern their systems after the Army model. As a result, the UNITREP system implemented by the JCS was to a large extent the product of Army work in the area of readiness measurement. The purpose of this system development effort was to create a system:

> to inform all levels of command of problems or trends which may degrade a unit's ability to accomplish its assigned mission. [Ref. 3: p. 23]

The Army's readiness report and the UNITREP were not designed to be a mechanism to convert funds appropriated by congress into increased unit readiness in a direct fashion. In fact, they were not even intended to aid supply, personnel or training experts in resource allocation decisions since other reports of a more detailed nature were designed to do this. The UNITREP is, however, the only report which ties all other readiness reports together. In this way it serves as one document to inform the chain of command about the overall readiness posture of a unit.

The Army uses the criteria outlined in Chapter II and set down in JCS Publication 6 to report readiness. This section will therefore only discuss differences between the active NCF UNITREP format and that specified in Army Regulation 220-1, *Field Organizations, Unit Status Reporting* [Ref. 18].

The first major difference is that the Army readiness reporting system does not require the computation of C-ratings based on mission area specific resource ratings. The resource C-ratings are determined directly from the resources measured.

1. Equipment On Hand

For the equipment and supplies on hand resource, Army units only report the status of selected equipment and determine a C-rating by comparing the quantities of the selected equipment on hand to the wartime requirement. The Army uses a Table of Organization and Equipment (TOE) or Modified TOE (MTOE) to prescribe the mission, organizational structure, personnel and equipment requirements for its tactical military units. The TOE is what Army doctrine prescribes for a particular type of unit. The MTOE is what the Force Commander (FORSCOM) decides to actually outfit a unit with based on the TOE. The TOE is in most respects similar to an NCF TA. TOE units do not report either the status of supplies or repair parts on hand. This is because unit allowable stockage levels and prescribed load lists are based on peacetime requirements. The items of equipment which are reported are determined by examining the unit TOE and selecting those which are designated as items with Equipment Readiness Code A (ERC-A). An ERC-A designator is given to a unit's primary weapons and equipment. Examples of the various ERC categories can be seen in Figure 4.2.

By not reporting the status of supplies or repair parts the Army is reporting readiness in its narrowest sense. The Army's UNITREP does indicate which units are ready but does not indicate the level of sustainability which these units possess. An Army unit without supplies or repair parts can only operate until its limited subsistence items are used up or the failures of equipment cannot be repaired due to a lack of spare parts.

The NCF on the other hand includes in its TAs 90 days worth of sustainability on supplies and repair parts, and 15 days for subsistence and fuel. The investment required by the RNCF is increased if it must include 90 days sustainability in the readiness calculation. An Army reserve unit with less sustainability than an RNCF unit would probably report a higher readiness rating to the JCS.

2. Pacing Items

In addition to computing a percent of ERC-A items on hand versus the wartime requirement, the Army has also incorporated specific unit type *pacing items* into the readiness report. These pacing items (ERC-P) are considered to be the most important pieces of equipment in a unit and were selected based on a prioritization of all equipment and weapon systems authorized by unit type and reflected in the TOE. For an armored tank battalion the pacing item is the tank. For an infantry battalion the pacing items are the TOW and DRAGON launchers. Units may have several or no pacing items. The pacing items for engineer units are shown in Table 13.

A composite C-rating is determined for all ERC-A and P items taken together, and a C-rating is determined for each pacing item. The unit's overall equipment and supplies on hand resource rating is equal to the lowest rating of either calculation above.

This concept of pacing items is similar to that of critical groups used by the NCF. Pacing items are only a few key items in an Army unit while NCF critical groups include 185 of the 239 pieces of CESE. For the RNCF the main concerns should be the physical weight of its CESE and whether there are sufficient quantities

Table 8-2
Equipment readiness code examples

Equipment	ERC
a. *Communications equipment.*	
(1) FM and HF voice command and control radios.	Tactical operations nets for maneuver brigades, combat divisions, corps, and other type major command HQ which direct tactical operations; combat arms units (see note); and MP units, ERC-A. Also ERC-A, specific radios of supporting commanders which by doctrine are required to be in a command net; for example, division support commander (DISCOM) and forward support battalion (FSB) commander. In all other units, code B.
(2) FM and HF admin log net radios.	In all units, code B.
(3) Wire and associated equipment.	In signal units, where wire and associated equipment supports an ERC-A system(s), code A. In all other units, code B.
(4) Radio teletypewriters (RATT).	In all units, code B (unless it is the primary means of communications).
(5) Multichannel radio equipment.	In signal units, code A. In all others, code B.
(6) COMSEC equipment.	Code will match radio supported.
(7) Radars.	In all units with primary mission of surveillance, code A. In all others, code B.
(8) Installation and accessory equipment for radios and COMSEC equipment.	Code will match radio supported.
b. *Weapons.*	
(1) Artillery weapons.	In all units, code A (except ceremonial).
(2) Individual weapons.	In combat arms and MP units, code A. In all other units, code B.
(3) Crew served weapons (Caliber .50 and under).	In combat arms and MP units, code A. In all other units, code B.
(4) Bayonets.	In infantry and Special Forces units, code A. In all other units, code B.
c. *Vehicles.*	
(1) Command and control vehicles.	In all units, code A (like vehicles in a unit may require variable coding; for example, commander's vehicle code A, chaplain's code B).
(2) Combat tracked vehicles.	In all units, code A.
(3) Recovery vehicles.	In maintenance units, code A. In all others, code B.
(4) Vehicles, to include fuel tank trailers and cargo trailers, used primarily for transport of POL or ammunition.	In all units, code A.
(5) Vehicles that are used to power ERC-A radios.	In all units, code A.
(6) Other vehicles.	All units, variable coding.
d. *Generators.*	If a sole power source for a code A item, use code A. In all other units, code B.
e. *Night vision devices.*	In all units with a primary mission which requires night surveillance (Infantry, Armor, Aviation, and MP), code A. In all other units, code B.
f. *Unit maintenance equipment.*	In all units, code B.
g. *Camouflage nets.*	In all units, code C.
h. *NBC defense equipment.*	
(1) Individual protective mask.	In all units, code A.
(2) Decontamination Apparatus, PDDA and LDS.	In all medical units whose primary mission is decon, Code A. In all other units, code B.
(3) Portable decontaminating apparatus.	In all units, code B.
(4) Alarms.	
(a) Detectors.	In NBC reconnaissance units, code A. In all other units, code B.
(b) Monitors.	In NBC reconnaissance, decontamination, and medical units, code A. In all other units, code B.
(5) Radiacmeters.	In NBC and other recon units, code A. In all other units, code B.
(6) Dosimeters and chargers.	In all units, code B.
(7) Collective protection.	In medical units, code A. In all other units, code B.
(8) Smoke generators.	In units whose primary mission is smoke generation, code A. In all other units, code B.
(9) Gas particulate filter units (GPFU).	In all units, code A.
i. *ADPE major item such as AN/MYQ-4.*	In all units, code A.
j. *Petroleum handling equipment.*	
(1) Petroleum laboratories.	In all petroleum lab units, code A. In all other units, code B.
(2) Collapsible POL storage bags, 10,000 gal and larger.	In all supply and service (S&S), supply and transportation (S&T), and POL supply operating companies, code A. In all other units, code B.
k. *Carpenter, pioneer, and demolition sets.*	Combat engineer and Special Operations Forces, code A. In all other units, code B.
l. *Wrist watches.*	In all units, code C.
m. *Band instruments.*	In all units, code B.
n. *Mess equipment.*	In all units, code C.

Note:
Combat arms units are: infantry, armor, field artillery, Special Forces, engineer, air defense artillery, and aviation.

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Figure 4.2 Equipment Readiness Code Examples.

on hand to perform its mission. Consideration should be given to incorporating suitable substitute equipment, including conversion factors, which allow for a more than one for one exchange. An example of this is the 15 ton dump truck which is equivalent to three 5 ton vehicles.

3. Equipment Readiness

The Army equipment readiness resource rating is determined by computing the Equipment Readiness (ER) rate. The ER rate is similar to the MC rate shown in Chapter II. It measures the total days that equipment possessed by a unit was available divided by the wartime required days for all equipment that a unit at full strength would be authorized. This is also similar to the NCF MC rate measurement. The difference between the Army's ER rate and the NCF's MC rate is that the Army uses historical readiness data. For active Army units this means the data on equipment for the past 30 days is used as a base to determine equipment readiness. For the Army Reserves and National Guard units the base used is the past 90 days. NCF units use a *snapshot* approach. The equipment readiness reported is the actual equipment readiness as of the day the UNITREP is prepared. Prior equipment readiness excellence or deficiencies are ignored.

The advantage of using historical equipment readiness is that it better represents the probabilities of different types of equipment being operational when needed in a contingency. During a mobilization though, Army units will report their current readiness in the same manner as the NCF. Another advantage to using historical readiness data in peacetime is that it shows trends in equipment maintenance management, reliability and supply support. Measuring only current readiness can mask the fact that a piece of equipment has been down for 29 of the last 30 days and only up on the day the UNITREP was prepared.

There is a clear advantage for the RNCF to report its equipment readiness in the same manner as the Army rather than the active NCF. Since the information on CESE and ER will be provided to RNCF units by the Civil Engineer Support Office rather than the units determining the rating for themselves, this more informative historical readiness can be a partial substitute for the real-time familiarity with the equipment which is enjoyed by the active forces.

4. Equipment Mission Capable Rate

In addition to measuring equipment readiness based on the wartime requirement, Army units also measure an Equipment Mission Capable (EMC) rate.

