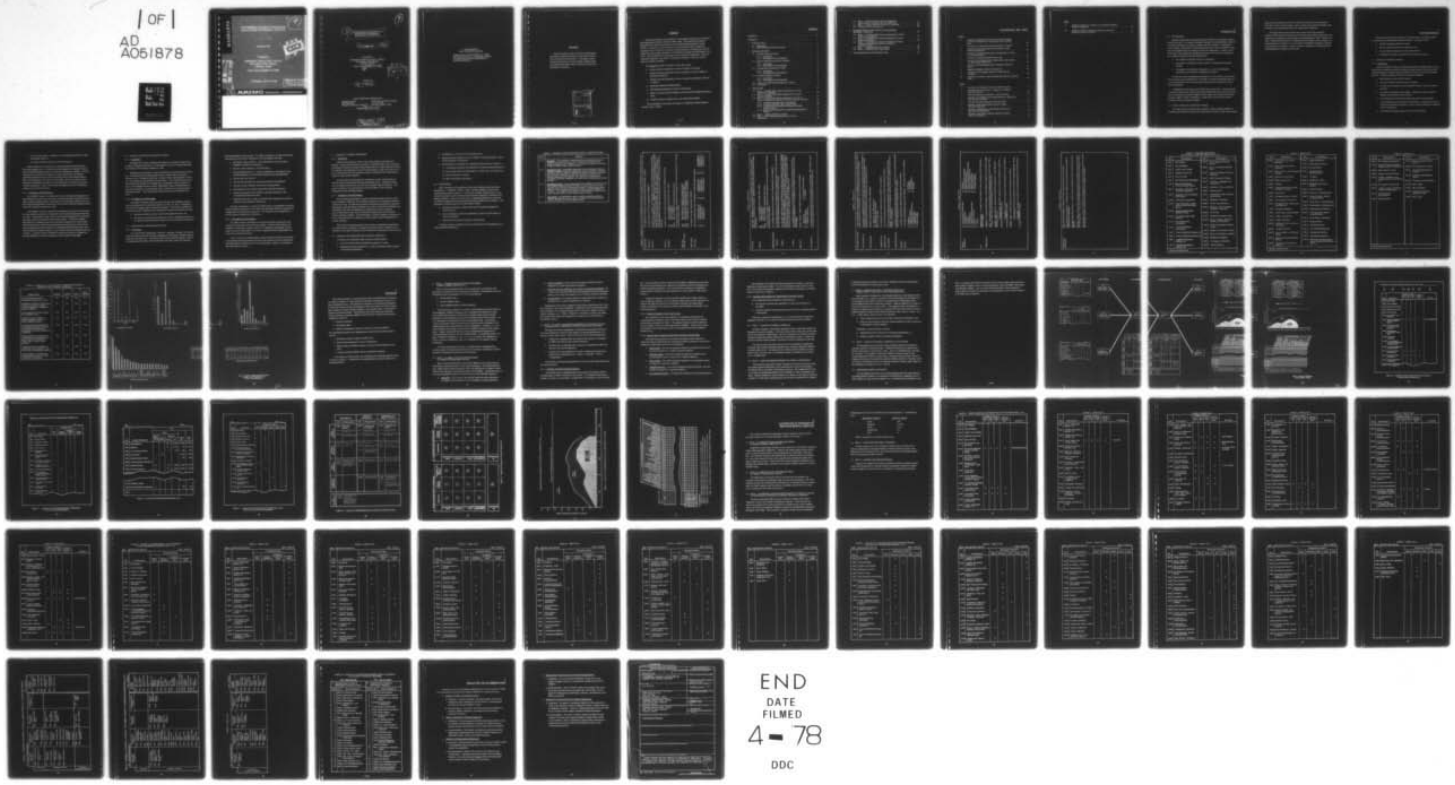
AD-A051 878 ARINC RESEARCH CORP ANNAPOLIS MD F/G 13/10
A RECOMMENDED PROCEDURE FOR MEASURING AND ASSESSING SHIP MATERI--ETC(U)
NOV 74 N J SCARLETT N00604-73-C-0450
UNCLASSIFIED 1613-01-1-1335 NL

1 OF 1
AD
A051878



END
DATE
FILMED
4-78
DDC

A RECOMMENDED PROCEDURE FOR MEASURING AND ASSESSING SHIP MATERIAL CONDITION

November 1974

Prepared for

COMMANDER SERVICE FORCE, PACIFIC
Pearl Harbor Naval Shipyard
Honolulu, Hawaii

Under Contract N00604-73-C-0450

Publication 1613-01-1-1335

ARINC RESEARCH CORPORATION

(9)

(6) A RECOMMENDED PROCEDURE FOR MEASURING AND ASSESSING SHIP MATERIAL CONDITION,

(11) November 1974 (12) 76p.

Prepared for

COMMANDER SERVICE FORCE, PACIFIC
Pearl Harbor Naval Shipyard
Honolulu, Hawaii

Under Contract (15) N00604-73-C-0450

Prepared by

(10) N. J. Scarlett

ARINC RESEARCH CORPORATION

HEADQUARTERS
2551 Riva Road
Annapolis, Maryland 21401

HONOLULU SUPPORT OFFICE
P.O. Box 3290
Honolulu, Hawaii 96801

(14) Publication 1613-01-1-1335

Prepared under Contract N00604-73-C-0450, which grants to the U.S. Government a license to use any material in this publication for government purposes.

ABSTRACT

Present methods and data sources for measuring and assessing the material condition of Navy ships are examined and discussed in this report. To develop a recommended best approach, the most suitable existing method was identified and studies made to develop procedures for enhancing its usefulness.

SUMMARY

This report describes and illustrates a recommended procedure for measuring and assessing the material condition of Navy ships. The procedure is based on application of the data base provided by the Current Ships Maintenance Project (CSMP). The objective of the procedure is to provide maintenance management personnel with a tool that will be useful in gaining visibility concerning the material condition of ship systems/equipment, as defined by the Equipment Identification Code (EIC). Material condition is expressed in terms of mission essentiality, impact on operational capability, and extent of maintenance manpower required to restore items to a baseline condition.

The suggested procedure consists of seven basic steps:

a. Classify systems/equipments in terms of mission essentiality.

b. Classify systems/equipments material condition in terms of impact on operational capability.

c. Classify systems/equipments in terms of extent of maintenance required to restore.

d. Summarize material condition status.

e. Rank systems/equipments on basis of importance.

f. Monitor material condition changes at various points throughout operating cycle.

g. Compare material condition with a pre-established standard.

The illustrations in this report are based on a sampling of ships within the Service Force, Pacific.

CONTENTS

ILLUSTRATIONS AND TABLES

Figure

Table

Table

1
INTRODUCTION

1.1 BACKGROUND

Effective maintenance management requires visibility concerning the material condition of a ship. For example, decisions relating to decommissioning of ships are to a large extent based on material condition; and the formulation of maintenance budget requests and allocation of fixed maintenance funds require quantitative knowledge of the material state of shipboard systems and equipments. In short, most of the decisions that maintenance management personnel of all levels are required to make depend on factual information pertaining to:

a. The condition of specific systems or equipments

b. The relative essentiality of these systems or equipments to the ship's mission

c. The quantity of maintenance resources (i.e., labor and materials) required to restore them to a satisfactory condition.

Of interest to those seeking this information are 1) the source or sources that will provide the most comprehensive, up-to-date, and readily retrievable data; and 2) how to document the data in a manner providing maximum visibility to maintenance management.

Investigation of these factors formed the basis of this study. ARINC Research Corporation was tasked to examine the present methods and data sources for measuring and assessing the material condition of Navy ships; and to determine how these practices might be refined, integrated, or augmented to provide a tool useful in managing a ship's maintenance program.

1.2 STUDY APPROACH AND REPORT FORMAT

The initial step in this study was to carefully examine existing methods for quantifying ship material condition and to determine the extent to which these methods

satisfy the basic objectives of material condition measurement and assessment. From this review, the most suitable baseline method was selected and studies made to develop a recommended procedure for enhancing its usefulness.

The format of this report follows the sequence of the study approach. Section 2 briefly describes existing methods for material condition measurement and assessment, and points out the advantages and disadvantages of each. Section 3 outlines a recommended procedure for applying the most suitable of these methods as a measurement/assessment tool. The procedure is illustrated in Section 4, utilizing data on Service Force Ships. Section 5 presents a synopsis of the conclusions and recommendations resulting from the study.

2
EXISTING METHODS

This section discusses the advantages and disadvantages of existing methods for measuring and assessing ship material condition. Discussed are the:

a. Casualty Reporting (CASREPT) System

b. Board of Inspection and Survey (INSURV) System

c. Current Ship's Maintenance Project (CSMP) System

d. COMSERVPAC Regular Overhaul (ROH) Planning Procedures

2.1 CASUALTY REPORTING SYSTEM

2.1.1 Description

Under the CASREPT system, individual ships submit message reports to advise operational commanders and other interested activities whenever mission-essential equipment/material condition affects the ability of the ship to perform its intended mission. CASREPTs basically contain the following information:

a. Reporting ship's name and hull number.

b. Fleet and TYCOM to which the ship is assigned.

c. The EIC and nomenclature of the equipment/system in which the casualty occurred.

d. A narrative description of the casualty, indicating the cause, extent of damage, and corrective action required.

e. The expected time by which corrective action will be accomplished.

f. A coded indication of the severity of the casualty, in relation to the ability of the ship to perform its mission. (Table 1 lists and defines the applicable severity categories.)

g. Parts data for materials required to correct the casualty.

h. The APL/CID number, if applicable, for the equipment/system in which the casualty occurred.

i. The repair echelon required to correct the casualty.

Initial CASREPTs are followed up by Periodic Situation Reports whenever information changes occur. Casualty Correction Reports are submitted to advise when the equipment/material has been restored to satisfactory condition. Casualty information, both current and historical, is summarized in the Consolidated CASREPT Reporting System provided periodically by the Fleet Material Support Office, Mechanicsburg. The report is in two parts: Part I is a summary of all CASREPTs outstanding at the time of report preparation, and Part II summarizes historical information. Table 2 herein lists and explains the types of information contained in the summary reports.

2.1.2 Advantages and Disadvantages

The CASREPT system is a significant tool in the planning and management of ship maintenance relative to the correction of mission essential equipment/systems. Hence, while providing visibility concerning major maintenance problems, this system's design and application is such that it covers only a small but important fraction of the total maintenance burden for a ship.

The CASREPT system is considered to represent a valid source of information for determining the criticality or essentiality of the systems/equipments that make up a ship. In illustration, Table 3 lists the total systems/equipments for ATF/ARS type ships, based on the first two EIC indenture levels. A review of CASREPT summaries for a sampling of three ARS type ships (covering a four-year calendar period from 1970-73) revealed that approximately one-third (31 out of 98) of these systems/equipments had been reported as casualties that affected the ability of the ship to perform its intended mission. These casualty items are denoted by asterisks in Table 3. A similar review of CASREPT summaries can serve to establish the mission essentiality of systems/equipments on other types of Navy ships.

2.2 BOARD OF INSPECTION AND SURVEY (INSURV)

2.2.1 Description

All ships of the Fleet are subjected periodically to an extensive inspection by the Board of Inspection and Survey. Such inspections provide a relatively thorough determination of the material condition of a ship.

Deficiencies are itemized in a report submitted at the conclusion of the inspection. The deficiencies are organized into areas of departmental or divisional cognizance (e.g., navigation, operations, weapons, deck, main propulsion, electrical, and auxiliaries) and classified as to importance. Type I deficiencies are those which would cause the ship to be unseaworthy, substantially reduce its ability to carry out its assigned mission or tasks, substantially reduce the effectiveness of personnel or material, or cause serious injury to personnel or serious damage to important material. Type II deficiencies include all items not considered to be Type I.

2.2.2 Advantages and Disadvantages

The INSURV inspection system provides a thorough and significant measurement and assessment of the material condition of a ship. As such, it constitutes a vital tool for managing a ship's maintenance program. The principal limitations of the system from the standpoint of total maintenance management objectives are that:

a. Inspections normally occur at relatively infrequent intervals, and

b. The system is not inherently designed to provide a quantitative indication of the extent of maintenance action required in the correction of deficiencies.

