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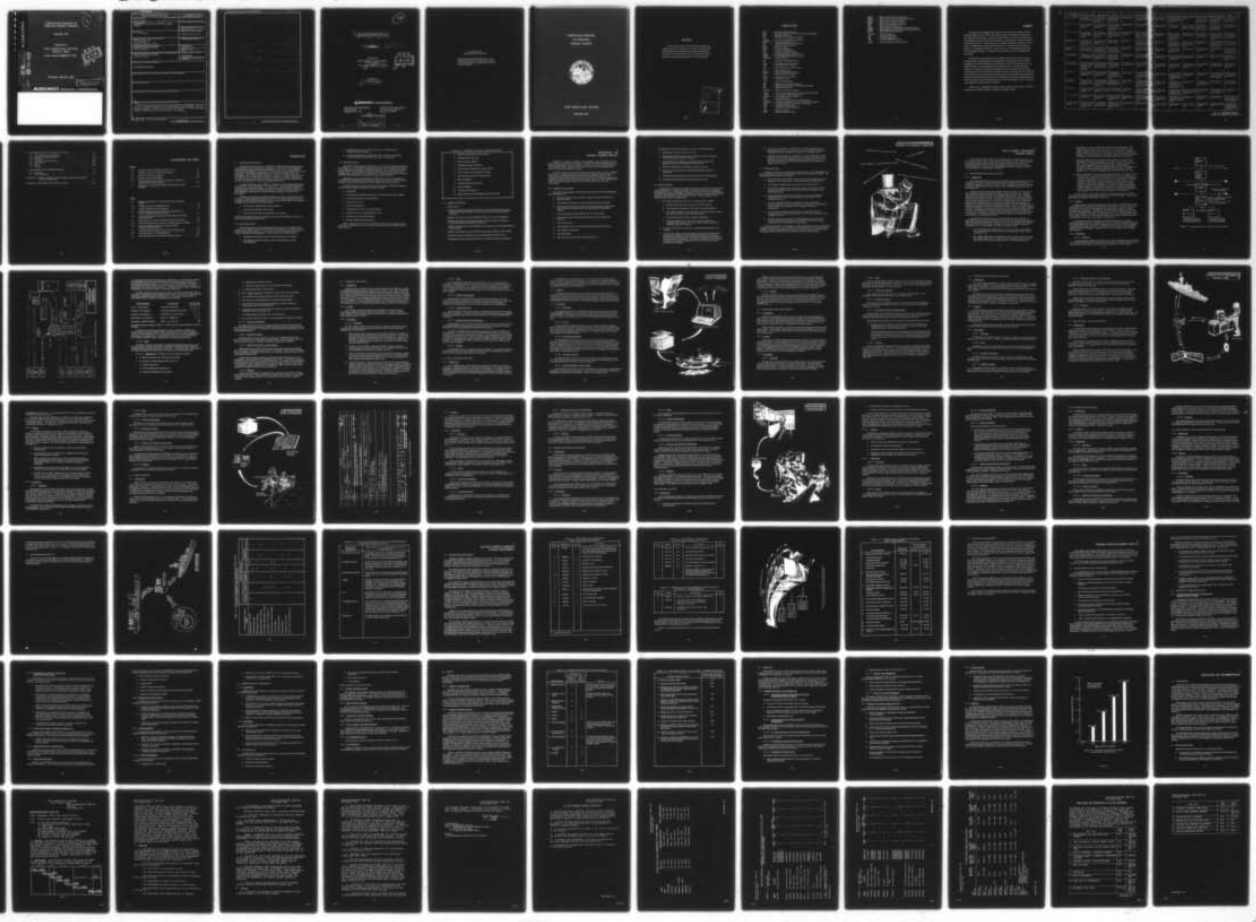

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COMPUTERIZED PROGRAMS FOR IMPROVING OVERHAUL PLANNING

November 1975

Prepared for

PEARL HARBOR NAVAL SHIPYARD
Honolulu, Hawaii

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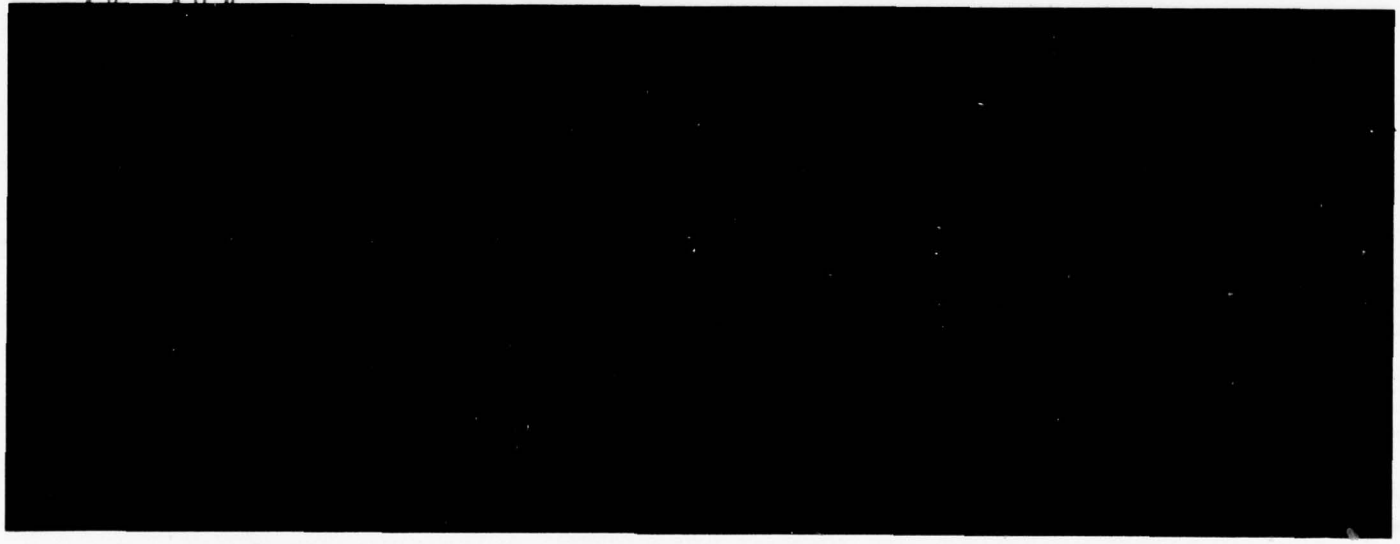

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COMPUTERIZED PROGRAMS FOR IMPROVING OVERHAUL PLANNING

PEARL HARBOR NAVAL SHIPYARD

November 1975

ABSTRACT

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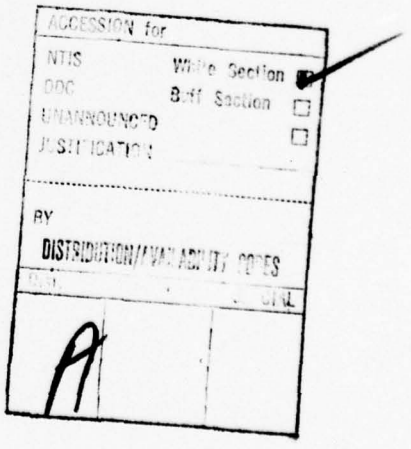

ABBREVIATIONS

ADP	–	Automatic Data Processing
ASCII	–	American Standard Code for Information Interchange
APL	–	Allowance Parts List
A&P	–	Alterations and Projects (Program)
CASDO	–	Computer-Aided Ship Design Office
CRUDES	–	Cruiser-Destroyer Force
CID	–	Component Identification (Number)
CNO	–	Chief of Naval Operations
COAR	–	Customer Order
CPM	–	Critical Path Method
CPU	–	Central Processing Unit
CPC	–	Common Peripheral Channel
COSAL	–	Consolidated Ship's Allowance List
CSMP	–	Current Ship's Maintenance Project
CASREPT	–	Casualty Report
EIC	–	Equipment Identification Code
FMP	–	Fleet Modernization Program
FCN	–	Financial Control Number
HME	–	Hull, Mechanical, and Electrical
IOM	–	Input/Output Module
INSURV	–	Board of Inspection and Survey
ICN	–	Industrial Control Number
JO/KO	–	Job Order/Key Operation
JML	–	Job Material List
LOE	–	Light-Off Examination
MIS	–	Management Information System
3M	–	Maintenance and Material Management (System)
MR	–	Material Requisition
NAVSEA	–	Naval Sea Systems Command
PERA	–	Planning and Engineering for Repairs and Alterations
POT&I	–	Pre-Overhaul Test and Inspection
PHNSY	–	Pearl Harbor Navel Shipyard
PC	–	Production Control
PERT	–	Program Evaluation and Review Technique
PEB/LOE	–	Propulsion Examination Board/Light-Off Examination
PMS	–	Planned Maintenance and Review Technique
P&E	–	Planning and Estimating
PSI	–	Peripheral Subsystem Interface
ROH	–	Regular Overhaul
RIR	–	Repair Inspection Record

SARP	–	Ship Alteration and Repair Package
SFOMS	–	Ship's Force Overhaul Management System
SWBS	–	Ship's Work Breakdown Structure
SWLIN	–	System Work List Item Number
SSDI	–	Ship Systems Definition and Index
SPCC	–	Ship's Parts Control Center
SECAS	–	Ship Equipment Configuration Accounting System
SAMIS	–	Ship Alteration and Management Information System
SSWD	–	Ship System Work Definition
TYCOM	–	Type Commander
TDI	–	Technical Data Index
T&I	–	Test and Inspection
TRS	–	Technical Repair Standard
WOJO	–	Work-Oriented Job Order (System)

SUMMARY

Pearl Harbor Naval Shipyard has initiated an Overhaul Improvement Program, directed initially toward FF-1052 class ships but with the capability of expansion to other ship classes and types. The goal of this program is to make more efficient use of maintenance resources (personnel and money), as reflected in overhauls of shorter duration and less cost. To achieve this goal, PHNSY is focusing its attention in three areas: accomplishing overhaul planning activities as completely and accurately as possible, increasing the productivity of the work force, and eliminating unnecessary work and support functions. A prime tool in each of these areas is automatic data processing.

In this study, 12 data systems of the PHNSY Overhaul Improvement Program associated with overhaul planning and management were examined relative to their amenability for implementation by ADP techniques, and the associated hardware and software needed. It was determined that automation of the 12 overhaul planning systems, or modules, would lead to substantial returns in overhaul time and funds saved; that the cost of the additional necessary hardware required would be a relatively small addition to the present computer facility investment at PHNSY; that compatibility with other NAVSEA data systems would be maintained; and that these planning modules could be extended with equal potential benefit to other Naval shipyards with a relatively small expansion in their computer facilities.

Table A-1 is a management summary of the planning modules studied. Table A-2 summarizes the PHNSY system's interfaces with shipyard MIS.

Overhaul Planning Program Module	Present Problem Areas	Purpose/Goal	Data Base	Users	Program Relationship
Ship Systems Definition and Index (SSDI)	Lack of common configuration language. Multiple systems used, e.g., EIC, SAC, SWBS.	Tailor Master SWBS Index to ship class; further define systems/equipments; depict graphically.	Structured system and graphic diagrams using SWBS and standard fifth-level coding. Covers total ship.	Overhaul planning personnel; ship's force.	Used in all modules for cross-referencing data, indexing data files, and data retrieval.
Technical Data Index (TDI)	Technical data not tied together by common index, nor easily retrieved.	Gather accurate data; index, analyze, and record it for overhaul planning use.	Data files for COSAL/validation data, plans/tech manual index, PEB/LOE data, and general information; all SSDI-indexed.	Shipyard planning and production personnel.	Provides easy access to tech data to support other modules.
Ship Alteration Program	Up-to-date status of shipalts programmed and material status required not readily available.	Through SAMIS interface, provide status of plans and material for alts to be accomplished.	SAMIS program supplemented by info from PERA, Planning Yard, and Alts and Projects reports.	Shipyard planning personnel and project coordinators.	Provides alteration portion of SARP; and data for the POT&I, Material, Work Packaging, JO/KO, and SFOMS modules.
Maintenance Material History	Past maintenance history not assembled and indexed for easy retrieval for planning next overhaul.	Assemble past maintenance history, indexed by SSDI for use in planning overhaul.	3M system reports, CASREPT data; past overhaul records.	Shipyard planning personnel.	Provides inputs for POT&I, SARP, Material, Work Packaging, Work Specs, and SFOMS modules.
Current Ships Maintenance Project (CSMP)	CSMP not sufficiently up to date nor complete for shipyard requirements. Indexed to EIC.	Maintain CSMP on shipyard computer indexed by SSDI. Update monthly using 3M tapes. Improve CSMP quality.	Complete CSMP from 3M system, SSDI-indexed on shipyard computer. Updated monthly using 3M tapes.	Shipyard planning personnel; ship's force.	Inputs initial repair portion of SARP and forms data base for SFOMS.
Pre-Overhaul Test & Inspection (POT&I)	POT&I plans not refined by considering repairs and alts already planned for accomplishment.	Develop POT&I plan to provide accurate material condition with minimum of testing and inspection.	Class POT&I plan tailored to ship and supplemented by test memos. Upgraded through feedback of results.	Shipyard planning personnel; ship's force; POT&I team.	Provides input to SARP. Uses data from CSMP, shipalt, and Material History modules.
Ship Alteration and Repair Package (SARP)	New SARP must be prepared for each overhaul. Preparation, revising and printing are time consuming. SARP quality often questionable.	Develop computerized baseline SARP and use data from other modules to refine. Maintain through overhaul.	Baseline SARP (from WHIPPLE) supplemented by data from other FF-1052 class overhauls.	Overhaul planning personnel; shipyard; TYCOM; ship's force.	One of key program modules. Interfaces with most other modules.
Work Packaging	Work not being packaged to fit accomplishing activity's needs and way of doing work.	Produce work packaged in a manner best accomplished by production shops.	Authorized work and work packaging guidelines, updated and refined on basis of experience. Indexed by SSDI.	Planners and estimators; schedulers.	From work identified in SARP, provides base for preparing work specifications and inputs for Material Support module.
Production Work Specifications	Work specifications, JO/KO preparation not standardized. Knowledge of repetitive work not used.	Prepare higher quality and more comprehensive work specs, standardized for future overhauls and computerization.	Standard JO/KO work specifications on microfiche and indexed by SSDI. Supporting file of TRSs.	Planners and estimators; production shops.	Prepared for work-packaged units. Inputs from CSMP, POT&I and Tech Data Index modules used. Inputs to Material module.
Material Support	Early identification and ordering of material to support the overhaul required.	Provide automated procedures for early identification and ordering of material.	Series of complex computer software and data files. APL data tapes.	Overhaul planning personnel; supply personnel.	New MIS program being developed. Interfaces with SARP, CSMP, Work Specs, and Tech Data Index modules.
Overhaul Test Program	Coordinated plan for all testing during an overhaul required.	Prepare Overhaul Test Plan covering all testing required during overhaul.	Listing of all tests, developed from SSN-584 and SSN-637 ITPs. Computerized and SSDI indexed.	Test personnel; planning personnel; schedulers; ship's force.	Based on data from SARP, Work Packaging and Work Spec modules. Interfaces with POT&I module.
Ship's Force Overhaul Management System (SFOMS)	System for management of ship's force portion of work package that interfaces with MIS required.	Provide improved system, interfacing with shipyard programs, to support ship's force.	Computerized files of authorized work, manpower data and material information (ship's force).	Ship's force; shipyard overhaul manager.	Inputs from SARP and CSMP modules.

	Users	Program Relationship	Products Produced	Hardware Requirements	Software Requirements	Schedule
and sing	Overhaul planning personnel; ship's force.	Used in all modules for cross-referencing data, indexing data files, and data retrieval.	SSDI book for ship class.	H-6060 computer system. Mag tape file storage. Time-share capability including disk space.	COBOL and FORTRAN programs for batch processing. BASIC programs for interactive system.	FF-1052 class complete. DDG-2 class being prepared. Software programs complete.
L/ ns/ d a; all	Shipyard planning and production personnel.	Provides easy access to tech data to support other modules.	Specific reports of data required. Visual representation through time sharing of specific data.	H-6060 computer system. Microfilm/ microfiche files. Time share capability, including disk space.	Series of FORTRAN data storage and management programs. BASIC programs for interactive system.	Programs operational. Data files being loaded as time permits.
pple- n ard, cts	Shipyard planning personnel and project coordinators.	Provides alteration portion of SARP; and data for the POT&I, Material, Work Packaging, JO/KO, and SFOMS modules.	Reports and on-line info listing Alteration Plan and material status.	H-6060 computer system, including time share capability. Data link with SAMIS.	Programs for batch processing and interactive access. PHNSY general-purpose data storage & retrieval system.	Program requirements have been designed. Software will be developed when SAMIS data link established.
, st	Shipyard planning personnel.	Provides inputs for POT&I, SARP, Material, Work Packaging, Work Specs, and SFOMS modules.	Reports of systems/ equipments with history of high frequency repairs. Also available on-line.	H-6060 computer system with time share capability.	COBOL pgms for inputting data. FORTRAN pgms to input data from 3M UNIVAC tapes. Time share BASIC.	Programs mostly completed. Data base still small. Scheduled for increase in early 1976.
om rd d tapes.	Shipyard planning personnel; ship's force.	Inputs initial repair portion of SARP and forms data base for SFOMS.	Reports of ship deferred maintenance items.	H-6060 computer system with time share capability.	FORTRAN batch programs. Time share BASIC.	Programs operational for batch processing. Time sharing to be developed when additional disk space available.
d est d of	Shipyard planning personnel; ship's force; POT&I team.	Provides input to SARP. Uses data from CSMP, shipalt, and Material History modules.	POT&I plan consisting of RIRs and supporting documentation.	H-6060 computer system with time share capability.	COBOL and FORTRAN programs. Time share BASIC.	Programs defined. Initial efforts will be for batch processing. BASIC programs will follow.
om om ss	Overhaul planning personnel; shipyard; TYCOM; ship's force.	One of key program modules. Interfaces with most other modules.	Printed SARPs, as required, up to date with authorized work and estimates.	H-6060 computer system with time share capability.	FORTRAN and COBOL programs for batch. Time share BASIC.	Batch programs operational. Time share programs being developed.
nd ide- f re- xed by	Planners and estimators; schedulers.	From work identified in SARP, provides base for preparing work specifications and inputs for Material Support module.	Authorized work packaged in industrially organized unit.	H-6060 computer system with time share capability.	FORTRAN program to produce work packaging sheets. COBOL program for data input. Time share BASIC.	Batch programs being tested. Time share to be developed when disk space available.
ork dexed ing	Planners and estimators; production shops.	Prepared for work-packaged units. Inputs from CSMP, POT&I and Tech Data Index modules used. Inputs to Material module.	Job Order/Key Operation writeups.	H-6060 computer system with time share capability. Microfilm/ microfiche files.	BASIC programs for cross-reference file.	Programs complete. Estimate 6-12 months to complete data files.
com- d data apes.	Overhaul planning personnel; supply personnel.	New MIS program being developed. Interfaces with SARP, CSMP, Work Specs, and Tech Data Index modules.	Scratch material sheets; JMLs; various material, status reports; material requisitions.	H-6060 computer system with time share capability.	Over 30 programs using COBOL and FORTRAN, plus maximum use of utility programs.	Essentially complete and operational.
, de- -584 SSDI	Test personnel; planning personnel; schedulers; ship's force.	Based on data from SARP, Work Packaging, and Work Spec modules. Interfaces with POT&I module.	Integrated Test Plan for ship's overhaul.	H-6060 computer system with time share capability.	FORTRAN programs. Time share BASIC.	Specifications have been prepared. Batch programs scheduled for July 1976. Time share when disk space available.
s of man- terial s	Ship's force; shipyard overhaul manager.	Inputs from SARP and CSMP modules.	Variety of status reports for ship's force work.	H-6060 computer system with time share capability.	COBOL and FORTRAN programs. Time share BASIC.	File maintenance and most report generator programs operational. Tutorial and interface programs scheduled for early 1976.

TABLE A-1. MANAGEMENT SUMMARY: OVERHAUL IMPROVEMENT PROGRAM MODULES

TABLE A-2. PROGRAM INTERFACES WITH SHIPYARD MIS

NAVSEA MIS Application	Overhaul Planning Program Module(s)
Workload Forecasting	Ship System Definition and Index
Production Control	Current Ship Maintenance Project, Pre-Overhaul Test and Inspection, Ship Alteration and Repair Package, Work Packaging, Production Work Specifications, Overhaul Test Program, Ship's Force Overhaul Management System
Production Scheduling	Overhaul Test Program, Ship's Force Overhaul Management System, Ship Alteration and Repair Package
Design	Technical Data Index, Ship Alteration Program, Ship Alteration and Repair Package, Work Packaging, Overhaul Test Program
Cost	Ship System Definition and Index, Ship Alteration and Repair Package, Work Packaging
Industrial Material	Maintenance Material History, Material Support, Ship's Force Overhaul Management System
Shop Stores	Maintenance Material History, Material Support

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1
INTRODUCTION

1.1 BACKGROUND OF STUDY

During the past several years, considerable attention has been directed toward improving ship overhaul planning and management. Pearl Harbor Naval Shipyard, recognizing that concentrated effort was needed to improve its overhaul planning process, has undertaken a comprehensive Overhaul Improvement Program for FF-1052 class ships. The objective of this program is to make more efficient use of its maintenance resources (personnel and money), leading to overhauls of shorter duration and less cost. Present efforts relate to a series of five regular overhauls of FF-1052 class ships over a three-year period, with the goals that the fifth overhaul be 25% less costly and 20% shorter in duration than the first.

To achieve the above goals, PHNSY is focusing on increasing the productivity of the work force – both "white collar" and "blue collar" – and eliminating unnecessary overhaul work and support functions. To attain increased productivity, PHNSY is taking advantage of the new systems and programs recently developed in the areas of ship maintenance management, particularly those pertaining to automatic data processing.

NAVSEA has recognized the potential significance of the Overhaul Improvement Program's telecommunication aspects (use of ADP, time-sharing procedures, etc.) in relation to other NAVSEA programs, and has commissioned PHNSY to document the development efforts with a view to determining:

a. The program's applicability to other shipyards

b. Its interfaces with other data systems

c. The associated hardware and software requirements.

PHNSY tasked ARINC Research Corporation, under Contract N00604-75-C-0431, to assist in the NAVSEA-assigned effort.

1.2 STUDY OBJECTIVE

The primary objective of the ARINC Research study was to investigate those modules of the PHNSY Overhaul Improvement Program which use interactive processing and external data systems, i.e., those that could take advantage of ADP procedures, techniques, and capabilities. The work was to be directed toward:

a. Identifying the potential extent of computer applications at PHNSY.

b. Identifying cost effective applications for implementation at other naval shipyards.

c. Documenting interfaces needed between these applications and NAVSEA-sponsored systems.

d. Providing justification for supporting higher authority requirements for ADP equipment augmentation and software development.

1.3 STUDY APPROACH

The PHNSY Overhaul Improvement Plan was reviewed to identify the modules to be evaluated, i.e., those which use interactive processing and external data systems and are thus readily amenable to ADP implementation. Twelve modules were identified (see Table 1-1) and analyzed in detail to determine their required data base, potential users, required hardware/software for computer implementation, interfaces with other Navy data systems, and present status of implementation.

Additionally, the processing hardware and software needed to implement the 12 modules was identified, and a preliminary analysis was made of the total cost and potential cost savings of this portion of the Overhaul Improvement Program.

In addition to the 12 modules documented in this report, PHNSY has instituted a series of local computer programs or systems, entitled:

a. Design MIS

b. Discrepancies Identification System for Complex Ship Overhauls (DISC)

c. Job Order Revision and Double Finaling

d. Cost Control Curves

e. Fixed Cost Application

f. Planning Work Product Forecasting System

g. Automated Advance Planning Milestone Plan

h. Design On-Line Work Status System

i. Scientific/Engineering Applications

These computerized tools were not included in this study since they are either "stand alone" applications or were developed independently of the Overhaul Improvement Program.

TABLE 1-1. OVERHAUL PLANNING PROGRAM MODULES

1.	Ship System Definition and Index (SSDI)
2.	Technical Data Index (TDI)
3.	Ship Alteration Program
4.	Maintenance Material History
5.	Current Ships Maintenance Project (CSMP)
6.	Pre-Overhaul Test & Inspection (POT&I)
7.	Ship Alteration & Repair Package (SARP)
8.	Work Packaging
9.	Production Work Specifications
10.	Material Support
11.	Overhaul Test Program
12.	Ship's Force Overhaul Management System (SFOMS)

1.4 FORMAT OF REPORT

In this report,

- Section 2 provides background information on the overhaul planning process, citing the deficiencies that the Overhaul Improvement Program is intended to correct.
- Section 3 provides the details indicated in Section 1.2 for the 12 modules.
- Section 4 discusses the interfaces of these modules with other elements of the NAVSEA Management Information System.
- Section 5 identifies the required hardware and software for ADP implementation of the modules.
- Section 6 provides an overall technical and economic analysis of the modules.
- Section 7 gives the conclusions and recommendations from this study.
- Appendixes provide support information, as identified in the above sections.

2
BACKGROUND: THE OVERHAUL PLANNING PROCESS

Planning for a regular overhaul at a Navy shipyard requires the interaction of many programs, systems, and activities. The objective of this planning process is to define a work package, allocate available resources, obtain the required materials, and schedule the work. Because of the many variables involved in planning, that process is inherently difficult to manage.

A ship's overhaul work package consists of two major types of work – alteration and repair. Development of the two associated work packages proceeds along different routes, but these packages must be merged before the overhaul. The remainder of this section describes the process by which overhaul work packages are presently developed, and how that procedure could be improved. Subsequent sections of this report document the elements of the PHNSY program to achieve this improvement.

2.1 PRESENT PROCEDURES

The repair work package is generally developed and the work accomplished by the following process:

a. The type commander tasks PERA to prepare the Ship's Alteration and Repair Package.

b. PERA tasks the shipyard to conduct POT&I and prepare the SARP.

c. The shipyard conducts preoverhaul tests and inspections, prepares the SARP, estimates overhaul costs, and submits the work package to TYCOM.

d. TYCOM screens the SARP and approves the work package.

e. The shipyard orders materials and prepares worker-oriented job orders.

f. The overhaul starts.

g. TYCOM approves new work incrementally throughout the overhaul.

h. The overhaul is completed.

i. The ship departs.

j. After about three years, the process starts over.

Development of the alteration package consists of the following tasks:

a. Planned alterations are listed in the FMP.

b. The shipyard is tasked about a year in advance (A-360) to perform advance planning for specified alterations.

c. The alteration work package is incorporated into the SARP; the shipyard shipchecks and estimates alteration costs.

d. The CNO funded alteration package is provided at A-180.

e. The CNO alteration package is modified through the prearrival conference.

f. TYCOM-funded alterations are firmed at the prearrival conference.

g. The shipyard obtains materials and prepares job orders.

2.2 IDEAL METHOD

Developing the overhaul work package by the above processes results in certain recurring problems. Typically, the SARP is prepared late and is of questionable quality because of late or incomplete inspections; access to the ship is restricted due to conflict with operational schedules; and each ship overhaul is treated virtually as if that class of ship had never been overhauled before. These problems can be addressed in the manner outlined below.

a. The following actions are taken well in advance of the overhaul:

   1) Results desired from the overhaul are clearly specified.

   2) The equipment configuration of the ship is accurately defined.

   3) The material condition of the ship, and the repairs needed to achieve the desired overhaul results, are determined.

   4) The time and location of the overhaul is established.

   5) Accurate estimates are made of the resources required to accomplish the overhaul. (Resources include funds, manpower, facilities, material, and time.)

b. The above resources are reserved or acquired and stockpiled for the overhaul.

c. Details of the repair work are packaged in worker-oriented job orders that best fit the manner in which the shipyard productive work force accomplishes and tests its work while still providing a full audit trail for financial control and reporting. Technical documentation and materials are staged to the shipyard productive work force in the same worker-oriented job order units.

d. The overhaul is conducted as originally estimated and planned, and is efficiently managed by the shipyard using its computerized Management Information System to enhance the effectiveness of shipyard effort.

e. Significant data regarding the overhaul are accurately gathered, indexed, analyzed, recorded, and communicated for improvement of future overhauls and of operation, maintenance and constructions practices; and to provide an accurate baseline of the material condition of the ship as it departs from overhaul.

2.3 PROBLEM AREAS

Variations occur from the ideal actions outlined above, with varying degrees of impact on the Navy's ability to economically overhaul surface ships on schedule. The most important variations are listed below.

a. The results desired from the overhaul are not clearly specified, and are changed or evolved during the overhaul planning and execution period.

b. The equipment configuration of the ship is not accurately known.

c. The material condition of the ship and the repairs necessary to achieve the desired overhaul results are not determined early enough or with sufficient accuracy.

d. Funds, manpower, facilities, and materials required or available to accomplish the overhaul are not determined early enough or with sufficient accuracy.

e. Due to all of the above factors, manpower, material and facility reserves cannot be well developed in advance of overhaul. Consequently, detailed repair work planning is often accomplished late and incompletely.

f. Due to late and incomplete authorization of repair work, the work package cannot be efficiently planned and assembled into effective worker-oriented job orders.

g. The Navy has not agreed upon a common language to be used by Fleet system commands and shipyards to facilitate the gathering, indexing, analyzing, and communicating of overhaul data.

Recognizing the above circumstances, PHNSY embarked on a series of programs, building on existing ones, to try to stabilize the planning process and accomplish ship overhauls within the established time limits and as economically as possible. The remaining sections of this report document the elements of this program.

PROBLEMS IN OVERHAUL PLANNING

Overhaul Results Not Clearly Specified

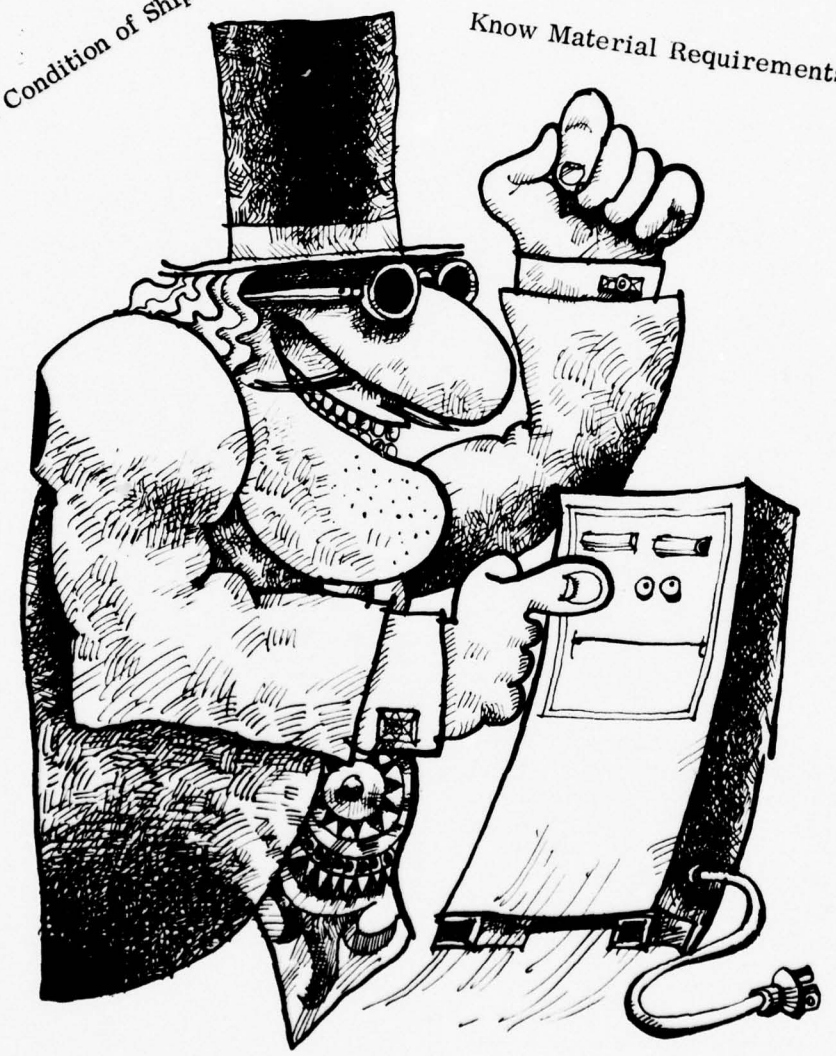
No Common Language

Ship's Equipment Configuration Unknown

Funds, Manpower, Facilities Required Unknown

Material Condition of Ship Unknown

Know Material Requirements Too Late for Order



3
PHNSY OVERHAUL IMPROVEMENT PROGRAM MODULES

The 12 modules of the PHNSY Overhaul Improvement Program (see Table 1-1) are discussed in this section. Described for each module are the overhaul planning/performance function it will support, the required data base, projected users, relationship to other modules in overhaul planning, products produced, computer hardware/software requirements for implementation with ADP techniques, and the present schedule for implementation at PHNSY.

3.1 SHIP SYSTEMS DEFINITION AND INDEX

3.1.1 Background

One of the significant deficiencies associated with the planning process for ship overhauls is the lack of a common ship-configuration language for use by Fleet commands, shipyards, and other activities. Such a language would greatly facilitate the process of gathering, indexing, analyzing, and communicating overhaul data, as discussed below.

Considerable information concerning the material condition of a ship and how that condition was reached is generated during a ship's overhaul cycle. Between ship's force and shipyard personnel, everything pertinent about a ship's material condition will generally be known. The problem is that the information is either not collected, and is therefore lost or dissipated in a short time; or is not indexed and recorded by any method that will allow it to be efficiently processed, sorted, and organized for the potential users. A great deal of ship overhaul information is gathered in the PHNSY Management Information System, but only a small fraction is indexed and organized for reuse in subsequent overhauls. The "as released" material condition of the ship is, for all practical purposes, lost soon after the ship completes overhaul. The details of conditions found and work actually performed during an overhaul do not get indexed, recorded, and put effectively to use on the next overhaul at a shipyard – let alone get transmitted to another shipyard overhauling the same class of ship, or to the type commander.

The problems noted above lay not in any unwillingness of the personnel or organizations involved, but in the fact that the Navy has not yet adopted and enforced a single Ship Systems Definition and Index nor developed a standardized intercommand data bank to allow for the storage, exchange, and reuse of overhaul planning and execution data. As a consequence, the following situations exist:

a. For identifying systems/equipments, the Fleet uses EICs, the shipyards utilize the SWBS, the COSAL utilizes service application codes, PERAs use SWLINs, etc.

b. The shipyard MIS collects a significant amount of detailed data concerning the execution phase of the overhaul, but is organized primarily to assist the shipyard in managing the approved work. Only the most general

information is readily transferable directly to the 3M data banks. The shipyard MIS data are usually organized around the job order structure, which is based on SWBS. The 3M data banks are indexed by EIC and in theory contain all known deferred maintenance work and all unaccomplished shipalts. The 3M data banks are difficult to maintain by present procedures, and further are only superficially compatible with shipyard data banks.

c. The ship configuration files (COSALs) are not indexed by either EIC or SWBS and are therefore incompatible with either Fleet or shipyard data files. There is no standardized computer-based data file to provide direct assistance in planning overhaul repair packages, maintaining data generated during the overhaul, initiating planning for the next overhaul, and passing on useful organized information to other shipyards, TYCOM, NAVSEA, etc., to utilize in planning other overhauls of the same class.

d. Ship configurations are usually not reflected accurately or completely in the COSAL data bank despite the validation effort of ship's force during each overhaul cycle. Disparity between COSAL records and actual configuration contributes significantly to the cost and time for ship overhauls. Lack of confidence in the records spawns incalculable lost time and motion, and "overkill" in shipchecks, in addition to the direct problems of ordering materials for the wrong components, etc. Improvement of the reliability of ship configuration lists and their availability in a computerized format keyed to a common language index would make a significant contribution to improving the process of planning and executing repair packages.

As one of the first steps in improving its overhaul planning process, PHNSY prepared a Ship Systems Definition and Index for FF-1052 class ships. Copies of this SSDI book are available from PHNSY, Code 200.03.

3.1.2 Purpose

Existing means of ship system definition (EIC, SWBS) present difficulties in the interpretation and communication of ship system information. Problems result from the variations in logic for structuring the ship, nomenclature, degree of system breakdown, and numbering. The SSDI was developed with the objective of tailoring the master index (SWBS) to a specific ship class (FF-1052) by defining system, subsystem, and equipment boundaries and displaying them in an easily understood format (see example, Figure 3-1). This step was considered an absolute necessity to allow broad inter-file, inter-command exchange of information.

To provide the degree of definition and uniformity required for the other advanced planning modules, an additional two levels of coding was adopted conforming to the SWBS guidelines. This common-language index has been developed to support computerized information systems, to facilitate storage, retrieval, and exchange of overhaul planning information. Figures 3-2 and 3-3 are examples of the resulting SSDI diagrams.

