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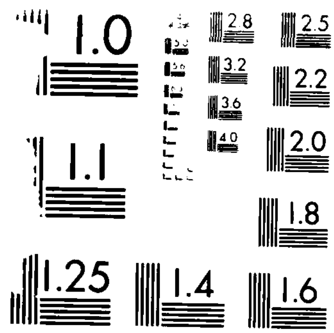
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NAVAL POSTGRADUATE SCHOOL

Monterey, California

THESIS

REDUCING REPAIR TURN AROUND TIME OF
DEPOT LEVEL REPAIRABLES AT NAVAL SHIPYARDS

by

Joseph R. Rodwell, Jr.

December 1985

Thesis Advisor: Alan W. McMasters

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This thesis examines the key issues that have caused Repair Turn Around Time (RTAT) of Depot Level Repairables (DLRs) managed by the Ships Parts Control Center (SPCC) and overhauled by naval shipyards to be excessive. Many of the DLRs repaired by naval shipyards exceed the Naval Supply System command's goal of 60 days. Four Navy Shipyards were visited to gather RTAT data on DLRs and identify potential improvements in the Designated Overhaul Point (DOP) repair process that will reduce RTAT. An analysis of the policies and procedures used by SPCC in preparing the workload forecase as well as the effects of the forecast on the shipyard repair process was also conducted. Recommendations are made to improve the management of repairables in shipyards through Command support and the use of an Automated Repairables Management Information System (ARMIS). Recommendations are also offered to improve piece part support used in the repair of DLRs.

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Reducing Repair Turn Around Time of Depot Level Repairables at Naval Shipyards

by

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Lieutenant Commander, United States Navy
B.S., University of South Carolina, 1972

Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

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ABSTRACT

This thesis examines the key issues that have caused Repair Turn Around Time (RTAT) of Depot Level Repairables (DLRs) managed by the Ships Parts Control Center (SPCC) and overhauled by naval shipyards to be excessive. Many of the DLRs repaired by naval shipyards exceed the Naval Supply System Command's goal of 60 days. Four Navy shipyards were visited to gather RTAT data on DLRs and identify potential improvements in the Designated Overhaul Point (DOP) repair process that will reduce RTAT. An analysis of the policies and procedures used by SPCC in preparing workload forecast as well as the effects of the forecast on the shipyard repair process was also conducted. Recommendations are made to improve the management of repairables in shipyards through Command support and the use of an Automated Repairables Management Information System (ARMIS). Recommendations are also offered to improve piece part support used in the repair of DLRs.

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Finally, to my wife Joan, for her support and assistance.

I. INTRODUCTION

A. BACKGROUND

This thesis will examine each step in the organic depot (naval shipyard) repair cycle to determine if the repair turn around time (RTAT) of Depot Level Repairables (DLRs) managed by the Navy's Ships Parts Control Center (SPCC) can be reduced.

RTAT as used in this thesis refers to the period of time from receipt of a funding document from SPCC to the time the depot level repairable is returned to the supporting stock point in "A" condition. Although the current 90 day RTAT standard set forth by the Chief of Naval Material (CNM) in the Navy Repairables Management Manual is possible, most Navy shipyards (NSYs) are not organized to support this time frame. With increasing procurement lead times for many of the DLRs repaired by these DOPs it is imperative the Navy manage repair of scarce DLRs more effectively. In general, if the RTAT can be reduced from 90 to 60 days it will have the same effect as increasing DLR assets in the repair pipe line by 33 percent.

During the early 1980's the Naval Audit Service reviewed the repairables programs of several naval shipyards. The following excerpts highlight some of the problems that have historically caused RTAT at naval shipyards to be excessive.

1 NAVSHIPYD does not have a Repairables Management organization with central authority and responsibility. [Ref. 1: p. 1].

2 Fixed priced agreements with repairables program customers are not entered into the maximum extent practical. [Ref. 1: p. 6].

3 NAVSHIPYD does not provide as intensive support to the repair of items as contemplated by governing directives. Its production shops are dedicated to overhaul and repair of ships on the waterfront, and repairables work is accepted only as shop schedules permit. [Ref. 2: p. 1].

4 NAVSHIPYD does not accomplish the repair of items in accordance with repair program manager assigned completion dates or priorities. [Ref. 2: p. 1].

5 NAVSHIPYD provides erroneous data in its 2F/2S Cognizance and Secondary Item Repair Program Reports to repair program managers. [Ref. 2: p. 25].

B. OBJECTIVES

The objectives of this research effort are to:

1. Describe the policies and procedures used by SPCC to workload DLRs at organic Designated Overhaul Points (DOPs).
2. Examine the effects of workloading on the policies and procedures used at naval shipyards to repair DLRs.
3. Describe the repair cycle currently in use at naval shipyards.
4. Examine each segment of the DOP repair cycle to identify possible alternatives to current policies and procedures at both SPCC and naval shipyards for reducing repair turn around time.

C. METHODOLOGY

The initial literature search revealed many Navy Instructions and Defense Logistics Studies Information Exchange (DLSIE) reports and studies that stressed the need for the Navy to more effectively manage depot level repairables. However, these studies did not address the specific issue of how to reduce repair turn around time at naval shipyards. As a consequence, recent Naval Postgraduate School theses covering DLRs were reviewed to gain a more complete understanding of the repairables cycle and identify possible ways of reducing RTAT.

Performance information was collected by visiting four naval shipyards; NAVSHIPYD Long Beach, Mare Island, Norfolk and Charleston. A visit to SPCC was also made to gather information concerning the policies and procedures used by SPCC in workloading.

D. CHAPTER OUTLINE

Chapter II presents a description of the repair policies and procedures employed by SPCC and naval shipyards in the repair cycle. A detailed explanation of each segment of the DOP repair process is given to provide the reader with an understanding of the complexities involved, beginning with the establishment of a job to make repairs and ending with the return of a completed repaired carcass to the supply system in a ready for issue (RFI) condition. Chapter III identifies problems that have contributed to excessive RTAT at naval shipyards and explores possible alternatives to current practices used to workload and repair DLRs. Chapter IV is an executive summary of the problems and offers conclusions and recommendations based on the analyses of Chapter III.

II. THE REPAIRABLES CYCLE

A. BACKGROUND

The increasing complexity of weapons systems has caused the supply system to reevaluate the maintenance and stocking philosophy of wholesale systems assets. The life cycle cost of weapons systems has also increased. Many of these cost are directly related to maintaining assets which are repairable. An item is designated as a repairable if it is more cost effective to repair it than to procure a replacement. Historically, repairing a DLR component has been accomplished at one fourth the cost of a new item and at one third the procurement lead time [Ref. 3:p. IX-5]. Current policy is to repair if the repair cost does not exceed seventy five percent of the current purchase price. The increased cost associated with the maintenance and repair of DLRs has dictated increased attention to management of repairable components. As a result, SPCC has transferred most of the previously managed consumable items to the Defense Logistics Agency (DLA) and has concentrated on the management of DLRs.

During the acquisition process of major weapon system a decision is made concerning the maintenance of each component that makes up the system. These components are classified as either consumeable or repairable. Consumable items will be discarded when they fail or exceed their useful life and a replacement will be procured. For repairables, a Level of Repair Analysis is made to determine the lowest level authorized to repair or condemn the item. The Navy uses a three level maintenance concept. Based on technical and testing requirements of the component, repairables may be repaired at the organizational, intermediate or depot level. Organizational maintenance involves those actions that can be taken by the operating unit on a day by day basis to keep the item working. Intermediate maintenance is performed by a designated maintenance activity in support of the operating unit. Intermediate maintenance is normally accomplished by tenders, or at shore based repair facilities. These activities have the capability to perform repairs that are beyond that of the operating unit. They include such functions as calibration, field changes and replacing parts. Depot maintenance are those repairs necessary to bring a failed or damaged carcass back to original manufacturer's specification. Due to the extensive nature of the repairs and the machinery and test equipment involved, naval shipyards have been designated as the depot maintenance activities for many non-aviation DLRs.

When a system is first put into service the original equipment manufacturer (OEM) is normally designated as the interim depot for repair of DLRs. The reasoning behind this philosophy is that it is prudent to defer setting up organic depots when the system is new and subject to design changes and modifications. As the system matures and demand data is accumulated, the Hardware Systems Command (HSC) evaluates it and decides who should be the designated overhaul point (DOP). Assignment of a permanent DOP is a detailed and time consuming process made in accordance with the NAVMAT approved Depot Utilization Plan and NAVMAT Instruction 4000.41 [Ref. 3:p. IV-12]. Concurrently, inventory management responsibility is also assigned. Normally the inventory management function is assigned to NAVSUP Inventory Control Points (ICPs). It is the responsibility of the IM to manage material under their cognizance and have the item available to operating forces when and where it may be needed. As an example, in the Class Maintenance Plan for FFG-7 Class Frigates, Long Beach Naval Shipyard was designated as the overhaul depot for approximately 200 hull, mechanical and electrical DLRs. SPCC was assigned as the IM.

As repair requirements are identified the IM funds the DOP for repair. Until recently the standard time to accomplish repair has been 90 days. Due to funding constraints and increasing procurement lead times, NAVSUP now wants repair turn around time (RTAT) reduced to 60 days [Ref. 4]. If this can be accomplished it will have the same effect as reducing the number of failed carcasses required in the repair pipeline by one third. If RTAT for all DLRs can be reduced to 60 days the Navy may realize savings amounting to more than 180 million dollars, (average daily demand for DLRs is approximately three million dollars) [Ref. 4]. If this goal can be obtained, the Navy can not only save a great deal of money but can also improve fleet support and readiness. In order to accomplish this task Naval Sea Systems Command (NAVSEA) and NAVSUP must work together identifying and eliminating wasted or unnecessary time in the repair cycle.

As indicated in Chapter 1, this thesis will look at what NAVSEA and, in particular, naval shipyards can do to achieve a 60 days RTAT. To accomplish this it is first necessary to briefly review the segments of the current repair cycle at both SPCC and naval shipyards in detail. The cycle is defined for this thesis as the time from when a repair requirement is generated by the IM to the completion of repairs by the shipyard and a completed DLR is returned to the Designated Support Point (DSP). A DSP is normally the Naval Supply Center (NSC) nearest the DOP. Figure 2.1 is a flowchart of the non-aviation component repair cycle [Ref. 3]. The numbers in parenthesis are the sequence of events in the repair cycle.

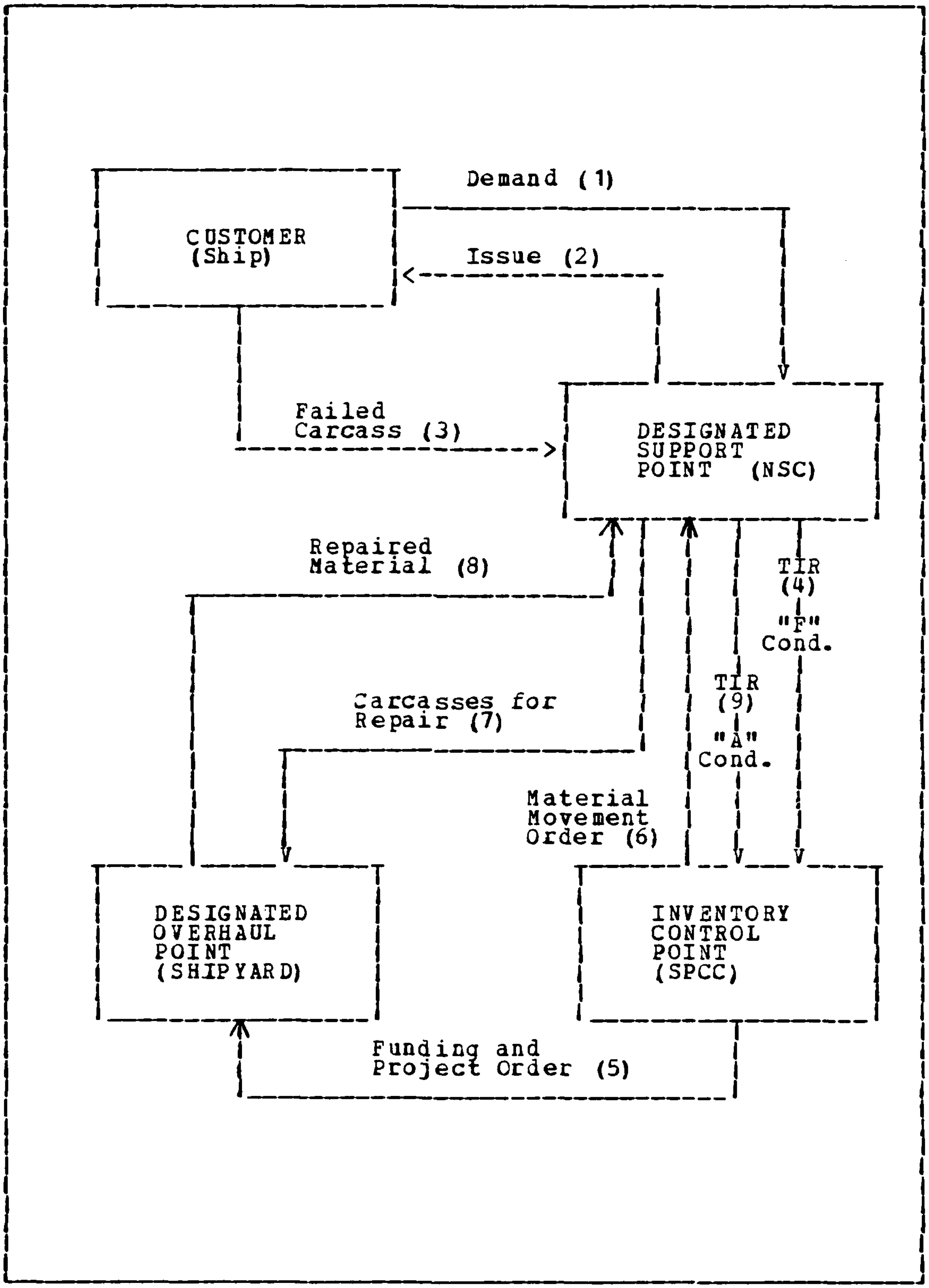


Figure 2.1 Non-Aviation Component Repair Process.

B. DETERMINING REPAIR REQUIREMENTS AT SPCC

When a DLR fails in operation it must be returned to the supply system so it can be scheduled for repair. Each operating unit has a copy of the Master Repairable Item List (MRIL). The MRIL contains a listing of all DLRs, the DOP or DSP as well as turn-in procedures and shipping instructions. The failed DLR is normally sent to the NSC nearest the depot having maintenance responsibility for the item. When the carcass is received at the DSP its location and status, such as ready for issue (RFI) or not ready for issue (NRFI) is reported to the IM via Transaction Item Reporting (TIR). Event 4 in Figure 2.1 is the reporting of the receipt of a failed carcass to the IM. Event 9 is the reporting of the receipt of a completed DLR.

The ICP uses the Uniform Inventory Control Point (UICP) computer system to track and monitor the status of all wholesale system assets. The TIR process is the primary means by which the UICP is updated on actions against any asset. This includes: demands, carcass returns, repair inductions to the DOP, repair regenerations, disposals, and receipts of material from procurement or repairs. TIR also calculates and accumulates procurement and repair times. [Ref. 5]

SPCC uses TIR information in four UICP programs to determine the procurement and repair requirements for DLRs. [Ref. 3: p. VII-2]

1. Levels program. Forecasts several key requirements determination elements such as demand, procurement lead time, requisition frequency, and turn around time. Computes wholesale requirements levels such as reorder point, order quantity, and repair level.
2. Supply Demand Review (SDR) program. Compares current inventory assets to requirements (set levels) and makes recommendations to purchase, terminate a

purchase, expedite a purchase, redistribute on-hand assets, or recall material from disposal.

3. Cyclic Repairables Management (B08) program. Compares current inventory assets to the computed repair level to determine repair requirements.
4. Stratification program. Compares forecast requirements with forecast asset levels to project future procurement and repair requirements for budget purposes.

SDR's primary function is to compare assets against requirements over the procurement lead time. If requirements exceeds assets, the IM will receive a recommendation to purchase additional units. The Repair Scheduling (B08) application of UICP compares assets against requirements over the depot turn around time. B08 also uses the urgency of need levels and fleet requirements to recommend repair and redistribution requirements to the IM. Appendix A contains copies of the forms that must be reviewed by the IM prior to workloading the DOP.

B08 divides repair requirements into 4 levels to be used by the DOP to schedule repair work. Repair requirements fall into the following four categories based on urgency of need: [Ref. 3]

1. Level one. High priority backorders and approved special projects.
2. Level two. Other end-use backorders and planned program requirements of a continuing nature.
3. Level three. Backorders for stock and funded planned program requirements due within average depot turn around time.
4. Level four. Wholesale system safety levels. Economic repair quantity.

In addition to the urgency of need, the IM must also consider budget constraints when forecasting repair quantities. The UICP Stratification program uses basic supply data on each item of inventory to calculate the funds required to support the wholesale inventory. The program considers cost of repair, repair turn around time, assets available, and demand. Based on this information the program calculates expected deficiencies and simulates expected procurement and repair requirements for budget preparations. Once the money has been appropriated, the stratification program is rerun to decide what procurements and repairs can be done within the approved budget. It is at this time that the first workload conferences are convened for a given fiscal year.

Semiannually, workload conferences are held to determine and negotiate workload for each organic DOP. Figure 2.2 is a flowchart of the procedures used by SPCC in workload forecasting of quarterly requirements. [Ref. 6]. Normally, attendees at this conferences are program managers for Depot Maintenance, NAVSEA and NAVELEX inventory and maintenance managers, NAVSUP repairables management personnel, SPCC item managers, Fleet Intensified Repairabled Management (FIRM) personnel, NSC personnel and depot personnel from each shipyard [Ref. 3]. Conferences are conducted 75 days prior to the beginning of the workload period. At the conferences, which last one week, representatives of each shipyard and item managers negotiate workload for the upcoming two quarters. Based on capability and capacity, shipyards accept or reject workload requirements. After the conference SPCC prepares quarterly funding documents and repair schedules that will make funds and carcasses available at the beginning of the quarter the work is to be performed.

SPCC uses three types of repair schedules: Cyclic Repair Requirements or "S" schedules, Interim Repair Requirements or "R" schedules and Projected Repair Requirements or "P" schedules. "S" schedules are generated bi-weekly or monthly

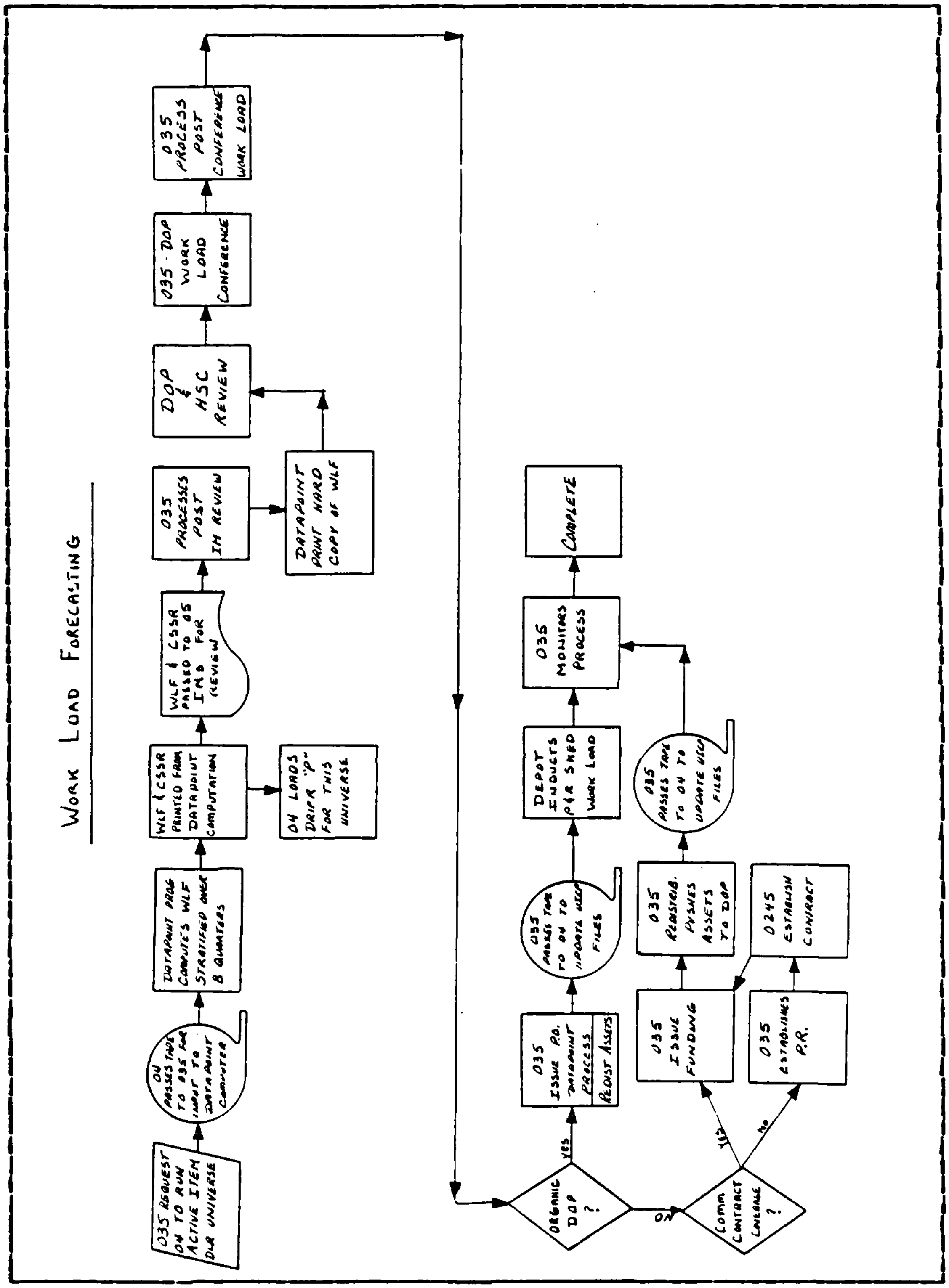


Figure 2.2 Flowchart of SPCC's Workload Forecasting Model.

and authorize repairs for low volume items by the DOPs. "R" schedules are for end-use high priority emergency requirements. "P" schedules are generally composed of those items that are scheduled during the workload conferences for planned requirements.

Funds for "P" schedules are open to obligation for 120 days. This is to allow the shipyard to program for DLRs not available at the DSP at the beginning of the quarter but expected to materialize before the end of the quarter. If the carcass is not made available during the quarter the DOP requests that the IM cancel (BSR) the repair requirement and returns the funds if the cancellation is approved.

Project orders are also issued for "S" and "R" schedules to cover any emergent requirements that may occur during the quarter. Figures 2.3, 2.4 and 2.5 are flowcharts of the details of SPCC's B08 cyclic process, processing high priority repair and interim repair requests. Developing a workload must be coordinated between three departments at SPCC. The Planning and Data Systems Group (Code 04) manages and maintains the UICP computer programs and files. The Repairables Support Department (Code 035) manages the repairable program and prepares and issues the funding documents to the DOPs. The IMs are assigned to the Weapons Support Group (Code 05). High priority and interim repair request are initiated by the individual IMs. [Ref. 6]

C. SHIPYARD REPAIRABLES CYCLE

The Shipyard Management Information System (SYMIS) is designed to support the repair and overhaul of ships. It is not designed to manage a repairables program. Although SYMIS is not programmed to provide management information on a repairables program, it does contain all of the data related to the program (ie. cost, job orders, and piece parts requirements). The CNM Repairables Management Manual points out that:

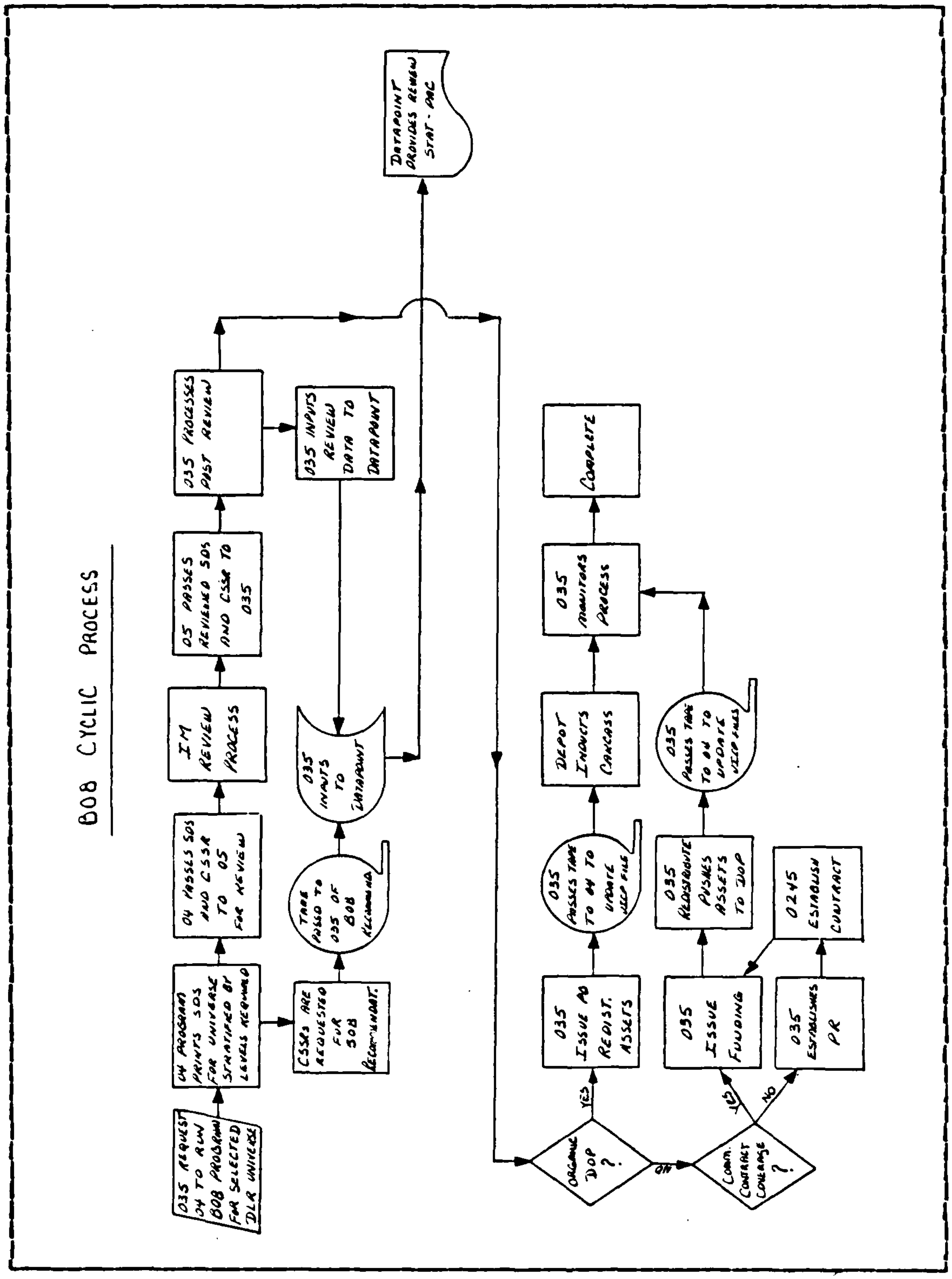


Figure 2.3   B08 Cyclic Process.

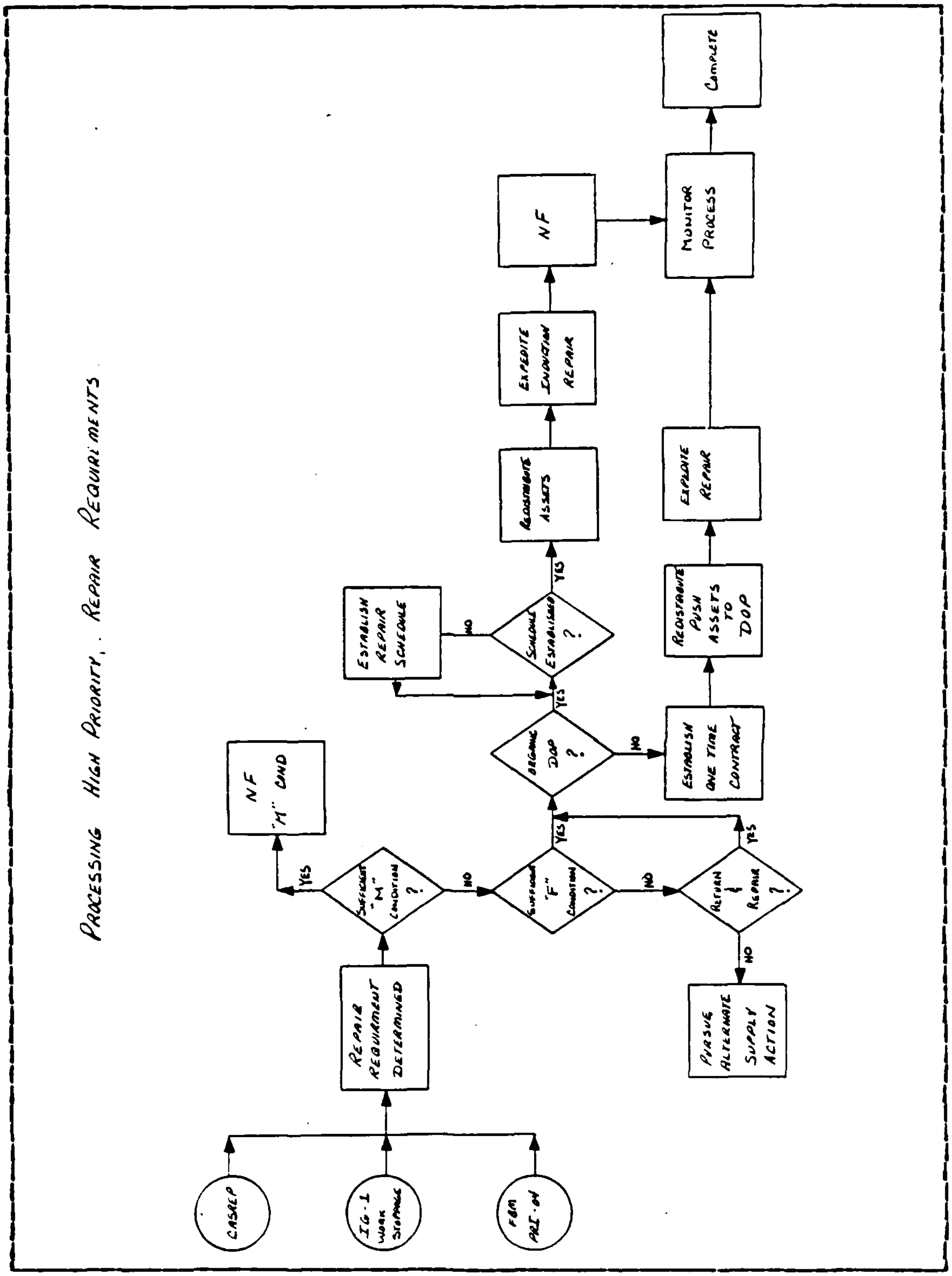


Figure 2.4 Processing High Priority Repair Requirements.