2.3 CURRENT SHIP'S MAINTENANCE PROJECT

2.3.1 Description

The Current Ship's Maintenance Project is a reporting, storage, and retrieval program designed to provide visibility regarding all maintenance (except preventive) required at any given time. The system, which is part of the 3M program, utilizes the Maintenance Data Form (OPNAV 4790/2K) as the basic vehicle for recording

deferred maintenance requirements. The CSMP is designed to provide the following information on each deferred maintenance action pertaining to the ship:

a. Job control number, which includes identification of the work center assigned to manage the maintenance

b. EIC and, where applicable, APL/CID number

c. The operational status (i.e. whether nonoperative or operative but with reduced capability) of the equipment/material requiring maintenance

d. Date the item was reported

e. The priority with which the maintenance should be accomplished

f. The type of ship availability required for accomplishment

g. Nomenclature for the equipment/material requiring maintenance

h. Narrative description of the condition requiring maintenance, and recommended maintenance action

i. Estimated ship's force, tender, and depot labor (expressed in man-days) required to accomplish the maintenance.

The above information, as reported by ship's force, is summarized in periodic (usually monthly) printouts for use by ship's force and other activities concerned with management of the maintenance programs. The summaries can be organized in a variety of ways to facilitate their utilization.

2.3.2 Advantages and Disadvantages

The CSMP provides essentially all of the data elements required to provide visibility in measuring a ship's material condition. Inherent in the system is the capability to summarize, compute, analyze, or organize the maintenance requirements of a ship in consideration of severity of equipment/material degradation and extent of the maintenance burden.

From a review of a sampling CSMP summary reports for Service Force ships, it would appear that the principal limitations of the system as a tool for measuring/assessing material condition relate to the completeness, accuracy, or timeliness with which data are entered.

2.4 OVERHAUL PLANNING PROCEDURE

2.4.1 Description

Under current practices, Service Force ships undergo systematic ROH planning. The procedure consists of a number of specified steps, some of which are specifically directed at the measurement/assessment of the ship's material condition. For example, the preparation of a work request package by ship's force and the conduct of preoverhaul tests and inspections provide a significant base of information relative to ship material condition.

Also included in the planning is the formulation of labor requirements and material costs associated with individual maintenance items. Estimates of these costs for shipyard work items are made by the assigned industrial activity. Estimates for ship's force are formulated as part of the Ship's Force Overhaul Management System (SFOMS) program.

2.4.2 Advantages and Disadvantages

The ROH planning procedure currently being implemented for Service Force ships essentially contains all of the elements necessary for measuring the material condition of a ship. The data base created by the procedure provides the means for diagnosing or analyzing material condition on the basis of a structured definition and description of the ship, and quantifies the maintenance resources required. Figure 1 illustrates various ways in which ROH planning data can be utilized to measure material condition. In the illustrations, material condition is measured in terms of the estimated cost required to restore specific systems/equipments to a baseline condition.

While the ROH planning procedure does provide a comprehensive approach to measuring material condition, its principal constraint is that it is limited to consideration of one specific segment of time within the total operational cycle of a ship.

2.5 CRITERIA FOR MEASURING SHIP MATERIAL CONDITION

A procedure for assessing a ship's material condition should:

a. Cover the total corrective maintenance program for a ship

b. Quantify the extent of resources (i.e., labor and material costs) required to accomplish maintenance

c. Be applicable at any point in the operational cycle

d. Express material condition in terms relatable to mission readiness, safety, or other measures of criticality

e. Permit analysis or diagnosis of maintenance problem areas in relation to:

1) A structured description and definition of the ship's systems/equipments

2) The required echelon of maintenance (i.e., depot, IMA, or ship's force)

3) Type of availability required

4) Ship's maintenance organization.

2.6 CONCLUSIONS

Table 4 summarizes the capabilities of the four existing systems previously discussed (i.e., CASREPT, INSURV, CSMP, and ROH planning) in terms of the characteristics listed in Section 2.5. In general, no single existing system is considered to provide all of the characteristics considered important in measuring ship material condition. However, at least as far as potential application is concerned, the CSMP is regarded as the most suitable data base available for this purpose. This conclusion is primarily based on the facts that the CSMP:

a. Provides a continuous, dynamic data base at all points throughout the ship's life cycle

b. Can, as designed, quantify the maintenance required (at least insofar as labor is concerned)

c. Embraces all corrective maintenance requirements.

For these reasons, the CSMP has been used as the basis in developing the procedure described in Section 3.

TABLE 1. SEVERITY-CODE DEFINITIONS USED IN CASREPT SYSTEM

Code	Definition
C-4	Not Ready – The condition of equipment/material precludes the unit's capability to perform in two or more of its primary mission areas. Backup equipment is not available; or, using its own resources, the unit is unable to effect repairs within 96 hours.
C-3	Marginally Ready – Substantial degradation in the condition of mission essential equipment/material significantly reduces its ability to perform effectively and/or to conduct sustained operations, but does not result in the total loss of capability in more than one primary mission area. Backup equipment is not available, but using its own resources or immediately available assistance, the unit is able to effect repairs within 96 hours.
C-2	Substantially Ready – Minor degradation in the condition of mission essential equipment/material affects its ability to perform in one or more mission areas, but does not appreciably reduce its effectiveness and/or ability to conduct sustained operations because 1) backup equipment is available, or 2) using its own resources or immediately available assistance, the unit is able to effect repairs within 24 hours.
C-1	Fully Ready – No degradations exist in mission essential equipment/material condition; the unit is capable of effectively performing all its primary missions for the prescribed periods.

TABLE 2. DESCRIPTION OF DATA ELEMENTS CONTAINED IN CASREPT SUMMARY REPORTS (Sheet 1 of 5)

SHIP TYPE	The applicable ship type as prescribed by SECNAVINST 5030.1 (series).
HULL NR	The hull number of the ship reporting the CASREPT.
CAS FLT	Casualty Fleet – Casualty Fleet designations are made based upon location of the ship at the time the CASREPT occurs. Designators 6 and 7 are used for all ships in or in transit for the 6th and 7th Fleets as applicable. All other ships are given the designators 1 or 2 based upon location off the West or East Coast of CONUS respectively. The Casualty Fleet designator does not change but remains with the CASREPT for historical reference purposes.
CUR FLT	Current Fleet – The most current operational fleet assignment of the ship.
CASREPT	YR Year of CASREPT message Date Time Group MO Month of CASREPT DA Day of CASREPT TIME Hour of CASREPT message Date Time Group. For Naval Letter or Spdltr reports the first position of the hour field will be "S", followed by the letter serial number.
REP TYP (REPORT TYPE)	CAS Abbreviation for CASREPT (Casualty Report) SIT Abbreviation for SITREP (Situation Report) COR Abbreviation for CASCOR (Casualty Correction) CAN Abbreviation for CASCAN (Casualty Cancellation)
SHIP NAME	The name of the ship reporting the CASREPT.
TYP COM	This code identifies the Type Commander to which the ship is assigned.

11 – COMNAVAIRLANT	15 – COMSERVLANT	23 – COMPHIBPAC
12 – COMCRUDESLANT	16 – COMSUBLANT	24 – COMINEPAC
13 – COMPHIBLANT	21 – COMNAVAIRPAC	25 – COMSERVPAC
14 – COMINELANT	22 – COMCRUDESPAC	26 – COMSUBPAC

TABLE 2. (Sheet 2 of 5)

TYP DSK	Type Desk – Designates a branch within NAVSHIPS that has the maintenance responsibilities for a selected group of ships. Application of this code permits collective arrayal of casualties.
CASCOR	YR Year of CASCOR message Date Time Group MO Month of CASCOR DA Day of CASCOR TIME Hour of CASCOR message Date Time Group. For Naval Letter or Spdltr reports the first position of the hour field will be "S" followed by the letter serial number.
DOWNTIME HOURS	For casualties that have been corrected, the following hours are computed:
SUPPLY	For casualties which have been CASCORed this reflects the number of hours the equipment was down while awaiting parts as given in the CASCOR message.
MAINT	For casualties which have been CASCORed this reflects the number of hours the equipment was down due solely to maintenance. It is the resultant figure of subtracting the CASCOR message DTG from the CASREPT message DTG; obtaining a balance; then subtracting the hours awaiting parts given in the CASCOR message. The underlying assumption is that what time is not spent in awaiting parts is maintenance time.
TOTAL	For casualties which have been CASCORed this reflects the total number of hours the equipment was CASREPTed. If the CASREPT and CASCOR are the same day, the total will be ØØØØ.
REP ACT	Repair Activity – Repair echelon required to correct the casualty S – Ships Force R – Shipyard/Tender T – Technical Assistance O – Overhaul Repair Facility D – Drydock
APL/CID NR	The number associated with the item in relation to its application. This number is used as the item reference number in the production of allowance parts list.

TABLE 2. (Sheet 3 of 5)

NAVSHIPS NUMBER	A Navy identification number assigned by NAVSHIPS to the Operation/Maintenance manual, usually prepared by the manufacturer, for a given ships system and/or equipment.
JOB CONTRL NR	This number is assigned at the work center level on each ship under the Navy Maintenance and Material Management System. Four digit control numbers are assigned for each maintenance action, preceded by the four-digit work center identifier code.
MGR (Manager)	Identifies equipment/weapons system relationship AA – SMS ship, not SMS equipment AB – SMS ship, SMS equipment Blank if not SMS ship
CASREPT ETR	The estimated time of repair when the CASREPT was reported.
CURRENT ETR	The current estimated time of repair as obtained from Situation Reports.
EIC/NOMEN	The most current Equipment Identification Code available from the 3M EIC Coding System. Nomenclature of the equipment reported on the basic CASREPT taken from the CASREPT as submitted.
DEF/MAINT/OVHL	A narrative describing any deferred maintenance, recent overhaul or contract information which the reporting ship feels is applicable to the casualty.
EXTENT	A narrative describing the extent of damage caused by the casualty.
CAUSE	A narrative describing the cause of the casualty. Base cause codes are as follows: Ø – Unknown 1 – Material Failure 2 – Design Failure/Deficiency 3 – Personnel Error 4 – Battle Damage 5 – Storm Weather 6 – Collision 7 – Grounding 8 – Fire/Explosion 9 – Sabotage

TABLE 2. (Sheet 4 of 5)

CAUSE (Continued)	A – Normal Wear/Deterioration B – Cannibalization C – Corrosion D – Flooding E – Contamination F – Repair/Overhaul Inadequate G – Electrical Ground H – Lost J – Fouled	K – Moisture L – Parts Defective/Damaged M – Obsolete/Obsolescent N – Power Loss/Overload/Fluctuation P – Excessive Dynamic Load Q – Battery Dead/Weak R – Aircraft Jet Blast S – Personnel Shortage
SIT	Situation Report – A synopsis of each SITREP is given including the ETR (Estimated Time of Repair)	
PARIS DATA	FSN/PN – The Federal Stock Number or Part Number required to correct the casualty. COG – The cognizance symbol identifies the designated inventory control point, office or agency which exercises supply management of the FSN or PN. ALLOW – YES if all parts required to correct the casualty were on the applicable allowance parts list. – NO if any one of the parts required to correct the casualty were not on the applicable allowance parts list. – IF BLANK – No parts are required or parts information was not provided in the basic CASREPT message. ON/BD – YES if all parts required to correct the casualty were onboard. – NO if any one of the parts required to correct the casualty were not onboard. – IF BLANK – No parts are required or parts information was not provided in the basic CASREPT message.	

TABLE 2. (Sheet 5 of 5)

PARIS DATA (Continued)	REQ (Required Quantity) – Number of items required to correct the casualty. RQN (Requisitioned Quantity) – Indicates the quantity of the particular item for which a requisition was submitted. RQN NR (Requisition Number) – Number of the requisition by which required items were ordered. STATUS – Supply status of item requisitioned to correct the CASREPT where provided by the reporting ship. (Codes used in standard MILSTRIP requisition processing are used.) H/A (Holding Activity) – MILSTRAP routing identifier code for the supply activity to which the requisition required to correct the CASREPT was originally submitted.