3.1.3 Description

3.1.3.1 Data Base

The Ship Systems Definition and Index is an orderly identification and structuring of the systems and subsystems that make up the total ship. The SSDI defines the systems as well as their boundaries and interfaces, creating a common language

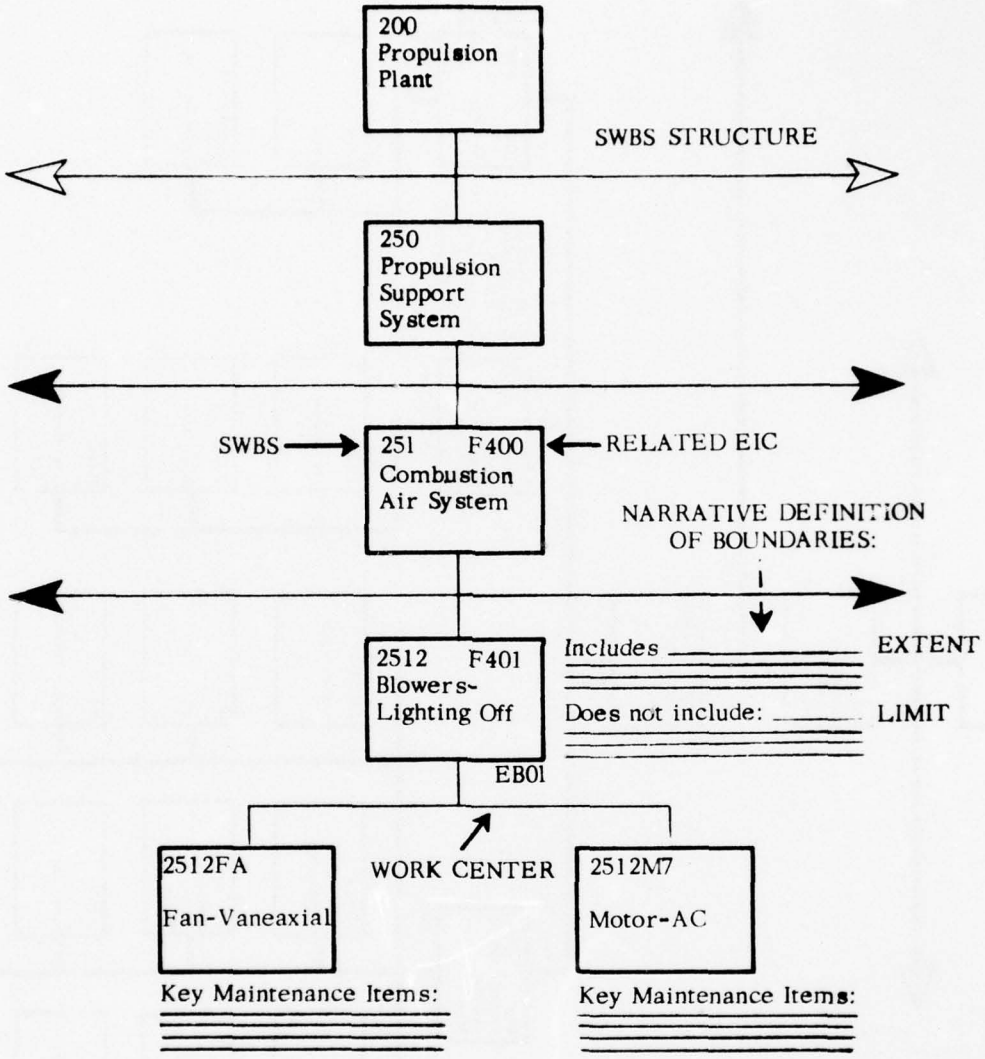


Figure 3-1. Example of System Diagrams Included in SSDI

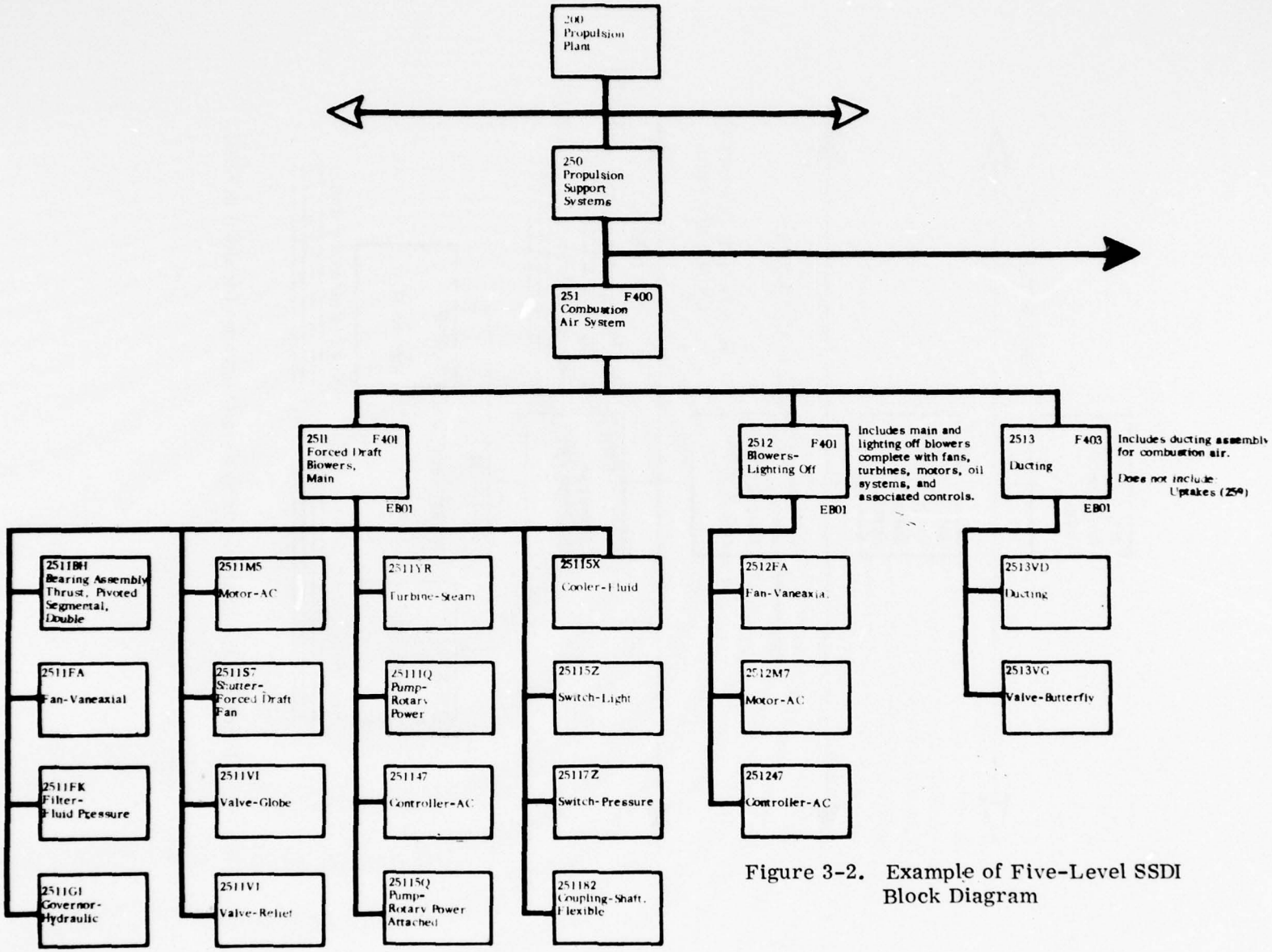
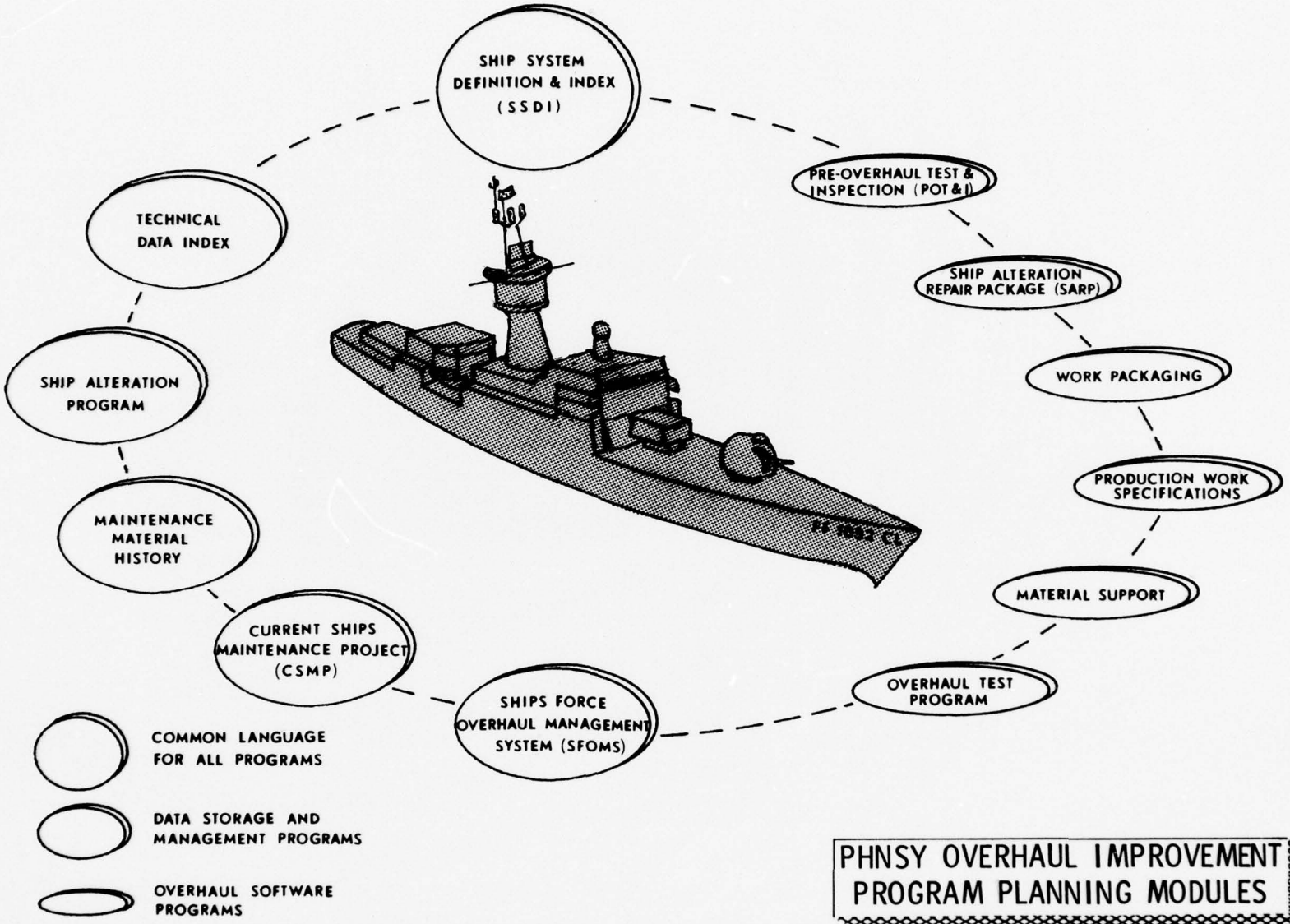


Figure 3-2. Example of Five-Level SSDI Block Diagram



PHNSY OVERHAUL IMPROVEMENT PROGRAM PLANNING MODULES

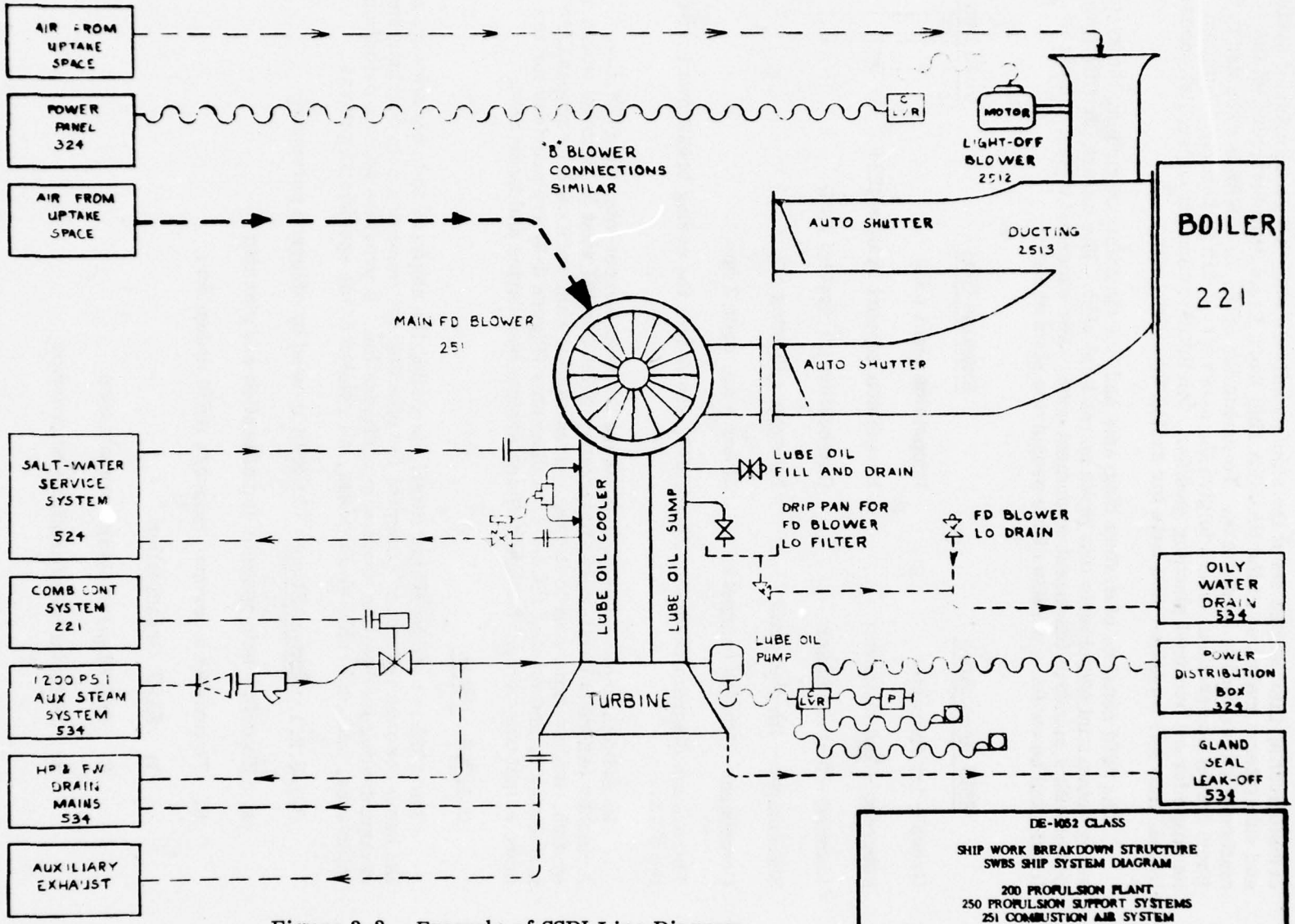


Figure 3-3. Example of SSDI Line Diagram

communicating information about the ship's configuration. All structuring of systems and subsystems make use of the NAVSEA Ship Work Breakdown Structure as the mathematical narrative framework. To create the SSDI, the SWBS is extended to five (from three) hierarchical levels to give the necessary detail to become a common language for all overhaul planning modules. An SWBS equipment coding list sponsored by NAVSEA 048 was used as a base for coding this fifth level.

The SSDI consists of system diagrams and line diagrams describing the systems, subsystems, and equipments that make up the total ship. The lowest, or fifth level, is coded with a standard functional equipment code. The expanded coding system is illustrated below for a portion of the propulsion plant system:

SSDI Breakdown	Example Unit	Code Number
Group – 1st character	Propulsion plant (200)	2
Subgroup – 2nd character	Propulsion support system (250)	5
Element – 3rd character	Combustion air system (251)	1
Subelement – 4th character	Blowers - lighting off	2
Component – 5th/6th character	Motor - ac, over 3 hp	M7

The system diagram example, Figure 3-2, shows how the coding breakdown is used in the SSDI.

In addition to providing code numbers for ship components, the SSDI also furnishes (where not self-evident) narrative definitions of what is included within a system, its key maintenance items, representative ship work centers responsible for maintenance, and related EICs. Line diagrams (Figure 3-3) are provided for the more complex systems, further defining system boundaries and interfaces.

3.1.3.2 Users

The SSDI is used by all personnel, including the shipyard and ship's force, as the basic common reference document for planning and managing ship overhaul and communicating information about ship configuration. It provides system definition and interfaces, and applicable SWBS codes, all related to the specific ship class.

3.1.3.2.1 Shipyard Use – The SSDI is used by shipyard personnel:

a. To define ship systems for alteration and planning

b. To provide a common language (SSDI codes) for:

   1) SARP Organization

   2) POT&I planning and organization

   3) Material identification and ordering

4) Management information systems

5) Data file organization (all overhaul planning module files)

c. For coding ship COSAL validation data.

3.1.3.2.2 Ship's Force Use – The SSDI is used by ship's force personnel:

a. As a checklist for planning inspections (POT&I, post-ROH, etc.)

b. To provide a common language for maintenance documentation

c. As a reference for determining completeness of PMS coverage and identifying related EIC and SWBS codes

d. To provide a common set of system descriptions for the development of PEB/LOE instructions, plans, etc.

e. To identify shipyard and ship's force work interfaces

f. As an aid for shipboard COSAL or system/equipment validation and coding.

3.1.3.3 Program Relationship

The SSDI provides the common language, through use of its fifth level coding, for cross-referencing elements of all overhaul planning modules, construction of data files, and retrieval of data. The codes also interface with the MIS programs by virtue of their SWBS structure.

3.1.3.4 Products Produced

The SSDI module is used to generate a ship-class, SWBS-based SSDI book. This book can also be used manually for many purposes, without reliance on the computer processing systems. Appendix B discusses applications of the SSDI.

3.1.3.5 Hardware and Software Requirements

Implementation of the SSDI module requires a computer system and magnetic tape file storage for batch processing routines. Interactive routines require full-time sharing capability, including disk file space. The computer system utilized at PHNSY is the basic Honeywell 6060.

Batch programs include COBOL and FORTRAN software that allow retrieval, manipulation, and modification of all SWBS fifth-level codes. Although the narrative description of the systems is contained in the data base, no keying is done on that field. In the interactive mode, "BASIC" programs allow the instant retireval of any system or subsystem by input of SWBS number, including the output of a line drawing representing the hierarchy and position of the subsystem.

3.1.3.6 Schedule

Initial batch and interactive applications are complete for FF-1052 class ships. SSDI books for the DDG-2 class are under development, and scheduled for completion in January 1976. Additional SSDIs will be developed for other classes of ships as required.

3.2 TECHNICAL DATA INDEX

3.2.1 Background

Essential to the development of the overhaul improvement program is a means of assembling significant technical data about the overhaul. For a ship, information is available concerning equipments installed, plans and technical manuals, and such items as repairs significant to the PEB/LOE, but this information is not tied together by a common index nor easily extracted from the various reference sources. In addition, there is no way of assembling significant items that develop during the planning or overhaul phases, such as significant CASREPTs, problem repair items, or repair parts to be alert for. To alleviate these problems, the Technical Data Index (TDI) was established, and this Overhaul Improvement Program module is described below.

3.2.2 Purpose

The Technical Data Index module was established to provide a means of assembling significant technical data about the overhaul. The goal is to gather, index, analyze, and record data useful in preparing for the current overhaul and the improvement of future overhauls.

3.2.3 Description

3.2.3.1 Data Base

The TDI module consists of several data files, indexed to the SSDI to permit retrieval of all pertinent information concerning a specific system/component. Separate files are provided for:

a. Ship validation data resulting from the NAVSEC-SECAS hull, mechanical, and electrical (HME) and electronics validation programs. This file contains descriptions of equipments installed on the ship, their location, CID, quantities, responsible work centers, etc. By virture of its SSDI code and CID, component repair-part data can be extracted from the APL data tapes furnished by SPCC.

b. An index of selected plans, drawings, technical manuals, and other design software to each level of the SSDI. The software will be stored in an accompanying microfiche file for rapid retrieval.

c. Data covering PEB/LOE-significant items as gathered from past overhauls and LOEs, and data supplied by other activities such as PERA(CRUDES). This file can be used to ensure that this work is covered during the overhaul, either by the shipyard or ship's force.

d. General information, set up for storage by any user of any information he desires to retain for planning the overhaul. Examples would be a significant CASREPT that a planner would want to consider when deciding what repairs should be made to an equipment, or the identification of equipments repaired in a previous overhaul that had unforeseen material problems or exceeded an estimated cost by a significant amount. The intent of the general file is that it be a user-oriented means of serving individual needs.

3.2.3.2 Users

The Technical Data Index files are available for use by overhaul planning personnel. Depending on the type of data they require, such as repair parts needed, specific plans to reference or use, number of equipments installed, etc., they can retrieve the information from the appropriate file by entering the applicable SSDI code. Design and Production personnel can also access the files for data to carry out their functions.

3.2.3.3 Program Relationship

The TDI and its associated files provide a tie-in between other Overhaul Improvement Program modules for storage and retrieval of specific data. The TDI supports preparation of the SARP, the ordering of repair/replacement parts/ equipment, work packaging, and the writing of production work specifications.

3.2.3.4 Products Produced

The TDI provides visual representation of specific data items required through time-sharing methods, or produces reports of specific data information as requested. Reports can consists of any degree of information on file related to a specific SSDI code/level.

3.2.3.5 Hardware/Software Requirements

Implementation of the Technical Data Index module requires a computer system and magnetic tape file storage for batch processing routines. Interactive routines require full-time sharing capability, including disk file space.

A series of FORTRAN data storage and management programs is included in this application. All data are stored in a standardized file format to allow one set of programs to accomplish all maintenance functions. An independent set of FORTRAN programs has been developed to support the SECAS-HM&E validation program, which encompasses data input forms used in shipboard validation and three types of output reports. A set of interactive BASIC programs for direct inquiry into the data files has also been developed.

3.2.3.6 Schedule

All TDI programs are currently operational at PHNSY. The plans and technical manual data file have not been completely loaded into the H-6060 computer system; however, this is being accomplished as time permits.

3.3 SHIP ALTERATION PROGRAM

3.3.1 Background

The accomplishment of ship alterations (military and technical improvement alterations, ordnance alterations, electronics field changes, etc.) during an overhaul constitutes a significant portion of the overhaul work package. Knowledge of the alterations programmed for accomplishment, material required, and plans available or to be prepared is essential for orderly planning of the overhaul and the completion of the work.

Late authorization of alterations, lack of required material, and late plan development have caused many overhauls to be completed late and beyond budgeted funds. Various systems are in operation for resolving these problems, but successful overhaul planning and accomplishment still require that the shipyard actively manage the alteration portion of the work package.

3.3.2 Purpose

The Ship Alteration Program was initiated to aid in identifying the status of plans and material for planned alterations, to alert managers to problem areas, and to otherwise support the accomplishment of the alterations. This Overhaul Improvement Program module will interface with the FMP through NAVSEA's Ship Alteration and Management Information System, and with the Alterations and Projects Program.

3.3.3 Description

3.3.3.1 Data Base

The principal data base for the Ship Alteration Program module is that of the FMP and SAMIS, supplemented by information obtained from other sources such as PERA(CRUDES), the Planning Yard, NAVSEA (shipalt material control), and A&P reports. Data are assembled early in the overhaul planning phase and indexed by the SSDI.

3.3.3.2 Users

Information from the Ship Alteration Program is made available to shipyard planners and project coordinators for development of POT&I plans, preparation of the SARP, and material ordering. Additionally, the information can be used to determine the feasibility of accomplishing the alteration, i.e., whether the plan and material status support the overhaul schedule.

3.3.3.3 Program Relationship

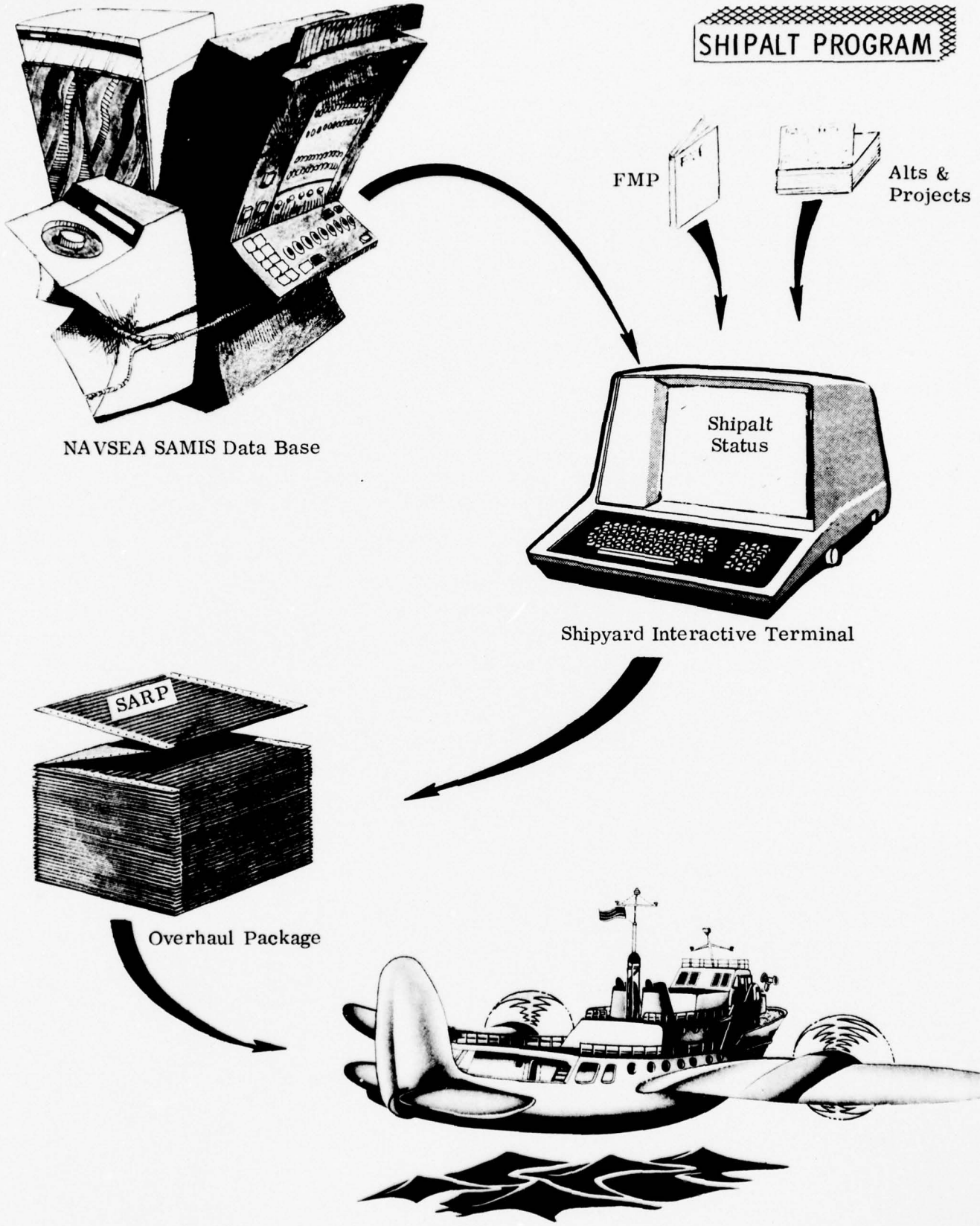
The Ship Alteration Program provides valuable information (the alteration portion of the SARP) to several other modules of the Overhaul Improvement Program. With the equipments/systems affected by an alteration known, the POT&I plan can be refined to eliminate unnecessary tests and inspections. Alteration material information is provided to the Material Support module to permit early ordering of material. This module also provides useful information to the Work Packaging, Production Work Specifications, and SFOMS modules.

3.3.3.4 Products Produced

The Ship Alteration Program produces hard-copy reports listing programmed alterations and the plan/material requirements and status for each alteration. This same information is also available on an on-line basis.

3.3.3.5 Hardware/Software Requirements

The Honeywell 6060 computer system, including time sharing and communications capabilities is required for this module. A data link is required between PHNSY and the SAMIS computer system in NAVSEA, which uses voice grade lines.


SHIPALT PROGRAM
FMP
Alts &
Projects
NAVSEA SAMIS Data Base
Shipalt
Status
Shipyard Interactive Terminal
SARP
Overhaul Package

PHNSY is currently loading data into shipalt data files in a manual gathering mode, using Alterations and Projects Program and Fleet Modernization Program information. Program requirements have been designed for both batch processing and interactive access based on the NAVSEA SAMIS program technical specifications. The actual software incorporating the SAMIS data link has not been prepared, pending completion of SAMIS. Software from the PHNSY general-purpose data storage and retrieval system, keying all data by SWBS number, is currently being used.

3.3.3.6 Schedule

The Ship Alteration Program will not be operational until the SAMIS program has achieved its initial milestones and permission is granted for PHNSY to access the system. Several successful tests have been run linking the shipyard H-6060 via the time-sharing communications link to Navy East Coast computer facilities, and operating the H-6060 from remote terminals on the East Coast over voice-grade telephone lines.

3.4 MAINTENANCE MATERIAL HISTORY

3.4.1 Background

Knowledge of maintenance history can be a valuable asset in the planning for ship overhaul. Early identification of equipments/systems having high maintenance requirements can alert the overhaul planners to include these items in the work package and take action to obtain the necessary repair material. This information can also be used to reduce the scope of or pinpoint POT&I requirements.

Material History Reports are available through the 3M program and the Casualty Report system. Additionally, significant information can be obtained from past overhaul records. There exists a need, however, to assemble this information and index it for ready access.

3.4.2 Purpose

The purpose of the Maintenance Material History module is to assemble maintenance history data on a ship's equipments and system, index it to the SSDI, and have it readily available to overhaul planning personnel. Knowing the past history of repairs for identified high-maintenance systems/equipments will permit overhaul planners to proceed with planning for necessary repairs without waiting for CSMP or POT&I inputs. In addition, this program will permit retaining pertinent past-overhaul experience and records for use in planning future overhauls.

3.4.3 Description

3.4.3.1 Data Base

The data base for this module will be developed from various reports available from the 3M program for the ship class and individual ships. This information, currently indexed by EIC will be cross-indexed to the SSDI to correlate it with the other program modules. In addition, data from the Casualty Reporting system and past overhaul records will be similarly indexed and added to the data base.

3.4.3.2 Users

Data from the Maintenance Material History module will be used by the overhaul planners to develop the SARP and the POT&I plan. Known repair jobs will be identified and required repair material ordered. Data will also be used in work packaging, and in preparation of production work specifications.

3.4.3.3 Program Relationship

This module provides data to the POT&I, SARP, Material Support, Work Packaging, Production Work Specification and SFOMS modules.

3.4.3.4 Products Produced

Hard-copy reports of equipments/systems having a history of high-frequency repairs are produced by SWBS/SSDI category. Information will also be available through time-sharing.

3.4.3.5 Hardware and Software Requirements

Implementation of the Maintenance Material History module requires a computer system and magnetic tape file storage for batch processing routines. Interactive routines require full time-sharing capability, including disk file space.

Maintenance Material History data are taken from the 3M system in two ways:

a. Manually selecting CASREPT summary data from printed outputs, and reinputting the data through COBOL programs to reside in the PHNSY standard data base, keyed by SWBS number.

b. Using FORTRAN programs, taking data directly from UNIVAC tapes (3M) and reformatting and keying the data in SWBS sequence in the data base for the Maintenance Material History module. BASIC programs allow on-line access during the periods the shipyard has loaded the magnetic tape file to disk.

3.4.3.6 Schedule

Most of the Maintenance Material History programs are currently functioning; however, the data bases are still small. Complete summary CASREPT data for the FF-1052 class for the past year are available, but daily CASREPT data are just beginning to be captured. The inputting of component maintenance history data will begin about March 1976. Input of pertinent past shipyard data on overhaul maintenance will commence following the completion of the USS WHIPPLE overhaul in April 1976.

3.5 CURRENT SHIP'S MAINTENANCE PROJECT

3.5.1 Background

The Current Ships Maintenance Project, a product of the 3M program, provides ship maintenance managers with a consolidated listing of deferred corrective maintenance items. Such items are originally reported to the TYCOM on OPNAV form 4790.2K; the data are entered in the 3M computer; and reports are provided the ship monthly.

The CSMP provides the basic input for starting the preparation of the repair portion of the overhaul work package. In theory, this document should provide adequate information for the shipyard to initiate repair planning. However the deferred actions usually do not contain sufficient narrative information to fully describe the problems and the required repairs. In addition, the items are indexed by EIC and not the SWBS, and the CSMP is usually not complete or up to date.

3.5.2 Purpose

To improve the usefulness and quality of the CSMP for application by the shipyard, this overhaul planning module is directed to maintaining the CSMP on the shipyard computer. The first step is to have ship's force enter the SWBS coding on deferred action forms using the SSDI. The shipyard will then maintain a file of the CSMP and update it monthly using data tapes from the 3M computer. To improve the quality of the data entries, the shipyard reviews the CSMP with ship's force early in the planning phase.

This module interfaces with the SARP, and provides initial inputs for the ship's overhaul repair package and data for preparing the POT&I plan.

3.5.3 Description

3.5.3.1 Data Base

The data base for the CSMP module is the ship's CSMP file, provided by the 3M program and indexed by SWBS. Updates are obtained monthly from the 3M computer.

3.5.3.2 Users

The CSMP is used by overhaul planners to assemble the preliminary SARP and to plan the POT&I; and by the shipyard and ship's force to develop the SFOMS data base.

3.5.3.3 Program Relationship

The CSMP module is a key source for the items to be included in the repair package portion of the SARP and in the SFOMS, and also provides data for developing the POT&I plan.

3.5.3.4 Products Produced

The products from this module are listings of a ship's deferred maintenance items, identified as to EIC, SWBS, cognizant work center, and accomplishing activity. Information as to related plans, technical manuals, and CIDs is also included.

3.5.3.5 Hardware and Software Requirements

The CSMP module requires a computer system and magnetic tape file storage for batch processing routines. Interactive routines require full time-sharing capability, including disk file space.

Only the batch-mode FORTRAN programs are currently developed. These programs allow manual input of form 4790.2K data or automatic input of the UNIVAC CSMP tape from the 3M system. The 4790.2K data are stored in the Honeywell system in a format similar to that of the CSMP file, with the addition of SWBS keys.

System and programming specifications have been prepared for the interactive time-sharing mode. This software also interfaces with the SFOMS module for direct update of the CSMP at overhaul completion time.

3.5.3.6 Schedule

CSMP tapes for FF-1052 class ships have been loaded and monitored on the H-6060 computer system for several months. The intent is to maintain monthly updated CSMP files for all ships beginning 10 months prior to overhaul start date. The time-sharing mode will be completed when the necessary disk space for data storage becomes available.

3.6 PRE-OVERHAUL TEST AND INSPECTION

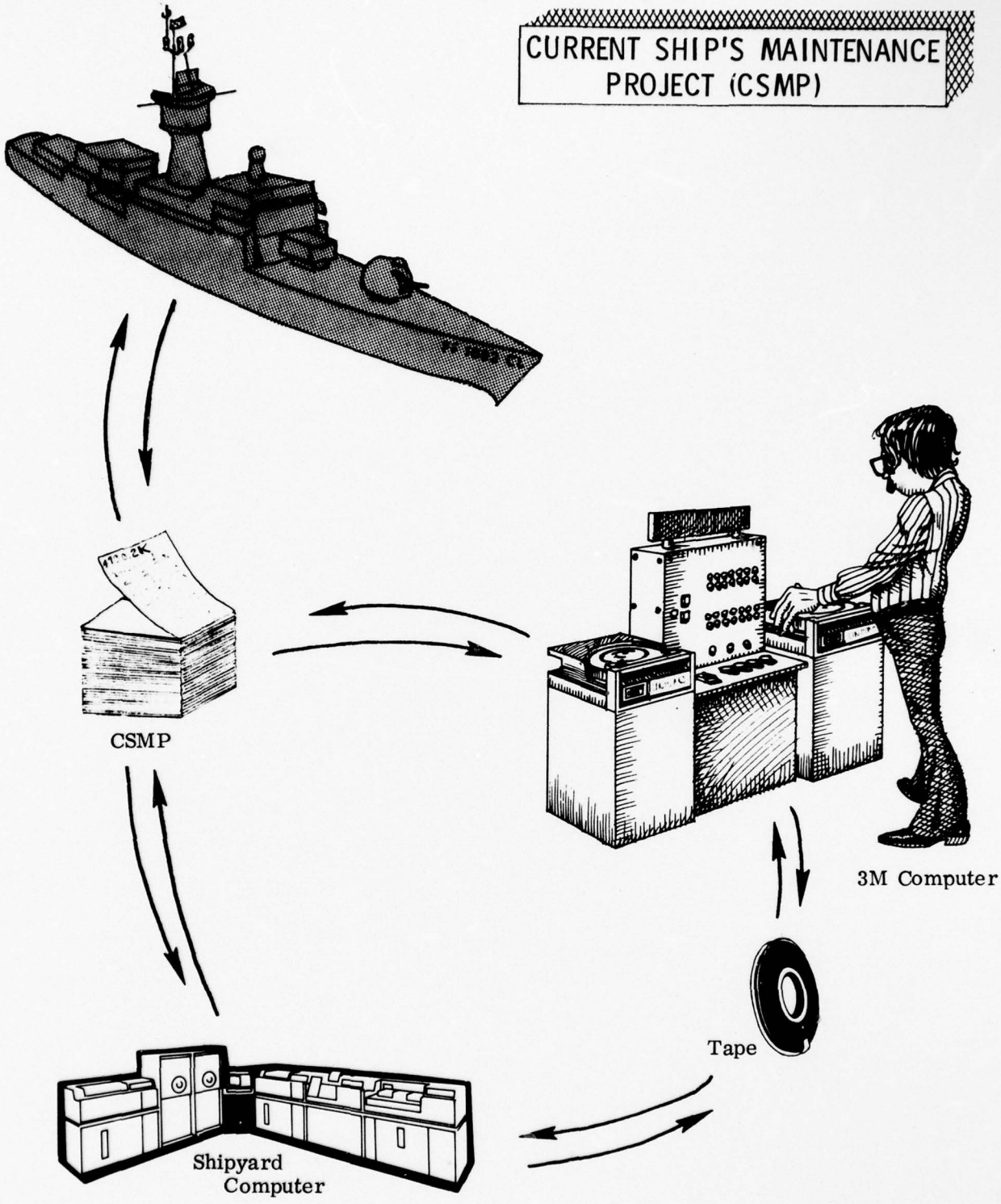
3.6.1 Background

Pre-Overhaul Test and Inspection is accomplished early in the overhaul planning stage to provide data for determining the actual condition of a ship's systems and equipments, and recommending required repairs. Current practices require preparing a POT&I plan in the form of a book that provides for test and/or inspection of all ship systems and equipment. Results are recorded on a Repair Inspection Record (RIR) that is part of the book.

The POT&I plan is usually prepared by the overhauling shipyard, but can be prepared by PERA or another shipyard. The plan is divided into systems in accordance with the SWBS. It is supplemented by test memorandums and other design software when required.

Under existing procedures, a new POT&I plan is prepared for each ship. There is no procedure, however, for refining the plan as the Ship Alteration and Repair Package is developed, by deleting the requirement for a T&I of those systems and equipments identified as requiring major repair or replacement. By restricting a POT&I plan to only those items truly requiring T&I, considerable time and money can be saved in this phase and higher quality results should be obtained. Automation of the data base and the plan preparation should also reduce costs.

CURRENT SHIP'S MAINTENANCE PROJECT (CSMP)



3.6.2 Purpose

The POT&I program has the objective of providing an accurate picture of the ship's material condition and valid recommendations for formulating the repair package. This will result in identifying the work necessary to:

a. Improve the ship's material condition to better ensure safe and reliable operation during its operating cycle.

b. Meet the material conditions required for a successful PEB/LOE.

c. Assemble an accurate overhaul work package.

Secondary objectives of this program are to automate the preparation of the POT&I and the recording of the results, and to incorporate feedback information for improving and refining the POT&I process.

3.6.3 Description

3.6.3.1 Data Base

The POT&I plan is based on the ship class (FF-1052) POT&I plan developed from experience accumulated during testing on several ships of the class. The plan has been generated to provide documentation of the tests and inspections required to formulate a comprehensive repair package and to document the rationale for recommended repairs. The plan divides the ship into systems in accordance with the SWBS-based SSDI, thereby ensuring that all systems/equipments are covered. It is supplemented by detailed test memos and software necessary to systematically test/evaluate major components of the ship.