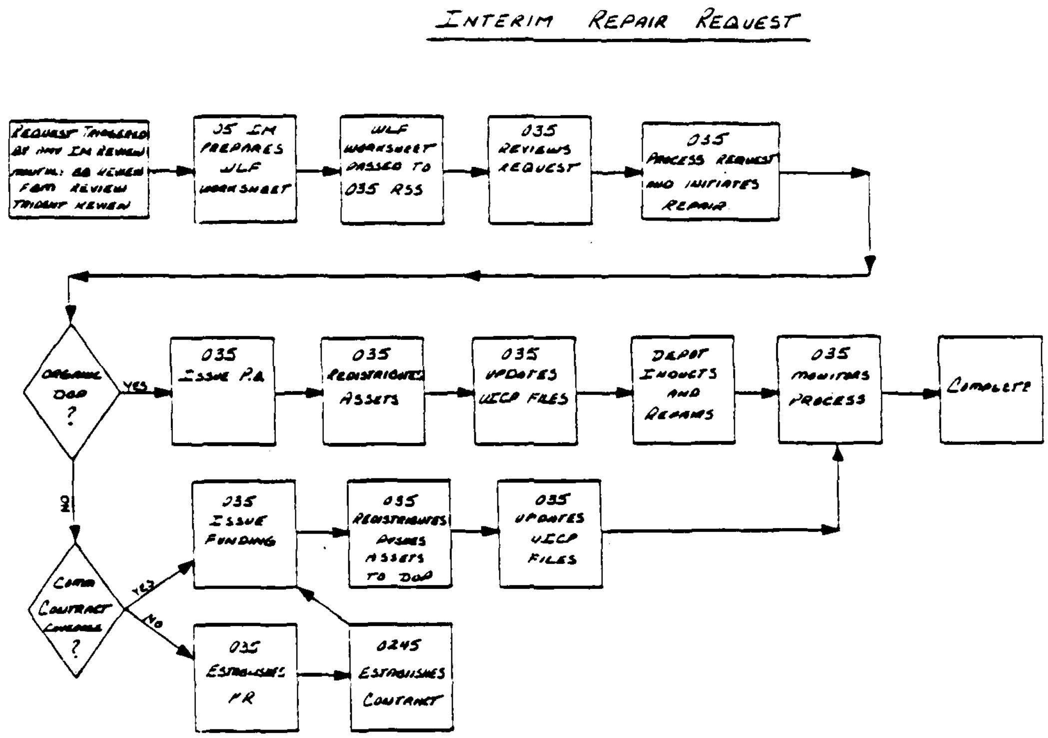


Figure 2.5 Processing Interim Repair Request.

> Changes are therefore necessary to improve the standard SYMIS and provide a greater capability for managing repairables programs within the shipyard. [Ref. 3: p. XI-16]

Most shipyards process repairables information manually. However, Long Beach Naval Shipyard has developed and implemented an Automated Repairables Management Information System (ARMIS)[1] ARMIS is a relational data based computer system used in conjunction with SYMIS to provide management information, scheduling and automatically prepare many of the forms and reports that were formerly done manually.

Other initiatives that have improved repairables management include the Customer Order Documentation System (CODS) which permits electronic transfer of funds and has automatically prepares the Customer Order Acceptance Record (COAR). A COAR is basically the contract whereby the shipyard agrees to repair a component(s) for a particular price. It contains basic information about the repairs, source of funds, amount, what is to be repaired and quantity. Figure 2.6 is a copy of a COAR generated by CODS.

The recent implementation of a Material Management (MM) function of SYMIS has increased visibility and control of shipyard inventory receipt and processing. This system tracks the status of all material ordered to support repairs on both ships and DLRs. The Material Requirements (MR) portion has been modified to maintain a history of all material used to repair a specific DLR.

The Fleet Material Support Office (FMSO) has recently developed a program, (UR22), for automating the repair induction process. To date, the UR22 program has been incorporated in the Stock Point Uniform Automated Data

---

[1]Detailed information on ARMIS is contained in Chapter III.

CUSTOMER ORDER ACCEPTANCE RECORD COAR NO: 64JMH

COAR TITLE: REFIT SPCC
REVISION NO: 001 ITEM NO: 2004 BSS NO: NWPN35-4275-9540

HULL TYPE	HULL NBR	FND ADM	CHR COD	C/B LIN	DLA COD	AVL TYP	START DATE	COMP DATE
		224	A	53	W	0	101284	093085

FUNDS AUTHORIZED	ORD TYP	REC ===	STAB LABOR	STAB MATL	PG YR	FPOFFR FPO	FPACPT FPA	REQ IND	FP Y/N
3,520.00	R3		34.40	10.77	5				N

FUNDING DOCUMENT UIC YR FD	APPN & SUBHD ============	OBJ CLS	ALLOT/PROJ ORDER	SUB ALL	SFI ===
N0010485WR02002	AA17X4911 2310	000	8100302002	0	A

AAA	TT	PAA	COST CODE	UIC	EXP. DATE
00104	7T	00000	0000000A561N	00104	093005

JOB ORDER	ITEM IDENT	INV. PRICE ==========	NOMENCLATURE ============
64JMH77H66	6635010451572	911.00	CIRCUIT CARD ASY.

WBSC	WSSC	FYDC	WPC	UNITS AUTH.	CLOSURE ADVANCE	CLOSURE RECEIVED
L11	999	2	I	005		

ACTIVITY NAME	ACTIVITY ADDRESS	ZIP CODE
SPCC	MECHANICSBURG PA	17055

THE ABOVE FUNDS ARE ESTIMATED REQUIREMENTS TO COMPLETE THE WORK AND SERVICES DESCRIBED HEREIN. THE UNDERSIGNED HAS READ VOL. 2, APPENDIX A OF NAVCOMPT MANUAL, CONSIDERS THE COAR, WHEN APPROVED, A DELEGATION OF AUTHORITY TO ADMINISTER FUNDS AND IS AWARE OF HIS RESPONSIBILITY AS FUNDS ADMINISTRATOR.

COAR NO: 64JMH

REMARKS:
F/D 7T 7H
85WR02002 3,520.00

FUNDS ADMINISTRATOR SIGNATURE DATE
101284

EXPENDITURE OF FUNDS REQUESTED CHARGEABLE TO ABOVE CUSTOMER ORDER IS APPROVED

BUDGET STATISTICS SIGNATURE DATE
G.L. GARRISON 101284

TO BE FILLED OUT BY DEPT. PERFORMING WORK
THIS IS TO CERTIFY ALL WORK IS COMPLETE.

TO BE FILLED OUT BY ORIGINATING DEPT.
THIS IS TO CERTIFY CUSTOMER ORDER MAY BE CLOSED.

RETURNED:
NO WORK PERFORMED

CUSTOMER ORDER CANCELED

DEPT/OFFICE SIGNATURE DATE DEPT/OFFICE SIGNATURE DATE

Figure 2.6 Automated Customer Order Acceptance Record.

Processing System (UADPS-SP) at one DSP. This program allows the DOP to make inductions using a terminal located at the shipyard. [Ref. 7]

D. MAJOR SHIPYARD FUNCTIONS

The repair of DLRs within the shipyard is composed of six major functions. These are Production Controller (PC), Funds Administration Planning and Estimating (P&E), Scheduling, Induction, and Actual Repair.

1. Production Control

At the beginning of each quarter SPCC prepares the funding document and repair schedule. This is normally put in the mail and sent to the production controller at the shipyard. For emergency requirements naval messages are used. Upon receipt of the funding document, the PC will verify the quantity authorized for repair and ensure the funds match the repair quantity. He also verifies that the shipyard has the capability and capacity to repair the item. Any discrepancies are usually resolved by telephone with the item manager.

2. Funds Administration

The funding document and repair schedules are then sent to the comptroller where a Customer Order Acceptance Record (COAR) will be established in SYMIS. This allows repair costs to be charged against the right job when the actual repair starts. Normally one COAR is established per funding document even though it may contain a hundred or more different line items. This practice also allows the financial administrator (normally the PC) to shift funds between line items. When one line item's repair cost exceeds the quoted repair price, funds from another item that is under cost can be used to cover the item that is over cost.

When the COAR has been established in SYMIS the PC can then prepare the log sheet and work estimate sheets

(WES). Figures 2.7 and 2.8 are samples of a log sheet and work estimate sheet. Log sheets are used as a management tool by the PC to keep pertinent data of the line item on each project order including NSN, BSS number, nomenclature, job order number, authorized quantity, repair costs, estimated repair hours, date job was issued and date completed. It should be noted that log sheets are not common to all shipyards. In addition, only ARMIS can automatically generate a log sheet.

Methods of retaining information on what is being repaired on each funding document vary between shipyards and production controllers within shipyards. WESs are internal planning department sheets which contain pertinent information of what will be repaired. WES sheets are used by P&E to write job orders. One WES must be prepared for each line item on the project order. Usually, WES sheets are prepared manually by the PC, only ARMIS has automated the preparation of WES.

3. <u>Planning and Estimating</u>

P&E will prepare a work control document (WDC) for each WES. The work control document is a detailed outline of what work must be accomplished and hours authorized for each shop and work centers. The WCD also contains any technical documentation applicable to the repairs. Figure 2.9 is a sample WCD.

For items which have a repair history P&E personnel have generated standard Job Material Lists (JMLs). JMLs are in-house requisitions sent to the supply department for known piece part requirements.

Some shipyards use Wang computers to maintain a list of piece parts required to repair DLRs. The Wang computers are also used to process requisitions for piece parts into the SYMIS. However, if P&E is unfamiliar with the line item he must research what piece parts are required and hand prepare JMLs.

REPAIRABLE LOG SHEET
N00104 85 P003144 7G
EXP 1 31-JUL-06

REPORT: LOCPP

FISCAL YEAR/QUARTER

ITEM	NOMENCLATURE NSN BSS NO.	AUTH QTY	TOTAL REPAIR COST	JOB ORDER	MH EST.	DOLLAR EST.	JOB ORDER ISSUE QTY	JOB ORDER ISSUE MH	JOB ORDER ISSUE DATE	KEY IN QTY	KEY IN DATE	DATE SCHED COMP	DATE 620 CLOSE
3001	ASTRONOMIC RECORDER 6625 00 0182104 NWPN35-5181-9449	1	1733	66DXL77G66	39	1733	1	38	7/5/5	1	8/7/5	9/20/5	
3002	BRC-16 SWITCH CONTROL 5820 00 0868974 NWPN35-5181-9450	2	830	66EAN77G66	16	830	2	14	7/5/5	2	7/20	9/20/5	
3003	OSCILLATOR 6625 00 0896697 NWPN35-5181-9451	1	978	66DXN77G66	22	978	1	21	7/5/5				
3004	AC/DC METER CALIB 6625 00 1072078 NWPN35-5181-9452	1	1955	66DXN77G66	44	1955	1	43	7/5/5	1	7/30/5	10/25/5	

Figure 2.7 Sample Log Sheet.

4. Scheduling

After the WCD and associated JMLs have been prepared P&E forwards the WCD to scheduling. Scheduling reviews the current workload for the affected shops and schedules the repair of the carcass. The WCD is then sent to local printing for reproduction and distribution. Copies of the WCD are also sent to keypunch to be input into SYMIS. When the WCD information has been entered into SYMIS the job is open to repair charges by the authorized shops. The WCD is passed to the applicable shop planners who monitor the actual repair process. The shop planner establishes key operation for each job order in SYMIS. Key operation are those activities that must take place to repair the carcasses. Examples of key operations are open and inspects, repair and test. The shop planner authorizes the number of hours for each work center to complete each key operation. When this information has been put into SYMIS the shop can induct up to the authorized quantity and commence repair.

5. Induction

To induct a carcass, most shipyards prepare a JML which is forwarded to the DSP holding the failed carcass. In the future, they will use the automated induction program (UR22) developed by FMSO . The UR22 program gives the person making the induction visibility of all "F" condition[2] assets at the DSP and automatically generates an induction notice via CRT input at the DOP. The carcass is then shipped directly to the applicable repair shop in the shipyard. This program also generates ZUC and ZUB cards. The ZUC functions as a proof of receipt by the shipyard and is signed when the material is received. Once signed, the card is retained by the DSP. The ZUB card remains with the

[2]"F" condition code refers to a failed DLR that has been returned to the DSP for repairs.

```
WORK ESTIMATE SHEET - JOB ORDER: 67CHK27H66  CREATED ON: 13-NOV-85

REFIT: SPCC                               JOB TITLE: 7H-5985-00-333-2534

PLANNER: 224.12 ENGLISH                          JOB LEAD SHOP: 6620

FUNDING DOCUMENT: N00104-86-WR05028   ITEM NO: 3004

BSS NO: NWRN35-5303-9530  NOMENCLATURE: WAVEGUIDE HORN

TECH MANUAL:                  PART NO: BR716604       APL: EP7467350
                                          GS16659
                                          1448540

UNITS AUTHORIZED TO REFIT:   1   NSN:-5985-00-3332534

+++++++++++++++++++++++++ ESTIMATE DATA +++++++++++++++++++++++++

TOTAL MAN/HOURS ALLOWED:  16

SHOPS:...66.....71..
HOURS:    15:    1:
```

Figure 2.8   Sample Work Estimate Sheet.

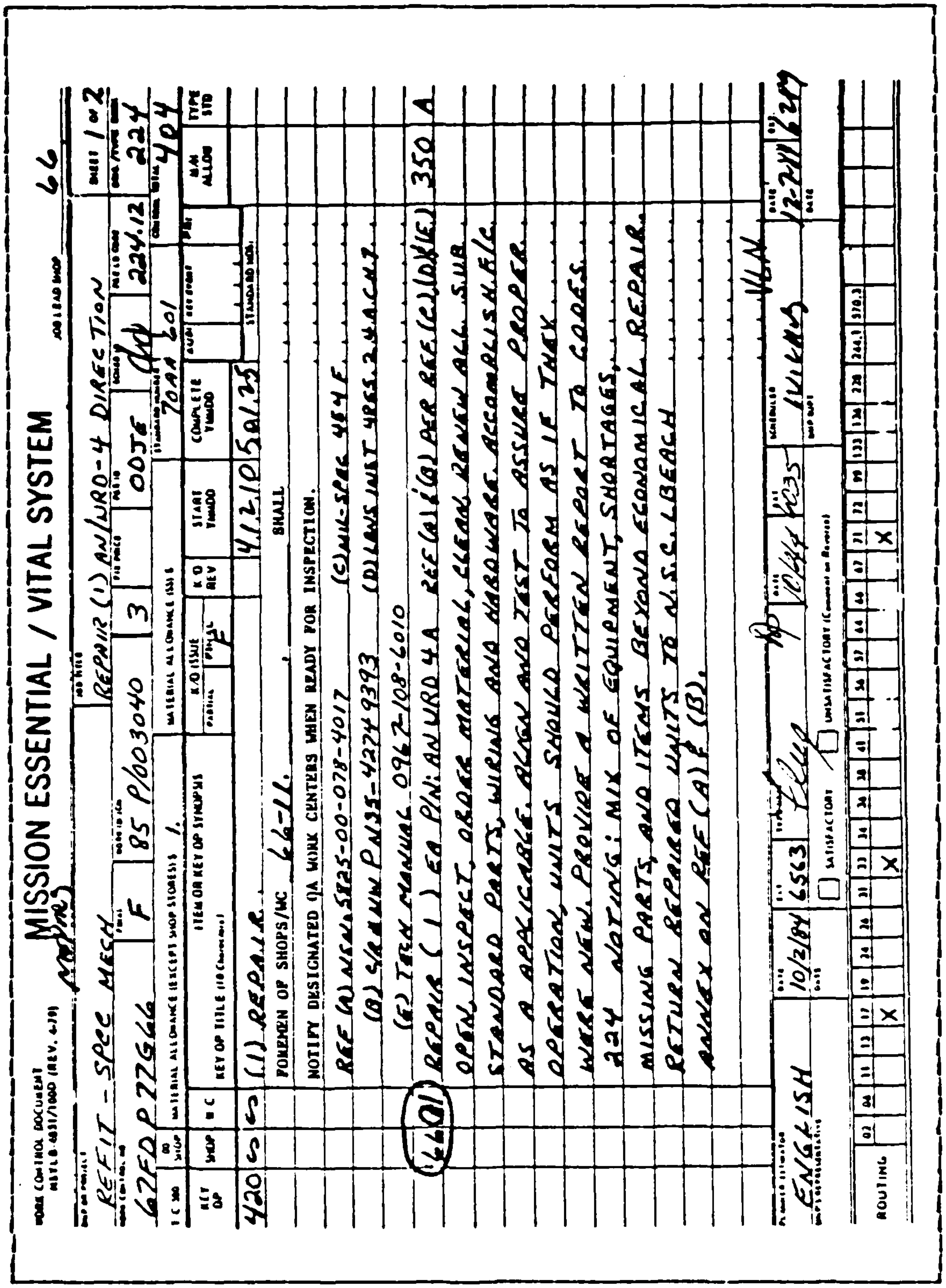
carcass and is returned to the DSP when repairs have been completed. [Ref. 8]

Several shipyards have prepared local induction sheets that are passed to the DSP to induct carcasses. The stock point then pulls the carcass and forwards it to the DOP. At this point the DSP reports the change in condition code from "F" to "M" via TIR to the ICP. The signed ZUC card is used for TIR. "M" condition means the carcass is in repair.

6. <u>Repair In Process</u>

When the shop receives the carcass it is inspected to determine if it can be repaired. This is only a cursory inspection to see if all major components are present. If the carcass can not be repaired economically the item is removed from "M" condition and placed in "H" condition (disposal) and returned to the DSP and another carcass is inducted. If the disposal action is approved by the IM or on site SPCC representative, the usable portions of the carcass are cannibalized and retained by the shipyard for use in later repairs. For carcass with missing subassemblies a Defective Material Report (DMR) is prepared and forwarded to the IM. If the turn-in activity is known, the IM will request the missing parts be sent to the shipyard or the turn-in activity will be charged the price of a new replacement for the failed carcass vice only the repair price.

During the repair process the mechanic may identify additional repair parts. If the lead time on these parts are expected to exceed 30 days the item should be placed in "G" condition (awaiting parts). By placing a carcass in "G" condition the IM is notified via TIR that repairs have stopped due to a lack of repair parts. The DOP is required to list the required parts and associated requisition numbers on the monthly refit reports. To accomplish this



WORK CONTROL DOCUMENT
NAVSEA 4851/1000 (REV. 4-78)

MISSION ESSENTIAL / VITAL SYSTEM

JOB LEAD SHOP 66

SHIP OR PROJECT: REFIT - SPEC MECH
JOB TITLE: REPAIR (1) AN/WRD-4 DIRECTION
SHEET 1 of 2

JOB CONTROL NO.: 67FDP77G66 F 85 P/003040 3 OOJE 224.12 224 404

MATERIAL ALLOWANCE (EXCEPT SHOP STORES) SHOP STORES 1.

KEY OP	SHOP	WC	KEY OP TITLE (10 Characters) / ITEM OR KEY OP SYNOPSIS	K/O ISSUE	K O REV	START TIMED	COMPLETE TIMED	STANDARD HOURS	MAN ALLOW	TYPE STD
420	6	6	(1) REPAIR	F		4/12/0	5/01/25			
			FOREMEN OF SHOPS/WC 66-11 SHALL							
			NOTIFY DESIGNATED QA WORK CENTERS WHEN READY FOR INSPECTION.							
			REF (A) NSN 5825-00-078-4017 (C) MIL-SPEC 484F							
			(B) S/R NWN P N35-4224 9393 (D) LANS INST 4855.2 MACH							
			(E) TECH MANUAL 0967-108-6010							
6601			REPAIR (1) EA P/N: AN/WRD 4A REF(A)&(B) PER REF(C)(D)&(E)						350	A
			OPEN, INSPECT, ORDER MATERIAL, CLEAN, RENEW ALL SUB							
			STANDARD PARTS, WIRING AND HARDWARE. ACCOMPLISH R/C							
			AS APPLICABLE. ALIGN AND TEST TO ASSURE PROPER							
			OPERATION. UNITS SHOULD PERFORM AS IF THEY							
			WERE NEW. PROVIDE A WRITTEN REPORT TO CODES							
			224 NOTING: MIX OF EQUIPMENT, SHORTAGES,							
			MISSING PARTS AND ITEMS BEYOND ECONOMICAL REPAIR.							
			RETURN REPAIRED UNITS TO N.S.C. L BEACH							
			ANNEX ON REF (A)&(B).							

PLANNER/ESTIMATOR: ENGLISH DATE: 10/2/84 EXT: 6563
SATISFACTORY / UNSATISFACTORY (Comment on Reverse) DATE: 10/4/84 EXT: 1035 SCHEDULER: WILKINS DATE: 12/21/84

ROUTING: 02 04 11 13 17 19 24 26 31 33 34 36 38 41 51 56 57 64 66 67 71 72 99 133 134 220 244.1 370.3

Figure 2.9 Sample Work Control Document.

the shipyard will notify the DSP to place the carcass in "G" condition. While in "G" condition the RTAT is interrupted and the carcass put in custody storage. Custody storage may or may not be at the DSP depending on the complexity of the equipment as well as local agreements made between the DOP and DSP. When the parts arrive at the shipyard, the carcass is returned to "M" condition and rescheduled for repair.

When the repair has been completed the DLR is returned to the DSP and reported in "A" condition via TIR (ZUB card). The shipyard attaches a documentation tag to each completed DLR identifying the DOP, the mechanic who repaired the item and the date repairs were completed. This tag remains with the item until it is placed in service by the end user. Preservation of the DLR is accomplished by the DOP prior to returning the DLR to the DSP. With very few exceptions the DSP will package the DLR. Most shipyards provide separate funding to the DSP for this service. Before the DLR can be issued it must be stowed at the DSP and its location reported via a ZUD transaction. This TIR notifies the IM the DLR is in RFI condition.

E. DOP REPORTING REQUIREMENTS.

In addition to the information reported to the ICP concerning RTAT, the DOP is required to submit monthly refit status reports containing the following information. [Ref. 3: p. XII-4,5].

1 Repairable Surveys: The number of units beyond economic repair. This is entered in SPCC's Repair History File and is used in computing wearout and survival rates. Intermediate Maintenance Activities (IMA) surveys obtained from the 3M system are not included in the computation of survival rate at the depot, but are an additional element in the computation of the wearout rate. Items condemned or surveyed by the DOP will be transferred from "M" to "H" condition and expended from "H". Expenditures from "H" will be used to compute wearout and survival rates.

2 Repair Completions: The number of units that were completely repaired during the time period, by NSN and by DOP (transfers from "M" to "A" condition). This information is entered in the Repair History File.

3 DOP NIF Rates: Navy Industrial Fund rates for the cost-per-hour work performed by a DOP. These are stabilized rates and normally do not change during the fiscal year.

4 DOP Workload Standard (NORM): Organic DOP repair time plus administrative time required to complete repair of an item. This information is maintained by the DOP and used in conjunction with the applicable NIF rate to determine the DOP repair price.

5 DOP Capability Code: This code reflects current, actual repair capability or noncapability at a specific DOP and provides noncapability by reason. It is used in the BC8 probe and MRIL assignments.

6 DOP prime shop: The DOP prime shop area for each specific component is listed.

7 Type Repair Directive Code: The type of repair directive is identified: NWS = Scheduled B08 requirement; NWP = Projected or workload requirement; NWR = Interim requirement.

8 Bill Of Essential Support Parts: Repair part requirements (by NSN) are identified for all repairables for which that repair facility is the assigned DOP. The probability factor (expressed as a percentage) that particular repair part will be required in the repair of a single unit of the repairable is also listed.

9 Repair Price: These prices are computed from observed repair actions for a specific NSN and dated to show the date the item repair price was negotiated.

10 Repair Cost: Includes direct labor cost to repair, material cost to repair, and other costs such as overhead are presented. This provides visibility of price variances for comparison among commercial, interservice, and organic facilities for like items. Manhours to do repair are also listed.

11 Beyond Economical Repair: Identify items for which repair costs will be excessive (greater than 75 percent of current procurement cost).

12 Current Funds Received: The dollar value of all repair schedules received and accepted at the DOP is listed.

13 Current Funds Scheduled: The dollar value of all schedules accepted for which there has been no induction (outstanding requirements) is listed.

14 Current Funds in Process: The dollar value of repair schedules that have been inducted for repair but are not yet complete is listed

15 Funds Obligated or Expended to Date: The dollar value of all schedules that have been inducted and/or completed during the fiscal year is listed.

16 Other Reporting Requirements: Unique data requirement emanating from special procedures for processing repairable material for Security Assistance Program (SAP), training equipment, battery jars, etc. is listed.

F. RTAT PERFORMANCE

CNM defines repair turn around time as:

> the time from generation of a repair directive to the date repair is completed, indicated by a TIR transferring the item from "M" to "A" condition. [Ref. 3: p. XII-3]

To maintain visibility and management control over DLRs in the repair process CNM requires that the SPCC IM maintain RTAT by item and family group. Actual RTATs are to be compared with established performance goals. To enable the ICP to measure RTAT the depot is required to report the various segments constituting RTAT. [Ref. 3: p XII-3]. Figure 2.10 is a graphic portrayal of the RTAT segments and performance goals. The definitions of the segments are: [Ref. 3: p. XIII-9].

1 DOP Acceptance: Time from ICP forwarding of a repair schedule and funding to a DOP to the date of acceptance by the DOP.

2 DOP Carcass Request: Time from DOP acceptance of repair schedule to the date of request for carcasses from the DSP.

3 DOP Material Receipt: Time for DOP request for carcasses until DOP receipt of material.

4 DOP Induction: Time from DOP receipt of carcasses until repair start date ("M" condition TIR).

5 DOP Repair in Process: Time in "M" condition (exclusive of "G" condition time). This time will be measured for each repair action via TIRs and computed as a periodic average for NSN, COG and DOP.

6 Awaiting Parts: Time in "G" condition as measured by TIRs. Time will be computed for each repair action and used in developing a DOP and system average AWP time and in highlighting excessive AWP situations as they occur.

7 RFI Receipt Time: Time from completion of a repair until the item is reported in "A" condition via TIR. This includes time in preservation and packaging after the repair has been completed. This time is measured for each repair action and used to compute the average DOP time to make repairables ready for shipment after repair.

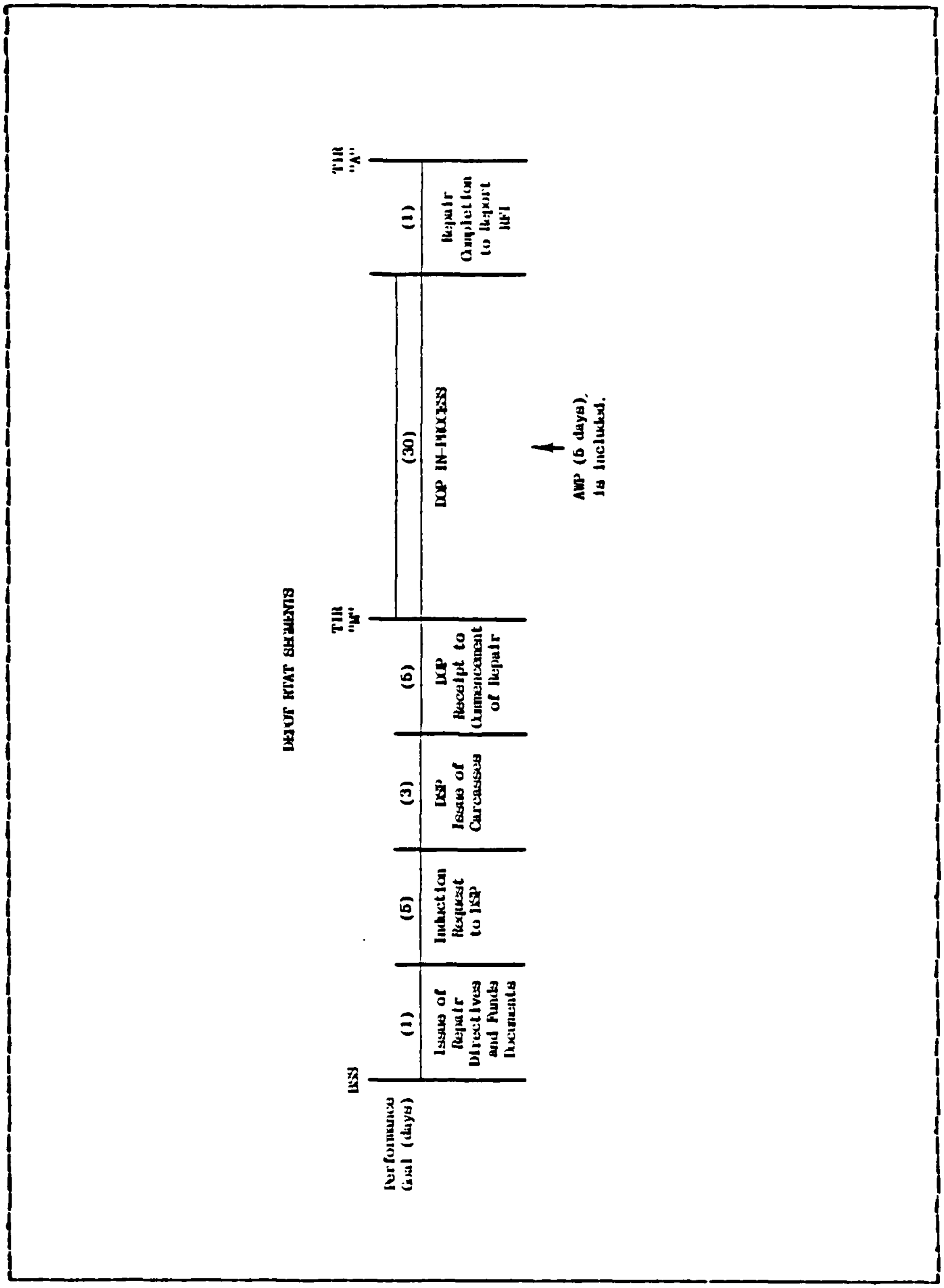


Figure 2.10 Depot RTAT Segments.

G. SUMMARY

This chapter provides the reader with a general overview of the repair cycle as well as a feel for the complexities involved in effectively managing the repair of DLRs. It provides a brief description of how SPCC determines DLR repair requirements and workloads the shipyards. A more detailed description is provided of the steps and procedures each shipyard takes to repair DLRs. It also details performance goals and reporting requirements set forth by CNM.

Some simplifications were made and the chapter is not intended to be a complete picture of how each shipyard and/or SPCC actually operates. Each step in the repair process is a complicated interface of various activities, computer systems, and individuals. Each is dependent upon the other to effectively manage repairables. In such a complicated environment there is ample opportunity for problems to develop. The next chapter will look at each step in the repair process and identify problems that tend to increase RTAT and hinder effective management at both SPCC and the shipyards.

III. ANALYSIS OF THE REPAIRABLES CYCLE

A. GENERAL

As outlined in Chapter II, the repairables cycle is a complicated system with numerous interfaces between various organizations, computer systems and people. To efficiently move a failed carcass through the repairables cycle these organizations, computer systems and people must coordinate their actions and ideas.

This chapter will address current practices and procedures which tend to increase repair turn around time and will recommend actions which may be taken to reduce RTAT. Many of the recommendations are based on the author's personal experience as the Repairables Management Officer at Long Beach Naval Shipyard from March 1982 to May 1984. Additionally, areas in which individual shipyards have taken the initiative to implement policies and procedures that have reduced RTAT will also be explored. Prototype improvements have been developed in both the organization and automation areas at individual DOPs. However, little has been done at the system level to coordinate these improvements at all organic DOPs. The specific areas which will be discussed are:

1. Institutional issues, related to the problems in measuring DOP performance;
2. Depot organization as it pertains to repairables management and DLR repairs;
3. Workload forecasting as it affects organic DOPs.
4. Administrative time, the time required to process funding documents at the DOP; this time includes preparation of all documentation necessary to induct a carcass for repair as well as the induction time.

5. <u>Repair In Process Time</u> (<u>RIPT</u>), the time from receipt of the carcass in the repair shop until repair is completed and turned over to the DSP in "A" condition.
6. <u>Preservation, packaging and storage time</u>, is the time required for the DSP to P&P, and store the DLR in RFI condition.
7. <u>Automated Repairables Management Information System</u> (<u>ARMIS</u>)

Several Naval Audit reports conducted in the early 1980's point out the deficiencies in the repairables management functions at shipyards.

> NAVSHIPYD does not have a Repairables Management Organization with centralized authority and responsibility. As a result, repairables processing is fragmented and lacks overall coordination and direction [Ref. 1: p. 3].