TABLE 3. SYSTEMS/EQUIPMENTS
APPLICABLE TO ARS TYPE SHIPS (Sheet 1 of 3)

EIC	Nomenclature	EIC	Nomenclature
1100	Hull Fittings	4700	*Power Supply Conversion System
1300	Canvas/Rigging	8B00	Small Arms/Motor/Machine Guns
1400	Ladders and Gratings	8C00	Explosive Ordnance Disposal Equipment
1500	Bulkheads and Doors	A100	Shell Plating and Planking
1600	Deck Covering	A300	Framing, Longitudinal and Transverse
1700	Hull Insulation and Sheathing	A500	Platforms, Flats, and Decks
1800	*Storerooms/Stowage Lockers (Salvage Equip.)	A600	Superstructure
1900	Workshop, Laboratory, and Test Area Equipment	A700	Foundations, Main Propulsion and Auxiliary
1A00	Equipment and Furnishings, Utility Space	A800	Bulkheads, Structural
1B00	Commissary Equipment	A900	Trunks and Enclosures
1C00	Furn./Equipage, Living/ Office/Control/Machinery Spaces	AA00	Sponsons, Armor Castings, Forgings, Weldments
1D00	Furnishings/Equipage, Medical, Dental	AB00	Sea Chests
3100	*Generating Plant, Ships Service	AC00	Ballast and Buoyancy Units
3300	*Generating Plant, Emergency	AD00	Doors, Hatches, Manholes, Scuttles, and Closures
4100	Power Distribution Switchboard	AE00	Masts and Kingposts (Except Cargo)
4300	Power Distribution System, AC	C100	*Engines and Controls, Diesel
4400	Power Distribution System, DC	C300	*Gears and Clutches, Detached
4500	Lighting Distribution System, AC	C400	*Shafting, Mechanical
4600	Lighting Distribution System, DC	C500	Air Supply, Combustion
		C600	Exhaust System

*Mission-essential item.

TABLE 3. (Sheet 2 of 3)

EIC	Nomenclature	EIC	Nomenclature
C700	Fuel Oil Service System, Detached	N400	Degaussing System
C800	*Lube Oil Service System, Detached	P100	*Radar Surface Search
C900	*Water System, Circulating and Cooling	P600	*IFF Equipment
CB00	*Generator and Controls	Q100	Antenna System, Communications
CC00	*Motor and Controls	Q300	Teletypes
CD00	Cabling	Q700	Amplifiers, Audio
CE00	Centralized Controls, Main Propulsion Auxiliary	Q900	*Multicouplers-Tuners, Antenna
GB00	*Gun Mounts	QA00	Infrared System
L100	Navigation System, LORAN	QB00	*Receiver, Communications
LB00	Gyrocompass LC and XLC	QC00	Control Devices, Remote Communications
LF00	Navigation Aids, Optical and Miscellaneous	QD00	*Transceiver, Communications
LG00	Compass, Magnetic	QE00	*Transmitter, Communications
LH00	Instruments, Meteorological	QF00	*Cryptographic Equipment
LJ00	Lights, Navigational	QR00	Test Equipment, Special Communications
LK00	Lights, Signaling	R500	Sonar System, Navigation
M300	Amplified Voice Communication System	T100	*Heating System
M400	Telephone System	T300	*Ventilation System
M500	Alarm, Safety, and Warning System	T400	Air-Conditioning System
M600	Ships Orders and Indicating System	T500	Refrigeration System
M700	Recording and Projection System	T700	Plumbing Installations
		T800	*Firemain, Flushing, Sprinkling, Washdown and Saltwater Service

*Mission-essential item.

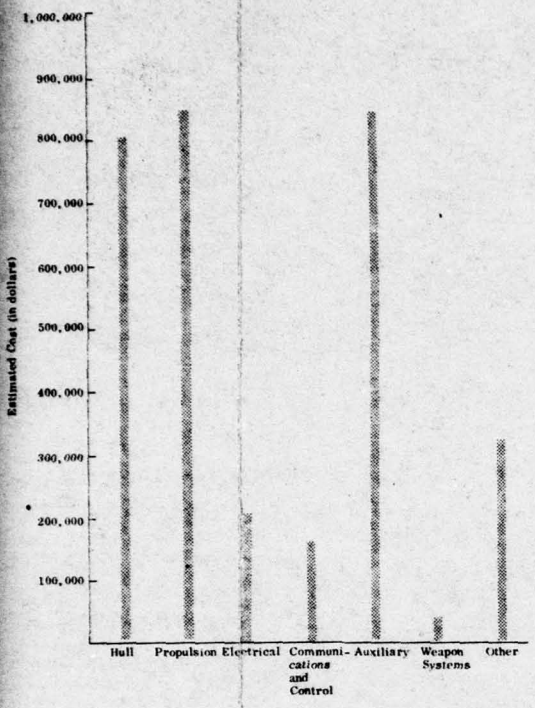
TABLE 3. (Sheet 3 of 3)

EIC	Nomenclature	EIC	Nomenclature
T900	*Fire Extinguishing Systems	TL00	*Steering and Ship Control System
TA00	Drain, Ballast, Trimming, Heeling, and Stbl Tank System	TM00	*Deck Machinery, General
TB00	Water System, Fresh	TS00	Cargo Handling Ship and Dockside
TC00	Scuppers and Deck Drains	TT00	Underway Replenishment System
TD00	Filling, Ventilation, and Transfer System, Fuel/Diesel Oil	W000	Electronic Test Equipment
TF00	*Air System, Compressed	Y300	*Boat, Utility
TH00	Exhaust, Supply, and Drains Auxiliary Steam System	YA00	*Boat, Inflatable
TJ00	Service System, Miscellaneous	YC00	*Handling and Stowage Equipment, Boat
TK00	*Distilling Plant	Y600	*Boat, Work

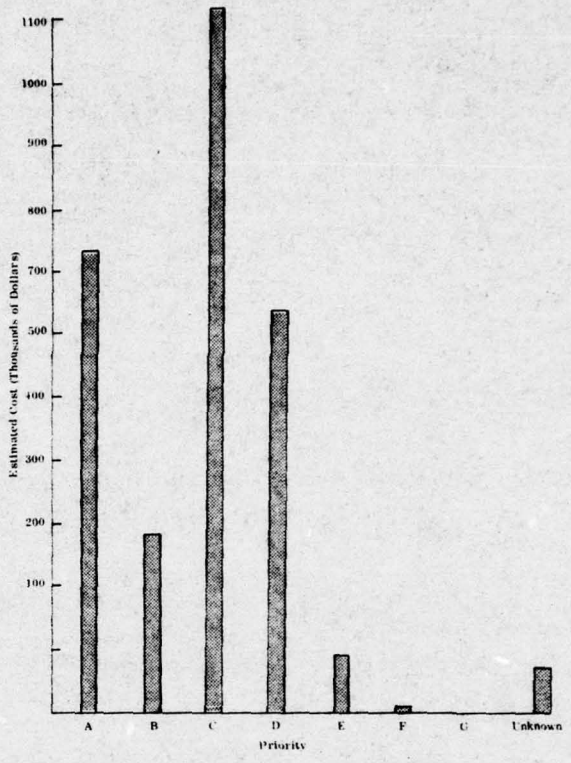
*Mission-essential item.

TABLE 4. SUMMARY OF CAPABILITIES OF EXISTING METHODS OF MEASURING SHIP MATERIAL CONDITION

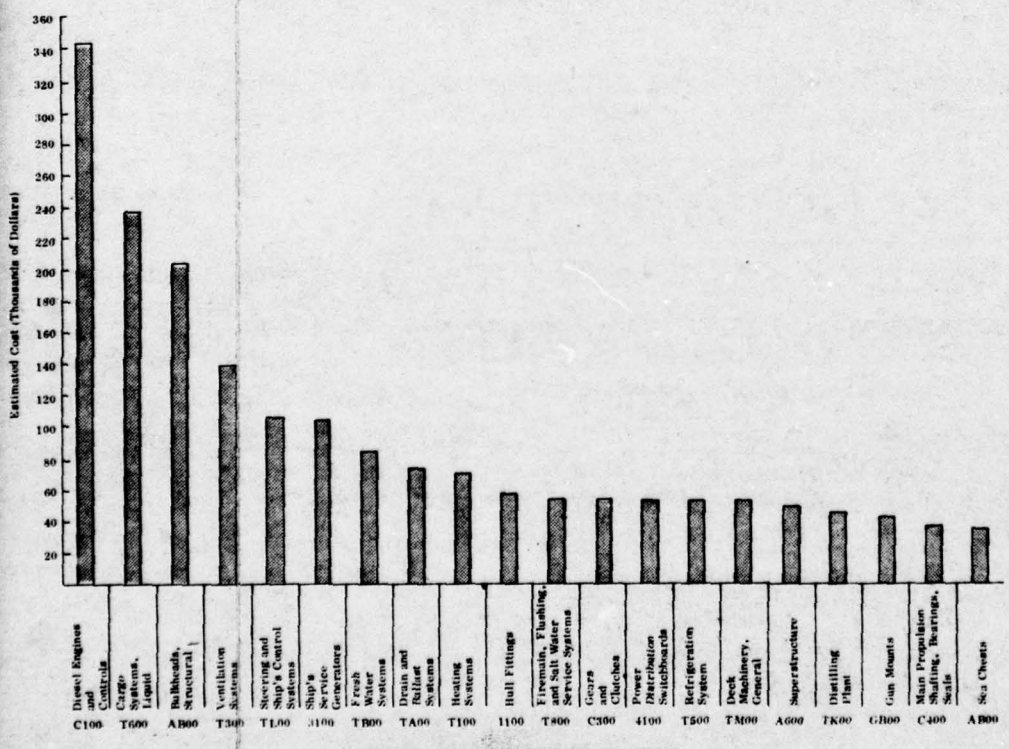
Characteristic	CASREPT	INSURV	CSMP	ROH Planning
Covers the total corrective maintenance program for a ship.	No	Yes	Yes	No
Quantifies the extent of maintenance resources required to restore systems/equipment to satisfactory material condition.	No	No	Yes	Yes
Can be applied at any time during the operational cycle.	Yes	No	Yes	No
Relates material condition to mission readiness, safety, or other criticality measure.	Yes	Yes	No	Yes
Permits analysis or diagnosis of maintenance problems in relation to a structured definition and description of the ship systems and equipments.	Yes	No	Yes	Yes
Permits analysis or diagnosis of maintenance requirements in relation to echelon of maintenance (depot, IMA, or ship's force) required.	Yes	No	Yes	Yes
Permits analysis or diagnosis of maintenance requirements in relation to type of availability required.	No	No	Yes	No
Permits analysis of maintenance requirements in relation to ship's maintenance organization.	Yes	No	Yes	Yes



DISTRIBUTED BY MAJOR SYSTEM



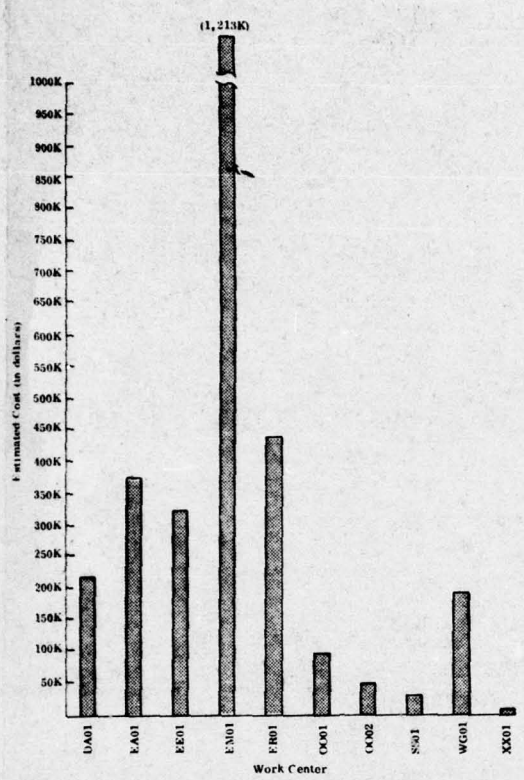
DISTRIBUTED BY PRIORITY



DISTRIBUTED BY SYSTEMS/EQUIPMENT

Accomplishing Activity	Est. Total Cost ($)	Pct. Total
Shipyard	1,966,373	67
Tender	37,083	1
Ship's Force	911,525	31
Total	2,914,981	100

ITY



DISTRIBUTED BY WORK CENTER

Accomplishing Activity	Est. Total Cost ($)	Pct. of Total Pkg.	Estimated Cost ($) for Work Assigned to Each Accomplishing Activity (By Priority)							
			A	B	C	D	E	F	G	Unknown
Shipyard	1,966,373	67.3	434,465	171,203	807,210	435,362	44,858	5,121		68,154
Tender	37,083	1.3			23,664	7,956	5,463			
Ship's Force	911,525	31.3	295,272	108,131	284,244	184,964	37,259	155		1,500
Total	2,914,981	100.0	729,737	279,334	1,115,118	628,282	87,580	5,276		69,654

DISTRIBUTED BY ACCOMPLISHING ACTIVITY

Figure 1. Examples of Methods for Measuring Material Condition in Terms of Maintenance Cost (Based on ROH Planning Data)

2

3
PROCEDURE

This section describes a recommended procedure and guidelines for measuring the material condition of a ship using the Current Ships Maintenance Project as the basic information source. The procedure is intended as a maintenance management tool that will provide visibility concerning the nature and extent of corrective maintenance required to restore material condition to an acceptable state. The procedure consists of seven basic steps. The first three steps (not necessarily sequential) involve reviewing or analyzing CASREPTs and the CSMP to classify ships systems/equipments in terms of:

1 – Mission essentiality

2 – Operational status

3 – Extent of maintenance required to restore to a baseline condition.