The POT&I plan will be computerized and simplified so that it can be automatically generated based on the ship's systems and components. The plan will be keyed by a standardized file containing the narratives of system tests and procedures. The program will receive inputs from the CSMP and provide an interface with the SARP.

3.6.3.2 Users

The POT&I plan is used by the shipyard's shipcheck team, and by ship's force, to conduct tests and inspections and record the results.

3.6.3.3 Program Relationship

The POT&I plan is the guidance vehicle for testing and inspecting ship systems and components, recording the results, and providing recommendations for better defining the overhaul work package. The results and recommendations are major inputs to the SARP. The POT&I plan is refined by inputs from the CSMP, Ship Alteration, and Material History modules.

3.6.3.4 Products Produced

For every system and component tested and/or inspected, the POT&I plan produces an RIR that documents the system/component material conditions, the recommended repairs, and the rationale for determining those repairs.

3.6.3.5 Hardware and Software Requirements

Application of the POT&I module requires a computer system and magnetic tape file storage for batch processing routines. Interactive routines require full time-sharing capability, including disk file space.

Preliminary system specifications for the required set of COBOL and FORTRAN programs have been prepared, but no software is available. Some of the software from the CSMP program will be employed to generate the modified 4790.2K forms that will be used for recording the POT&I results. Only batch processing will be used initially. When the POT&I program machine interfaces with the SARP, SSDI, and Overhaul Test Program modules have been implemented, the BASIC interactive software will be developed.

3.6.3.6 Schedule

The initial computerized POT&I plan is scheduled to be applied to USS HOLT in May 1976.

3.7 SHIP ALTERATION AND REPAIR PACKAGE (SARP)

3.7.1 Background

The Ship Alteration and Repair Package is a compilation of all work to be accomplished during overhaul by the shipyard and associated Forces Afloat activities. This book contains six parts:

a. Part 1, General Information

b. Part 2, Preface

c. Part 3, Ship System Work

d. Part 4, Work List Item Cross-Index

e. Part 5, Record of Changes

f. Part 6, Glossary

Part 3, Ship System Work, is subdivided into 10 parts, one for each of the major groups of SWBS. Individual work items are contained within Ship System Work Descriptions within each SWBS group, and these SSWDs are identified by System Work List Item Number. This seven-digit alphanumeric code designator identifies the SWBS group, the type of work, and the customer. Each SWLIN includes identification data (hull number, system and job title, job control number, etc.), estimated costs, and work descriptions in accordance with a prescribed format.

The SARP is usually prepared by the overhauling shipyard. Initial inputs to the SARP are generally shipyard/TYCOM routine items and identified alterations, after which are incorporated repair items, POT&I items, cost estimates, etc., as they become available. The proposed SARP (consisting of all identified work) is then screened by the customer, who authorizes the specific work to be accomplished. The authorized SARP then becomes the prime document identifying what work is to be

accomplished, and by whom. From that document, the work is scheduled, job orders prepared, and material ordered.

Because of the size and complexity of a SARP for a specific ship overhaul and the variety and quantity of the various entries required, its preparation is time-consuming and costly. The revising and updating of a SARP, from its conception until overhaul completion, is a tedious task. Consequently the quality of SARPs varies considerably, and they are seldom error-free.

3.7.2 Purpose

To facilitate the preparation of SARPs, PHNSY established a program to generate a computerized SARP for the overhaul of USS WHIPPLE, and to expand on this with a goal of preparing a baseline SARP for FF-1052 class ships. With such a SARP existing in a computer data base, future preplanning SARPs are to be computer generated. This baseline SARP would make full use of information accumulated from previous overhauls of ships of the class, and utilize the shipyards' experience as to what repairs can be expected. The direct benefits expected from computerization of the SARP are:

a. It may be quickly and easily modified to reflect current decisions affecting work.

b. All estimated costs are automatically recomputed and summarized, together with growth estimates.

c. Data elements may be automatically entered into the MIS data base, thus eliminating the manual completion of transaction forms and the keypunching of data (i.e., job order, man-hour, and material estimates)

d. The mechanics of printing preliminary SARPs for the Work Definition Conference and final SARPs for distribution is greatly simplified.

e. Its data interface readily with that of other Overhaul Planning Program modules. For example, ship's force's data from SARP can be used to provide the initial loading of the SFOMS file, and the Job Breakdown records can be used to prepare an initial JO/KO writeup.

3.7.3 Description

3.7.3.1 Data Base

The data base for the FF-1052 class SARP consists of the SARP file developed for USS WHIPPLE, supplemented by information from other FF-1052 class overhauls. This file will eventually become a baseline SARP containing essentially all significant jobs relating to ships of the class. From this file, a preliminary SARP can be produced for a specific ship overhaul early in the planning stage. A new file, using the baseline SARP as a base, is then generated for each ship. This file compiles all proposed shipyard and associated ship's force work, divided into authorized/nonauthorized repairs and shipalts.

Throughout the overhaul planning phase and the overhaul, the data base is continually updated. Direct interface with the CSMP and SFOMS modules is provided, with SWBS/SSDI indexing used.

3.7.3.2 Users

The SARP file is used by the overhaul planners to display the current status and content of the overhaul repair and alteration work package.

3.7.3.3 Program Relationship

The SARP is a key module of the Overhaul Improvement Program, since it interacts (receives and outputs data) with the majority of other program modules.

3.7.3.4 Products Produced

This module produces an updated SARP (see sample, Figure 3-4) at intervals as required by the overhaul planning process, such as before and after the work definition conference. In addition, ship's force jobs from the SARP can be used for initial loading of the SFOMS file, and the job breakdown records can be used in preparing the production work specifications.

3.7.3.5 Hardware and Software Requirements

Application of the SARP module requires a computer system and magnetic tape file storage for batch processing routines. Interactive routines require full time-sharing capability, including disk file space.

The SARP batch system programs (FORTRAN and COBOL) have been developed and are being used to produce SARPs for USS WHIPPLE and USS KNOX. An interactive (FORTRAN and text editor) system is under development that will enhance the batch system by greatly speeding the process of changing the file to reflect detailed changes in the work package.

3.7.3.6 Schedule

As noted above, the SARP batch system is operational. The interactive system is scheduled for use on USS HOLT starting in June 1976.

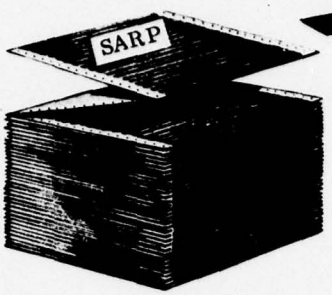
3.8 WORK PACKAGING

3.8.1 Background

Before the advent of the Work Oriented Job Order System, work specifications or job orders were issued individually for most authorized work items. Some grouping of "like" work items was accomplished, but there were no standard procedures or instructions for doing so. Issuing jobs in this manner sometimes resulted in duplicate coverage of work, redoing work (because a completed job interfered with a later job), or missed work. Additionally, the production shop's work scheduling and cost accounting was difficult and time consuming.

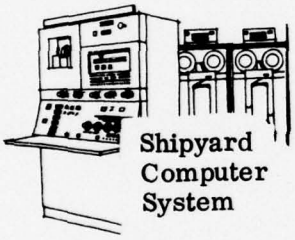
Under the WOJO system, work is to be planned and packaged in the manner in which it is to be accomplished by the various production shops. Full implementation of this sytem requires detailed guidelines and procedures for assembling these work packages.

WORK PACKAGING

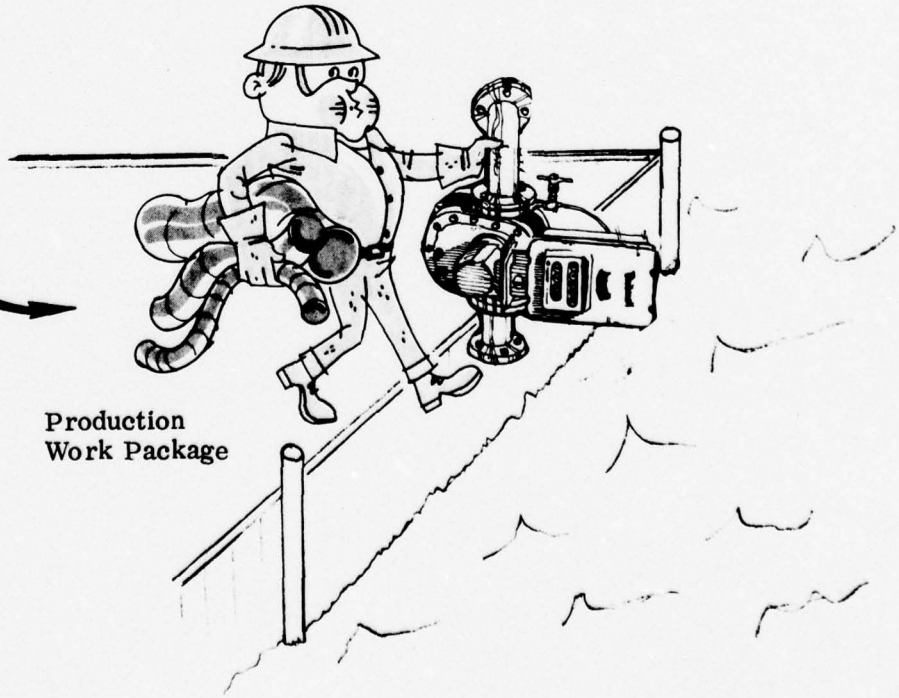


Overhaul Package

Work Package
Guidelines —
FF-1052



Shipyard
Computer
System



Production
Work Package

USS WHIPPLE — SWLIN 245A01 REV 1 — SHEET 1 OF — SARP PAGE 39

DATE RUN 04/12/75

SHIP SYSTEM WORK DESCRIPTION

HULL NUMBER	SYSTEM	JCN	TITLE
1062	PROPULSORS		PROPULSION

SWLIN	SWBS	EIC
245A01		F303

I. SCOPE

LINE	SEQ	FMT	JCN	DESCRIPTION	M/H	MATL $	COST $	ASGN PRI
1	1	1		REMOVE PROPELLER, SHOP PERFORM COMPLETE MECHANICAL INSPECTIO	1476	550		SY
1	2	1		IAW DESIN MEMO OF 10/7/4, REPAIR PROPELLER TO NORMAL/ROUTINE				
1	3	1		PROCEDURES, FIT AND REINSTALL.				
2	1	1		TAKE SHAFT RUNOUT READINGS AND FURNISH REPORTS ON SHAFT AND	0	0		
2	2	1		PROPELLER READINGS TO DESIGN FOR EVALUATION/RESOLUTION.				

LEAD WS	P&E	PEID	JOB ORDER	CLASS EST	DOC CON NUC SUB JIT RAD	DR NO
237	W. HQ	7WH1	1634424510	FEASIBILITY		

II. JOB BREAKDOWN

LINE	SEQ	FMT	SWBS	LCODE	KCP	WS	MHR	KCP TITLE
1	0	2	245ICM	237	320	38	184	REMOVE PROPELLER
2	0	2	245ICM	237	320	31	1114	REPAIR PROPELLER
3	0	2	245ICM	237	321	38	178	REINSTALL PROPELLER

ENGR MATL J/I 1 J

III. REMARKS

1	0	3	PDT # I 245-[illegible]
2	0	3	ESTIMATE REVISED TO COVER REPAIR OF PROPELLER IAW CCDP
3	0	3	LTR 3/22/5.
4	0	3	ESTIMATE SUBJECT TO CHANGE UPON DOCK INSPECTION AND UPON
5	0	3	RECEIPT OF SHOP REPORTS.
6	0	3	REPAIR WORK REQUIRES THE FOLLOWING GAGES:
7	0	3	2010 HAF 0389, BLADE GAGE 2010 HAF 0390, HUB GAGE
8	0	3	AVAILABLE FROM NAVSEA UPON REQUEST BY COGNIZANT TDO

P-SHOPS	02	06	11	17	23	26	31	38	41	51	56	64	67	71	72	74	99	TOT MHRS	TOT LBO
MHRS	60	8	28	10	136		800	222				60		16	80			1420	29933

MATL SOURCE	28/29	SS	JML	TMATL	N-SHOPS	20	19	24	32	33	39	30	34	35		
MATL ESTIMATES	0	350	200	550	MHRS			32						24	56	1283

ESTIMATED GROWTH OF 20% = 37752

TOTAL P&E LABOR ESTIMATES 1476 31216

SALES EST (MATRL TOTAL) 550 31766

Figure 3-4. Sample Output of SARP Module

3.8.2 Purpose

The purpose of the Work Package module is to provide instructions/procedures and assign responsibilities for accomplishing the industrially oriented work packaging of all authorized work compatible with WOJO. Its goal is to produce a combination of work items packaged in a manner that can best be accomplished as a single integrated effort by production shops within minimum time and cost. Work packaging is to be accomplished through complete cooperation and participation by PHNSY Planning & Estimating, Design, and Production.

3.8.3 Description

3.8.3.1 Data Base

Overhaul work is planned and packaged on a system, area, equipment-type, or scheduling basis. The package can consist of one authorized work item or several from the SARP, and from one or more funding sources. Thus repair, shipalt, ordalt, etc., type work can be combined into a single work package if the proper criteria are met.

Work packaging guidelines and category definitions are provided for reference. These guidelines constitute a catalog of routine work packages sequenced by shop group, shop, ship type, and SWBS number. As experience is gained, these guidelines will be upgraded based on historical data concerning past packaging methods, experience on like ships, and inputs from the production shops and planners/ estimators. Computerization of these guidelines is planned.

Work packaging is accomplished by a group made up of representatives of the Planning and Production departments. Work packaging commences with the initial establishment of SARP SWLINs 8 months prior to the overhaul start date.

3.8.3.2 Users

The work packages developed by this module are used by planners and estimators to prepare production work specifications, and by scheduling personnel to schedule the work accomplishment.

3.8.3.3 Program Relationship

The Work Packaging module relies on the SARP for the authorized work items to be packaged, and provides the work packages for preparing production work specifications. All data are indexed by SWBS/SSDI. Data are also provided to the Material Support Module.

3.8.3.4 Products Produced

By application of this module, authorized work items are packaged into an industrially organized unit that can be managed and scheduled economically and accomplished efficiently.

3.8.3.5 Hardware and Software Requirements

Application of the Work Packaging module requires a computer system and magnetic tape file storage for batch processing routines. Interactive routines require full time-sharing capability, including disk file space.

The FORTRAN programs that produce work packaging worksheets from the SARP data base are now in use, and additional programs that help accomplish FCN to ICN proration are being tested. A manual data base comprised of work package guidelines for all production shops is being tested; these guidelines will be fed into the computerized data base via COBOL input programs. The BASIC software allowing interactive access to the data will be developed in the near future.

3.8.3.6 Schedule

Overhaul of USS BADGER (commencing July 1976) will be the first full test of the Work Packaging module. This application has been employed to a limited extent on the USS KNOX overhaul (start date February 1976). The time-sharing portion of this module cannot be employed until more disk space is available.

3.9 PRODUCTION WORK SPECIFICATIONS

3.9.1 Background

The Production Work Specifications, in the form of job orders and key operations, is the means of communicating instructions to the Production Department for the accomplishment of work elements. The generation of timely, comprehensive, and accurate work specifications is essential for a good overhaul. It is anticipated that with a succession of similar ship-class overhauls, the workload will be highly repetitive and the added time and cost of preparing higher quality work specifications will be justified.

3.9.2 Purpose

The purpose of the Production Work Specification module is to aid the preparation of higher quality, more comprehensive work specifications, standardized for reuse on future overhauls and suitable for computerization. These work specifications will reflect the SARP scope narrative and the requirements of the Work Packaging and Material Support modules. Technical Repair Standards will be used when available.

The goal supported by this module is to issue all possible work specifications before the overhaul start date, and to expedite the issue of those for requirements generated during the open and inspect stages of the overhaul.

3.9.3 Description

3.9.3.1 Data Base

As the standardized, high-quality set of work specifications is developed, it will be stored on microfiche and indexed and retrieved through a computerized SWBS cross reference file. Standard shipalts and repair items in the baseline SARP will be covered, and compatibility with the work packaging concepts will be maintained. A supporting file of Technical Repair Standards will also be established.

3.9.3.2 Users

The Production Work Specification job orders/key operations are issued to the Production Department.

3.9.3.3 Program Relationship

The authorized work items from the SARP, and as grouped in work packaging, are the basis for preparing the Production Work Specifications. Data from the CSMP, Technical Data Index, and POT&I modules is also used. Material requirements developed as the specifications are prepared are provided to the Material Support module, and material availability and identification data are obtained from that module.

3.9.3.4 Products Produced

Job orders/key operations are produced and delivered to the Production Department, providing instructions for the accomplishment of the authorized work.

3.9.3.5 Hardware and Software Requirements

Application of the Production Work Specification module requires a computer system and magnetic tape file storage for batch processing routines. Interactive routines require full time-sharing capability, including disk file space.

BASIC programs have been prepared that provide for a cross-reference file between SWBS number and a location for storage of the JO/KO writeup on microfilm or microfiche. Due to massive storage requirements and input/output functions for Production Work Specifications, the work specification narratives have not been stored digitally. The programs simply tell the user where to find the data on a microfiche pack or microfilm reel. PHNSY intends to use the same approach for storage and retrieval of Technical Repair Standards being developed by NAVSEA and PERA(CRUDES).

3.9.3.6 Schedule

The above-mentioned software is ready for use, and PHNSY is now proceeding to develop high quality work specifications as the data base. The shipyard estimates that perhaps 6 months to a year will be needed to develop a complete FF-1052 package. The shipyard intends to reevaluate this program once Portsmouth Naval Shipyard begins its pilot program in this area, which does include digital storage of work specifications. The TRSs are due in preliminary form in January 1976.

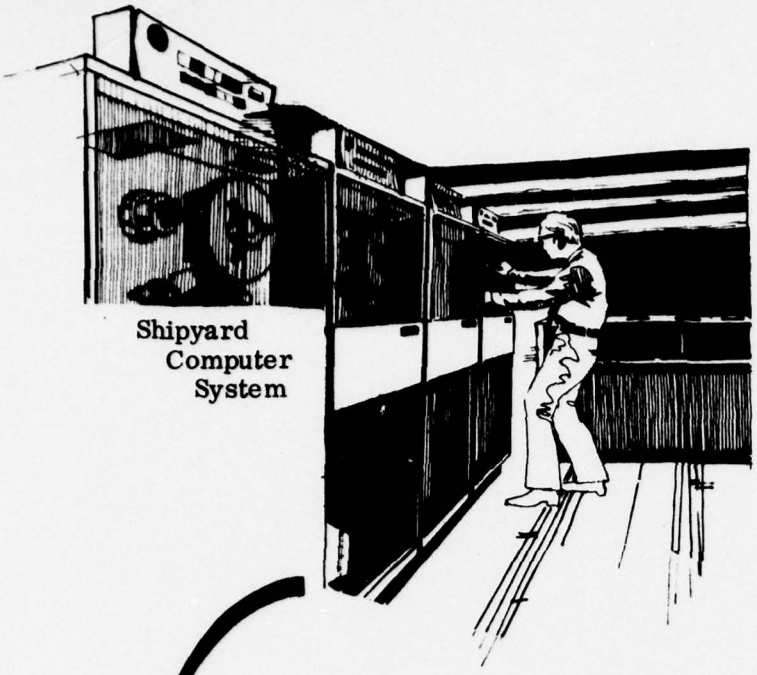
3.10 MATERIAL SUPPORT

3.10.1 Background

One of the principal problems in completing an overhaul on schedule has been to provide the production shops with all necessary hardware in sufficient time. This requires:

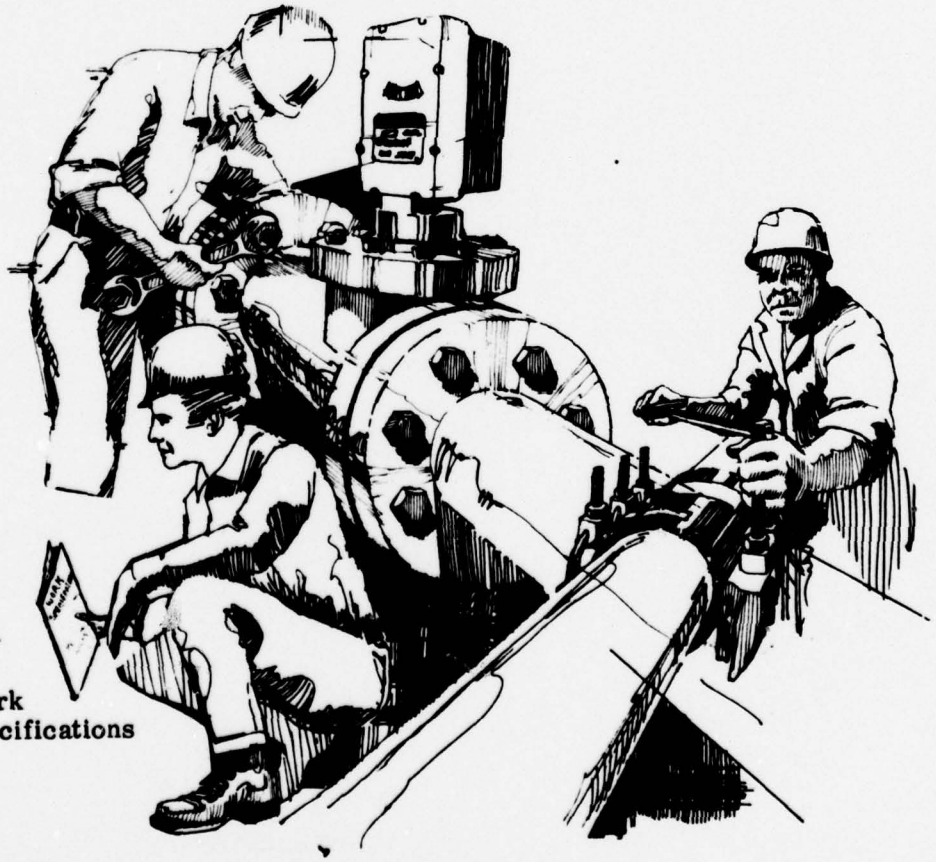
a. Early and comprehensive material requirement identification and requisitioning.

PRODUCTION WORK SPECIFICATIONS



Shipyard Computer System

Microfilm Storage



Work Specifications

b. Streamlining the material requisitioning process.

c. Congruence between material ordering and work packaging/scheduling.

Prior to implementation of a computerized material ordering system at PHNSY, planners were required to extract material requirements for ship overhauls manually from various sources, which involved a substantial amount of clerical effort. Use of historical data was minimal since there were no systematic methods established to identify, categorize, generate, and document these history files. Hence the objectives of the computerized material ordering system were to streamline the process of material identification, requisition, and verification by automating clerical processes, and to systematically build historical files for use in subsequent overhauls.

3.10.2 Purpose

The purpose of the Material Support module is to provide an automated procedure by which ship overhaul material requirements can be identified, requisitioned, and verified (for completeness), using historical files to the maximum extent possible. The goals of this module are:

a. Timely and accurate identification of material requirements

b. Comprehensive material requisitioning

c. Elimination of time consuming and expensive clerical processes

d. Congruence between the material support processes and production scheduling, work packaging, and end-use key operations.

3.10.3 Description

3.10.3.1 Data Base

The Material Support module consists of a series of complex computer software used to automate the overhaul material flow in conjunction with the shipyard MIS Industrial Material application. It results in the automatic preparation of material ordering documents, with a considerable reduction in manual efforts. There is maximum utilization of historical data, yielding an initial data base vice starting from scratch.

Material procurement information from past overhauls is automatically used to generate baseline procurement data. This is primarily accomplished through the use of computerized historical material files. Because of the established material file and peripheral software for management-oriented reports, incomplete ordering actions are more readily identified and material procurement status is readily available.

3.10.3.2 Users

The products of this module are used by overhaul planners to identify and requisition the required material, and by overhaul managers for determining material status during the overhaul.

3.10.3.3 Program Relationship

The material support module, in conjunction with the shipyard MIS Industrial Material application, is one of the key modules during overhaul. It interfaces with the Technical Data Index, SARP, CSMP, and Production Work Specification modules, both providing and receiving data.

3.10.3.4 Products Produced

This module produces the following products:

a. APL/COSAL data identified by CID and extracted from magnetic tapes by the computer to automatically generate scratch material sheets that serve as the principal review and ordering document for planners. Because APL tapes are obtained from SPCC just prior to material ordering, information such as stock numbers and prices are current, thus, minimizing the use of manual ordering information from other sources.

b. Procurement documents (DD-1348s) for standard stock items are computer generated directly from magnetic tape, thus minimizing key-punch requirements. MIS transaction cards for JML screening by ship-stores MIS applications are also computer generated.

c. Computer generated JMLs for P&E are work-package oriented (e.g., by job order/key operation). JMLs for supply are reformatted to be compatible with established supply procedures (e.g., sorted by ordering document number for easy reference). Machine-generated reports can be easily produced for any user per his specific requirements.

3.10.3.5 Hardware and Software Requirements

Implementation of the Material Support module requires a computer system and magnetic tape file storage for batch processing routines. Interactive routines require full time-sharing capability, including disk file space.

More than 30 computer programs have been developed and implemented using both COBOL and FORTRAN source languages to support this module. Maximum use is made of utility programs available with the Honeywell system software. Key programs of this system are modified versions of software developed at Portsmouth Naval Shipyard for the SSN/SSBN material ordering system.

3.10.3.6 Schedule

Use of the Material Support module commenced with material ordering for the overhaul of the submarine USS POGY (late 1974 to early 1975). The module is presently being applied to overhauls of surface ships, e.g., USS KNOX (FF-1052) and USS BADGER (FF-1071). It is significant to note that a standard MIS Material Requisitioning application is currently being developed by CASDO; however, this will be a batch-oriented system that will not include an interactive capability. PHNSY will convert to the use of the standard when it is available, but will continue to use its interactive programs in conjunction with this standard MR.

3.11 OVERHAUL TEST PROGRAM

3.11.1 Background

Overhaul testing in one form or another begins near the middle of the overhaul period and continues until the end of the overhaul. Much of the testing is accomplished at a critical time during the final weeks of the availability. Because of the quantity and complexity of these tests, and of the great variety of shipyard departmental groups having responsibility for accomplishing them, an efficient integrated test organization and management plan is required. Such a plan will result in more reliable and responsive test planning and better execution of testing.

3.11.2 Purpose

The purpose of the Overhaul Test Program module is to prepare a document listing all testing of ship components and systems required during the overhaul. Its goal is to develop a key management tool for ensuring that all necessary tests are performed, and eliminating duplications by coordinating requirements by systems.

3.11.3 Description

3.11.3.1 Data Base

The test plan will consist of a document, initially prepared manually, that lists all test requirements. Development of this plan will be guided by the Integrated Test Plans for SSN-584 and SSN-637 class ships.

The plan will be constructed in a manner that will facilitate future computerization of the data base and of report preparation. The test requirements will be indexed and listed by SWBS/SSDI number. Interfacing requirements between systems will be documented using the SSDI as a guide.

3.11.3.2 Users

The test plan will be developed to be responsive to the needs of all major users, including test personnel, planners and estimators, design personnel, schedulers, and ship personnel.

3.11.3.3 Program Relationship

The test plan produced in this module will use input data from the SARP and its associated modules to identify the tests required, and will provide data for work packaging and preparation of Production Work Specifications.

3.11.3.4 Products Produced

This module will produce an integrated test plan and provide all test requirements needed for the successful completion of the overhaul.

3.11.3.5 Hardware and Software Requirements

Implementation of the Overhaul Test Program module requires a computer system and magnetic tape file storage for batch processing routines. Interactive routines require full time-sharing capability, including disk file space.

System specifications, such as required data elements, integrated test plan output reports, etc., have been prepared. FORTRAN programs that accomplish a similar function for submarine overhauls are being modified to provide the software for this module. Previously developed interactive BASIC programs from the SSDI and SARP modules will be employed to provide some of the required time-share software.

3.11.3.6 Schedule

This program will be made fully operational in the batch mode prior to the start of overhaul for USS BADGER, scheduled for July 1976. The interactive portion cannot be completed before the acquisition of more disk space.

3.12 SHIP'S FORCE OVERHAUL MANAGEMENT SYSTEM (SFOMS)

3.12.1 Background

During the past few years, emphasis has been placed on providing ship's force with an efficient management system for the accomplishment of its portion of the overhaul work package. Original management systems relied on manual assembling of the data and preparation of the reports. These were followed by systems using commercial time-sharing services and operated by ship's force personnel. With the installation of the present computer equipment at PHNSY, it became possible to provide this service directly. In addition, for the first time, the data could be interfaced with the shipyard's MIS data base and the other overhaul program modules.

3.12.2 Purpose

The above-mentioned SFOMS module was developed as an improvement to a system originally developed in 1971 for COMSERVPAC to key the ship's data base to the shipyard's MIS data base. This will permit up-to-date status information for both shipyard and ship's force to be readily available and interchangeable. As the program is further developed, the interchange of information with other modules, such as SARP, POT&I, etc., will be possible. This is in addition to the basic purpose of providing ship's force with an on-line capability for assembling data on its work package and work progress, and providing the required management reports.

3.12.3 Description

3.12.3.1 Data Base

The initial data base for SFOMS includes information on manpower available, job descriptions and key operations, scheduling data, and material requirements. The shipyard assists the ship in preparing this data.

Initial job loading comes from the ship's force work identified in the SARP and CSMP. In addition, there are available some standard ship's force jobs for inserting in the package. Work is described using key operations, and man-hour estimates for accomplishment are developed.

Using key milestones provided by the shipyard, the work is scheduled. The computer then massages the data and prints reports of manpower available vs. manpower requirements for meeting the schedule. As the overhaul progresses, the data are updated to show actual expenditures of manpower and the status of jobs. Through

its interface with MIS, both the ship and the shipyard managers can determine the work package performance.

3.12.3.2 Users

The principal users of the various management reports generated by the SFOMS module are the ship's maintenance managers. The data also provide shipyard managers with the status of ship's force jobs that interface with shipyard work, and permits analysis of manpower available to accomplish the work assigned to the ship.

3.12.3.3 Program Relationship

The SFOMS module will utilize information from the SARP to establish the initial data base. Through the MIS interface, the shipyard can communicate information to ship's force concerning such data as key milestone dates and changes, JO/KO schedules, etc. In turn, SFOMS will provide the shipyard with the status of work that interfaces or impacts on shipyard work. SFOMS also relates to other program modules, including CSMP, POT&I, and Material Support.

3.12.3.4 Products Produced

SFOMS reports can be generated in a variety of reports that permit ship's force to identify jobs started/not started, jobs in jeopardy, material problems, manning problems, etc.

3.12.3.5 Hardware and Software Requirements

The hardware requirements for the SFOMS module consist of a minimum of one terminal for each user, and any interactive computer with batch capability (optimized for the Honeywell 6060 system) and full time-sharing capability, including disk storage.

Supporting software consists of:

a. A report generation and sort program, written in COBOL and batch-based. This program can be initialized automatically by the interactive module. The file maintenance program is written in FORTRAN-Y, and can be run either interactively or in batch.

b. A tutorial program for teaching terminal operators, which is being written in time-share BASIC.

c. Programs for interfacing with the MIS, SARP, and CSMP modules, which are being prepared in COBOL and FORTRAN.

3.12.3.6 Schedule

The file maintenance program and most report generators are complete and operational, and are in use on two overhauls. The tutorial and interact programs are scheduled for completion in early 1976.

4
NAVSEA MIS PROGRAM INTERFACES

The Overhaul Planning Program has focused on solving operational problems and processes that are not automated within the current NAVSEA MIS. To ensure that resources were not wasted by "reinventing the wheel", PHNSY went outside of MIS only in situations where it could not accomplish the desired results by using existing data bases and programs within MIS. Therefore the 12 modules outlined in Section 3 are those functions that could not be implemented within the current processing boundaries, programs, and/or data bases of MIS.

In keeping with the philosophy of supplementing and complementing the MIS, PHNSY designed many of its modules to run concurrently with the standard MIS job stream. In cases where it was needed to assess certain updated data elements from MIS files, such as the Cost Master, they read and operate on the data through programs which run during those times when the magnetic tape files have been mounted in the computer and input to the system as a standard procedure in MIS.

4.1 OPERATIONAL SAFEGUARDS

During the developmental phases of the overhaul modules, PHNSY attempted to eliminate the possibility of disturbing any MIS data bases or program processing. As an example, in the case where it was needed to access the basic data file for the MIS Production Control application (Profile-1501), a duplicate magnetic tape file was made each week. All processing was accomplished from this duplicate set of records.

4.2 USE OF MIS DATA ELEMENTS

Every effort was made to interface with all possible data elements within MIS to eliminate storage and manipulation of duplicate records. For example, the SFOMS program module reads the Production Control Master file for JO/KO start/complete dates for interrelating the shipyard and ship's force production schedule.

4.3 MIS INTERFACE OBJECTIVES

A major goal in interfacing with NAVSEA MIS has been to bridge the gap between existing computerized maintenance and material management applications (3M) and shipyard operation under MIS. As outlined in Section 3, a number of 3M computer-generated reports and data bases provide valuable direct input into the generation of the overhaul repair package. Large subsystems of MIS are dedicated to monitoring this same package from a financial and production scheduling viewpoint.

In interfacing and making the maximum use of NAVSEA MIS in these applications, PHNSY attempted to avoid expansion of MIS programs and making the management system more complex. The shipyard's goal has been to simplify for the users the

operations and management functions of MIS, and make the applications more effective in support of the ship overhaul work. For example, computer-generated work packaging forms based on the SARP file allow for simplified FCN/ICN proration tables and procedures that enhance the use of the "PC" (production control) and "FV" (cost) applications of MIS.

4.4 MIS PROGRAM INTERFACES

Table 4-1 is a matrix depicting those Overhaul Planning Program modules that interface via computer program software with NAVSEA MIS subsystems. Table 4-2 discusses the type or nature of information in each MIS subsystem accessed by the planning modules.

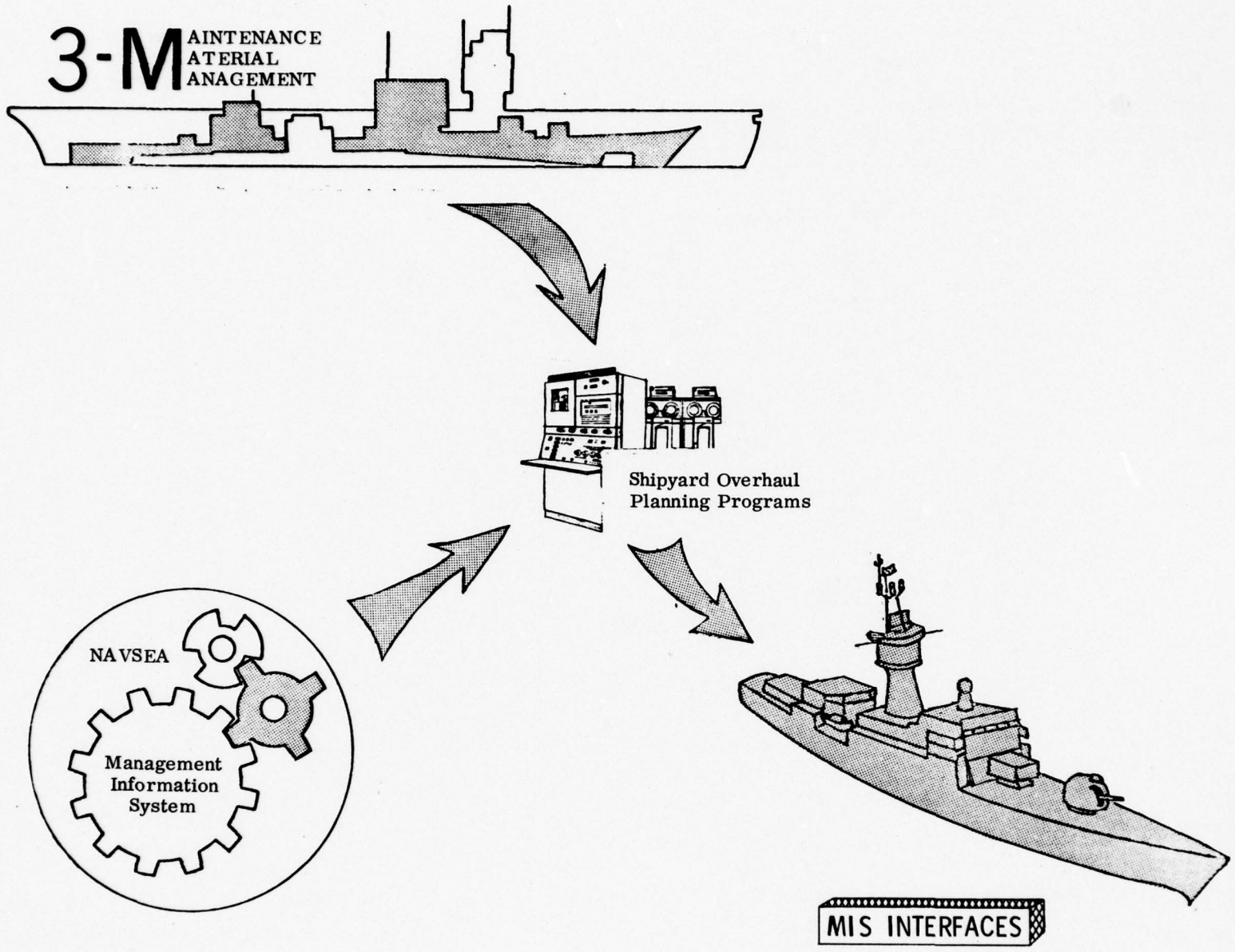

3-M
AINTENANCE
ATERIAL
ANAGEMENT
Shipyard Overhaul
Planning Programs
NAVSEA
Management
Information
System
MIS INTERFACES

TABLE 4-1. NAVSEA MIS SUBSYSTEMS THAT MACHINE-INTERFACE WITH OVERHAUL PLANNING PROGRAM MODULES

Overhaul Planning Program Module	NAVSEA MIS Subsystem						
	Workload Forecasting	Production Control	Production Scheduling	Design	Cost	Industrial Material	Shop Stores
Ship System Def. & Index	X				X		
Technical Data Index				X			
Ship Alteration Program				X			
Maintenance Material History						X	X
Current Ships Maintenance Project		X					
Preoverhaul Test & Inspection		X					
Ship Alteration & Repair Package		X	X	X	X		
Work Packaging		X		X	X		
Production Work Specs							
Material Support						X	X
Overhaul Test Program		X	X	X			
Ship's Force Overhaul Mgt. Sys.		X	X			X	

TABLE 4-2. TYPE OF DATA INTERFACED BETWEEN NAVSEA MIS AND OVERHAUL PLANNING MODULES

NAVSEA MIS Application	Type of Information or Data Element Accessed by Planning Modules
Workload Forecasting	Distribution of man-day forecasts by ship and shop for selected ship systems as defined by five-level SWBS. Included are actual labor force expenditures on issued jobs, and designated manning curves.
Production Control	Key operation and job order status information, such as labor estimates and expenditures, scheduled and actual start/complete dates, etc. A limited amount of cumulative summary data at the COAR level is also read.
Production Scheduling	PERT/CPM network data concerning schedule dates, critical jobs, and event and activity data on selected keyops.
Design	Schedule and status information on design software products. Included are related allowances and expenditures for production of test memos, design drawings, etc. (PHNSY has been working with its own interior design application until the NAVSEA standard is released.)
Cost	Cost Master File, for data such as expenditures at the keyop, job order, and COAR level. Monitoring of Financial Control Number to Industrial Control Number proration matrices is also accomplished.
Industrial Material	Direct interfaces are established with this application in almost every phase of its operations through the computer material order and historical usage system. These automatic interfaces include job material lists, receipts and adjustment data, issues, material status (904 reports), prepricing, bulk material, commitments, shipyard direct material inventory, etc.
Shop Stores	All standard shop-store material procurements and certain inventory transactions.