The report goes on to say this problem stems from:

1 Lack of dedicated personnel;

2 Lack of recognition/support for repairables within the shipyard;

3 Lack of precisely defined departmental functions and responsibility regarding repairables; and

4 Lack of interfaces between shops, shop planners, progressmen and expediters.

Another report cited a similar problem.

> NAVSHIPYD does not provide as intensive support for the repair of 2F/2S cognizance and secondary items as contemplated by governing directives. ... its production shops are dedicated to overhaul of ships on the waterfront, and repairables work is accepted only as shop schedules permit [Ref. 2: p. 2].

These reports were based on specific problems at two different DOPs. However, the problems cited are common to most of the shipyards visited. The problems addressed in the audit reports as well as several problems that were not mentioned will be examined in this chapter.

B. INSTITUTIONAL ISSUES

Before examining the problems with the repair cycle, it is important to define segmented RTAT responsibilities and look at the criteria currently in use to measure DOP performance. These are important because they affect the policies and procedures adopted at the DOPs.

SPCC measures DOP performance in two ways, (1) RTAT and (2) workload backlog [Ref. 9]

1. RTAT

SPCC uses TIR information to compute RTAT by National Stock Number (NSN), Cognizance Symbol (cog), and Depot. SPCC defines DOP repair turn around time as the time from when the carcass and funding are available to the time the carcass is reported in ready for issue (RFI) condition [Ref. 9]. This definition differs from CNM's definition presented at the end of Chapter II, which includes the induction time but does not include preservation, packaging and storage time. SPCC's definition includes the additional time the item is in preservation and packaging (P&P) as well as the time the DSP takes to stow the item and TIR it as RFI. With the exception of one shipyard visited, P&P and storage are accomplished after the item is turned over to the DSP in "A" condition [Ref. 10].

Both SPCC's and CNM's definitions include the time it takes the DSP to deliver the carcass to the DOP once the request for induction has been made. It is the DSP's responsibility, not the DOPs, to move the carcasses to the DOP in a timely manner.

The shipyards have a problem with both of the above definitions because both definitions contain times over which the DOP has no control.

When discussing what can be done to reduce RTAT it is important to specify who has responsibility for each segment of the cycle. DOP's should not be measured on segments of RTAT over which they have no control. NAVSUP should provide definitive guidance on who has responsibility for each segment of the repair cycle as well as realistic times for each segment to be accomplished.

RTAT is computed exclusive of "G" condition time (awaiting parts). Current regulations require the DOP to package a DLR and return it to the DSP when a item is placed in "G" condition. Additionally, the DOP should cancel the requisitions and have the DSP reorder the required parts. When the parts are received, the DLR and the repair parts are returned to the DOP to complete repairs.

For the larger DLRs it is not cost effective to gather up all the sub-assemblies and component parts that have been sent to various shops and workcenters for repair. Consequently, most DOPs do not use "G" condition for these larger items. At one DOP visited, "G" condition was not used at all and at another only one DLR was in "G" condition. When "G" condition is not used RTAT suffers. SPCC is also unaware that repair has stopped and can not expedite the required repair parts.

To encourage the use of "G" condition, NAVSUP should authorize local agreements between the DOP and DSP to allow larger DLRs to remain in the custody of the DOP pending receipt of the parts. The policy of canceling the DOP's requisitions and the DSP reordering the parts should be rescinded, particularly in view of the increasing procurement lead times. The DOPs will have to assume responsibility for notifying the DSP when a DLR has been placed in "G" condition as well as when repairs have restarted.

2. Workload Backlog

SPCC uses the workload backlog statistics to measure how much work the DOP has on hand. Backlog is the total number of carcasses scheduled minus those completed and or canceled (BSR). Based on the last six quarters data, SPCC computes the average number of units completed each quarter and compares that figure to the average number of units available for induction. If the the average number completed each quarter exceeds the average number of units scheduled, the DOP is said to be working down its backlog.

Figure 3.1 is a sample of the form used to compute backlog. In this example, the DOPs average units completed the last two quarters is 118 percent of the average units available for induction. However, the report shows the current backlog will still support one and one half quarters worth of work. Table I is a summary of the backlogs that SPCC has calculated for 7H cog for each of the DOPs visited in this study, based on the last six quarters' workload.

TABLE I

7H WORKLOAD BACKLOG IN UNITS

DOP	SCHEDULED	COMP.	BSR*	BACKLOG	AVE. BACKLOG
1	2648	1687	740	221	1.65 qtrs
2	10591	8016	1421	1154	1.55 qtrs
3	2947	1327	312	1308	7.16 qtrs
4	1544	1002	149	393	5.31 qtrs

* BSR is a document identifier used by SPCC to cancel repair requirements.

These figures were made available to the DOPs at the last workload conference held in September 1985. As pointed out earlier, many of the DOPs were not canceling (BSR) carcasses that were not available during the quarter in hopes the carcasses would materialize in the future. Subsequent to this report, the DOPs have reduced the backlog by canceling many of the carcasses that were not available for induction.

SPCC recognizes that this information does not accurately reflect the backlog but is forced to use whatever information is available. In this case, the data on DLRs scheduled and completed is available via TIR reporting.

DOP BACKLOG AND PRODUCTIVITY ANALYSIS
DOP: NSY LONG BEACH (7H)

	DATE	UNITS SCHEDULED	COMPLETED	BSR		BACKLOG
1Q FY84	12/31/84 -	1888	1464	222		202
	6/30/85		1602	224		62
	Difference		138	2		140
2Q	12/31/84 -	1651	1288	271		92
	6/30/85		1345	272		34
	Difference		57	1		58
3Q	12/31/84 -	1467	1077	154		236
	6/30/85		1222	157		88
	Difference		145	3		148
4Q	12/31/84 -	1386	837	226		323
	6/30/85		980	235		171
	Difference		143	9		152
1Q FY85	12/31/84 -	2205	502	0		1703
	6/30/85		1720	151		334
	Difference		1218	151		1369
2Q	12/31/84 -	1994	0	0		1994
	6/30/85		1147	382		465
			1147	382		1529
TOTAL		10591	8016	1421	13%	1154
DIFFERENCE TOTALS			2848	548		3396

AVE UNITS SKED LAST 6 QTRS 10591/6	=	1765
AVE UNITS BSR'd LAST 6 QTRS 1421/6	=	236
AVE UNITS AVAILABLE FOR INDUCTION	=	1529
AVE UNITS COMPLETED LAST 2 QTRS 785 + 2848/2 = 3633/2	=	1816
% COMPLETED VS AVAIL	=	1 18%
UNITS REMAINING FROM PRIOR QUARTERS	=	1154
UNITS REMAINING FROM CURRENT QUARTER MINUS PROJECTED BSRs	=	1675
TOTAL UNITS IN BACKLOG	=	2829
AVE UNITS COMPLETED	=	1816
% OF UNITS IN BACKLOG	=	1.55 QTRS

Figure 3.1 SPCC Backlog Computations Sample.

When units completed are used in the computations the work in-process is ignored. To accurately measure backlog, man-hours authorized should be compared to man-hours expended. With the exception of one DOP, man-hour information is not readily available. Only Long Beach NSY, which has ARMIS, can automatically generate man-hour information in a timely manner.

The author was faced with a similar problem in gathering statistical data for this thesis. A great deal of time was required to gather and compile the data at the non-automated shipyards. At one DOP the lack of any automated repairables management information by either the DOP or DSP, as well as time constraints, precluded gathering segmented RTAT on the DOP's performance. It is obviously difficult to determine what actions should be taken if accurate information on the current situation is not available.

C. DOP ORGANIZATION

1. General

Historically, the primary mission of naval shipyards has been to provide logistic support for the construction, conversion, overhaul, repair, alteration, and drydocking of U.S. Navy ships and service craft. Additionally, shipyards have been assigned depot responsibility for overhaul of DLRs.

At most shipyards the DLR workload accounts for less than five percent of the total shipyard effort [**Ref. 11: p.11-3**]. Consequently, shipyards are organized and management information systems have been set up to support the ship related work (ie. construction, conversion, overhauls, etc.).

Although the shipyard priority list indicates that the repair of DLRs is relatively high, the low volume of repairs as compared to the waterfront workload precludes most shipyard commanding officers from dedicating personnel to the repairables programs. In this thesis, dedicating personnel refers to having people assigned to a program on a permanent basis. For example, personnel dedicated to the repairables program would not be assigned to do work on ships on the waterfront. Their primary responsibility would be to repair DLRs.

During several of the interviews conducted for this thesis, repair of DLRs was referred to as "filler" work.[3] Without dedicated shop personnel to repair DLRs, repairables will continue to be used as filler work.

Most shipyards could survive without the DLR workload. However, the ICPs cannot survive without having organic DOPs. With the increasing number of DLRs (approximately 90,000 at SPCC alone) and the increasing complexity of weapons systems, it may be difficult for SPCC to locate commercial DOPs with the capability and capacity to provide timely repair of DLRs.

2. Proposed Organization

There was unanimous agreement between the shipyards visited and SPCC that the single most important factor in reducing RTAT at the shipyards was for NAVSEA and shipyard commanders to support the repairables program at their shipyards. If a repairables program is to be actively supported the shipyard needs to address four separate functions: (1) Planning, (2) Production, (3) Transportation and (4) Supply.

a. Planning

As a direct result of one of the audit reports mentioned above, Long Beach NSY established a dedicated planning office called the Repairables Management Office (RMO). Historically, this shipyard has been the largest DOP with respect to the number and value of DLRs repaired. It has been designated the DOP for over 4500 different DLRs,

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[3]Work that is accomplished when the waterfront workload is low and can not provide work for all the production workers.

3500 of which are managed by SPCC. The remainder are managed by NAVSEA and the old NAVELEX organization. In Fiscal Year (FY) 84 this DOP was funded over $65 million dollars to repair DLRs (this represents approximately ten percent of that shipyard's total workload).

Figure 3.2 is the NAVSEA approved organization chart for the Long Beach RMO. Figure 3.3 is a skeletonized organization chart that shows the relationship between the planning (RMC) and production (RRC) departments. The primary benefit of an RMO organization is the consolidation of the production controller and planner and estimater functions in one office. By having the P&E personnel in the same office and dedicated to repairables, the time required to generate the Work Control Document (WCD) / Job Order (JO) is reduced. The other major benefit of this organization structure is the centralization of authority and responsibility for managing repairables.

Due to the volume of repairables managed at Long Beach NSY, the number of PCs (5) and P&Es (6) is large when compared to other DOPs. The PCs are organized by DLR type. Two are assigned to SPCC items and two are assigned to NAVSEA items. One is assigned to manage the Pacific Fleet Winch Repair program. Three mechanical P&E, one electronic P&E, one electrical P&E and a P&E supervisor are fully employed in preparing WCDs and ordering material.

The most important factor is to have personnel dedicated to the program not the number assigned. For example, the smallest DOP analyzed in this thesis repairs approximately 500 DLRs for SPCC with funding less than $1 million dollars in FY 84 [Ref. 7]. Although this shipyard does not do the volume of DLR repairs that the larger shipyards do, the process and procedures involved in the administrative and repair functions are essentially the same. This shipyard does not need as many people assigned

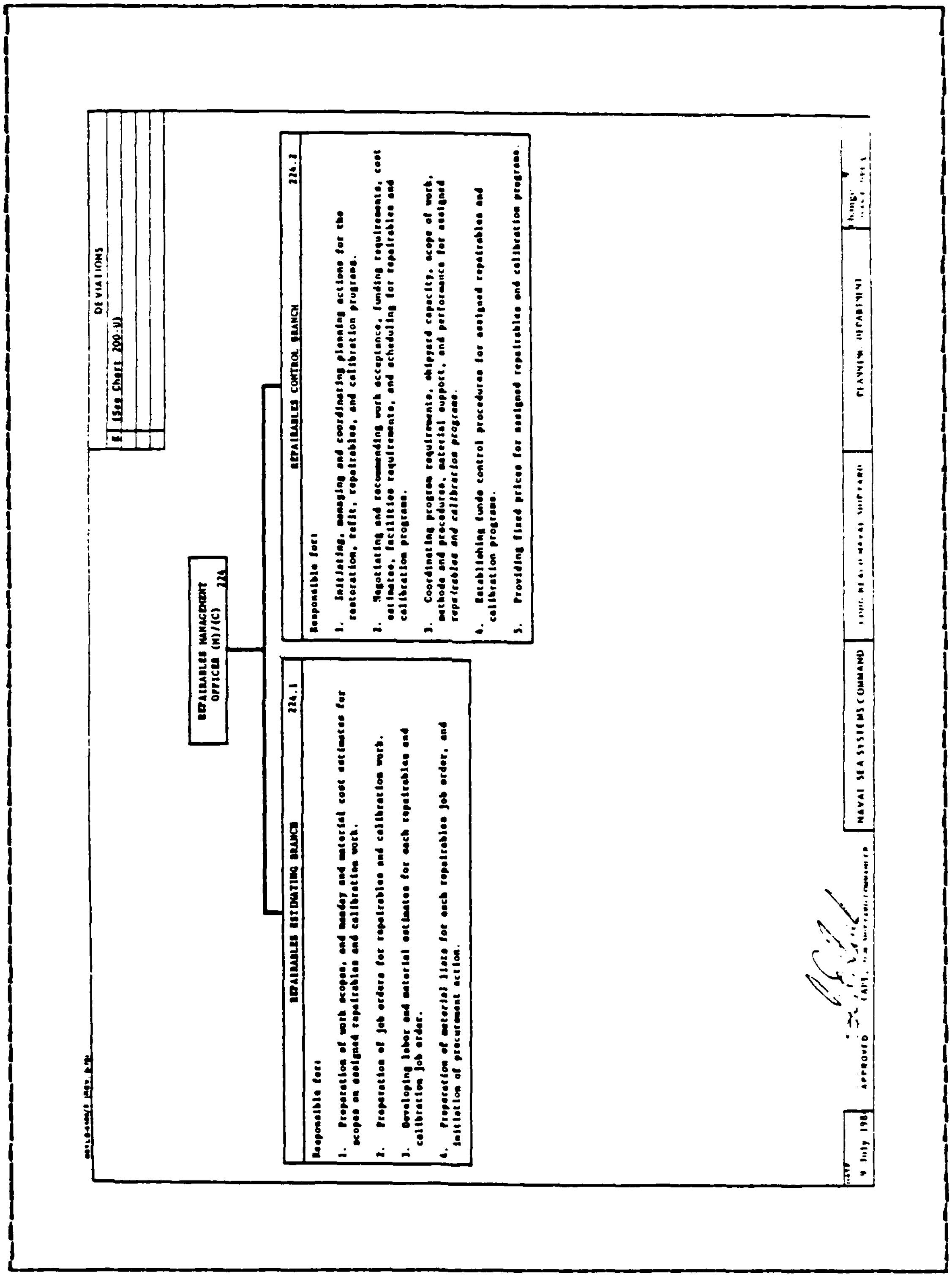

Figure 3.2 NAVSEA approved Repairables Management Office.

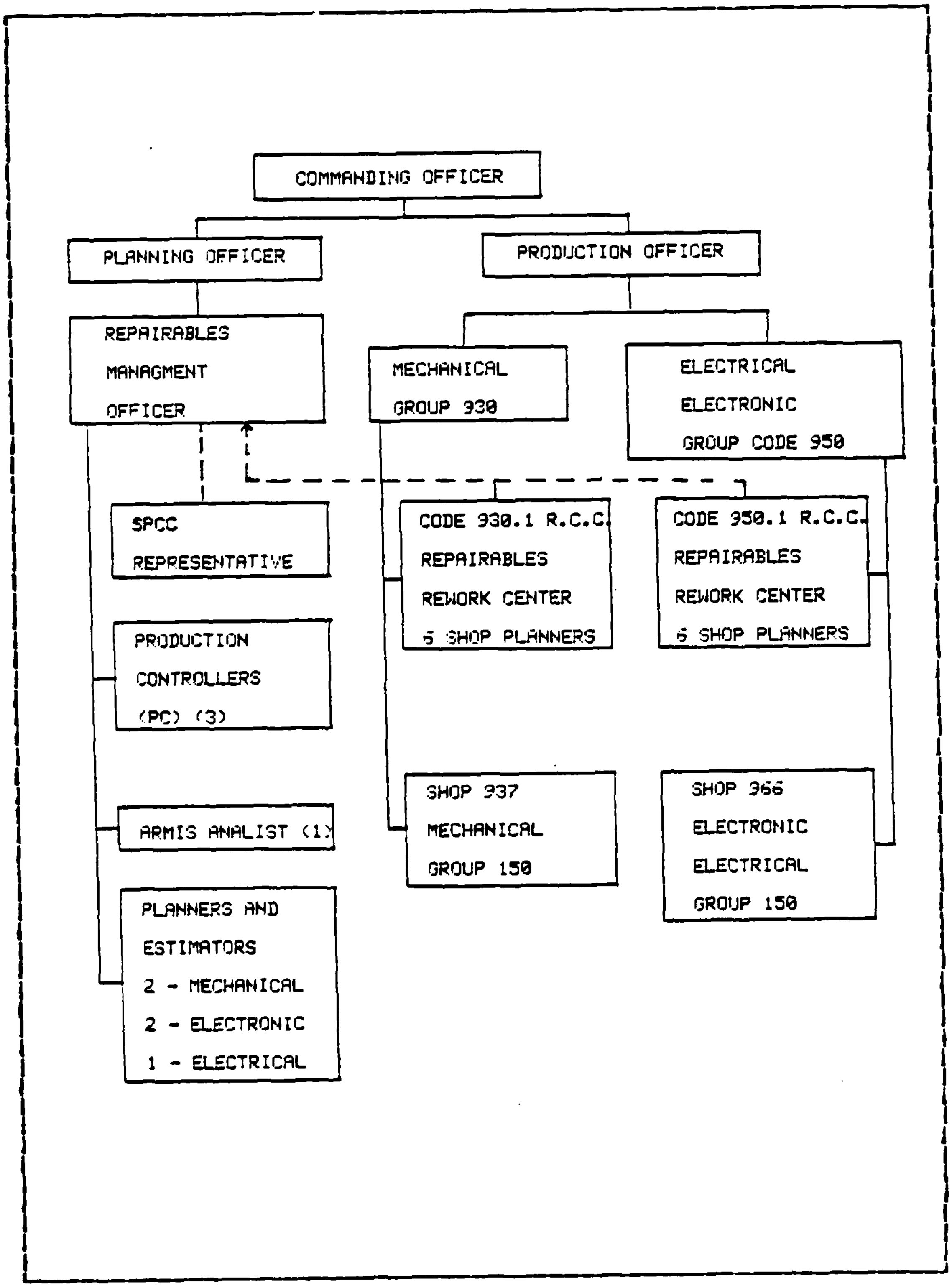

Figure 3.3 Long Beach NSY RMO and RRC Organization.

to the repairables program but it does need a dedicated organization with centralized authority and responsibility. At this DOP only one PC is used for managing the entire repairables program.

b. Repairables Rework Centers

Repairable Rework Centers (RRC) are designed to have dedicated mechanics and shop planners assigned to work centers whose primary responsiblity is the repair of DLRs.

RRCs were first introduced into selected shipyards in 1978. Currently, only two shipyards have RRCs (NSY Long Beach and NSY Norfolk). The driving factor in establishing RRCs dates back to 1975 when several shipyards were faced with (1) major reductions in the waterfront workloads, (2) underutilization of electronic repair facilities and (3) a need to provide customers a lower priced cost center[4] due to rework funding deficiencies. [Ref. 11: p. I-1.]

In 1981 an RRC was formally established in the Electronic/Electrical Group (Code 950) at Long Beach NSY. Efforts are also being taken to establish a similar organization in the Mechanical Group (Code 930). Recently the LBNSY organization was expanded to include a Shop Superintendent (Code 966). A shop superintendent is responsible for several work centers. Currently there are approximately 300 dedicated shop personnel assigned to the two RRCs at Long Beach NSY.

About the same time an RRC was established in the Electronic Shop at Norfolk NSY. Although not formally organized, the Norfolk RRC has continued to have personnel dedicated to the repairables program.

Figure 3.4 is the formal organizational chart of the Electronic / Electrical Group (Code 950) RRC at Long Beach NSY. This is the largest RRC at any shipyard and

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[4]lower priced cost centers refer to establishing tailored stabilized rates for DLR repairs.

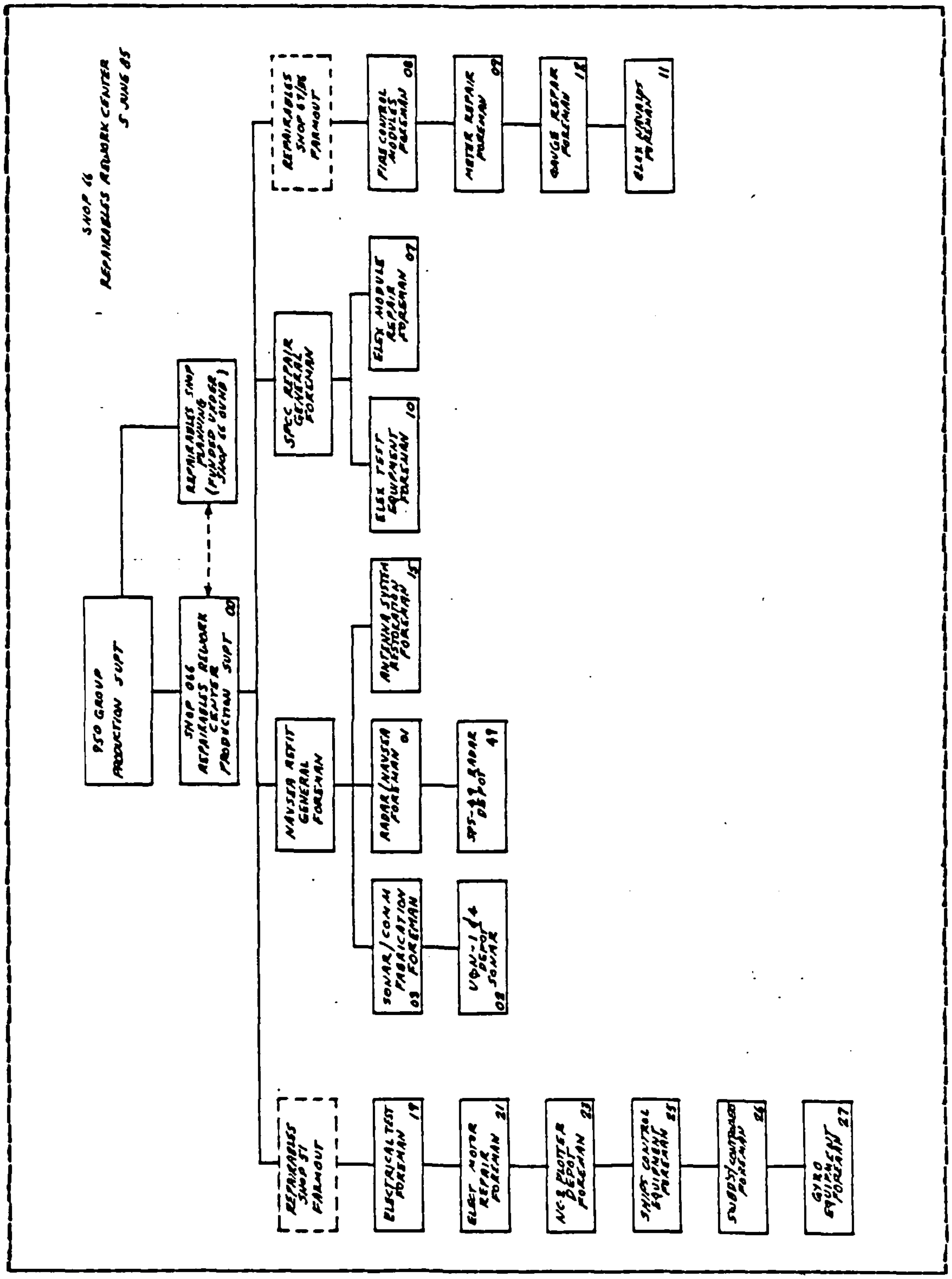

Figure 3.4 Electronic / Electrical RRC.

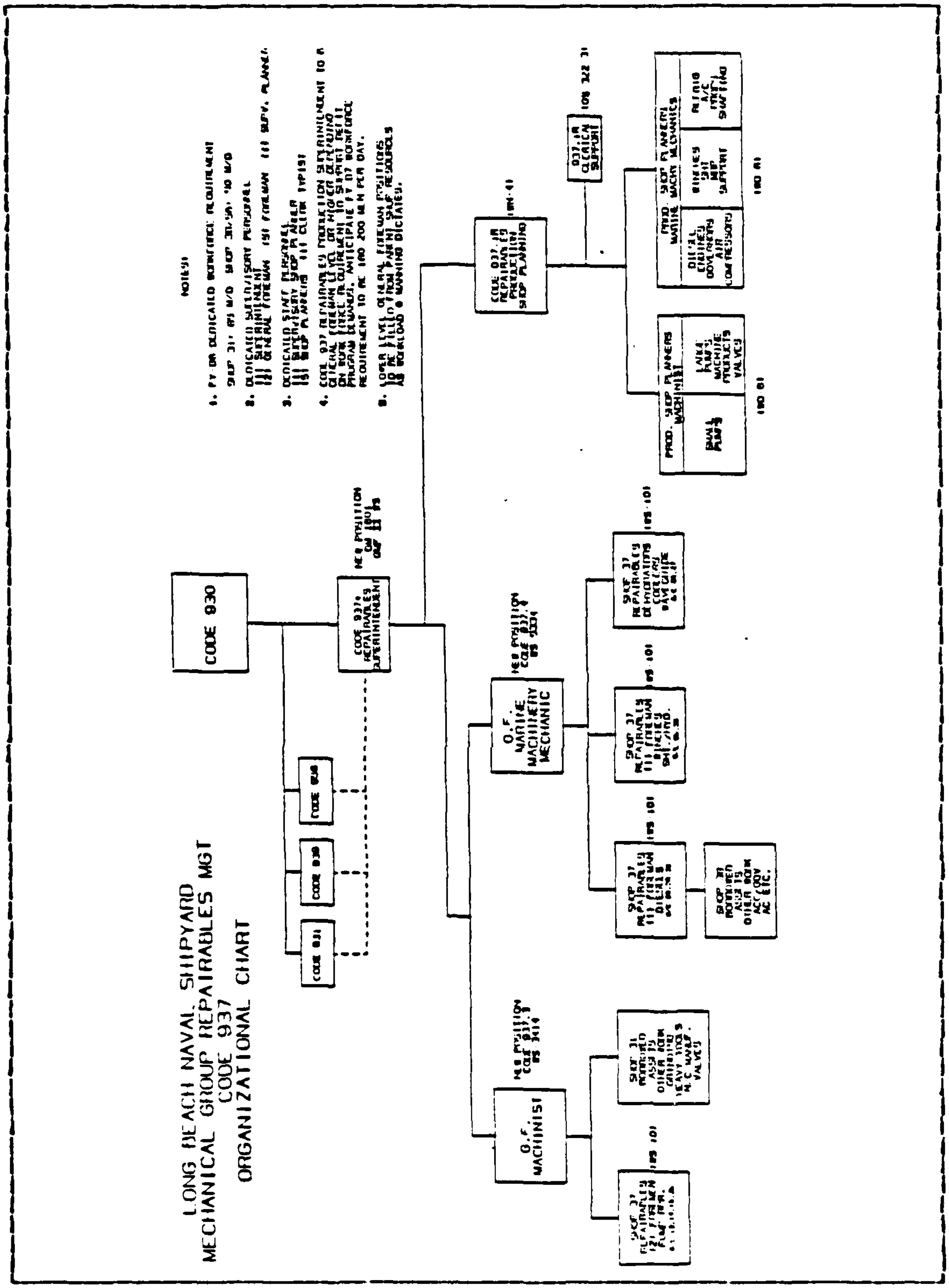

Figure 3.5 Mechanical RRC.

employs approximately 150 personnel. Figure 3.5 is the proposed Mechanical Group (Code 930) RRC. Although the formal organization has not been fully implemented, this RRC also has approximately 150 personnel working on DLRs each day.

The larger an organization is the greater the need for a formalized structure. However, size is not the only criterion that should be used to justify a formal organization. Even the shipyard that does the least amount of DLR repairs has enough work to establish an RRC. Instead of 150 people it could be as few as 15. A minimum of one shop planner needs to be assigned to monitor induction, repairs in process and the steps for returning DLRs in "A" condition. The number of shop personnel assigned should be based on the number of man-years of work accepted by the DOP. If the DOP accepts the work it should be willing to dedicate the people to do the work. As the workload increases so can the the size of the RRC.

In the years since RRCs were first introduced in naval shipyards, major benefits and improvements have resulted for DLR customers.

1. Repair prices have been reduced. RRCs allow the shipyards to segregate the repairs of DLRs and organize the work force. By making repairs in a production mode, separate stabilized rates can be developed for each work center. Prior to the RRC concept, DLRs were repaired using the applicable ship rate. NSY Long Beach has 25 different rates based on the type of equipment, complexity of the repair and piece part requirements.

At NSY Long Beach analyzing the repair price has been made much easier using ARMIS. ARMIS retains cost information for material, labor and overhead by DLR. Actual charges are compared with estimates to determine if the repairs have been priced correctly and the rates are adjusted accordingly. Rates are submitted and approved by NAVSEA annually.

2. Dedicated personnel were assigned to repair DLRs.

3. RTAT was reduced. Table II is a summary of 7G, 7H and 7Z cog RTATs over the last five years at NSY Long Beach. RTAT has been reduced from over 100 days in FY-81 to just under 50 days for those FY-85 DLRs that have been completed to date.

TABLE II

HISTORY OF RTAT BY COG. FOR NSY LONG BEACH

YEAR	COG	UNITS COMPLETE	AVE.RTAT
FY-81	7G	1533	100
FY-81	7H	927	114
FY-81	7Z	N/A	N/A
FY-82	7G	5442	98
FY-82	7H	N/A	N/A
FY-82	7Z	2588	109
FY-83	7G	1426	112
FY-83	7H	4151	96
FY-83	7Z	435	102
FY-84	7G	1248	74
FY-84	7H	4811	72
FY-84	7Z	703	87
FY-85	7G	145	47
FY-85	7H	623	46
FY-85	7Z	91	50

Although comparable data was not readily available at Norfolk's RRC, SPCC personnel are confident the RRC concept has reduced RTAT significantly at that shipyard also. [Ref. 9]

Table III groups NSY Long Beach repair history data for the Electronic/Electrical RRC by cog and RTAT. Based on this information, approximately fifty percent of both the 7G and 7H cog DLRs have RTATs less than 60 days. When the data is reviewed in this way the manager can concentrate his attention on those DLRs that have excessive

RTATs. ARMIS can also list the individual NSNs that make up each category.

TABLE III

REPAIR TURN AROUND TIME

7G Cog RTAT for 307 NSNs	
less than 60 days	= 162
60 to 90 days	= 52
90 to 120 days	= 24
above 120 days	= 69
7H Cog RTAT for 1005 NSNs	
less than 60 days	= 499
60 to 90 days	= 140
90 to 120 days	= 77
above 120 days	= 289

Using the ARMIS in conjunction with the RRC, shop performance can be monitored to the shop foreman level. Figure 3.6 is a sample of a shop manning report obtained using the RRC and ARMIS combination. Using the number of man hours authorized and the number of man-hours expended, ARMIS computes the number of men needed to complete the work assigned to a foreman. This figure is compared to the number of personnel which worked the previous week. In this sample, the shop foreman has enough work to keep 35 people employed for the next two weeks and 28 people employed the following week and so on. However, the foreman worked only 12.5 people last week. If this foreman is going to meet his Repair in Process Times (RIPTs) he will have to assign more personnel. With this type of information available the manager can foresee problems such as, inadequate staffing, and take corrective action.