The remaining four steps involve organizing the results of the first three steps in order to:

4 – Summarize material condition in tabular form

5 – Rank systems/equipments in terms of significance

6 – Monitor material condition changes at various points throughout the life cycle

7 – Compare material condition with pre-established standards.

A flow diagram of these events, and a sampling of the accompanying data forms, are given in Figure 2. Procedures for accomplishing these steps are given in the following sections.

3.1 STEP 1 – CLASSIFY SHIPS EQUIPMENTS/SYSTEMS IN TERMS OF MISSION ESSENTIALITY

Step 1 involves identifying which systems/equipments of a particular ship/class/type are essential to the accomplishment of mission. Determination of mission essentiality can be accomplished in any of the following ways:

a. Review INSURV data

b. Review CASREPT data

c. Make judgments based on mission analysis.

Of the above three methods, the second is recommended as the most practical. In this approach, CASREPT summaries for a sampling of the class/type of ship under consideration would be reviewed and a tabulation made of those systems/equipments in which casualties have occurred during the period of observation. Figure 3 illustrates a recommended format for tabulating the data. The listing in column 2 of the table would be derived from the first two levels of indenture of the staging diagram for the ship class/type under consideration. Columns 3, 4, and 5 would be based on the results of review of the CASREPT summary for the sampled ships. Column 6 would identify those systems/equipments that experienced a mission-affecting casualty in any of the sampled ships. In compiling the table, only those CASREPTs classified as C-2, C-3, or C-4 severity (see definitions in Table 1) would be considered, since C-1 casualties do not degrade mission performance.

It is recommended that the review of CASREPT data be supplemented by mission analysis to identify any additional items that may be considered as mission essential even though not reported as such in the past.

3.2 STEP 2 – CLASSIFY EACH SYSTEM/EQUIPMENT IN TERMS OF OPERATIONAL STATUS

Step 2 would be performed by reviewing the CSMP at a given point in time to determine the operational status of each system/equipment. In accomplishing this step, CSMP entries would be grouped by EIC at the second level of indenture (which could be done manually or by automated printout of the CSMP). Operational status of each system/equipment would be assessed in terms of the following categories:

a. Inoperative – All or some of the material within the system/equipment (as defined by the second level of EIC indenture) is totally inoperative.

b. Reduced capability – All or some of the material within the system/equipment is of reduced operational capability.

c. Degraded material conditions, but no effect on operational capability – All or some of the material within the system/equipment requires maintenance action, but the state of the material does not affect operational capability.

d. No degradation – No material within the system/equipment is degraded to the point where corrective maintenance is required.

Classification into the above categories would follow consideration of all of the CSMP entries for each system/equipment. Judgement concerning operational status would be based on the descriptive narrative for the line items, together with the "status" indication (e.g., "OPER", "REDCAP", "NONOP") as listed in the CSMP. The results of this step would be tabulated or summarized in a format such as illustrated in Figure 4.

3.3 STEP 3 – CLASSIFY EACH SYSTEM/EQUIPMENT IN TERMS OF EXTENT OF MAINTENANCE REQUIRED TO RESTORE MATERIAL CONDITION

This step would involve quantifying or classifying the maintenance burden of each system/equipment relative to each category of accomplishing activity (i.e., shipyard, tender, ship's force). This could be done in any of the following ways:

a. Cumulate the estimated labor and material cost required to accomplish all CSMP line items for each system/equipment.

b. Cumulate only the estimated labor required to accomplish all CSMP line items for each system/equipment.

c. Classify each system/equipment in terms of maintenance burden using broad terms and guidelines (e.g., "Major", "Moderate", "Minor", "Insignificant").

The benefits and limitations associated with each of the above basic approaches are discussed below.

3.3.1 Cumulate Estimated Labor and Material

This method involves estimating labor requirements and material costs for accomplishing all CSMP line items for each system. The validity of these figures depends, of course, on the accuracy, completeness, and availability of the elemental

data. Labor estimates could be derived from the CSMP if sufficiently accurate data has been entered by ship's force. Material cost estimates could be formulated from standard estimating techniques. This would result in a summary of maintenance requirements for individual systems/equipments in a form similar to that shown in Figure 5.

It should be noted that, while this method would provide a highly useful indicator of material condition, it is also difficult to apply since the labor estimates contained in the CSMP are generally of questionable accuracy and completeness. Further, acquisition of the necessary material-cost information is presently a time-consuming process.

3.3.2 Cumulate Estimated Labor Requirements

As an alternative to the above approach, the necessary maintenance for restoring material condition could be determined simply on the basis of manpower requirements provided by the CSMP. This approach would not consider material cost as a factor of interest in measuring material condition. Hence, while simpler to accomplish, this measurement would be less accurate than the first approach (Section 3.3.1).

3.3.3 Classify System/Equipment Maintenance Burden in Broad Terms

The third basic approach to determining maintenance burden would be to classify the extent of that burden for restoring the material condition of each system/equipment, using broad terms such as the following:

a. Major burden – The system/equipment requires an estimated 100 man-days or more to restore it to a baseline material condition.

b. Moderate burden – The system/equipment requires an estimated 10 to 100 man-days of labor to restore it to a baseline condition.

c. Minor burden – The system/equipment requires 1 to 10 man-days of labor to restore it to a baseline condition.

d. Insignificant burden – The system/equipment requires less than 1 man-day of labor to restore it to a baseline condition.

e. No maintenance burden – No maintenance required on the system/equipment.

The advantage of this approach is that considerably less effort is required to establish the maintenance burden. The use of the approach would result in a summary of the extent of maintenance required for all systems/equipments, in a format similar to that shown in Figure 6.

3.3.4 Recommended Approach for Determining Maintenance Burden

It is recommended that a program be implemented to:

a. Increase the accuracy and completeness of labor estimates given in the CSMP.

b. Provide a material cost data base that can be used for estimating material requirements.

Until such a program is implemented, it is recommended that the approach suggested in Section 3.3.3 be used in measuring/assessing material condition.

3.4 STEP 4 – TABULATE MATERIAL CONDITION

In steps 1 through 3, each system/equipment would be individually assessed to determine its material condition. From the results of these steps, the overall condition for the ship can be summarized. One way of doing this is to tabulate the status of systems/equipments using a format such as illustrated in Figure 7, which indicates the specific condition category into which all systems/equipments would fall.

The purpose of the summary would be to provide maintenance management personnel with visibility concerning specific items requiring maintenance attention and those which do not. The summary would reflect material condition at a given point in time, but could serve as a continuous display if maintained on a periodic (e.g., monthly) basis.

3.5 STEP 5 – RANK SYSTEMS/EQUIPMENTS IN TERMS OF IMPORTANCE

The information generated in steps 1 through 3 can also be used as the means for ranking systems/equipments on the combined basis of mission essentiality, operational status, and extent of maintenance required. The ranking could be used as a means for establishing priority in the conducting of a ship's maintenance program. Systems/equipments could be ranked, for example, in the manner illustrated in Figure 8, which shows operational status as the prime consideration for ranking.

It should be noted that priorities could also be established with first consideration given to the extent of the maintenance burden.

3.6 STEP 6 – MONITOR MATERIAL CONDITION CHANGES AT VARIOUS POINTS THROUGHOUT SHIP OPERATING CYCLE

Step 6 consists of maintaining a chronological summary of ship material condition at periodic (e.g., monthly or quarterly) intervals throughout the operating cycle. This summary would provide visibility concerning trends in degradation and the overall effectiveness of the maintenance program. Material condition as a function of time can be monitored in a variety of ways. One suggested means is illustrated in Figure 9, in which material condition is measured in terms of the number of mission essential systems having material-condition problems rated "major", "minor", and "no". In this context, major problems are defined as:

a. Those requiring more than 10 man-days of corrective maintenance, and

b. Those for which material within the system/equipment is either inoperative or operating at reduced capability.

Conversely, "minor problems" are those:

a. Requiring less than 10 man-days of corrective maintenance, or

b. Having no negative impact on operational capability.

3.7 STEP 7 – ANALYZE MATERIAL CONDITION OF TYPE/CLASS

The preceding steps are directed toward providing visibility concerning the material condition of an individual ship. Additional visibility can be gained from a purview of all ships of a given class or type. Thus, by completing steps 1 through 6 for "all ships", it is possible to determine whether the material state of each system/equipment is unique to a given ship or common to the type/class. Figure 10 suggests one format for summarizing material condition status for a ship type, based on selective consideration of the more important material condition states (defined in the illustration as categories A, B, C, and D).

3.8 VARIATIONS IN BASIC PROCEDURE

In the preceding discussions, the recommended procedure for measuring and assessing material condition was illustrated with reference to a particular level of detail relative to a ship systems definition (i.e., the second level of indenture of the

EIC). It should be noted that the procedure could as well be applied with reference to other means of defining a ship's systems/equipments, such as the Ship's Work Breakdown Structure (SWBS). Also, it is noted that the procedure could be applied in greater detail, if desired, by application of the approach to a lower level of indenture in the ship systems definition.

EIC	Nomenclature	CASREPT History			Mission Essential Rem	Remarks
		Ship A	Ship B	Ship C		
1100	Hull Fittings					
1300	Canvas/Rigging					
1400	Ladders and Gratings					
1500	Bulkheads and Doors					
1600	Deck Covering					
1700	Hull Insulation and Sheathing					
1800	Storerooms/Stowage Lockers (Salvage Equip.)	X	X	X	•	Salvage Equipment

Ship: _____ Date: _____

EIC	Nomenclature	Operational Status			
		Inoperative	Reduced Capability	Degraded; No Mission Effect	No Degradation
1100	Hull Fittings			X	
1300	Canvas/Rigging			X	
1400	Ladders & Gratings			X	
1500	Bulkheads and Doors			X	
1600	Deck Covering			X	
1700	Hull Insulation and Sheathing			X	
1800	Storero...	X			

SHIP: _____ Date: _____

EIC	Nomenclature	Maintenance Required				
		Major	Moderate	Minor	Insig.	None
1100	Hull Fittings		X			
1300	Canvas/Rigging			X		
1400	Ladders and Gratings		X			
1500	Bulkheads and Doors		X			
1600	Deck Covering		X			
1700	Hull Insulation and Sheathing		X			
1800	Storerooms/Stowage Lockers (Salvage Equip.)		X			
1900	Wast... boratory and					

DATA COLLECTION

DATA SUMMARIZA

STEP 1
Classify systems/equipments in terms of mission essentiality.

STEP 2
Classify systems/equipments in terms of operational status.

STEP 3
Classify systems/equipments in terms of maintenance required.

STEP 4
Tabulate materiel condition.

	INOPERATIVE		REDUCED CAPABILITY	
	EIC	Nomenclature	EIC	Nomenclature
Major Maintenance	T800	Firemain System	TF00	Compressed Air Syste...
Moderate Maintenance				
Minor Maintenance				
Insignificant Maintenance				
No Maintenance				

DATA SUMMARIZATION

DATA ANALYSIS

STEP 5
Rank systems/ equipment in terms of importance.

STEP 4
Tabulate material condition.

STEP 6
Monitor material condition changes.

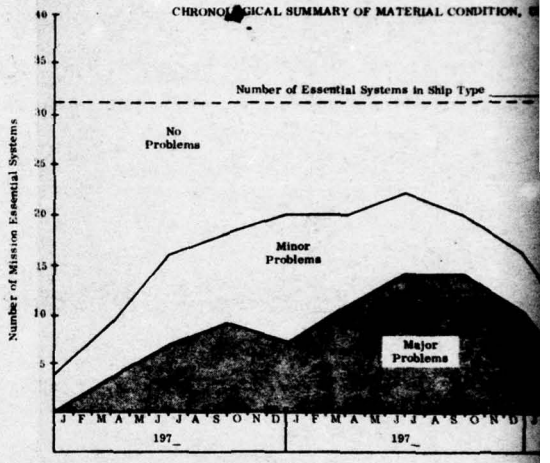
STEP 7
Compare material condition against baseline.