TABLE 13

PACING ITEMS OF EQUIPMENT FOR ARMY ENGINEER UNITS

UNIT TYPE	PACING ITEMS
ENGINEER:	
1) Engineer Bn, Abn Div.	Tractor,full-tracked; truck dump 5 ton; truck,dump 5/2 ton and loader scoop,5/2 CY.
2) Engineer Bn, Cbt, Corps	Truck,tractor M916, semi-trailer,low bed 40 ton; tractor,full-tracked; and truck,dump 5 ton.
3) Engineer Cbt Bn, Mech, Corps	APC,M113; semitrailer,40 ton ; truck,tractor M916; and tractor full-tracked.
4) Engineer Co, ADM, Corps	Tool kit,spec weapons; radio set AN/PRC-77; radio set, control grp,AN/GRA-39; and truck,cargo 5/2 ton.
5) Engineer, light equip, abn	Grader,road motorized; loader scoop,5/2 CY; tractor full tracked; and truck,dump 5 ton.
6) Engineer Co, MAB	End bay,MAB; interior bay MAB; transporter, MAB; and bridge erection boat,27 FT.
7) Engineer Co, medium girder bridge	Medium girder bridge assets and truck,dump 5 ton.
8) Engineer Co, panel bridge	Panel (Bailey) bridge assets and truck,dump 5 ton.
9) Engineer Co, float bridge	Bridge erection boat,27 FT; class 60 components; truck, stake 5 ton; and compressor, 250 CFM.
10)Engineer Co, aslt flt bridge, ribbon	Bridge erection boat,27 FT; interior bay,float bridge; ramp bay,float bridge; and transporter,float bridge.
11)Engineer Co, Inf Bde, MAB	End bay,MAB; interior bay, MAB; and transporter,MAB.
12)Engineer Co, ARC	CEV; AVLB; APC,M113; and tractor,full-tracked.
13)Engineer Co, Sep Armored Bde, MAB	CEV; AVLB; APC,M113; and tractor,full-tracked.
14)Engineer Port Construction Co	Crane trk Mtd,25 ton; crane shovel 40 ton; tractor,full tracked; and truck,tractor.
15)Engineer Bn, ARMD/MECH Div	APC,M113; AVLB; CEV; and loader scoop 5/2 CY.
16)Engineer Bn, Inf Div	Truck,dump 5 ton; CEV; and loader scoop 5/2 CY.
17)Engineer Bn, Pipeline Construction	Crane wheel mtd, 20 ton; tractor wheeled,IND; tractor,full-tracked; and truck tractor,LET.
18)Engineer Cbt Bn, Abn	Loader scoop, 5/2 CY; tractor,full-tracked; truck, dump,5 ton; and scraper,11CY

An EMC rate is calculated by adding the days that equipment on hand is available and dividing by the number of possible days that it could have been available. EMC rates expressed as a percentage were developed to disregard that portion of the required equipment that a unit does not have. Figure 4.3 shows a sample format for Army ER and EMC rate calculations.

2. Non-aviation unit: 1/ through 4/

Line item	Req	On-hand	Available days	Possible days	Required days
Carrier, M113	13	7	166	210	390
Carrier, M577A1	7	7	195	6/ 200	210
Tank, M60A2(PI)	54	51	1384	1530	1620
Truck Tank, M559	4	1	27	30	120
Truck Cargo, M520	5	2	56	60	150
	83	68	1828	2030	2490

EMC% = $\frac{\text{Available Days}}{\text{Possible Days}} = \frac{1828}{2030}$ = .90 x 100 = 90%

PI-EMC% = $\frac{\text{Available Days}}{\text{Possible Days}} = \frac{1384}{1530}$ = .904 x 100 = 90% (M60A2 is only pacing item.)

ER% = $\frac{\text{Available Days}}{\text{Required Days}} = \frac{1828}{2490}$ = .734 x 100 = 73% = C-2

PI-ER% = $\frac{\text{Available Days}}{\text{Required Days}} = \frac{1384}{1620}$ = .854 x 100 = 85% = C-2 (M60A2 is only pacing item.)

Figure 4.3 Sample Format for ER and EMC Rating Calculations.

The difference between a unit's EMC rate and its ER rate can be of significance to military planners:

> One significant feature of this measurement is the idea that it is a difference value between an intended performance level, i.e., a standard, and the actual performance level that the unit is capable of. {sic} This use of a difference value as a measure has a number of benefits including the focusing of management attention on the gap that must be closed by management action or by additional resources. It also gives the managers the feel for what is required to change the readiness level if it is unacceptable. A single value of unit readiness does not have this feature. [Ref. 19: p. 30]

There are obvious reasons for incorporating an EMC rating into the RNCF UNITREP. The EMC rating can provide an indication of the condition of the equipment that a snapshot may obscure. It also separates out the condition of the equipment on hand versus the wartime requirement. This added information can be used to help satisfy the needs of both the resource sponsors and the RNCF organization.

5. **Unit Commander's Assessment**

The overall C-rating for an Army unit is calculated subjectively by unit commanding officers. While the Navy, and the NCF in specific, requires the overall C-rating to be equal to the lowest resource area C-rating, the Army allows leeway in making this determination:

> The start point for determining the overall status of a unit is the lowest unit status rating attained in a measured resource area (personnel, EOH, ER, or training). However, the overall C-rating may vary from the lowest measured resource area rating unless one or more of the areas is measured as C-5. If no resource is rated as C-5, the commander can subjectively upgrade or downgrade the unit's overall rating if the calculated rating is not truely representative of the status of the unit. For example, if the education level, quality of leadership, morale, or cohesion in a unit are unusually high a commander may want to subjectively upgrade the unit's overall rating. On the other hand, if the shortage of certain equipment items is having a greater impact on the unit than the calculated EOH rating indicates, the commander may want to subjectively downgrade the unit's overall rating. Calculated resource area ratings cannot be subjectively changed. [Ref. 18: p. 15]

While unit commanders may subjectively raise their unit's overall C-rating, senior commanders may also append remarks to these reports. The senior commanders may not however change any rating as the reports progress up the chain of command.

Units which report an overall C-4 or C-5 rating are required to submit Mission Accomplishment Estimates (MAEs). The MAE is the unit commander's estimate of the extent to which the unit can accomplish its wartime mission if it were to be deployed as of the date of the UNITREP. The MAE is expressed as a percentage of the wartime mission that can be accomplished. It is included in Part II of a UNITREP as part of the remarks and is intended to provide a more definitive estimate of the ability of a unit to perform its wartime mission than an overall rating of C-4 or C-5 can provide.

The ability to raise an overall C-rating may or may not be appropriate for an RNCF unit. The MAE, however, is worthwhile including in Part II of a UNITREP because it provides an additional assessment of a unit's readiness.

The element of subjectivity is present in any system that tries to measure and quantify an intangible such as readiness. The Army recognizes this in their overall C-rating and in the MAE. If subjectivity is not allowed at the unit level to some extent, it must be recognized that subjective assumptions are then being made, (by default), at higher levels by the designers of the readiness measurement system.

C. SUMMARY

In summary the major differences between the active NCF and Army readiness reporting systems is that the Army does not evaluate units based on mission area specific resources but measures each resource area directly. The Army does not measure or report supplies and repair parts in a UNITREP while the NCF does. The Army uses a pacing item approach to evaluate selected key equipment where the NCF measures 77% of its CESE as part of its mission area specific resources. The mission capable assessment for equipment readiness is based on historical readiness in the Army and based on a snapshot approach in the NCF. The Army allows the unit commanding officers to subjectively upgrade or downgrade a unit's overall C-rating while NCF commanding officers may only downgrade a unit's rating.

The active NCF reports equipment on hand versus the wartime requirement because the wartime requirement is the baseline, while Army units report equipment based on current assets as well as wartime requirements. Army units reporting an overall C-4 or C-5 rating must include a narrative assessment and mission accomplishment estimate in the UNITREP while NCF units do not.

An advantage to the Army approach is that readiness is less costly to attain since it reflects only readiness and does not include sustainability. Another advantage is that the incorporation of a subjective assessment allows incremental gains in resources to be reflected if they materially affect the overall readiness of a unit. A disadvantage of the Army's system is that readiness can become unreadiness if the sustainability is not added in short order by a responsive and flexible logistics system. An advantage of the NCF readiness system is that it is a more rigorous approach to measuring readiness. It is however a system which relies on the dollar value of material to reflect its military worth and this is not always the case. The Army's ERC-A and P items are more reflective of the critical equipment needed to perform a unit's mission. The negative part of measuring only critical equipment is that this equipment can not stand alone and requires the support of non-critical components in order to perform.

The next chapter will introduce a model which can be used to correct some of these deficiencies and can be used by the RNCF to help determine the contribution to readiness made by prepositioning war reserve material stock.

their place. When requirements change, PWRMS assets can then be either reapplied to other CNO special projects or used to generate reinvestment funds. In essence this means that PWRMS assets which are not reapplied to other CNO special projects can be used to satisfy peacetime demands. The funds generated from these sales are then used to satisfy new or higher priority PWRMR which are financed by the Navy Stock Fund.

CESO was granted a waiver from the normal management of PWRMS by OP-04, the Deputy Chief of Naval Operations (DCNO) for Logistics, to allow the RNCF assets to be containerized. By granting this waiver, recognition was given that the RNCF requirement would be continuing and not subject to change for the foreseeable future. This waiver meant that the RNCF PWRMS assets could not be restratified and applied against other PWRMR. Restratification is the process where PWRMS assets are identified to a specific CNO special project. If a higher priority project is initiated then assets of lower priority projects will be reassigned if funds are not otherwise available. The waiver effectively prevented this from occuring but did not grant any exemption from the normal Navy stockage policy for PWRMS. As a result, a decision was made by NAVSUPSYSCOM that the RNCF assets, which are now being procured, will not be line item reportable as PWRMS. Only the total dollar value of the material is to be reported.

There is as yet no agreement between NAVSUP and NAVFAC on whether the unpurchased and deferred material will continue to remain as PWRMR or will be transfered to Other War Reserve Material Requirements (OWRMR). If this material is reclassified as OWRMR, as NAVSUP wants, it means that the RNCF will not receive any additional material until after all other initial mobilization requirements are filled. OWRMR, as was noted in Chapter III, is that group of material which represents additional requirements to support a second prescribed period of time following mobilization. This means that the RNCF will most likely be precluded from carrying out its mission.

The problem, as it has defined itself, is now to determine the effect that funding constraints and stockage policies have on limiting the readiness of the RNCF. One method is to use the Procurement Leadtime[9] (PCLT) of the material which is not currently stocked as PWRMS.

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[9]PCLT = PLT + ALT. PLT is production leadtime. ALT is administrative leadtime.

Figure 5.1 shows a pictorial representation of a procurement leadtime. This is the time that it takes from the initial registering of demand until the item is manufactured and delivered to the ordering activity. As can be seen in the figure, this period includes the administrative leadtime for processing the order. The PCLT can be used to help determine if individual RNCF units can have sufficient material on hand to operate successfully according to JCS readiness reporting criteria by their mobilization departure date. To do this, certain reasonable assumptions must be made concerning supply system stocks.

```
               PCLT
     |------------------------------->|

     1     ALT      2     PLT         3
     |------------->|---------------->|

1) A buy is generated.
2) A contract is awarded.
3) First receipt of material by an ordering activity.
```

Figure 5.1 Components of Procurement Leadtime.