Appendix B contains flow charts of how the RRC at Long Beach uses ARMIS to process WCDs and induct carcasses for repair. [Ref. 13]

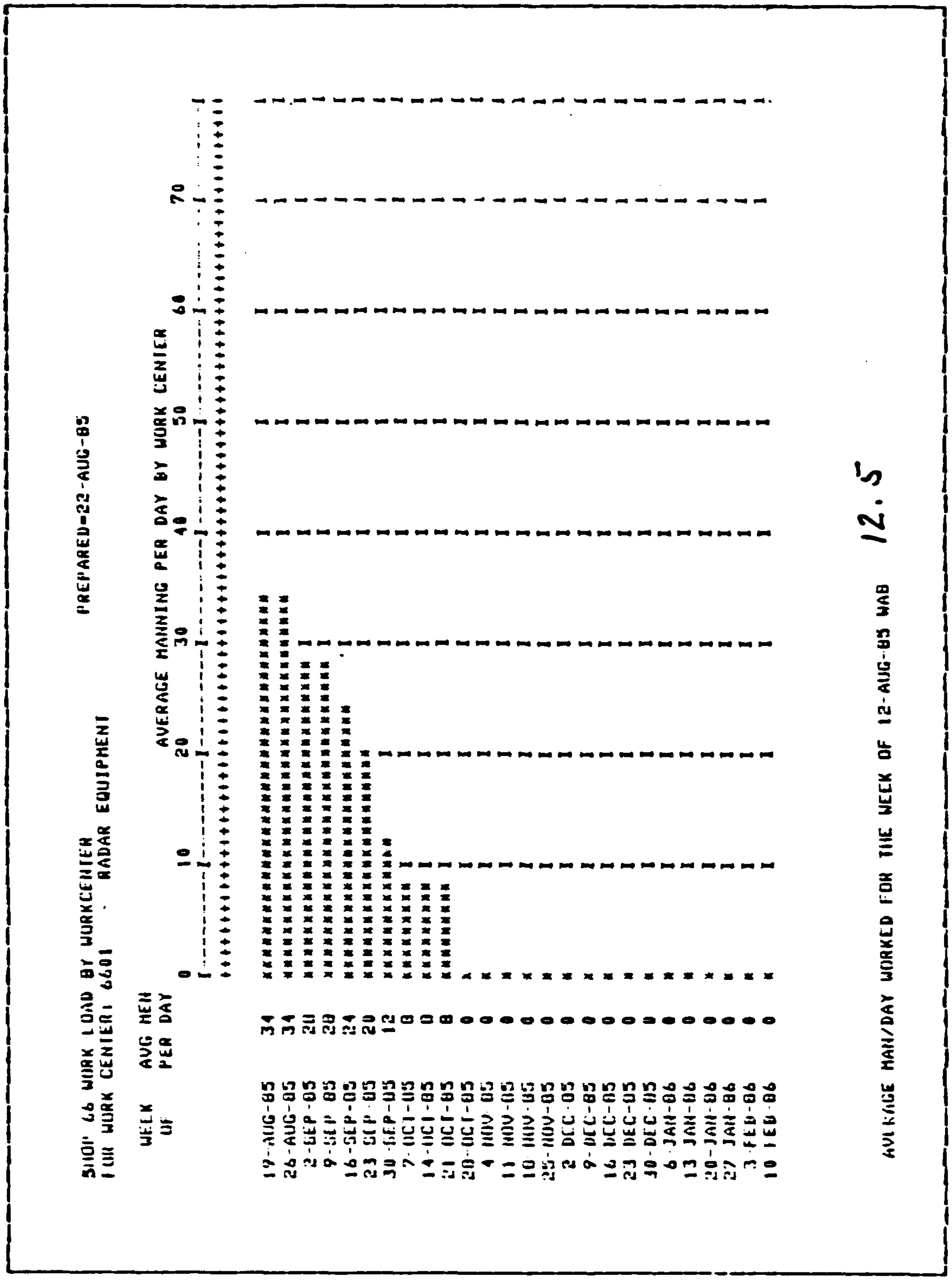

Figure 3.6 Shop Manning Requirements Sample Report.

c. Transportation Services

There are two support services that directly effect RTAT at shipyards; (1) transportation and (2) supply support services.

Transportation problems, both within the shipyard and between the DOP and DSP, were found to be increasing RTAT at all four shipyards visited. In most cases the delays occurred when failed carcasses were being moved in or out of the DOP. In one case, completed DLRs were staged in a large box prior to being delivered to the DSP. This box, because of its size , is only picked up once a week and then only if it is full [Ref. 12]. This practice automatically adds an average of three and a half days to the repair in process time for those items staged in the box.

Another problem that has caused delays is the losing of carcasses after the induction request has been made. At one shipyard, a sample of six FY 85 project orders involving 1493 carcasses was reviewed. Of the 1493 carcasses, 294 or 20 percent were shipped from the DSP but not received. Because there was no DOP or DSP monitoring of the movement of the carcasses it is difficult to determine the disposition of these carcasses. Due to the large number of carcasses that are reported shipped but not received, several of the shipyards have instituted signature receipt. Previously, the DSP driver was dropping the carcasses off at the DOP without requiring a signature [Ref. 13]. Signature control has added some time to the receipt process but has reduced the number of lost carcasses.

Shipyards without RRCs have DLRs delivered to the Material Control Centers (MCC) in the various shops. MCCs are designed primarily to stage material coming off ships in overhaul as well as material being returned to the ships when repairs have been completed. To help eliminate the impact of transportation delays between the DSP and DOP, the DSP that supports Long Beach NSY has begun making daily pick up and delivery at the RRC. By making deliveries and pick-ups at the RRC, the shop planners have more control and visibility of the DLR. Having the RRC control movement of DLRs also reduces the chance the material will be mixed with DLR being repaired for ships on the waterfront.[5]

Finally, arranging transportation/materials handling services within the DOP has also been difficult due to competition from the waterfront workload for cranes and other materials handling equipment. These delays can increase RTAT unnecessarily.

d. Supply Support Services

Organizing certain DOP supply activities or functions to support the repairables program could have a significant impact on reducing RTAT. Two functions that are important are : (1) shop stores support and (2) expediting of piece parts used to repair DLRs.

Two of the shipyards visited cited instances where shop stores' personnel were not supporting the repairables program. In both cases shop personnel directly involved in the repair process had provided shop store managers with lists (approximately 2000 NSNs each) of material they felt were needed to support the repair of particular DLRs. According to the personnel interviewed, no action was taken to stock these items in shop stores. Management attention and affirmative action on the production shop's request for support would obviously eliminate delays caused by lack of repair part support. [Ref. 13, 14].

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[5]Concurrent repair of DLRs is not normally authorized and causes inaccurate demand data for the Supply system. Concurrent repair is when the operating ship or activity has the DLR repaired at the DOP without notifying the IM. Concurrent repair is a significant problem but will not be addressed in this thesis.

Once piece parts have been placed on order it is the shipyard supply department's responsibility to expedite material based on priority and urgency of need. Only one DOP indicated they had a dedicated expediter assigned to the repairables program [Ref. 13]. At the other shipyards expediting piece parts for the repairables program was considered in direct competition with waterfront requirements. As indicated earlier, at most shipyards DLR work is accomplished only when it doesn't interfere with the waterfront work.

D. WORKLOAD FORECASTING

Workload forecasting is a key factor in reducing RTAT. Without a steady and reliable workload it is very difficult for the DOP to schedule man-power and machines to support a repairables program in shipyards. When the planned workload is not available at the beginning of the quarter, production workers will be left idle or must be reassigned. If carcasses arrive later during the quarter in which they were workloaded, repairs will normally be delayed until the carcasses can be inducted and personnel reassigned. Such inaccuracies in the forecasted workload can and do cause major problems for the DOPs.

If the DOP can be assured of a consistent workload it can staff the the shops accordingly and integrate the DLR workload with ship repairs. Consistency of the workload is more important than volume. The volume of work only becomes important when the shop has been manned to meet a certain workload level. For those organic DOPs who repair a large number of DLRs each quarter, RRCs have been established which have dedicated shop personnel. These personnel rely on the forecasted workload to keep them employed for the entire quarter. If the actual workload is less than the forecasted workload, the RRC manager must schedule the inductions over the entire quarter even though he could repair the carcasses faster [Ref. 12].

Workload forecasting is the responsibility of SPCC and has a direct effect on many of the policies and practices adopted by shipyards. SPCC's policy in recent years has been to workload only those non-ready for issue (NRFI) carcasses that are on hand at a DSP or are due in from operating units. This policy was put into effect due to a number of complaints by the DOPs that carcasses were not available for repair after they had been workloaded.

Although some improvements in carcass availability has been made, there still seems to be a problem. Using the DOP's monthly refit reports, sample data was extracted to determine the percentage of workloaded carcasses that are subsequently cancelled because the carcass was mis-identified or was not on-hand at the DSP. At one DOP a sample of three project orders covering the first three quarters of FY-85 revealed that only 42 per cent of the 118 different 7H cog stock numbers workloaded actually had carcasses available. Repairs to 69 of these stock numbers were cancelled because the DSP did not have carcasses available or when the carcass was delivered to the DOP it had been mis-identified and was a carcass for some other NSN.

A similar sample was taken at another DOP. This sample involved six FY-85 project orders to repair 204 different stock numbers with varying quantities of carcasses assigned to each NSN. 438 of these carcasses, involving 71 NSNs, were either not in stock (NIS), not received or mis-identified.

This information does not significantly differ from the information available at SPCC. In a recent briefing SPCC noted that the carcass cancellation (BSR) rate has averaged approximately 22 percent at organic DOPs. [Ref. 15]

The recently established Repairables Policy and Systems Office (Code 0503) at SPCC is trying to identify and take corrective action on the problems of repairables management.

In addition to carcass availability, this office is investigating problems with carcass visibility, DOP management, repair requirement identification, institutional issues, ADP issues and financial issues. [Ref. 15]

Much of the carcass timing problem is a result of the operating units not being timely in returning their failed carcasses. If the carcass does not arrive at the DSP during the quarter it was workloaded, repair of that carcass is cancelled by SPCC. Eliminating planning for due-in quantities would improve the accuracy of the workload forecast. Thus, if SPCC were to base the workload solely on on-hand non-RFI carcasses, the percentage of available carcasses should increase.

Another action that may improve workload forecasting is to develop an automated interface between the B08 and the shipyard's computer system. The Aviation Support Office (ASO) uses a magnetic tape of the Cyclic Repairables Management Program (B08) to workload the Naval Air Rework Facilities (NARF) on a weekly basis. The NARF receives 90 percent of its workload automatically by interfacing the B08 tape with the NARF's weekly induction scheduling system. [Ref. 6].

Under the present system used by SPCC and organic DOPs, 90 percent of the workload must be accomplished manually by reviewing over 19,000 NSNs each quarter. Figure 3.7 and 3.8 are samples of two of the forms that must be reviewed by the IM for each NSN. For each of the NSNs workloaded the IM must compare and verify the actual stock status on the Consolidated Stock Status Report (CSSR) with the forecasted workload figures on the repair workload forecast. The UADPS Supply Demand Review program provides the CSSR forms and SPCC's DATAPOINT system computes the workload forecast. DATAPOINT receives information on a selected universe of NSNs via magnetic tape from UADPS. For example, UADPS may

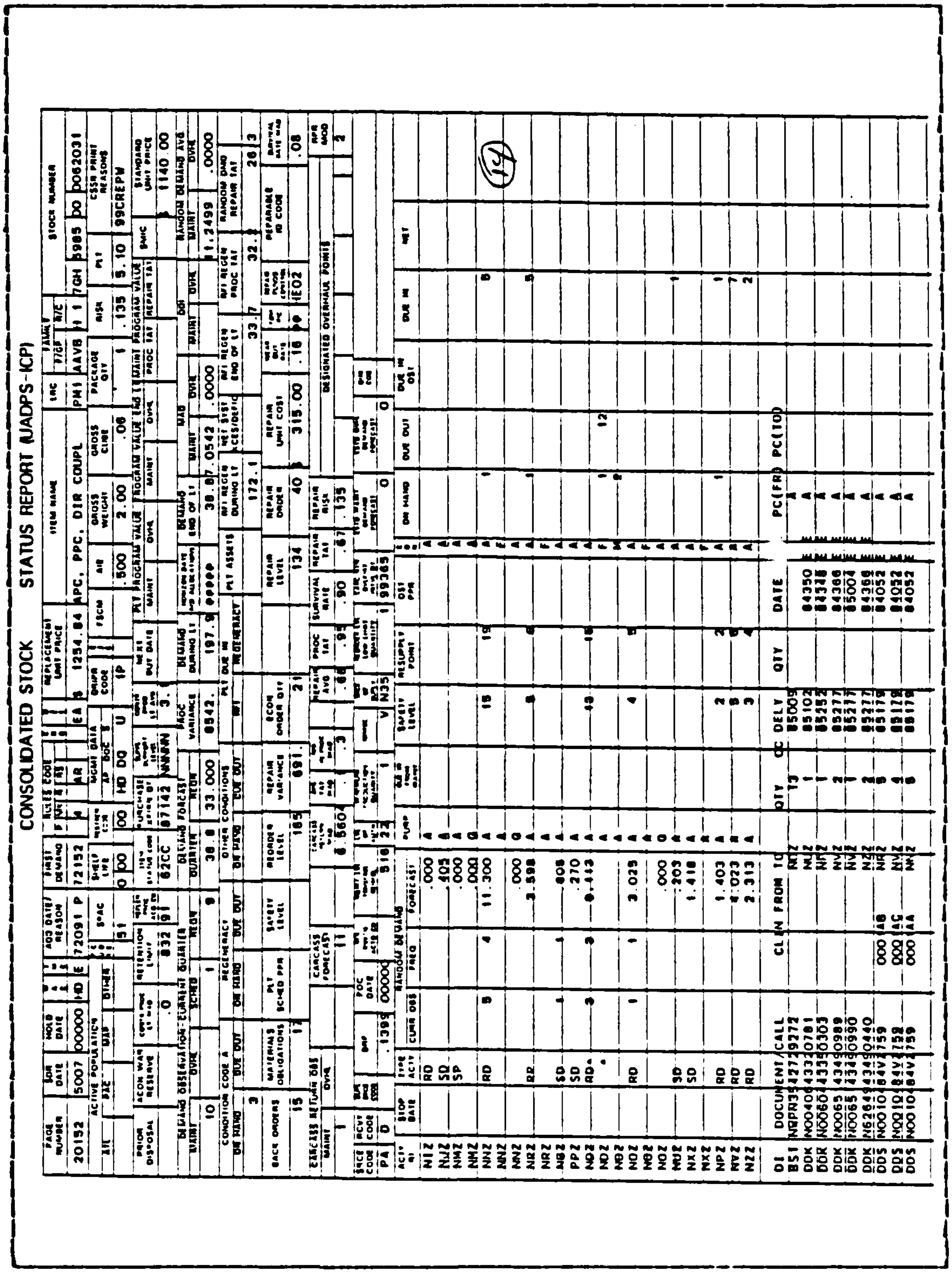

Figure 3.7 Consolidated Stock Status Report.

SPCC REPAIR WORKLOAD FORECAST

COG	NSN	SMIC	LRC	FGC	REL
7Q4A	5985-00-0062031		PN1	AAVB	O

ITEM NAME: APC, PPC, DIR COUPL

EXTRACT DATE: 84353
CURRENT DATE: 84357
EQUIPMENT NAME: AN-30078/URT, AMPLIF
S2300709 EP UJ7
AN-3007/URT SER F1-F

STANDARD PRICE: $1,140.00
REPLACEMENT PRICE: $1,254.84
NET PRICE: $501.00
REPAIR PRICE: $315.00

PLT: 5.10 REQ. FREQ.: 32.000 REORDER LEVEL: 112 SR: 0.90 CRF: 35.9
RTAT: 0.62 DEMAND: 38.810 REPAIR LEVEL: 88 M/H:

			OPENING POSITION	1Q	2Q	3Q	4Q	5Q	6Q	7Q	8Q
REQUIREMENTS:	IQ 1 BOs, DOs - CASREPTS	I			55	74	81	88	97		
	ALL OTHER BOs - DOs	II	4	4							
	999 PPRs	II	30	30							
	DEMAND X RTAT	III	39	39							
	DEMAND	III	39.		39	39	39	39	39	39	39
	ALL OTHER PPRs - PWRs	III		7	3			2			
	REPAIR SAFETY LEVEL	IV	39	39	39	39	39	39	39	39	39
	ECONOMIC REPAIR QUANTITY	IV	39	39	39	39	39	39	39	39	39
	TOTAL REQUIREMENTS			158	175	191	198	207	214	117	117
ASSETS:	ON HAND		4	4						27	20
	DUE IN (DDS/A2) BY QTR		3	3	23	32	32	32	163	32	32
	FUNDED REPAIR (BS1/DDS*)		18	18							
	TOTAL ASSETS			25	23	32	32	32	163	59	52
	REPAIR REQUIREMENT			133	152	159	166	175	51	58	65
	NRFI ON HAND (UNFUNDED)		1								
	CARCASS RETURN FORECAST		36	20	36	36	36	36	36	36	36
	PRODUCTION QUANTITY			~~19~~	~~[illegible]~~ 11	~~[illegible]~~ 11	~~[illegible]~~ 11	~~[illegible]~~ 11	~~[illegible]~~ 11	~~[illegible]~~ 11-	~~32~~ 11
	REPAIR COST			$5,670	$10,080	$10,080	$10,080	$10,080	$10,080	$10,080	$10,080
	CARCASS CONSTRAINT			128	134	141	148	159	21	28	36
	ESTIMATED BUY QTY			131			22			21	

	1ST QUARTER UNITS	M/H	DOLLARS	2ND QUARTER UNITS	M/H	DOLLARS	3RD QUARTER UNITS	M/H	DOLLARS	4TH QUARTER UNITS	M/H	DOLLARS
LEVEL I	0		$0	0		$0	0		$0	0		$0
LEVEL II	9		$2,835	32		$10,080	32		$10,080	32		$10,080
LEVEL III	9		$2,835	0		$0	0		$0	0		$0
LEVEL IV	0		$0	0		$0	0		$0	0		$0
TOTALS	18		$5,670	32		$10,080	32		$10,080	32		$10,080

	UNITS	M/H	DOLLARS
1ST YEAR	114		$35,910
2ND YEAR	128		$40,320
3RD YEAR	128		$40,320
4TH YEAR	128		$40,320
5TH YEAR	119		$37,485

DOP	2ND QUARTER: M/H	QUANTITY	3RD QUARTER: M/H	QUANTITY
N65584A		11 ~~32~~		32

11-11-11-11
level 2 →

IMS SIGNATURE SECTION HEAD BRANCH HEAD DIVISION HEAD GROUP HEAD - CO

Figure 3.8 SPCC Repair Workload Forecast.

be asked to generate a tape of all DLRs that have experienced any activity in the last two years. Using the data tape from UADPS, DATAPOINT generates a workload sorted by DOP and develops the workload forecast selecting only those DLRs that have due-in or on-hand quantities at the DSP.

E. ADMINISTRATIVE TIME

Administrative time is the time required to process funding documents at the shipyard and to order and receive a carcass to be repaired. Its two main components are documentation preparation time and induction time. Figure 3.9 is a diagram of the actions that must be accomplished during the administrative time. Documentation time, the induction process and induction time will be discussed separately because the DOP is responsible for the documentation time and induction process while the DSP is responsible for the induction time.

To measure the administrative time at DOPs, sample data was collected at both a "non-automated" and "automated shipyard". The non-automated shipyard prepares documents manually, with the exception of the COAR. Using the Customer Order Documentation System (CODS) mentioned earlier, all shipyards have now automated preparation of the COAR. The automated shipyard, Long Beach, uses ARMIS. Table IV is a summary of document preparation and induction times at the two shipyards; shipyard 1 is non-automated, shipyard 2 uses ARMIS.

1. Documentation Time

The ARMIS system has reduced documentation preparation time significantly at the automated shipyard. The time required to process the documentation necessary to make repairs using ARMIS was only one sixth the time required by the manual system. This reduction in time is due primarily to two factors; (1) the RMO organization discussed earlier and (2) the fact that ARMIS has automated many of the

```
A = Receipt of funding document
B = Production Controller verifies NSN,
    funds, and quantity
C = Comptroller establishes COAR in SYMIS
D = Production controller sets up
    record/file of repairs
E = Production controller writes WES
F = P&E write WCD/JO
G = Scheduling
H = Key punch authorized man-hours in SYMIS
I = WCD/JO sent to local printing for
    duplication and distribution
J = Request for induction sent to DSP
K = DSP pulls carcass and ships to DSP
L = Receipt of carcass in MCC/RRC

A B   C   D   E        F          G H&I  J      K        L
|---|---|---|---|------------|--|---|--|-------------|

|<---DOCUMENT PREPARATION TIME---->|<INDUCTION TIME>|

|<---------------ADMINISTRATIVE TIME---------------->|
```

Figure 3.9 Elements of Administrative Time.

functions that must be performed manually at the non-automated shipyard. A detailed discussion of ARMIS is provided at the end of this chapter.

2. <u>Induction Time</u>

The difference in induction times is attributed to the responsiveness of the related DSP. Even though DOP 1 has implemented the UR-22[6] induction program, which automatically generates inductions at the DSP as part of the DSP's UADPS-SP, the DSP serving DOP 1 takes twice as long to move carcasses to the DOP. The UR-22 program uses a CRT terminal located in the shipyard which gives the PC direct access to UDAPS-SP to make inductions. Therefore, the induction time

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[6]The UR-22 program was develop by FMSO in 1983 and installed at DOP 1 in early 1984. The system was designed to work at all DSPs, but to date has only been installed at one. [Ref. 16]

TABLE IV

DOP ADMINISTRATIVE TIMES

DOCUMENT PREPARATION TIME

DOP	NUMBER IN SAMPLE	TOTAL DOCUMENT PREPARATION TIME	AVERAGE TIME
1	48	2886 days	60 days
2	410	4112 days	10 days

INDUCTION TIME

DOP	NUMBER IN SAMPLE	TOTAL INDUCTION TIME	AVERAGE TIME
1	78	1194 days	15 days
2	3465	23653 days	7 days

TOTAL AVERAGE ADMINISTRATIVE TIME

DOP	
1	75 days*
2	17 days

* When carcasses are available this figure may be as low as 60 days.

recorded for DOP 1 consists entirely of the time it takes the DSP to pull the carcass from storage and ship it to the DOP. Using the ARMIS system DOP 2 automatically generates induction sheets which must be hand carried to the DSP. Implementing the UR-22 program at DOP 2 is expected to reduce RTAT by at least one day.

Some shipyards have coordinated their actions with the supporting DSP to reduce the impact of induction time on RTAT. Working together, the DOPs and DSPs have allocated personnel and facilities to pre-stage carcasses at or near the DOP. Additionally, the DSPs supporting these shipyards normally send representatives to the workload conferences. Then just prior to receiving the official funding document an advance copy is given to the DSP representative and all carcasses that are available are moved to DSP location near the shipyard.

3. Induction Process

The induction processes used by the various shipyards also affects RTAT. Three of the shipyards visited use the UADPS-SP UR-17 report to monitor DLRs flowing between the DOP and DSP. The fourth DOP does not use the UR-17 because the DSP has elected not to generate this report. The UR-17 report contains such information as: number of carcasses available at the DSP, condition codes, time and quantity inducted, shipped, received and completed. For the shipyards without ARMIS, the UR-17 is the only report that provides the data necessary to compute induction times used to schedule both manning and repair of the DLRs. The program also produces punched cards that act as signature receipts, are used to TIR the DLRs from "F" (failed) to "M" (in repair) condition and from "M" to "A" (meets OEM specs.) or "G" (awaiting parts) condition. The report also shows when a DLR has been stored and is available for the IM to issue.

At the DSP that doesn't use the UR-17 the DOP has no visibility of the carcasses available for induction. The DOP must call and have each item checked to see if it is available for induction. Additionally, this DOP must manually prepare two DD 1348 forms for each induction. This is very time consuming. A review of induction notices that were waiting to have 1348s typed revealed one that had been sitting in the typist's in-basket for over three months [Ref. 18].

Another aspect of the induction process that has a significant impact on RTAT is the timing of the induction request. The DOP that is currently using the UR-22 program normally makes an induction request when the estimate sheets are prepared by the PC [Ref. 8]. By making inductions in this manner many of the carcasses arrive at the DOP before the administrative loop can produce the WCD/JO. As mentioned earlier, if signature control of carcasses delivered to the shipyard is not used and the shop is not aware of the repair requirement, the carcass may not be matched to the WCD/JO. This practice may be contributing to the number of carcasses reported not received.

For DOPs with relatively small DLR workloads, making inductions shortly after the funding documents have been received is satisfactory, provided the shop or MCC is aware of the repair requirement and is expecting the carcasses. For the larger DOPs, inductions must be scheduled throughout the quarter to maintain level manning in the RRCs.

Another constraint may be that the shop does not have the space to store three months' worth of work. Consequently, carcasses must be scheduled and inducted throughout the quarter they are workloaded.

Based on SPCC's definition of depot RTAT, that the repair clock starts when funding and the carcasses are available, DOPs are forced into artificially high administrative times. For example, if 3 carcasses are available when the funding document is received but, due to scheduling constraints, the DOP can only work one carcass a month, the carcasses scheduled for the last two months will have RTATs which are at least 30 to 60 days longer than is true. If quarterly forecasting of RTAT's continues, then RTATs computed by SPCC will remain high for the larger DOPs. By automating the workloading so that it occurs on a weekly or monthly basis using B08, ARMIS and DATAPOINT, the average value RTAT as measured by SPCC would be reduced.

F. PIECE PART SUPPORT AND REPAIR-IN-PROCESS TIME

Repair-in-process time (RIPT), as defined in this thesis, is the time from receipt of a carcass in the DOP to the time the carcass has been repaired and returned to the DSP in "A" condition. In this section, piece part support will be considered as a primary influence on reducing RIPT.

1. Measuring RIPT

Prior to looking at how RIPT can be reduced it is helpful to understand how SPCC measures RIPT. Like RTAT, SPCC measures RIPT by NSN, cog and depot type (organic and commercial). The RIPT seen by SPCC is a composite of several DOPs' efforts to repair that particular NSN. By measuring RIPT in this manner SPCC can not isolate which DOPs are performing within the desired RIPTs for any particular NSN or cog and which are not.

Because the SPCC data do not accurately reflect RIPT, samples were taken from two DOPs to determine realistic values for an automated and non-automated depot. The results of these samples are presented in Tables V and VI and have been aggregated by Federal Supply Classification (FSC).[7] The repair-in-process time shown in the two tables does not include induction, P&P and storage time. The sample for Table V included 328 different 7H NSNs. This DOP does very well in repairing selected FSCs. Of the 328 NSNs completed 60 were from five FSCs. These five FSCs represented 1277 of the 1639 units completed or 78 percent. These included only 61 NSNs or 18 percent of all NSN's repaired by the depot. This group of FSCs had an average repair in-process time of only 10.5 days. The remaining 268 NSNs correspond to only 362 completions and have an average repair-in-process time of 52.5 days.

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[7]The FSC is the first four digits of the NSN and represents the family group and class of the DLR. For instance, the FSC for diesel engines is 2815.

TABLE V

NON-AUTOMATED DOP
REPAIR IN PROCESS TIME

FSC	NSNs	TOTAL RIPT	UNITS COMP.	AVE. RIPT
1220	2	516	74	17.9 days
5845	39	8292	462	3.8 days *
5865	16	3097	161	19.0 days
6140	1	428	269	1.6 days **
6630	3	1172	311	3.8 days *
BALANCE	268	19006	362	52.5 days
TOTALS	328	32509	1639	19.9 days

* DLRs repaired in transducer repair facility.
** NSN 6140-00-635-1398, Battery Jars.

Table VI provides a complete picture of the RIPTs for the DLRs repaired by the Electronic/Electrical RRC at Long Beach NSY and was generated by ARMIS in less than thirty minutes (it took several hours of sorting data by hand to generate Table V using the UR-17 report for the non-automated DOP).

There are several points that can be gleaned from the information in Tables V and VI.

1. DLRs that are workloaded and repaired in large volumes can support a production line operation and will reduce RIPT.
2. DLRs that are workloaded infrequently and in small numbers will have higher RIPTs.
3. Aggregate measures of RIPT can be easily distorted by a relatively few NSNs that are repaired in large quantities.

2. <u>Piece Parts</u>

Piece parts are those components used to repair a carcass. These components can be consumable in nature (ie. screws, bolts, gaskets, washers, etc.) or other repairables.

Normally, piece parts are ordered by P&E when the job orders are prepared. Piece parts may also be ordered by shop planners or mechanics as new requirements are

TABLE VI

AUTOMATED DOP
REPAIR IN PROCESS TIME

FSC	UNITS COMPLETED	AVE. RIPT
1075	11	52 days
1240	1	154 days
1250	12	43 days
1285	14	43 days
3950	229	40 days
4140	169	95 days
4310	28	149 days
4320	2	18 days
5355	1	83 days
5805	332	29 days
5825	38	24 days
5830	2	94 days
5840	1047	39 days
5845	8	27 days
5915	33	11 days
5930	18	49 days
5955	14	38 days
5965	1	46 days
5985	46	265 days
5990	16	53 days
5999	99	36 days
6105	189	109 days
6110	733	35 days
6115	1	379 days
6125	54	165 days
6130	34	61 days
6230	6	92 days
6320	79	4 days
6350	50	61 days
6605	1180	50 days
6625	115	21 days
6650	29	114 days
6660	2	77 days
6675	30	51 days
6680	52	43 days
6685	41	47 days
TOTAL	4716	50 days

identified when the carcass is disassembled. A third source of repair parts is shop stores. The impact of shop stores on the repairables program has been discussed earlier.

Until recently piece part initial provisioning for the depot level for major weapons systems and associated DLR subassemblies has taken a back seat in the acquisition process. When funding was tight most project managers opted to reduce support functions instead of reducing the number of systems purchased. This practice resulted in fleet comments such as, "it takes 5 DDGs to keep 3 operating".

In the mid 1970s the surface community recognized the benefits of modular repairs and began designing and provisioning ships accordingly. The FFG-7 Class "Lo-Mix" and Spruance Class destroyers were designed for modular repairs. By replacing DLRs before they broke, the ships could be kept in operation longer and would require fewer major overhauls. This was also one of the first class of ships where the DLRs were provisioned to the DOP level. Recognizing the importance of provisioning to the depot level and supporting the logistics pipeline should improve RIPT in the long run.

But what can be done in the short run? Piece part requirements are also driven by forecasted DLR requirements. The importance of accurate forecasting was addressed earlier with respect to dedicating personnel and facilities at the DOP's. The same arguments apply to stocking and ordering piece parts. However, shipyards can not afford to stock piece parts for repairing carcasses that don't materalize. As Navy Industrial Fund activities, organic depots are paid only for the work that is performed for the customer. Any advance ordering of piece parts to repair carcasses that may or may not materalize must be absorbed in the NIF corpus. Given the accuracy of the forecast, it is understandable why the DOPs are hesitant to invest in piece part support for the repairables program. One shipyard is so skeptical of the forecast that it doesn't order piece parts until the carcass has been received and torn down. If the accuracy of the forecast and timing can be improved DOPs would have no reason not to pre-order piece parts.

In addition to the accuracy of the forecast, DOPs are also concerned about the extent of cannibalization of the carcasses. [Ref. 7]. Often carcasses are missing major sub-assemblies when they are inducted. A good example is Main Feed Pump (MFP) rotating assemblies. When a MFP rotating assembly is turned in by an operating unit, the carcass should be composed of a housing, the shaft, impellers, and various smaller component parts. More often than not one or more of the impellers are missing.

One of the reasons impellers are cannibalized is the scarcity of impellers that meet OEM specification. The mechanics on board ships are aware of this problem and will retain the impellers as operating spares. The lack of quality impellers in the supply system,[8] has also lengthened the RIPT for the MFPs. Several MFP rotating assemblies have been in the repair process in excess of two years awaiting impellers that meet OEM specifications. The supply system has provided two shipments of impellers all of which were unacceptable. Each MFP rotating assembly requires four impellers at a cost of $2,400.00 each.