5
SHIPYARD COMPUTER HARDWARE/ SOFTWARE REQUIREMENTS

5.1 HARDWARE REQUIREMENTS

Additional shipyard computer hardware is required to implement and make fully operational the 12 Overhaul Improvement Program modules. The current shipyard computer configuration can handle the additional batch processing requirements; however, the key to effecting economies in most of these planning applications is having the data bases on-line and immediately accessible.

The present Honeywell 6060 system has a small core memory (96,000 36-word bits), and very limited disk space available for additional application data bases and programs. The CPU core size is sufficient for current NAVSEA MIS operations and time-sharing requirements at PHNSY; however, a test was run simulating full load of the planning modules and serious degradation of response time and batch process throughput was experienced.

All available disk space is currently being used, including some temporary space normally reserved for standard software utilities such as sorts, which are required for efficient program execution. All efforts are being made to share the limited resources until the additional hardware will allow full operation of the planning modules.

The required ADP hardware for implementing the 12 modules is listed in Tables 5-1 through 5-3. Table 5-1 lists the basic minimum computer hardware installed at all Navy shipyards (including PHNSY) to support the current NAVSEA Management Information System; Table 5-2 the additional time-sharing front-end hardware installed on the Honeywell 6060 at PHNSY in support of engineering and scientific applications; and Table 5-3 the minimum additional hardware (to that listed in Tables 5-1 and 5-2) that PHNSY feels is essential to support the overhaul planning modules. The items identified in Table 5-3 were selected as an optimum tradeoff between cost of hardware and the minimum amount of data that must be on-line simultaneously.

Figure 5-1 is a graphic depiction of present and required hardware quantities, as a function of total cost, reflected in the three preceding tables. It should be noted that the entire time-sharing systems (Tables 5-2 and 5-3) make up only 26 percent of the system investment, but will allow many new users at the shipyard to make effective use of the entire Honeywell system.

This additional hardware will allow for a very large volume of data to be stored and accessed on-line, thus making it practical for many users to query status information while selected users can be updating the files. It should be noted, however, that the additional hardware will not allow for all modules and data bases to be on-line simultaneously; selected modules will be loaded for preselected time intervals, thus permitting sharing of the limited resources. Experience at PHNSY has shown that this approach of having certain data available only certain hours of each day or week can be tolerated, and would be utilitarian for all shipyard users.

TABLE 5-1. BASIC HARDWARE, HONEYWELL
MODEL 6060 COMPUTER SYSTEM

Item	Model/Type	Qty	Description
1	CS6060	1	6060 Central System with one processor, one system controller, 64K memory*, and one input/output multiplexer with six CPC channels and one PSI channel.
2	MM6060	1	Additional 32K memory
3	IC6002	3	Additional IOM channels
4	CO8030	1	Master console
5	MTC502	1	Magnetic tape dual channel controller
6	MTH505	7	Magnetic tape handler (9 track)
6A	MTH504	1	Magnetic tape handler (7 track)
7	CRZ201	2	ASCII card reader
8	CPZ201	1	ASCII card punch
9	PRT201D	2	ASCII printer
10	DSS181	1	Disk storage subsystem with one controller for three storage units.
11	DSU181	3	Disk storage unit
12	DCH181	1	Dual simultaneous channel
13	MG8030	1	Motor generator
14	GC6000	1	Motor generator control unit

*64,000 36-bit words.

TABLE 5-2. TIME-SHARING HARDWARE ON H-6060 COMPUTER SYSTEM AT PHNSY

Item	Model	Serial	Description	Qty
1	SPA 355	150	Front-end network processor, 16K	1
2	HLA 355	150S	High speed line adapter	1
3	HSC 355	150S	High speed general-purpose channel	3
4	LLA 355	150S	Low speed line adapter	1
5	LSC 355	150S	Line speed channel package interface	5
6	MM6060	1060	Memory, 32,000 words	1
7	–	–	Remote terminals, all low speed (10 to 30 cps); Singer M-4010050-01; Execuport M-300; UNIVAC DCT-500; Lear-Siegler M-ADM1(CRT).	15

TABLE 5-3. MINIMUM ADDITIONAL HARDWARE NEEDED ON H-6060 TO SUPPORT PLANNING MODULES

Item	Model	Description	Qty
1	MM6061	Memory extension from 131K to 196K words	1
2	DSS190B	Removable disk storage subsystem (236×10^6 characters); includes two DSU190B's (see below)	1
3	DSU190B	Additional disk pack drive (118×10^6 characters)	1

It is felt that with resource sharing, proper distribution of disk and core space, and efficient job stream management to limit CPU processing time, the hardware listed in Tables 5-1 through 5-3 will adequately provide all machine assets required to utilize the 12 overhaul planning modules.

Table 5-4 shows the required disk and core spaces for each of the planning modules.

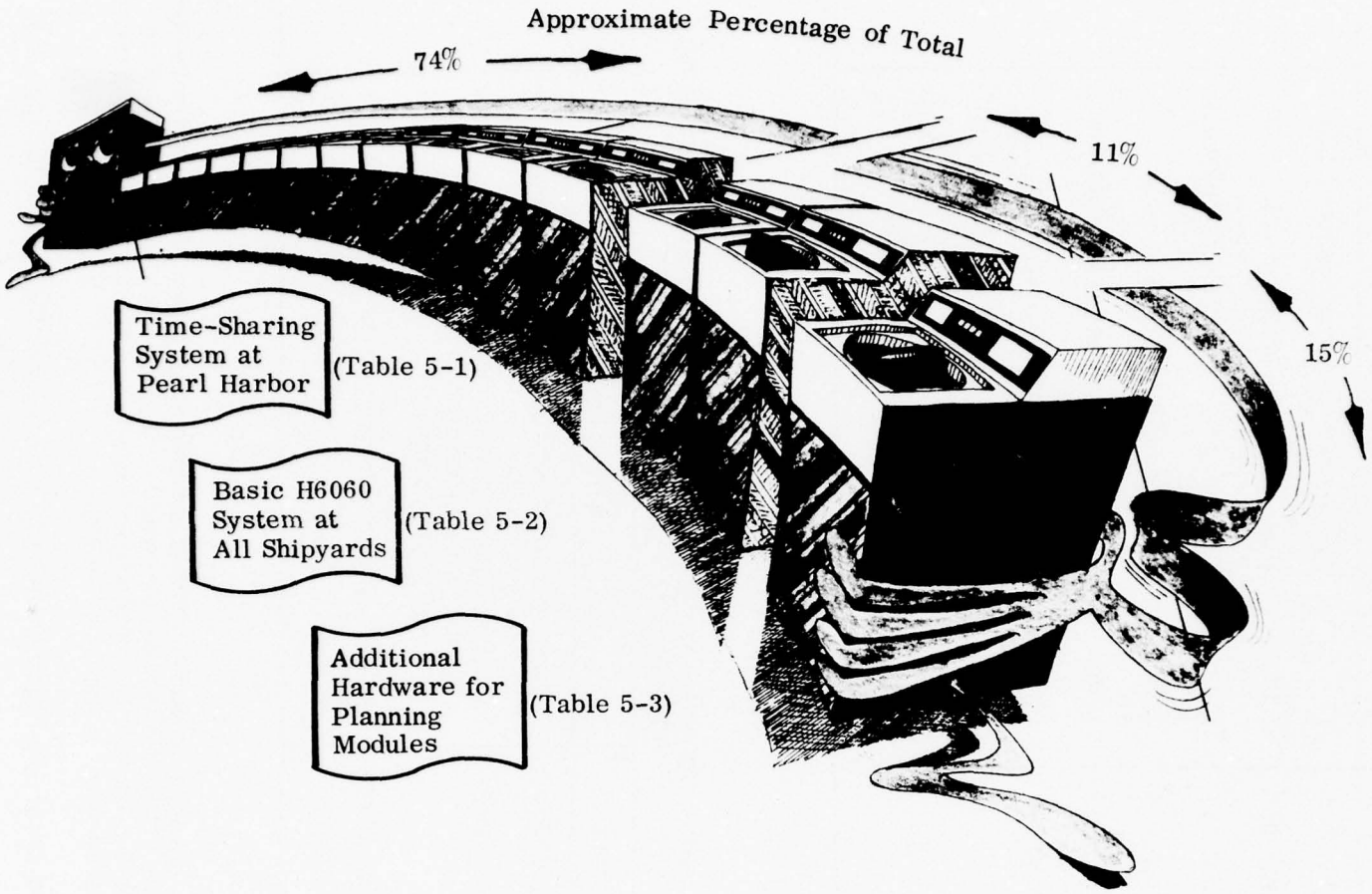


Figure 5-1. Present and Required Computer Hardware at PHNSY for Implementing Overhaul Modules

TABLE 5-4. PLANNING MODULE STORAGE/PROCESSING SPACE REQUIREMENTS

Planning Module	Disk Space Range (Links)	CPU Core Reqmt, 36-Bit Words	
		Monitor	Program
1. Ship System Definition & Index	265-560		15,000
2. Technical Data Index			
Validation/COSAL	660-1400		15,000
Plans and technical manuals	790-1690		20,000
General information file	390-830	8,000	8,000
PEB/LOE	140-260		8,000
3. Ship Alteration Program			
Ship Alteration Management Information System	390-830		20,000
Alterations & Projects	165-420		20,000
Fleet Modernization Program	140-260		8,000
4. Maintenance Material History			
Maintenance Material Management reports	1600-3400	10,000	20,000
Casualty reports	240-540	8,000	10,000
Past overhaul records	1800-3800	8,000	20,000
5. Current Ships Maintenance Project	530-1130		12,000
6. Preoverhaul Test & Inspection	660-1400		15,000
7. Ship Alteration & Repair Package	1060-2250		15,000
8. Work Packaging	265-560		22,000
9. Production Work Specifications			
Job orders/key operations	1460-3100	8,000	75,000
Technical Repair Specifications	165-420		10,000
10. Material support	Batch	None Additional Req'd	
11. Overhaul test program	660-1400		12,000
12. Ship's Force Overhaul Management System	1320-2800	10,000	20,000

5.2 SOFTWARE REQUIREMENTS

The current approach to implementing the 12 planning modules is to develop all application programs within the PHNSY Planning and Data Processing departments. However, due to extremely limited programmer resources within the shipyard and the need to give first priority to daily production and waterfront support, a considerable time period will be required to place the modules into operation and complete their documentation. The documentation includes all operating instructions and training aids needed for the non-data-processing shipyard users of the reports, output forms, and interactive data bases.

Some 200 programs in various states of development make up the software that supports the planning modules. These programs are written in high level, machine-independent languages (FORTRAN and COBOL) in accordance with Navy specifications. Generally, the time-share version of FORTRAN is used for interactive file maintenance and data query, while lengthy reports are prepared in COBOL and output to the high-speed printer in the machine room to take advantage of batch processing efficiencies. The longer reports may be initiated at terminals, and while the output may be too lengthy for convenient printing at the slow-speed remote sites, the software has the capability of scanning the output data for specific information and giving abbreviated reports.

These modules make maximum use of Honeywell standard software, such as utility sorts, text editor, and the subroutine library when appropriate to reduce the programming burden. One significant software feature used is the dynamic allocation of file space, where files are created and released under program control, thereby significantly reducing the amount of "disk space" tied up by a planning module.

It is expected that current contractor support will continue for the major Honeywell software (such as the GECOS operating system) and the major languages (COBOL, FORTRAN, YFORT, and BASIC).

6
PROGRAM TECHNICAL/ECONOMIC ANALYSIS

The technical and economic analysis presented in this section was directed toward that portion of the shipyard's Overhaul Improvement Program comprised of the modules described in Section 3. The analysis considered these modules collectively, since it was considered that evaluation of individual modules would not show the interactive effects of one on the other and their combined support of the program.

The format of this discussion is in general adherence to a Navy-prescribed procedure for evaluating automated data system development plans.

6.1 PROBLEM/OPPORTUNITY STATEMENT

In a comprehensive review of its operations, PHNSY identified several problem areas that affect the completion of ship overhauls on time and within budget. The problems cited by PHNSY are:

a. The size of the repair package is continuously and rapidly increasing.

b. Shipyard workload planning is not performed according to a uniform schedule.

c. Work package preparation is late and inadequate.

d. Ship configuration data are uncertain and unsystematized.

e. Material acquisition is late, and thus more costly (e.g., air shipments, non-bid purchases).

f. Overhaul tasks are manned on a "crash" basis.

g. No common system is established for indexing, storing, sorting, and retrieving overhaul data.

h. Closed-loop feedback in overhaul planning and execution is inadequate and not systematized.

i. There is inefficient learning from one overhaul to the next.

j. Little overhaul-related information is exchanged between shipyards.

Overhaul planning by Navy shipyards is in accordance with specific instructions and procedures. This planning function requires the assembly and analysis of a large quantity of data and information, and the generating of numerous reports, specifications, requisitions, and design documents. The majority of this work is accomplished manually by personnel of the shipyard, primarily those of the Planning Department. In addition, because of the large quantity of data from a variety of

sources, it is not possible to take full advantage of historical records, the degree of commonality of repairs and equipment between ships, etc.

With the installation of the present computer installations at naval shipyards, the addition of time-sharing capability, and the many developments in recent years toward improving ship overhaul planning and management, it is now considered possible to significantly improve the overhaul planning process. Specifically:

a. To determine the material condition of the ship and define the overhaul work package well in advance of the overhaul;

b. To establish accurately and record the equipment configuration of the ship;

c. To estimate accurately the resources (funds, material, manpower, facilities and time) required, well in advance of the overhaul;

d. To identify and order material early to ensure its availability when required for the overhaul;

e. To develop details of the work before the overhaul, package the work in worker-oriented job orders, and provide the necessary technical documentation;

f. To gather, index, analyze, and record significant data regarding the planning, management, and accomplishment of the overhaul, and provide feedback for the next overhaul; and

g. To manage efficiently the accomplishment of the overhaul work, both shipyard and ship's force.

6.2 PRESENT PROCESSES/PROCEDURES

6.2.1 Determination of Ship Material Condition and Definition of Work Package

A shipyard's first knowledge of the material condition of a ship comes with the review of the CSMP or the first receipt of the work request package. This usually occurs at about A-120. The work requirements given in the CSMP or work request package are usually neither sufficiently complete nor descriptive to permit accurate planning for repairs. To further determine the material condition and define the repairs required, a POT&I plan is prepared and tests and inspections accomplished by the shipyard and ship's force. This is done at about A-90, depending on location and availability of the ship. The information obtained from the above sources, supplemented by recent inspection reports by other activities, such as INSURV, PEB, etc., constitutes the material condition of the ship.

The overhaul work package is defined in the SARP. This manually prepared document describes all identified work to be accomplished during the overhaul of the ship. This book is generated by the shipyard in accordance with established instructions and procedures. Preparation starts with the inclusion of identified alterations, shipyard routines, and the initial CSMP/work request items. As planning progresses, the POT&I results, new work items, accomplishing activity, and cost estimates are added.

The above process starts at about A-360 and continues until the start of the overhaul. Updated versions of the book are prepared manually and distributed periodically during the planning phase. Following the work definition conference, the SARP indicates authorized and nonauthorized work. Section 3.7 of this report presents a more detailed description of the SARP.

6.2.2 Determination of Ship's Equipment Configuration

The equipment configuration of a ship is contained in various documents, including ship plans, technical manuals, and COSAL. Once a ship leaves its building yard, the equipments on the ship are repaired, altered, changed, etc.; and unless the technical documentation is continually updated, accurate configuration knowledge is lost. This can result in wrong repair parts/material being ordered, or inaccurate repair specifications being prepared.

To counteract this situation, an equipment validation is conducted, usually prior to the ship's overhaul. When accomplished by ship's force, the validation is of a quality that varies from ship to ship. The information is usually far from complete, and is not organized in a manner easy to use; and equipments and components are generally not identified relative to ship systems. Considerably more accurate and comprehensive results are obtained when SECAS personnel conduct the validation. Such validation efforts are infrequent, however, particularly in the HM&E area. Further, the data have not been indexed to SWBS (except for WHIPPLE) and are thus difficult to manage.

6.2.3 Estimation of Resource Requirements

Accurate estimation of resource requirements necessitates accurate knowledge of the work to be accomplished, when it is to be performed, and the time, money, and manpower available. Alteration work, particularly that which is NAVSEA funded, is generally better defined and earlier in the planning phase than repairs, thus permitting reasonably accurate estimates of resources required.

By the present method of overhaul planning, the repair portion of the overhaul is usually not firm until after the overhaul has started. Results desired from the overhaul are not clearly specified, and are changed throughout the overhaul planning and execution stages. Lack of accurate configuration knowledge and late determination of the material condition and required repairs significantly affect the estimation of resource requirements. This results in late and incomplete detail planning, and consequently impacts on overhaul accomplishment and cost.

6.2.4 Material Requirements

Repair material requirements cannot be determined until the repair work is defined. With the long lead times required for many material items, late identification and requisitioning results in serious problems in accomplishing the overhaul.

Once the repair work is identified, there begins the time-consuming tasks of manually researching the identification of repair parts and preparing the requisitioning documents, and these tasks occur at a time when the personnel should be preparing work specifications. Insufficient knowledge of equipment configurations can result in the ordering of wrong repair parts. Since it is essential to order long lead-time material early, much guesswork is involved and some overhaul intended items frequently end up being surplus.

6.2.5 Detailing Work Requirements

Once the work package is defined, detailed work specifications and supporting technical documentation can be developed. For each work item authorized, a job order/key operation writeup is prepared. Little consideration is usually given to preparing worker-oriented work packages or use of standard job specifications, and at times duplicate work specifications are prepared. Supporting technical documentation (plans, test memos, etc.) is also prepared to support these JO/KOs. Duplication can also result in this area.

6.2.6 Data Management

A large amount of technical data concerning the material condition of a ship is generated during its life cycle. However, because of the way the data are recorded (if at all), and the wide variety of data-collecting vehicles, much of it is lost or not retrievable and cannot be used to plan an upcoming overhaul. Elements of this problem are:

a. No common indexing language is used in assembling the data.

b. The data are widely dispersed, e.g., overhaul records are maintained by the shipyard, design data by planning yards, and material information by Supply.

c. Obtaining information concerning a specific ship and its equipment, indexing it for proper correlation, analyzing it, and then applying the results to the current overhaul is rarely done well (if at all) because time and manpower do not permit. As a result, equipments with a high history of maintenance requirements are overlooked, problem material items are not identified, common repetitive repairs are not recognized, work specifications are duplicated, etc. In effect, the planning for an overhaul essentially starts from scratch each time.

6.2.7 Overhaul Management

Efficient management of an overhaul is essential to meeting time and cost requirements. The shipyard MIS is used to enhance this function. The status of work and costs is monitored constantly and corrective actions are taken when required. Management of ship's force work is usually supported by the SFOMS, which is prepared and updated either manually or with computer assistance.

6.3 OBJECTIVES

6.3.1 PHNSY Overhaul Improvement Program

To resolve the problems discussed in Section 6.2, PHNSY initiated an Overhaul Improvement Program. This program (reproduced in Appendix A) is initially aimed at overhauls of FF-1052 class ships. These ships were selected because the sequential number scheduled for overhaul during the next few years would provide a reasonable base to develop procedures and techniques that take advantage of the common features and repetitive nature of repairs between ships of a class. The stated goal of this program is for the fifth overhaul (USS BREWTON) to cost 75% of the first overhaul (USS WHIPPLE) and be accomplished in 80% of the time. To reach this goal, the following objectives were established.

6.3.2 Determination of Material Condition and Definition of Work Package

Determination of a ship's material condition and definition of its overhaul work package well in advance of overhaul is considered essential, and the following objectives were defined by PHNSY:

a. Development of a ship-class baseline SARP incorporating historical data from past overhauls, computerized for quick-retrieval summation of estimated costs and ease of updating and preparation of copies. This SARP would be the basis for generation of each ship's overhaul SARP.

b. Development of a POT&I program that recognizes those equipments having historically high-maintenance requirements, firmly identified repair items, and the effect of alterations to be accomplished; and reduces the POT&I requirements accordingly, thereby decreasing the cost and time for accomplishing POT&I.

c. Improvement of the quality and availability of the ship's CSMP by maintaining it on the shipyard computer and working with ship's force; indexed for compatibility with the SARP and POT&I programs.

d. Establishment of computerized technical data files consisting of 3M system maintenance material history for the class, CASREPT data, past ship overhaul records, PEB/LOE history, configuration data, etc. These files would be commonly indexed and available on-line for rapid review and analysis.

e. Development of procedures to access and utilize alteration data available from the SAMIS and A&P programs.

6.3.3 Determination of Ship's Equipment Configuration

Accurate ship-configuration information is a prerequisite to effective work package definition, material ordering, work specification preparation, and other elements of the program. Toward this end, the following objective was defined:

a. Support of SECAS validation efforts for each ship; and on receipt of results, storing the data in the computer, indexed for compatibility with other programs.

6.3.4 Estimation of Resource Requirements

Estimation of resource requirements entails early definition of the work package, determination of the budgeted funds, and assignment of the overhaul period. This assures that the resources required will be reserved or acquired and then stockpiled for the overhaul.

6.3.5 Material Requirements

Related to early definition of the work package is the early identification of material requirements. Toward the goal of having 100% of the material required by

by the start of the overhaul, PHNSY established the objective of making full use of computer capabilities to develop programs compatible with MIS that would:

a. Store historical material usage data

b. Prepare scratch material sheets

c. Prepare JMLs

d. Prepare requisition documents

e. Make use of SPCC APL data tapes for latest material information

f. Support work packaging concepts.

6.3.6 Detailing Work Requirements

To enhance the effectiveness with which overhaul work is accomplished, PHNSY defined the following objectives:

a. Develop work packaging concepts to prepare industrially oriented work packages to support the performance of the work in a manner best suited to the production shops.

b. Develop high quality work specification and job order/key operation writeups, standardized for reuse on future overhauls and suitable for computerization. The JO/KO writeups would make full use of available TRSs.

c. Develop an Overhaul Test Program to identify and combine all overhaul testing requirements.

6.3.7 Data Management

To manage the large quantities of data required for the overhaul program, PHNSY established the following objectives:

a. Develop a common configuration language for indexing and sorting data. This language would be in the form of an SSDI, based on the SWBS; and computer adaptable.

b. Make full use of computer hardware, techniques, and procedures in all programs developed.

c. Maintain compatibility and interfacing capability with established computer systems and programs.

6.3.8 Overhaul Management

For increased efficiency in the management of the overhaul, the following objectives were defined:

a. Maximum use of shipyard MIS

b. Increased use of locally (PHNSY) developed management programs

c. Development of an improved SFOMS, whose data programs can interact with those of the shipyard MIS.

6.4 ASSUMPTIONS AND CONSTRAINTS

6.4.1 Assumptions

Establishment of the shipyard's Overhaul Improvement Program was based on the following assumptions:

a. A significant cost savings in overhauling FF-1052 class ships would be realized by establishing a formal program with established program elements, associated milestones, and stated goals.

b. Increased use of ADP with a strong orientation to interactive processing and use of external data systems would significantly improve the overhaul planning process.

c. Existing shipyard computer installation, including the time-sharing front-end hardware at PHNSY that supports scientific and engineering programs, is sufficient to support starting the program.

d. Software requirements could initially be handled by in-house personnel.

6.4.2 Constraints

The following constraints to establishing the shipyard's Overhaul Improvement Program were identified:

a. Lack of a common configuration language for indexing, storing, and manipulating the data.

b. Limited programmer resources and the need to give first priority to daily production and waterfront support could delay full implementation and documentation of all program elements.

c. Limited memory capacity and disk storage without augmentation could limit the effectiveness of the program.

6.5 ALTERNATIVES

To establish the Overhaul Improvement Plan, PHNSY considered the following approaches (some in combination):

a. Continue existing overhaul planning.

b. Refine the existing practices.

c. Develop new procedures/systems.

d. Use similar automated data system or system module already operational.

e. Use existing resources.

f. Use contractor.

These alternatives are discussed below.

6.5.1 Continue Existing Practice

The alternative of continuing existing practices was rejected because of the problems identified in Section 6.1. Current procedures do not take advantage of historical data, the commonality between ships of a class and overhauls, and the advantages offered by ADP. As a result, overhaul costs continue to climb and overhaul availabilities get longer.

6.5.2 Refine Existing Practices

The current overhaul planning process has evolved over many years. The basic elements remain the same: identifying the work required, allocating resources, accomplishing the work, etc. The need is for improved tools, techniques, and procedures for accomplishing the tasks.

6.5.3 Develop New Procedures/System

Analysis of existing data systems (e.g., 3M, shipyard MIS) showed that the design of new system was not required.

6.5.4 Use or Combine with Similar Systems

This alternative is essentially what is proposed herein. The shipyard programs use or interface with established systems and data bases. The elements build on these systems and improve the accessing and manipulation of the data. Existing computer facilities are utilized and, in some cases, added to.

6.5.5 Use Existing Resources

This alternative is used in conjunction with that of Section 6.5.4.

6.5.6 Use Contractor

Contractor support services in selected areas could be required to meet module implementation milestones, but contractor operated hardware will not be needed.

6.6 COSTS

The time allotted for documenting the Overhaul Improvement Program modules, and the available data, did not support a complete economic analysis of the program. The basic premise of the Overhaul Improvement Program is to use the existing ADP installation at PHNSY and the services of its Planning and Data Processing departments.

6.6.1 Hardware Operating Costs

At PHNSY, the only additional computer hardware required to support the planning modules is that hardware delineated in Table 5-3 of Section 5. This hardware leases for approximately $7,000 per month, or $84,000 per year. No additional operating personnel are required at present to support the time-sharing facilities.

For those shipyards having no time-sharing facilities, all hardware shown in Tables 5-2 and 5-3 of Section 5 would be required. This would be an additional expense of about $12,000 per month, or $144,000 per year. However, it would not be necessary to allocate all time-share expenses against the planning modules, since many other in-house applications of the computer system exist.

6.6.2 Program Development Costs

Cost data related to development of various modules and associated documentation was not separately identified and accounted for. The Systems Engineering Group in the shipyard Planning Department has developed and accomplished all work on these modules while continuing to perform its normal operational tasks. Significant among the normal duties of this group is the provision of all scientific/engineering computer support at the shipyard, and Planning Department support of MIS operations. This group comprises four to five engineers who currently spend about 50% of their time developing and implementing these program modules. In addition to this effort, other shipyard codes and departments, such as the Planning and Estimating Division and the Management Engineering and Information Office, provide assistance when required. This assistance has primarily been in the form of critiquing proposed specifications and procedures, or in implementing the use of a program module.

The man-hours expended by the Systems Engineering Group in support of these program modules have been primarily an overhead expense. However, direct labor charges have been used where the program was developed while simultaneously accomplishing an overhaul planning activity in direct support of an overhaul. For example, the computerized material order system was used to order all overhaul material for USS POGY, beginning 1 July 1975; and the SARP module formulated and issued the computerized SARPs for the overhauls of USS WHIPPLE and USS KNOX. These operations resulted in direct labor charges.

Table 6-1 identifies the funding sources for the overhaul modules discussed in this report. Table 6-2 is a listing of specific overhaul planning functions and their associated man-day expenditures for a typical ROH of an FF-1052 class ship. These functions are some of the major ones that the 12 planning modules are being designed to support. The associated man-days are estimated typical expenditures for accomplishing each function for an FF-1052 class overhaul, using existing manual methods and procedures.

TABLE 6-1. FUNDING SOURCES FOR PLANNING MODULES

Planning Module	Funding Source		Remarks
	Shipyard Indirect Overhead	Ship Direct Overhaul	
1. SSDI (FF-1052)	X		Contractor support was used to produce this SSDI. Funds were jointly provided by PHNSY and NAVSEC SECAS.
2. Technical Data Index	X		NAVSEC SECAS provided the validation/COSAL support to this module.
3. Ship Alteration Program	X		
4. Maintenance Material History	X		
5. CSMP	X	X	
6. POT&I	X	X	
7. SARP	X	X	
8. Work Packaging	X		Charleston Naval Shipyard provided much background data for this module. No financial support was involved.
9. Production Work Specifications	X		
10. Material Support	X	X	Portsmouth Naval Shipyard (PNS) provided considerable support from its P&E Division on this module. Financial remuneration was made by PHNSY to PNS.
11. Overhaul Test Program	X	X	
12. SFOMS	X	X	

TABLE 6-2. MAN-DAYS REQUIRED FOR OVERHAUL PLANNING FUNCTIONS

Overhaul Planning Function	Typical Man-Days (Est.) for FF-1052 Class Ship
1. Review and update CSMP.	110
2. Prepare and accomplish POT&I.	1074
3. Maintain latest status of all authorized shipalts, including technical changes, applicable plans, and material availability.	337
4. Ensure knowledge of ship systems and components aboard ships.	215
5. Prepare recommended SARP and refine to final SARP with latest cost estimates following Work Definition Conference.	276
6. Access all applicable plans and technical specifications and make available to work force.	405
7. Identify and order all required material.	1012
8. Package all work in a manner that Production can accomplish most effectively.	313
9. Prepare all Production Work Specifications.	1264
10. Identify all possible PEB/LOE items and ensure that authorized work includes accomplishing these items.	43
11. Prepare overhaul test plan and ensure that all of its requirements are met.	289
12. Provide a computerized SFOMS and review and monitor the accomplishment of the ship's force portion of the work package.	276

6.7 BENEFITS

The benefits to be achieved from implementation of the Overhaul Improvement Program are discussed below. Some of the benefits have already been noted, but are repeated here for continuity of discussion.

Because the program is just being started, benefits in terms of specific time or dollar savings cannot be identified. The main stated goal of the program – to reduce the man-day cost of an FF-1052 class ship overhaul by 25%, and the length of the overhaul by 20% – will not be evaluated until FY 78/79. However the results of earlier overhauls in the series should provide, at some earlier date, indications of progress toward achieving this goal.

6.7.1 Benefits of Meeting Program Objectives

6.7.1.1 Early Determination of Ship Material Condition and Definition of Work Package

Successful completion of this objective will result in:

a. An accurate picture of the ship's material condition

b. Provision of valid recommendations for formulating repair requirements

c. Early development and approval of the complete repair and alteration package (70% at A-8 months, essentially 100% at A-3 months)

d. Elimination of nonessential work

6.7.1.2 *Early Determination of Ship's Equipment* Configuration

Meeting this objective will significantly improve the quality and accuracy of work package definition, material ordering, work specification preparation, and other elements of the program.

6.7.1.3 Accurate Estimation of Resource Requirements

Improvement in this area will ensure realistic assignment of work to the shipyard, ship's force, and IMA.

6.7.1.4 Development of Material Requirements

Benefits from developing this program will be improvement in material availability and in reutilization of excess material. The goal is that all of the needed material be available at the start of the overhaul.

6.7.1.5 Detailing Work Requirements

Successful meeting of the objectives in this area will result in:

a. Improvement and standardization of work packaging for Production Department efficiency.

b. Standardization of repair and alteration work.

6.7.1.6 Effective Data Management

Efficient management of data is essential to the success of an overhaul. Accomplishing the objectives will result in:

a. Improvement and standardization of job engineering and planning.

b. Improvement and standardization of software.

c. Effective feedback of information from one overhaul to the next.

6.7.1.7 Effective Overhaul Management

The benefits obtained from meeting the overhaul management objectives will be improved overhaul planning and accomplishment, early alerting to problem areas, and cost-effective management of funds and manpower.

6.7.2 Benefits from Using Computerized Tools

In addition to the benefits discussed above, the use of computerized tools would result in the following additional and supporting benefits:

a. Relieve personnel of considerable routine and quantitative decision-making.

b. Increase productivity of the work force by replacing detailed clerical tasks with review functions.

c. Reduce the number of human errors associated with processing.

d. Increase the value of the available information due to greater timeliness (i.e., reduced processing time).

e. Reduce per-unit processing costs.

f. Provide rapid mobilization and expansion potential through computer files.

g. Permit more comprehensive analyses through utilization of information not previously available.

h. Reduce physical storage requirements for data files due to greater density of magnetic storage.

i. Rapid availability of well indexed information that previously has been unavailable.

j. Less dependence on the memories of a few experienced personnel.

6.7.3 Overall Benefits

Implementation of the Overhaul Improvement Program and the meeting of its objectives will, in addition to the benefits mentioned above, assist in:

a. Raising the ship's material condition to that necessary to ensure trouble-free operation and performance of missions during the upcoming operating cycles, assuming that organizational, intermediate, and depot level maintenance continues as currently prescribed by CINCPACFLT.

b. Bringing main propulsion and associated auxiliary equipment to the conditions prescribed by the CINCPACFLT PEB.

c. Achieving a successful full power trial before the end of the overhaul.

d. Completing the overhaul within the prescribed time.

e. Expenditure of the minimum funds and other resources necessary to achieve the above benefits.

6.7.4 Summary

In considering the benefits of these Overhaul Improvement Program modules, the only conclusive statement that can be made from available data is that the costs are very small compared with the anticipated benefits and economic returns. If the current level of effort of 3 man-years per year for developing and implementing the remaining nonoperational modules is considered, the associated cost is a small percentage of that presently spent on each overhaul in accomplishing the same functions these modules are designed to support.

One approach for examining costs is to attach a dollar figure to the PHNSY goal for FF-1052 class overhauls. The shipyard is attempting to cut the cost of the fifth overhaul in the current series by 25% and reduce its length by 20%, relative to the first overhaul. If the cost reduction goal is realized, a savings of $2,750,000 per ship would result, based on the present cost of $11 million for an FF-1052 class overhaul. If a linear cost reduction is assumed from the first ship to the fifth, a total savings of almost $7 million would result, as shown in Figure 6-1. Even recognizing that in some planning areas, such as determining the ship's equipment and system configuration, more effort (and thus greater cost) will be required in ADP implementation of the modules, the total investment per year in the new program would still be a small portion of the anticipated cost return for one ship.

No attempt was made to set a dollar value on having an FF-1052 class ship available to the fleet for an additional 7 weeks out of each operating cycle. It would seem, however, that this factor alone would justify the cost of the program.

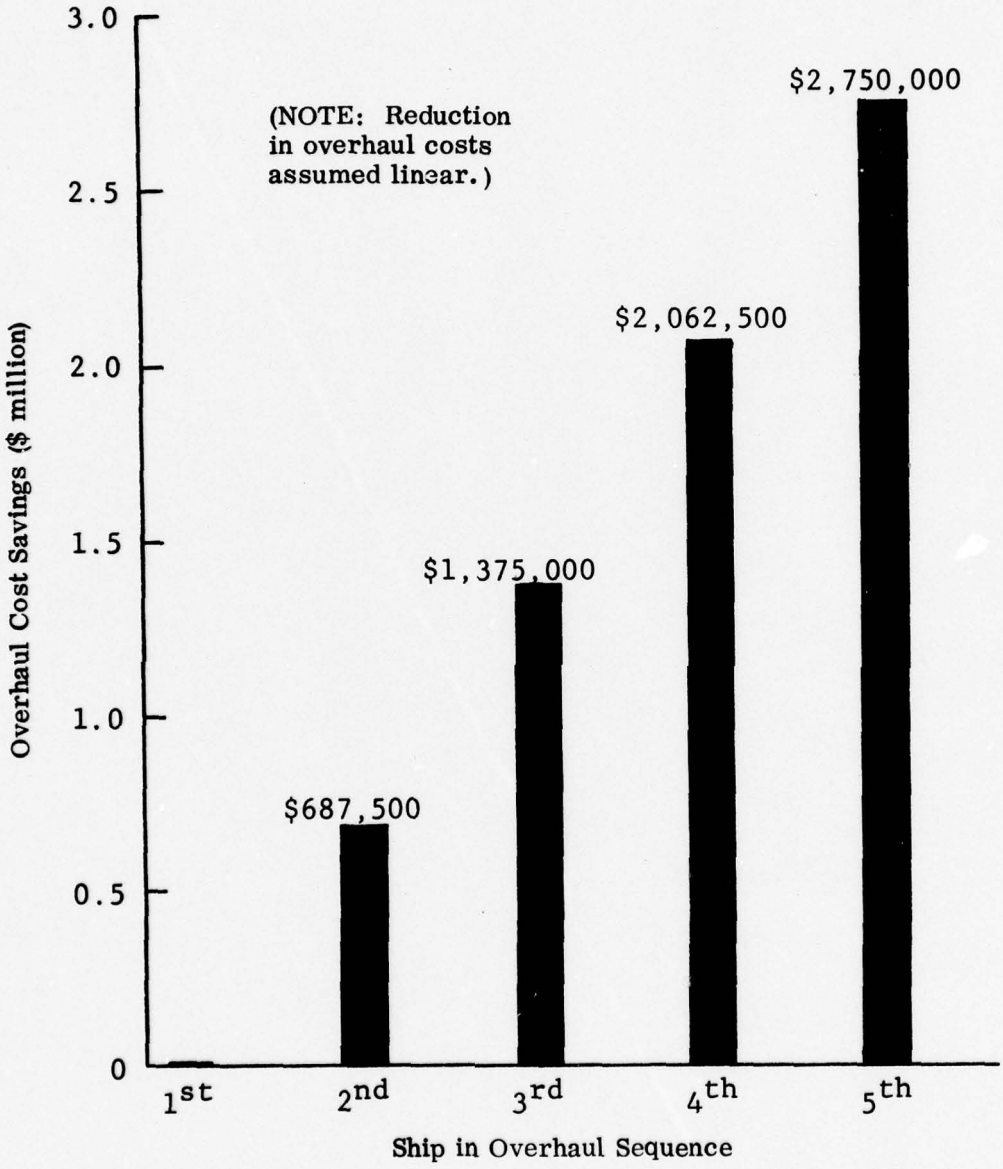


Figure 6-1. Estimated Cost Savings for PHNSY Overhaul Improvement Program

7
CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

Even in this early stage of Overhaul Improvement Program development and implementation, it is apparent that the benefits to be derived from these efforts will far exceed the investment. Present activities, including those associated with the planning modules discussed herein, indicate the possibility of substantial returns in terms of both dollars saved and shorter overhaul availabilities. Pearl Harbor Naval Shipyard now has the computer hardware, software, and technology to achieve automation of functions that traditionally consume large sums of human effort and money, and impose delays in the overhaul cycle. With the provision of additional disk storage, the shipyard's complete program can be fully implemented.