The first assumption is that there won't be adequate stocks of material in the supply system to satisfy all mobilization requirements. Based on the material with which the RNCF is concerned and which is not being considered for stockage by the supply system, this assumption is reasonable. The second assumption is that the peacetime procurement leadtime approximates the initial wartime procurement leadtime. This second assumption is also reasonable since there will be new but opposing influences affecting the procurement leadtime. While industry will require time to increase its production capacity, it will be able to divert stocks destined for other customers to DOD. At the same time, the contracting agencies will be inundated with procurement requests which will offset the time saved by diverted industry stocks. If these assumptions are reasonably valid it is then possible to proceed.

Data on procurement leadtimes are maintained at Inventory Control Points (ICPs) such as the Ships Parts Control Center (SPCC) and the Aviation Supply Office (ASO) for the Navy. Other DOD ICPs such as the Defense Construction Supply

Center (DCSC) and the Defense General Supply Center (DGSC) also maintain PCLT and other data on materials they manage.

It is necessary to understand how this data is collected and transformed before showing how it can be used in readiness reporting. The goal of the next section is to show how procurement leadtimes and their variability are developed and used by ICPs to make predictions about future events.

B. UNIFORM INVENTORY CONTROL PROGRAM

The Navy's wholesale inventory program, known as the Uniform Inventory Control Program (UICP), is maintained by FMSO and used by both SPCC and ASO. In a demand based inventory model such as UICP, historical procurement leadtimes are collected along with the demands for material in order to determine reorder levels for the items carried in stock. The reorder level is thus a function of the forecasted demand over a procurement leadtime. This can be seen in Equation 5.1 where demand is the quarterly demand average and leadtime is average procurement leadtime in quarters. Both the procurement leadtime and demand are random variables. They contain risk for an inventory control point concerned with running out of stock.

$$\text{Reorder Level} = \text{forecasted Demand} * \text{forecasted Leadtime} \qquad \text{(eqn 5.1)}$$

In the case of the RNCF, knowing the average procurement leadtime alone is insufficient information on which to base a decision. Two other items are important considerations. The first is whether an average PCLT is a good indicator of the future PCLT and the second is the variability of the PCLT. The average procurement leadtime by itself only conveys the information that half of the time material was ordered and received by the PCLT.

For the sake of simplicity, if the average PCLT was based on only two observations where the first observation was 10 days and the second was 90 days, then the material which was ordered could have arrived in 50 days plus or minus 40 days. Knowing the variability or standard deviation (σ_y) is essential when a management decision is being made on when to order or, on whether or not, to preposition stock for a mobilization contingency. The same level of importance can be attached to knowing the forecasted PCLT and standard deviation. With the added information of the standard deviation of a PCLT, a confidence interval can then be established which provides a predetermined level of acceptable risk.

To determine the standard deviation of a PCLT it is necessary to compute the probability-weighted average of squared deviations from the mean of the PCLT population as can be seen in Equation 5.2. The UIC program however does not compute σ_y. Instead, it uses an approximation called the Mean Absolute Deviation (MAD). Equation 5.3 shows the formula for the MAD calculation. The mean absolute deviation is the UICP proxy for σ_y and assumes that $\sigma_y = (1.25) * \text{MAD}$.

$$\sigma_y = \sqrt{\{\sum (y_i - \mu_y)^2/(n-1)\}}, \qquad \text{(eqn 5.2)}$$

where $\mu_y = E(Y)$ and y_i = ith PCLT observation

$$\text{MAD} = (\sum | y_i - \mu_y |)/n, \text{ for } i = 1 \text{ to } n \qquad \text{(eqn 5.3)}$$

Since UICP is a semiautomatic system, some filter values are incorporated into the program code which screen out individual PCLT and PLT observations that do not fall within ICP specified parameters. An example of the parameters established by SPCC can be seen in Equations 5.4 and 5.5.

0.5(old average forecasted PLT) < (observation) < 2.0(old average forecasted PLT) (eqn 5.4)

0.5(old average forecasted PCLT) < (observation) < 2.0(old average forecasted PCLT) (eqn 5.5)

If either or both of the values for a PCLT and PLT fall outside of the parameters, they are sent by a computer generated report to the item manager who must validate and re-input the data to the system. If this is not done, both the PCLT and PLT will be discarded and not used in any further calculation.

When a cyclic levels and forecasting program is run each quarter, a new average PCLT is calculated using procurement leadtime data which has made it past the filters or was re-input by the item manager. As can be seen in Equation 5.6 the new average PCLT is expressed in terms of quarters.

$$\text{average PCLT} = (\sum \text{PCLT}_i)/(91n), \text{ for } i = 1 \text{ to } n \qquad \text{(eqn 5.6)}$$

The new PCLT is then used to forecast the next quarter's PCLT by use of an exponential smoothing technique. As was stated by Sullivan in *An Analysis of Demand Forecasting Emphasizing Inventory Effectiveness*:

> the widespread appeal, among industry and the military, for the exponential smoothing technique is apparent. To utilize exponential smoothing a manager need have only three data elements: the most recent observation, the most recent forecast and a weighting parameter. This data storage consideration has been of primary importance to multi-item inventory systems where demand forecasts are routinely prepared for several thousand items. Combining such features as low data processing and storage costs together with high applicability, exponential smoothing appears as a rational choice for the Navy's forecasting method. [Ref. 21: p. 7]

The use of this technique can be seen in Equation 5.7 where a new average forecasted PCLT is developed. To a large extent the α-values affect the accuracy of the forecast and should be chosen by sensitivity analysis for each line item of inventory. The reality, as can be seen in Table 14, is that the same values are assigned to all items managed by a Navy ICP. The important point to note here is that the α-values at SPCC are dependent on the age of the last PCLT observation and more weight is given to the current PCLT as the previous observation ages.

new average forecasted PCLT =

(α)(new average PCLT) + (1 - α)(old average forecasted PCLT), (eqn 5.7)

where $0 \leq \alpha \leq 1$

TABLE 14

ALPHA (α) VALUES FOR EXPONENTIAL SMOOTHING IN UICP

ICP:	TIME SINCE LAST OBSERVATION:		
	1-2 qtrs	3-4 qtrs	4 or more qtrs
ASO	0.5	0.5	0.5
SPCC	0.2	0.5	1.0

A new forecasted MAD for the PCLT (MAD_{pclt}) is then developed. This calculation also uses exponential smoothing and the same α-values as the PCLT. Equations 5.8 and 5.9 show how the forecasted MAD is computed. Equation 5.9 is used by SPCC when $\alpha = 1$ which means, that when the last observed PCLT is more than four quarters old, full weight is given to the new forecasted PCLT.

new forecasted MAD_{pclt} =
$(\alpha)(|\text{new average PCLT - old average PCLT}|)$ + (eqn 5.8)
$(1 - \alpha)(\text{old forecasted } MAD_{pclt})$, if $\alpha \neq 0$

New forecasted MAD_{pclt} =
$0.051(\text{new forecasted PCLT})^{.884}$, if $\alpha = 0$ or 1 (eqn 5.9)

As a forecasting tool the exponential smoothing technique is moderately successful. Other techniques such as the Box-Jenkins method or Regression analysis are more desirable and effective but also demand a great deal more storage capacity and computer time. The reality of the Navy's UIC program is that it balances the benefits of accurately predicting customer demands against the costs of operating the system. A key point is that forecasted PCLT and MAD can be used with a satisfactory degree of confidence for making predictions. In addition this is the only type of PCLT data available to the RNCF, with the exception of local procurements, for use in determining a unit's ability to prepare by a mobilization deployment date.

C. A MODEL FOR DETERMINING THE EXPECTED MATERIAL READINESS OF RNCF UNITS

For each item of material which is not currently in PWRMS a confidence level can be established for the likelihood that the material will be received by a specified date, once it is ordered. This can be done by use of a normal table Z-value. The normal table is being used as an approximation to the underlying distribution. No claim, however, is made that the true distribution of the population is normal. Unfortunately the data required to obtain the true distribution is not yet available, since the population of material which will be stocked is not known with any degree of certainty. Table 15 shows the Z-values and associated level of confidence which equate to the C-ratings for the supplies on hand portion of the equipment and supplies on hand resource. Figure 5.2 displays a normal population histogram with an area of risk shown in shade. By adding Z standard deviations to the mean of a normal population, a level of confidence that the material to be ordered will be received in the calculated time can be achieved.

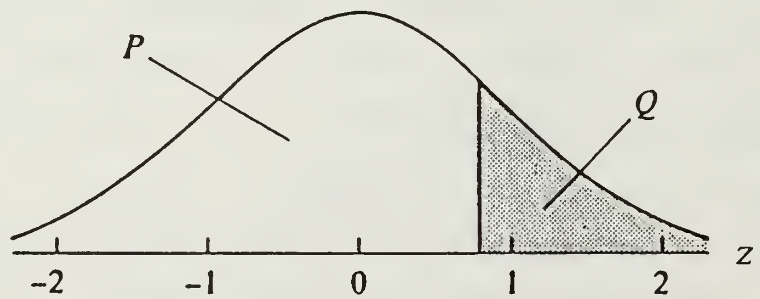
Equation 5.10 shows the calculation for a 90% level of confidence using a known mean and standard deviation. Equation 5.11 shows the substitution of the forecasted PCLT and MAD figures into Equation 5.10.

TABLE 15

Z-VALUES AND THE ASSOCIATED C-RATINGS

Z	Confidence	Risk	C-Rating
1.65	90%	10%	C-1
1.29	80%	20%	C-2
.94	65%	35%	C-3

Risk = 1 - Confidence



The ordinate represents the probability density.

The areas under the graph represent tail probabilities with P representing the probability of an occurance and Q representing the risk.

Figure 5.2 Normal Distribution Histogram with Risk.

$X = \mu_y + 1.65\,(\sigma_y)$, where X is time in quarters (eqn 5.10)
for a 90% chance of material being received.

$X =$ (forecasted average PCLT) + 1.65(1.25 * forecasted MAD_{pclt}) (eqn 5.11)

By determining the number of days that a unit has until it deploys after a general mobilization is declared and adding to this the expected number of days prior to a mobilization[11] that the requisitions for deficient material will be entered into the system, the total time available to fill deficiencies can be determined. If this number of days is then subtracted from the confidence value established in Equation 5.11, (which must also be converted into days), then an expected days short value can be found and used to select candidates for stockage, or for intensive management during mobilization.

The concept of applying a probability distribution for each item's PCLT can also be used in another way. If a unit had no material on hand and began ordering at some point prior to mobilization, then the expected quantities of material on hand at mobilization can be estimated. This is done by summing the calculated probabilities of receiving each item ordered, within the time constraint, after multiplying by the items dollar value. An example of this can be seen in Table 16.