In the last couple of years, SPCC and the DOPs have developed procedures to help identify those activities that have cannibalize carcasses. When the DOP reports a cannibalized carcass to SPCC the turn-in activity will be charge the standard price for a replacement if they do not return the cannibalized parts. Although this procedure is available, it is not fully utilized by all the DOPs.

Quality control of repair parts purchased by the supply system has been a recurring problem. Normally, repair parts are purchased based on form, fit and function criteria. If the part looks like what it is supposed to be the part is accepted. In most cases inspecting for form, fit and function is acceptable because it would be cost prohibitive to inspect the thousands of parts the supply system purchases each day. However, for those parts that have Defective Material Reports (DMR) written, it may be wise to inspect the next batch of parts that the vendor

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[8]The supply system as used in this context refers to parts purchased by both Navy ICPs and the Defense Logistic Agency.

produces. This has not been the case in the past. Another option is to put inspection criteria in the contracts for those parts that that have two or more DMRs submitted in a year. To resolve the quality problem with MFP rotating assembly impellers, SPCC has agreed to purchase the impellers from the OEM.

To illustrate the impact of cannibalization and quality of piece parts on RTAT, RTAT was computed for two MFP rotating assemblies. Three Byron Jackson rotating assemblies (NSN 7H 4320-00-884-8202) repaired prior to 1981 had an average RTAT of 117 days. During this time frame there were no problems with the impellers. Beginning in 1982, when quality and cannibalization became a problem, the average RTAT for eight Byron Jackson rotating assemblies increased to 575 days. For twenty eight Worthington MFP rotating assemblies (NSN 7H 4320-00-667-0085) completed prior to 1982, RTAT averaged 133 days. When quality impellers became a problem, RTAT for the forty eight Worthington rotating assemblies completed since 1982 has averaged 431 days. [Ref. 19]

Several shipyards have taken initiative to improve piece part support. At two of the shipyards visited, P&E personnel have develop lists of piece part requirements for DLRs they routinely repair. These lists have been loaded on WANG computers and automatically generate job material list (JMLs) for those items that are open purchased.[9] At Long Beach NSY the program has been expanded and includes an interface with SYMIS. This program generates MILSTRIP requisitions which are passed via AUTODIN to the supporting

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[9]Open purchases are for items that do not have NSNs assigned and must be procured from a commercial source.

DSP for piece parts that have NSNs assigned. At Long Beach the RRC shop planners also maintain a file in ARMIS which contains items that should be stocked in shop stores to support DLR repairs.

Table II of this chapter listed RTATs for both 7G and 7H COG DLRs. The majority of the DLRs that had excessive RTATs require a large number of piece parts or have parts that are difficult to manufacture or procure. If the DOP has the capability and capacity to manufacture these parts, SPCC should provide the DOP with separate funding and allow the DOP to make the parts in volume. If the capability does not exist at the DOP, the DOP should provide SPCC with a list of the parts that have been difficult to procure. SPCC can then procure the parts at the wholesale level. This list should be in addition to the list of parts creating a "G" condition for an item in repair, which is provided with the monthly refit reports. That list only provides those parts which need to be expedited because they have delayed repair of a DLR by at least 20 days. It does not consider future repairs.

Manufacturing Resource Planning (MRP) has been installed at one DOP to provide material for selected DLRs [Ref. 17]. Based on forecasted DLR repair requirements the MRP system pre-orders piece parts using lead times and frequency of replacement to have the correct parts available when the DLR is inducted for repair. Appendix C provides a brief description of the MRP system currently in use at Long Beach. To date this system has only been used to order parts for two types of DLRs, both of which are managed by NAVSEA. These are MSO diesel engines and sealed hydrolic transmissions used on auxiliary type ships (AFS, AO, AE). At the present time this system has not proven to be cost effective and should not be exported to other shipyards in its present configuration. Efforts are continuing to improve the MRP application and, in the long run, this type of system may prove to be applicable to industrial repairs.

The NARFs are installing an MRP system under the Automated Storage, Kitting and Retrieval System (ASKARS)/Workload Planning concept, which is more sophisticated than this shipyard system. An important feature of that system is that the local DSP will be responsible for stocking the piece parts needed by the DOP. NARF Alameda is the prototype for this new system developed by SPS Corporation and NSC Oakland is its DSP.

An alternative to MRP is to modify the existing Material Requirements (MR) program. Some modifications have already been made to the MR program in SYMIS to accumulate piece part usage on DLRs. MR was originally designed to retain usage history on ship overhauls, but has been modified at Long Beach NSY to retain a history of the piece parts used on DLR. The history is retained by COAR and NSN. This was one of the reason Long Beach NSY converted from establishing a COAR per funding document to using a COAR for each line item of the funding document. Although this requires a little extra work on the part of the comptroller department, it has reduced the workload of the PCs. It also precludes the PC from manipulating the funds between line items and encourages more accurate charging by the shop mechanic. As DLRs are completed the usage data is added to previously completed DLRs.

When the MRP program was first started, work on the local MR program was halted. The local MR program works in its present form but is not being fully utilize and still needs some minor changes to be fully effective. With a few changes and a concerted effort by the DOP this program could be integrated with ARMIS and provide a basis for determining piece part requirements of DLRs. Appendix D contains a description and samples of the information the local MR program provides.

Charleston NSY is also developing a similar MB program that will maintain an automated data base containing historical JMLs and material order/usage data from previous ship availabilities as well as ordering data for current and future availabilities. This system could also be modified and incorporate the historical data on piece parts used to repair DLRs. A functional description of the capabilities of this new program is available at Charleston NSY (Code 229).

Several of the shipyards have complained that the requisition and receipt procedure that must be followed to requisition and receive piece parts takes too long [Ref. 12, 13]. Requisition and receipt process time is the time from the original identification of the requirement (written JML) until the part is actually received by the shop mechanic.

One shipyard performed an analysis of requisition and receipt process time. The sample consisted of 26 requisitions for NSN material used to repair a DLR. The shipyard measured the following times:

1. The time required for the requisition to be prepared and processed through the shipyard's requisition process to the supplier of the material. All requisitions were for NSN material. The average time was 30 days.
2. The time required by the stock point to process the requisition and ship the material to the DOP. The average time was 9 days.
3. The time required for the DOP to process the receipt and notify the shop the material was available for pick up. The average time was 31 days.

Figure 3.10 and 3.11 are flow charts of the steps involved in ordering and receiving material at this DOP. Similar steps must be performed at other DOP. Figure 3.12 is a summary of the times involved to complete each step.

It includes the shortest, longest and average times. Under the most optimistic circumstances the minimum requisition and receipt time is 28 days. It should be noted that this DOP orders material using a "D" usage code[10]

The sample verifies that a problem exist with the methods employed to process requisitions and receive repair parts. Interviews with supply department personnel indicated that during the period of time the sample was taken the SYMIS computer was experiencing considerable down time and may have contributed to the excessive times reported. When SYMIS is down material can not be ordered or received. SYMIS generates the documentation, such as material movement orders, that must accompany the material as it moves from location to location. Only in emergencies will material be ordered, received or moved without paper work. [Ref. 20]

The study offered several possible solutions [Ref. 21].

1. Order piece parts for DLRs with an "E" use code. This would eliminate the time required to stow material in DMI.
2. Increase staffing in both order processing and receipt areas.
3. Develop a program to modify critical coding.[11]
4. Restrict the use of critical coding to priority 1 or 2 and "G" condition material.

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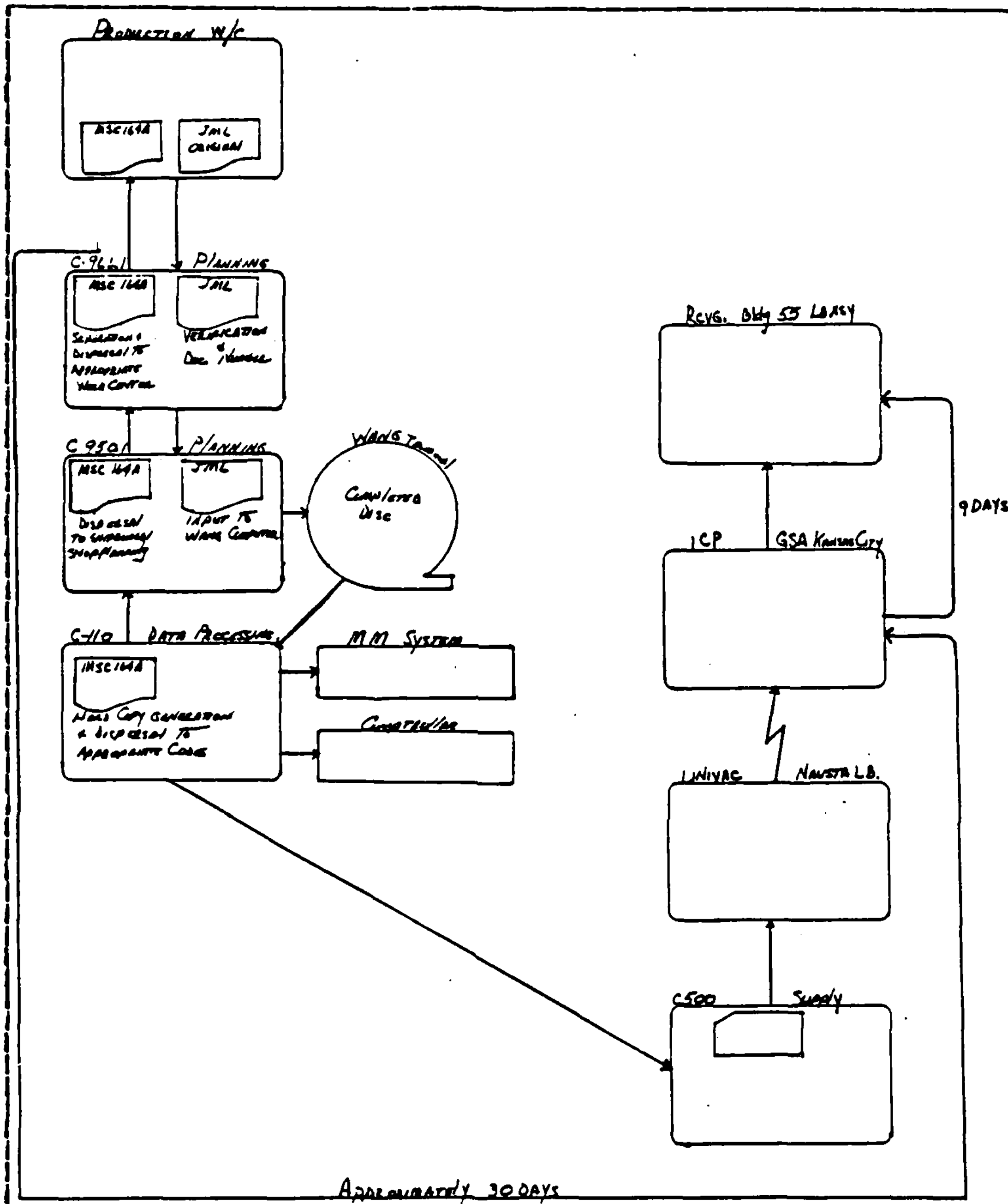
[10]"D" usage codes indicate the material should be placed in Direct Material Inventory (DMI) for use on a specific job. "E" coded requisitions, which the majority of the shipyards use for DLR repair parts, indicates the material should be sent directly to the shop that initiated the requisition.

[11]For requisitions that are critical coded an automatic notification is sent via CRT to the shop that originated the requisition when the item is received.



Document Path From Originator to Receiving Center

Figure 3.10 DOP Requisition Process.

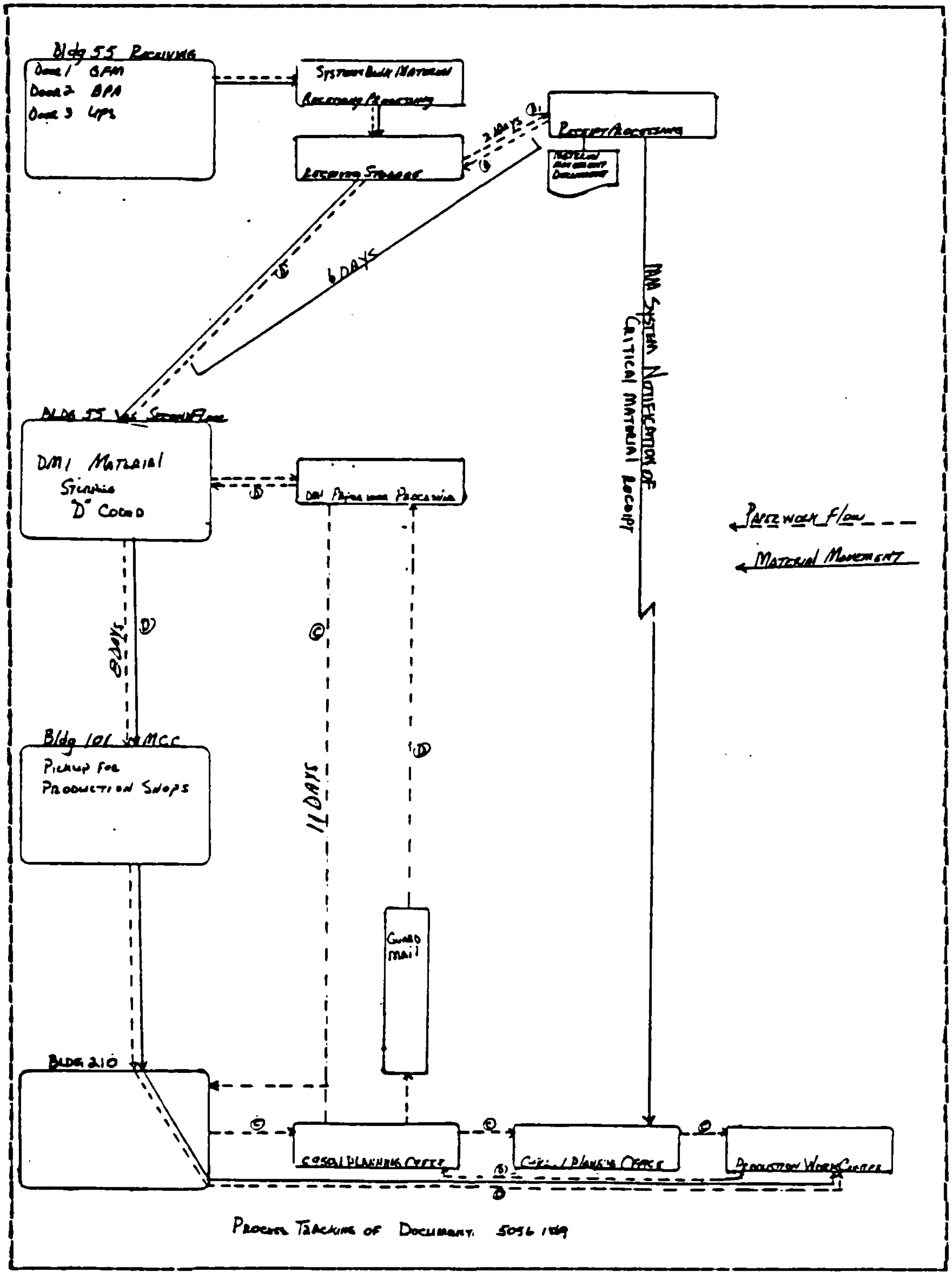


Figure 3.11 DOP Receipt Process.

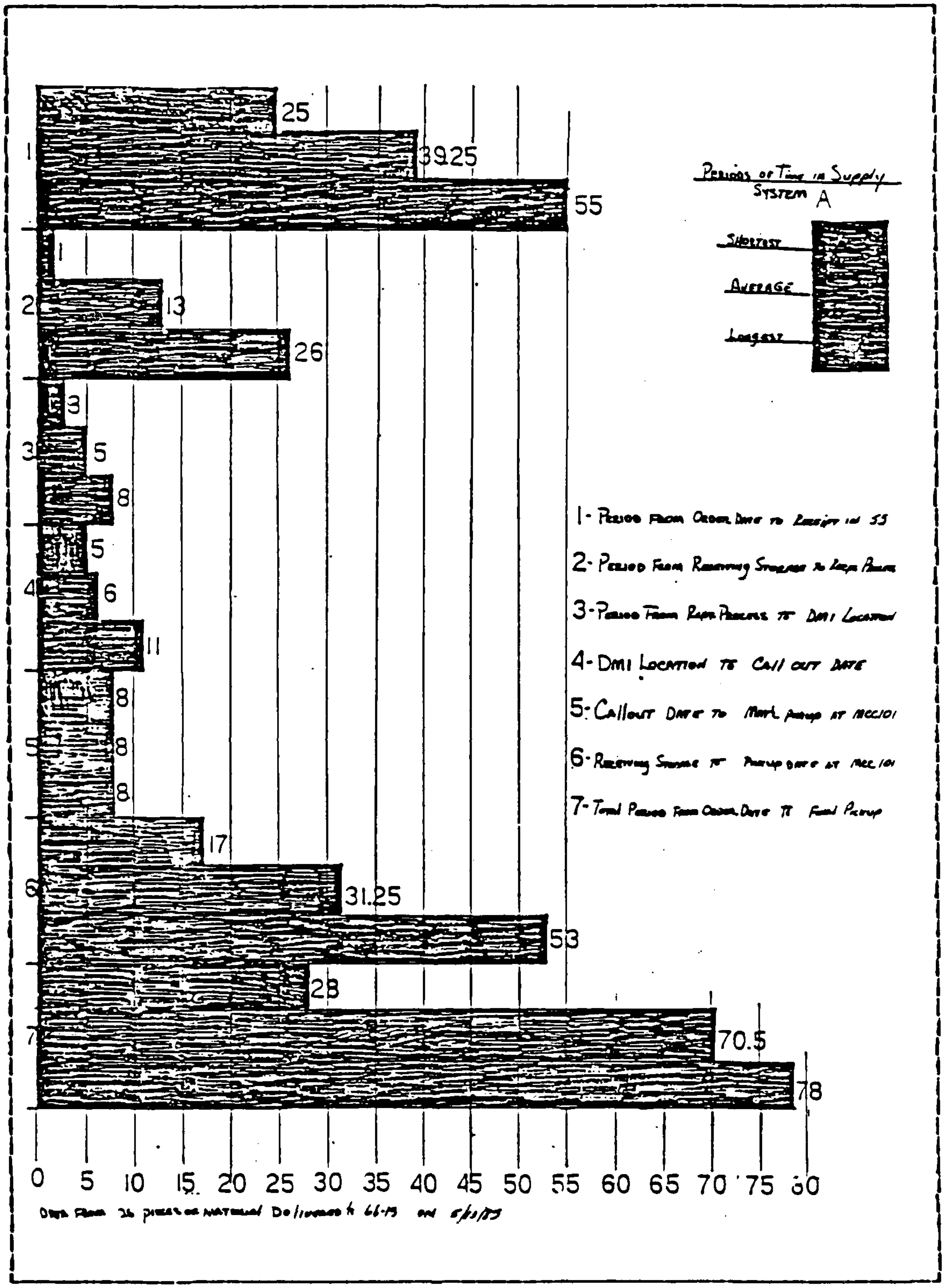


Figure 3.12 Requisition and Receipt Times.

5. Develop minimum time frames for non-receipt of material and automatically upgrade the requisition to critical and begin expediting action as soon as these minimums have been exceeded.
6. Update the material requirements list of P&E personnel and pre-order material when funding is received.

These solutions may reduce the time it takes to order and receive material at this DOP. However, several of the shipyards visited use the "E" usage codes and still complain that order and receipt times are excessive. [Ref. 14, 7]

A more effective solution would be to modify or streamline the procedures employed to order and receive material. This would require modifying portions of the SYMIS as well as shipyard procedures and is beyond the scope of this thesis.

G. PRESERVATION, PACKAGING AND STORAGE

SPCC's position concerning P&P is that because the repair funds that are provided to repair a DLR includes P&P, it is the DOP's responsibility to monitor and take actions to reduce P&P time [Ref. 22]. With the exception of one DOP visited, P&P is accomplished by the DSP. Normally, each shipyard will issue a funding document to the DSP to perform the P&P function. P&P involves protecting and boxing the DLR for storage and eventual shipment to the end user.

Currently there is no uniform way to accurately measure how long a DLR spends in P&P at either a DSP or DOP. It is possible to measure the P&P and storage times at those activities that use the UR-17 program and where the DSP performs both functions. If P&P is accomplished by the DOP this time is pooled with the repair-in-process time. If it is done by the DSP the time is included with the stow time. The ARMIS is capable of monitoring this time but doesn't because the DSP performs the P&P function where ARMIS is used. Storage under both definitions is still counted as part of the DOP's RTAT even though the DOP has no control over this segment.

By measuring the difference in the time the ZUB (report of receipt of an "A" condition DLR) and the ZUD (report of storage) transactions are processed, storage time could be calculated. At two of the DSPs, the repairables clerk maintains manual records on P&P and storage times. According to these individuals, P&P and storage times average six to seven days [Ref. 23, 24]. One DSP is currently in the process of developing a UADPS-SP program to capture this time. When developed, it should provide both SPCC and the DSPs with information on what the actual times are. SPCC does not currently monitor this time [Ref. 9].

SPCC's definition of RTAT includes P&P and storage times even though the DOP has little or no control over these segments. When these times are combined with the induction time, the total represents a significant portion of RTAT that a DOP has no control over.

H. AUTOMATED REPAIRABLES MANAGEMENT SYSTEM (ARMIS)

One of the major problems faced by all concerned in trying to reduce RTAT is the problem of converting the data in SYMIS and the UICP computer systems into meaningful management information.

As previously discussed in this chapter the ARMIS system has been in use at one DOP for over three years and has proven to be an efficient and cost effective method of reducing RTAT. The system has also proven to be an effective management information system. The system is very flexible and has the potential to reduce RTAT even further.

The ARMIS system was develop and implemented at Long Beach NSY in 1983 to support the growing repairables program. When Long Beach was designated the DOP for over two hundred DLRs to be used on "LO-MIX" FFG-7 Class ships in the Class Maintenance Plan, it was anticipated that the repairable effort would grow from approximately five percent to as large as twenty percent of the shipyard workload [Ref. 17].

ARMIS uses a relational data base[12] computer system to store and manipulate data into meaningful information as well as to generate many of the forms and reports needed to manage the program. The system is extremely "user friendly" and requires very little training or programing knowledge to use effectively. The system manager was previously a shop planner and only required two weeks of training to perform effectively in the system manager role. In addition, with only two weeks training a manager or technician can also learn to write programs and extract information tailored to his or her needs.

The primary objectives of ARMIS are:

1. Accurate and expeditious generation of monthly reports supplied to customers and for in-house management functions. Information is updated daily using magnetic tape interfaces between SYMIS and ARMIS. Monthly reports are up-to-date and contain all the information required by NAVMAT's Navy Repairables Management Manual.
2. Automated control and monitoring of the life cycle of DLRs from the receipt of a funding document through the final billing process. Appendix E contains a description of the information and data flow within ARMIS from receipt of a funding document to final billing.

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[12]A relational data based computer systems allows the user to retrieve, sort and manipulate data from several files at one time.

3. Provide a catalog of all DLRs overhauled by the shipyard in a central file with easy access.
4. Automatically generate work estimate sheets, log sheets, induction sheets as well as management reports and listings. Appendix F contains samples of these sheets reports and listings.
5. Interface with the Customer Order Documentation System (CODS) and SYMIS. CODS generates a COAR for each DLR using standard information about the DLR, such as NSN, nomenclature, man-hours authorized, repair price, customer, and stabilized rates.
6. Retain a history of completed DLRs at the COAR and NSN level.
7. Monitor repair performance at the shop, work center and foreman level.
8. Automated forecasting of quarterly workloading requirements at the shop and work center level.

The standard information is maintained in ARMIS and updates CODS on a weekly basis via magnetic tape. ARMIS receives cost data from SYMIS, also via magnetic tape. This allows real time information retrieval. For example, much of the statistical information used in this thesis was generated by ARMIS. Data can be sorted and a report generated in a matter of minutes. Figure 3.13 shows the relationship and interfaces of the RMO, RRC, CODS and SYMIS.

To assist in workloading ARMIS uses the hours required to repair a DLR. By matching the workloaded hours with the man-hours available in the shops and work centers, shop planners can determine if the forecasted workload is adequate to support the number of personnel assigned to that shop. If not, ARMIS can generate a list of DLRs that will give the required workload. This list is passed to the IM for review and action.

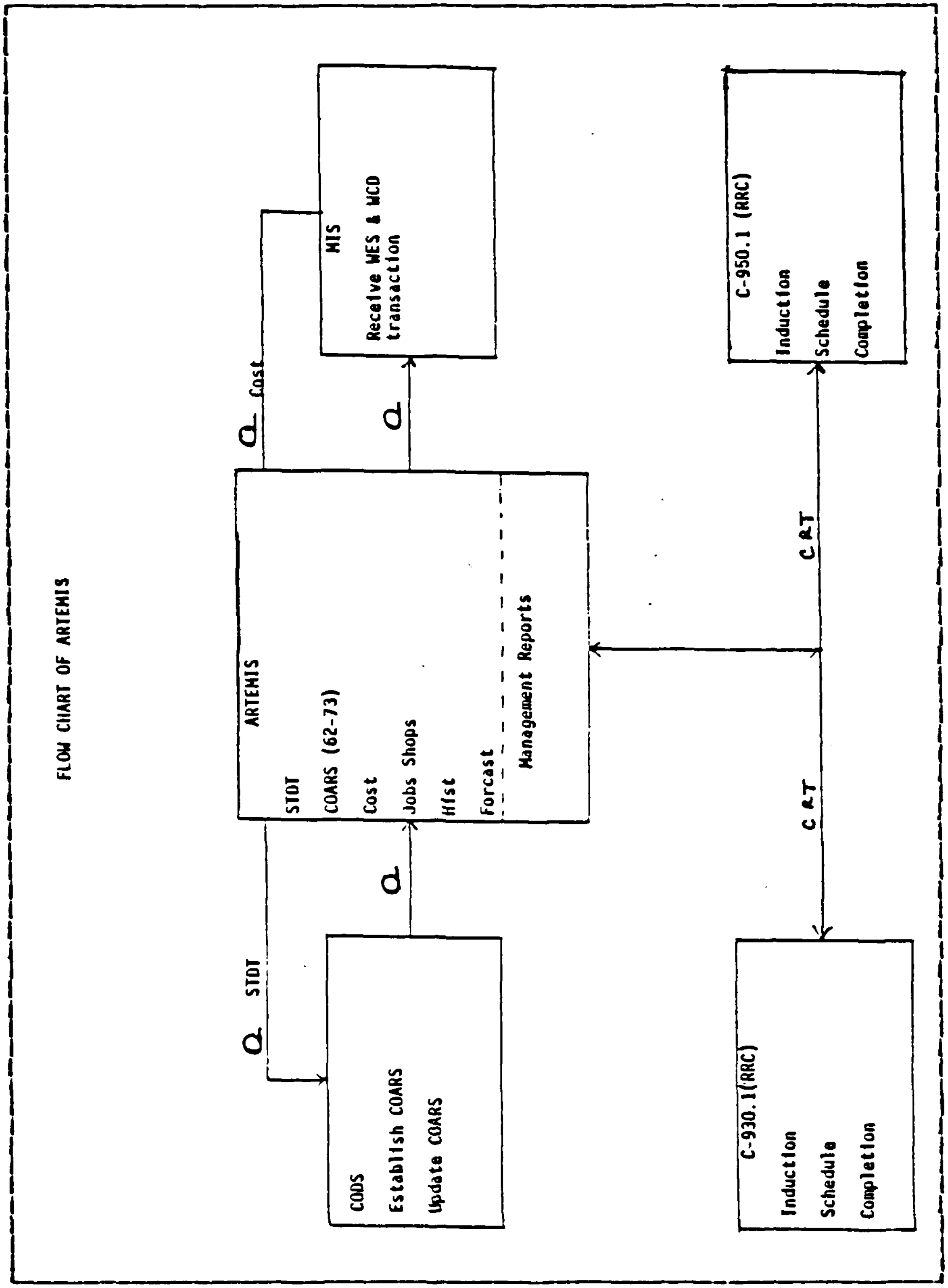

Figure 3.13 RAO, RRC, CODS and SYMIS Interface.

As noted in references used throughout this thesis many of the problems associated with excessively long RTATs can be attributed to the lack of an automated repairables system that provides information and meets the needs of the managers. The ARMIS currently in use at Long Beach has eliminated many of these problems for one DOP. The system is owned by the Navy and can be exported with only minor changes to the software.

On a larger scale, ARMIS could be used in a network composed of organic DOPs, NAVSEA and SPCC. By allowing the customers inquiry access into the files at the various DOPs the need for monthly reports could be eliminated. As mentioned in the forecasting section, ARMIS could also be used to automate the workload by interfacing with the SPCC DATAPOINT system.

ARMIS could be modified to receive weekly tapes from SPCC and automate the workload in much the same manner as ASO and the NARFs have done [Ref. 6]. Long Beach NSY has requested a quarterly workload tape in the past, but has not receive one to date. A tape interface between ARMIS and the B08 on a bi-weekly or monthly basis would eliminate the need to rely on due-in quantities to set up DOP workload. As carcasses are received at the DSP they could be workloaded to the appropriate DOP.

From a telephone conversation with Metier Management Systems, Inc. (the developers of ARTEMIS)[13] they estimate ARMIS could be implemented at other DOPs at a cost of $230,225.00 per DOP. The necessary training is estimated to be $40,000.00 for all DOPs. Metier is also willing to develop a "custom" course designed to specifically meet the needs of ARMIS users. Appendix G is a copy of the Metier's

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[13]ARTEMIS is the trade name for a scheduling system develop by Metier, Inc.. The scheduling application of ARTEMIS is currently being installed at all shipyards. ARMIS uses the same system with the scheduling function disconnected.

response to a request for estimates on hardware and training cost.

Many of the recommendations made in this section are ambitious but they are also realistic and can be accomplished with NAVSEA's support and financial backing. A major factor in reducing RTAT is to provide the DOP with a computer system that is flexible and meets the user's needs.

I. SUMMARY

This chapter has attempted to provide a detailed look at the key issues that affect RTAT. Forecasting and the DOP repair process have been examined to identify problems and develop alternatives that, if implemented, may reduce RTAT. These alternatives will form the basis for the recommendation and conclusions outlined in the next chapter. The problems outlined in this chapter should not be viewed as all inclusive but as significant issues that must be addressed if RTAT is to be reduced.

IV. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

A. SUMMARY

The DOP repair cycle is a complicated process that requires numerous interfaces between various organizations, computer systems and people. As a carcass is moved through the repairables cycle these organizations, computer systems and people must coordinate their actions and ideas if they are to significantly reduce repair turn around time (RTAT).

At present, most shipyards are not organized to support the Naval Supply Systems Command's (NAVSUP) RTAT new goal of 60 days. In fact, the analysis contained in this thesis indicates that more than fifty percent of the DLRs repaired at naval shipyards exceeds 60 days and that only approximately 65 percent of the DLRs completed meet the old NAVSUP goal of 90 days. If RTAT for all DLRs can be reduced to 60 days the Navy may realize savings amounting to more than 180 million dollars.

The thesis has examined each step in the DOP repair cycle to determine if the RTAT of DLRs managed by SPCC can be reduced.

Chapter II provides the reader with a general overview of the repair cycle as well as a feel for the complexities involved in managing the repair of DLRs. It provided a brief description of how SPCC determines the quarterly repair requirements and workloads the shipyards. A detailed description of the steps and procedures the shipyard must follow to complete the repair of a DLR was also provided.