This program, when fully developed, should improve the type commander's ability to make intelligent decisions concerning each availability, and ease the negotiation and work authorization process. The program has been designed to make efficient use of the myriad sources of data available for planning a ship's overhaul. Efficient use of this data has not been possible prior to the application of ADP techniques and equipment.

With the recognition of the many areas of commonality between ships of a class and between overhauls, the use of ADP to index, store, and manipulate data should materially improve the quality of overhaul planning, the cost effectiveness of the overhaul, and the documentation of the ship's post-overhaul material condition. It is believed that the key element of this program is the common indexing of all data to 5th level SWBS, aided by the SSDI application.

The approach being employed in the creation and augmentation of the planning modules, though ambitious, is proving both fruitful and reliable.

It is concluded that the program applications could be effectively used in other Navy shipyards with a minimum of additional ADP equipment and software, since the existing basic computer installations at the shipyards can satisfy most of the requirements. In addition, there are no major changes to existing Navy procedures or systems.

7.2 RECOMMENDATIONS

Based on the results of this study, it is recommended that:

a. Pearl Harbor Naval Shipyard continue developing and implementing these Overhaul Improvement Program modules.

b. That PHNSY procure the additional required computer hardware needed for full ADP implementation of the modules (see Section 5).

c. A complete audit plan be instituted at PHNSY to further document the costs and cost savings associated with the Overhaul Improvement Program.

d. NAVSEASYSCOM select modules demonstrated satisfactorily at PHNSY for future implementation at other naval shipyards.

e. The modules be further reviewed relative to their incorporation directly into the NAVSEA MIS program.

f. Procedures be initiated to eventually adopt the five-level SWBS/SSDI as the single indexing system for the Navy.

APPENDIX A

PHNSY OVERHAUL IMPROVEMENT PROGRAM PLAN FOR FF-1052 CLASS SHIPS

PEARL HARBOR NAVAL SHIPYARD
Pearl Harbor, Hawaii

NAVSHIPYDPEARLINST 4850.104
Code 200
24 October 1975

NAVSHIPYDPEARLINST 4850.104

From: Commander, Pearl Harbor Naval Shipyard

Subj: FF-1052 Class Overhaul Improvement Program

Encl: (1) FF-1052 Overhaul Objective
(2) Comparison of Pearl Harbor Homeported FF-1052 Class Ships
(3) Improvement Work Areas
(4) Class Tasks and Schedule
(5) Requirements, Planning Tasks, and Schedule
(6) Overhaul Planning Tasks and Schedule
(7) Production Phase Tasks and Schedule
(8) Glossary of Terms and Acronyms

1. Purpose. The purpose of the FF-1052 program is to reduce the cost and duration of FF-1052 overhauls by taking advantage of a smooth succession of heel and toe overhauls of Pearl Harbor homeported FF-1052's at Pearl Harbor Naval Shipyard. The goal is to reduce the manday cost and duration of the fourth overhaul following USS WHIPPLE (FF 1062) to no more than 75% of the mandays and no more than 80% of the time of WHIPPLE ROH while accomplishing in each overhaul the repairs necessary to meet the overhaul objective stated in enclosure (1), and equivalent alteration work.

2. Background. The following FF-1052 Class ships are homeported at Pearl Harbor and are currently scheduled or are under negotiation for overhauls as shown below in Table 1.

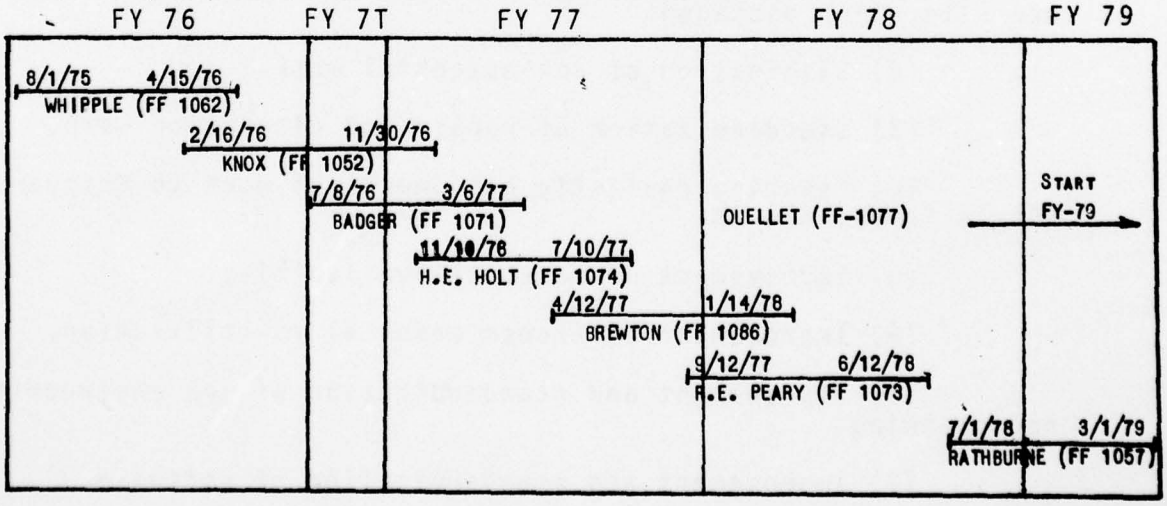


TABLE 1

The Pearl Harbor FF-1052's have a high degree of as-built commonality. Enclosure (2) shows the construction yard and commissioning date, the principal components of the ships as-built, and the significant alterations that have been made to each ship. If the overhaul schedule shown in Table 1 above can be retained, Pearl Harbor Naval Shipyard can effectively plan the succession of overhauls as a group, rather than individually. The ships can be drydocked and berthed in the same location repeatedly. Specialized jigs, tools, fixtures, facilities, and tradesmen teams can be developed and applied that would not be possible for one-of-a-kind overhauls. Some of the advantages of a production line operation can be achieved. Improved overhaul planning and material acquisition and management procedures can be applied that capitalize on computerized indexing, storing, organizing, and retrieving of large volumes of repair and alteration data. Through the effective use of Pearl Harbor Naval Shipyard developed (and other) computer programs and procedures, information that is developed during the planning and accomplishment of one overhaul can be rapidly and efficiently applied to the next.

3. Approach

a. The approach to achieving the goal of reduction in time and manday costs of FF-1052 overhauls will be to IMPROVE THE PRODUCTIVITY OF THE SHIPYARD by taking full advantage of the repeated overlapping overhauls of the eight very similarly configured FF-1052's and improving as many of the procedures as possible that limit the efficiency of planning and production work, including but not limited to:

(1) Early development and approval of complete repair and alteration packaged.

(2) Elimination of non-essential work.

(3) Standardization of repair and alteration work.

(4) Ensuring realistic assignment of work to Shipyard, Ship's Force, and IMA.

(5) Improvement of material availability.

(6) Improvement of excess material re-utilization.

(7) Improvement and standardization of job engineering and planning.

(8) Improvement and standardization of software.

(9) Improvement and standardization of work packaging for Production Department efficiency.

(10) More effective jigs, tools, fixtures, and facilities.

(11) Effective feedback of information from one overhaul to improve the next.

b. To achieve these improvements in efficiency and productivity the required effort will be divided into three avenues:

First: Accomplish work in the work areas discussed in enclosure (3) to provide general and background assistance in accomplishing the second and third avenues of effort.

Second: Accomplish the Class tasks assigned, scheduled, and discussed in enclosure (4) to assist and make specific improvement in FF-1052 overhaul planning and accomplishment.

Third: Accomplish the individual ship requirements planning, overhaul planning, and production work in accordance with the generalized schedule and task descriptions provided in enclosures (5), (6), and (7) respectively, utilizing the procedures and products developed as Class tasks, enclosure (4), and the work accomplished in the work areas, enclosure (3), to maximum advantage.

c. The goals of the FF-1052 program will be well publicized to all hands to stimulate direct and imaginative participation by everyone in the Shipyard. Achievement awards will be authorized liberally to reward those who suggest ways to improve our performance to help meet our goals.

d. Shipyard managers shall communicate freely with other Naval Shipyards and Supervisors of Shipbuilding involved in repetitive overhaul of FF-1052 Class ships. They shall obtain and apply information useful to Pearl Harbor Naval Shipyard in achieving the program goals and shall assist the other shipyards and SUPSHIPS by passing on lessons learned, and other useful information, as rapidly and efficiently as possible.

e. Teams of needed Shipyard personnel will be formed and held constant to perform repetitive complex jobs.

4. Action

a. Enclosures (4) through (7) provide schedules of the principal events of the FF-1052 program.

b. The Shipyard managers assigned as lead codes to plan and coordinate specific tasks and work areas, in enclosures (3) through (7), shall have the authority to make assignments to Shipyard personnel as necessary to accomplish the intent of their assigned work area or task in a timely manner. They shall work through normal Shipyard supervision. Conflicts will be resolved by appropriate levels of supervision.

c. The Shipyard manager assigned as lead code, in enclosures (3) through (7), to plan and coordinate specific tasks and work areas shall keep their supervisors informed of progress and problems through normal channels. In addition, with the coordination of Code 214.2, they shall deliver a quarterly written and oral progress report to the Shipyard Commander, and principal Department and Office Heads.

d. Code 214.2, shall be responsible for coordinating the entire Shipyard effort under the FF-1052 program. He shall also be the lead code for keeping this instruction current.

e. Code 200.03, shall be responsible for coordinating all effort under the program involving computerized procedures or processes.

f. Code 331.1, shall be responsible for coordinating Production Department effort.

g. Code 560, shall be responsible for coordinating Supply Department effort.

h. The Quality Assurance Officer, Code 330, shall be responsible for coordinating the Quality Assurance effort.

i. Special procedures developed under this instruction shall normally be implemented as departmental or Shipyard notices or instructions. Special attention shall be given to including a clear statement regarding extent of applicability of such notices or instructions and cancellation dates. Where the specialized FF-1052 program instructions conflict with standard Shipyard instructions (such as the PPC Manual) the specialized instruction shall clearly state that it supersedes other Shipyard/Department instructions where conflicts exist.

j. A quarterly review shall be coordinated by Code 140 to evaluate progress in achieving the Shipyard goal of progressively improving performance on the total, and the elements of the FF-1052 Class work package.

k. A semiannual review shall be coordinated by Code 140 to determine which FF-1052 procedures shall be incorporated

into standard Shipyard instructions and procedures for other than FF-1052 overhauls. Assignments for instruction revision shall be made by Shipyard notice following the review.

H. A. HOFFMANN

Distribution:
NAVSHIPYDPEARLINST 5210.7A
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Stocked:
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FF-1052 REGULAR OVERHAUL OBJECTIVES

1. To raise the ship's material condition to that necessary to ensure trouble-free operation and performance of missions during the upcoming operating cycle, assuming organizational, intermediate, and depot level maintenance during the upcoming operational cycle as currently prescribed by CINCPACFLT.

2. To bring the main propulsion and associated auxiliary equipment to the condition acceptable to the CINCPACFLT Propulsion Examining Board.

3. To achieve a successful full power trial prior to completion of the overhaul.

4. To complete the overhaul within the time agreed upon at the start of the overhaul with no C-3 or C-4 CASREPTS.

5. To achieve such alterations to the ship as approved by the Type Commander and Chief of Naval Operations.

6. To expend the minimum funds and other resources necessary to achieve the above.

FF-1052 CLASS SHIPS HOMEPORTED AT PEARL HARBOR

SHIP	HULL NO.	CONSTRUCTION YARD	DATE COMMISSIONED
KNOX	(FF 1052)	Todd, Seattle	12 Apr 1969
RATHBURNE	(FF 1057)	Lockheed, Seattle	16 May 1970
WHIPPLE	(FF 1062)	Todd, Seattle	22 Aug 1970
BADGER	(FF 1071)	Todd, San Pedro	1 Dec 1970
ROBERT E. PEARY	(FF 1073)	Lockheed, Seattle	23 Sep 1972
HAROLD E. HOLT	(FF 1074)	Todd, San Pedro	26 Mar 1971
BREWTON	(FF 1086)	Avondale, Westwego	14 Jul 1972
OUELLET	(FF 1077)	Avondale, Westwego	12 Dec 1970

ENCLOSURE (2)

NAVSHIPYDPEARLINST 4850.104
24 October 1975

SELECTED PRINCIPAL COMPONENTS WITH APPLICABILITY TO FF-1052 CL SHIPS HOMEPORTED AT PEARL HARBOR

Legend: x = Applicable
- = Not Applicable

SWBS	SYSTEM	MAJOR CIDS	HULL NOS. 1052	1057	1062	1071	1073	1074
2211BU	Propulsion Boilers	021450070*	x	-	x	x	-	x
		021450071*	x	-	x	x	-	x
		021200184**	-	x	-	-	x	-
		021200185**	-	x	-	-	x	-
2511YR	Forced Draft Blower	057800178	x	x	x	x	x	x
2556Q1	Mn Condensate Pump	016020858	x	x	x	x	x	x
2551Q4	Mn Feed Pump	016031604	x	x	x	x	x	x
2552Q1	Mn Feed Booster Pump	016020863	x	x	x	x	x	x
2561Q1	Mn Condenser Circ Pump	016020850	x	x	x	x	x	x
2623	Mn LO Service Pump	016160528	x	x	x	x	x	x
26413K	LO Purifier & Motor	760200203	x	x	x	x	x	x
		174752353	x	x	x	x	x	x
3111GT	SSTG	162900159	x	x	x	x	x	x
3111G3	SSTG Governor	701110293	x	x	x	x	x	x
3112GT	Emer Diesel Generator	166130007	x	x	x	x	x	x

* Mfr - Combustion Engineering
** Mfr - Babcock and Wilcox

NOTE: FF-1086 & FF-1077 data unavailable at this time.

ENCLOSURE (2)

Legend: x = Applicable
- = Not Applicable

SWBS	SYSTEM	MAJOR CIDS	HULL NOS. 1052	1057	1062	1071	1073	1074
3112G1	Emer Gen Governor	701110282	x	x	x	x	x	x
31414M	400 Hz Motor Generator	181120081	x	x	x	x	x	x
		182930002	-	x	x	-	x	-
42623G	Mk 19 Gyro Compass	252360031	x	x	x	x	x	x
4263DE	Indicator, DRA	282130003	x	-	x	x	x	x
		282130004	-	x	-	-	-	-
4264P1	Plotter	282130001	x	x	x	x	x	x
5141QX	AC Sys Chilled Water Pump	016150611	x	x	x	x	x	x
5141AN	AC System Coolers	326040015	x	-	x	x	-	x
		326040020	x	-	x	x	-	x
		326040023	x	-	x	x	-	x
		326040004	-	x	-	-	x	-
		326040012	-	x	-	-	x	-
		326040028	-	x	-	-	x	-
5142RS	AC Refrigeration Plant	325000305	x	x	x	x	x	x
		325000310	x	x	x	x	x	x
516116	Refrig Unit Condenser	043010181	x	x	x	x	x	x
5161M7	Refrig Sys AC Motor	174751258	x	x	x	x	x	x
5211Q1	Fire Pump	016150582	x	x	x	x	x	x
551103	HP Air Compressor	061900224	x	x	x	x	x	x
551504	LP Air Compressor	061900264	x	x	x	x	x	x

FF-1052 CLASS MAJOR SHIPALT STATUS

SHIP HULL NO.	S/A 0024 AN/SQS-26	S/A 0077 LAMPS-HELO FACILITY	S/A 0080 LAMPS-HANGAR MODS	S/A 0084 COMM PKG	S/A 0087 IVDS-SQS-35	S/A 0096 LAMPS-PERS ACCOMM	S/A 0101 CHT-SEWAGE
WHIPPLE (FF 1062)	AUTH	AUTH	AUTH	AUTH	S/A COMP	AUTH	AUTH
KNOX (FF 1052)	S/A COMP	PARTIAL	PARTIAL	AUTH	AUTH	PARTIAL	AUTH
BADGER (FF 1071)	AUTH	S/A COMP	S/A COMP	AUTH	S/A COMP	S/A COMP	AUTH
HAROLD E. HOLT (FF 1074)	AUTH	S/A COMP	S/A COMP	AUTH	S/A COMP	S/A COMP	AUTH
BREWTON (FF 1086)	PLAN	S/A COMP	S/A COMP	PLAN	S/A COMP	S/A COMP	PLAN
ROBERT E. PEARY (FF 1073)	PLAN	S/A COMP	S/A COMP	PLAN	S/A COMP	S/A COMP	PLAN
RATHBURNE (FF 1057)	S/A COMP	S/A COMP	S/A COMP	PLAN	PLAN	S/A COMP	PLAN
OUELLET (FF 1077)	S/A COMP	S/A COMP	S/A COMP	S/A COMP	N/A	S/A COMP	S/A COMP

S/A COMP - SHIPALT COMPLETED
AUTH - AUTHORIZED
PARTIAL - PARTIALLY COMPLETED-AUTHORIZED
PLAN - PLANNED TO BE DONE
N/A - NOT APPLICABLE

WORK AREAS FOR IMPROVEMENT OF FF-1052 OVERHAULS

To improve the efficiency of FF-1052 overhauls, Pearl Harbor Naval Shipyard is directing its effort at increasing the productivity of the total Shipyard workforce. The major work areas in which we have ongoing work or programs intended to improve productivity that can be brought to bear on improving FF-1052 overhauls are listed and described in this enclosure. A lead code is assigned each of these work areas to lead the Shipyard in meaningful work therein. Code 214.2 is assigned as overall coordinator for this effort and Code 200.03 is assigned responsibility for coordinating and leading the development of all computer oriented work.

Work Area	Lead Code	Assist Codes
1. PRE-OVERHAUL TEST AND INSPECTION (POT&I)	219	200.03, 225,244, 190
2. SHIP ALTERATION & REPAIR PACKAGE (SARP)	219	200.03, 225,377
3. MATERIAL HISTORICAL USE AND ORDER SYSTEM (MR)	225	200.03, 560
4. SUPPLY DEPARTMENT - MATERIAL SUPPORT	560	
5. SOFTWARE SUPPORT - PLANNING & ESTIMATING DIVISION	225	200.03
6. SOFTWARE SUPPORT - DESIGN DIVISION	244.1	200.03
7. WORK PACKAGING	219	200.03, 219,235, 375
8. SCHEDULING	375	219
9. QUALITY ASSURANCE	130	240,380, 500
10. PEB/LIGHT-OFF EXAMINATION	330	244.14, 244.16, 365
11. INTEGRATED TEST PLAN	365,190	200.03, 244.14, 244.16

ENCLOSURE (3)

Work Area	Lead Code	Assist Codes
12. FINANCIAL CONTROL & MONITORING	214.2	219
13. SHIP'S FORCE OVERHAUL PROGRAM	200.03	225,375, 190,214.2
14. PREFAB AND REFIT PROGRAM	219	225,240
15. PRODUCTION FACILITIES AND TOOLS	380	240
16. TRAINING AND PERSONNEL ASSIGNMENT	330	180
17. INCENTIVE AWARDS AND PROMOTION	160	214.2
18. OUTSIDE CONTRACTOR SUPPORT	214.2	244.2

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2 OF 3
AD A051 809

1. PRE-OVERHAUL TEST AND INSPECTION (POT&I)

Lead Code
219

Summary:

The POT&I program has the major function of providing an accurate picture of a ship's material condition and of providing valid recommendations for formulating the repair package. Our major objectives in enhancing this effort are to automate the preparation of the POT&I software, restructure the time table for accomplishment to better fit the ships' operating schedules, improve and refine the plan with a feed back loop to eliminate unnecessary testing or add essential inspection procedures, and to modify the total program to allow direct interface with the CSMP and SARP programs.

Brief Discussion:

Pre-Overhaul Testing and Inspection will be accomplished in three distinct phases in the overhaul planning stage to provide the necessary data for determining the actual condition of a ship's systems and equipments, and recommending required repairs. Practices call for preparing a POT&I plan in the form of an automated report that provides for testing and/or inspection of all the ship's systems and equipment. Results will be recorded on a form called a Repair Inspection Record (RIR) which is in the format of a 2-KILO Form from the 3M system. The POT&I plan is also supplemented by test memorandums or other Design software when required. Accomplishment of the acutal tests and inspections is by Ship's Force and Shipyard personnel.

Modus Operandi:

The POT&I plan inspection and testing criteria will be reviewed and amended to reflect all experience accumulated to date during testing of ships of this Class.

A method will be developed for use of the 2-KILO Form for documenting the results of the POT&I. This will include documenting the complete rationale for recommended repairs.

The POT&I plan will be systematized in accordance with 5 level Ships Work Breakdown Structure (SWBS) based Ships System Description Index (SSDI), thereby ensuring that all systems/equipments are covered.

1. PRE-OVERHAUL TEST AND INSPECTION (POT&I) (Continued)

It is planned to computerize and simplify the plan so that it can be automatically generated based on the ship's systems and components onboard (i.e. those items delineated in the SECAS validation). The plan will be keyed by a standardized file containing the narratives of systems tests and procedures. The program will receive inputs from the CSMP and provide an interface with the SARP.

2. SHIP ALTERATION REPAIR PACKAGE

Lead Code
219

Summary:

Our FF1052CL baseline SARP project is aimed at making full use of information accumulated from previous FF1052CL overhauls and to utilize all of the Shipyard's experience in anticipating and preparing for those SHIPALTS and repairs to be accomplished on upcoming overhauls. This information now exists in a computerized data base so that each individual ship's planning SARP may be computer generated and all data elements manipulated.

Brief Description:

The computerized FF1052CL SARP is a compilation of all proposed Shipyard and associated Ship's Force work for each overhaul divided into authorized, non-authorized, repairs and SHIPALTS subsections. This SARP identifies all work by Ship Work Breakdown Structure (SWBS) and integrates related customer work requirements while eliminating duplication and conflicts in work assignments and groupings.

This SARP data base has been computerized to allow direct interface with other computerized information systems such as CSMP and SFOMS.

Modus Operandi:

All current SARP procedures and instructions are in effect. In addition, the following will be accomplished:

During the preplanning and planning stages of each overhaul, the current Ships Maintenance Project (CSMP) for each ship will be maintained on the Shipyard computer. The CSMP will be keyed by SWBS and updates received monthly from the 3M computer.

The latest status of all approved FF1052CL SHIPALTS including material availability will be accessed through SAMIS and NAVSEA.

A standard repair profile will be maintained within the SARP data base which lists all the ship systems and components which have a high frequency of requiring repair of a major nature.

2. SHIP ALTERATION REPAIR PACKAGE (Continued)

SARP updates will be received from PERA (CRUDES) which represent an accounting of all FF1052CL repair and SHIPALT work at other naval shipyards and SUPSHIP activities.

All information within the SARP will be kept current during the overhaul cycle including material costs and labor manhour changes.

3. MATERIAL HISTORICAL USE AND ORDERING SYSTEM

Lead Code
225

Summary:

This system as applied on FF1052CL overhauls consists of a complex series of computer software used to automate the overhaul material selection and requisition flow in conjunction with Shipyard MIS Industrial Material Application. It basically results in the automatic preparation of material ordering documents accomplished through the use of computerized historical material files. The major objective of this system is to streamline the process of material identification, requisition, and verificiation by automating the clerical process, and systematically building historical files to improve our material support of following overhauls.

Brief Description:

In accomplishing surface ship overhauls in the past at Pearl Harbor, the Planning and Estimating Division of the Shipyard has manually extracted material requirements for ship overhauls from various sources which involved a substantial amount of clerical effort at a critical time.

Use of historical data has been minimal or time consuming since there have been no systematic methods established to identify, categorize, generate, and document these history files.

The major elements of this computer oriented material ordering system include:

(a) Maximum utilization of historical data, thereby having a data base to start with vice starting from scratch.

(b) APL/COSAL data identified by Component Identification Numbers (CID) are extracted from magnetic tapes by the computer to automatically generate Scratch Material Sheets (SMS) that serve as the principal review and ordering document for Planners. This list will be bumped against the SHIPALT material to be ordered to minimize duplication and/or ordering material for equipment which will be removed from the ship. Because APL tapes are obtained from SPCC just prior to material ordering, information such as stock numbers and prices are current, thus minimizing the use of manual ordering information from other sources.

3. MATERIAL HISTORICAL USE AND ORDERING SYSTEM (Continued)

(c) Prepare list for each SHIPALT which can be used on follow ships with the same SHIPALTS authorized keeping in mind that if a SHIPALT is not authorized, repair parts may be needed instead.

(d) Procurement documents (i.e. DD 1348's) for standard stock items are computer generated directly from magnetic tape, thus minimizing key punch requirements and transcription errors. MIS transaction cards for JML screening by shop stores MIS applications are also computer generated.

(e) The procedure establishes a systematized method of ordering material. Because of the established material file and peripheral software for management oriented reports, incomplete ordering actions are more readily identified and material procurement status is readily available.

(f) Computer generated JMLs for P&E are work package oriented (e.g. by JO/KO). JMLs for supply are reformatted to be compatible with established supply procedures (e.g. sorted by ordering document number for easy reference). Machine generated reports can be easily produced for any user per his specific requirements.

(g) Use this system to collect like items (same stock number) and bulk order like items; then, upon receipt of material, sort issues to end-use key operations.

Modus Operandi:

In support of the FF-1052 overhauls material requirements, we will focus our efforts within this system on the following procedures or methodology:

(a) Timely and accurate identification of material requirements.

(b) Comprehensive material requisitioning.

(c) Elimination of time consuming and expensive clerical processes.

(d) Congruence between the material support processes and production scheduling, work packaging and end-use key operations.

4. SUPPLY DEPARTMENT - MATERIAL SUPPORT

Lead Code
560

a. SHOP STORES

Summary:

The availability of a computerized FF-1052 Class SARP and an automated ordering system allows predicting new shop store items instead of waiting for enough usage to qualify the item.

Brief Description:

The shop store system currently picks up new items for stock based upon Planning/Production Departments' recommendations and by reviewing DMI usage. The computerized data files will allow the Supply Department to predict what items will be required in shop stores to support the FF-1052 Class rather than waiting for history to identify what should have been stocked.

Modus Operandi:

The baseline SARP provides the probability of accomplishing a particular repair or alteration. The COSAL files and material data for these repairs/alts are available. By extracting the material data for high probability repair/alts for each ship and then compiling this data, those items with sufficient usage to qualify for shop stores will be isolated.

The qualifiers will be stocked immediately, thus defeating lead time problems for later ships.

Local codes will be assigned to each new item so that the FF-1052 inventory can be selectively managed. This will also allow simplified excessing when the FF-1052 string is completed.

Common "nuts and bolts" items configured to each ship will be stocked in a Pre-Expended Van located near the ship.

The availability of the COSAL tapes will allow stocking repair parts for support of the refit program, LOE critical systems and ACC repairs.

4. SUPPLY DEPARTMENT - MATERIAL SUPPORT (Continued)

b. RIPOUT

Summary:

Improve the ripout function by acquiring local staging area and by improving Planning Department identification of ripouts.

Brief Description:

The first improvement is to acquire a ripout staging area in the immediate vicinity of Dry Dock 4. Space will be provided for shop personnel to accomplish minor restoration of the ripout material on site. Isolating the material close to the dry dock should minimize transportation damage and minimize possibility of loss. This should also allow virtually all material to be under cover precluding damage to lagging, etc., from the weather.

The second and potentially greater improvement is Planning Department providing documentation of ripouts (including interferences to the Production and Supply Departments. This will include providing the ripout tags.

Modus Operandi:

No significant change in procedures is required in the first phase. As the Supply Department improves its capabilities in RIPOUT, a control system providing location and status of each ripout item will be added. Once the control program is operational, SFOMS ripouts and ship to FMAG/TENDER material will be added to the system.

Planning Department participation shows great promise. As alterations or repairs are being planned, ripouts are evident; given adequate Class plans and shipchecks, interferences are also evident. Development of an addendum to current job orders to identify the ripouts and routing the job order via the Piermaster organization would provide the mechanic with all tags and documentation prior to starting the job. Under this system, virtually no item removed from the ship can escape control.

4. SUPPLY DEPARTMENT - MATERIAL SUPPORT (Continued)

c. STORAGE OF PRODUCTION FACILITIES

Summary:

The Supply Department will provide storage for the increased number of jigs, dies and other manufacturing devices.

Brief Description:

The assembly line nature of the FF-1052 Class overhauls will allow economical increased usage of various manufacturing devices. The Supply Department will store these items in order to minimize loss and damage and to free production space.

Modus Operandi:

The increased number of dies and jigs will become a major storage problem for the shops. The Supply Department will provide storage for these devices in Building 159.

The shop will determine what devices are to be stored, make out a shipping/identification tag (MISR) and send the material to the warehouse. Supply will acknowledge receipt by returning a copy of the tag showing location. The devices can be called out by memo, copy of the MISR or telephone.

4. SUPPLY DEPARTMENT - MATERIAL SUPPORT (Continued)

d. EXCESSING

Summary:

Retention of large amounts of excess FF-1052 material appears logical. Additionally, useful data will be provided to other shipyards to increase utilization.

Brief Description:

Due to the large degree of similarity of the FF-1052 Class ships, the possibility of usage of excess material on a subsequent ship is high. Manual sourcing of the material will be improved by including the fifth level SWBS identification in the job order number--this will entail a change in current Comptroller procedures but the gain in information is of great magnitude.

The identification by fifth level SWBS will also allow other shipyards to determine applicability to their work in progress and requisition critical material. This will be accomplished by assigning a unique ship activity (Code 052) in the UDM job order. A special "catalog" of FF-1052 Class UDM will be provided periodically to other shipyards.

Modus Operandi:

Current procedures for control of UDM call for identification of material at the hull type level. This will be modified to the Class level to improve manual sourcing. The major improvement is inclusion of SWBS fifth level identification in the job order vice date inducted to UDM. This allows manual scoping of all material available for a given component or any higher level in the SWBS system. Mechanized sourcing will also continue based upon National Stock Number.

An existent standard MIS report MC-201B reports DMI on hand in job order, then stock number sequence. Since the UDM job order will identify UDM by cost class 76, the class by the next two digits and the fifth level SWBS by the next six (i.e., 7652261345 - repair parts or components of a fuel oil control valve for a FF-1052 Class ship), the sorting provided by this report provides virtually instant access to on-hand assets.

4. SUPPLY DEPARTMENT - MATERIAL SUPPORT (Continued)

This report also indicates date of last action for each item so that slow or non-movers can be identified and excessed within NAVSEA parameters for management of UDM or its successor.

4. SUPPLY DEPARTMENT - MATERIAL SUPPORT (Continued)

e. SFOMS REPORT

Summary:

The Supply Department will assist Ship's Force in material problem areas.

Brief Description:

The work accomplished by the Ship's Force during the availability is often critical to completing the overhaul on time. The Ship's Force work is not exempt from the material procurement problems experienced by the Shipyard. The Supply Department will assist Ship's Force in expediting material.

Modus Operandi:

As each ship enters the Shipyard, the Supply Officer will be contacted and offered training for his storekeepers in expediting techniques. Concurrently, an expediting area and telephone will be offered in the same area as Code 503.

If material is not available in the system, access will be allowed to shop stores on a case basis.

5. SOFTWARE SUPPORT - PLANNING & ESTIMATING DIVISION

Lead Code
225

Summary:

An essential process leading to a successful FF1052CL overhaul is the software support provided by the Planning and Estimating Division to the Production Department. The majority of productive work can be enhanced by the generation of timely, comprehensive and accurate work specifications. Our plan calls for issuance of all possible work specifications prior to overhaul start date and at a rate which meets Production Department requirements, expediting all required modifications and issuance of JO/KOs during the overhaul open and inspect stages.

Brief Description:

In FF1052CL overhauls, we anticipate a highly repetitive workload. It is therefore justifiable to invest in higher quality and more comprehensive work specifications to be re-used on each subsequent overhaul. These standardized work specifications will reflect the SARP scope narrative and material requirements program.

Where possible, all technical specifications will be listed or detailed through provision of discrete pages from technical manuals.

Modus Operandi:

This improvement program includes the following key activities:

(a) A standardized, high quality set of work specifications will be developed for all repetitive SHIPALTS and those repair ietms in the baseline SARP repair profile. These work specifications will be stored on microfiche and indexed and retrieved through a computerized SWBS cross reference file.

(b) All JO/KO issues will be released in a timely manner to support pre-fab and production work. A lead time of 30 days prior to Key OP start date for issuance of all pre-fab Key OPs will be established to support material staging requirements.

5. SOFTWARE SUPPORT - PLANNING & ESTIMATING DIVISION (Continued)

(c) All JO/KO issues will be congruent with and responsive to the new FF1052CL work packaging philosophy and guidelines.

(d) Work specifications shall make maximum use of the new set of technical repair standards (TRS) presently being developed for the FF1052CL by PERA (CRUDES). The preliminary issues of these TRSs are scheduled for release to Pearl Harbor Naval Shipyard in January 1976.

6. SOFTWARE SUPPORT - DESIGN DIVISION

Lead Code
244.1

Summary:

The Design Division can support the FF1052CL overhaul improvement goals by timely issue of the software prior to overhaul start date and streamlining and enhancing its waterfront support during the overhaul cycle. Its software support must be in consonance with the total improvement program such as P&E's Work Specifications Standards, Work Packaging, PEB/LOE Program, and Production's Prefab and Refit Program. Many of these new approaches will require the Design Division to modify the manner in which it prepares and issues software.

Brief Description:

The repetitive nature of the upcoming six FF1052CL overhauls provides an opportunity for the Design Division to streamline its generation of plans, design memos, test memos, and engineering reports and concentrate on waterfront support. A high quality initial plan or memo which is kept current will be applied on all subsequent overhauls. Expedient technical resolutions of waterfront problems which are documented will help us attain our overhaul improvement goals.

Modus Operandi:

All current instructions and procedures governing Design Division support to the waterfront are in effect with the following additions for all FF1052CL overhaul work:

(a) A standard set of plans will be selected from the Ship Plan Index for each FF-1052 keyed to SWBS number in the FF1052CL Ship System and Index Book, and maintained in a separate microfilm aperture card file.

(b) All Design Division software in support of repetitive SHIPALTS and those repair items in the baseline SARP repair profile will be reviewed and refined for use as standard issues.

(c) Shipchecks will be made at JO/KO closure on selected work items to assure installation drawings match the arrangements as accomplished. Revisions to plans

6. SOFTWARE SUPPORT - DESIGN DIVISION (Continued)

and memos will be issued promptly to document variances to ensure their applicability on following overhauls.

(d) Added emphasis will be placed on standardizing SHIPALT installations to support extensive prefab work and to avoid costly unique arrangements. Ship's Force requested variances should be carefully screened and approved only if a substantive improvement in the design is warranted or a cost savings accrued.

(e) All test memos used in both POT&I and production work testing will be of high quality and responsive to the Integrated Test Plan requirements.

(f) All Design Division software will support the new FF1052CL Work Packaging Guidelines and general approach to packaging for the Production Department needs.

(g) Select "jeopardy" jobs and provide special technical support to minimize probability of job turning sour. Provide preventive action feedback to QAO, by Notice of Non-Conformance (NON), on all sour jobs or those which hold up work.

(h) Provide quick reaction waterfront support to minimize overhaul costs.

7. WORK PACKAGING

Lead Code
219

Summary:

It is intended that the results of the work packaging effort be a combination of authorized work items packaged in a manner that can best be accomplished as a single integrated effort by Production in a minimum of time and cost. This tool is aimed at gaining the maximum utility and effectiveness from the Shipyard Production Department's efforts.

Brief Description:

All production work for each of the FF-1052 overhauls will be planned and packaged based on a set of criteria such that a single industrial work package (job order) is issued to production shops for the accomplishment of uniform or similar work elements. These industrial work packages will consist of one authorized work item or a combination of items encompassing repairs, SHIPALTS, and ORDALTS. A set of FF-1052 Class work packaging guidelines for each production shop structured by fifth level SWBS system are being generated based on the following selection criteria:

(a) Functional Systems

(b) Types of Equipment

(c) Area on Location

(d) Scheduling Requirements

(e) Logical Combinations

(f) Category Combinations

All authorized work items for each FF-1052 overhaul will be packaged or grouped based on these guidelines and any unique SHIPALT or repair work provisions or conditions for that overhaul.

7. WORK PACKAGING (Continued)

Modus Operandi:

Following are the key events in accomplishing this work packaging plan is support of FF-1052 Class overhauls:

(a) Establishment of Planning Department work package group.

(b) Completion of preliminary work package guidelines for all production shops.

(c) Preparation of work package tools.

(d) Presentation of work package techniques, tools, and procedures to key Shipyard personnel.

(e) Establishment of Shipyard Work Package Review Group.

(f) Complete repackaging of USS WHIPPLE SARP.

(g) Critique the packaging philosophy, tools and procedures.

(h) Publish proposed work packaging instructions and use of guidelines.

(i) Accomplish introductory training and presentations of this effort throughout cognizant Shipyard divisions.

(j) Repackage USS KNOX SARP where applicable.

(k) USS BADGER work estimate sheets are to be initially prepared reflecting our new standard FCN versus ICN package.

8. SCHEDULING

Lead Code
375

Brief Description:

Scheduling FF-1052 Class overhauls does not involve unique or new concepts, but rather encompasses feedback of information from each overhaul to successive ones, with an overall goal of shortening the critcial paths and thus the overhaul durations by 25%.

Modus Operandi:

(a) Establish a "standard" PERT/CPM FF-1052 Class overhaul schedule as a framework basis.

(b) To free up scheduler's time for review and continual schedule updating, utilize to the maximum computer developed GANTT short range and special purpose schedules.

(c) Dovetail SFOMS work schedules with Shipyard work schedules to identify and eliminate interface/ conflicts.

(d) Identify and incorporate key Ship's Force events (e.g., re-embark crew, fueling, load stores, load SOAP, etc.) into milestone schedule and ensure Shipyard work is timed to support these events.

(e) Schedule a two-week Shipyard holiday closure when overhaul spans Christmas and New Year.

(f) Schedule effective use of pre-overhaul RAV.