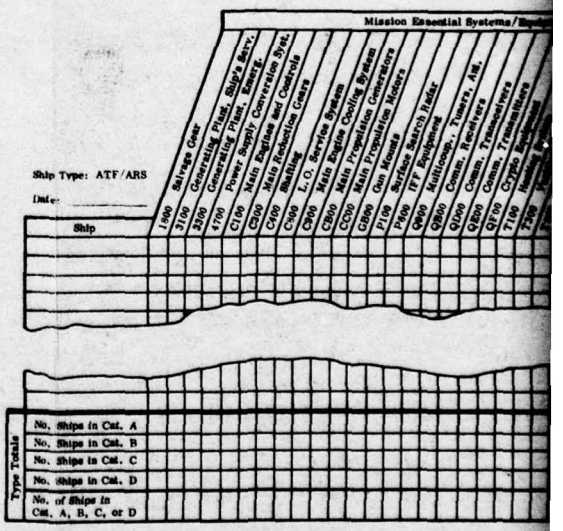
	INOPERATIVE		REDUCED CAPABILITY		DEGRADED; NO MISSION EFFECT	
	EIC	Nomenclature	EIC	Nomenclature	EIC	Nomenclature
Major Maintenance	T800	Firemain System	TF00	Compressed Air System	1500	Bulkhead and Doors
Moderate Maintenance						
Minor Maintenance						
Insignificant Maintenance						
No Maintenance						

Ship: _____ Date: _____

A. Ranking Based on Extent of Maintenance Required to Restore			B. Ranking Based on Performance Capa		
Rank	EIC	System/Equipment	Rank	EIC	Syst
1	T800	Firemain System	1	T800	Firemain
2	TF00	Compressed Air System	2	TF00	Compress
3	3100	Ship Service Generators	3	1800	Storeroom Gear)
4	C100	Main Engines	4	QD00	Comm. Transce
5	T100	Heating Syst. (Aux. Boiler)	5	P100	Surface S
6	T300	Ventilation System	6	3100	Ship Ser
7	TM00	Deck Machinery	7	C100	Main En
8	1800	Storeroom Eq. (Salvage Gear)	8	T100	Heating Boiler
9	QD00	Comm. Trans	9	T300	Ventilat

CHRONOLOGICAL SUMMARY OF MATERIAL CONDITION, S





Category Definitions:

Category A – System/equipment contains inoperative material; major corrective maintenance

Category B – System/equipment contains reduced capability material; major corrective maint

Category C – System/equipment contains inoperative material; moderate corrective maintena

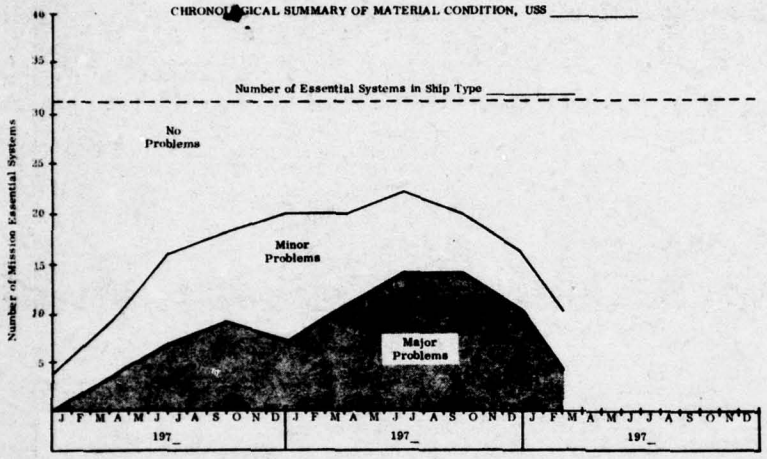
Category D – System/equipment contains reduced capability material; moderate corrective ma

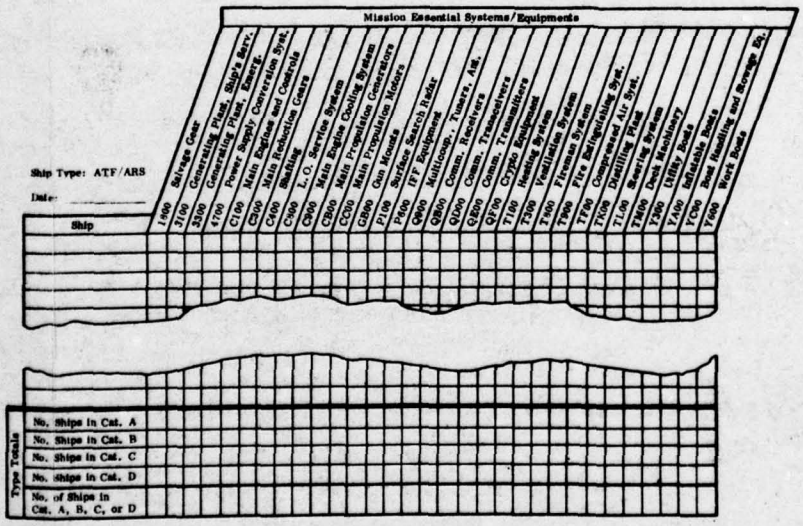
Figure
Ass

Ship: _____ Date: _____

A. Ranking Based on Extent of Maintenance Required to Restore			B. Ranking Based on Impact on Performance Capability		
Rank	EIC	System/Equipment	Rank	EIC	System/Equipment
1	T800	Firemain System	1	T800	Firemain System
	TF00	Compressed Air System		TF00	Compressed Air System
3	3100	Ship Service Generators	3	1800	Storeroom Eq. (Salvage Gear)
	C100	Main Engines		QD00	Communication Transceivers
	T100	Heating Syst. (Aux. Boiler)	5	P100	Surface Search Radar
	T300	Ventilation System	6	3100	Ship Service Generators
	TM00	Deck Machinery		C100	Main Engines
8	1800	Storeroom Eq. (Salvage Gear)		T100	Heating Syst. (Aux. Boiler)
	QD00	Comm. Trans		T3	

CHRONOLOGICAL SUMMARY OF MATERIAL CONDITION, USS _____





Category Definitions:

Category A — System/equipment contains inoperative material; major corrective maintenance required

Category B — System/equipment contains reduced capability material; major corrective maintenance required

Category C — System/equipment contains inoperative material; moderate corrective maintenance required

Category D — System/equipment contains reduced capability material; moderate corrective maintenance required

Figure 2. Procedure for Measuring/ Assessing Material Condition

Summary of Mission Essential Systems for Ship Type _____

① EIC	② Nomenclature	③ CASREPT History Ship A	④ Ship B	⑤ Ship C	⑥ Mission Essential Item	⑦ Remarks
1100	Hull Fittings					
1300	Canvas/Rigging					
1400	Ladders and Gratings					
1500	Bulkheads and Doors					
1600	Deck Covering					
1700	Hull Insulation and Sheathing					
1800	Storerooms/Stowage Lockers (Salvage Equip.)	X	X	X	•	Salvage Equipment
1900	Workshop, Laboratory and Test Area Equipment					
1A00	Equipment and Furnishings, Utility Space					
1B00	Commissary Equipment					
1C00	Furn./Equipage, Living/Office/Control/ Machinery Spaces					
1D00	Furnishings/Equipage, Medical, Dental					
3100	Generating Plant, Ships Service	X	X	X	•	
3300	Generating Plant, Emergency	X	X	X	•	
4100	Power Distribution Switchboard					
4300	Power Distribution AC					

Figure 3. Format for Determining Mission Essentiality of Ship Systems/Equipments

Summary of Operational Status of Ship Systems/Equipments

Ship: _____ Date: _____

EIC	Nomenclature	Operational Status			
		Inoperative	Reduced Capability	Degraded; No Mission Effect	No Degradation
1100	Hull Fittings			X	
1300	Canvas/Rigging			X	
1400	Ladders & Gratings			X	
1500	Bulkheads and Doors			X	
1600	Deck Covering			X	
1700	Hull Insulation and Sheathing			X	
1800	Storerooms/Stowage Lockers (Salvage Equip.)	X			
1900	Workshop, Laboratory, and Test Area Equip.	X			
1A00	Equipment and Furnishings, Utility Space	X			
1B00	Commissary Equipment		X		
1C00	Furn./Equipage, Living/Office/Control/ Machinery Spaces		X		
1D00	Furnishings/Equipage, Medical, Dental			X	
3100	Generating Plant, Ships Service		X		
3300	Generating Plant, Emergency		X		
4100	Power Distribution Switchboard		X		

Figure 4. Format for Classifying Ship Systems/Equipments in Terms of Operational Status

Ship:_____ Date:_____

EIC	System/Equipment	Cost					
		Labor				Mat'l ($)	Total ($)
		Ship's Force (M-D)	IMA (M-D)	Shipyard (M-D)	Shipyard ($)		
C100	Main Engines			100	13,500	3,250	16,750
C400	Shafting			10	1,350	70	1,420
C800	L.O. Service System			2	270	400	670
GB00	Gun Mounts		25			2,500	2,500
P100	Surface Search Radar	4				500	500
QB00	Communications Receivers						
T100	Heating System	12		10	1,350	14,000	15,350
T800	Firemain System	8		20	2,700	12,000	14,700
TK00	Dist[illegible]						
YA00	Inflatable Boats						
YC00	Boat Handling and Stowage	8				675	675
Total							

Figure 5. Format for Summarizing Maintenance Cost

Ship: _____ Date: _____

EIC	Nomenclature	Maintenance Required				
		Major	Moderate	Minor	Insig.	None
1100	Hull Fittings		X			
1300	Canvas/Rigging			X		
1400	Ladders and Gratings		X			
1500	Bulkheads and Doors		X			
1600	Deck Covering		X			
1700	Hull Insulation and Sheathing		X			
1800	Storerooms/Stowage Lockers (Salvage Equip.)		X			
1900	Workshop, Laboratory and Test Area Equipment		X			
1A00	Equipment and Furnishings, Utility Space		X			
1B00	Commissary Equipment		X			
1C00	Furn./Equipage, Living/ Office/Control/Machinery Spaces	X				
1D00	Furnishings/Equipage, Medical, Dental		X			
3100	Generating Plant, Ships Service	X				
3300	Generating Plant, Emergency			X		
4100	Power Distribution Switchboard		X			
4300	Power Distribution System, AC					X
4400	Power Distribution S					X

Figure 6. Format for Recording Extent of Maintenance Labor Burden for Ship Systems/Equipments

	INOPERATIVE		REDUCED CAPABILITY		DEGRADED; NO MISSION EFFECT	
	EIC	Nomenclature	EIC	Nomenclature	EIC	Nomenclature
Major Maintenance	T800	Firemain System	TF00	Compressed Air System	1500	Bulkhead and Doors
Moderate Maintenance						
Minor Maintenance						
Insignificant Maintenance						

No Maintenance	

Figure 7. Format for Tabulating Ship System/Equipment Material Status

A. Mission Essential Systems/Equipments

	Inoperative	Reduced Capability	Degraded; No Effect on Mission
Major Maintenance	(1)	(5)	(9)
Moderate Maintenance	(2)	(6)	(10)
Minor Maintenance	(3)	(7)	(11)
Insignificant Maintenance	(4)	(8)	(12)

No Maintenance	(25)

B. Nonessential Systems/Equipments

	Inoperative	Reduced Capability	Degraded; No Effect on Operational Capability
Major Maintenance	(13)	(17)	(21)
Moderate Maintenance	(14)	(18)	(22)
Minor Maintenance	(15)	(19)	(23)
Insignificant Maintenance	(16)	(20)	(24)

No Maintenance	(25)