Chapter III attempted to provide a detailed look at the key issues in each segment of the depot repair cycle that has increased RTAT and explored possible alternatives that can reduce RTAT. The impact of workload forecasting on the DOPs' repairables policies and procedures was also examined. The specific areas examined in Chapter III included:

- Institutional Issues
- Depot Organization
- Workload Forecasting
- Administrative Time
- Induction Time and Process
- Effects of Piece Parts on Repair in Process Time
- Preservation, Packaging and Storage

B. CONCLUSIONS AND RECOMMENDATIONS

These conclusions and recommendations are based on the analyses in Chapter III of current practices and procedures associated with the DLR repair cycle. Recommendations are offered of possible actions to take to reduce RTAT for DLRs repaired at naval shipyards to achieve the new SPCC goal of 60 days.

1. Institutional Issues

Before any progress can be made to reduce RTAT to 60 days several institutional issues must be resolved.

a. Filler Work

To date NAVSEA and the shipyard commanders have viewed the repair of DLRs as "filler work". Thus, the single most important action that can be taken to reduce RTAT is for both to support the repairables efforts, by insuring dedicated personnel are hired and trained specifically for repairing DLRs.

b. RTAT Subdivision

Based on conversations with personnel directly involved in the repairables programs at the shipyards there seems to be a great deal of confusion on the definition of the repair time SPCC is trying to reduce to 60 days. The confusion arises from the various definitions promulgated by SPCC and CNM.

For example, currently, SPCC measures RTAT at the DOP level as the time from when the DOP receives a funding document and a carcass is available, to the time the carcass has completed the repair process and is stored at the DSP. This SPCC definition assumes the DOP is responsible for induction, preservation, packaging and storage times. CNM's definition of depot RTAT included induction time but did not include preservation, packaging and storage time. Even so, both definitions include functions normally performed by the DSP. Most DOPs have no control over how long it takes the DSP to perform these functions.

Therefore, RTAT should be divided into well defined segments with responsibilities and goals assigned to each by agreement between NAVSEA and SPCC. The DOPs should be responsible for:

- Administrative time. This is the time from receipt of a funding document to the time an induction request is submitted to the DSP or the Work Control Document / Job Order is delivered to the shop, which ever is later.
- Repair in Process Time. This is the time from when the shop receives a carcass in "F" condition until the carcass is returned to the DSP in "A" condition, exclusive of "G" condition time. Carcasses which are surveyed or mis-identified should not be counted.

The DSP should be responsible for the induction time, which occurs after the administrative activities and before the repair-in-process can begin. The DSP should also be responsible for the time associated with preservation, packaging and storage because these functions occur after the DOP has returned the repaired DLR to the DSP.

By dividing RTAT into these segments the managers at SPCC, the DSP and the DOP can concentrate on those segments for which they have control.

c. "G" Condition Delays

NAVSUP's policy of having carcasses returned to the DSP for storage and the cancelling of outstanding requisitions for repair parts when a carcass is placed in "G" condition has caused many of the DOPs not to use "G" condition for larger DLRs. Consequently, RTAT appears longer than it should be.

DOPs and DSPs should be allowed and encouraged to make local arrangements for the storage of the larger DLRs at the DOP when repair of the item is delayed due to the lack of repair parts. It is not normally cost effective to gather all the removed components, reassemble the item, and transport it to the DSP. The policy requiring the DOP to cancel outstanding requisitions and have the DSP reorder the material is inefficiant and time consuming, leading to larger RTATs.

2. DOP ORGANIZATION

The primary mission of naval shipyards has been to provide logistic support for the construction, conversion, overhaul, repair, alteration and drydocking of U. S. Navy ships and service craft. Consequently, shipyards tend not to be organized to support a repairables program.

To provide such support requires a centralized authority and responsibility to effectively and efficiently manage the repairables program. NAVSEA has already authorized and approved a Repairables Management Organization (RMO) at Long Beach NSY. NAVSEA has also approved the Repairables Rework Centers at two shipyards (Long Beach and Norfolk NSYs). The RMO and RRC concepts have proven they can reduce RTAT. These concepts should be expanded to all shipyards that perform a DOP function.

3. Workload Forecasting

SPCC's workload forecasting drives many of the policies and procedures used by the shipyards. Based on forecasted workloads, DOPs plan manning and repair parts requirements to support the repairs of DLRs. Due to the inaccuracies of these workload forecasts the DOPs have been hesitant to dedicate personnel and facilities to support the repairables programs. In addition, the DOPs are hesitant to order piece parts in advance using the NIF corpus funds because they are concerned the parts will not be used.

SPCC should attempt to improve the accuracy and consistency of the workload forecasts. Efforts should also be made to automate the workload scheduling. SPCC's DATAPOINT computer system is used to generate the quarterly DLR workload for each DOP. The Automated Repairables Management Information System (ARMIS), currently in use at Long Beach NSY, is capable of accepting a magnetic tape from DATAPOINT with only minor program changes. An interface between the Shipyard's Management Information System (SYMIS) and DATAPOINT is possible but would be difficult to program and do very little to reduce RTAT. The shipyard MIS is designed to manage the overhaul of ships where ARMIS is designed to support a repairables program.

4. ADMINISTRATIVE TIME

Administrative time is the time required to process funding documents at the shipyard. This time includes preparation of all the documents necessary to induct a carcass for repair. This time tends to be excessive at most DOPs. In some cases, the time to manually prepare the documentation necessary to repair a carcass exceeds 60 days.

As a consequence of developing ARMIS Long Beach NSY has been able to reduce administrative time to less than one week because ARMIS automatically generates many of the forms and reports needed to manage the program efficiently. Interfaces between ARMIS, SYMIS and the Customer Order Documentation System (CODS) have also been developed. Additionally, ARMIS provides meaningful management information upon request. This system is extremely flexible and should be exported to other DOPs. Only minor programing changes would be needed. It is also "user friendly" and most changes could be made with as little as two weeks training.

ARMIS can also compute the times for each segment of the DOP repair cycle.

5. Induction Time and Processes

Induction time is the time it takes the DSP to deliver a carcass to the DOP. The process by which the DOP makes inductions as well as the time it takes for the DSP to move the carcass to the DOP typically adds at least one week and often two weeks to RTAT.

The recently developed automated induction program (UR-22), which is part of the Stock Point's Uniform Automated Data Processing System (UADPS-SP), is in use at Mare Island NSY. This program has reduced inductions times at that DOP and could do the same at other DOPs. The UR-22 program should be made available to all DOPs. However, because the UR-22 program is part of UADPS-SP, the DSP must initiate a request to Fleet Material Support Office, Mechanicsburg, Pa. to have it installed [Ref. 16]. NAVSUP should encourage the DSPs to use the UR-22 program to reduce RTAT as well as speed the induction process for the DOP.

At some DOPs and DSPs, losing carcasses after an induction request has been made has delayed repairs. Signature control should be used to monitor the movement of carcasses between the DOP and DSP.

All DSPs should also send representatives to the bi-annual workload conferences. This would foster good working relationships between the DOP and DSP as well as allow the DSP personnel to take an active role with SPCC in solving the problems associated with inductions, preservation, packaging and storage. By obtaining advance copies of the workload forecast, DSPs should pre-stage carcasses at or near the DOP and communicate with SPCC about shortages.

6. Piece Parts and Repair-in-Process Time (RIPT)

The lack of required repair parts from both the Navy's supply system and the shipyard's supply departments and, in some cases, the poor quality of the parts that are supplied have resulted in excessive RIPT. Historically, the lack of initial provisioning of piece parts for new major weapons systems to the depot level has caused many of these problems. Today, the Department of Defense is requiring that more emphasis be placed on logistics support of new weapons system procurements. This should improve the availability of piece parts in the long run.

Quality control of repair parts purchased by the Navy's supply system has also been a recurring problem. For example, the repairs of some Main Feed Pump rotating assemblies have been delayed over two years waiting for the supply system to procure acceptable repair parts. For parts that have Defective Material Reports submitted, the Inventory Control Points should impose quality standards in the procurement contracts and ensure the vendor meets those standards prior to accepting the parts. Accepting repair parts based on form, fit and function criteria is unacceptable when quality problems have been identified.

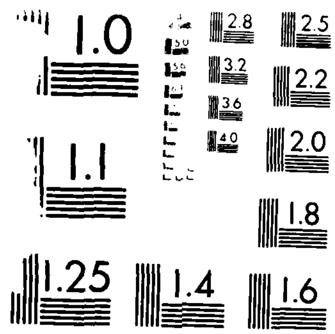
Several of the DOPs complained that their requisitioning and receipt processing times take too long. At one shipyard, a sample of 26 requisitions for repair parts stocked in the Supply System revealed that it took an average of 69 days for a technician to order and receive the part. To correct this problem, the procedures used to order and receive material at the DOPs needs to be streamlined.

Additionally, DOPs' shop stores do not carry many of the repair parts needed in the repairables programs. When lists of material are provided to shop store managers by production workers, an effort should be made to carry those repair parts that meet shop stores criteria.

Two shipyards, Long Beach and Charleston, have expanded the Material Requirements (MR) programs in the SYMIS to capture piece parts usage on past ships' availabilities. Long Beach has modified this program to also include piece parts usage history on DLRs. Using this information a

AD-A165 425 REDUCING REPAIR TURN AROUND TIME OF DEPOT LEVEL REPAIRABLES AT NAVAL SHIPYARDS(U) NAVAL POSTGRADUATE SCHOOL MONTEREY CA J R RODWELL DEC 85 2/2

UNCLASSIFIED F/G 15/5 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

DOP can more accurately determine which repair parts and in what quantity are needed to repair a carcass. A cross-fertilization of ideas between Charleston and Long Beach NSYs should be encouraged on this effort and when de-bugged, these programs should be made available to all DOPs.

7. <u>Preservation, Packaging and Storage</u>

SPCC's position is that preservation and packaging is the DOPs' responsibility because they are funded to accomplish these functions. Usually, however, the DSP performs these activities. As a consequence, preservation, packaging and storage should not be included as part of the DOP repair time because the DOP has no control over how long the DSP takes to perform these functions. In addition, although the DOP is funded to provide the preservation and packaging function it is not cost effective to duplicate the facilities that exist at the DSP.

Preservation, packaging and storage should be assigned to the DSP and should be measured separately. SPCC, in particular, should develop a method to monitor this segment of the repair cycle to quantify the impact on RTAT. Finally, efforts to reduce the time required to perform these functions should be directed to the appropriate DSP.

APPENDIX A

SPCC WORKLOAD FORMS

DCP: N65884A

QUARTERLY WORKLOAD FORECAST

FY: 1984 QUARTER: 1
PAGE: 1

COG NSN ITEM NAME PART/DRAWING NO. SYSTEM(S)	LRC	1. MANHOURS 2. RTAT 3. SURVIVAL RATE 4. REPAIR COST		REPAIR DUES	QTY	FORECAST QTR 1	QTR 2	QTR 3	QTR 4	TOTAL	EXTENDED COST
7G2C 6625-00-0041142 TEST SET SUBASSEMBL 138242 5828084E EP UJD AN/UPM-137A, TEST SE	PZB	1. 2. 1.00 3. 0.85 4. $148				20	20			20	$297
REMARKS: AIR FORCE ITEM											
7G 5820-01-0047007 CIRCUIT CARD ASSEMB A70732-501 AN/URT-23	PM1	1. 8. 2. 0.20 3. 0.57 4. $300	 $655			20	1	20	1	2	$600
REMARKS:											
7G1C 5805-00-0055425 CIRCUIT CARD ASSEMB 1732-1045 IP-1038/U, DATA DISP	PNB	1. 24 2. 2.00 3. 0.05 4. $848	 200 400	NWPN3550000000	1	22	1	1	1	5	$4,246
REMARKS:											
7G1C 5805-00-0055438 POWER SUPPLY SUBASS 1732-2105 CV-2772/U, CONVERTER CV-2772(FG-1)/U, CON CV-2771/U, CONVERTER	PNB	1. 24 2. 0.45 3. 0.57 4. $808	 250 60	NWPN3550000001	1		1	20	1	3	$2,894
REMARKS:											
7G2A 5805-00-0052441 CIRCUIT CARD ASSEMB 1735-3030 C-9529(XO-1)/U, CONT C-6585/U, CONTROL-IN	PNB	1. 12 2. 1.77 3. 0.85 4. ~~3704~~	324 200 200 724	NWSN3581830002	8	23	3	3	3	10	$14,818
REMARKS:											
7G4A 5985-00-0062031 APC, PPC, DIR COUPL 01A228003-21-11 AM-3007B/URT SNEP SH AM-3007B/URT, AMPLIF AM-3007/URT SER F1-F	PM1	1. 4 2. 0.03 3. 0.00 4. $314	 125	NWPN3551800208 NWPN3542720272	11 12	11	11	11	11	44	$13,818
REMARKS: Check class on PO											

CONSOLIDATED STOCK STATUS REPORT (UADPS-ICP)

PAGE NUMBER	SOR DATE	HOLD DATE			ADD DATE/ REASON	FIRST DEMAND	RULES CODE			REPLACEMENT UNIT PRICE	ITEM NAME	LRC	FAMILY F/GP	R/C	STOCK NUMBER
20152	5007	00000	HD	E	72091 P	72152	4	AR	EA	$ 1254.84	APC, PPC, DIR COUPL	PM1	AAVB	H 1	7GH 5985 DO 0062031

ACTIVE POPULATION	SPAC	SHELF LIFE		MGMT DATA	DRIPR CODE	FSCM	AIR	GROSS WEIGHT	GROSS CUBE	PACKAGE QTY	RISK	PLT	CSSR PRINT REASONS
	51	0 00	00	HD DQ U	1P		.500	2.00	.06	1	.135	5.10	99CREPW

PRIOR DISPOSAL	ACON WAR RESERVE		RETENTION LIMIT		ITEM STATUS CODE	PURCHASE			NEXT BUY DATE	PLT PROGRAM VALUE MAINT	OVHL	PROGRAM VALUE END LT MAINT	OVHL	MAINT PROGRAM VALUE PROC TAT	REPAIR TAT	SMIC	STANDARD UNIT PRICE
		.0	832	91	62CC	87142	NNNNN	3.									$ 1140.00

DEMAND OBSERVATION-CURRENT QUARTER MAINT	OVHL	SCHED	REQN	DEMAND FORECAST QUARTER	REQN	PROC VARIANCE	DEMAND DURING LT		DEMAND END OF LT	MAD MAINT	OVHL	DDI MAINT	OVHL	RANDOM DEMAND AVG MAINT	OVHL
10		1	9	38.8	33.000	8542.	197.9	●●●●●	38.8	7.0542	.0000			1.2499	.0000

CONDITION CODE A ON HAND	DUE OUT	REGENERACY ON HAND	DUE OUT	OTHER CONDITIONS ON HAND	DUE OUT	PLT DUE IN RFI	REGENERACY	PLT ASSETS	RFI REGEN DURING LT	NET SYST XCESS/DEFIC	RFI REGEN END OF LT	RFI REGEN PROC TAT	RANDOM DMD REPAIR TAT	
3									172.1		33.7	32.	26	3

BACK ORDERS	MATERIALS OBLIGATIONS	PLT SCHED PPR	SAFETY LEVEL	REORDER LEVEL	REPAIR VARIANCE	ECON ORDER QTY		REPAIR LEVEL	REPAIR ORDER	REPAIR UNIT COST			REPAIR CONTROL	REPARABLE ID CODE	SURVIVAL RATE MAD
15	17			165	691.	21		134	40	$ 315.00	.16	PP	HEO2		.08

CARCASS RETURN OBS MAINT	OVHL		CARCASS FORECAST		CARCASS RETURN MAD				REPAIR AVG	PROC TAT	SURVIVAL RATE	REPAIR TAT	REPAIR RISK	DESIGNATED OVERHAUL POINTS	RPR MOD
1			11		6.5604	.	.3		.68	.95	.90	.67	.135		2

SRCE CODE	RCVY CODE		BRF	POC DATE											
PA	D		.1399	00000		516	22	1	V	N35	1	99365	0	0	

ACTY RI	STOP DATE	TYPE ACTY	RANDOM DEMAND CURR OBS	FREQ	FORECAST	PUMP	DUE IN FROM MAINT	SAFETY LEVEL	RESUPPLY POINT	OST PPR	C	ON HAND	DUE OUT	DUE IN OST	DUE IN	NET
NIZ		RD			.000	A					A					
NJZ		SD			.405	A					A					
NMZ		SP			.000	A					A					
NMZ					.000	G					A					
NNZ		RD	5	4	11.300	A		15	19		A	1			5	
NNZ						A					E					
NNZ					.000	G					A					
NRZ		RD			3.598	A		5	6		A	1			5	
NRZ						A					F					
NBZ		SD	1	1	.605	A					A					
PPZ		SD			.270	A					A					
NDZ		RD	3	3	9.113	A		12	16		A					
NDZ						A					F	1	12			
NDZ						A					M	2				
NOZ		RD	1	1	3.025	A		4	5		A					
NOZ						A					F					
NOZ					.000	G					A					
NUZ		SD			.203	A					A				1	
NXZ		SD			1.418	A					A					
NXZ						A					F					
NPZ		RD			1.403	A		2	2		A	1			1	
NVZ		RD			4.023	A		5	6		R				7	
NZZ		RD			2.313	A		3	4		A				2	

(14)

DI	DOCUMENT/CALL	CLIN	FROM	TO	QTY	CC	DELY	QTY	DATE	AF	E	PC(FR)	PC(TO)
BST	NWPN3542729272			NDZ	13		85009					A	
DDK	N004064332O781			NUZ	1		85102		84350	E	E	A	
DDK	N006064335O303			NPZ	1		85252		84348	E	E	A	
DDK	N006543490989			NVZ	2		85277		84366	E	E	A	
DDK	N006543490990			NVZ	1		85277		85004	E	E	A	
DDK	N626494349O440			NZZ	2		85277		84366	E	E	A	
DDS	N001084V2759	000	AB	NRZ	5		85179		84052	E		A	
DDS	N001084V2759	000	AC	NVZ	4		85179		84052	E		A	
DDS	N001084V2759	000	AA	NNZ	5		85179		84052	E		A	

CONSOLIDATED STOCK STATUS REPORT (UADPS-ICP)

PAGE NUMBER	SDR DATE	HOLD DATE	ADD DATE/REASON	FIRST DEMAND	RULES CODE	REPLACEMENT UNIT PRICE	ITEM NAME	LRC	FAMILY F/CP	N/C	STOCK NUMBER
20152 A	5007										7GH 5985 DO D062031

ACTIVE POPULATION: ATL, PAC, MAP, OTHER — SPAC — SHELF LIFE — MGMT DATA AP DOC — DRMPR CODE — FSCM — AIE — GROSS WEIGHT — GROSS CUBE — PACKAGE QTY — RISK — PLT — CSSR PRINT REASONS

PRIOR DISPOSAL — ACON WAR RESERVE — RETENTION LIMIT — PURCHASE XPIRN DT — NEXT BUY DATE — PLT PROGRAM VALUE MAINT OVHL — PROGRAM VALUE END LT MAINT OVHL — MAINT PROGRAM VALUE PROC TAT REPAIR TAT — SMIC — STANDARD UNIT PRICE

DEMAND OBSERVATION-CURRENT QUARTER MAINT OVHL SCHED REQN — DEMAND FORECAST QUARTER REQN — PROC VARIANCE — DEMAND DURING LT — DEMAND END OF LT — MAD MAINT OVHL — DDI MAINT OVHL — RANDOM DEMAND AVG. MAINT OVHL

CONDITION CODE A ON HAND DUE OUT — REGENERACY ON HAND DUE OUT — OTHER CONDITIONS ON HAND DUE OUT — PLT DUE IN RFT REGENERACY — PLT ASSETS — RFI REGEN DURING LT — NET SYS ACES/DEFIC — RFI REGEN END OF LT — RFI REGEN PROC TAT — RANDOM DMD REPAIR TAT

BACK ORDERS — MATERIALS OBLIGATIONS — PLT SCHED PPR — SAFETY LEVEL — REORDER LEVEL — REPAIR VARIANCE — ECON ORDER QTY — REPAIR LEVEL — REPAIR ORDER — REPAIR UNIT COST — REPARABLE ID CODE

CARCASS RETURN OBS MAINT OVHL — CARCASS FORECAST — REPAIR AVG — PROC TAT — SURVIVAL RATE — REPAIR TAT — REPAIR RISK — DESIGNATED OVERHAUL POINTS — RPR MOD

SRCE CODE — RCVY CODE — BRF — POC DATE — ON HAND — DUE OUT — DUE IN OST — DUE IN — NET

ACTY RI — STOP DATE — TYPE ACTY — RANDOM DEMAND CURR OBS FREQ FORECAST — PURP — SAFETY LEVEL — RESUPPLY POINT — OST PPR

DI	DOCUMENT	ACTY	P	SUPAD	QTY	REQD	CODE	PRJ	ADV
BPR	DLR OSI	NRZ	A	GEOSUP	2	99999	NNYYYN	798	
BPR	PLND MAINT	NZZ	A		3	99999	NNYYYN	798	
BPR	PLND MAINT	NNZ	A		1	99999	NNYYYN	798	
BPR	DLR OSI	NRZ	A	GEOSUP	1	99999	NNYYYN	798	
BPR	DLR OSI	NDZ	A	GEOSUP	3	99999	NNYYYN	798	
DGA	N00104402OVO11	NNZ	A		2	99999	NNYYYN	PLO	
101	EBM ARRANG RL	NRZ	A	DLR	1	99999	NNYYYN	EB2	
101	PSRKAGEQUITY	NNZ	G	CLSSA	7	85122	NNYYYN	CLS	
101	MOD FLSIP 0003	NOZ	G	RO7957	1	86001	NNYYYN	UA4	
101	MOD FLSIP 0058	NNZ	G	RO4669	1	87001	NNYYYN	UA4	
401	N655803262985	NNZ	A	22REST	1	86274	NNNNNN	NL1	28

DI	DOCUMENT	ACTY	P	SUPAD	QTY	REQD	CODE	PRJ	ADV
BPR	PLND MAINT	NOZ	A		1	99999	NNYYYN	798	
BPR	DLR OSI	NXZ	A	GEOSUP	4	99999	NNYYYN	798	
BPR	PLND MAINT	NBZ	A		1	99999	NNYYYN	798	
BPR	DLR OSI	NVZ	A	GEOSUP	3	99999	NNYYYN	798	
DGA	N00104402OVO11	NVZ	A		5	99999	NNYYYN	PLO	
DGA	N001044111Z879	NNZ	A		1	99999	NNYYYN	PNO	
101	DUE OUT MAR85	NMZ	G		2	99999	NNYYYN	MAR	
101	SAUDI FOSS	NNZ	G		3	85219	NNYYYN	DEL	
101	MOD FLSIP 0003	NOZ	G	RO7967	1	86159	NNYYYN	UA4	
401	N65580326 23985	NNZ	A	22REST	1	86099	NNNNNN	NL1	28

ALTERNATE NIIN	REL	NIIN	REL	NIIN	REL	NIIN	REL
001689635	41M	000784717	41M				

APPL	CODE	CLS	QTY	PCT	MC
52300710			1	100	20
52300707			1	100	20
52300709			1	100	20

BACKORDER DOC/S	QTY	PRJ	FD	PR	2B	ST
N6267843247060	1	NK1	T5	03		BB
V0563643450009	2	HJO	JZ	05		BB
N6264943490440	2	770	28	06		BB
R2002543511159	1	LE5	NB	06		ZB
N6141443300307	1	LK5	UV	13		BB
N00065143490989	2	770	26	05		BB
N00040643320781	1	770	26	06		BB
PTKB4240480454	1	BG1	48	06		BB
V0720043200A201	1	LKS	SB	06		BB
N6141443310308	1	LKS	UV	13		BB
N00065143490990	1	770	26	05		BB
N00060443350303	1	770	26	06		BB
R08809434 94102	1	GK5	JZ	06		ZB
V2002743 49A403	1	LE5	SB	06		BB

ACTY	RPT	DC	STOP	RCN	OB OH	A OH	W OH	B	OTH	DI	DO	NET
R5J	84225	AD			1							1-
R5K	84226	AD			1	1						
R9R	84226	AK			6	2				4		4-
R6W	84225	AG			1	1						
R7B	84226	AP			1	1						
R7P	84225	AG			1							1-
R7Q	84225	AP										
R2U	84225	AA			1		1					

CONSOLIDATED STOCK STATUS REPORT (UADPS-ICP)

PAGE NUMBER: 20152 B | SOR DATE: 5007 | HOLD DATE | ADD DATE/REASON | FIRST DEMAND | RULES CODE | REPLACEMENT UNIT PRICE | ITEM NAME | LRC | FAMILY | STOCK NUMBER: 7GH 5985 00 D062031

ACTIVE POPULATION (ATL, PAC, MAP, OTHER) | SPAC | SHELF LIFE | MGMT DATA (AP DOC S) | ORIPR CODE | FSCM | AIE | GROSS WEIGHT | GROSS CUBE | PACKAGE QTY | RISK | PLT | CSSR PRINT REASONS

PRIOR DISPOSAL | ACON WAR RESERVE | RETENTION LIMIT | PURCHASE XPIRN DT | NEXT BUY DATE | PLT PROGRAM VALUE (MAINT, OVHL) | PROGRAM VALUE END LT (MAINT, OVHL) | MAINT PROGRAM VALUE (PROC TAT, REPAIR TAT) | SMIC | STANDARD UNIT PRICE

DEMAND OBSERVATION-CURRENT QUARTER (MAINT, OVHL, SCHED, REQN) | DEMAND FORCAST (QUARTER, REQN) | PROC VARIANCE | DEMAND DURING LT | DEMAND END OF LT | MAD (MAINT, OVHL) | DDI (MAINT, OVHL) | RANDOM DEMAND AVG (MAINT, OVHL)

CONDITION CODE A (ON HAND, DUE OUT) | REGENERACY (ON HAND, DUE OUT) | OTHER CONDITIONS (ON HAND, DUE OUT) | PLT DUE IN (RFT, REGENERACY) | PLT ASSETS | RFI REGEN DURING LT | NET SYST XCES/DEFIC | RFI REGEN END OF LT | RFI REGEN PROC TAT | RANDOM DMD REPAIR TAT

BACK ORDERS | MATERIALS OBLIGATIONS | PLT SCHED PPR | SAFETY LEVEL | RECORDER LEVEL | REPAIR VARIANCE | ECON ORDER QTY | REPAIR LEVEL | REPAIR ORDER | REPAIR UNIT COST | REPARABLE ID CODE

CARCASS RETURN OBS (MAINT, OVHL) | CARCASS FORECAST | REPAIR AVG | PROC TAT | SURVIVAL RATE | REPAIR TAT | REPAIR RISK | DESIGNATED OVERHAUL POINTS | RPR MOD

SRCE CODE | RCVY CODE | ERF | POC DATE

ACTY RI	STOP DATE	TYPE ACTY	RANDOM DEMAND CURR OBS	FREQ	FORECAST		PURP	DUE IN FROM MAINT	SAFETY LEVEL	RESUPPLY POINT	OST PPR	ON HAND	DUE OUT	DUE IN OST	DUE IN	NET
ACTY	RPT	DC	STOP RON	OB OH	A OH	W OH	B	OTH DI	DO	NET						
R2V	84226	AJ		5						5-						
R2W	84225	AA		1					1	1-						
R2X	84225	AJ		1						1-						
R3D	84226	AJ		1						1-						
R3F	84225	AA		1						1-						
R3H	84225	AA		1						1-						
R4K	84004	AE		1		1										
R4N	83258	AN		1		1										
R4U	84226	AF		1						1-						
R4X	84226	AN		1		1										
R4Y	84226	AN		1		1										
R4P	84020	AF		1						1-						
R9F	84225	AK		6	1					7-						
R9H	84225	AK			1					1						
R9J	84225	AB		4						4-						
R9K	84225	AB		5						5-						
R9N	84226	AK		5	2					3-						
GRAND TOTALS:				50	9	5			5	36-						

SPCC REPAIR WORKLOAD FORECAST

COG	NSN	SMIC	LRC	FGC	REL
7G4A	5985-00-0062031		PM1	AAV8	0

EXTRACT DATE: 84353   STANDARD PRICE: $1,140.00
CURRENT DATE: 84357   REPLACEMENT PRICE: $1,254.84

ITEM NAME: APC, PPC, DIR COUPL   EQUIPMENT NAME: AM-3007B/URT, AMPLIF
S2300709 EP UJ7
AM-3007/URT SER F1-F   NET PRICE: $501.00
REPAIR PRICE: $315.00

PLT: 5.10   REQ. FREQ.: 32.000   REORDER LEVEL: 112   SR: 0.90   CRF: 35.9
RTAT: 0.62   DEMAND: 38.810   REPAIR LEVEL: 86   M/H:

			OPENING POSITION	1Q	2Q	3Q	4Q	5Q	6Q	7Q	8Q
REQUIREMENTS:	1Q 1 BOs, DOs - CASREPTS	I									
	ALL OTHER BOs - DOs	II	4	4	55	74	81	88	97		
	999 PPRs	II	30	30							
	DEMAND X RTAT	III	39	39							
	DEMAND	III	39.		39	39	39	39	39	39	39
	ALL OTHER PPRs - PWRs	III		7	3			2			
	REPAIR SAFETY LEVEL	IV	39	39	39	39	39	39	39	39	39
	ECONOMIC REPAIR QUANTITY	IV	39	39	39	39	39	39	39	39	39
	TOTAL REQUIREMENTS			158	175	191	198	207	214	117	117
ASSETS:	ON HAND		4	4						27	20
	DUE IN (DDS/A2_) BY QTR		3	3	23	32	32	32	163	32	32
	FUNDED REPAIR (BS1/DDS+)		18	18							
	TOTAL ASSETS			25	23	32	32	32	163	59	52
	REPAIR REQUIREMENT			133	152	159	166	175	51	58	65
	NRFI ON HAND (UNFUNDED)		1								
	CARCASS RETURN FORECAST		36	20	36	36	36	36	36	36	36
	PRODUCTION QUANTITY			~~18~~	~~32~~ 11	~~32~~ 11	~~32~~ 11	~~32~~ 11	~~32~~ 11	~~32~~ 11	~~32~~ 11
	REPAIR COST			$5,670	$10,080	$10,080	$10,080	$10,080	$10,080	$10,080	$10,080
	CARCASS CONSTRAINT			128	134	141	148	159	21	28	36
	ESTIMATED BUY QTY			131			22			21	

	1ST QUARTER UNITS	M/H	DOLLARS	2ND QUARTER UNITS	M/H	DOLLARS	3RD QUARTER UNITS	M/H	DOLLARS	4TH QUARTER UNITS	M/H	DOLLARS
LEVEL I	0		$0	0		$0	0		$0	0		$0
LEVEL II	9		$2,835	32		$10,080	32		$10,080	32		$10,080
LEVEL III	9		$2,835	0		$0	C		$0	0		$0
LEVEL IV	0		$0	0		$0	0		$0	0		$0
TOTALS	18		$5,670	32		$10,080	32		$10,080	32		$10,080

	UNITS	M/H	DOLLARS
1ST YEAR	114		$35,910
2ND YEAR	128		$40,320
3RD YEAR	128		$40,320
4TH YEAR	128		$40,320
5TH YEAR	119		$37,485