The purpose for weighting the material not stocked by its dollar value is that this is currently how the NCF weights its supplies on hand in its UNITREP calculations. A more appropriate method for determining readiness would be to assign an essentiality code to each item as was discussed in Chapter IV. This essentiality code could then act as an additional weighting factor and the results would more accurately reflect the relative importance of an item. In addition, different weights may be given to the same material. An example of this would be to weight items in kits or assemblies with one value and weight the same items found in the Central Tool Room (CTR) as spares with a lesser value.

Since the PWRMS assets of the RNCF will be configured to unit sets and will be filled on an OPLAN-based priority listing, as was shown in Figures 3.3 and 3.4, those units which are scheduled to deploy first will be the ones with the most material

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[11] It is expected that there will be some period of increasing hostilities which will provide an advance warning that a general mobilization is likely to occur. It is normal to assume that some supply requisitions may be made prior to mobilization based on the belief that the RNCF will be mobilized.

TABLE 16

VALUE WEIGHTED PROBABILITIES COMPUTATION

Item	Value		Probability		Expected Value
1	6.00	X	.10	=	.60
2	7.00	X	.20	=	1.40
3	1.00	X	.50	=	.50
4	12.00	X	1.00	=	12.00
5	4.00	X	.40	=	1.60
	30.00				16.10

16.10 / 30.00 = 53.67% is the probability weighted expected percentage of ordered material to be received.

prepositioned. When computing a dollar value weighted probability of receiving material by the mobilization deployment date for individual units, the varying amounts of material on hand for each unit can be taken into account by assigning a probability of 1.00 to these items. An example of this can be seen in item four of Table 16. A probability of 1.00 reflects the fact that there is no risk involved and the item's availability is deterministic.

As stated previously, this model can be used to determine the probability weighted expected value of the material on hand by the mobilization deployment date once the underlying population distribution of the PCLTs is known with some degree of confidence. This data is not as readily available as is the UICP forecasted average PCLT or the UICP forecasted MAD_{pclt}. The actual distribution is also not known or used in UICP by the Navy inventory control points. Knowing the UICP forecasted PCLT can at least provide some guidance to allocating incremental funds to long leadtime material which would not be expected to arrive prior to a unit's mobilization deployment date. In any event, the UICP forecasted PCLT by itself represents a sample mean from the current population and is adjusted by exponential smoothing to achieve a time-weighted moving average of the PCLT population. If a sufficiently large sample of means is extracted from a population, the Central Limit Theorem states that the sampling distribution of these means will be normal [Ref. 22: p. 259].

As a final point on the use of this model, if the expected dollar value of material on hand is calculated and divided by the total dollar value of a unit's TA, then a probability weighted expected percent of material on hand can be determined. This can be seen at the bottom of Table 16. A probability weighted expected percent of material on hand can also be calculated which is based on the assumption that there is currently no material on hand. These calculations can be done for each unit and the difference between the two percentages should provide a good indication of how much readiness was purchased by prepositioning war reserve material stock.

If NAVSUP succeeds in transfering the RNCF PWRMR to OWRMR then the assumptions used in this model will most likely be invalid. In this case RNCF units will have to either deploy with the material on hand or wait until after all other units' PWRMR requirements are ordered. This means that the RNCF's resource C-ratings will not improve from what they will be on the date of the transfer until well after a general mobilization is announced.

D. SUMMARY

The conclusions and recommendations for ascertaining and reporting RNCF readiness to the JCS were included in Chapter I for the convenience of the reader and will not be repeated here. It is hoped that this thesis has provided insight into the nature of readiness and will assist the Reserve Naval Construction Force to some degree in achieving an accurate readiness assessment.

E. RECOMMENDATIONS FOR FURTHER RESEARCH

1) Once the RNCF PWRMS material from the current buy is received and system cancellations and shortages are determined, the National Stock Numbers (NSNs) can be screened against ICP data bases to select the PCLT data needed to determine the true population distribution of PCLTs. This model can then be tested to see if a normal curve can be fitted to the overall population to accurately determine the expected value of material on hand by the mobilization deployment date of each unit.
2) Essentiality coding can be used to determine an essentiality weighted dollar value for each item within an RNCF TA. This can be done by a subjective assessment methodology such as Saaty's *Analytic Hierarchy Process* [Ref. 23]. Excellent decision assisting computer software is available. For example, *Expert Choice* [Ref. 24] can help in making the trade-offs and pair-wise

comparisons needed to arrive at the weightings. By determining an essentiality weighted dollar value for TA items, a more accurate assessment of readiness can be achieved.

3) Pacing items of CESE can be selected for each unit type within the RNCF in a manner similar to that done for each type of Army unit. The methodology for selecting pacing items was developed by the U.S. Army Concepts Analysis Agency in Washington, D.C. Pacing items can be selected and used to determine their effect on RNCF unit readiness and whether their inclusion will more accurately portray RNCF readiness.

4) Unit tables of allowance can be screened to remove sustainability items from readiness computations. This will then allow a readiness computation to be made which is equivalent to that used by Army units. The effect on readiness of including sustainability can be determined and reported separately in Part II of an RNCF UNITREP.

APPENDIX

NCF TABLE OF ALLOWANCE, INTRODUCTION AND REPRESENTATIVE EXCERPTS

This appendix is intended to serve as a brief introduction to an NMCB/RNMCB table of allowance.

This appendix was extracted from the 1985 NMCB TA-01 [Ref. 17]. Pages 71 through 80 introduce the table of allowance and explain its purpose, authority and organization. Pages 81 through 84 show the air echelon portion of the construction tools and equipment, (section 6), by group and facility. Pages 85 through 88 show one of the groups, a four man plumbers kit (group 80001) and the national stock numbered items of which it is composed.

1. PURPOSE. The purpose of the Table of Allowance (TOA) is to identify and quantify the basic personnel, material, and equipment for the performance of the unit's mission(s) in contingency/wartime/disaster recovery operations. The TOA is designed to sustain construction operations for 90 days, except for fuel and subsistence, which are limited in the TOA to 15 days support.

NOTE: Ammunition is not listed within NCF TOAs, and is managed in accordance with fleet directives. CINCLANTFLTINST C8010.4 series and COMNAVLOGPACINST 8015.1 series refer.

2. AUTHORITY AND RESPONSIBILITIES. Commands having authority and responsibility for TOAs are as follows:

a. The Chief of Naval Operations (CNO-Code OP 44) is responsible for the doctrine and policy for all NCF units. CNO approves all NCF TOAs and any changes that impact on the unit's mission.

b. The Chief of Civil Engineers (NAVFAC-Code 06) is responsible for advising CNO (OP 44) in TOA matters concerning mission and state-of-the art technological advances.

c. Fleet Commanders (COMCBPAC/COMCBLANT) are responsible for recommending revisions to TOAs under their cognizance.

d. The Civil Engineer Support Office (CESO) is the system manager responsible for maintaining NCF TOAs, developing new allowances as directed by COMNAVFACENGCOM, and collecting field recommendations for revisions to existing TOAs.

3. UPDATING TOAs. Publication and distribution of NCF TOAs and related management aids are on a bi-annual update cycle (NAVFACINST 4423.1B applies).

4. GENERAL TOA INFORMATION. NCF allowances provide personnel, material and equipment to enable the unit to carry out operational requirements. Since the unit will be expected to build any number of different facilities in any climatic condition, judicious selection of items is necessary to prevent the allowance from reaching excessive proportions. A compromise must be reached, balancing bulk against capability. The NCF Allowance represents the best selection for providing general construction capability, but they are not all inclusive. They are not, nor should they be, capable of meeting every conceivable operational requirement. When an assigned project requires tools or equipment in excess of the unit's capability, the allowance is supplemented by augmentation. Augment tools, equipment and/or personnel may come from the Naval Construction Force Support Unit (NCFSU), or be provided by the responsible fleet or operational commander.

5. ABFC/TOA STRUCTURAL ORGANIZATION. Individual line items of material and equipment are identified by stock number, either National Stock Number (NSN) or Navy Item Control Number (NICN). Stock numbers for Civil Engineer Support Equipment (CESE) are listed within Equipment Cost Codes (ECCs). Other stock numbers are assembled within functional ASSEMBLIES. ASSEMBLIES are grouped functionally into either GROUPS or FACILITIES. GROUPS and FACILITIES are segregated by major category or material into SECTIONS, and by purpose into ECHELONS, within NCF TOAs and/or Advance Base Functional Component (ABFC) System Components.

a. ABFC COMPONENT/NCF TOA. An ABFC Component/NCF TOA is a design for personnel, material and equipment required to perform specific taskings delineated in OPNAVINST 5450.- series instructions. Components and TOAs are given names to indicate their functions, and unclassified codes consisting of letter (alpha) and number combinations. For example: a Naval Mobile Construction Battalion (NMCB) in the NCF TOA system is designated "TA-01", and has an ABFC counterpart designated "P-25". The Naval Construction Force Support Units (NCFSU) TOA is designated "TA-13", and has an ABFC counterpart "P-31".

b. ECHELONS. In both contingency and day-to-day operations, an NCF unit may be required to support, simultaneously, multiple projects, tasks and locations. Preplanning for such contingencies and management of resources required to support these operations are aided by "echeloning" certain TOAs. For example, the NMCB TOA is echeloned into an Air Detachment, an Air Echelon (Minus Air Det), and a Sea Echelon. This echeloning is based on anticipated prioritization of personnel, material and equipment, and availability of airlift versus sealift support. The NCFSU TOA is echeloned to augment and support various special operations which are beyond the organic capability of the NMCBs.

(1) Echelons are indicated by the ALPHA suffix code in the GROUP numbering system explained below in paragraph 5.d (1).

c. SECTIONS. NCF allowances are divided into Sections, which are an indication of major categories of material. Sections are two digit numbers, numbered from 01 to 26, as shown in Illustration I below.

d. GROUPS/FACILITIES. GROUPS and FACILITIES are on the same level in regard to the structural organization of Components and TOAs. They are coded with 5 numerics, followed by 1 or 2 alpha codes.

(1) GROUPS are functional subdivisions of SECTIONS (major categories of material). In the NCF TOA system, each digit of the group number has meaning as delineated below and shown in Illustration I.

(a) The first digit is always "0".

(b) The second and third digits indicate the SECTION (major category of material).

(c) The fourth digit indicates the Material Management Code (MMC). Material Management Codes have been assigned in order for the computer program to generate the specific documents/management aids required for efficient management of TOA assets. (See paragraph 6 below for amplification on TOA documents/management aids available.)