(g) Schedule prefab work as carefully as the remainder of the work.

9. QUALITY ASSURANCE

Lead Code
130

(a) Pending development of the Quality Assurance Program manual implementation plan, follow the intentions of NAVSHIPYDPEARLINST 4355.15, "Quality Assurance Procedures for Government Source Inspection of Non-Nuclear Vendor Purchased Material; establishment of."

(b) The Discrepancy Identification System for Complex Ship Overhauls (DISC) shall be applied to all FF-1052 Class overhauls. DISC requirements are defined in NAVSHIPYDPEARLINST 5260.3.

(c) In addition, the Surface Ship Surveillance Program shall be utilized to the maximum extent appropriate in areas not subject to actual inspection by Quality Assurance.

(d) Review all Quality Assurance procedures and streamline for economical application to multiple ships.

10. PEB/LIGHT-OFF EXAMINATION

Lead Code
330

Summary:

One of the major goals during the overhaul cycle is that of successfully passing the Propulsion Examination Board's Light-Off Examination (LOE). This examination is designed to ensure that the 1200 PSI propulsion plant has been restored to high standards and that the Ship's Force is capable of maintaining it properly. Over the past two years, considerable efforts have gone into improving our procedures in this matter. We are now embarking on a systematic and comprehensive program to ensure first-time passing of light-off examinations on all FF1052 Class ships.

Brief Description:

This Shipyard is primarily concerned with ensuring that all components of the 1200 PSI propulsion plant and supporting hardware have been properly overhauled and/or are in satisfactory operating condition prior to LOE commencement. Implicit here is the responsibility for all hands to communicate and seek resolution of potential LOE discrepancies regardless of TYCOM authorization throughout the planning and overhaul cycle.

Modus Operandi:

The following activities are in addition to the standard operating procedure in determining the accomplishing the authorized overhaul work package.

(a) Maintain a list of all previous LOE discrepancies sequenced by compartment number and systems (SWBS Index) to prevent repetition of past errors.

(b) Review and ensure that all Planning and Production Department software (e.g. work specifications, test memos, etc.) meet and clearly state LOE requirements. Resolve technical questions where LOE requirements are ill-defined.

(c) Institute a thorough review and analysis of the SARP prior to and following the Work Definition Conference for all LOE work items. A major intent here is to avoid considerable growth and new work at LOE time.

10. PEB/LIGHT-OFF EXAMINATION (Continued)

(d) Review and keep cognizant of all LOE work items assigned to Ship's Force; use automated procedures in the Pearl Harbor Ship's Force Overhaul Management System (SFOMS) when possible.

(e) Ensure that the Quality Assurance Office is advised in advance of MOCK LOE and is provided copies of all LOE reports.

(f) TDO, Ship Superintendent and Code 365.1 will meet immediately following each MOCK LOE to determine those items that are LOE critical. TDO will negotiate with TYCOM and simultaneously issue coverage to proceed on the "LOE critical" items when authorization is required.

11. INTEGRATED TEST PLAN

Lead Code
365/190

Summary:

The FF1052CL Integrated Test Plan will be a document which lists, in one place, all required testing of ship components and systems. This plan will include all tests performed by production shops, Production Test Branch, Combat Systems Division, and Forces Afloat. This is the key management tool for ensuring all necessary tests are performed and eliminating duplications by coordinating requirements by systems.

Brief Description:

Overhaul testing on FF1052CL ships occurs over one-third to one-half of the overhaul cycle. Much of the testing is accomplished at a critical time near the end of the overhaul with testing responsibilities spread between at least five different department entities (i.e. Codes 190, 365, 240, etc.). Due to uniformity in test requirements across systems and the repetitive nature of these tests in these overhauls, this test plan is being developed to result in more reliable and responsive test planning and better execution of actual testing.

Modus Operandi:

An Integrated Test Plan will be developed using the SSN584CL and SSN637CL Integrated Test Plans as guidance. This initial test plan will be a manual document with consideration given to computerizing the data base and reports in the near future. This test plan will include the following parameters:

(a) All test requirements will be indexed and listed by Ship Work Breakdown Structure (SWBS).

(b) All system interfaces where required for testing purposes will be documented using the FF1052CL Ship System Definition and Index Book (SSDI) as a guide. This is essential in determining such things as the effect on testing of a system when associate systems have encountered production delays.

(c) The test plan will be responsive to the needs of all major users such as Codes 190 and 365, Shops,

11. INTEGRATED TEST PLAN (Continued)

Engineers and Technicians, Schedulers, and Planners and Estimators.

(d) Codes 190 and 365 are given joint lead on this task to assure practical development to their needs and effective coordination between these two major Shipyard groups who plan and monitor the bulk of the Shipyard's surface ship testing work.

12. FINANCIAL CONTROL AND MONITORING

Lead Code
214.2

The principal thrust of the FF-1052 program is to reduce cost and time by improving productivity. Establishing and managing to specific, preselected cost goals will, however, assist the Shipyard in measuring its performance and progress to determine which "improvements" are paying off and which are not. The following financial control and monitoring procedures will be applied to the FF-1052 program in addition to the normal procedures utilized on other overhauls:

(a) Cost control curves shall be prepared and analyzed for all FF-1052 overhaul jobs. Data from previous overhauls shall be made available in the form of overlays for ready comparison.

(b) Cost curves (planned, previous FF-1052 history, and expenditures) shall be maintained for both labor and material broken down by COAR, ship's system, and other useful breakouts. The data and curves to be maintained will be planned in advance so that data collecting and plotting can be done incrementally with minimum effort and maximum benefit to the TDO and other users.

A meaningful monthly cost report will be developed and implemented that will show in detail how the Shipyard is progressing toward its FF-1052 program goals on each ship separately, the program as a whole, and in comparison with other shipyard and SUPSHIP FF-1052 overhauls.

A desired funding profile for both TYCOM and NAVSEA funds shall be developed, approved by the Shipyard Commander, and the funds sought from customers. The funding profile will represent the most restrained cash flow necessary to accommodate the program needs.

Improved fix pricing procedures will be developed for the FF-1052. The second in the series and beyond shall be fixed priced prior to ROH start with a planned renegotiation immediately following LOE to pick up new work. The customers shall be informed monthly of predicted total overhaul cost broken down as follows:

12. FINANCIAL CONTROL AND MONITORING (Continued)

(a) Second FF-1052 and after:

Fixed price + new work authorized to date after F.P. + estimate of additional new work to be authorized

(b) USS WHIPPLE: Prior fix price offer:

Basic package + growth issued + growth reserved + new work authorized + new work estimate.

13. SHIP'S FORCE OVERHAUL PROGRAM

Lead Code
200.03

Summary:

In accomplishing an overhaul on an FF1052CL ship, a portion of the work is assigned to Forces Afloat. A successful overhaul requires that a sizeable proportion of this Ship's Force assigned work be completed in a timely manner while meeting specifications. In meeting our goals for the upcoming FF1052CL overhauls, we are giving increased attention to determining, estimating, monitoring and assisting the Ship's Force in completion of their portion of the work package.

Brief Description:

In assisting the Ship's Force with their work assignments, we are concentrating on these two phases:

(a) Definition of Forces Afloat work package.

(b) Overhaul work management phase.

The first phase involves a critical analysis of the size and scope of the work the Ship's Force (preferably by work center) can reasonably expect to accomplish. This includes all IMA and Tender assigned work.

The second phase involves monitoring the status on a weekly basis of the Ship's Force productive effort. All major jobs are actually tracked based on manpower estimates and expenditures. It is essential that Ship's Force work on systems which the Shipyard is working on be keyed to our productive schedule. This Shipyard is developing a computerized Ship's Force Overhaul Management System (SFOMS) which provides an excellent vehicle for accomplishing these goals.

Modus Operandi:

There are several computerized management information systems available to the Ship's Force for managing their workload. Since it is easier for us to function using our own developed SFOMS, we will promote its use with the Type Commander and Ship's Force for each overhaul. In all cases, regardless of which SFOMS is

13. SHIP'S FORCE OVERHAUL PROGRAM (Continued)

employed, Planning and Estimating Division will review and critically analyze the Ship's Force work package and manpower budget.

A method will be perfected for communicating to Forces Afloat changes to key information in our own Shipyard Management Information System (e.g. key event milestones, JO/KO schedules, etc.).

14. PREFAB AND REFIT PROGRAM

Lead Code
219

Summary:

Considerable time savings can be obtained by early start of material fabrication. This concept allows level workload scheduling and avoids overtime by stretching out the time available to accomplish a job. Similarly, a refit program where components are shop overhauled and put "on the shelf" allows longer material ordering lead time and quick response for installation.

In order to preclude loss and damage to refit material, ready-for-issue items will be transferred to Supply Department. The material will be visible for manual or computer sourcing.

Brief Description:

The redundancy provided by a series of FF-1052 ship overhauls allows the opportunity to prefab in quantity material for authorized alterations. By identifying high failure rate equipment, and those items requiring long lead time material or long repair times, a refit program can be established. This can shorten availability duration, reduce shop manning peaks and improve repair quality by using manufacturer's parts vice refurbished or shop produced parts.

One of the benefits of a series of fairly standard ships is the ability to restore components during periods of low shop workload. These restored components will then be available to replace (rather than repair) components in subsequent ships.

The key to a successful refit program is visibility of the components in the program. This visibility ensures usage. Ready-for-issue components will be placed in UDM. This will allow computer sourcing from ordering programs for <u>any</u> availability, i.e., can save time on TAs and RAs or be manually selected by reviewing UDM stock lists. To aid in the manual review, a quarterly printout of items stocked in FF-1052 UDM will be provided (MC201B).

14. PREFAB AND REFIT PROGRAM

Modus Operandi:

Prefab Program

(a) Identify planned alterations and obtain NAVSEA authorization/funding to commence prefabrication.

(b) Wherever feasible, issue work for fabrication of multiples of components depending upon the number of planned/funded alterations.

Refit Program

(a) Using historical data, identify high failure rate equipments and equipment requiring extensive repair time. Identify equipment whose repair time controls critical paths during ship overhauls.

(b) Evaluate refit candidates for feasibility. Obtain cost estimates to acquire spares.

(c) Solicit direct TYCOM funding for spare equipments. Ascertain other methods for funding or acquisition of refit items. Obtain NAVSEA approval.

(d) A proposed restructuring of the UDM job order is described under Excessing. The same system will allow identification of refit material to the fifth level SWBS. This will allow review of available refit assets at the component level by virtually all hands. On hand, ready for issue data will be updated weekly and distributed on microfiche MC-201B.

Non ready for issue components could also be included as a "due" to DMI. This would allow sourcing of anticipated demands and would involve expediting/progressing of critical components in the refit program. Due to the adverse impact this might have upon shop workoad scheduling, consideration of farming refit work out to contractors or other shipyards is recommended.

15. PRODUCTION FACILITIES AND TOOLS

Lead Code
385

Summary:

Support facilities, standardized work sites, special tools and jigs can reduce work time for jobs in two ways: (1) simplify the work procedure, and (2) improve productivity through better work conditions.

Brief Description:

Application of these concepts to the FF-1052 string of overhauls provides an opportunity to amortize the cost of new or improved facilities or tools over a series of overhauls. Careful decisions should allow many of these items the flexibility for application on other overhauls as well.

Modus Operandi:

Production Facilities

(a) Designate Dry Dock 4 as the dry dock for all FF-1052 overhaul dockings. Retain FF-1052 support equipment on site.

(b) Designate Building 370 as the site for Ship's Force miscellaneous storage/workshop requirements. Consider utilities improvements to better support Ship's Force.

(c) Revamp Building 388 as a Shipyard field office for Shop/Waterfront Design/Combat Systems/Ship Superintendent office use and as a covered storage/minor work area.

(d) Propose special staging structures to support dry dock work.

(e) Propose special purpose services arrangements or equipment such as portable air conditioning units, blowers, portable fluorescent lights, service equipment platforms/modules, utility accesses, etc., to improve work conditions and speed up response to shop requests for temporary services.

15. PRODUCTION FACILITIES AND TOOLS (Continued)

Tools and Jigs

(a) Propose and acquire additional or unique tools which will expedite or simplify work.

(b) Design and fabricate special jigs to simplify work. Catalog and retain for use. Provide for preservation or packaging where necessary to ensure serviceability for the succeeding overhaul.

16. TRAINING AND PERSONNEL ASSIGNMENT

Lead Code
330

Summary:

A fundamental precept in improving repetitive operations is to take advantage of learning experiences and problem solving. This pays off in efficiency, quality and uniformity of the work accomplished. Conversely, repair and testing of highly technical equipment and systems do not leand themselves to "learning by experience", but require preliminary training in schools or mock-ups to avoid disastrous failures.

Brief Description:

Application of this concept encompasses every department of the Shipyard and requires early implementation to get results. Because of personnel turnover or assignment to other work in progress, current practice in assigning personnel to overhauls has been a matter of "who is available?". To take advantage of experience, assignment of personnel for the series of FF-1052 overhauls must be carefully thought out and planned. Because of overlapping schedules, two sets of personnel may be required in some areas. Implicit in these instances is a need to ensure close communication between key members of the two teams.

Modus Operandi:

The following guidelines will be used in addition to the usual methods of selection and assignment of personnel:

(a) Obtain and distribute a condensed index of specialized equipment and systems installed and/or being installed on the FF-1052 Class of ships.

(b) Review these listings to ensure qualified personnel are assigned/available. Where deficient, arrange for training courses.

(c) Review equipment/systems for which training or schools may not be feasible because of the high level of expertise required. For these cases, identify manufacturer or Navy Tech Reps and arrange for their services at key overhaul points.

16. TRAINING AND PERSONNEL ASSIGNMENT (Continued)

(d) Based upon FF-1052 ROH schedule overlaps, select two sets of personnel where necessary to ensure adequate manning.

(e) Document and publish planned personnel assignments, particularly key members of the overhaul team.

(f) To the maximum extent, encourage personnel to schedule leave such that they will not be absent for long periods of time and particularly not during key periods of the overhaul.

(g) Verify that personnel assigned meet any specialized physical requirements, in particular, those required for work within the pressurized sonar dome.

(h) Optimize use of special pre-overhaul skills training for ships.

17. INCENTIVE AWARDS AND PROMOTION

Lead Code
160

(a) Incentive Awards

Streamline current incentive award procedures within extra-Shipyard regulations to provide for maximum involvement of all Shipyard personnel, maximum use of cash rewards and fast approval/reward action. Give special publicity to encourage "awardable" ideas and action for FF-1052 program. Encourage liberal interpretation when evaluating ideas/performance to encourage real participation at all levels. Development of Superior Achievement Award and Beneficial Suggestion Award program appears to be particularly promising. Department Heads can authorize up to $350 per award with no limit to number per person per year.

(b) Promotion

Develop and implement a good solid promotion program in and out of the Shipyard. Design program to ensure knowledge and understanding at all levels in the Shipyard. Everyone needs to know the Shipyard's objectives, understand that achieving the objectives will help HIM(HER)/Shipyard/Navy, and understand how each can contribute. Out-of-Shipyard portion of program should be aimed at:

Emphasizing benefits to Navy.

Portraying Pearl Harbor Naval Shipyard as a growing, aggressive team-playing Shipyard that is busting its tail to help the Fleet by being both smart and responsive.

(c) Include Ship's Force in incentive award program.

(d) Invite other shipyards to participate and set up procedures to provide other shipyards/activites with the lessons learned at Pearl Harbor Naval Shipyard.

18. OUTSIDE CONTRACTOR SUPPORT

Lead Code
214.2

Summary:

At certain periods in the routine overhauling of ships, it may become necessary to obtain assistance from outside activities.

Brief Description:

During periods of high Shipyard workload and/or during periods where certain Shipyard skills may be temporarily over-taxed or non-existent, it becomes necessary to contract to outside activites for either actual conduct and/or inspection of work.

Modus Operandi:

Code 214.2 will take the lead in identifying those areas where outside contractor support is required. Code 214.2 will insure that the details involved in the financial management, scheduling and security requirements of outside contractors are arranged for with Codes 530, 377 and 830 respectively.

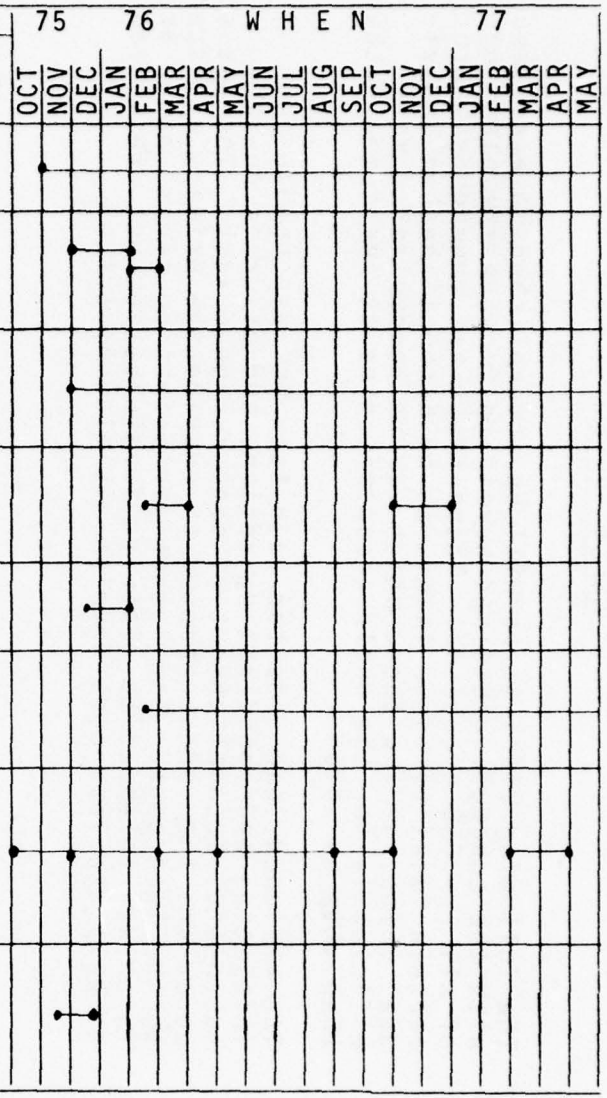
Code 214.2 will also insure that Code 377 and the proper Planning and Estimating codes are informed of NAVSEA/ NAVSEC certification team visits.

CLASS TASKS

The following Class tasks will be accomplished in accordance with the schedule contained herein to improve the planning of all FF-1052 overhauls. These tasks are prerequisite to certain tasks assigned later, to be accomplished on individual ships, or are those which can be accomplished more efficiently for the whole group of ships at one time, rather than ship by ship.

The assigned lead code for each task is responsible for initiating and coordinating action, and assuring on-time successful accomplishment of each assigned task. The assist codes are the codes expected to provide the primary assistance to the lead code. The "other participating codes" noted are in no way intended to restrict participation but are listed to help the lead code develop his plan of action.

TASK #	WHAT TASK TITLE	WHO LEAD CODE	WHO ASSIST CODE	WHO OTHER PARTICIPATING CODES	WHEN
C-1	Build configuration files and validate	200.03			
C-2	Prepare consolidated FF-1052 alteration lists	219	244.1		
C-3	Prepare standard FF-1052 repair package S-RP-0	200.03			
C-4	Prepare consolidated FF-1052 tech repair standard index	244.1	200.03		
C-5	Prepare consolidated test memos & index	365	244.1 200.03		
C-6	Prepare class critical attribute and inspection criteria plan	240 190	130 225		
C-7	Develop a list of multiple ship LLT and bulk procurement material and order same	219	several		
C-8	Establish make or buy criteria and administrative procedures therefor	225	503		



TASK #	WHAT TASK TITLE	WHO LEAD CODE	ASSIST CODE	OTHER PARTICIPATING CODES	WHEN
C-9	Develop a standard work package breakdown for the S-RP-0	200.03	219 375		Complete → ← Refine →
C-10	Develop standard SWLIN breakdown for FF-1052 SARP	200.03	219		Complete → ← Refine →
C-11	Develop specialized work package breakdowns for each ship including probable alts	219	200.03		
C-12	Develop skeleton critical path network schedules	375	219		Complete → ← Refine →
C-13	Prepare a basic pictorial work booklet for FF-1052 overhauls	214.2	240		
C-14	Develop interim TRS's	240	225		
C-15	Jigs/fixtures/facilities	380	214.2		
C-16	Determine new Shop Stores stock	510	200.03		

WHEN: 75 (OCT NOV DEC) 76 (JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC) 77 (JAN FEB MAR APR MAY)

Task #		Lead Code
C-1	BUILD CONFIGURATION FILES AND VALIDATE	200.03

The configuration of each of the Pearl Harbor FF-1052 ships will be recorded on computer tape along with the fifth level SWBS systems indicator for each item shown on the configuration tape. This task will require considerable ingenuity. The most desirable method of accomplishing will be to obtain the services of SECAS to perform HM&E validations of equipment and simultaneous insertion of the SWBS fifth level designators. Electronic equipment for all FF-1052s has already been validated by SECAS but the SWBS fifth level designator has not been inserted yet.

C-2	PREPARE CONSOLIDATED FF-1052 ALTERATION LIST	219

Heavy emphasis will be given to STANDARDIZATION of SHIPALT installations on all FF1052CL overhauls. A matrix of all FF-1052 alterations shall be made for the Pearl Harbor FF-1052s. The matrix shall be filled in to show current NAVSEA intentions for alteration accomplishment on these ships in the upcoming overhaul. The matrix shall be reviewed for anomalies and the anomalies checked out with NAVSEA and others as appropriate. The NAVSEA 923 SLM, CNO Project Managers, and other appropriate parties shall be contacted directly to ensure the validity of the matrix. When it appears to be accurate, it will be forwarded to NAVSEA (923 LSM) officially as the Shipyard's planning document. It will be kept up to date at all times and officially promulgated within the Shipyard as a planning document. It will be the basis for combined planning of SHIPALTS for FF-1052s.

C-3	PREPARE STANDARD FF-1052 REPAIR PACKAGE S-RP-0	200.03

The purpose of this task is to reduce to SARP format (minus alterations) of all the repairs that could logically be expected on any FF-1052 of the approximate age and material condition of those homeported at Pearl Harbor. A great deal of history (although pretty much unstructured) is available and will be utilized. The intent of this S-RP-0 is to provide a starting point for all FF-1052 repair planning. Task R-8 in requirements planning utilizes the S-RP-0 to create the SARP I for any individual FF-1052 at approximately A-13 months. The S-RP-0 should contain

Task #		Lead Code

historical information on the frequency of each repair as experienced to date. It is expected that the S-RP-0 will become a more and more useful document as we proceed through the FF-1052 overhauls and that it will come into maturity late in the cycle.

C-4 PREPARE AND MAINTAIN CONSOLIDATED FF-1052 TECH REPAIR STANDARD (TRS) INDEX — 244.1

Purpose of this task is simply to index all TRS's available for application to FF-1052s including interim TRS's that will be developed at Pearl Harbor Naval Shipyard in the course of accomplishing these overhauls. The TRS's will be cross indexed in all possible useful manners including SWBS at fifth level.

C-5 PREPARE CONSOLIDATED TEST MEMO INDEX — 365

The purpose of this task is to provide a consoldated index of all FF-1052 test memorandum to assist in optimizing re-use of same, and to assist in building in integrated test plan. All possible useful test memorandum information will be indexed and cross indexed for maximum usability. Indexing shall be by SWBS fifth level among others.

C-6 PREPARE CLASS CRITICAL ATTRIBUTE AND INSPECTION CRITERIA PLAN — 240 190

The new Quality Assurance Manual (NAVSEA) requires the selection of critical attributes for inspection on all shipyard work. Code 240 and Code 190 are the technical agents that are required to select these critical attributes and develop inspection criteria. The intent of this task is to develop a detailed working plan for the uniform selection of critical attributes and development of inspection criteria plans for each FF-1052 overhaul. The plan should be based on economical, practical application of QA principles within the policies of the Shipyard and should emphsize re-application from one ship to another. The learning curve from one ship to another will be factored into this Class plan to keep it updated. The details of the plan should be indexed and cross indexed in as many ways as useful including SWBS fifth level.

Task #		Lead Code
C-7	DEVELOP A LIST OF MULTIPLE SHIP LLT AND BULK PROCUREMENT MATERIALS, AND ORDER SAME	219

Utilizing the consolidated FF-1052 alteration list developed in Task C-2 and the standard repair package developed in Task C-3 as a basis, a detailed study of material requirements shall be made to determine those materials that should be procured by the Shipyard as long lead time or bulk procurement materials. Other materials that will be "government furnished" will be identified for special treatment and follow through with the provider. In developing the list of materials to order as long lead time or bulk heavy reliance will be placed in the advice of the Supply Department to identify those materials that will be difficult to get or for which there is profit in obtaining as long lead time or bulk. Once identified the materials shall be ordered by Code 225/229 in accordance with funding arrangements made by Code 214.2. Catalog of these materials for future use shall be the responsibility of Code 229 and storage for prompt retrieval and distribution shall be the responsibility of the Supply Department. The long lead time and bulk procurement lists and action thereon shall be periodically reviewed and updated to take advantage of latest information on material availabilities.

C-8	ESTABLISHED MAKE OR BUY CRITERIA AND ADMINISTRATIVE PROCEDURES THEREFORE	225

The purpose of this task is to formalize the "make or buy criteria" for materials for the FF-1052 program recognizing that there will be a series of ships requiring the same material and not just one. Any time it becomes desirable to manufacture material locally because it is not available from the supply system or by contract, it may very well be economical and sensible to manufacture enough of the items for not only the ship at hand but the follow ships. Additionally the timing of the make/buy decision is of extreme importance if it is to be an economical decision. Detailed make or buy criteria and administrative procedures therefore should be developed for the FF-1052s split up into as many categories (possibly by class of materials) as useful. The criteria should be economical in nature and supportable by good business sense.

Task #		Lead Code
C-9	DEVELOP A STANDARD WORK PACKAGE BREAKDOWN FOR THE S-RP-O	200.03

This task is an outgrowth of the work packaging effort led by Code 200.03 over the past few months. Based on experience on USS WHIPPLE work packaging a standard work package breakdown will be developed for the standard FF-1052 repair work developed and documented under Task C-3. This standard work package breakdown will be the basis for the development of the specialized work breakdown for each FF-1052 after combination with the alterations planned for that particular overhaul, see Task C-10. The work package breakdown is the basis for the development of job orders and key operations and is to be standardized to the maximum extent possible to optimize re-utilization of the structure of the work package from one overhaul to the next. The work breakdown will be that which best suits the Production Department effort.

C-10	DEVELOP STANDARD SWLIN BREAKDOWN FOR FF-1052 SARP	200.03

There are significant advantages to having the SWLIN breakdown of repair work on a ship to be the same as the job order breakdown. The SWLIN breakdown is used primarily for work package negotiation between Shipyard and customer. The job order breakdown is the translation of the work package agreed to in terms of the SWLIN into work instructions for the shops. If the SWLIN and job order breakdown are identical, or nearly so, the translation of SWLIN to job order is significantly easier, less complex, less time consuming, and more accurate than when they are not correlated. The thrust of this task is to develop a standard SWLIN breakdown for the FF-1052 SARP based on the work package breakdown developed in Task C-9 to generate as nearly as practical a one-to-one relationship between SWLIN's and job orders for even multiples of job orders.

C-11	DEVELOP SPECIALIZED WORK PACKAGE BREAKDOWN FOR EACH SHIP INCLUDING PREFERABLE ALTS	219

The thrust of this task is to take the standard work package breakdown developed in Task C-9 and for each individual FF-1052 consider the alterations planned

Task # | Lead Code

for that ship (see Task C-2) and develop the preliminary work breakdown structure that will result from combining the Alts and repairs. This task will provide the initial work packaging structure tailoring for each ship. A good deal of judgment is required to determine how far to go with this task prior to Work Definition Conference II after POT&I. A basic principle to follow in accomplishing this task is that the primary purpose of work packaging is to assist the Production Department and repeat work packages from one ship to another are highly desirable. At the same time whenever the needs of Production can be served and at the same time a one-to-one relationship between ship alterations and work package breakdown can be maintained significant benefits will develop in the area of simplified material ordering, funds control, and job writing.

C-12 DEVELOP SKELETON CRITICAL PATH NETWORK SCHEDULES 375

Based on the work package breakdowns for each ship developed in Task C-11, skeleton critical path network schedules should be developed for each ship. There will be a high degree of commonality between the skeleton critical path networks from one ship to another and a standard network may emerge. This skeleton critical path network will be utilized for advance planning purposes and for further refinement as the work package solidifies to develop the final critical path network.

C-13 PREPARE A BASIC PICTORIAL WORK BOOKLET FOR FF-1052 OVERHAUL 214.2

The purpose of this task is to develop a simplified but detailed pictorial document that will explain to the workmen level in the Shipyard what will be accomplished during the upcoming FF-1052 overhaul. The basic booklet addressed in this task will be prepared in such a manner that it can be modified relatively easily and adapted to the particular FF-1052 overhaul in question. The booklet should be easy reading, lots of pictures and diagrams, aimed at the Shipyard workmen, be unclassified, and give a good, clear picture of what is being accomplished during the overhaul, the time frame that it is to be done in, and special emphasis placed on the controlling tasks and key events thereon.

Task #		Lead Code
C-14	DEVELOP INTERIM TECHNICAL REPAIR STANDARDS (TRS)	240

Whenever a Class "B" overhaul is planned on a specific piece of shipboard equipment, we are, in effect, preparing a technical repair standard for that piece of machinery. What is lacking to make it a true technical repair standard is the format, and the engineering validation to ensure that it is adequate and does not overkill the problem. The thrust of this task is to establish a procedure for identifying the equipment for which technical repair standards are desired and not yet developed, taking copies of job orders, test memoranda, material orders and the like that make up the body of information that in effect is a technical repair standard and combining same into an administratively manageable package, giving it a label as an interim technical repair standard and re-utilizing same for follow on work. These interim repair standards should be also provided to PERA (CRUDES) for application at other shipyards. Proper management of this task will allow us to cut costs greatly in the area of planning by reuse of this proven paperwork. The interim TRS's should be numbered in such a manner that they can be integrated into the TRS index developed in PERA C-4.

C-15	DEVELOP LIST OF JIGS, FIXTURES, AND FACILITIES FOR FF-1052 CLASS	380

A review should be conducted by Code 380 to determine what jigs, fixutres, and facilities will definitely be profitable for application to the FF-1052 Class overhauls. This list will be developed and with Code 214.2 assistance customer funds will be sought out to implement where appropriate. Where overhead charges are appropriate for funding Code 380 will seek out the funds. The list developed under this task will become the basis for further refinement of individual overhaul needs in Task 0-20.

C-16	DETERMINE NEW SHOP STORES STOCK	510

Based upon the review of material in Task C-7, determine those items which have sufficient predicted demands to qualify for shop store stock. These items will be added to the applicable shop store in quantities appropriate to lead time and cost.

REQUIREMENTS PLANNING TASKS

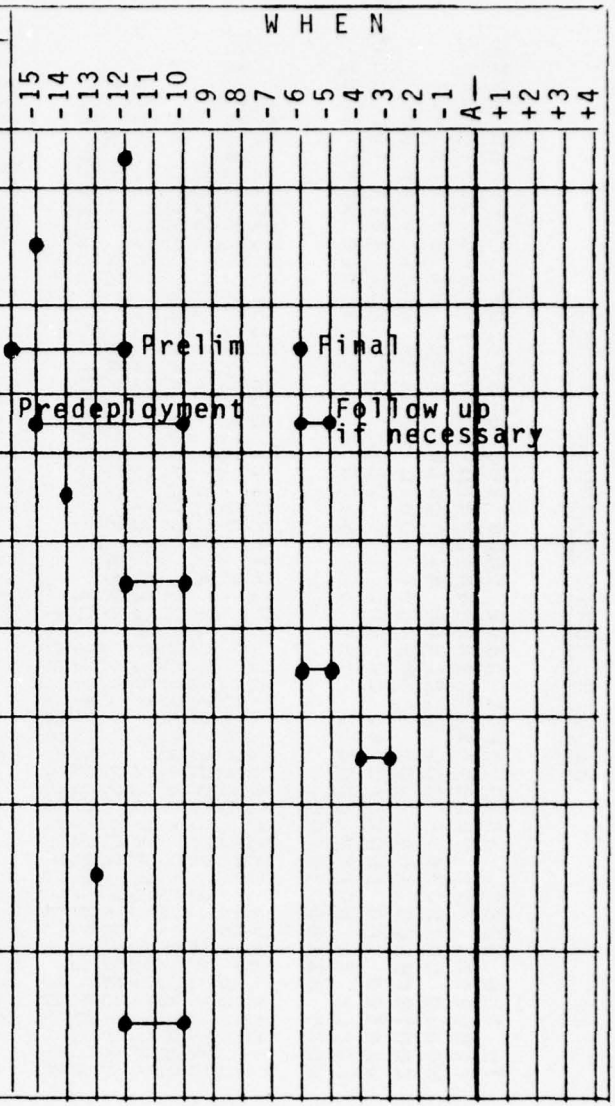
In the past, Shipyards have received a set of screened work requests for repairs. The shipyard planners and designers would shipcheck and prepare estimates, then at an arrival conference the Type Commander would decide what work he wanted the shpyard to do and the remainder was left for Ship's Force to worry about. The Shipyard accomplished what they were asked to do.

Times have changed. THE SHIPYARD IS NOW RESPONSIBLE FOR CONDUCTING PRE-OVERHAUL TESTS AND INSPECTIONS, REVIEWING ALL MAINTENANCE RECORDS HISTORY AND DATA, APPLYING SOUND ENGINEERING/PLANNING/ECONOMIC JUDGMENT AND RECOMMENDING TO THE TYPE COMMANDER A BALANCED SET OF SPECIFIC REPAIR WORK ASSIGNMENTS FOR SHIPYARD, SHIP'S FORCE, AND IMA THAT WILL ACCOMPLISH THE OBJECTIVES OF THE OVERHAUL ON SCHEDULE AND AT THE LOWEST POSSIBLE COST.

Additionally the shipyard plans the details of the approved alterations and integrates them with the repairs. These complex and difficult efforts are referred to as REQUIREMENTS planning.

The assigned lead code for each task is responsible for initiating and coordinating action, and assuring on time successful accomplishment of each assigned task. The assist code(s) (is/are) the code(s) expected to provide the primary assistance to the lead code. The "other participating codes" noted are in no way intended to restrict participation but are listed to help the lead code develop his plan of action.

TASK #	WHAT REQUIREMENTS/PLANNING TASK TITLE	WHO LEAD CODE	ASSIST CODE	OTHER PARTICIPATING CODES	WHEN
R-0	Prepare ROH game plan	214.2			
R-1	Determine Ship configuration. Validation/COSAL tape	200.03			
R-2	Determine alteration requirements	219			
R-3	Shipcheck for alts	240			
R-4	Evaluate standard repairs	190 244.16	219	225	
R-5	Pre-deployment POT&I	190 244.14	219	225	
R-6	Follow up POT&I	190 244.14	219	225	
R-7	Pre-overhaul full power trial	244.14	219	225	
R-8	Prepare preliminary SARP I based on standard FF-1052 repair package	219	244.12	225	
R-9	Determine Forces Afloat work capacity (manpower budget for SFOMS)	200.03			



TASK #	WHAT REQUIREMENTS/PLANNING TASK TITLE	WHO LEAD CODE	WHO ASSIST CODE	WHO OTHER PARTICIPATING CODES	WHEN
R-10	Prepare SARP II based on pre-deployment POT&I	219	244.14		
R-11	Prepare SARP III based on follow up POT&I	219	244.14		
R-12	Prepare SARP IV based on full power trial	219	244.16		
R-13	Conduct work Definition Conference I (SARP I)	214.2	244.14 219	225	
R-14	Conduct Work Definition Conference II (SARP II)	214.2	219 244.16	225	
R-15	Conduct Work Definition Conference III (SARP III)	214.2	219 244.16	225	
R-16	Conduct Work Definition Conference IV (SARP IV)	214.2	219 244.16	225	
R-17	Conduct overhaul work package analysis	244.16	219 225	200.03	
R-18	TYCOM confirm ROH work package	214.2			
R-19	PHNS provide initial planning estimate (or fixed price) for approved overhaul work	214.2	219 225		

WHEN: -15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 A +1 +2 +3 +4

TASK #	WHAT REQUIREMENTS/PLANNING TASK TITLE	WHO LEAD CODE	WHO ASSIST CODE	WHO OTHER PARTICIPATING CODES	WHEN -15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 A +1 +2 +3 +4
R-20	Forward preliminary estimate of alteration to NAVSEA	214.2	225		
R-21	Forward final estimate of alterations to NAVSEA	214.2	225		

Task #		Lead Code

R-0 PREPARE ROH GAME PLAN 214.2

Prepare regular overhaul game plan in accordance with NAVSHIPYDPEARLINST 4850.93A covering all of the salient points of this FF-1052 instruction. The purpose of the game plan is to guide the entire Shipyard in the planning and conduct of the particular overhaul being described; therefore, it should be specific and detailed in those areas that differ from the norm.

R-1 DETERMINE SHIP CONFIGURATION BY VALIDATION AND COSAL TAPE 200.03

This is a very important phase of overhaul planning that is normally taken for granted. SECAS has been chartered to provide HMNE validation of ships and they are starting with FF-1052 Class. SECAS has an office at Pearl Harbor and we work every closely with them. It must be determined early what the configuration baseline for the overhaul is. Ideally the baseline will be generated by a hands-on validation of the ship's equipment and an updated COSAL tape with the fifth level SWBS designator assigned to each component. Second best is as described above but with selective validation. Third best is same as above with no validation. Least desirable and useful is a COSAL tape without SWBS fifth level designators. Without the SWBS fifth level designators assigned much of the automated material ordering and job planning processes cannot be effectively used. Therefore, it is important that the best possible ship's configuration method be selected for each ship very early and arrangements made to accomplish and document same.

R-2 DETERMINE ALTERATION REQUIREMENTS 219

At twelve months prior to overhaul start, or earlier, it is essential to know what alterations will be accomplished on the overhauling ship. Frequently tasking letters are obtained from PERA (CRUDES) at this time and in addition information can be obtained from NAVSEA. Class planning task C-2 requires the development of a SHIPALT and ORDALT list well in advance of A-12 to assist in this task. The specific list of alterations for the overhauling

Task # | Lead Code

the ship will be developed, published to all involved parties in the Shipyard for action and will be addressed to all interested parties outside the Shipyard such as NAVSEA, PERA (CRUDES), Type Commander, and ship with a caution note that changes to the SHIPALT Package after this time although they may be directed by NAVSEA, will be expensive and generally counterproductive to a smooth and economical overhaul. Every effort will be made to standardize the SHIPALTS approved among the FF-1052s and partial alteration approval shall be requested where it is beneficial.