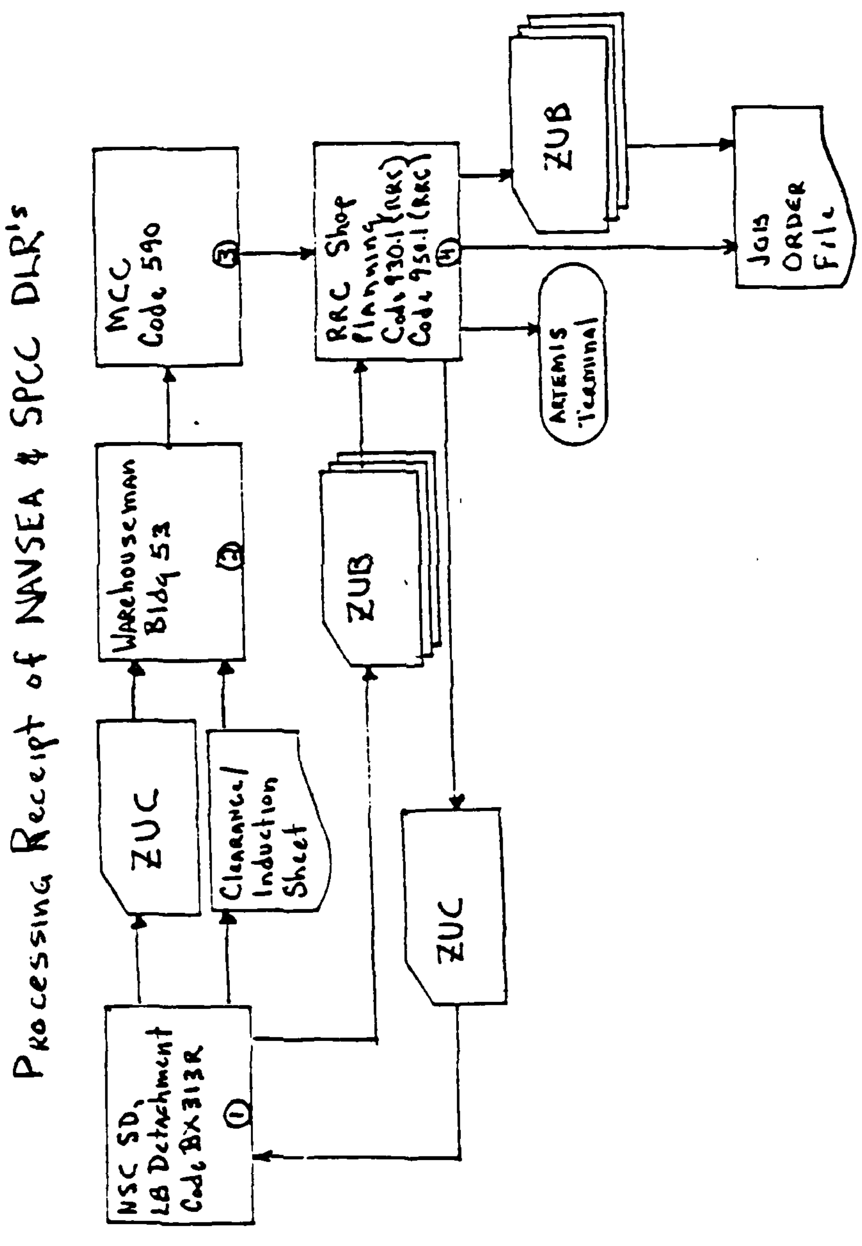
DOP	2ND QUARTER: M/H	QUANTITY	3RD QUARTER: M/H	QUANTITY
N65584A		11 ~~32~~		32

11-11-11-11
level 2 →

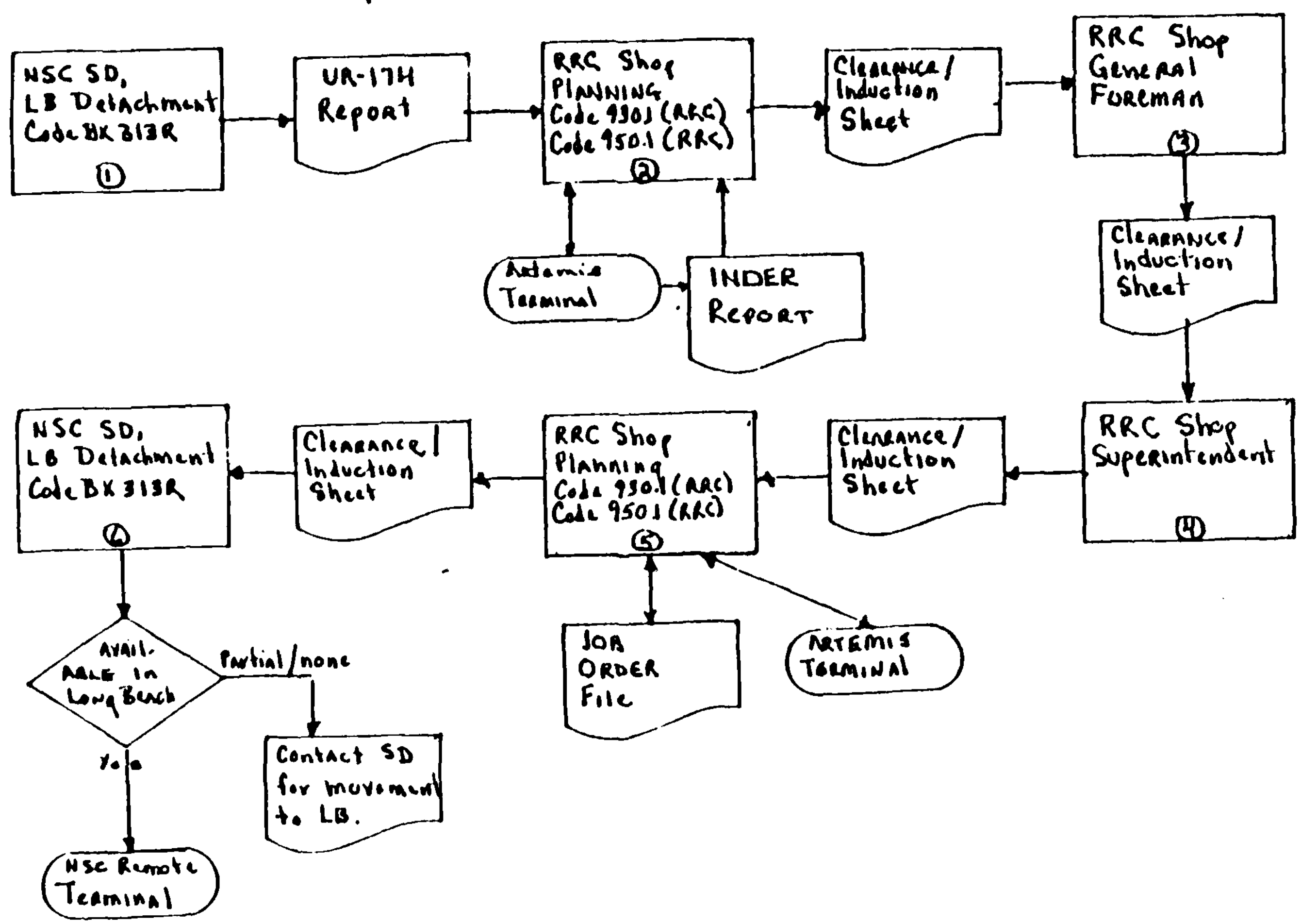
IMS SIGNATURE   SECTION HEAD   BRANCH HEAD   DIVISION HEAD   GROUP HEAD - CD

APPENDIX B

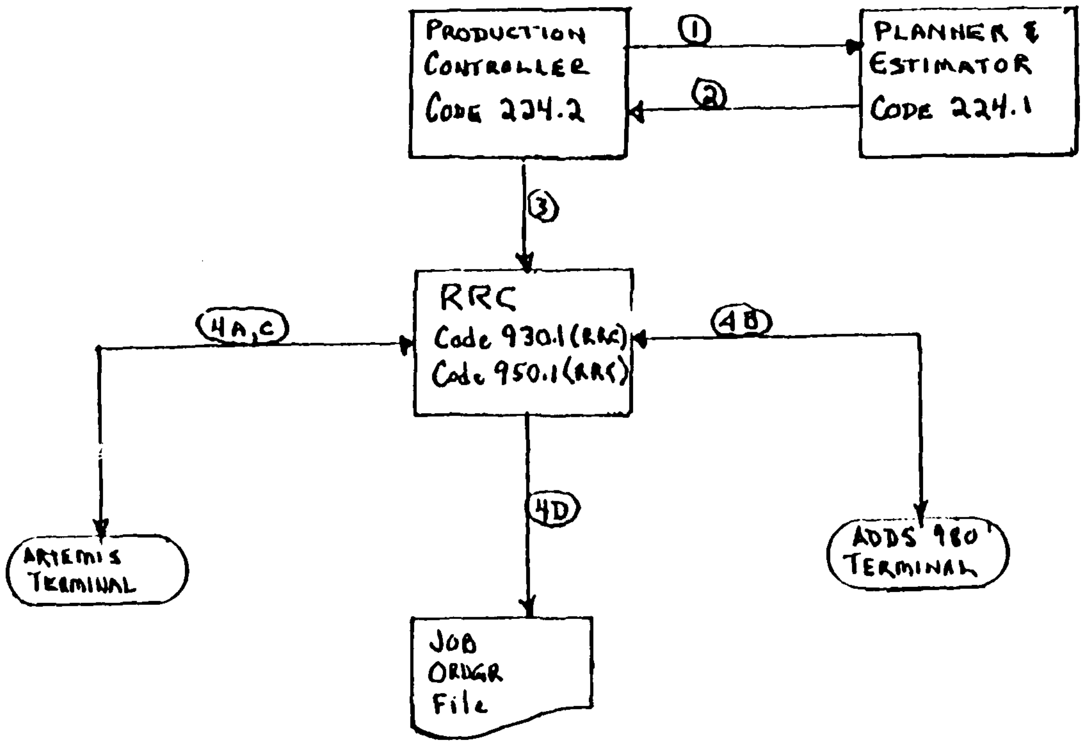
RRC FUNCTIONAL FLOW CHARTS



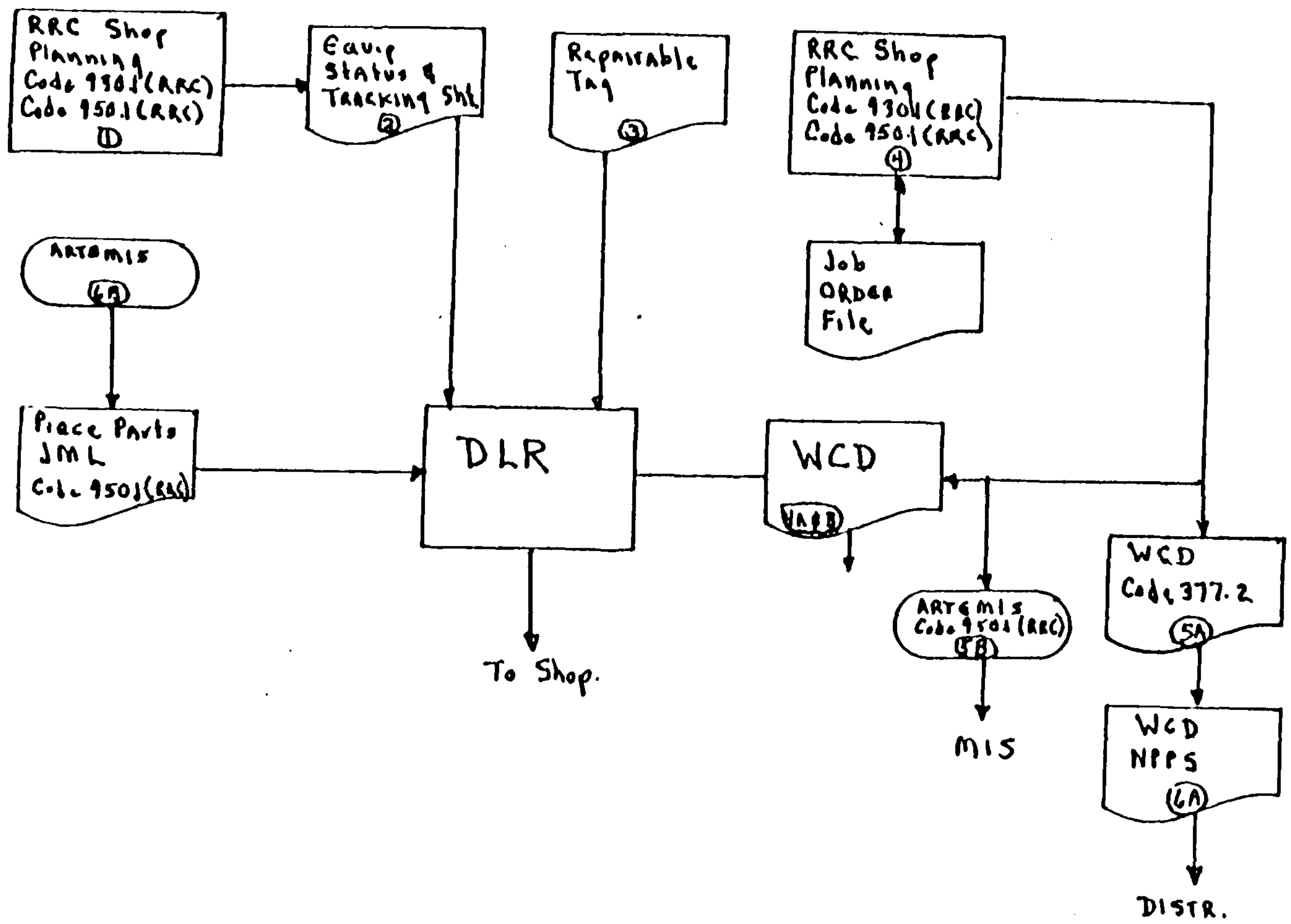
Processing of Inductions for SPCC DLR's



PROCESSING OF INFORMATION WORK CONTROL DOCUMENT (WCD)



Processing Issuance of Work Control Document



APPENDIX C

LONG BEACH NSY MRP SYSTEM DESCRIPTION

USER PROCEDURE MANUAL

DATE	SECTION NAME	SECTION	PAGE
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Objective:

The objective of Manufacturing Requirements Planning (MRP) is to plan and control material for the repairables program. The system is a timely, accurate, easy to use, shop-oriented tool for managing material used in the overhaul of major repairable components.

Closed Loop Concept:

The Closed-Loop Manufacturing Resource Planning (MRP) system is a proven, comprehensive planning and control system for resources (material, labor, and facilities) required to meet the overall business objectives of the Shipyard. This closed-loop system for the Long Beach Naval Shipyard (LBNS) begins with the planning activity. This includes determining which components are to be overhauled at LBNS, by quarter, and then developing a more detailed Master Production Schedule of when each overhaul is to be performed for the overhaul's within the nearest quarter. The term "Closed-Loop" means that there is timely feedback between the execution and planning functions, which will ensure proper actions are taken when changes in the Master Production Schedule occur. For example, if a job order cannot be completed on time, this information is fed back to the Master Production Schedule so that adjustments to scheduled due dates of other overhauls can be made and the proper management action taken.

Once the planning phase is complete and the Master Production Schedule has been tested and is attainable, the execution activities begin. The execution activities include detailed planning, ordering, and monitoring of each job order and its material requirements.

System Functions:

The MRP system performs a broad range of important material planning and control functions. These functions have been logically grouped into different application modules. The material-related MAC-PAC modules, which are implemented at the Shipyard, are briefly described below:

(1) Design Engineering - This module maintains the Part Master File and the Product Structure (Bill of Material) File. The Part Master File identifies each part number in the system and describes how it is controlled in the storeroom. The Product Structure File defines the bill of material for each major repairable component. This product structure lists the materials, by part number and quantity, required to perform each class of overhaul on each major repairable component.

Name: MRP OVERVIEW (continued)

(2) Inventory Control - This module monitors the status of each part number in the system. It tracks not only the quantity on-hand in the storeroom, but also the quantity on-order (requisition or manufacturing order) and when the on-order quantity is due from the vendor or the producing shop. This module also tracks the detailed issue status of each job order, by part.

(3) Requirements Planning - This module has two primary functions. First, it maintains a Master Production Schedule of Shipyard repairs for the next year or two. This Master Production Schedule shows the anticipated repair schedule for each class of overhaul on each type of component, by day. Second, this module processes the Master Schedule against the bills of material to determine the materials needed to satisfy the Master Production Schedule. Using material requirements planning techniques, it reserves materials already on-hand and on-order. The module then identifies any additional materials required to complete the scheduled work and determines when to order, how much to order, and when the materials ordered should be received in the storeroom.

Other MRP modules, which maintain operation routings and plan and monitor labor and material on the shop floor and develop standard costs and monitor actual versus standard costs, are also available.

The Design Engineering module is used to develop and maintain the material specifications required to support MRP. This module maintains the Part Master File and the Product Structure File. The Part Master File identifies each stock number in the system and describes how it is processed within MRP. The Product Structure File defines the bill of material for each major repairable component controlled by MRP by stock number and the quantity required to perform each class of overhaul on each type of component. The main objectives of Design Engineering are:

(1) To develop and maintain accurate product structure information for repairable items.

(2) To develop and maintain part information.

(3) To minimize production costs through effective control of product engineering changes and part-related data.

The Design Engineering module supports these objectives by:

(1) Providing organization and maintenance of product structure data for each overhaul (the Product Structure File is a structured list of materials and the quantities of each part required to perform a given class of overhaul).

(2) Maintaining, for each item, the part master data pertaining to planning, purchasing, inventory, and production control. All part order policies, including lead times, and part usage policies are maintained on the Part Master File through the use of the Design Engineering module.

PART MASTER FILE

The MRP Part Master File is a list of all parts processed by MRP within a shop. This includes all DMI and shop store material. A part cannot be ordered, received, issued, or overhauled unless it exists in the MRP Part Master File.

The stock number is used to uniquely define each part on the Part Master File. The following key information is maintained in addition to the stock number of the part.

(1) Reference. Reference information identifies the type of part and includes a description of the part for identification purposes.

(2) Order Policy. Order Policy information specifies how shop store's requisitions and JML order quantities will be calculated by Requirements Planning. Examples of order policy information are the safety stock quantity, a minimum order quantity, and a maximum order quantity.

PART MASTER FILE (continued)

(3) Lead-Time. Lead-time information specifies when the component parts analyzed by Requirements Planning should be ordered. The leadtime of some parts at the Shipyard is highly variable. The leadtime can be effected by how, where, and from whom the part will be acquired. Because of this, management attention should be directed at maintaining realistic lead-times to ensure that within a reasonable probability, material is received on time.

(4) Inventory. Inventory quantity balances provide planners, supply clerks, and shop personnel with the quantity on-hand and the quantity on-order for all parts. This includes inventory balances for shop stores and DMI material.

PRODUCT STRUCTURE FILE

The Product Structure File contains a list of material required for each overhaul class. These product structures are used by the Requirements Planning application module to determine material requirements. For planning purposes, the quantity required is calculated by multiplying the quantity of the part required for each parent times the usage frequency. For example, if two valves are components of one sealed hydraulic transmission, but they are replaced in only 50 percent of the overhauls, only one valve could be ordered for each scheduled overhaul. The quantity per parent and the usage frequency are defined for each part on the Product Structure File.

Each product structure reflects the way a major repairable component is overhauled. This is done by defining the parts belonging to each sub-assembly. This allows mechanics and planners to easily identify each part while performing an overhaul.

ENGINEERING CHANGE FILE

MRP provides control over the addition of a new product structure. The Engineering Change File provides this control.

An Engineering Change Order transaction must be submitted for each new parent being input into the Product Structure File. On this transaction, the date at which Requirements Planning will begin using the product structure is specified. This date is called an effectivity date. To ensure that inaccurate data will not be used to plan material requirements, the effectivity date should first be specified as several years in the future. Doing this is termed opening an Engineering Change Order.

CROSS REFERENCE FILE

The Cross Reference File provides MRP users with a list of manufacturer's part numbers for each stock number. This file supports the needs of the shop personnel who use the manufacturer's part number (obtained from technical manuals) to identify a part.

CROSS-REFERENCE FILE (continued)

The cross reference of stock numbers allows MRP to print the manufacturer's part number on all documents used by shop personnel. Cross reference reports are available by stock number, by manufacturer's part number, and by part description. Also, cross-reference information can be obtained through on-line inquiry conversations using either the stock number or the manufacturer's part number.

JML DETAIL FILE

The JML Detail File is a list of all purchased parts processed by MRP within a shop. This includes all DMI and shop stores material. The stock number is used to uniquely define each part on the JML Detail File. Information on the JML Detail File is used by shop personnel for writing JML's.

SYSTEM CONTROLS

The MRP system provides procedural and system controls that assist users in maintaining accurate and up-to-date information. Although MRP will automatically recognize many user errors and data inconsistencies, the ultimate responsibility of accurate data rests with the users.

Following is a brief description of the controls provided by MRP.

(1) Manual Procedures. Manual procedures require the approval of input documents by key personnel before they are entered into MRP.

(2) Batching Controls. Batching controls verify that all transactions were processed.

(3) Terminal Sign-on Procedures. Terminal sign-on procedures control access to the MRP system at the transaction level to prevent unauthorized entry of data.

(4) Input Validation. Input validation verifies that invalid data does not corrupt the MRP data base. For example, if a field has predefined values, MRP will allow only the correct values of the field to be entered.

(5) Detailed Audit Trails. Detailed audit trails document all changes to the MRP Master Files for user verifications.

(6) Error Recycling. Error recycling ensures that all transactions that are rejected by MRP are corrected and processed properly.

(7) Master File and Run-to-Run Control. Master File and run-to-run controls notify system operators when program errors occur and when system errors occur.

(8) Data Base Audit Reporting. Data Base Audit Reporting verifies that existing data on the Part Master File is complete.

The Inventory Planning and Control Module monitors the status of each part in MRP. Ensuring accurate inventory balances by controlling the movement and usage of material within the Shipyard is critical to MRP. The primary objectives are:

(1) Reduce the amount of working capital tied up in inventories.

(2) Increase overhaul efficiency, through improved control over material availability.

(3) Minimize costly write-offs due to inventory obsolescence.

The Inventory Control module supports these objectives by defining and processing all the transactions necessary for control of on-hand and on-order balances. Stock status and repair and requisition order status reports highlight shortage, surplus, past-due, and obsolete inventory conditions.

Within the Inventory Control application, shop paperwork is also prepared. This paperwork identifies the status of component requirements maintained for each job order. The reporting provides an indication of component availability and a measure of part substitution and part usage variances.

IP&C Functions

Master Production Schedule:

Planners use various quarterly schedules to develop a Master Production Schedule which identifies the week in which the components will be overhauled. A preliminary Master Production Schedule is determined by weighing available labor and machine resources against the workload. Once this Master Production Schedule has been approved, the components to be overhauled by period are input to the Requirements Planning function. The Master Production Schedule is the driving force for the planning activity. The Master Production Schedule for a major repairable component reflects anticipated overhauls needed, by time period, as projected by NSWSES, NAVSEA, SPCC, etc.

The forecasted quantities are entered as "advance planned" orders into the Master Production Schedule. These "advance planned" orders are exploded by MRP through the Product Structure File to calculate the gross part requirements (i.e., the total quantity of parts which are likely to be needed to perform the scheduled overhauls). The MRP system reviews the on-hand and on-order positions of each part, applies the acquisition lead times for each part, and produces time-phased net material requirements. The MRP system creates planned requisitions for parts with suggested order placement dates. When the placement date is reached, the MRP system will produce a report requesting the planner to firm the requisition in MRP and submit a JML into the MIS system. When updated forecast information is

Master Production Schedule: (continued)

received. The Master Production Schedule will be changed to reflect the revised information. MRP will then examine the affected part requirements and determine whether new supply orders are required.

Plan Material

Material planning consists of identifying parts needed, projecting the need for parts over time, and ordering parts to meet these needs.

The definition of the part is the foundation upon which material planning and control is built. Critical information is maintained about the part; such as stock number, description, part type, material planning information, on-hand and on-order quantities and part cost. Without all this information, the MRP system cannot function properly and interface with the Shipyard MIS system.

One of the most critical factors to be identified is accurate lead times. MRP uses the lead-time information to determine when to order a part to insure that it arrives at the Shipyard when it is needed. Lead times for many parts are highly variable. A lead-time reporting system will use data developed by the MRP system to compare actual lead times to current lead times on the Part Master File and suggest appropriate changes.

After a part has been defined, planning bills of material will be input into the MRP system. The planning bills of material itemize the materials that make up a major repairable component. The total quantity of each part likely to be needed in an overhaul is the total quantity in the component adjusted for the usage frequency of each part. "Usage frequency" is simply the probability, expressed as a percentage, of a part's being replaced during a repair. Usage frequency is the key to material planning since, for a given overhaul, part requirements cannot be determined with precision until the disassembly, inspection and testing are completed. Usage frequencies for each part will be based on historical usage, manufacturer's engineering estimates and estimates supplied by production work center personnel. The MRP system will maintain its own historical usage data to be used to update these initial estimates of usage frequencies.

The MRP system will capture all receipts for outstanding requisitions, of both DMI and Shop Stores material. DMI parts will be tracked into and out of Building 55 to Building 129, while Shop Stores parts will appear as being received directly by Building 129.

Process Overhaul

After a major repairable component arrives in the shop, it is first disassembled and inspected. At this time, the parts required are listed on a system created inspection report (Material Requirements/Pick List) which will be used for picking the parts in the MCC and as the source document for entering issue transactions into the MRP system. Using the quantities written on this document by the mechanic, the MRP system's planned part requirements for this component will be changed to the actual parts required for the overhaul. As the job order is completed, all issue information will be entered into the MRP system and will be retained for use in usage history analysis. Unplanned but required parts, which are not on-hand after a component is inspected, will be ordered immediately.

Usage Tracking

Usage frequency is one of the primary differences between using MRP in the ship overhaul environment versus a manufacturing environment. Unlike manufacturing, in performing overhauls, parts' requirements typically cannot be determined with precision until a component is disassembled, inspected and tested. Usage frequency provides a method for planning material in this uncertain environment.

The term "usage frequency" means the probability, expressed as a percentage, that a part within a component will be replaced during an overhaul. It does not relate to the probability that the component itself will fail or be missing.

Material planning in MRP is accomplished by developing planning bills of material for each component to be repaired. Planning bills of material contain the usage frequency of the parts in a component. Only parts that have a predictable usage frequency should be listed in the planning bills. Other parts are managed by maintaining a safety stock for the part. Planning bills are used to determine the quantity of each part in a component that will probably be needed to complete an overhaul. When components are placed in the Master Production Schedule, the Requirements Planning module of MRP uses the planning bill of material to calculate the gross material requirements. The gross requirements area netted against on-hand and on-order quantities to determine whether additional orders are necessary. This occurs months in advance of receiving the major repairable component. Suggested material orders are then offset, based on anticipated acquisition lead time. Suggested orders are reported to the appropriate planner for confirmation or denial of the placement of the order.

Usage Tracking (continued)

Once the repairable is disassembled and inspected, the actual part requirements will be determined. When these parts are issued to the job order, the part usage will be captured by the MRP system. A reason code associated with each issue will be indicated. The usage reason code will be: (1) replacement, (2) failure, or (3) missing. By tracking the usage reason, the classification will allow shop personnel to report trends for specific parts. This will be especially useful in overhauls of new components from new classes of ships.

MRP will provide a maintenance process to allow planners to adjust the usage frequency. Planners will receive information from MRP suggesting that the usage frequency of certain parts be changed (exception information based on usage history). The planners will review this information and decide which parts to update and what usage frequency value to enter. This review process will allow the planner to apply judgment and experience to override computer suggested actions when appropriate.

The usage frequency maintenance system will:

(1) Capture and retain in a historical usage file issue and job order data that accounts for all actual overhauls. This data will be detailed enough to account for actual usage by stock number, overhaul class, and model.

(2) Provide the ability to scan the historical usage file to select those items warranting special analysis because historical usage rates deviate significantly from the established (actual) usage rate.

(3) Provide the planner with "computer recommended" usage frequency based on statistical computation of historical average.

(4) Provide summary or detail information about individual part usage.

(5) Provide a reason code for usage history updates to prevent inaccurate updates to nonactive parts or to parts whose usage frequency has been overridden by planners independent of computer suggested usage values.

(6) Provide assistance in determining appropriate safety stock levels for individual or selected parts.

Order Tracking:

Montioring of part requirements is continuous throughout the cycle of an order. From the time an order is entered into the Master Production Schedule until its completion any changes (such as an increase in scheduled quantity of a major repairable component or a change in the requirements reported on the Material Requirements/Pick List document) are analyzed by MRP. MRP will produce action reports when: (1) shortage conditions occur, (2) suggested requisition status changes are not initiated on time, (3) material receipts are past due, or (4) other situations occur that require corrective action. These action reports are directed to the appropriate planner responsible for ordering the part identified on the report.

The status of parts on order is continually monitored by the MRP system. As each requisition is processed arrival dates are calculated, based on the purchase lead time of the part involved. If the part has not been received as of the calculated arrival date the system notifies the appropriate planner that immediate action needs to be taken. In addition, the effect of the delayed receipt on the related job orders is highlighted.

Unrecorded Assets

All material existing in the shop but not recorded by the MIS system will be collected, recorded and controlled by MRP. These goldpile parts will be segregated in physical locations separate from identical recorded asset parts and these locations will be referred to as "UA" (unrecorded asset) locations by the MRP system. The Shipyard MIS system will be able to monitor only the balances of recorded assets.

The MRP system will treat unrecorded asset parts similar to recorded asset parts, but will distinguish between the two in two basic ways:

(1) Goldpile locations and quantities will appear first on MRP generated picking documents and the Shop Stores clerk will have instructions to issue from exisitng UA locations first. As unrecorded assets are depleted, they will not be replenished. The Shipyard MIS system's visibility to actual balances will become more realistic over time as unrecorded assets diminish.

(2) During physical cycle counts unrecorded assets will be counted separately and will not be reconciled when comparing the MRP and MIS system balances (so no artificial out-of-balance situations will occur).

Message File

System messages are used to trigger analysis and reports through communication between system programs. A message relationship exists when exception conditions are detected by one application to be examined or resolved by another application. This is done through the use of communication messages between programs of the two applications.

The relationships between Inventory Control and the other MRP applications are summarized below:

INVENTORY CONTROL MESSAGE RELATIONSHIPS

APPLICATION	IC REQUIRES BUSINESS DATA	REQUIRES IC BUSINESS DATA	MESSAGE RELATIONSHIP
Design Engineering	X		
Requirements Planning		X	X
On-Line Inquiry		X	

The relationships between Requirements Planning and the other MRP applications are summarized below:

REQUIREMENTS PLANNING MESSAGE RELATIONSHIPS

APPLICATION	RP REQUIRES BUSINESS DATA	REQUIRES RP BUSINESS DATA	MESSAGE RELATIONSHIP
Design Engineering	X		X
Inventory Control	X	X	X
On-Line Inquiry		X	

The Part Master File and Product Structure File are created by Design Engineering and either maintained or used by Inventory Control. The Part Master File is maintained by Inventory Control, and is used by Requirements Planning, Inventory Accounting and On-Line Inquiry.

The Order Data Base, created and maintained by Inventory Control, is used by Requirements Planning and On-Line Inquiry.

The Inventory Control application sends messages to Requirements Planning on potential shortage or excess inventory conditions for parts requiring replanning. Following is a brief description of those messages passed between Inventory Control, Requirements Planning and Design Engineering.

Message File (continued)

From	To	No.	Brief Description
RP	IC	200	Order Analysis. Sent when either an order add or change is processed.
RP	IC	210	Sent if either of the following exception conditions occur on orders with a status other than planned: - Reschedule earlier - Increase quantity
RP	IC	220	Sent if an effectivity exception is encountered when exploding component requirements for an order change transaction.
IC	RP	310	Requirements Planning Analysis. Sent whenever a transaction is processed which could cause excess supply. Also whenever a shortage condition is detected.
DE	RP	310	Requirements Planning Analysis. Sent whenever there is a change in any factor that could change the order policy or order lot size.
IC	RP	310	Requirements Planning Analysis. Sent whenever a transaction is processed which could cause excess supply or whenever a shortage condition is detected.
DE	RP	320	Requirements Planning Replanning. Sent whenever changes are made to the Part Master File and Product Structure File data that could effect the calculation of planned order or component demand (e.g., make/buy code, change effectivity date, delete component, etc.).
DE	RP	330	Requirements Planning Reschedule. Sent whenever lead times are changed on the Part Master File.
IC	RP	340	Master Schedule Report Request. Sent to request master schedule reports for selected parts.
IC	RP	350	Master Schedule Change. Sent to print all master scheduled parts that have had a change.
IC	RP	360	Order Requirement/Planning Action Consolidation. Sent so that parts with exception conditions (on the day Requirements Planning is run) are printed only on the Planning Action report rather than on two different exception reports on the same day.