(d) The fifth digit in the GROUP number is arbitrarily assigned and is a sequential number utilized to subdivide material within a Section by organizational interest. (In Section 02, Group Sequence Number "1" may apply to material in the Armory, while in section 05, Group Sequence Number "1" may apply to material for ALFA Company.)

(e) The sixth digit in the GROUP number is an ALPHA character indicating the applicable NCF TOA (TA-##). Only those allowances which have been "echeloned" have an additional ALPHA character as a seventh digit indicating the ECHELON.

EXAMPLES

UNIT	TA-##	6th	7th	ECHELON TITLE
NMCB	TA-01	A		
		A	D	Air Detachment
		A	E	Air Echelon
		A	S	Sea Echelon
SEABEE TEAM	TA-03	C		N/A
RNMCB	TA-09	A	D	Air Detachment
		A	R	Readiness Support Allowance

ILLUSTRATION I NCF TOA GROUP NUMBERING SYSTEM

0 N N N N A A (N=Numeric, A=Alpha)

First Digit Always "0"

SECTION Codes (01 - 25)

01 PERSONNEL

02 WEAPONS & INFANTRY EQUIPMENT

03 CBR, DAMAGE CONTROL & SAFETY

04 ADMIN & GENERAL SERVICES

05 MAINTENANCE & SHOP TOOLS/EQUIP

06 CONSTRUCTION TOOLS/EQUIPMENT

07 CONSTRUCTION CONSUMABLES

08 MOUNTOUT RELATED MATERIALS

09 CLOTHING & BEDDING (GREENS)

10 MEDICAL & DENTAL

11 COMMUNICATIONS & ELECTRONICS

12 FORMS & PUBLICATIONS

13 DIVING EQUIPMENT & SUPPLIES

14 WATERFRONT, SMALL CRAFT & MARINE

15 FACILITIES F/ECH (AIR DET)

16 FACILITIES F/ECH (AIR ECHELON)

17 FACILITIES F/ECH (SEA ECHELON)

18 FACILITIES F/ECH (AS SPECIFIED)

TA & ECEHLON Codes (As applicable)

Examples

AD NMCB Air Det

GB PHIBCB Blue Beach

NC NCFSU Augment F/NMCBs

GROUP Sequence Number

Defined in Specific GROUP Title

MATERIAL MANAGEMENT CODES (MMC)

0 NO TOA Aids Provided

1 CTR Controlled Kits (Kit Inventory Listings)

(No 1114 Cards available f/Kits)

2 CTR Tools & Tool Related Support Material Other Than Kits (OTK) (Combined MTO, 1114 and 1075 cards provided)

3 Equipage No Aids provided, however listings and cards are available.

4 Operating Space Items (OSI) (INDIVIDUAL Assembly Lists) No cards are provided

5 Operating Space Items (OSI) (Separate GROUP MTOs are provided. No 1114 or 1075 cards are provided.

6 Storerooms, Other than CSR (Separate Group MTOs, and 1114s are provided. No 1075s are provided.

19 SCHOOLS (NCTC) TRAINING EQUIP

20 CIVIL ENGINEER SUPPORT EQUIP (CESE)

21 FACILITIES

22 FACILITIES SUPPORT MATERIAL

23 PETROLEUM/OIL/LUBRICANTS (POL)

24 PROVISIONS (SUBSISTENCE)

25 CESE REPAIR PARTS (COSALS)

26 ISO CONTAINER REQUIREMENTS

7 Central Storeoom (CSR) (Combined MTO, 1114s & 1075 cards provided.)

8 MMC Not Currently Assigned

9 MMC Not Currently Assigned

*NOTE: Additional Inventory Aids are available and are listed below. These Aids will be provided upon request only.

7. COMP, TCA FAC/GROUP, ASSY		8. Indicate Qty Req'd FACSO RPT SYM	TAB STK	XEROX	OTHER	INVENTORY AID SELECTIONS TITLE	SEQUENCE
		83552C01				NAVSUP 1109 CARDS FOR ASSY OTHER THAN KITS	ASSY, NIIN, SUMMARY
		83528R01				KIT/ASSY SEQ LIST FOR OTHER THAN KITS	ASSY, NIIN, SUMMARY
		83543R01				NAVSUP 1114 STOCK RECORD CARDS FOR	ASSY, NIIN, SUMMARY
		83550R01				ASSEMBLY OTHER THAN KITS	NIIN, SUMMARY
						NAVSUP 1114 STOCK RECORD CARDS FOR	
		83572R01				FACILITY/GROUP	FAC/GRP, NIIN, SUMMARY
		83546R01				BIN ID GUM LABELS (NON-KITS)	ASSY, NIIN, SUMMARY
		83530R01				MATERIAL TAKE-OFF (MTO) #1	NIIN
		83535R01				SUMMARY	COG, NSN
		83540R01					NSN
		83527R01				MATERIAL TAKE-OFF (MTO) #2	PROJECT
		83532R01				CONSOLIDATED CROSS REFERENCE	ALPHA
		83532R02					NIIN
						NAVSUP 1075 INVENTORY RECORD FOR	
		83575C01				FACILITY/GROUP	FAC/GRP, NIIN, SUMMARY
		83526R01				NAVSUP CONTRIBUTIONS FOR NAVFAC COMPONENTS	COMPONENT, SECTION, COG,
		83526R02				2C COG REQUIREMENTS BY SECTION	NSN
		83561R01				KIT INVENTORY LIST FOR MANUAL INVENTORY	KIT NO, SEQ NO, ALPHA
		83592C01				SPECIAL 1109 CARDS FOR FAC/GRP	FAC/GRP, NIIN, SUMMARY
		83593C01				SPECIAL 1109 CARDS KITS [illegible] SER	KIT NO, SEQ NO, ALPHA
		83594C01				SPECIAL 1109 CARDS ASSY NON-KITS	ASSY, NIIN, SEQ NO.

e. ASSEMBLIES/EQUIPMENT COST CODES (ECCs)

(1) An ASSEMBLY is one or more stock numbered line items assembled to support a specific task or function and identified by a five digit numeric code, i.e. Individual Infantry Equipment for one man is identified as ASSEMBLY 02000. Kit, Plumbers for four men is ASSEMBLY 80001.

(2) Equipment Cost Code (ECC) Civil Engineer Support Equipment (CESE), consisting of Automotive, Construction, Weight and Material Handling Equipment (MHE), and Camp Support Equipment are identified with a six digit numeric Equipment Cost Code (ECC) as defined in Management of Transportable Equipment (NAVFAC P-300), i.e. the ECC for a QUARTER TON UTILITY TRUCK "JEEP" is 030731.

(3) CESE Collateral Equipment, which enhances or extends the equipment's capability, may be identified by the CESE's ECC with an alpha suffix, i.e. the Deep Water Fording Kit for a Jeep is identified as 030731A.

f. STOCK NUMBERS. To register as a valid requirement in the ABFC/TOA system, a line item must be cataloged with either a National Stock Number (NSN), recognizable DoD wide, or a Navy Item Control Number (NICN), which could be a form, a publication, or a locally catatoged item. NSN/NICNs are 13 digits, of which the first six have meaning (Federal Supply, Group & Class and Country Code), and the last seven are sequentially assigned serial numbers. Information regarding non-stock numbered material may be found in header or note data within ASSEMBLIES.

(1) Stock Number Associated Data. Data within a stock number, and associated with it in the NCF TOA system, provides additional information as follows:

(a) Group and Class. The first four digits of a valid stock number indicate the Group and Class of material, as defined in Federal Supply Classification (FSC) publications, i.e. Within Group 51 - "Hand Tools", there are a number of Classes of Hand Tools, such as:

5110 Hand Tools, Edged, Non-powered (chisels, saws, etc.)
5120 Hand Tools, Non-edged, Non-powered (hammers, pliers, screwdrivers, etc)
5130 Hand Tools, Power driven (power saws, drills, etc.)

(b) National Item Identification Number (NIIN). The NIIN consists of the the last nine digits of the NSN/NICN, that is, Country Code and sequentially assigned seven digit serial number. Stock record cards for storeroom material are normally maintained in NIIN sequence.

1. Country Codes. The two digits in the 5th and 6th positions of the stock number indicate either the country cataloging the item, i.e. "00" indicates material cataloged by agencies of the U.S Government prior to the conversion in 1975 from Federal Stock Numbers (FSNs) to NSNs; "01" indicates material cataloged by the U.S. agencies since conversions to NSNs; "LF" for forms and "LP" for publications managed by Navy Publications and Forms Center (NPFC), Philadelphia; "LL indicates material with limited DoD interest and cataloged locally.

NOTE: FACILITIES - always start with a numeric other than "0". (Example 134 45 E.)

Since FACILITIES are numbered differently than GROUPS, "ALPHA" Codes cannot be utilized to designate which echelon a particular FACILITY is in. In this situation, Sections 15 through 17 are utilized to differentiate FACILITIES within ECHELONS.

(2) FACILITIES are pre-engineered, functional designs of construction related material and equipment in support of Components and TOAs. They are coded with a Category Code/Nomenclature (CCN) code, required by DoDINST 4165.3 to identify, classify and quantify all military real property facilities owned or controlled by DoD and assigned to the Department of the Navy. The CNNs, which are indicative of the use made of the facility, have been developed on the structured base of the three digit DoD specified Facility Classes, Category Groups and Basic Categories. Within the Navy, two additional digits and one or two alpha codes have been added to provide more definitive and effective categorization of the Navy's facility assets. Department of the Navy Facility Category Codes (NAVFAC P-72) refers.

ILLUSTRATION II FACILITIES CATEGORY CODE/NOMENCLATURE NUMBERING SYSTEM

N N N N N A A

FIRST digit is always a numeric other than "0" which indicates one of the nine broad DoD Facility Classes

1 = Operational & Training Facilities

2 = Maintenance & Production

3 = Research, Development & Testing

4 = Supply Support

5 = Hospital/Medical

6 = Administrative Support

7 = Housing & Community Support

8 = Utilities & Ground Support

9 = Real Estate (Class I Property)

SECOND digit identifies the DoD Category Group within the Facility Class

THIRD digit identifies the DoD Basic Category

FOURTH & FIFTH digits identify specific Navy Facilities within the DoD Basic Categories

ALPHA suffix codes are used to distinguish between individual designs within the ABFC System

2. The last seven digits uniquely identify each stock number item. For Navy Item Control Numbers (NICN) cataloged by CESO, the first three of these seven digits may be assigned LC1, LC2, and LC3 indicate locally assigned temporary stock numbers, while LCA, LCB, and LCC indicate locally assigned permanent stock numbers.