Figure 8. Suggested Ranking of Systems/Equipments

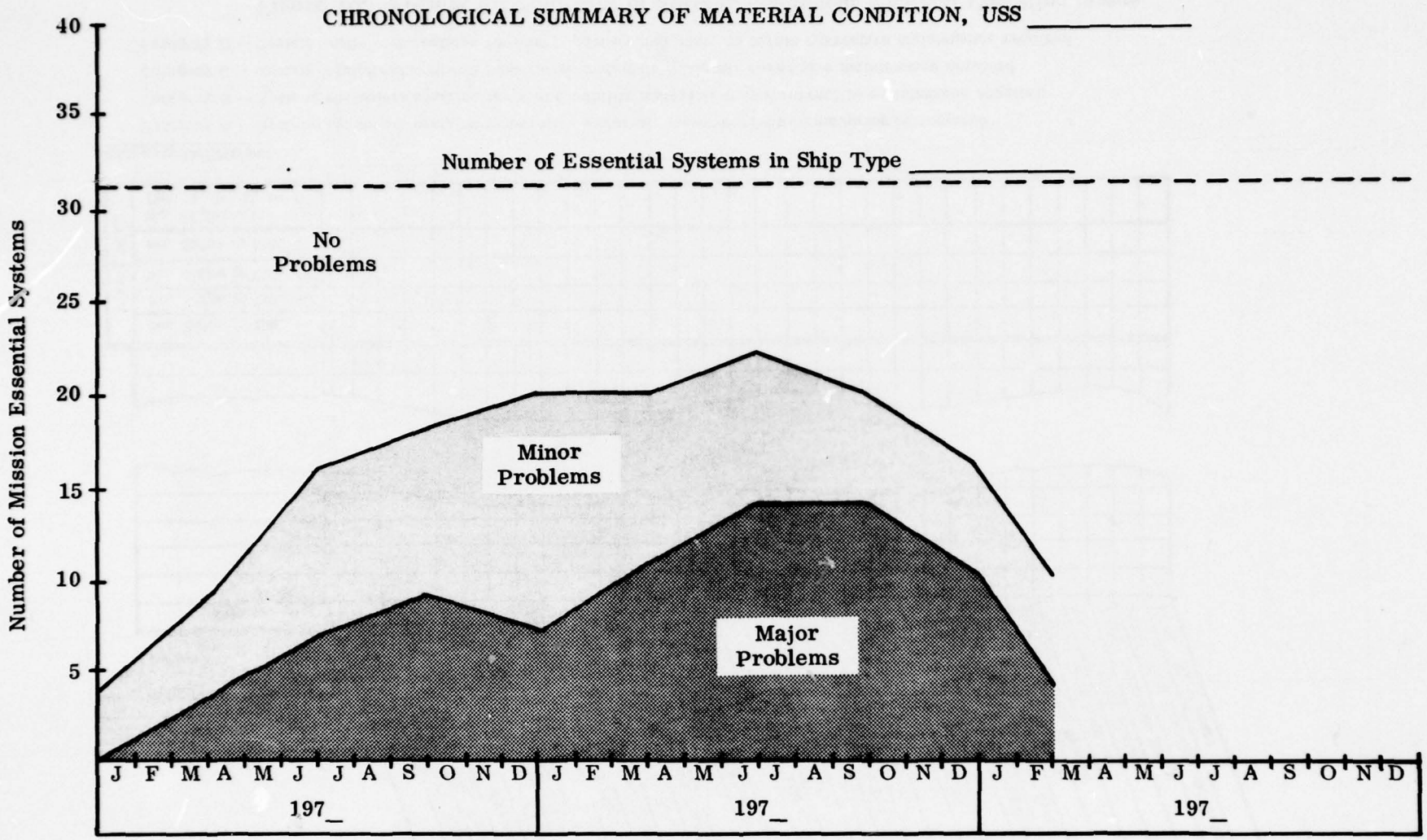
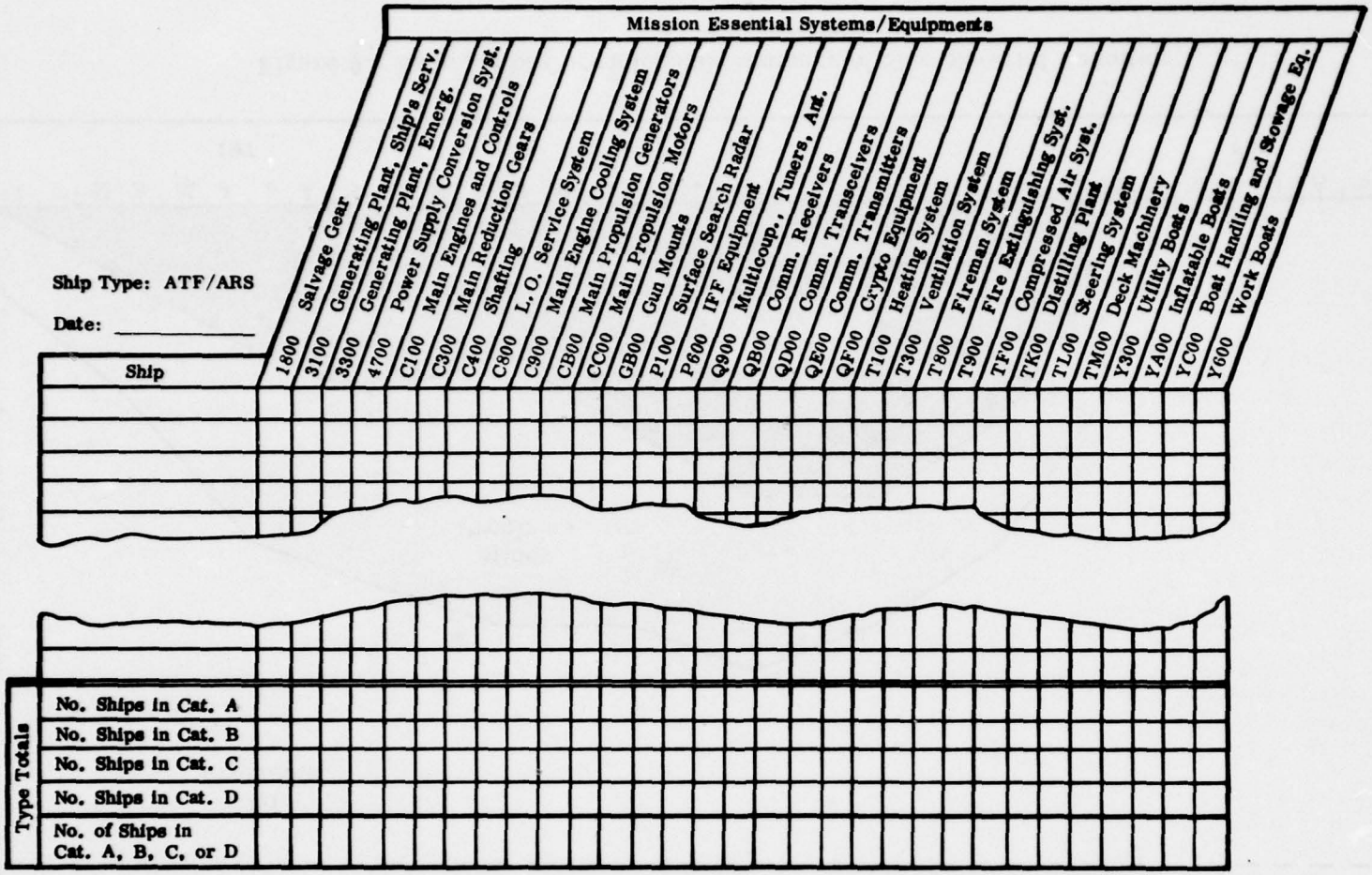


Figure 9. Example of Chronological Summary of Ship Material Condition



Category Definitions:

Category A — System/equipment contains inoperative material; major corrective maintenance required

Category B — System/equipment contains reduced capability material; major corrective maintenance required

Category C — System/equipment contains inoperative material; moderate corrective maintenance required

Category D — System/equipment contains reduced capability material; moderate corrective maintenance required

Figure 10. Format for Summary of System/Equipment Material Condition Status

4
ILLUSTRATIONS OF PROCEDURE FOR MEASURING MATERIAL CONDITION

This section illustrates the application of steps 1 through 5 of the procedure described in Section 3 to selected samplings of Service Force ships.

4.1 STEP 1 – CLASSIFYING SHIP SYSTEMS/EQUIPMENTS IN TERMS OF MISSION ESSENTIALITY

CASREPT summary data covering a 4-year period were reviewed for a sampling of three ARS-type ships of SERVPAC. Using an EIC staging diagram for the ARS as a base, it was determined that 98 systems/equipments are applicable to that ship type. The CASREPT summary data indicated that 31 of these systems are essential, i.e., have been reported at least once as casualty items affecting the ability of the ship to perform its mission. Table 5 lists the systems/equipments applicable to the ARS type and identifies those considered to be mission essential, based on a review of CASREPT data.

4.2 STEP 2 – CLASSIFYING EACH SYSTEM/EQUIPMENT IN TERMS OF OPERATIONAL STATUS

The CSMP dated 31 December 1973 for the USS DELIVER (ARS-23) was examined to determine the operational status of each system/equipment. The determination was made by considering the coded indicator of operational status as appearing in the CSMP, together with the narrative description provided with each entry. Table 6 summarizes the results of the review.

4.3 STEP 3 – CLASSIFYING EACH SYSTEM/EQUIPMENT IN TERMS OF EXTENT OF MAINTENANCE REQUIRED TO RESTORE MATERIAL CONDITION

The above-referenced CSMP was also reviewed to classify each system/equipment in terms of the extent of maintenance required. In this process, line items were grouped by EIC (at the second level of indenture) and a gross estimate made of the extent of maintenance manpower required to accomplish the maintenance delineated in the CSMP. Where possible, estimates available from ROH planning

documentation were used in classifying the systems/equipments. Classifications were:

Maintenance Required	Man-Days Needed
Major	>100
Moderate	>10-100
Minor	>1-10
Insignificant	>0-1
None	0

Table 7 summarizes the results of this review.

4.4 STEP 4 – TABULATING MATERIAL CONDITION

Results of steps 2 and 3 are presented in matrix form in Tables 8 and 9. Table 8 summarizes the material condition of mission-essential systems of the DELIVER as of 31 December 1973, while Table 9 presents corresponding information for non-mission-essential systems.

4.5 STEP 5 – RANKING SYSTEMS/EQUIPMENTS

Table 10 is a ranking of the material condition of mission-essential systems of the DELIVER based on 1) estimated extent of maintenance required to restore material condition, and 2) the extent of degradation of operational performance.

TABLE 5. MISSION-ESSENTIAL SYSTEMS FOR ARS TYPE SHIPS (Sheet 1 of 6)

EIC	Nomenclature	CASREPT History			Mission Essential Item	Remarks
		Ship A	Ship B	Ship C		
1100	Hull Fittings					
1300	Canvas/Rigging					
1400	Ladders and Gratings					
1500	Bulkheads and Doors					
1600	Deck Covering					
1700	Hull Insulation and Sheathing					
1800	Storerooms/Stowage Lockers (Salvage Equip.)	X	X	X	•	Salvage Equipment
1900	Workshop, Laboratory and Test Area Equipment					
1A00	Equipment and Furnishings, Utility Space					
1B00	Commissary Equipment					
1C00	Furn./Equipage, Living/Office/Control/ Machinery Spaces					
1D00	Furnishings/Equipage, Medical, Dental					
3100	Generating Plant, Ships Service	X	X	X	•	
3300	Generating Plant, Emergency	X	X	X	•	
4100	Power Distribution Switchboard					
4300	Power Distribution System, AC					

TABLE 5. (Sheet 2 of 6)

EIC	Nomenclature	CASREPT History			Mission Essential Item	Remarks
		Ship A	Ship B	Ship C		
4400	Power Distribution System, DC					
4500	Lighting Distribution System, AC					
4600	Lighting Distribution System, DC					
4700	Power Supply Conversion System	X	X	X	•	M-G Sets
8B00	Small Arms/Motor/ Machine Guns					
8C00	Explosive Ordnance Disposal Equipment					
A100	Shell Plating and Planking					
A300	Framing, Longitudinal and Transverse					
A500	Platforms, Flats, and Decks					
A600	Superstructure					
A700	Foundations, Main Propulsion and Auxiliary					
A800	Bulkheads, Structural					
A900	Trunks and Enclosures					
AA00	Sponsons, Armor Castings, Forgings, Weldments					
AB00	Sea Chests					
AC00	Ballast and Buoyancy Units					

TABLE 5. (Sheet 3 of 6)

EIC	Nomenclature	CASREPT History			Mission Essential Item	Remarks
		Ship A	Ship B	Ship C		
AD00	Doors, Hatches, Manholes, Scuttles, and Closures					
AE00	Masts and Kingposts (Except Cargo)					
C100	Engines and Controls, Diesel		X	X	•	Main Engines
C300	Gears and Clutches, Detached	X		X	•	Main Reduction Gear
C400	Shafting, Mechanical	X	X	X	•	Propellor; Shaft Bearings
C500	Air Supply Combustion					
C600	Exhaust System					
C700	Fuel Oil Service System, Detached					
C800	Lube Oil Service System, Detached	X	X		•	L.O. Purifier
C900	Water System, Circulating and Cooling	X	X		•	
CB00	Generator and Controls	X		X	•	
CC00	Motor and Controls			X	•	
CD00	Cabling					
CE00	Centralized Controls, Main Propulsion Auxiliary					
GB00	Gun Mounts	X	X		•	
L100	Navigation System, LORAN					