Message File (continued)

From	To	NO.	Brief Description
RP	SF	510	Order Delete. Sent when Requirments Planning needs to have an order deleted by Shop Floor Control.

INVENTORY PLANNING AND CONTROL MASTER FILES

Order Header File

The Order Header File contains information regarding the status of each job order and requisition order. The following data is included in the file: (1) the date the order was input into the system; (2) the order type, e.g., purchase order; and (3) the order status, e.g., planned, firm, cut, pick.

Requirement Detail File

The Requirement Detail File contains specific information on the supply and demand status of material for each job order. Information from this file is used to detect shortage conditions. The planned, firm, cut and pick dates for all parts are maintained in this file.

Order History File

The Order History File contains order information for each job order number. The file includes all parts in the overhaul of a carcass and shows the actual usage frequency of the parts.

APPENDIX D

LOCAL MR FUNCTIONAL DESCRIPTION

11NO-NSYLB-5230/172 (5-74)

LONG BEACH NAVAL SHIPYARD
DATA PROCESSING OFFICE

PROGRAM DESCRIPTION FORM

PROGRAM NUMBER	REVISION NUMBER	SOURCE LANGUAGE
MRC551	01	COBOL
PROGRAM NAME		SUBMITTED BY
UPDATE INCOMPLETE HISTORY FILE (MRC5514 or MRC4521)		LBNS

PROGRAM PURPOSE

Update incomplete History File MRC5514) for extraction of Material usage history data and other Material requirements.

PROGRAM DESCRIPTION

INPUT: Input includes

1. The incomplete Master Record file MRC4521 or MRC5514 in Job Order sequence (186 character record).
2. Card input, MR Transaction file, MRC5510 containing:
   a. Coar cards
   b. Job order cards

OUTPUT: Output includes

1. The incomplete History file, MRC5514, will be the same as the input record format (186 character record), in job order sequence.
2. The complete History file, MRC5511 is a 156 character record, in Job Order sequence (compressed).
3. The Job Order file, MRC5513, is in card format (80 characters) is in Job Order sequence.
4. The Reject file, MRC5512, is in card format (80 character record).

PROCESSING: Transaction file input is read and coded. COAR cards are coded with a "Ø", Job order cards are coded with a "1" in the first position of the sort key.
Card input is then sorted on the first position of the sort-key and the Job Order (positions 1-12).
COAR cards are validated on the Hull field, cc 73-80, for greater than spaces. If Hull field is valid, COAR cards are loaded into a table (100 entries maximum) to be matched against the incomplete History file.
If COAR cards are invalid they are written to the reject file and coded with an "R" in card column 11.
COAR cards update the Hull field only. A "D" in cc 12 in the COAR card will delete the entire COAR History record or records from the incomplete Master file.
Job Order cards are used to update, change or delete records on the incomplete Master file.
Job Order cards are validated for spaces in the mandatory fields.
Job Order cards must have data in the following fields (with the exception of records with a "D" in cc 12);

1.	Mandays	Cols. 31-36
2.	Number of Units	Cols. 27-29
3.	SA,OR,OP,APL	Cols. 43-57
4.	Inst, Plan, Stk	Cols. 58-72

MINIMUM HARDWARE CONFIGURATION
REQUIRED BY SLAVE PROGRAM

______	CARD PUNCH	24	K CORE MEMORY
______	CARD READER	______	LINKS DISC STORAGE
______	PRINTER	6	TAPE HANDLERS

The SA,OR,OP, or APL field or the Inst, Plan, Stk field can have data in either field, but not necessarily both fields.
If Job Order record is found to be invalid it is written to the reject file and coded with an "R" in card column 11.
Job Order cards with a "C" in cc 12 will change the Job Order field only, of the incomplete Master file records.
Job Order cards with a "D" in cc 12 will delete the entire History record or records from the incomplete Master file.
A Job Order card file is produced for each Job Order written to the incomplete master file. This card is coded with an alpha character indicating which field or fields are missing in order to be passed to the completed History file (MRC5511), cc 37-41.
Codes are as follows:

1. H = Hull field missing cc 37
2. U = Number of units field missing cc 38
3. M = Mandays field missing cc 39
4. A = APL field missing cc 40
5. P = Plan field missing cc 41

Both APL and PLAN field must be blank to be coded.
The completed History file (MRC5511) is created from the Incomplete Master file. It is a compressed file.
The transaction date is converted from Gregorian to Julian.
The completed History File is then sent to Program NR. MRC560 to update the Job Order File.
A record count is provided for all input and output files.

SPECIAL INSTRUCTIONS

NOTE: IF MRC551 IS PROCESSED MORE THAN ONCE PRIOR TO PROCESSING MRC452, MRC5514 OUTPUT FILE WILL BE USED AS INPUT, IN LIEU OF MRC4521.

EACH TIME MRC551 IS PROCESSED, THE MRC5514 OUTPUT FILE MUST BE USED IN MRQ558 TO PRODUCE AN INCOMPLETE HISTORY REPORT BY COAR.

11ND-NSYLB-5230/172 (5-74)

LONG BEACH NAVAL SHIPYARD
DATA PROCESSING OFFICE

PROGRAM DESCRIPTION FORM

PROGRAM NUMBER	REVISION NUMBER	SOURCE LANGUAGE
MRC988	Ø1	COBOL
PROGRAM NAME: PRODUCE SUMMARY EXTRACT AND DATA FILE (MR REPORT GENERATOR)		SUBMITTED BY: LBNS

PROGRAM PURPOSE

TO PROVIDE SCRATCH SHEETS FOR ORDERING MATERIAL IN ADVANCE OF A SHIPS ARRIVAL FOR REPAIR AND TO PRODUCE EXTRACT FILE TO UPDATE WANG DATA FILE.

PROGRAM DESCRIPTION

INPUT:	1.	SORTED EXTRACT FILE	MRC9851
	2.	SORTED JOB ORDER FILE	MRC5601
	3.	SORTED EXTRACT TRANS	MRC9751
OUTPUT:	1.	WANGFILE	MRC9881
	2.	RPTFILE	MRC9882

PROCESSING: SORTED EXTRACT TRANSACTION FILE IS LOADED INTO A TABLE (TABLE LIMIT IS 500 MAX).

DESIGNATOR Ø57 CONTROLS THE PROCESSING OF MRC988.

THE SORTED JOB ORDER FILE IS READ AND MATCHED BY EXTRACT TYPE TO THE EXTRACT TRANSACTIONS INPUT TABLE. WHEN A MATCH OCCURS "PART I" OF THE SCRATCH SHEET IS PRINTED WITH THE CARD IMAGE FROM THE TABLE AND THE MATCHING JOB ORDER RECORD OR RECORDS. THE COMPONENT AND MANDAY AVERAGE TOTALS ARE CALCULATED PER JOB ORDER AND PRINTED ON "PART I" OF THE SCRATCH SHEET. THESE TOTALS ARE USED IN CALCULATING THE AVERAGE QUANTITY FOR ITEMS WHICH MATCH THE CARD INPUT AND ARE EXTRACTED FROM MRC9851. ITEMS EXTRACTED FROM MRC9851 ARE PRINTED ON "PART II" OF THE SCRATCH SHEET IN "NIIN SEQ" AND IN NUMERICAL ORDER. THE WANGFILE IN CODE SEQUENCE IS CREATED FROM THE DATA EXTRACTED.

THE WANG FILE HAS 3 RECORD TYPES:

1. HEADER RECORD-(WANG-REC1) CONTAINS THE EXTRACT DATA MATCHED BY THE COMPLETED HISTORY FILE. WANG ITEM NUMBERS FOR HEADER RECORDS WILL ALWAYS SHOW ZERO (00000) WITH THE ADDITIONAL ELEMENTS, HULL NR., EXTRACT DATA TYPE ETC.
2. DATA ITEMS-(WANG-REC2) ALL ITEMS EXTRACTED FROM MRC 9851 IN "NIIN SEQ" AND IN CORRESPONDING NUMERICAL ORDER TO THE ITEMS PRINTED ON "PART II" OF THE SCRATCH SHEET.
3. TOTAL RECORD'(WANG-REC3) INCLUDES THE TOTAL NUMBER OF RECORDS EXTRACTED PER CODE, HULL NR. AND THE FILE IDENTIFICATION.

MINIMUM HARDWARE CONFIGURATION
REQUIRED BY SLAVE PROGRAM

____	CARD PUNCH	25	K CORE MEMORY
____	CARD READER	____	LINKS DISC STORAGE
X	PRINTER	5	TAPE HANDLERS

A TOTAL PAGE IS PRINTED AS THE NEXT TO LAST PAGE OF THE SCRATCH SHEETS,
A LIST OF THE CODES (231, 232, 233, 234, 235, 236, 237, 238)
AND THE NUMBER OF ITEMS EXTRACTED PER CODE.
THESE TOTALS ARE ALSO DISPLAYED ON THE EXECUTION REPORT.

A LIST OF UNMATCHED EXTRACT TRANSACTION RECORDS, MRC 9751, ARE PRINTED
ON THE LAST PAGE OF THE SCRATCH SHEETS.

ALL EXTRACT TRANSACTION RECORDS ARE PRINTED ON THE EXECUTION REPORT
AND UNMATCHED ONES ARE FLAGGED WITH AN ASTERISK.

1. The first record on the Sorted Extract Transaction file, MRC9751 is read. The file identification of the input Extract Master file is determined by the value in positions 30-31 of this first record:

POS. 30-31	Extract Label ID	Extract Name
AP	MRC5671	APL Master
ST	MRC5681	ST Master
All Others	MRC5691	OT Master

2. The MRC9751, Transaction file, is matched to the Extract Master on field "Extract-1". If positions 106-107 of the master do not equal positions 30-31 of MRC9751, the Job Stream is aborted, the message "MRC980 Extract Field DISAGREES" is displayed on Sysout, and "MRC980 JOB ABORTED" on the console.

3. Any MRC9751 records that do not have a matching record on the Master file are displayed on the sysout.

4. Each selected (matched) master record that has an FSC matching the values from 10 designators (sorted in an internal array) and that has position 2 of the NIIN not equal to "A" through "Z" is deleted. All other selected Master records are written to the Extract File, MRC9801.

APPENDIX E

FUNCTIONAL DESCRIPTION OF ARMIS

ARTEMIS SYSTEM OVERVIEW

This document describes the total information flow within the ARTEMIS REPAIRABLES MANAGEMENT SYSTEM from the receipt of a funding document (the equivalent of a purchase order) to final billing of all items on that funding document.

STEP 1 - Planning Department, Code 224, annotates funding document with schedule induction number (BSS) and the priority.

STEP 2 - Comptroller Officer, Code 620, receives a new Funding Document and enters all data that is consistent for all attached line items in the PRIME (CODS) computer system. The line items known as "COARS" (Customer Order Acceptance Record) are also entered in PRIME(CODS). All revisions or corrections to Funding Documents for COARS are made in PRIME(CODS).

STEP 3 - NITE 1 BATCH PROGRAM
This program is performed once a day, in the evening, a magnetic tape from PRIME(CODS) is passed to ARTEMIS containing three files.

CODS1 - Number of records contained in file CODS2. This is needed to create a "header" record on the file ARTEMIS passes to MIS each night.

CODS2 - MIS/COST transactions originating on the PRIME computer.

CODS3 - Entire live COAR file - as PRIME(CODS) sees it.

NITE1 does the following:
* Purges the three files from the put/get cartridge.
* Reads the current three files from the tape to the put/get cartridge (and translates them from EBCDIC to ASCII).
* Signs onto ARTEMIS with batch file CODAR (CODS TO ARTEMIS) I. D. 600, PRO CODS.
* Delets dataset COARS from library.
* Erases CODS3 (from I. D.)
* Get the new CODS3 and executes the file to bring the new "live" COARS into the dataset COARS.

STEP 4 - TAPE 1 BATCH PROGRAM
This program is performed once a day, in the evening. TAPE1 creates a file which will be passed to MIS via magnetic tape.

TAPE1 does the following:
* Signs onto I. D. 622 PRO TAPER to check that it has not already been run, by comparting the Last Run Date (LRD) to today's date, and to erase files WCD1 and WCD2.
* Signs onto I. D. 950, PRO RMS and executes file WCDER, which creates four different records which are passed to MIS, These records are: WCD Creation, WCD Rescedule, WCD Close, and WCD Open

These records are copied to file WCD2, file WCD1 contains a count of these records. Files WCD1 and WCD2 are moved to I. D. 622.

* Signs back onto I.D. 622, PRO TAPER and executes file CODCK, which looks for COARS that should get WES'S but are missing important field. File WESER is then executed, which merges CODS 1 (number of records passed to MIS from CODS), CODS 2 (records from CODS to be passed to MIS), WCD 2 (WCD transactions from Code 950), and WES records (generated by file WESER) into on file called TOPUN and sent to put/get area. LDR (Last Run Date) is now set to today.

STEP 5- TAPE 2 BATCH PROGRAM
This program is performed once a day, in the evening. TAPE 2 puts the file created by TAPE 1 onto magnetic tape. A printout is made of what is on the tape for filing in binder. The magnetic tape is sent to the MIS System.

STEP 6- This is the first step that is part of the "Job Status Tracking" module . Almost all steps in this module may be performed off-line via a series of programs written for the 2649 terminal as a stand alone processer or on line. We will deal only with the on-line methods.

Code 930 or 950 (Repairables Rework Center) selects option "A" on their Menu to create a Keyop (short for key operation). They enter the COAR number, the Keyop number they are creating, the date of induction (if no date is input, the default date is the actual date), and the number of units inducted. "Inducted" in this application means the RRC has requested a number of carcasses to be overhauled. A record is created in the dataset KOPS for each keyop.

STEP 7- The RRC's use option "B" on their Menus to report receipt of carcasses (the date carcasses are received and the number of carcasses). The record created in option "A" is reviewed and these two fields are entered. The receipt date marks the beginning of Repairable Turn Around Time (RTAT).

STEP 8- The RRC's use option "C" to report that carcasses have either been completed, surveyed, found to be wrong, etc. To accomplish this, they must enter the COAR, Keyop, transaction quantity, transaction date (this marks the end of RTAT) and the transaction flag (how did it leave? complete, scrapped, etc.).

STEP 9- This step and the next one are only performed when repair work on a carcass is interrupted due to a lack of parts (referred to as "G" condition). The user (RRC) will use option "D" to put a carcass in "G" condition). This creates a record in the "GITMS" dataset.

STEP 10- When the parts which held up the repair effort arrive, the user uses option "E" to report to the system the date the carcass returned to "M" condition.

STEP 11- option "H" on the RRC Menu will A (proof carcass transactions and B) "roll up" transactions to Keyop level. Among the checks made are A) the Keyop has been established, B) no more carcasses are being reported leaving the shop floor than were received against that Keyop, C) the transaction flag is either "A", "B", "F", "H", "J", "K", "P","W", or D) the date the carcass was reported leaving is after the date the carcass was reported received.

STEP 12- NITE2 or TUESD or FRIDY BATCH PROGRAM
This step is performed once a day, in the evening, On Tuesday the TUESD batch program is performed instead if NITE2. On Friday the FRIDY batch program is performed instead of NITE2.

NITE2 does the following:

* Enters new COARS from PRIME (CODS) in to the correct I.D. (930 or 950) JOBS dataset.
* performs all RRC roll up transactions to the COAR level and RTAT calculations in each I.D. (930 & 950).
* Replaces JOBS dataset in I.D. 900 with updated JOBS dataset from I.D. 930 and I.D. 950.
* Enters new COARS from PRIME (CODS) into I.D. 600, PRO CODS dataset COST.

TUESD does the following:

* Performs the functions listed under NITE2.
* Performs six checks and any errors found are spooled on six error reports.

FRIDY does the following:

* performs the functions listed under NITE2.
* Enters I.D. 622, PRO TAPER and prepares depot report for Code 630.21 and spools report.

STEP 13 - XOVER BATCH PROGRAM
This program is run once a week on Friday after all NITE programs have been run.

XOVER does the following:

* Enters I.D. 224, PRO RMS and executes current STBR file, which enters current stabilized rates in STDT dataset.
* Saves the following I.D.'s 100,110,224,621,622,900 on disk.
* Enters I.D. 100 PRO RMS overlays datasets STDT and SHOPS with current STDT and SHOPS datasets from I.D. 224.
* Executes file ARCOD, which copies out standards data to a file and sends file to put/get area. File TPCOD puts this data on magnetic tape. This tape is sent to the PRIME (CODS) system to update their standards database.

STEP 14 - COST PROGRAM
This program is run once a week on Monday morning.

COST does the following:

* A magnetic tape is received from MIS with current cost information. File: TOUS enters this data into put/get area.
* File COST gets data from put/get area and enters data into dataset COST in I.D. 600, PRO CODS.
* Executes file FDRPT which prints the Funding Document Report.

STEP 15 - EOMER PROGRAM
This program is run once a month.

EOMER does the following:

* Enters I.D. 930 and I.D. 950 and executes file HISTR.
* File HISTR creates historical file which contains records from JOBS dataset where COR has a charge code of Z in COARS dataset.
* These historical files are moved from respective I.D.'s to I.D. 600, which are then entered into dataset HIST.
* Enters I.D. 224 PRO RMS and executes file PCRPT then spools report.
* Enters I.D. 900 PRO RMS and prepares reports CLOS2, CLS2A, and OVREX.
* Enters I.D. 930 and I.D. 950 to execute file CL9X0.
* File CL9X0 prints report of records which will be deleted in datasets JOBS, KOPS, TRNS, and GITMS. These records are then deleted.

APPENDIX F

SAMPLE ARMIS REPORTS AND FORMS

2S CINCLA REFIT REPORT

REPORT SYMBOL: NAVSEA 4440/1

1.TO:
COMMANDER, NAVAL SEA SYSTEMS COMMAND, WASHINGTON DC
20362 ATTN: CODES 51F/52F/53F/54F/0413/62YG/62KL

2.REPORTING ACTIVITY
LONG BEACH NAVAL SHIPYARD
CODE 224/620/930/950

3.REPORT PERIOD
1-31 JANUARY 85
PREPARED 31-JAN-85

4.SIGNATURE

FUNDING DOCUMENT	NOMENCLATURE BSS NR.	NATIONAL STOCK NO.	LOCAL JOB ORDER NO.	START DATE	QUANTITY AUTH	QUANTITY SCHD	QUANTITY COMP	% COMP	COMP DATE	FUNDS AUTH		FUNDS EXPEND	REMARKS
02-PO 4A111 2023	PACKARD 2D050R3 105 NWPN232069X15200	2S 2015- 00-5001007	64DBP-32637 A		1	1	0	0		59,000	S A	31067 00000	BSR= 0 WRONG MATL= 0 SURVEY= 0 'G' COND= 0
	IN WORK IN SHOP= 1												
	COMMENTS: NO CRANK												
02-PO 4A111 2040	PACKARD 2D050R3 105 NWPN23-2132-X154	2S 2015- 00-5001007	64DBY-32837 A		2	2	1	50		110,000	S A	114090 98080	BSR= 0 WRONG MATL= 0 SURVEY= 0 'G' COND= 0
	IN WORK IN SHOP= 1												
	COMMENTS: COMPLETED S/N 20B-R3 6/3/84												
03-PO 4A111 2002	PROP SHAFT MS0421 NWPN23-2355-X153	2S 2010- 00-0235052	64FCJ-32637 A	030512	1	1	0	0		44,200	S A	35515 21534	BSR= 0 WRONG MATL= 0 SURVEY= 0 'G' COND= 0
	IN WORK IN SHOP= 1												
	COMMENTS:												
03-PO 4A111 2001	MS0421CL PROP SHAFT NWPN23-2355-X150	2S 2010- 00-0085075	64FCK-32637 A		1	1	0	0	850121	44,200	S A	6100 3415	BSR= 1 WRONG MATL= 0 SURVEY= 1 'G' COND= 0
	IN WORK IN SHOP= 0												
	COMMENTS:												
03-PO 4A111 2002	PROP SHAFT MS0421 NWPN23-3215-X151	2S 2010- 00-0235052	64FCZ-32637 A	040210	1	1	1	100	850130	44,200	S A	41601 25651	BSR= 0 WRONG MATL= 0 SURVEY= 0 'G' COND= 0
	IN WORK IN SHOP= 0												
	COMMENTS:												
03-PO 4A211 2011	PACKARD 1D1700 MAIN NWPN23-3130-X150	2S 2015- 00-5001299	64DDT-32637 A	030622	1	1	0	0		107,053	S A	51660 72619	BSR= 0 WRONG MATL= 0 SURVEY= 0 'G' COND= 0
	IN WORK IN SHOP= 1												
	COMMENTS: NO CRANK												

COAR LISTING - ALL COARS ON N00024-85-WR03318 COG IS 2F
RUN ON 20-MAY-85 EXPIRED 30-SEP-85

SORTED IN YR FD COAR SEQUENCE

C H R	COAR	ITEM NO. ITM	C C	NIIN NIN	UNIT AUTH URQ	UNITS COMP	AUTH. FUNDS CFA	LABOR EXP	MATL EXP	ACTUAL EXP	STAB EXP	MAN HRS ALLOW	MAN HRS EXP
A	67WND	3001	01	0255831	1	0	11,000	8,051	429	8,480	13,060	244	234
A	67WNE	3002	00	3462139	1	0	6,500	1,858	2,668	4,526	3,432	113	62
C	67XJG	3003	00	4611506	1	1	1,500	840	32	873	1,249	20	22
A	67XJH	3004	01	0640194	1	1	500	606	17	622	908	9	16
C	67XJJ	3005	01	0640194	1	1	500	270	430	700	414	9	7

####################TOTALS FOR N00024-85-WR03318 ####################

TOTAL FUNDS AUTHORIZED	20,000
TOTAL FUNDS COMMITTED	20,000
TOTAL FUNDS EXPENDED (ACTUAL)	15,201
TOTAL FUNDS EXPENDED (STABALIZED)	19,064
TOTAL FUNDS REPROGRAMABLE	0

ACTUAL NUMBER OF LINE ITEMS ON FUNDING DOCUMENT 5

##

CODE 966 REPAIRABLES CLEARANCE/INDUCTION SHEET
**** *** *********** ****************** *****

MANHOURS= 32 ORIGNATOR=FREY

START= 9-16-85 PHONE= 6289

COMPL= 10-18-85 PREPARED=18-JUL-85

INDUCTION DATE	FUNDING DOCUMENT		INDUSTRIAL CONTROL NO.	KOP
9 Sep 85	85	P003149	67KWH77H66	420

COG	FSC	CC	NIN	INDUCTION QTY	LEAD SHOP	DOCUMENT NUMBER
7H	5840	00	5739940	4	6611	NWPN35-5181-9883

5291

FOREMAN
****
PEARSON

MFR.
****
21877

PART NUMBER
**** ******
1882757

NOMENCLATURE
****
SPS-40B AMP 5A11

INVPRICE
****
2900.00

REPAIRABLE LOG SHEET
N00104 85 P003144 7G
EXP : 31-JUL-86

REPORT: LOCRP

FISCAL YEAR/QUARTER

ITEM	NOMENCLATURE NSN DSG NO.	AUTH QTY	TOTAL REPAIR COST	JOB ORDER	MH EST.	DOLLAR EST.	JOB ORDER ISSUE QTY	MH	DATE	KEY OP QTY	DATE	DATE SCHED COMP	620 CLOSE
3001	ASTRONOMIC RECORDER 6625 00 0182184 NWPN35-5181-9449	1	1733	66DXL77G66	39	1733	1	38	7/5/5	1	8/7/5	9/20/5	
3002	SRC-16 SWITCH CONTROL 5820 00 0868974 NWPN35-5181-9450	2	830	66EAH77G66	16	830	2	14	7/5/5	2	8/20	9/20/5	
3003	OSCILLATOR 6625 00 0896697 NWPN35-5181-9451	1	978	66DXH77G66	22	978	1	21	7/5/5				
3004	AC/DC METER CALIB 6625 00 1072098 NWPN35-5181-9452	1	1955	66DXH77G66	44	1955	1	4.3	7/5/5	1	7/30/5	10/25/5	

REPAIRABLES HISTORY FOR 7H 6685 00 0014179
CONTROL, FUEL RATIO
GEN REGULATOR MODEL 1803

COAR	COG	UCP	EST	AVE MHE	AUTH FUND	STAB EXPD	ACT EXPD	BSR QTY	RT1	RT2	TAT	RTAT	G COND	NBR KOP	DATE COMPLETED	ENTERED HISTORY
70MJV	7H	1	27	50.0	961.00	1759.23	1307.00	0	1.0	0.0	3.0	3.0	0.0	1	8-SEP-80	7-DEC-81
62CAA	7H	8	27	25.6	7584.00	7195.76	7622.00	0	0.0	0.0	127.0	127.0	0.0	1	3-MAR-81	7-DEC-81
62CBJ	2H	3	27	45.3	4740.00	4766.80	4465.77	2	3.5	0.0	45.0	45.0	0.0	2	10-APR-81	1-DEC-81
62CCP	7H	6	27	26.0	5577.00	5577.01	4638.25	0	8.5	2.5	41.5	41.5	0.0	2	19-OCT-81	30-JAN-82
64NAA	7H	1	27	24.0	1102.00	942.01	537.75	9	6.0	0.0	105.0	105.0	0.0	1	17-APR-82	3-SEP-82
64NBJ	7H	6	27	25.4	6612.00	5985.63	6172.65	1	4.0	0.0	70.0	70.0	0.0	2	27-JUL-82	3-JUN-83
64NCJ	7H	0	27	0.0	0.00	0.01	0.15	4	10.0	0.0	0.0	0.0	0.0	1	29-JUL-82	3-JUN-83
64NFT	7H	0	27	0.0	0.00	0.01	0.15	6	0.0	0.0	0.0	0.0	0.0	1	22-APR-83	8-DEC-83
64NDL	7H	3	27	29.0	3306.00	3692.29	3112.15	1	7.0	0.0	189.0	189.0	0.0	1	22-AUG-83	8-DEC-83
64NEW	7H	1	27	26.0	1192.00	1130.49	885.95	5	4.0	69.0	313.0	313.0	0.0	1	18-JAN-84	2-MAY-85
64NLK	7H	0	0	0.0	0.00	0.01	0.15	5	0.0	0.0	0.0	0.0	0.0	0	1-OCT-84	7-FEB-85
64NKH	7H	0	27	0.0	0.00	0.01	0.15	3	0.0	0.0	0.0	0.0	0.0	1	17-OCT-84	4-APR-85
64NHG	7H	5	27	24.6	5960.00	5583.48	7093.95	0	12.0	4.0	177.4	177.4	0.0	2	12-DEC-84	4-APR-85

HISTORY SUMMARY
34.0 UNITS COMPLETED IN 13.0 JOBS
AVERAGE RTAT IS 108.7 DAYS. AVERAGE TAT IS 108.7 DAYS
AVERAGE TIME TO INDUCT IS 6.5 DAYS; TIME TO START WORK IS 6.3 DAYS
ESTIMATE IS 27 MANHOURS. AVERAGE MANHRS PER COMPLETION IS 28.2 MANHOURS
GAIN/LOSS PER UNIT COMPLETION HAS BEEN $ 11.80
AVERAGE GAIN/LOSS PER JOB HAS BEEN $ 30.87

APPENDIX G

ARMIS HARDWARE AND TRAINING COST ESTIMATES

METIER

August 23, 1985

Lt. Cmdr. Bob Rodwell
7 Mervine Street
Monterrey, California 93940

Dear Mr. Rodwell:

Per our recent conversation, I have developed the attached "Minimum Configuration" to meet the needs of a Repairables Program. This configuration would in my estimation allow a D.O.P. such as Long Beach to adequately meet the throughput and data storage requirements for the first one to two years. The minimum configuration could easily be upgraded both in throughput and storage as these requirements grow over time.

There are, of course, other items that you should consider if you were to implement this system at all Designated Overhaul Points. A "custom" class, designed to specifically meet the needs of the Repairables users, could be developed. This would greatly expedite implementation time at each site. Also, you may want to budget some consulting to optimize all the new features that have been built into the ARTEMIS application since the Long Beach system was implemented four years ago. I would suggest setting aside at least $40,000 for this. (This is not absolutely necessary but would definitely be worthwhile.)

Note that the prices shown on the Minimum System Budgetary Estimate are current commercial prices; I'm sure the Navy would be able to negotiate some discount if they were to buy several of them. You should also include annual System Support costs in your Cost/Benefit study. A very rough rule-of-thumb is to take 1% of the list purchase price per month. (One year of System Support is included with the initial purchase).

Please do not hesitate to contact me should you have any questions or concerns.

Sincerely,

Bob Lambert

Robert M. Lambert
Account Manager

RML:ls
encl.

METIER MANAGEMENT SYSTEMS, INC.
17780 FITCH AVENUE, SUITE 140
IRVINE, CALIFORNIA 92714
(714) 660-7100

METIER

REPAIRABLES MANAGEMENT PROGRAM

BUDGETARY ESTIMATE - MINIMUM CONFIGURATION

Model Number	Qty.	Description	List Price
6401	1	ARTEMIS System, including: • 6401 Processor • Scheduling and Relational DBMS Software • 65 MByte Disc Drive • Basic Terminal • Basic Printer	$230,000
(4502)	(1)	DELETE Scheduling DBMS	(30,000)
3233	1	800/1600 BPI Tape Drive	18,000
3425	1	300 LPM Printer/Plotter	7,500
3401	3	Basic Terminal	4,725
			$230,225

LIST OF REFERENCES

1. Naval Audit Service Western Region, Repairables Management Audit Report C13549, 15 Apr 1985.

2. Naval Audit Service Western Region, Repairables Program Audit Report C13759, 29 Jan 1985.

3. Chief of Naval Material Instruction 4440.14B, Navy Repairable Management Manual, 17 Feb 1982.

4. Miss Amie Burrison, NAVSUP Code 063, interview 23 Sep 1985.

5. Naval Supply System Command Publication 553, Inventory Management, A Guide to Requirements Determination in the Navy., Sep 1984

6. Mr. Mike Beliveau, SPCC Code 0503E, interview 23 Sep 1985.

7. Mr. Ray MacDaniels, NSY Charleston Code 212, interview 26-27 Sep 1985.

8. Mrs. Cathy Schieber, NSY Mare Island Code 215, interview 9 Aug 1985.

9. Mr. Jan Sipe, SPCC Code 035, interview 23 Sep 1985

10. Mr. Eddie Belcher, NSY Norfolk Code 214, interview 25 Sep 1985.

11. Naval Sea Systems Command, Naval Electronic Systems Command, Repairables Rework Study, Phase 1 Report, Description of Repairables Workload and Repair Facilities, June 1976.

12. Mr. Leroy Brinson, NSY Norfolk Code 966, interview 25 Sep 1985.

13. Mr. Ed Fry, NSY Long Beach Code 950.1 RRC, interview 23 Aug 1985.

14. Mr. Steve Myers, NSY Norfolk Code 214, interview 25 Sep 1985.

15. CDR. Mike Jenkins U.S.N., SPCC Code 0503, interview 23 Sep 1985

16. Mr. Russ Mayes, FMSO, telephone interview 23 Sep 1985.

17. Mr. Art Green, NSY Long Beach Code 224, interview 23 Aug 1985.

18. Mrs Trudy Gasque, NSY Charleston Code 521, interview 27 Sep 1985.

19. Mr. Bob Sabol, NSY Long Beach Code 224, telephone interview, 14 Nov 1985.

20. CAPT. H. Rice, U.S.N., NSY Long Beach Code 500, interview 22 Aug 1985.

21. Mr. Vic Gray, NSY Long Beach Code 966, interview 23 Aug 1985.

22. Mr. Carlos Crespo, SPCC Code 035, interview 23 Sep 1985.

23. Mrs. M. Ramierez, NSC Annex Long Beach, telephone interview, 14 Nov 1985.

24. Mrs. C. Mahn, NSC Annex Mare Island, telephone interview, 14 Nov 1985.

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