(c) Cognizance (COG) Symbols. COG symbols are assigned within the Navy Supply System only, to identify the inventory manager and whether the item is managed as a Navy Stock Account (NSA) or an Appropriate Purchase Account (APA) item, i.e. 9g = Navy Stocks of Defense General Material, 2B = Material Handling.

(d) Acquisition Advice Code (AAC). An AAC is a single alphabetic character which indicates how (as distinquished from where), and under what restrictions, and item is acquired, i.e. ACC "D" indicates DoD managed and stocked material; "G" indicates GSA managed and stocked material; "L" indicates material to be purchased locally, etc.

(e) Weight (WT), Cube (CU), and Unit of Issue (UI) and Price. Weight and cube data in the ABFC /TOA data base are estimated for each item's unit of issue. Actual weight and cube will vary, depending on methods of over-packing for storage and shipment. Unit of issue and price information, while current at time of printing the NCF/TOA, should be validated in the most current Management List-Navy (ML-N) or Management List Consolidated (ML-C) prior to requisitioning requirements.

(f) Shelf-Life Codes. Shelf-Life Codes are a one digit alpha or numeric, devoting the shelf-life span of material from date of manufacture. For NCF TOAs, shelf life codes are listed in the Consolidated Cross Reference/MTO documents, and defined in Afloat Supply Procedures (NAVSUP P-485) Appendix 9.

(g) Hazardous Codes. Identify material that requires special storage facilities and handling precautions. The Consolidated Hazardous Items List (CHIL), (NAVSUP P-4500) outlines the requirements for stowage of dangerous and semi-safe materials.

6. NCF TOA SYSTEM DOCUMENTS/REPORTS/MANAGEMENT AIDS. Numerous documents/ reports/management aids are available from the ABFC/TOA program. Listed below are ones applicable to units managing or concerned with NCF TOAs.

a. GROUP/FACILITY CROSS REFERENCE TO TA-SECTION (GRP/FAC X REF). This report is a listing of groups and facilities in numerical sequence with descriptions (titles) and quantities, cross-referenced to the TA and Section, and serves as a Table of Contents.

b. ASSEMBLY/ECC CROSS-REFERENCE TO GROUP/FACILITY (ASSY/ECC X REF). This report is a listng of assemblies and ECCs in numerical sequence with descriptions (titles) and quantities, cross-referenced to each applicable group or facility.

c. ABRIDGED TOA. The ABRIDGED TOA is an abbreviated form of the "master" UNABRIDGED allowance format. The difference between the two is that individual stock numbers are not shown in the ABRIDGED format. It is a good document for weight, cube, cost and quantity data summarized at the ASSY/ECC, GRP/FAC, Section, Echelon and total TOA.

d. UNABRIDGED TOA. The Unabridged contains the required quantities of Group/Facility "A" in the allowance, and shows the required quantity for one (1) Assembly "B." The Assembly lists the National Stock Number (NSN) quantities contained on one (1) Assembly. A total is given for the weight, cube and cost of one (1) Assembly, and there the quantity is extended to total quantity required, i.e. number of Group/Facility "A" times number of Assemblies "B".

e. CONSOLIDATED CROSS-REFERENCE/MTO (CONS XREF/MTO). The CONS XREF/MTO provides a complete overview of each line item in the TOA. It is available in both ALPHA sequence and NIIN sequence of stock numbers. The ALPHA SEQ CONS XREF/MTO is the document most used by personnel in the field to identify requirements to stock number, and should be available in the major supply support centers (CSR, CTR, etc.) and staff/company offices or shops. In addition to the basic stock number data (COG, AAC, NSN/NICN, TITLE, U/I, SHELF-LIFE CODE, WT, CU, COST), it consolidates and summarizes data by: the number of times a particular stock number is used in an ASSEMBLY/ECC, number of times that ASSY/ECC is used in a GROUP or FACILITY, number of times that GRP/FAC is used in an ECHELON, and then totals the data for the entire TOA.

f. RECORD OF CHANGES (ROC). The Record of Changes is a comparison between the current edition of the TOA and the previous edition. The intent is to notify the user of the changes, i.e. total quantity change, unit of issue change, COG symbol change, FSC change, and transfers.

(1) Items listed in one edition but not in the other will be annotated as "NOT IN THE OLD ALLOWANCE" or "NOT IN THE CURRENT ALLOWANCE." Such items may be true additions or deletions to the TOA or GROUP, but in most cases they indicate stock number changes of the same or substitutable material. The ROC is in alpha sequence, so that in most cases, like items will be listed together and stock number changes will be easy to distinguish. However, personnel updating TOAs should be alert to the following exceptions:

(a) When the nomenclature on the new stock number is different from that on the old stock number, the items may be listed some distance from one another in the ROC.

(b) When a set, kit, or outfit is no longer procureable under one stock number, the old stock number may be replaced with numerous new stock numbers, without changing actual assets to the TOA.

g. STOCK RECORD CARDS (NAVSUP Forms 1114). Stock record cards are provided for Material Management Codes "2" for CTR, "7" for CSR and "6" for the various storerooms in the unit's allowance. NAVSUP Form 1114 cards cannot be provided for 80000-80999 series kits; however, they are available for all storeroom items in the TOA. After the initial outfitting of a unit or camp with complete stock records, subsequent updates will entail stock record cards for only those stock numbers not listed in the previous TOA storeroom groups.

h. STOCK LOCATOR CARDS (NAVSUP Forms 1075). Stock locator cards are provided for the CSR Material Management Code "7" and CTR Material Management Code "2". They are not provided for other storerooms within a unit's allowance, but can be ordered separately from the Civil Engineer Support Office (CESO 1571) if a specific need arises. As with the NAVSUP Forms 1114 above, after initial outfitting, subsequent updates will include only those stock numbers not in the previous CSR/CTR allowance.

i. BIN ID GUM LABELS are available, upon request, for marking individual line item locations within storerooms and operating spaces.

j. KIT INVENTORY LIST. These lists are provided for Material Management Code "1" CTR Controlled Kits for manual inventory, and have columns to handle seven inventories. Line items are listed in alpha sequence, with space provided for quantity and dollar value of shortages, departmental serial number of the NAVSUP Form 1250 documenting the shortage, and the signature of the person having custody of the kit.

l. ASSEMBLY CONTROL LIST FOR OTHER THAN KITS are provided for Operating Space Items (OSI) for Material Management Code "4" that are normally signed over to personnel on a semipermanent basis. (Administrative, General Services and Special Staff operating space items, i.e. Chaplains Kit, Photographer's equipment and supplies, Medical/Dental materials, etc.; however, these listings are available for all assemblies other than 80000-80999 series assemblies)

m. MATERIAL TAKE-OFF (MTO) REPORT #1 is a line item NIIN summary of material which may be run at the Project, TOA or GROUP level. When run at the GROUP level, it provides Stock Number Sequence List (SNSL) for the various storerooms and operating spaces.

(1) For Material Management Code "2" CTR Tools and Tools Support and "7" Central Storeroom (CSR) combined group MTOs are provided.

(2) For Material Management Codes "5" Operating Space Items and "6" Storeroom other than CSR, separate Group MTOs are provided.

(3) MTO reports are available upon request for all groups in NSN, NIIN or Cog/NSN sequence.

n. NSN BREAKDOWN OF SETS, KITS AND OUTFITS (SKO), commonly known as the "SKO", provides a list and description of items contained within a stock number. This product aids in the inventory process and procurement of replacement components and selected tool repair parts. The "SKO" is distributed to NCF units separately from their TOA Update package.

o. SUBSTITUTE ITEM LIST is a cross-reference between stock numbers in NCF TOAs which have been superceded by new "prime" numbers, assuming that the superceded material will be "utilized until exhausted". This list is issued in "PRIME-TO-SUB" and "SUB-TO-PRIME" format.

7. NCF PACKUP/MANAGEMENT CONCEPTS. While ASSEMBLIES are the basic building blocks of NCF TOAs, the material within an assembly is packed and managed one of two ways, as either:

a. INDIVIDUAL ASSEMBLIES. Tradesman Kits (80000-80999 series assemblies) and certain operating space items are packed and managed at the individual assembly level. Kit Inventory Lists and Assembly Content Lists for Other Than Kits are the primary management aids provided for these assemblies.

b. GROUPS OF ASSEMBLIES. For storeroom material and certain operating space items, assemblies are grouped and line items are summarized for management purposes. For example, the same sling is used for both M16A1 rifles (ASSY 02052) and for M-870 shotguns (ASSY 02060). By grouping these assemblies, the Armory can be provided a summarized list of total number of slings available.

	Drawing Zone	QTY	WEIGHT	CUBE	ESTIMATED UNIT-$-VAL	ESTIMATED TOTAL-$-VAL
EXTRACTED FROM 80014 AND 83000						
84003 LIFTING DEVICES (TOP & BOTTOM) F/TRICONS 8X8X6.5		1	1,875	118	7,500.00	7,500.00
84004 LIFTING DEVICES (TOP & BOTTOM) F/STD 20'S 8X8X20		2	9,536	676	11,130.00	22,260.00
* GROUP 00541AE TOTAL		1	25,433	1,340	75,732.75	75,732.75
00561AE AIR ECH ALFA CO TOOLROOM (ATR)		1				
80414 ALFA COMPANY TOOL ROOM (ATR)		1	4,101	183	22,409.87	22,409.87
EXTRACTED FROM ASSY 80014						
82011 WRENCH SET IMP PNEU 10R SCKTS 3/4 TO 3 1/8		1	171	6	1,026.98	1,026.98
84000 MISC. RIGGING GEAR		1	6,618	229	14,043.43	14,043.43
* GROUP 00561AE TOTAL		1	10,890	418	37,480.28	37,480.28
** SECTION 5 TOTAL			79,184	3,960		384,560
SECTION 6 CONSTRUCTION TOOLS AND KITS						
00611AE AIR ECH CTR TOOL KITS (CONSTRUCTION COMPANIES)		1				
NOTE: FOR RAPID RUNWAY REPAIR AND WAR DAMAGE SUPPORT, KIT MASON TOOLS (ASSY 80020) AND KIT CONCRETE PLACEMENT (ASSY 80056) CAN BE OBTAINED FROM NCFSU						
80001 KIT PLUMBERS (F/4 MEN)		5	1,574	42	2,060.13	10,300.65
80003 KIT TANK ERECTION F/4 MEN		2	1,764	49	4,518.27	9,036.54
80004 KIT GAS CUTTING&WELDING W/ROD		4	730	69	750.18	3,000.72
80009 KIT WELDING GMA		1	101	3	1,501.73	1,501.73
80019 KIT CARPENTERS TOOLS		21	3,593	189	760.80	15,976.80
80024 KIT ELECTRIC ARC WELDING ACCESSORIES 400 AMP W/O WELDER		3	807	50	1,297.09	3,891.27
80029 KIT 20X48 AND 40X100 RIGID FRAME ERECTION TOOLS		1	660	27	5,792.30	5,792.30