TABLE 5. (Sheet 4 of 6)

EIC	Nomenclature	CASREPT History			Mission Essential Item	Remarks
		Ship A	Ship B	Ship C		
LB00	Gyrocompass LC and XLC					
LF00	Navigation Aids, Optical and Miscellaneous					
LG00	Compass, Magnetic					
LH00	Instruments, Meteorological					
LJ00	Lights, Navigational					
LK00	Lights, Signaling					
M300	Amplified Voice Communication System					
M400	Telephone System					
M500	Alarm, Safety, and Warning System					
M600	Ships Orders and Indicating System					
M700	Recording and Projection System					
N400	Degaussing System					
P100	Radar Surface Search	X	X	X	•	
P600	IFF Equipment		X		•	
Q100	Antenna System, Communications					
Q300	Teletypes					
Q700	Amplifiers, Auto					
Q900	Multicouplers-Tuners, Antenna	X	X	X	•	

TABLE 5. (Sheet 5 of 6)

EIC	Nomenclature	CASREPT History			Mission Essential Item	Remarks
		Ship A	Ship B	Ship C		
QA00	Infrared System					
QB00	Receiver, Communications		X		•	
QC00	Control Devices, Remote Communications					
QD00	Transceiver, Communications	X	X	X	•	
QE00	Transmitter, Communications	X			•	
QF00	Cryptographic Equipment		X	X	•	
QR00	Test Equipment, Special Communications					
R500	Sonary System, Navigation					
T100	Heating System	X	X		•	Auxiliary Boiler
T300	Ventilation System			X	•	
T400	Air-Conditioning System					
T500	Refrigeration System					
T700	Plumbing Installations					
T800	Firemain, Flushing, Sprinkling, Washdown and Saltwater Service		X	X	•	Pumps
T900	Fire Extinguishing Systems	X			•	
TA00	Drain, Ballast, Trimming, Heeling, and Stbl Tank System					

TABLE 5. (Sheet 6 of 6)

EIC	Nomenclature	CASREPT History			Mission Essential Item	Remarks
		Ship A	Ship B	Ship C		
TB00	Water System, Fresh					
TC00	Scuppers and Deck Drains					
TD00	Filling, Ventilation, and Transfer System, Fuel/Diesel Oil					
TF00	Air System, Compressed	X	X	X	•	
TH00	Exhaust, Supply, and Drains Auxiliary Steam System					
TJ00	Service System, Miscellaneous					
TK00	Distilling Plants		X	X	•	
TL00	Steering and Ship Control System		X	X	•	
TM00	Deck Machinery, General	X	X	X	•	Deck Winches
TS00	Cargo Handling, Ship and Dockside					
TT00	Underway Replenishment System					
W000	Test Equipment, Electronic					
Y300	Boat, Utility			X	•	
YA00	Boat, Inflatable	X			•	
YC00	Handling and Stowage Equipment, Boat		X	X	•	Boat Winch
Y600	Boat, Work	X	X	X	•	

TABLE 6. EXAMPLE OF OPERATIONAL STATUS SUMMARY OF SHIP SYSTEMS/EQUIPMENTS (Sheet 1 of 7)

Ship: USS DELIVER (ARS-23) Date: 12/31/73

EIC	Nomenclature	Operational Status			
		Inoperative	Reduced Capability	Degraded; No Mission Effect	No Degradation
1100	Hull Fittings			X	
1300	Canvas/Rigging			X	
1400	Ladders & Gratings			X	
1500	Bulkheads and Doors			X	
1600	Deck Covering			X	
1700	Hull Insulation and Sheathing			X	
1800	Storerooms/Stowage Lockers (Salvage Equip.)	X			
1900	Workshop, Laboratory, and Test Area Equip.	X			
1A00	Equipment and Furnishings, Utility Space	X			
1B00	Commissary Equipment		X		
1C00	Furn./Equipage, Living/Office/Control/ Machinery Spaces		X		
1D00	Furnishings/Equipage, Medical, Dental			X	
3100	Generating Plant, Ships Service		X		
3300	Generating Plant, Emergency		X		
4100	Power Distribution Switchboard		X		

TABLE 6. (Sheet 2 of 7)

Ships: USS DELIVER (ARS-23) Date: 12/31/73

EIC	Nomenclature	Operational Status			
		Inoperative	Reduced Capability	Degraded; No Mission Effect	No Degradation
4300	Power Distribution System, AC				X
4400	Power Distribution System, DC				X
4500	Lighting Distribution System, AC				X
4600	Lighting Distribution System, DC				X
4700	Power Supply Conversion System				X
8B00	Small Arms/Motor/ Machine Guns	X			
8C00	Explosive Ordnance Disposal Equipment				X
A100	Shell Plating and Planking		X		
A300	Framing, Longitudinal and Transverse		X		
A500	Platforms, Flats, and Decks		X		
A600	Superstructure		X		
A700	Foundations, Main Propulsion and Auxiliary		X		
A800	Bulkheads, Structural			X	
A900	Trunks and Enclosures			X	
AA00	Sponsons, Armor Castings, Forgings, Weldments				X

TABLE 6. (Sheet 3 of 7)

Ship: USS DELIVER (ARS-23) Date: 12/31/73

EIC	Nomenclature	Operational Status			
		Inoperative	Reduced Capability	Degraded; No Mission Effect	No Degradation
AB00	Sea Chests		X		
AC00	Ballast and Buoyancy Units				X
AD00	Doors, Hatches, Manholes, Scuttles, and Closures		X		
AE00	Masts and Kingposts (Except Cargo)		X		
C100	Engines and Controls, Diesel		X		
C300	Gears and Clutches, Detached			X	
C400	Shafting, Mechanical			X	
C500	Air Supply, Combustion				X
C600	Exhaust System				X
C700	Fuel Oil Service System, Detached		X		
C800	Lube Oil Service System, Detached		X		
C900	Water System, Circulating and Cooling		X		
CB00	Generator and Controls		X		
CC00	Motor and Controls		X		
CD00	Cabling				X
CE00	Centralized Controls, Main Propulsion Auxiliary				X

TABLE 6. (Sheet 4 of 7)

Ship: USS DELIVER (ARS-23) Date: 12/31/73

EIC	Nomenclature	Operational Status			
		Inoperative	Reduced Capability	Degraded; No Mission Effect	No Degradation
GB00	Gun Mounts			X	
L100	Navigation System, LORAN				X
LB00	Gyrocompass LC and XLC			X	
LF00	Navigation Aids, Optical and Misc.		X		
LG00	Compass, Magnetic				X
LH00	Instruments, Meteorological		X		
JJ00	Lights, Navigational		X		
LK00	Lights, Signaling				X
M300	Amplified Voice Communication System		X		
M400	Telephone System				X
M500	Alarm, Safety, and Warning System				X
M600	Ships Orders and Indicating System		X		
M700	Recording and Projection System				X
N400	Degaussing System			X	
P100	Radar Surface Search	X			
P600	IFF Equipment				X
Q100	Antenna System, Communications		X		

TABLE 6. (Sheet 5 of 7)

Ship: USS DELIVER (ARS-23) Date: 12/31/73

EIC	Nomenclature	Operational Status			
		Inoperative	Reduced Capability	Degraded; No Mission Effect	No Degradation
Q300	Teletypes	X			
Q700	Amplifiers, Audio				X
Q900	Multicouplers-Tuners, Antenna				X
QA00	Infrared System				X
QB00	Receiver, Communications				X
QC00	Control Devices, Remote Communications				X
QD00	Transceiver, Communications	X			
QE00	Transmitters Communications				X
QF00	Cryptographic Equipment			X	
QR00	Test Equipment, Special Communications				X
R500	Sonar System, Navigation			X	
T100	Heating System		X		
T300	Ventilation System		X		
T400	Air-Conditioning System		X		
T500	Refrigeration System		X		
T700	Plumbing Installations			X	

TABLE 6. (Sheet 6 of 7)

Ship: USS DELIVER (ARS-23) Date: 12/31/73

EIC	Nomenclature	Operational Status			
		Inoperative	Reduced Capability	Degraded: No Mission Effect	No Degradation
T800	Firemain, Flushing, Sprinkling, Washdown and Saltwater Service	X			
T900	Fire Extinguishing Systems			X	
TA00	Drain, Ballast, Trimming, Heeling, Stbl Tank Systems		X		
TB00	Water System, Fresh		X		
TC00	Scuppers and Deck Drains			X	
TD00	Filling, Ventilation, and Transfer System, Fuel/Diesel Oil				X
TF00	Air System, Compressed	X			
TH00	Exhaust, Supply, and Drains Auxiliary Steam System				X
TJ00	Service System, Misc.				X
TK00	Distilling Plants		X		
TL00	Steering and Ship Control System		X		
TM00	Deck Machinery, General		X		
TS00	Cargo Handling Ship and Dockside			X	
TT00	Underway Replenishment System				X

TABLE 6. (Sheet 7 of 7)

Ship: USS DELIVER (ARS-23) Date: 12/31/73

EIC	Nomenclature	Operational Status			
		Inoperative	Reduced Capability	Degraded; No Mission Effect	No Degradation
W000	Electronic Test Equipment		X		
Y300	Boat, Utility				X
YA00	Boat, Inflatable		X		
YC00	Handling and Stowage Equipment, Boat		X		
Y600	Boat, Work		X		

TABLE 7. EXAMPLE OF MAINTENANCE LABOR BURDEN SUMMARY FOR SHIP SYSTEMS/EQUIPMENTS (Sheet 1 of 6)

SHIP: USS DELIVER (ARS-23) Date: 12/31/73

EIC	Nomenclature	Maintenance Required				
		Major	Moderate	Minor	Insig.	None
1100	Hull Fittings		X			
1300	Canvas/Rigging			X		
1400	Ladders and Gratings		X			
1500	Bulkheads and Doors		X			
1600	Deck Covering		X			
1700	Hull Insulation and Sheathing		X			
1800	Storerooms/Stowage Lockers (Salvage Equip.)		X			
1900	Workshop, Laboratory and Test Area Equipment		X			
1A00	Equipment and Furnishings, Utility Space		X			
1B00	Commissary Equipment		X			
1C00	Furn./Equipage, Living/ Office/Control/Machinery Spaces	X				
1D00	Furnishings/Equipage, Medical, Dental		X			
3100	Generating Plant, Ships Service	X				
3300	Generating Plant, Emergency			X		
4100	Power Distribution Switchboard		X			
4300	Power Distribution System, AC					X
4400	Power Distribution System, DC					X

TABLE 7. (Sheet 2 of 6)

SHIP: USS DELIVER (ARS-23) Date: 12/31/73

EIC	Nomenclature	Maintenance Required				
		Major	Moderate	Minor	Insig.	None
4500	Lighting Distribution System, AC					X
4600	Lighting Distribution System, DC					X
4700	Power Supply Conversion System					X
8B00	Small Arms/Motor/ Machine Guns		X			
8C00	Explosive Ordnance Disposal Equipment					X
A100	Shell Plating and Planking		X			
A300	Framing, Longitudinal and Transverse		X			
A500	Platforms, Flats, and Decks		X			
A600	Superstructure		X			
A700	Foundations, Main Propulsion and Auxiliary			X		
A800	Bulkheads, Structural		X			
A900	Trunks and Enclosures	X				
AA00	Sponsons, Armor Castings, Forgings, Weldments					X
AB00	Sea Chests		X			
AC00	Ballast and Buoyancy Units					X
AD00	Doors, Hatches, Manholes, Scuttles, and Closures	X				
AE00	Masts and Kingposts (Except Cargo)		X			
C100	Engines and Controls, Diesel	X				

TABLE 7. (Sheet 3 of 6)

SHIP: USS DELIVER (ARS-23) Date: 12/31/73

EIC	Nomenclature	Maintenance Required				
		Major	Moderate	Minor	Insig.	None
C300	Gears and Clutches, Detached			X		
C400	Shafting, Mechanical			X		
C500	Air Supply, Combustion					X
C600	Exhaust System					X
C700	Fuel Oil Service System, Detached		X			
C800	Lube Oil Service System, Detached		X			
C900	Water System, Circulating and Cooling			X		
CB00	Generator and Controls			X		
CC00	Motor and Controls		X			
CD00	Cabling					X
CE00	Centralized Controls, Main Propulsion Auxiliary					X
GB00	Gun Mounts		X			
L100	Navigation System, LORAN					X
LB00	Gyrocompass LC and XLC				X	
LF00	Navigation Aids, Optical and Miscellaneous		X			
LG00	Compass, Magnetic					X
LH00	Instruments, Meteorological				X	
LJ00	Lights, Navigational			X		
LK00	Lights, Signaling					
M300	Amplified Voice Communication System		X			