R-3 SHIPCHECKS FOR ALTERATIONS — 240

Alteration shipchecks shall be made in Pearl Harbor prior to the pre-overhaul deployment of the ship. The shipchecks can be made any time after the list of SHIPALTS is published in Task R02 and can be partially or incrementally made earlier based on Class SHIPALT lists prepared in Task C-2. Arrangements for SHIPALT checks shall be made with the Type Commander representative at MIDPAC. Scheduling shall be done for greatest efficiency, economy of operation, and thoroughness. Ensure that Type Commander provides adequate, dedicated scheduled time for this very important process. Conduct of the shipchecks will be coordinated by Code 244.1. Ensure that adequate photographs, measurements, sketches, and other data are taken, especially for interference items that customarily are shipchecked well to ensure high quality plans and to obviate the need for expensive revisits to the ship and late changes.

R-4 EVALUATE STANDARD REPAIRS — 190, 244.16

Task C-3 requires the preparation of a standard FF-1052 repair package. This task (R-4) is intended to provide the first tailoring of the standard repair package to the specific overhaul ship in question. It is intended that it be accomplished by knowledgeable planners, estimators, production controllers, Shipyard design personnel, and Type Commander and ship personnel reviewing the standard FF-1052 repair package and making value judgments based on the current knowledge of the ship material condition in question. The fifth level SWBS manual for the FF-1052 Class will

Task # | Lead Code

be used as the guide. Prior to development of the standard FF-1052 repair package (Task C-3) the best available information concerning previous FF-1052 overhauls will be utilized to conduct this review using the FF-1052 SWBS fifth level index as the guide. This review provides the basis for the development of the SARP I (Task R-8) as the real starting point for developing the work package for the ship in question.

R-5 PRE-DEPLOYMENT POT&I — 244.14, 190

The purpose of the pre-deployment POT&I is to conduct all possible pre-overhaul tests and inspections for the planning of the upcoming overhaul prior to deployment of the ship while it is still at Pearl Harbor. The test and inspection plans will be developed and scheduled so that all possible information can be collected pre-deployment and only that perishable information which must be collected later will be scheduled for collection during or after overhaul. Each M&E POT&I will be coordinated and scheduled with Combat Systems POT&I. The results of this POT&I will be used to modify the SARP I to give us the SARP II or the second refinement in the overhaul work package plan.

Lead for scheduling and coordinating is Code 219.

Lead codes for technical accomplishment are 244.14 and 190.

R-6 FOLLOW UP POT&I — 244.14, 190

The purpose of this POT&I is to test and inspect those equipments and systems that could not be adequately tested and inspected for overhaul purposes prior to deployment. Additionally this POT&I serves to update the information obtained from the pre-deployment POT&I and to confirm upgrading work that may have been accomplished by the ship or other repair activities since the pre-deployment POT&I. This task includes the requirement for establishing administrative procedures for the ship to notify the Shipyard when it accomplishes or has accomplished

Task # | Lead Code

significant work after the pre-deployment POT&I that would effect the overhaul planning being accomplished by the Shipyard.

Lead code for scheduling is Code 219.

Lead codes for conducting follow up POT&I are Codes 244.14 and 190.

Lead code for establishing administrative communication with ship is Code 219.

R-7 PRE-OVERHAUL FULL POWER TRIAL — 244.14

This is a specialized portion of the POT&I. The purpose is to conduct a pre-overhaul full power trial instrumented to the maximum useful extent. If a successful full power trial cannot be achieved, then it is desired to conduct a sustained high power trial at the highest attainable power for the purpose of identifying and quantifying propulsion plant shortcomings. In general this pre-overhaul full power trial should be conducted upon returning from the last deployment or after return to Pearl Harbor to optimize the currency and usefulness of the information.

Lead code for scheduling is Code 219.

Lead code for conducting trial is Code 244.14.

R-8 PREPARE PRELIMINARY SARP-I BASED ON STANDARD FF-1052 REPAIR PACKAGE — 219

This is the first SARP in a series of four distinct SARPS prepared for the specific overhaul. It is recognized that it will be incomplete; however, it serves as the vehicle for the beginning of coordinated planning for the overhaul. The computerized SARP format will be utilized. It will be based on the best information available at the time and will be based on the standard FF-1052 repair package, S-RP-O, after it is developed. Task R-4 discusses development of the information for SARP-I. The same personnel that will participate in POT&I will participate in the development of this SARP-I to give it continuity and meaning. Maximum feedback from previous FF-1052 overhauls will be utilized.

Task #		Lead Code
R-9	DETERMINE FORCES AFLOAT WORK CAPACITY (MANPOWER BUDGET FOR SFOMS)	200.03

The purpose of this task is to start the Ship's Force and Type Commander rep into seriously considering the capability of Ship's Force and other Forces Afloat activities for accomplishing overhaul work. Customarily Ship's Force and Forces Afloat capabilities are over-estimated and with shortages of funds with which to fund Shipyard overhaul work the Type Commander is deluded into assigning too much significant work to Forces Afloat. The procedures of the Ship's Force Overhaul Management System (SFOMS) will be utilized and Forces Afloat will be officially requested by the Shipyard to prepare and submit manpower budgets. The Shipyard will accumulate information concerning Forces Afloat work actually accomplished during FF-1052 overhauls and provide guidance to Ship's Force in developing their manpower budget. This task is merely the leading edge of the development of the Ship's Force work package but it is a much neglected task that needs considerable attention to detail.

R-10	PREPARE SARP-II BASED ON PRE-DEPLOYMENT POT&I	219

This version of the SARP is to be prepared in the same format as the others immediately following the pre-deployment POT&I. The same personnel that participated in preparing the first SARP and that participated in the conduct of the pre-deployment POT&I will participate in preparing SARP II. SARP II is to be a definitive document that recommends the overhaul work to be accomplished by the Shipyard, ship, and IMA to accomplish the objective of the assigned overhaul in the most economical manner. Where information is incomplete and must be developed during follow up POT&I or pre-overhaul full power trial such will be noted in the SARP II but otherwise it will be complete. After it is prepared a detailed working conference will be held by the personnel that conducted the pre-overhaul POT&I to determine that the SARP II does indeed reflect their recommendations. Where deficiencies exist, the SARP II will be corrected.

Task #		Lead Code
R-11	PREPARE SARP III BASED ON FOLLOW UP POT&I	219

During the conduct of this task SARP II will be modified to incorporate the results of the follow up POT&I and information provided by the ship concerning work accomplished since pre-deployment POT&I. The latest CSMP results will be reviewed and incorporated as appropriate. Upon completion of the preparation of SARP III a detailed working conference will be held by the personnel that conducted the follow up POT&I and others as appropriate to ensure that all of the information developed during the follow up POT&I, extracted from the CSMP and otherwise developed from information available concerning the ship is incorporated into the SARP III and that it indeed represents the Shipyard's recommendations of the most economical possible work package to be accomplished by Shipyard, Ship's Force, and IMA to accomplish the objectives of the overhaul. Bear in mind during the accomplishment of this task and task R-12 that the SARP is being prepared for the customer with the Shipyard actually working for PERA (CRUDES) and the Type Commander in preparing the SARP.

R-12	INCORPORATION OF THE INFORMATION DEVELOPED DURING THE FULL POWER TRIAL	219

Ideally nothing new would be developed here except confirmation of information that was not too certain on the SARP III.

R-13	CONDUCT OF WORK DEFINITION CONFERENCE I	214.2

This is the first of a series of four work definition conferences for each overhaul and is keyed to the SARP I. The purpose of this work definition conference is to establish as early as possible tentative agreement with the customers on the repair and alteration work that will be done on the overhaul, to ensure thorough understanding of the objective of the overhaul and the ground rules for planning and accomplishing same. It is further intended that this work definition conference approve for planning and material procurement purposes as much repair work as is feasible. This conference should be fairly simple to conduct but should include all of the key players,

Task # Lead Code

Type Commander, Ship's Force if possible, key POT&I personnel, type desk, and other key planning managers. Thorough and detailed records shall be kept of the conference. A report of the conference results shall be put out within one week of the date of the conference.

R-14 CONDUCT WORK DEFINITION CONFERENCE II 214.2

This is the second in the series of four work definition conferences and should be conducted with the same players as the first. This conference is intended to pretty much jell the overhaul work package and should release a good 70% or more of the total repair package. The alteration package should not be much in question except as it relates to the repair package. The conference should be definitive and the issues or precise assignment of work to Shipyard, Ship's Force, and IMA should be addressed squarely. The cost estimates used at this work definition conference are recognized as preliminary in nature but Code 225 should make them as good as possible. This conference should produce a definitive list of unknowns for all concerned to gather further details on to ensure that the next work definition conference can be conducted with accurate information. Ship's Force will not normally be at the Work Definition Conference II since they will probably be deployed. Material ordering, work packaging and job order preparation will commence in earnest following this conference. A definitive report of the conference shall be prepared and distributed within two working weeks of the conference.

R-15 CONDUCT WORK DEFINITION CONFERENCE III 214.2

This Work Definition Conference is the next to last and normally the most significant of the conferences. All work that is going to be accomplished with the exception of that made necessary by the information gathered at full power trial will be approved at this conference. The information presented by the Shipyard in SARP III must clearly and unequivocally represent the Shipyard's recommendation for the entire package of overhaul work necessary to accomplish the objective of the overhaul, including Shipyard, Ship's Force, IMA, and contract work. All outside

Task # Lead Code

agency certifications must be known and accounted for at this time. Ship's Force capability and IMA capability must be quantitatively known so that work is not overassigned to them. The Shipyard must be vigorous in the conduct of this conference to ensure that the work necessary for a thorough overhaul is approved by the Type Commander. As in the first two Work Definition Conferences, it is particularly important that the engineers, technicians, planners and estimators who participated in the POT&I and development of the SARP be in attendance at the Work Definition Conference to ensure thorough understanding by all parties of their recommendations. The results of this conference will be recorded in detail and distributed to all concerned within two weeks of the date of the conference.

R-16 CONDUCT WORK DEFINITION CONFERENCE IV 214.2

This is the final Work Definition Conference to be conducted following the full power trial. If the Work Definition Conference went well, then Work Definition Conference IV will provide only minor modifications or substantiation of the previous conference. The attendees at the conference will depend on the extent and nature of the revisions to the result of the last conference. In any case, the conference should be definitive and final. Results of the conference should be distributed to all concerned within one week of the conference.

R-17 CONDUCT OVERHAUL WORK PACKAGE ANALYSIS, IDENTIFY DEFERRED WORK THAT WILL LEAD TO INADEQUATE OVERHAUL 244.16

The purpose of this task is to conduct a thorough analysis of the overhaul work package as it has been approved following the Work Definition Conferences to determine and document that significant overhaul work that has been deferred by the Type Commander for any reason whatsoever that will prevent the ship from receiving an overhaul that will meet the stated objectives. It is essential that the precise work packages of Ship's Force and IMA be trackable to the SARP and that they be quantitatively identified to the capability of

Task #		Lead Code

Ship's Force and IMA to accomplish work. The results of the analysis will be forwarded to the Type Commander within one week of the completion of the Work Definition Conference IV. The report of the analysis will state in unequivocal terms the work that has been deferred or misassigned that will lead to overhaul that will not fulfill the stated objectives.

R-18 TYPE COMMANDER CONFIRM REGULAR OVERHAUL WORK 214.2

The Type Commander will be requested to confirm in writing his assignment of work to the Shipyard, Ship's Force, and IMA for the overhaul two months prior to the start of the overhaul and following the Shipyard's analysis of the overhaul work package. The purpose of this letter of confirmation is to establish a base line upon which to plot the overhaul.

R-19 SHIPYARD PROVIDE INITIAL PLANNING ESTIMATE FOR APPROVED OVERHAUL WORK AND ESTIMATE OF THE END COST OF THE OVERHAUL 214.2

The purpose of this task is to provide the initial planning estimate for the work package approved by the Type Commander and confirmed in Task R-18 and to provide an estimate of the end cost of the overhaul by including Shipyard estimates for the amount of new work that will mature prior to end of overhaul.

R-20 FORWARD PRELIMINARY ESTIMATES OF ALTERATIONS TO NAVSEA 214.2

The purpose of this task is to provide preliminary estimates of the SHIPALTS expected to be on the 180-day letter. NAVSEA instructions require that this estimate be forwarded at A-90, but providing these estimates early should provide a real help in stabilizing the SHIPALT work package. The goal is to have all of the estimates Class C or better at this time and this should be no problem for repeat alts. For those alts that are new for the overhaul under question possibly only Class D estimates can be provided at this time.

Task #		Lead Code
R-21	FORWARD FINAL ESTIMATES OF ALTERATIONS TO NAVSEA	214.2

The purpose of this task is to forward the final Shipyard estimates of NAVSEA approved alterations contained in the 180-day letter to settle the final question of alt approval and funding. NAVSEA instructions require this estimate at A-45; however, the Shipyard should be perfectly capable of submitting at A-90 with the large number of repeat alterations experienced in the FF-1052 program. Providing these estimates early is of great benefit to all concerned. All estimates shall be Class C or better at this time. Recommendations for cancellation of SHIPALTS to rationalize the difference between the NAVSEA 180-day letter SHIPALT cost estimate and the Shipyard's cost estimate shall be based on nonavailability of material, difficulty of accomplishing in Shipyard, or unavailability of plans/plan information. Type Commander, NAVSEA, ship, or CNO will review any cancellations of SHIPALTS, and determination of factors important from points of view other than the Shipyard will be made by those parties. It is important to provide NAVSEA with good rationale for any differences in costs between their estimates of a SHIPALT cost and the Shipyard's estimate. This is difficult to do when we do not know the NAVSEA estimate base, but judicious use of the telephone can be of good assistance. Once we have accomplished an alteration on one FF-1052, we then have excellent ground for comparing the cost of the next one. Except where there are identifiable and explainable mitigating circumstances the cost of each successive SHIPALT after first accomplishment should be less up to the fifth overhaul.

OVERHAUL PLANNING TASKS

The overhaul planning tasks are those necessary to plan the details of the work packages developed and approved during the REQUIREMENTS planning phase. Overhaul planning includes the development of detailed work package breakdown, the preparation of all job orders, plans and drawings, the development of detailed schedules, the acquisition of drawings, the development of detailed schedules, the acquisition of all materials, documentation, tools, jigs, and facilities necessary to accomplish the work packages, along with the training of personnel.

The assigned lead code for each task is responsible for initiating and coordinating action, and assuring on time successful accomplishment of each assigned task. The assist code(s) (is/are) the code(s) expected to provide the primary assistance to the lead code. The "other participating codes" noted are in no way intended to restrict participation but are listed to help the lead code develop his plan of action.

	WHAT	WHO			WHEN
TASK NO.	OVERHAUL PLANNING TASK TITLE	LEAD CODE	ASSIST CODE	OTHER PARTICIPATING CODES	-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 A +1 +2 +3 +4
0-1	Prepare Alt BACDs and working drawings	240			
0-2	Prepare Test Memos	240			
0-3	Determine critical attribute & inspection criteria and modify	240			
0-4	Order LLT/bulk Alt Material	229	244.16		
0-5	Prepare prelim SARP based on standard FF-1052 repairs & alts	219			
0-6	Prepare SARP II (WDC II)	219			
0-7	Prepare SARP III (WDC III)	219			
0-8	Prepare SARP IV (WDC IV)	219			
09	Prepare cost estimates for SARP I, II, III, IV	225			
0-10	Order repair LLT/STD/ BULK material	225	200.03 219		
0-11	Order material based on SARP II, III, IV	225	200.03		

	WHAT	WHO			WHEN
TASK NO.	OVERHAUL PLANNING TASK TITLE	LEAD CODE	ASSIST CODE	OTHER PARTICIPATING CODES	-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 A +1 +2 +3 +4
O-12	Review & cancel unnecessary material based on WDC II, III,IV	225			
O-13	Prepare pre-fab job orders	225			
O-14	Prepare detailed job orders	225			
O-15	Prepare pictorial work booklet	214.2			
O-16	Develop milestone schedule	375			
O-17	Develop Key operation schedule	375			
O-18	Deliver scheduled job order package to Production Shops	330			
O-19	Determine pre-fab work (alt and repair)	225			
O-20	Determine special jigs/ tools/fixtures/facilities	385			
O-21	Develop detailed integrated test plan	365	244.16 200.03		

WHAT		WHO			WHEN
TASK NO.	OVERHAUL PLANNING TASK TITLE	LEAD CODE	ASSIST CODE	OTHER PARTICIPATING CODES	-15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 A +1 +2 +3 +4
O-22	Develop quality assurance plan	130	Several		
O-23	Develop machinery history information collection plan	240	225		

Task #		Lead Code
O-1	PREPARE SHIPALT SOFTWARE	240

In accordance with DESIGNINST 4720.1B, develop SHIPALT PHASE I advance planning software, Scoping Documents, Advance B/M's and drawings lists by A-270. Undertake PHASE II, Supplementary Alteration Drawings (SAD's) upon completion of PHASE I. SAD's shall be issued by A-90. This effort shall be coordinated and status reported by Code 244.1.

O-2	PREPARE TEST MEMOS	240

Using the SARP, determine the requirements for all formal post RO tests. Develop Test Memos to support required tests. Test Memos shall be issued by A-0. Status shall be reported by Code 244.1.

O-3	DETERMINE CRITICAL AND MAJOR ATTRIBUTE CRITERIA	240

Chapter 7 of the new Quality Assurance manual (NAVSEA 0900-LP-083-0010) required that critical and major attributes of materials/components in vital and mission essential systems be identified. Chapter 7 further requires that formal inspection/verification criteria be provided for materials/components identified. A plan to implement Chapter 7 is proceeding in parallel with this FF-1052 Class overhaul management instruction. Software, as required by Chapter 7, shall be developed in accordance with the forthcoming Chapter 7 Implementation Plan. This effort shall be coordinated by Code 244.16.

O-4	ORDER LONG LEAD TIME AND BULK ALTERATION MATERIAL	229

The bulk and long lead time materials ordered/received under task C-7 shall be reviewed and compared with the specific alteration material requirement for the alterations approved for each separate overhaul under Task R-2. Additional bulk and long lead time materials shall be ordered by Code 225/229 based on funding provided by Code 214.2.

Task #		Lead Code
O-5	REPAIR PRELIMINARY WORK PACKAGE (SARP-I, WDC-1)	219

The purpose of this task is to take the results of Work Definition Conference I, held at approximately A-12 months, and make the first cut at structuring the standard FF-1052 SARP into a specialized SARP for the particular overhaul in question. Repairs made not necessary by accomplishments of alts will be struck from the standard SARP. The collective knowledge about the material condition of the ship up to the time of the Work Definition Conference I will be used to tailor the preliminary work package to the extent possible. Special problems will be identified for further investigation. Job order and Key OP numbers for the work package will be assigned to the maximum extent possible consistent with the standard work package. This work package will be the first in the series of four that culminate with the final approved work package for the overhaul. It will serve as the initial guide for long lead time and bulk material ordering for this particular overhaul.

O-6	PREPARE WORK PACKAGE II (SARP II)	219

The purpose of this task is to modify the Work Package I developed in task O-5 in accordance with the findings and recommendations of the pre-deployment POT&I, Task R-5, as approved in Work Definition Conference II. Work Package II should distinguish between work that has been definitely approved, work that is definitely disapproved, work that may be approved, and work whose decision is pending further POT&I results. The Work Package II will be expected to contain solid approval of 60% to 70% of the work that will be approved by the start of the overhaul as a minimum. Material ordering and job order writing will commence in earnest with the completion and internal Shipyard distribution of Work Package II.

O-7	PREPARE WORK PACKAGE III (SARP III)	219

Work Package III is the next to last refinement of the Work Package and is based on the results of the follow up POT&I and all information available to that point. It will be considered the final pre-overhaul work package except for modifications

Task # Lead Code

that may be made necessary as a result of the full power trial. Work Package III will have the same features as Work Package II except that it will be far more definitive. Specific unknowns and decisions that have yet to be made should be identified clearly and pinpointed to specific personnel for resolution in the Work Package.

0-8 PREPARE WORK PACKAGE IV (SARP IV) 219

This is the final iteration of the work package based on full power trials and Work Definition Conference IV. There should be no further matters to resolve with the Type Commander regarding work package approval at this point. This is the work package upon which will be based the initial overhaul planning estimate for fixed price. It will be the basis for the final scrubbing of the detailed shipwork schedule.

0-9 PREPARE COST ESTIMATES FOR SARPS I, II, III, IV 225

The purpose of this task is to provide rapid and effective cost estimating for the proposed work as developed in SARPS I, II, III, and IV. Estimates for SARP I should be made only on a selective basis for those items that it is felt by Code 219 that a good probability of approval of that work is likely. The cost estimates provided by Code 225 will be incorporated into the SARP and used at the Work Definition Conferences. Code 219 is reponsible to ensure that the cost estimates provided are properly entered into the SARPS and that an appropriate growth figure is added to the work package so that the sum of the estimates, including growth, is useful to the Shipyard and Type Commander in negotiating approved work. Code 214.2 is responsible to monitor the sales estimating process and ensure that the numbers used to negotiate with the Type Commander are valid.

0-10 ORDER REPAIR LONG LEAD TIME/STANDARD/BULK MATERIAL 225

Task C-7 ordered long lead time and bulk material for multiple ships. The purpose of Task 0-10 is to identify in addition to the material available from

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the multiple ship orders that material which should be ordered commencing at about A-11 months for the specific ship in question based on the knowledge of the work package available in Work Package I. In executing this task a careful review should be made between Planning and Supply to come to cost effective decisions.

0-11 ORDER MATERIAL BASED ON SARP II, III, IV — 225

This task incorporates the mainstream function of ordering overhaul material for the approved work on an incremental basis to ensure delivery of material to the Shipyard in time to start the overhaul without significant overkill. The computerized material ordering system currently being developed for standard MIS application will be utilized.

0-12 REVIEW AND CANCEL UNNECESSARY MATERIAL BASED ON WORK DEFINITION CONFERENCES I, II, III, IV — 225

This is a complex task requiring a lot of judgment but the idea is to make sure that we have the right material available for overhaul of each ship without excessive overkill and insurance. Items that were placed on order before on a contingency basis must be reviewed to see if the probability of need/ difficulty of obtaining the material warrant keeping it on order or if the order should be cancelled or the material disposed of. If the answer is to dispose then the decision must be made whether to dispose into accounts for possible future use, return to Supply, or out the door. The quality of judgment in attention to detail in this task will have a high impact on the overall cost of the overhaul.

0-13 PREPARE PRE-FAB JOB ORDERS — 225

A careful review shall be made of both SHIPALTS and repairs for the possibility of pre-fab work. Multiple ship pre-fab work is the most desirable and the longer ahead of time it can be planned the better. Fabrication of assemblies, casting of spare pump bodies, pre-fab or foundation, cable harnesses, deck houses, mast assemblies, etc., can

Task # Lead Code

all be profitable. Special funding arrangements may have to be made where the pre-fab is done significantly in advance of the overhaul.

Lead code for preparation of job orders is Code 225.

Lead code for identification of pre-fab work is Code 214.2.

O-14 PREPARE DETAILED JOB ORDERS 225

This task is self-explanatory except that maximum re-use of job orders from one overhaul to another is desired. Procedures shall be established to index, store, retrieve, edit, and re-use job orders from one overhaul to another to the maximum extent possible. Basic idea is to reduce the administrative effort required by Planners and Estimators to simply fill out forms and write the job orders. Maximum repetitiveness in the job orders will make them that much easier for Production Department to recognize and implement also. Job orders should all be prepared and delivered to Code 375 for detailed scheduling no later that A-30.

O-15 PREPARE PICTORIAL WORK BOOKLET 214.2

A simplified pictorial work booklet describing the work to be accomplished during each overhaul, shall be prepared and distributed to assist P&E, Design, Supply, and mainly Production in understanding the work to be accomplished during the overhaul. The same format shall be used for each overhaul and each booklet shall be prepared simply by modifying the last one. The booklet will contain marked up reduced size copies of general plans, diagrams, and sketches to the maximum extent that they are useful. The booklet shall not actually authorize work but it will be used to accurately depict to the Shipyard at large the details of work to be accomplished on that ship.

O-16 DEVELOP MILESTONE SCHEDULE 375

A milestone and key event schedule shall be developed along with the development of the work package. It shall be as similar as possible

Task # Lead Code

from one ship to the next and shall be laid out on a real time frame to build the overhaul schedule. It shall be used by Supply for the guidance in bulk procurement. The milestone schedule shall be carefully controlled and published for all concerned in planning and executing the overhaul. It shall be controlled by Shipyard instruction, and the milestones shall not be changed without Shipyard Commander's approval.

0-17 DEVELOP KEY OPERATION SCHEDULE 375

Critical path scheduling shall be used for the overhauls and the detailed Key OP schedule will be developed, critiqued and applied to the Shipyard job orders for distribution at approximately A-30 days. The schedule published shall support the desired overhaul completion date. Shipyard schedulers will participate with Ship's Force utilizing the particular version of SFOMS applied to the overhaul to develop detailed schedules for Ship's Force and IMA work. The interrelationships between Ship's Force, IMA, and Shipyard work necessary for maintaining effective updated schedule revisions shall also be generated. It should be borne in mind that the scheduling effort is not for Shipyard work alone but for all effort required to complete the overhaul.

0-18 DELIVER SCHEDULED JOB ORDER PACKAGE TO PRODUCTION SHOPS 330

This event marks a milestone in the beginning of the heavy productive work of the overhaul. Except for productive work it is intended that the jobs be delivered en masse and that the production teams who work on the ship be formally instructed in the content of the job orders.

0-19 DETERMINE PRE-FAB WORK (ALT AND REPAIR) 225

This task is equivalent to 0-13.

Task #		Lead Code
O-20	DETERMINE SPECIAL JIGS, TOOLS, FIXTURES, FACILITIES	385

After WDC II and the work package is fairly well determined, a special roundup should be made to determine what jigs, tools, fixtures, and facilities can be profitably applied to the upcoming overhaul. Many of them will be those used on the last overhaul and several new ones should be developed each overhaul from lessons learned from the last.

O-21	DEVELOP DETAILED INTEGRATED TEST PLAN	244.16

A plan shall be developed that documents and integrates all formal tests identifed in Task C-6 and O-3, or that are otherwise required for the repairs and alterations approved for each overhaul. This plan shall have provisions to insure maximum re-use of test specifications in successive overhauls.

O-22	DEVELOP QUALITY ASSURANCE PLAN	130

The implementation plan for the new Quality Assurance program manual will provide a satisfactory quality assurance plan for the FF-1052 Class overhauls. Actual implementation will be accomplished so as to benefit this Class of ships as early as possible. Meanwhile the quality assurance provisions of NAVSHIPYDPEARLINST 4355.1E will be followed and existing reporting practices will continue.

Develop integrated inspection plan utilizing inspection and verification points and surveillance areas as developed in Tasks C-6 and O-3.

O-23	DEVELOP MACHINERY HISTORY INFORMATION COLLECTION PLAN	240

Collection of and reporting to Ship's Force for entry in their ship's machinery history of significant data concerning overhaul work, machinery measurements, etc., is a giant Shipyard/Ship's Force task. Shipyard instructions are currently in draft to formalize these procedures for surface

Task # Lead Code

ships. For each overhaul the effective Shipyard instructions should be reviewed in detail and the adequacy of the instructions for the upcoming overhaul determined. Care should be taken to ensure that a detailed plan exists that will cause the required information to be collected at the right time, reported accurately and in an administratively traceable manner.

PRODUCTION PHASE TASKS

The tasks assigned herein encompass the effort necessary to support the actual accomplishment of the productive repair and alteration work for each overhaul.

The assigned lead code for each task is responsible for initiating and coordinating action, and assuring on time successful accomplishment of each assigned task. The assist code(s) (is/are) the code(s) expected to provide the primary assistance to the lead code. The "other participating codes" noted are in no way intended to restrict participation but are listed to help the lead code develop his plan of action.

TASK #	WHAT PRODUCTION PHASE TASK TITLE	WHO LEAD CODE	WHO ASSIST CODE	WHO OTHER PARTICIPATING CODES	WHEN
P-1	Accomplish pre-fab work	330			As scheduled
P-2	Utilize cost control curves & other cost/sched/progress analysis tools	214.2			Throughout
P-3	Revise planning estimate fix price offer/USCI monthly	214.2			
P-4	Conduct critique after each significant phase of ovhl	214.2	330		As scheduled
P-5	POT&I personnel examine opened equipment to obtain feedback re predictions	244.14			
P-6	Conduct underwater work/hull inspection review to confirm all such work early	225			Earlient possible
P-7	Conduct mock LOE inspection	330	244.14		Prior LOE
P-8	Conduct review of Forces Afloat repair package	214.2			

TASK #	WHAT PRODUCTION PHASE TASK TITLE	WHO LEAD CODE	ASSIST CODE	OTHER PARTICIPATING CODES	WHEN
P-9	Conduct review/analysis of predicted new work to complete	214.2			
P-10	Dispose of unused material as key ops close	225			
P-11	Conduct overhaul test program with POT&I personnel observing pertinent tests	365	244.14		
P-12	Conduct specified in-process inspections	130 300			
P-13	Collect and report selected data for ship's machinery history	244.2			
P-14	Update selected record drawings and data	244.2			Complete by C
P-15	Document the "as released" material condition of the ship	200.03	244.1 244.14	330 225	Complete by C; Update at C+60
P-16	Conduct ROH post mortem for feedback to improve follow ships	214.2	190 330	219, 225 244.12 244.1	Prior C+60

Task #		Lead Code
P-1	ACCOMPLISH PRE-FAB WORK	330

This task is self-explanatory but it should be noted that the accomplishment of pre-fab work prior to overhaul start is important to the overall game plan of reducing cost of FF-1052 overhauls.

P-2	UTILIZE COST CONTROL CURVES AND OTHER COST/ SCHEDULE/PROGRESS ANALYSIS TOOLS	214.2

The currently available cost control curves combined with the progress analysis being performed by Production Department on most overhauls in the Shipyard will be applied to the FF-1052 overhauls. Cost analysis curves will be set up for each job order, each customer order. Progress analysis will be set up for the selection of key jobs made by Code 214.2 and Code 330 thay they believe key to economical on-time completion of the overhaul. The current tools will be refined and new ones developed as necessary to provide all levels of management with good current data on cost control, progress, and schedule adherence.

P-3	REVISE PLANNING ESTIMATE/FIXED PRICE OFFER/ ULTIMATE SHOULD COST ISSUE PREDICTIONS MONTHLY	214.2

Procedures are being developed for accomplishment of this task on all ships undergoing overhaul at Pearl Harbor Naval Shipyard. Special emphasis should be given to FF-1052's to ensure compatibility of planning estimate/fixed price offer/ultimate cost issues in their monthly revisions with the overall goals of the FF-1052 program.

P-4	CONDUCT CRITIQUE AFTER EACH SIGNIFICANT PHASE OF OVERHAUL	214.2

A post mortem will be conducted at the end of each overhaul to determine areas of improvement to pass on to the next. Purpose of the task is to conduct a post mortem at the end of each significant phase of the overhaul to determine what can be done better in the next phase of the same overhaul and what needs to be passed on into the planning for

Task # Lead Code

the next FF-1052 overhaul. Waiting for the end of the overhaul is too late and too much has been forgotten. These critiques should be relatively short but conducted by hard-hitting well-informed people. The results will be reduced to writing and distributed to all concerned for action. The first step in this task is to identify those significant phases of the overhaul upon whose completion it is desired to conduct critiques. It is important that all concerned that are going to be involved in critiquing, know well in advance that a critique will be conducted so that they can think about the subject and select appropriate information. Several areas of pre-planning and material support should be evaluated, and into the productive phase, certainly, the completion of pre-fab and the completion of initial rip out are two significant phases that should be considered.

P-5 POT&I PERSONNEL EXAMINE OPENED EQUIPMENT 244.14

The same personnel that conduct POT&I should logically examine the equipment when it is opened to obtain feedback information regarding the accuracy of their predictions. During POT&I our engineers, technicians, and planners and estimators examine the operating ship to the depth possible in order to generate recommendations for overhaul. Their recommendations are generally accepted and overhaul proceeds on the strength of them. It is highly desirable to obtain as much feedback as possible concerning the actual condition of the equipment when open in order to improve the ability of the individual to make sound recommendations for repair work based on POT&I observations. Special action is required to ensure that this feedback is acquired and that significant findings are reduced to writing to ensure closing the feedback loop.

P-6 CONDUCT UNDERWATER WORK/INSPECTION REVIEW 225

The purpose of this task is to conduct a special underwater work/hull inspection review to ensure that all decisions concerning docking work are made as early as possible.

Task #		Lead Code
P-7	CONDUCT MOCK LOE INSPECTIONS	330

MOCK LOE inspections shall be conducted as they have been in the past at Pearl Harbor Naval Shipyard to uncover and identify work necessary for satisfactory completion of the LOE on the first try. The results of MOCK LOE inspections will be fed back to POT&I personnel to help improve the planning process.

P-8	CONDUCT REVIEW OF FORCES AFLOAT REPAIR PACKAGE	214.2

Traditionally, Forces Afloat are assigned too much repair work during an overhaul; they tend to get bogged down and shift the critical work to the Shipyard at the last minute. The purpose of this task is to conduct a detailed review of the Forces Alfoat repair package just after the overhaul starts at about A+1 and then later on at about A+5 when things normally get critical again. The review will be conducted for the purpose of flushing out any residual work that Ship's Force and IMA's cannot accomplish and negotiate with the Type Commander for Shipyard accomplishment of those items that are essential to completing the overhaul objectives.

P-9	CONDUCT REVIEW/ANALYSIS OF PREDICTED NEW WORK TO COMPLETE OVERHAUL	214.2

This task is actually accomplished almost continuously by Code 214.2 and others during the course of the overhaul, but the intent of this specific task is to conduct an extensive and exhaustive review at about A+5, the same time at which the Forces Afloat repair package review is made, to get a handle on what is remaining to be accomplished, but unapproved at this point, for the entire overhaul. The results of this task will be used to negotiate the new work predicted and to refine the financial predictions for the overhaul.

P-10	DISPOSE OF UNUSED MATERIAL AS KEY OPS CLOSE	225

Special emphasis needs to be placed on reviewing material surpluses or materials that have not been received or utilized for the overhauls Key OP by

Task # Lead Code

Key OP. If work packaging was done correctly, then the closure of each Key OP one-by-one represents indeed the closeout of a package of work that is meaningful to production. It is highly desirable to clear the materials that are staged at the MMC's and unused to make room for needed material. Careful screening shall be done to ensure that material is disposed of in the "best" manner possible as a combination of economics and availability for the next FF-1052 overhauls.

P-11 CONDUCT OVERHAUL TEST PROGRAM 365

The overhaul test program shall be conducted in accordance with Shipyard instructions, job order issues, and under the direction of Code 365. It is desired that pre-overhaul test personnel work with Code 365, and the shops, in observing pertinent tests to increase their skill in yet another way in observing shipboard tests of similar or the same equipment. Job order coverage should be issued for the POT&I personnel in this regard.

P-12 CONDUCT SPECIFIED IN-PROCESS INSPECTIONS 130

Conduct in-process inspections as specified in job orders or test memos or as directed by Quality Assurance Officer based on preventive action program indicators.

P-13 COLLECT AND REPORT SELECTED DATA FOR SHIP'S MACHINERY HISTORY 244.2

Task O-23 developed a machinery history information collection plan. Task P-13 is aimed at actual collection and reporting of this selected machinery history. It shall be done in accordance with the plan developed in O-23 and in support of Tasks P-14 and P-15.

P-14 UPDATE SELECTED RECORD DRAWINGS AND DATA 244.2

Selected record drawings and other documents as appropriate, shall be updated scrupulously in accordance with instructions. In addition to

Task # | Lead Code

the other selected record requirements, the ship's systems description index shall be updated as a selected record.

P-15 DOCUMENT THE "AS RELEASED CONDITION" OF THE SHIP 200.03

The purpose of this task is to ensure that the 3M CSMP of the ship and the 3M machinery history reflect the true material condition of the ship as it departs the Shipyard as well as recording the significant events and data from the overhaul. This is a new task and not familiar to the Shipyard. The task will have to be accomplished by a combination of ship inspection, review of documents, and review of CSMP and machinery history data. This is an extremely important task in that the results of it will be the documentation of the as released condition of the ship in great detail to serve as a measuring point for the degradation of the ship during its operating cycle. This task is correlated with the Extended Operating Cycle (EOC) program for the FF-1052's being managed by NAVSEA.

P-16 CONDUCT ROH POST MORTEM FOR FEEDBACK TO IMPROVE FOLLOW SHIPS 214.2

The thrust of this task is obvious. Shipyard procedures for conduct of post mortems will be followed except that FF-1052 overhaul post mortems will be more intensive and searching in nature and more timely due to the need to promptly feed into subsequent overhauls.

GLOSSARY OF TERMS AND ACRONYMS

TERM OR ACRONYM	MEANING
ACC	Automatic Combustion Control
APL	Allowance Parts List
BACD	Basic Alteration Class Drawing
CID	Component Identification Number
COSAL	Consolidated Allowance List
CSMP	Current Ship's Maintenace Project
DISC	Discrepancy Identification for Ship's Complex
DMI	Direct Material Inventory
IMA	Intermediate Maintenance Activity (Tender, Repair Ship, SUBASE, Fleet Maintenance Group)
JML	Job Material List
JO	Job Order
KO	Key Operation
LLT	Long Lead Time
LOE	Light-Off Examination
MCC	Material Control Center
MIS	Management Information System (Computerized data and information system used by all naval shipyards)
NON	Notice of Non-Conformance
PDM	Planned Direct Material
PEB	Propulsion Examining Board

TERM OR ACRONYM	MEANING
PERA	Planning & Engineering for Repairs and Alterations (PERA(CRUDES) is an activity based at Philadelphia Naval Shipyard charged with assisting Type Commanders and NAVSEA in planning Cruiser/Destroyer overhauls.)
POT&I	Pre-Overhaul Tests and Inspections
PPC	Production Planning & Control
RAV	Restricted Availability
ROH	Regular Overhaul
SARP	Ship's Alteration and Repair Package
SA-P	Ship's Alteration Package (without repairs)
S-RP	Ship's Repair Package (without alterations)
SECAS	Ship's Electronic Configuration Accounting System
SFOMS	Ship's Force Overhaul Management System
SLM	Ship's Logistic Manager
SWBS	Ship's Work Breakdown Structure (NAVSHIPS 0900-039-9010)
SWBS 5th Level	Ship's Work Breakdown Structure broken down two more levels than the three levels contained in NAVSHIPS 0900-039-9010.
SWLIN	Ship's Work List Item Number
TRS	Technical Repair Standard
UDM	Unallocated Direct Material
WDC	Work Definition Conference

APPENDIX B

EXPANDED APPLICATION OF SSDI

(A reprint of ARINC Research publication 1630-01-2-1428, Analysis of Expanded Application of Ships System Definition and Index (SSDI), July 1975.)