		Drawing Zone	QTY	WEIGHT	CUBE	ESTIMATED UNIT-$-VAL	ESTIMATED TOTAL-$-VAL
	WHEN USING THIS ASSEMBLY DRAW LADDERS AND PORTABLE SCAFFOLD SYSTEM FROM CTR AS REQUIRED						
80078	KIT, HOT LINE TOOLS, ELECTRICAL		1	347	18	2,699.06	2,699.06
80088	KIT POWER THREADING		1	284	9	1,845.00	1,845.00
80096	KIT WELDING GAS TUNGSTEN ARC TIG AIR COOLED CONTAINS ALL ITEMS REQUIRED FOR TIG OPERATION FOR USE WITH WELDING MACHINE, ECC 517061		1	40	4	604.96	604.96
80097	KIT, ARCAIR CUTTING AND GOUGING ELECTRIC TORCH		3	4,943	244	438.77	1,316.31
80098	KIT, REMOTE CONTROL FOR 400 AMP DIESEL WELDER ONLY (ECC 517061)		1	20	2	956.14	956.14
80107	KIT LUBRICATION EQUIPMENT AND ACCESSORIES		2	143	15	1,095.46	2,190.92
80108	KIT MINI LUBRICATION EQUIPMENT HAND OPERATED		1	28	2	455.35	455.35
80125	KIT SAW FILING AND BLADE SHARPENING (MANUAL)		1	143	6	1,123.53	1,123.53
	* GROUP 00611AE TOTAL		1	15,177	729	60,691.28	60,691.28
00621AE	AIR ECH CTR TOOLS-OTHER THAN KITS (OTK)		1				
06040	CTR POWER TOOL SUPPORT MATL		1	5,311	29	10,158.90	10,158.90
06041	CTR MISC POWER TOOLS F/NMCB'S		1	881	59	11,525.29	11,525.29
06043	GASES AND CYLINDERS		1	28,895	532	27,385.92	27,385.92
	MANAGE IAW NAVSUP P-485 PARA'S 3441 AND 4643						
06063	CTR MISC NON-POWER TOOL/SUPPORT MATL F/NMCB'S		1	12,681	712	65,078.89	65,078.89
06067	WELDING ELECTRODES AND FLUX		1	2,003	27	5,054.55	5,054.55
	NOTE: STORE IN HUMIDITY CONTROLLED AREA						

		DRAWING ZDNE	QTY	WEIGHT	CUBE	ESTIMATED UNIT-$-VAL	ESTIMATED TDTAL-$-VAL
06080	CTR CONSUMABLES		1	1,593	95	2,770.90	2,770.90
82001	SAW CHAIN GED 18N		4	202	19	412.68	1,650.72
82002	SET PAVING BREAKER, TAMPER, DRIVER AND DRILL COMBINATION, GED		1	283	5	4,771.67	4,771.67
82011	WRENCH SET IMP PNEU 1DR SCKTS 3/4 TO 3 1/8		1	171	6	1,026.98	1,026.98
82012	HAMMER SCALING PNEU		1	22	1	100.54	100.54
82013	SAW CIRC PNEU 12		2	338	16	1,680.87	3,361.74
82015	DRILL ELECTRIC PDRTABLE 3/4		2	143	5	803.04	1,606.08
82016	SAW CIRCULAR PDRTABLE 7 1/4N DDUBLE INSULATED WDRM DRIVE MDL 77 W/CASE		10	700	16	427.84	4,278.40
82017	SAW CIRCULAR PDRTABLE 8 1/4N DDUBLE INSULATED		4	216	6	330.92	1,323.68
82019	GRINDER/SANDER ELEC 7N DBLINS 5/8N-11 RH THREAD SIZE SPINDLE		3	134	6	142.39	427.17
82020	WRENCH SET IMP PNEU 1/2DR SCKTS 9/16-1 1/16		1	31	2	264.16	264.16
82021	BDRER WDOD PNEU PORT 1 1/4		2	202	6	1,120.11	2,240.22
82022	DRIVERS PDWDER ACTUATED LDW VELDCITY GENERAL PURPDSE AND HEAVY DUTY DX451-CBSK		2	320	8	1,815.26	3,630.52
82023	SAW RECIPRDCATING HORIZDNTAL PDRTABLE ELECTRIC W/BLADES		2	114	5	261.54	523.08
82025	HAMMER PNEU PDRT NAIL DR 6D-16D CAPACITY		2	342	5	618.15	1,236.30
82026	HAMMER NAIL PNEU 20-60D		2	149	4	1,374.54	2,749.08
82031	DRILL ELEC PORT 1/2		2	94	4	293.54	587.08
82032	WRENCH SET IMP ELEC 1/2DR SCKTS 9/16-1 1/16		1	57	3	392.29	392.29
82033	HAMMER PNEUMATIC PORTABLE RIVETING W/CHISELS		2	29	2	77.89	155.78
82036	PAVING BRKR SET PDRT PNEU 80LB		2	524	13	1,252.62	2,505.24
82038	SAW CIRC STL-CDNC 12N GED		2	124	8	787.22	1,574.44

		DRAWING ZONE	QTY	WEIGHT	CUBE	ESTIMATED UNIT-$-VAL	ESTIMATED TOTAL-$-VAL
82039	TAMPER PNEUMATIC 6N BUTT 48 LB		1	84	5	900.17	900.17
82047	DRILL ELEC PORT 3/8 HVYDT VARIABLE SPEED REVERSIBLE		6	268	12	302.04	1,812.24
82050	TAMPER VIBRATING PORT.RAMMER SET 4.2 HP GED		4	934	76	3,466.77	13,867.08
82051	ROTARY HAMMER ELECTRIC FOR DRILLING HOLES IN CON-CRETE FM 1/2 TO 2 1/2N DIA AND CHISELING CONCRETE		2	148	4	2,024.94	4,049.88
	SPECIAL DESIGNED BITS AND CHISELS IN THIS ASSEMBLY, ARE FOR USE WITH HILTI ROTARY HAMMER (HILTI) TE-52 AND TE-72.						
82068	WELDER, KIT, PLASTIC, PORTABLE F/PVC AND ABS		2	60	5	373.05	746.10
82072	SAW, RADIAL ARM PORT EMD, 15AMP, 115V AC, 8N		1	130	22	482.26	482.26
83001	MISCELLANEOUS CONSTRUCTION TOOLS		1	3,653	578	10,482.78	10,482.78
	* GROUP 00621AE TOTAL		1	60,836	2,296	188,720.13	188,720.13
	** SECTION 6 TOTAL			76,013	3,025		249,411
	SECTION 7 CONSTRUCTION ORIENTED CONSUMABLES						
00771AE	AIR ECH CSR CONSTRUCTION CONSUMABLES		1				
06001	PIPE-TUBING-HOSE W/FITTINGS		1	142	4	440.12	440.12
06002	SCREWS-BOLTS-NUTS-RIVETS & OTHER FASTENING DEVICES		1	1,719	28	1,982.99	1,982.99
06023	METAL STOCK, ALPHA CO. STEEL SHOP SUPPORT		1	4,794	11	1,149.62	1,149.62
06044	CHEMICALS COMPOUNDS INSECTICIDES PAINTS		1	4,664	143	3,165.42	3,165.42
	* GROUP 00771AE TOTAL		1	11,319	186	6,738.15	6,738.15
	** SECTION 7 TOTAL			11,319	186		6,738

SECTION 6 CONSTRUCTION TOOLS AND KITS

		DRAWING	ZONE	QTY	UI	WEIGHT	CUBE	ESTIMATED UNIT-$-VAL	ESTIMATED TOTAL-$-VAL
00611AE	AIR ECH CTR TOOL KITS (CONSTRUCTION COMPANIES)			1	GRP/FAC QTY 'A'				
	NOTE: FOR RAPID RUNWAY REPAIR AND WAR DAMAGE SUPPORT, KIT MASON TOOLS (ASSY 80020) AND KIT CONCRETE PLACEMENT (ASSY 80056) CAN BE OBTAINED FROM NCFSU								
80001	KIT PLUMBERS (F/4 MEN)			5	ASSY/ECC PER GRP/FAC QTY 'B'				
9GD 3439-01-067-9299	TORCH OUTFIT SOLDERING AND HEATING PROPANE/MAPP W/HOSE,REGULATOR,HANDLE AND 2-TIPS			1	EA	6.00	.35	69.03	69.03
9GD 3439-01-068-2003	TORCH AND HANDLE, HEATING, FOR USE W/ALL LP GASES INCLUDING MAPP GAS. USE W/NSN 3439-01-067-9299 FOR LARGE HEATING AND SOLDERING JOBS			1	EA	5.00	.25	152.82	152.82
9GD 3439-01-102-8629	SHEILD,HEAT AMPLIFIER,FITS SOLDERING TORCH TIP T-4 CONTAINED IN TORCH KIT NSN 3439-01-067-9299			1	EA	.25	.05	7.69	7.69
9ZD 4020-00-587-0994	CORD NYLON TWISTED 350FT			1	EA	.50	.20	1.94	1.94
9CD 4930-00-554-6778	OILER HAND PUMP 8 OZ			1	EA	5.00	.20	2.38	2.38
9QG 5110-00-186-4215	REAMER HAND 1/8 TO 2N FLUTED			1	EA	7.00	.16	80.14	80.14
9QG 5110-00-186-7107	CHISEL COLD 1/2			2	EA	.68	.01	.73	1.46
9QG 5110-00-221-8132	CHISEL COLD 5/8			2	EA	.68	.01	.82	1.64
9QG 5110-00-234-6539	FILE HAND BAST FLAT 12N			2	EA	2.18	.04	2.17	4.34
9QG 5110-00-236-3273	CHISEL,COLD 7/8			2	EA	1.90	.02	1.46	2.92
9QG 5110-00-241-9153	FILE AMPAT HLFRD BAST 10			2	EA	1.00	.02	3.09	6.18
9QG 5110-00-277-4590	BLADE HACKSAW 18T 12LG (10 PER BD)			1	BD	.50	.01	3.30	3.30
9QG 5110-00-288-6521	CUTTER TUBE 3/8-2 5/8			1	EA	1.00	.15	17.54	17.54
9QG 5110-00-293-0090	SAWS NEST KEY-COMPS-NAIL			1	SE	2.00	.00	5.42	5.42