TABLE 7. (Sheet 4 of 6)

SHIP: USS DELIVER (ARS-23) Date: 12/31/73

EIC	Nomenclature	Maintenance Required				
		Major	Moderate	Minor	Insig.	None
M400	Telephone System					X
M500	Alarm, Safety, and Warning System					X
M600	Ships Orders and Indicating System			X		
M700	Recording and Projection System					X
N400	Degaussing System				X	
P100	Radar Surface Search			X		
P600	IFF Equipment					X
Q100	Antenna System, Communications				X	
Q300	Teletypes		X			
Q700	Amplifiers, Audio					X
Q900	Multicouplers-Tuners, Antenna					X
QA00	Infrared System					X
QB00	Receiver-Communications					X
QC00	Control Devices, Remote Communications					
QD00	Transceiver, Communications		X			
QE00	Transmitter, Communications					X
QF00	Cryptographic Equipment				X	
QR00	Test Equipment, Special Communications					X
R500	Sonar System, Navigation			X		

TABLE 7. (Sheet 5 of 6)

SHIP: USS DELIVER (ARS-23) Date: 12/31/73

EIC	Nomenclature	Maintenance Required				
		Major	Moderate	Minor	Insig.	None
T100	Heating System	X				
T300	Ventilation System	X				
T400	Air-Conditioning System	X				
T500	Refrigeration System		X			
T700	Plumbing Installations			X		
T800	Firemain, Flushing, Sprinkling, Washdown and Saltwater Service	X				
T900	Fire Extinguishing Systems		X			
TA00	Drain, Ballast, Trimming, Heeling, and Stbl Tank System		X			
TB00	Water System, Fresh		X			
TC00	Scuppers and Deck Drains		X			
TD00	Filling, Ventilation, and Transfer System, Fuel/ Diesel Oil					X
TF00	Air System, Compressed	X				
TH00	Exhaust, Supply, and Drains Auxiliary Steam System					X
TJ00	Service System, Misc.					X
TK00	Distilling Plant		X			
TL00	Steering and Ship Control System		X			
TM00	Deck Machinery, General	X				
TS00	Cargo Handling Ship and Dockside				X	

TABLE 7. (Sheet 6 of 6)

SHIP: USS DELIVER (ARS-23) Date: 12/31/73

EIC	Nomenclature	Maintenance Required				
		Major	Moderate	Minor	Insig.	None
TT00	Underway Replenishment System					X
W000	Electronic Test Equipment			X		
Y300	Boat, Utility					X
YA00	Boats, Inflatable		X			
YC00	Handling and Stowage Equipment, Boat		X			
Y600	Boat, Work		X			

TABLE 8. SUMMARY OF MATERIAL CONDITION, MISSION-ESSENTIAL SYSTEMS/EQUIPMENTS

SHIP: USS DELIVER (ARS-23) Date: 12/31/73

	Major Maint. Required	Moderate Maint. Required	Minor Maint. Required	Insignificant Maint. Required	No Maint. Required
Inoperative	TB00 Firemain System TF00 Compressed Air System	1800 Storeroom, Stowage Equip (Salvage Gear) QD00 Communication Transceivers	P100 Surface Search Radar		4700 Power Supply Conversion P600 IFF Equipment Q900 Multicouplers
Reduced Capability	3100 Ships Service Generators C100 Main Engines T100 Heating System (Aux. Boiler) T300 Ventilation System TM00 Deck Machinery	C800 L.O. Service System CC00 Mn. Prep. Motors and Controls TK00 Distilling Plant TL00 Steering System YA00 Inflatable Boats YC00 Boat Handling and Stowage Equipment Y600 Workboats	3300 Emergency Gen. Plant C900 Mn. Engine Cooling System CB00 Mn. Propulsion Generators and Controls		QB00 Communication Receivers QE00 Communication Transmitters Y300 Utility Boats
Degraded; No Effect on Mission		G000 Gun System T900 Fire Extinguishing System	C300 Gear (Mn. C400 Mech. Shafting	QF00 Crypto Equipment	

TABLE 9. SUMMARY OF MATERIAL CONDITION, NON-MISSION-ESSENTIAL SYSTEMS/EQUIPMENTS (Sheet 1 of 2)

SHIP: USS DELIVER (ARS-23) Date: 12/31/73

	Major Maint. Required	Moderate Maint. Required	Minor Maint. Required	Insignificant Maint. Required	No Maint. Required
Inoperative		1900 Workshop and Test Equipment 1A00 Utility Space Equipment 8B00 Machine Guns Q300 Teletypes			4300 Pwr. Distribution, A. C. 4400 Pwr. Distribution, D. C. 4500 Lighting System, A. C. 4600 Lighting System, D. C. 8C00 Explosive Ord. Disposal Equipment AA00 Sponsons, Weldment AC00 Buoyance and Ballast C600 Mn. Engine Exhaust CD00 Cabling CE00 Mn. Prop. Switchboard and Controls L100 LORAN LG00 Magnetic Compass LK00 Signalling Lights M400 Telephone Systems M500 Alarm Systems M700 Projectors Q700 Audio Amplifiers
Reduced Capability	1C00 Living/Office Space Equipment AD00 Doors, Hatches, Scuttles T400 Air Conditioning System	1B00 Commissary Equipment 4100 Pwr. Dist. Switchboards A100 Shell Plating A300 Long/Transverse Framing A500 Platforms and Decks A600 Superstructure AB00 Sea Chests AE00 Masts C700 F.O. Service System LF00 Optical Nav Aids M300 Ampl. Voice System T500 Refrigeration System TA00 Drain, Ballast System TB00 Fresh Water Syst.	A700 Machinery Foundations LJ00 Navigational Lights M600 Order and Indicating Systems W000 Electronic Test Equipment	LH00 Meteorological Instruments Q100 Antenna Systems	

TABLE 9. (Sheet 2 of 2)

SHIP: USS DELIVER (ARS-23) Date: 12/31/73

	Major Maint. Required	Moderate Maint. Required	Minor Maint. Required	Insignificant Maint. Required	No Maint. Required
Degraded; No Effect on Mission	A900 Trunks and Enclosures	1100 Hull Fittings 1400 Ladders and Gratings 1500 Blkhds and Doors, Non-structural 1600 Deck Covering 1700 Hull Insulation 1D00 Medical Space Equipment A800 Blkhds, Structural TC00 Scuppers, Deck Drains	1300 Canvas and Rigging R000 Sonar Systems T700 Plumbing Installations	LB00 Gyro Compass N400 Degaussing System TS00 Cargo Handling System	QA00 Infrared Systems QC00 Comm. Control Devices QR00 Comm. Test Equipment TD00 D.O. Filling and Vent System TH00 Auxiliary Steam System TJ00 Misc. Service Systems TT00 Unrep Equipment

TABLE 10. RANKING OF SYSTEMS/EQUIPMENTS BASED ON SEVERITY OF MATERIAL CONDITION PROBLEMS

Ship: USS DELIVER Date: Dec. 31, 1973

A. Ranking Based on Extent of Maintenance Required to Restore			B. Ranking Based on Impact on Performance Capability		
Rank	EIC	System/Equipment	Rank	EIC	System/Equipment
1	T800	Firemain System	1	T800	Firemain System
↓	TF00	Compressed Air System	↓	TF00	Compressed Air System
3	3100	Ship Service Generators	3	1800	Storeroom Eq. (Salvage Gear)
	C100	Main Engines		QD00	Communication Transceivers
	T100	Heating Syst. (Aux. Boiler)	5	P100	Surface Search Radar
	T300	Ventilation System	6	3100	Ship Service Generators
↓	TM00	Deck Machinery		C100	Main Engines
8	1800	Storeroom Eq. (Salvage Gear)		T100	Heating Syst. (Aux. Boiler)
↓	QD00	Comm. Transceivers		T300	Ventilation System
10	C800	L.O. Service System	↓	TM00	Deck Machinery
	CC00	Mn. Prop. Motors and Controls	11	C800	L.O. Service System
	TK00	Distilling Plant		CC00	Main Prop. Motors and Controls
	TL00	Steering System		TK00	Distilling Plant
	YA00	Inflatable Boats		TL00	Steering System
	YC00	Boat Handling and Stowage Equipment		YA00	Inflatable Boats
↓	Y600	Workboats		YC00	Boat Handling and Stowage Equipment
17	G000	Gun System	↓	Y600	Workboats
↓	T900	Fire Extinguishing Syst.	18	3300	Emergency Generating Plant
19	P100	Surface Search Radar		C900	Mn. Engine Cooling System
20	3300	Emerg. Gen. Plant		CB00	Mn. Prop. Generators and Controls
	C900	Mn. Eng. Cooling System	21	G000	Gun System
↓	C300	Mn. Prop. Generators and Controls	↓	T900	Fire Extinguishing System
23	C300	Main Reduction Gear	23	C300	Main Reduction Gear
↓	T900	Fire Extinguishing Syst.	↓	C400	Mechanical Shafting
25	QF00	Crypto Equipment	25	QF00	Crypto Equipment

5
CONCLUSIONS AND RECOMMENDATIONS

Conclusions and recommendations resulting from the study of possible methods for measuring and assessing ships material condition are summarized below.

a. Material-Condition Measurement Factors

- Conclusion: Mission essentiality, operational status, and extent of maintenance action required are all vital factors in measuring and assessing the material condition of ships.
- Recommendation: That each of these three factors be considered in material-condition evaluation, as illustrated in the procedure described in Section 2.

b. Mission Essentiality of Systems/Equipments

- Conclusion: The most practical method of determining whether or not an individual system/equipment is essential to a ship's mission is through analysis of prior history based on ship's command judgment.
- Recommendation: That mission essentiality for individual systems/equipments be determined from review of CASREPT histories, as illustrated in step 1 of the recommended procedure.

c. Method for Defining Systems/Equipments

- Conclusion: Measurement and assessment of material condition should be accomplished using a standardized method for defining ships systems and equipments.
- Recommendation: That the EIC be used as the vehicle for such measurement. It should be noted that the Ship's Work Breakdown Structure or any other common language method of defining ships systems would be equally suitable for this purpose.

d. Most Applicable Existing Measurement/Assessment System

- Conclusion: The Current Ships Maintenance Project is the most suitably designed system for measuring and assessing ship material condition.
- Recommendation: That the CSMP be used as the principal data source for measurement/assessment purposes; and, concurrently, that programs for enhancing the completeness, accuracy, and timeliness of the CSMP be promoted.

e. Criterion for Measuring Extent of Required Maintenance

- Conclusion: The extent of maintenance required is best measured in terms of the estimated manpower required to restore a system/equipment to satisfactory condition. However, existing data bases such as the CSMP do not currently contain suitable manpower estimate information.
- Recommendation: That steps be taken to enhance the CSMP through inclusion of accurate and complete manpower estimate data; and that in the meantime, extent of maintenance requirements be expressed in broad terms such as those defined and illustrated in step 3 of the recommended procedure.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 1613-01-1-1335	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) A RECOMMENDED PROCEDURE FOR MESSURING AND ASSESSING SHIP MATERIAL CONDITION		5. TYPE OF REPORT & PERIOD COVERED
		6. PERFORMING ORG. REPORT NUMBER 1613-01-1-1335
7. AUTHOR(s) N.J. Scarlett		8. CONTRACT OR GRANT NUMBER(s) N00604-73-C-0450 new
9. PERFORMING ORGANIZATION NAME AND ADDRESS ARINC Research Corp. 2551 Riva Road Annapolis, Maryland 21401		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS COMMANDER SERVICE FORCE, PACIFIC Pearl Harbor Naval Shipyard Honolulu, Hawaii		12. REPORT DATE November 1974 13. NUMBER OF PAGES 39
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) COMMANDER SERVICE FORCE, PACIFIC Pearl Harbor Naval Shipyard Honolulu, Hawaii		15. SECURITY CLASS. (of this report) UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) UNCLASSIFIED/UNLIMITED		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Present methods and data sources for measuring and assessing the material condition of Navy ships are examined and discussed in this report. To develop a recommended best approach, the most suitable existing method was identified and studies made to develop procedures for enhancing its usefulness.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)