ANALYSIS OF EXPANDED APPLICATION OF SHIP SYSTEMS DEFINITION AND INDEX (SSDI)

July 1975

Prepared for

PEARL HARBOR NAVAL SHIPYARD
Honolulu, Hawaii

Under Contract N00604-75-C-0276

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ANALYSIS OF EXPANDED APPLICATION OF SHIP SYSTEMS DEFINITION AND INDEX (SSDI)

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ABSTRACT

Potential applications of the Ship Systems Definition and Index beyond its present usage as an overhaul preparation aid were investigated. A broad spectrum of Navy management functions and tools were examined relative to SSDI applicability, with conclusions and recommendations offered for each.

SUMMARY

This study demonstrated that the Ship Systems Definition and Index (SSDI) has potential application beyond its present usage as an overhaul preparation aid. Potential SSDI applications to various functions and tools associated with ship maintenance management are summarized in Table A.

Certain general advantages and limitations apply when considering the utilization of SSDIs based on Ship Work Breakdown Structure (SWBS) coding as a common communication medium. The advantages are that the SSDI:

a. Permits rapid and accurate coding of ship systems/equipments to five levels of complexity.

b. Identifies ship system/equipment boundaries and interfaces. Since this step has to be taken every time many of the management aids listed in Table A are applied, use of SSDI precludes the necessity of continually redefining work packages.

c. Expands on the usefulness of the SWBS code. Many management aids and systems utilize the basic (three-digit) SWBS supplemented with sequence numbers as a means of identifying items. Use of SSDI would provide a standard means of coding items to two additional levels of detail.

The principal limitations associated with the use of SSDI are:

a. The widespread use, exclusively in some management systems, of the "competing" Equipment Identification Code (EIC). Application of SWBS to such systems would necessitate either 1) the conversion of those systems to SWBS coding, 2) the provision in those systems for SWBS as well as EIC coding, or 3) a means of cross-referencing the SWBS and EIC numbering systems.

b. The necessity of making minor revisions to existing instructions, such as for Technical Repair Standards, Ship's Force Overhaul Management System, etc.

To fully utilize the advantages of the SSDI concept, its coverage could be expanded as specifically recommended in Table A, and generally as follows:

a. Structuring a "universal" SSDI, based on the SWBS Master Index; and

b. Building tailored SSDIs for individual ship classes.

TABLE A. SUMMARY OF POTENTIAL EXPANSION OF SSDI (Sheet 1 of 2)

Function/ Tool	Application	SSDI Requirements	Benefits	Constraints	Conclusions	Recommendations
3M/MDCS, including CSMP	Code work requests (form 4790/2K) in lieu of or in addition to EIC.	Master SSDI	Provide more logical and accurate basis for performing any type of cost/performance/ reliability/etc., analysis based on ship systems/ equipments.	Would require replaceing EIC with SWBS.	Would be costly to replace EIC with SWBS.	Cross-reference new SSDIs to EIC to extent possible. Consider adding SWBS code to MDCS reporting documentation.
POT&I	Use SSDI to identify and define the systems/ equipments to be inspected.	Additional class SSDIs	Each inspection record would have a unique code. Would provide a checklist to aid in defining POT&I items.	Would require revising instructions for preparing POT&I plans.	Application is feasible and would provide for better definition of individual inspection records. Only minor changes would be required to existing instructions.	Prepare a POT&I plan for a future overhaul organized to conform with SSDI.
SARP	Assign fifth-level code to "job" key operations and/or replace present SWLIN number.	Additional class SSDIs	Ties together POT&I, SFOMS, work specifications, material ordering data, etc. Serves as a checklist for defining items for preparation of work specifications.	Cannot include more than one fifth-level item in one key operation. Would require restructuring SWLIN.	Application of SSDI to SARP is feasible and is presently being accomplished at PHNSY. Further work is required to obtain full benefits.	Analyze present application of SSDI to SARP for USS WHIPPLE to identify areas for improvement, and implement improvements in next SARP prepared.
Material Ordering	Assign fifth-level SWBS code on JMLs.	Additional class SSDIs	Would tie together material ordered with SARP item and work specifications, and simplify historical data retrieval.	Requires changing instructions for preparing JMLs.	Application of SSDI to material ordering is feasible and will be accomplished by PHNSY.	Analyze current efforts at PHNSY and apply to a follow-on overhaul. Continue to construct a material-ordering data bank and assign SWBS codes.
Work Packaging	Use as reference/ checklist for defining work packages.	Addition class SSDIs	Would simplify packaging of work by systems/ subsystems.	Not generally suitable for work packaging by area.	Is feasible for use as a reference for system work packaging.	Use as a reference for work packaging by system, and document results. Conduct further study as to applicability for work packaging by area.
Shipboard Equipment Validation	Assign fifth-level SWBS code to SECAS HM&E validation aids.	Additional class SSDIs	Better definition of CID-numbered valaids to specific systems where installed. Ensures that all systems are validated.	SSDI has to be available at start of validation for full benefits.	Is feasible to use for validation, and would be useful in organizing the validation and in ensuring complete coverage by the validation team.	Provide SSDIs for use in future ship HM&E validations. Investigate applications of SSDI for SECAS electronics validations.
INSURV	Coding discrepancies.	Master SSDI	Provide interface with other systems/tools.	Would require restructuring INSURV discrepancy coding system.	SSDI not considered applicable at this time.	Provide INSURVs a copy of SSDi and invite comments on possible applications.
Drawings/ Manuals	Developing cross-index to plans and manuals, and a reference to locating specific plans/ manuals in their appropriate index.	Additional class SSDIs.	Provides reference for locating plan and manual numbers. If a cross-index to each level of SSDI existed, would be a valuable planning tool.	Requires developing a cross-reference.	Application of SSDI to plan/ manual numbering not feasible – they already use SWBS.	Develop index of plans/ manuals to each level of SSDI.

TABLE A. (Sheet 2 of 2)

Function/ Tool	Application	SSDI Requirements	Benefits	Constraints	Conclusions	Recommendations
SAMIS	Coding ship alterations.	None	Provide identification to other systems/tools. Shipalt records do not have an SWBS assigned.	Require extensive changes to shipalt program.	Application not feasible to numbering shipalts. SSDI can be used for coding shipalts into SARP.	Conduct further studies of possible applications.
URWR (SWAB)	Work description sheet definition and coding.	Master SSDI	Would augment boundary descriptions and permit better definition.	None	SSDI and URWR programs mutually support each other and should be expanded.	Institute study to prepare URWRs related to a current SSDI, realigning SSDI as necessary to obtain improved set of documents for maintenance management.
Standard Work Specs.	Coding specifications.	Additional class SSDIs	Provide specific tie-in with other types of documentation.	None	SSDI can be used to code standard work specs.	Conduct further study into identifying standard work specs with a fifth-level SWBS code as additional class SSDIs become available.
TRS	Coding TRSs.	Master SSDI	Provide cross-reference between equipment and specific systems.	None	SSDI can be used to provide a cross-index code between TRSs and ship systems.	As TRSs are developed, continue to assign SWBS code for data bank retrieval.
SFOMS	Coding work items and standard items and estimating guidelines.	None	Provide interface with shipyard MIS program and provide checklist.	None	SSDI should be used as reference for additional coding of ship's force work to provide cross-referencing to other maintenance management programs.	Continue to apply SSDI concepts to SFOMS. Encourage participation by ship's force.
Total Ship Test Program	Provide reference for developing the program.	None	Provides checklist for identifying systems and interfaces.	None	SSDI can be applied.	Provide SSDI for reference use by personnel developing total ship tests and trials.
Shipyard MIS	Provide coding for all segments.	Additional class SSDIs	Provide common language with finer definition.	Limited to ships where SSDI has been prepared.	Can be applied, and provides an additional degree of definition.	Continue to apply SSDI concepts to MIS where applicable.
PEB/LOE	Use SSDI to identify systems, subsystems, and equipments to be considered.	Additional class SSDIs	Ensure complete system coverage and provide interface with other systems/tools.	None	SSDI is applicable as a reference document for PEB/LOE preparation.	Continue to provide class SSDIs for use during PEB/LOE preparation.

CONTENTS

1
INTRODUCTION

The Ship Systems Definition and Index (SSDI) was developed as a management aid in preparing for ship overhaul. SSDIs define ship systems in a manner that facilitates the preoverhaul inspection conducted to determine work requirements, and provides a means of logically organizing the overhaul work package. However, a potentially broader usefulness of these diagrams became apparent after they became available to the maintenance management community and underwent several cycles of refinement. An investigation to evaluate the applicability of SSDIs to other ship-related functions and activities has been conducted by ARINC Research Corporation under Contract N00604-75-C-0276, and the results are presented in this report.

For this study, the following task objectives were established in conjunction with personnel of Pearl Harbor Naval Shipyard:

a. Identify the maintenance management functions to which the SSDI is potentially applicable.

b. Analyze the benefits and constraints associated with such applications.

c. Formulate conclusions regarding the feasibility of application in terms of technical, administrative, and economic factors.

d. Determine any associated requirements for refining the SSDI concept.

Section 2 of this report describes the SSDI concept and its present applications. Based on those applications and the potential inherent in the SSDI concept, Section 3 addresses the task objectives listed above.

2
DESCRIPTION OF SSDI

2.1 OBJECTIVES OF SSDI

The Ship Systems Definition and Index is an orderly identification and structuring of the systems and subsystems that make up a total ship. The SSDI defines the systems as well as their boundaries and interfaces, creating a common language for communicating information about a ship's configuration. As illustrated by Figure 1, the SSDI is designed to:

a. Provide a five-level breakdown of a ship's configuration, with the ship completely defined at each level.

b. Utilize the Ship Work Breakdown Structure (SWBS) coding, expanded to accommodate the five-level breakdown.

c. Tailor the SWBS to the configurations of specific ship classes or individual ships.

2.2 SSDI CODING

The Navy uses two principal coding systems for classifying ship systems, subsystems, and equipments – the SWBS and the Equipment Identification Code (EIC). EICs are the primary means of identifying shipboard systems, subsystems, and equipments when documenting actions in accordance with the procedures of the 3M system. The early SSDIs were structured to this language.

The SWBS is a general-purpose common language to be used throughout a ship's life cycle, from early design and cost studies through production and subsequent use and disposal. The SSDI serves to identify ship systems/equipments in documentation relating to cost, weight, performance specifications, system function and effectiveness, design, production, and maintenance. It combines into a single system the functions formerly served by the Bureau of Ships Consolidated Index (BSCI) and the Standard Subject Identification Code (SSIC). The SWBS language system is the core of the most recent SSDI set, tailored to DE-1052 class ships. The Navy's intent is that the future SSDIs also be SWBS-coded.

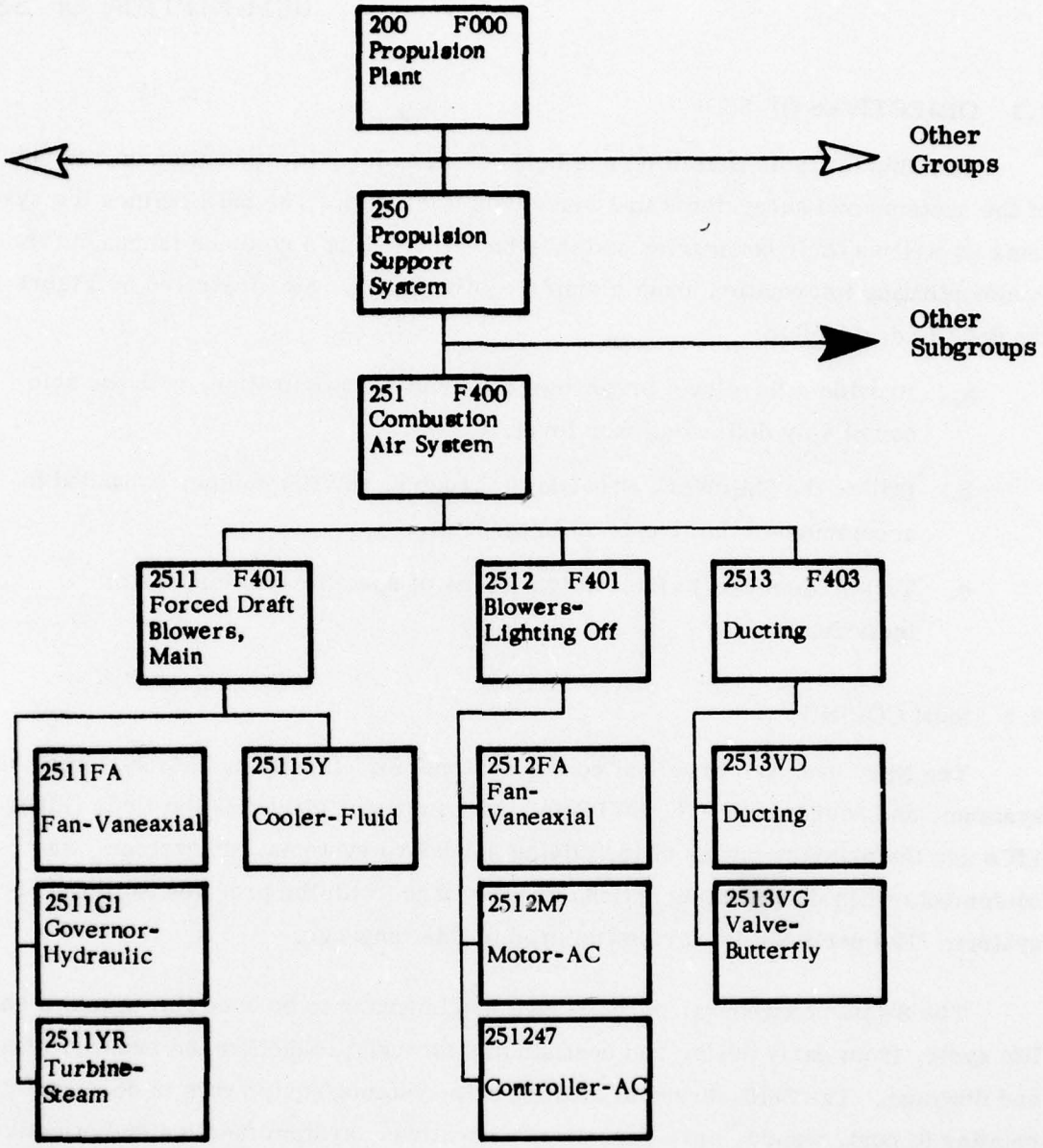

Figure 1. Portion of a Typica' Ship's System

To provide more precise identification of shipboard equipments, the three-digit SWBS has been expanded for SSDI usage to include a fifth-level equipment coding list developed by SECAS. The use of the expanded code is illustrated below for a propulsion plant subsystem ac motor of greater than 3 horsepower (SSDI code 2512M7):

SSDI Breakdown	Example Unit	Code Number
Group – 1st Character	Propulsion Plant (200)	2
Sub-Group – 2nd Character	Propulsion Support System (250)	5
Element – 3rd Character	Combustion Air System (251)	1
Subelement – 4th Character	Blowers - Lighting Off	2
Component – 5th/6th Character	Motor - AC, Over 3HP	M7

2.3 SSDI DIAGRAM TYPES

The SSDI contains two types of illustrations: 1) the system diagram, or basic structure; and 2) the line diagram, which provides supplementary information on an as-required basis. Each of these diagram types is discussed below.

2.3.1 System Diagram

An SSDI system diagram is prepared for each major ship system (hull structure, propulsion, etc.). As illustrated by Figure 2, the system diagram identifies:

a. System equipments

b. System boundaries

c. Key maintenance items within each system

d. Shipboard maintenance work centers

e. Where further detail can be obtained on complex portions of the system (i.e., reference is made to an SSDI line diagram).

2.3.2 Line Diagram

In some cases, notably for piping and electronic systems, the system diagram does not make clear the boundaries and interfaces associated with certain system elements. In those instances, a line diagram provides the needed clarification. Refer for example to Figure 3, a line diagram of the main forced-draft blowers. As shown in that figure, all equipment, components, and connection paths represented by solid

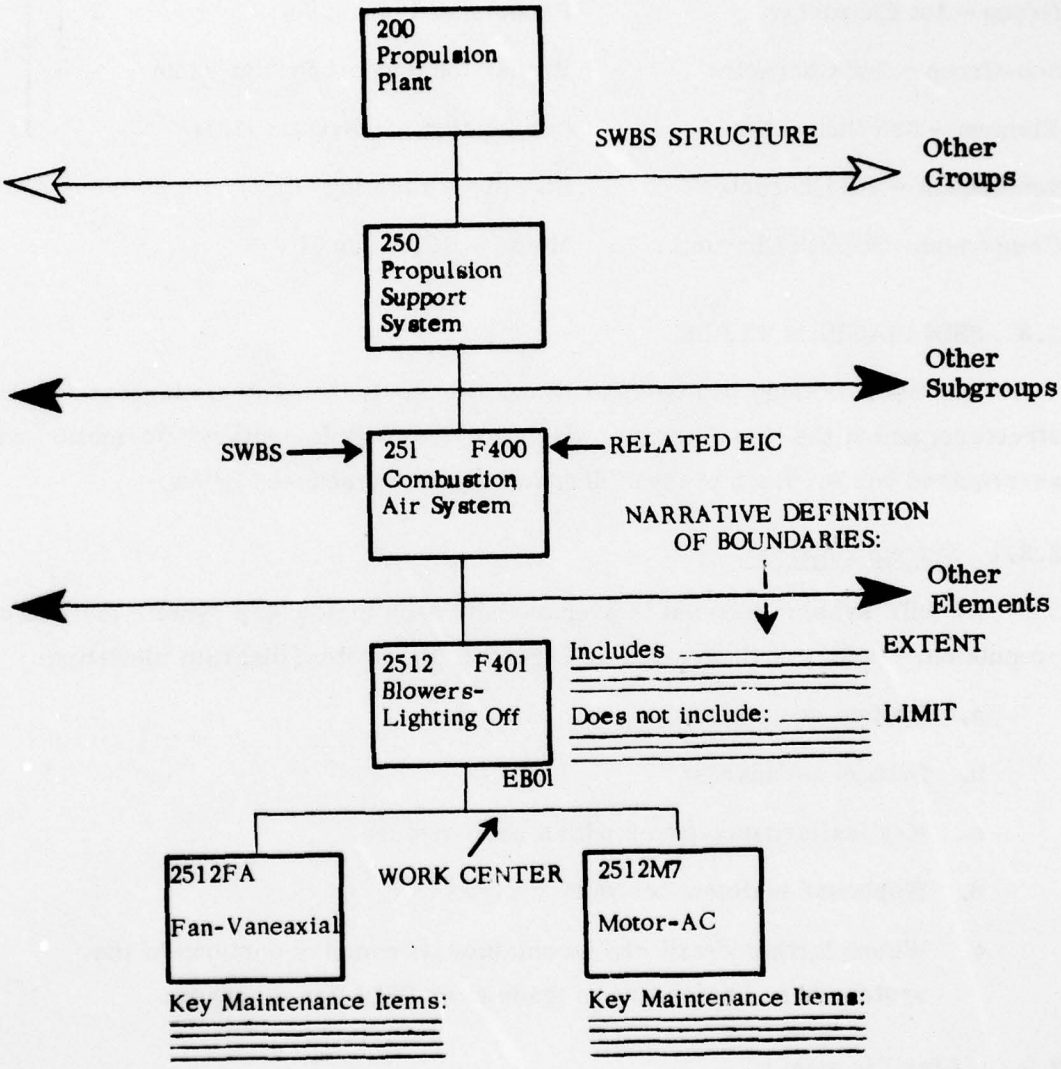

Figure 2. Example of System Diagrams Included in SSDI

AD-A051 809 PITTSBURGH UNIV PA CENTER FOR INTERNATIONAL STUDIES F/G 15/5
COMPUTERIZED PROGRAMS FOR IMPROVING OVERHAUL PLANNING,(U)
NOV 75 D N MCLAUGHLIN N00604-75-C-0431
UNCLASSIFIED 1634-01-1-1460 NL

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lines within the boundary are contained in the particular SWBS (in this case, 2511). Equipment or components shown as broken or dashed lines, even if located within the SWBS boundary, are assigned to another SWBS. (Note for example, the dividing points in the piping lines under "Turbine" in Figure 3.) Tracing the lines to the SWBS boundary will show the interfacing systems, subsystems, or equipments.

Although some of the line diagrams do show functional relationships, that is not their intent – their specific purpose is to aid in identifying the correct SWBS. For this reason the line diagrams are greatly simplified from the actual configuration. In many cases neither the correct number of equipments nor all interconnecting relationships are shown. For example, although two or more identical forced-draft blowers may be used in the combustion air system, only one is shown on the schematic (see Figure 3). This is because all blowers of the same type have the same SWBS number.

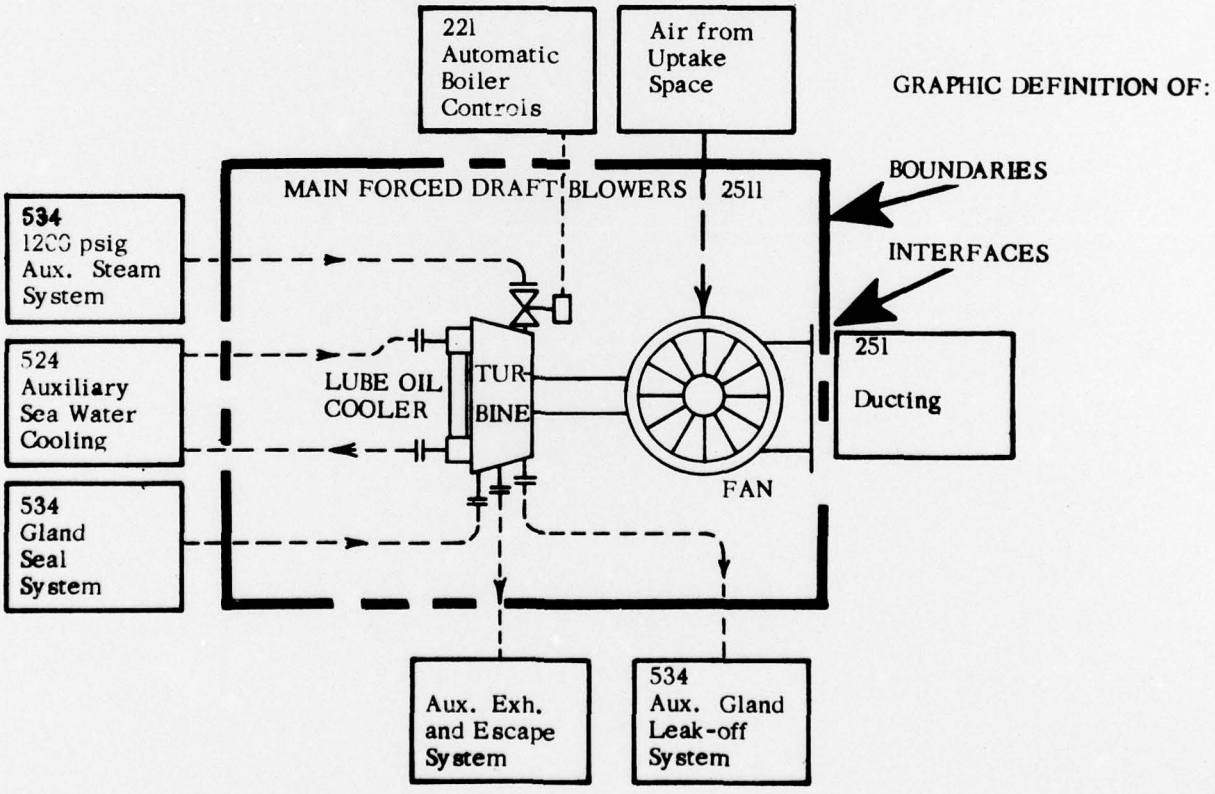

Figure 3. Example of Line Diagrams Included in SSDI

3
POTENTIAL FOR EXPANDED SSDI USAGE

Based on the makeup and current applications of the SSDI, as discussed in Section 2, a number of maintenance management functions and tools were identified as possibilities for expanded application of the SSDI concept. Each of these functions and tools, listed in Table 1, was evaluated as to potential SSDI applications and related benefits or constraints. Where SSDI application was considered feasible and desirable, a test plan was defined for exploring the application.

Results of this investigation are discussed in the following sections.

3.1 3M MAINTENANCE DATA COLLECTION SYSTEM

The EIC Master Index is the present source for assigning identification codes to systems, subsystems, and equipments when documenting maintenance actions for the Maintenance Data Collection System (MDCS). The effectiveness of the MDCS depends to a large extent on the accuracy of the source information, which is sometimes compromised by human errors associated with the nature of the EIC system. The user is required to research the entire EIC index in assigning codes, and the result has been the assigning of many wrong numbers due to lack of knowledge of what certain codes encompass. For example:

a. Some piping system codes also include pumps, driving units, and other components in addition to the piping and valves of the system.

b. There are six separate propulsion system codes.

Another common problem in EIC identification is coding at the wrong level, e.g., at the subsystem instead of the equipment level.

The EIC-structured SSDI provides a more ready means of locating and assigning the correct codes. The SWBS-structured SSDI for DE-1052 class ships provides some cross-reference to the EIC code, but would require additional modification for full compatibility with MDCS. Should SWBS coding be substituted for EIC in the MDCS, full application of the SWBS-coded SSDI could be made.

TABLE 1. MAINTENANCE MANAGEMENT FUNCTIONS/TOOLS

Program	Program Element	Main. Mgmt. Func/Tool
3M	MDCS	Current Ships Maintenance Project (CSMP)
		Material history reports
		Work requests (form 4790/2K)
Ship Overhaul	Overhaul Planning/Preparation	Pre-Overhaul Test and Inspection (POT&I)
		Ship Alteration and Repair Package (SARP)
		Material ordering
		Work packaging
		Shipboard Equipment Configuration and Accounting System (SECAS)
		INSURV deficiency reports
		Drawing/manual indexing and numbering
		Ship Alteration Management Information System (SAMIS)
		Uniform Repetitive Work Request (URWR)*
	Overhaul Accomplishment	Standard work specifications
		Technical Repair Standard (TRS)
		Ship's Force Overhaul Management System (SFOMS)
		Total Ships Test Program
		Shipyard Management Information System (MIS)
		Propulsion Examination Board/ Light-off Examination (PEB/LOE) preparation

*Will be replaced by Ship's Work Authorization Boundaries (SWAB)

- Conclusions: SSDIs structured to the EIC Index support the 3M functions, and should assist in increasing the accuracy of data submitted to the MDCS. The SWBS-structured SSDI, if completely cross-referenced to the EIC, could accomplish the same results. Consideration should therefore be given, when developing new SSDIs, to providing full EIC cross-reference. In summary, the question is not the applicability of the SSDI concept to the 3M functions, but whether 1) SWBS replace EIC in MDCS reporting, or 2) MDCS reporting procedures provide for entering SWBS as well as EIC identifiers.

- Recommendation: Consider adding the SWBS identification code to MDCS reporting documentation.

3.2 SHIP OVERHAUL

3.2.1 Planning and Preparation

Preparation for regular overhaul generally entails the following sequential actions:

a. Determine repair requirements, assess repair priorities, and select accomplishing activities.

b. Determine resources (dollars, manpower, and time).

c. Considering the repair priorities, make tradeoffs between requirements and available resources in terms of manpower, dollars, and time to define that portion of the work package to be accomplished and that portion to be deferred.

d. Prepare a detailed plan for accomplishing the work.

In carrying out these actions, a number of maintenance management functions and tools (as indicated in Table 1) are employed. The effectiveness with which functions and tools could be applied in accomplishing the above actions would be enhanced if there were a common language for correlating them. The application of such a language, SWBS, through the use of the SSDI is discussed in the following paragraphs.

3.2.1.1 Pre-Overhaul Test and Inspection (POT&I)

For each overhaul, a POT&I plan is generated to document the tests and inspections required to compile a comprehensive repair work package and document the rationale for the recommended repairs. These POT&I plans are developed and

assembled by major ship system, with individual inspection records for the maintenance-significant components. These components are assigned the SWBS element (third level) code, and numbered sequentially within this code, e.g., 251-1, 251-2.

Application of the SSDI to POT&I plans would ensure that all components within a system are covered, would identify the functional interfaces associated with testing, and would provide a unique code for each component's inspection record. (The code would be to either the fourth or fifth level, depending on degree of coverage, e.g., 2511 for the forced draft blower, or 2511YR for the FDB turbine.)

- Conclusion: Application of the SSDI to the development of the POT&I plan is feasible, and would provide for better definition of individual inspection records.

- Recommendation: Prepare a POT&I plan for a future overhaul organized to conform with the SSDI.

3.2.1.2 Ship Alteration and Repair Package (SARP)

The Ship Alteration and Repair Package lists alteration and repair work identified for a ship; gives estimated cost data; and serves as the vehicle for presenting work for authorization-to-accomplish decisions. The SARP is assembled by major ship system, utilizing the SWBS in the form of a System Work List Item Number (SWLIN). That document provides the interface between the 3M programs, ship-originated CSMP and/or work requests, and the shipyard accounting system. Application of the SSDI would ensure that specific work is assigned to correct SWLIN, and reduce the possibility of duplication of work items.

SWLINs are written to the level required to describe completely the work to be accomplished. At PHNSY the SWLIN includes equipment identification data, ship name and hull number, applicable system, job title, three narrative sections (scope, job breakdown, and remarks), and estimated manhour and cost data. Using the SSDI, a fifth-level code can be assigned to each job-breakdown line item, providing a more precise data retrieval, job costing, and identification of material required for each operation. Problems can arise, however, if more than one fifth-level component is covered in one work breakdown item. For example, if a pump and motor assembly have two different SWBS codes, the job order can be identified by only one of these codes. Further investigation is required in this area of SSDI application.

- Conclusions: Application of the SSDI to the SARP is feasible (and in fact is being done in a present study program), but further study is needed to obtain the full benefits of applying the SSDI in preparing the SARP.

- Recommendation: Perform an analysis of the present application of SSDI to the SARP of USS WHIPPLE (DE-1062) to identify areas of improvement, and prepare a plan for implementing these improvements on the next SARP prepared.

3.2.1.3 Material Ordering

Once work has been identified in the SARP, advance ordering of material can begin. Job material lists (JMLs) are keyed to the SWLIN and are prepared for each component identification code (CID). A job order number and key operation are also entered on the JML. Using the SSDI to enter a fifth-level code (generally one code per CID) would provide further unique traceability and identification. When a sufficient data bank of material-ordering information for a specific CID has been assembled, a unique fifth-level SSDI code would provide for ready retrieval of material-ordering data and improve the procurement process.

- Conclusion: Application of the SSDI to the material ordering function is feasible, and will be accomplished at PHNSY.

- Recommendations:

  a. Analyze the efforts to date on using the SSDI for material ordering programs, and apply the results to a follow-on overhaul activity.

  b. Continue to construct a material-ordering data bank and assign appropriate SSDI SWBS codes.

3.2.1.4 Work Packaging

The process of work packaging has resulted from studying ways to provide better procedures for work planning and production control. The objective of this process is to divide the overhaul package into logical units of work that fit the manner in which the job will be performed. Packaging is usually done on either a ship-system or ship-area basis. Thus a particular package could include three different categories of work: repair items, alterations, and special project tasks. Work specifications are then prepared for the defined package.

The SSDI as presently structured would not support work packaging on a ship-area basis (e.g., main deck, auxiliary machinery room). However, it is considered a valuable reference document for packaging work by systems or subsystems, and would provide visibility as to interfaces with other systems and subsystems.

- Conclusion: The SSDI can be used as a reference for work packaging by system.

- Recommendation: Use the SSDI as a reference for work packaging by system and document the results. Conduct further study as to its applicability for work packaging by ship area.

3.2.1.5 Shipboard Equipment Validation

SECAS HM&E ship validation aids are identified by CID number. The validation team adds the appropriate SWBS code. Using the SSDI, the validation team could verify that all system components are provided for and that the correct SWBS fifth-level code is assigned at the time of validation.

- Conclusion: The SSDI would be very useful in organizing HM&E validation and ensuring complete coverage by the validation team.

- Recommendations:

  a. Provide SSDIs for use in future ship HM&E validations.

  b. Investigate applications of SSDI for SECAS electronics validations.

3.2.1.6 INSURV Deficiency Reports

Reports of inspections conducted by the Board of Inspection and Survey are organized and numbered in accordance with INSURV procedures. Procedures exist in the 3M program for entering INSURV-identified deficiencies into the MDCS, at which time they are assigned EICs. There is no known plan to revise these procedures to adapt to the SWBS.

- Conclusion: Until SWBS coding is provided for in INSURV reporting, the SSDI is not considered applicable to INSURV operations.

- Recommendation: Provide a copy of the SSDI to INSURV and invite comments concerning possible applications.

3.2.1.7 Drawing/Manual Indexing and Numbering

Navy drawings and manuals are presently identified by SWBS and other coding systems. The SWBS-coded SSDI would be a useful tool in identifying the correct manual for a particular system/equipment. Another helpful aid would be a listing of technical manuals and drawings applicable to each level of the SSDI.

- Conclusion: The SSDI can be used as a reference for identifying drawings and manuals.

- Recommendation: Develop a reference index of plans and manuals for each level of the SSDI.

3.2.1.8 Shipalt Records and SAMIS

Shipalt records have EICs assigned, usually at the system or subsystem level. From a management viewpoint, appropriate SWBS coding would be desirable but this is not considered an area where the SSDI would be applicable. Once an alteration is programmed for accomplishment, an SSDI could be used for SARP coding and identifying system interfaces. Expanding this philosophy to the Ship Alteration Management Information System (SAMIS), no direct application of the SSDI can be identified.

- Conclusions:
  a. Application of the SSDI to SAMIS and shipalt record identification is not feasible.
  b. The SSDI can be used for incorporating alterations into the SARP.

- Recommendation: Conduct further studies of SSDI application to shipalt programs.

3.2.1.9 Uniform Repetitive Work Request (URWR)

NAVSEASYSCOM's program to develop URWRs is another major step in attempting to standardize overhaul planning procedures. The concept is based on developing a standard work request for an SWBS element or subset, e.g., one for boilers and one for automatic boiler controls.

Each URWR attempts to define the total range and boundaries of what is included in the SWBS element or subset, and specifies the work to be provided. However, the URWR does not break the systems down to the level required by its principal users, ship's force and shipyard.

URWRs and SSDIs have similar concepts and goals. If the URWR concept were to be expanded to a finer degree of breakdown, and if the development of new URWRs were coordinated with further development of SSDIs, a strong maintenance management tool would result. PHNSY letter Ser 200-2 of 9 July 1974 to NAVSEASYSCOM explains this concept in greater detail.

- Conclusion: The SSDI and URWR programs are mutually supportive and should be expanded toward full compatibility.

- Recommendation: Conduct a study to prepare a set of revised URWRs related to a current SSDI, realigning the SSDI as required, to result in an effective set of improved documents for material and maintenance management.

3.2.2 Overhaul Accomplishment

Many of the management functions and tools applicable to overhaul planning and preparation continue to apply during the actual overhaul. Still other management aids, as listed in Table 1, are required for this phase. The potential application of SSDI to each of these is discussed in the following paragraphs.

3.2.2.1 Standard Work Specifications

Several studies are in progress in which standard work specifications for shipboard repair work are being developed. Such specifications are usually identified with a five-digit control number, the first three of which are SWBS and the last two a sequence number. Application of the SSDI fifth-level SWBS would provide a more specific tie-in with other types of documentation.

- Conclusion: The SSDI can be applied for the identification of standard work specifications.

- Recommendation: Conduct further study into identifying standard work specifications with a fifth-level SWBS code as more SSDIs (additional ship classes) become available.

3.2.2.2 Technical Repair Standard (TRS)

Technical Repair Standards are intended to provide standard procedures for repairing an equipment and a list of material needed to support the repair. Usually equating to a specific CID number, these TRSs would be applicable to the fifth level of the SSDI.

The SSDI could be used to provide a cross-reference between the equipment and a specific ship system. No application of the SSDI to an individual TRS is envisioned.

- Conclusion: The SSDI can be used to provide a cross-index code between TRSs and ship systems.

- Recommendation: As TRSs are developed, continue to assign SWBS codes for data bank retrieval.

3.2.2.3 Ship's Force Overhaul Management System (SFOMS)

The SFOMS program provides information and methodology for use by ship's force personnel in managing their portion of the overhaul work package. Data processing procedures provide the required reports, which are normally organized by job and work center. SSDI codes should be incorporated into these reports to provide a cross-reference to the shipyard's programs, and can be used by ship's force to ensure that all systems are accounted for. In addition, the incorporation of SSDI codes into SFOMS accounting practices would be extremely useful in establishing and utilizing a SFOMS data bank.

- Conclusion: The SSDI should be used as a reference for additional coding of ship's force work to provide for cross-referencing to other maintenance management programs.

- Recommendation: Continue to apply SSDI concepts to the SFOMS program. Encourage participation by ship's force.

3.2.2.4 Total Ship's Test Program

The SSDI would provide a good reference for use during the planning for the Total Ship's Test Program. With the SSDI used as a checklist, systems could be identified, interfaces determined, and requisite tests and trials defined. Appropriate coding could be used to identify individual portions of the program for various systems and subsystems of the ship.

- Conclusion: The SSDI could be applied to the Total Ship's Test Program.

- Recommendation: Provide the SSDI for reference use by personnel developing total ship tests and trials.

3.2.2.5 Shipyard Management Information System (MIS)

The shipyard Management Information System provides cost, scheduling, planning, production, and material data. As evidenced throughout the previous analyses, use of the SWBS as a common language and the SSDI for further definition with respect to specific ships, would provide useful support to the shipyard MIS.

While SSDI is applicable to specific ships or ship classes, its SWBS orientation assures compatibility with MIS and its additional degree of definition provides for more detailed information when required.

- Conclusion: The SSDI can be applied to the shipyard MIS, and provides an additional degree of definition for overhaul planning and accomplishment for specific ship classes and types for which SSDIs have been prepared.

- Recommendation: Continue to apply SSDI concepts to MIS where applicable.

3.2.2.6 PEB/LOE Preparation

Preparation for PEB/LOE requires a concentrated effort, primarily by ship's force but also by the shipyard. Through the use of management plans and supporting programs such as SFOMS and MIS, the required work is identified, scheduled, and accomplished. In this program, the SSDI can be used as a reference for assuring complete system coverage and identifying system interfaces. Appropriate coding would ensure that the work is accounted for in the management progress reports.

- Conclusion: The SSDI is applicable as a reference document for PEB/LOE preparation.

- Recommendation: Continue to provide SSDIs for use during PEB/LOE preparation.