80001

	NSN	DESCRIPTION	DRAWING	ZONE	QTY	UI	WEIGHT	CUBE	ESTIMATED UNIT-$-VAL	ESTIMATED TOTAL-$-VAL
9QG	5110-00-293-0460	CUTTER,PIPE,MANUAL,1/8-2N,ONE CUTTER WHEEL AND TWO ROLLERS			2	EA	15.00	.21	36.82	73.64
9QG	5110-00-595-8325	HANDLE FILE ADJ JAWS			2	EA	.50	.02	1.57	3.14
9QG	5110-00-837-0990	WHEEL CUTTING F/PIPE CTR			6	EA	.60	.01	1.68	10.08
9QJ	5110-01-040-8943	FRAME HACKSAW ADJ 10-12			1	EA	1.40	.04	7.85	7.85
9QJ	5110-01-166-6512	CUTTER PIPE MANUAL 3/4-2N, 4-CUTTING WHEELS			1	EA	7.50	.21	67.25	67.25
9QG	5120-00-148-7917	WRENCH SET COMBINATION 5/16 THRU 1N 12PT BOX			1	SE	5.00	.05	23.28	23.28
9QL	5120-00-191-0229	WRENCH SPUD CLOSET EXTERNAL 1 1/4-1 1/2-2N			1	EA	1.00	.01	1.75	1.75
9QG	5120-00-197-9490	PUNCH CENTER 3/8PT X 5/8 X 6N			2	EA	.50	.00	1.30	2.60
9QG	5120-00-203-4656	HAMMER HAND ENG 2 1/2 LB			1	EA	3.00	.06	4.71	4.71
9QG	5120-00-203-4832	WRENCH BASIN 14			1	EA	1.75	.05	11.37	11.37
9QG	5120-00-223-7397	PLIERS SLIP JNT REG 8N			2	EA	1.24	.01	2.44	4.88
9QG	5120-00-237-4969	HANDLE SPEED 3/8 DR			1	EA	2.20	.05	3.10	3.10
9QG	5120-00-242-3249	WRENCH PIPE-STRAP 1/8-2N PIPE SIZE 12N LONG			1	EA	2.00	.03	7.36	7.36
9QG	5120-00-247-0748	SOCKET SET 3/8DR 1/4 THRU 1N 6PT DEEP W/O HANDLES			1	EA	3.00	.25	75.81	75.81
9QG	5120-00-264-3795	WRENCH OE ADJ 6N			2	EA	1.00	.02	3.14	6.28
9QG	5120-00-264-3796	WRENCH OE ADJ 12N			1	EA	2.00	.04	5.96	5.96
9QG	5120-00-277-1461	WRENCH PIPE 18			2	EA	12.44	.12	11.48	22.96
9QG	5120-00-277-1462	WRENCH PIPE 24			2	EA	16.88	.34	20.14	40.28
9QG	5120-00-277-1483	WRENCH PIPE 6N			2	EA	1.00	.02	5.58	11.16
9QG	5120-00-277-1484	WRENCH PIPE STRAIGHT 8N			2	EA	2.00	.08	5.74	11.48
9QG	5120-00-277-1485	WRENCH PIPE 10N			2	EA	3.00	.06	7.04	14.08
9QG	5120-00-277-1486	WRENCH PIPE 14N			2	EA	6.00	.12	8.66	17.32
9QG	5120-00-277-4244	PLIERS VISE GRIP 8.5N			2	EA	2.30	.06	3.47	6.94

NAVAL MOBILE CONSTRUCTION BATTALION

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80001		DRAWING	ZONE	QTY	UI	WEIGHT	CUBE	ESTIMATED UNIT-$-VAL	ESTIMATED TOTAL-$-VAL
9QG 5120-00-277-9076	WRENCH SPANNER,HOOK TYPE,WORKING DIA 2 THRU 4 3/4N			2	EA	2.00	.02	5.25	10.50
9QG 5120-00-277-9086	WRENCH MONKEY NON-MAG/SPARK 1 3/16 MAX CAP			1	EA	1.50	.01	36.28	36.28
9QG 5120-00-278-0351	PLIERS SLIP JOINT MULTI 8			2	EA	1.26	.01	4.55	9.10
9QG 5120-00-278-1276	SCREWDRIVER FLAT TIP 3/8X12N			2	EA	1.62	.05	1.41	2.82
9QG 5120-00-288-6468	WRENCH SPANNER,HOOK TYPE,WORKING DIA 3/4 THRU 2N			2	EA	.60	.01	3.63	7.26
9QG 5120-00-293-0478	CALKING TOOL HAND CURVED NOSE 8N			2	EA	2.00	.02	2.98	5.96
9QG 5120-00-294-4605	KNIFE PUTTY 1 1/4N			1	EA	.20	.00	1.14	1.14
9QG 5120-00-322-6231	SOCKET SET 3/8DR 3/8 THRU13/16 12PT REG KIT ALSO INCLUDES 1/2 THRU 13/16 DEEP W/RATCHET SPEED HANDLE 2 EXTENSION 6N AND 12N			1	SE	2.00	.50	33.57	33.57
9QG 5120-00-449-8083	WRENCH DE ADJ 10N			2	EA	2.26	.04	4.55	9.10
9QG 5120-00-511-1432	WRENCH SPUD ADJ INTERNAL			1	EA	1.75	.05	9.48	9.48
9QG 5120-00-781-0819	PLIERS SLIP JOINT 12N			1	EA	2.00	.00	6.28	6.28
9QG 5120-00-781-0820	PLIERS SLIPJOINT 16			1	EA	3.00	.00	9.96	9.96
9QG 5120-00-905-6729	SCREWDRIVER FLAT TIP 3/8X8N INSL			2	EA	2.76	.05	2.38	4.76
9QG 5120-00-935-4641	WRENCH SET HEX-HEAD "L" SHAPE 20PCS .028 THRU 3/4N			1	SE	4.00	.08	8.66	8.66
9QG 5120-00-997-2857	SCREWDRIVER REVERSIBLE BLADE NO.2 PHILLIPS X'1/4N FLAT TIP			2	EA	2.00	.00	3.03	6.06
9QG 5120-01-021-5730	PLIERS,LINEMAN,9N,HIGH-LEVERAGE/HIGH DIELECTRIC			1	EA	1.00	.01	9.10	9.10
9QJ 5120-01-051-5841	PLIERS IRON WORKERS HIGH LEVERAGE 9-9/32N			1	EA	1.00	.01	9.00	9.00
9QG 5120-01-070-4540	HAMMER BALL PEEN MCH 24 OZ DEAD BLOW UNICAST HNDL			2	EA	5.40	.08	25.99	51.98
9QG 5120-01-070-4542	HAMMER BALLPEEN MCH 16 OZ DEAD BLOW UNICAST HNDL			2	EA	4.00	.02	16.68	33.36
9QJ 5120-01-075-9327	HAMMER CARP 16 OZ CLAW CURVED SOLID STEEL			1	EA	2.00	.01	10.32	10.32
9QJ 5120-01-089-1237	HAMMER BALLPEEN MCH 12 OZ DEAD BLOW			2	EA	3.50	.04	13.94	27.88
9QL 5120-01-140-9244	WRENCH OFFSET HEX 1 1/8N - 2 5/8N CAPACITY SMOOTH			1	EA	2.00	.03	13.00	13.00

NAVAL MOBILE CONSTRUCTION BATTALION

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80001		DRAWING . ZONE	QTY	UI	WEIGHT	CUBE	ESTIMATED UNIT-$-VAL	ESTIMATED TOTAL-$-VAL
	5120-01-140-9244	JAW F/PLATED FINISH NUTS						
9QJ	5120-01-184-7985	WRENCH SET ADJUSTABLE PIN SPANNER 3/4-2N 1-1/4-3N 2-4 3/4 4-1/2-6-1/4 IN BAG SEE NSN IN SKO	1	SE	1.50	.01	82.51	82.51
9QJ	5120-01-204-9844	VISE,PORTABLE,TRISTAND,CHAIN, 1/8 TO 4N MINIMUM CAPACITY	1	EA	48.00	2.10	194.94	194.94
9QG	5136-00-081-1739	THREADER,PIPE,HAND STOCK AND DIE,1/8 THRU 2N DIE HEAD SET.SEE SKO FOR COMPLETE DESCRIPTION	1	SE	50.00	.30	292.41	292.41
9QG	5136-00-555-8912	THREADER,PIPE,HAND,ADJUSTABLE SEGMENTAL DIE,1 TO 2 NPT	1	EA	10.00	.20	232.85	232.85
9QG	5140-00-369-4927	CHEST SHT MTL WKR STL	1	EA	15.00	1.00	44.40	44.40
9QG	5180-00-596-1038	CUTTER AND FLARING TOOL,TUBING 1/8 THRU 1-1/8N CUTTER,SINGLE FLARE 1/8-3/4N,DOUBLE FLARE 3/16-1/2 N,W/SWAGING ADAPTER 3/16-3/4N	1	KI	5.00	.10	42.24	42.24
9QG	5210-00-223-9606	LEVEL LINE 3N	1	EA	.04	.00	.76	.76
9QG	5210-00-224-8794	PLUMB BOB SURV 16 OZ	1	EA	1.00	.02	8.01	8.01
9QG	5210-00-293-3511	RULE WOOD FOLDING H-DTY 72N	1	EA	.26	.01	2.71	2.71
9QG	5210-00-516-3356	LEVEL AND PLUMB 9N	1	EA	.45	.01	3.14	3.14
9QG	5210-00-545-5615	TAPE MEASURE FLEXIBLE 3M/10FT (METRIC/ENGLISH)	1	EA	.25	.00	2.00	2.00
9QG	5210-00-926-5430	LEVEL AND PLUMB ALUMINUM 28N LONG	1	EA	2.00	.05	10.61	10.61
9QJ	5210-01-187-6625	TAPE MEASURE STEEL 50FT POWERWINDER 3-POSITION CONTROL BUTTON FSCM 78525 P/N 34-150	2	EA	2.00	.02	14.73	29.46
9QG	8030-00-209-8005	ANTISEIZE CMPD PPJT GP 1LB F/WTR 350 DEG ST	6	CN	6.00	.12	1.30	7.80
9QG	8030-00-889-3535	TAPE ANTISEIZING 1/2X260	2	EA	.40	.01	.32	.64
		ASSEMBLY 80001 TOTAL FOR QTY	1		314.75	8.32		2060.13
		ASSEMBLY TOTAL FOR 'A' X 'B' QTY	5		1,574	42	2,060.13	10,300.65

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