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A CONTINUATION OF THE GUN WEAPON SYSTEM REPLACEMENT PROGRAM COORDINATION EFFORT STUDY

October 1978

Prepared for
DIRECTOR, GUN SYSTEM ENGINEERING DIVISION
NAVAL ORDNANCE STATION
INDIAN HEAD, MARYLAND
under Contract N00174-78-C-0105

ARINC RESEARCH CORPORATION

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Director, Gun System Engineering Division
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under Contract (15) N00174-78-C-0105

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The Gun Weapon System Replacement Program has initiated actions to coordinate various aspects of gun weapon system support with the Destroyer Engineered Operating Cycle Program. This study presents the results of analyses conducted on gun weapon systens inspections gun weapon systems.

ABSTRACT

The Gun Weapon System Replacement Program (GWSRP) has initiated actions to coordinate various aspects of gun weapon system support with the Destroyer Engineered Operating Cycle (DDEOC) Program. This study presents the results of analyses conducted on gun weapon systems inspections, gun weapon systems bid specifications, and overall coordination of the GWSRP and the DDEOC Program. All analyses were limited to items of significance to the DDEOC Program. The conclusions and recommendations presented are designed to provide the individual program managers with guidelines to coordinate efforts of their respective maintenance management activities and to improve their current procedures.

SUMMARY

This report presents the results of the second study ARINC Research has performed for the ongoing coordination effort between the Gun Weapon System Replacement Program (GWSRP) and the Destroyer Engineered Operating Cycle (DDEOC) Program under Contract N00174-78-C-0105 for the Gun Systems Engineering Division, Naval Ordnance Station, Indian Head, Maryland. This study addresses three specific tasks: (1) analysis of the inspections currently conducted on the gun weapon systems (2) analysis of the overhaul bid specifications written for gun weapon systems, and (3) continued support to the overall coordination of the two programs.

The systems analyzed are currently managed by the GWSRP and found on DDEOC Program Class ships. The initial step of the analysis was to collect and evaluate documents. At the same time, we identified opportunities to better integrate existing procedures. Discussions were held with appropriate technical activities to gain further information and insight into the analyzed documentation and to discuss the preliminary findings. Tentative integration actions and procedural improvements were developed, analyzed, and again presented to the principal activities for their suggestions. Their suggestions were used to formulate this report's conclusions and recommendations.

This analysis resulted in several conclusions and recommendations. The recommendations are for actions which if implemented should provide joint program coordination to enhance the overall support of gun weapon systems within the framework of the DDEOC Program.

CONCLUSIONS

From the analyses performed, the following principal conclusions were drawn:

- Gun Weapon System Inspections
  - The major gun weapon system inspections conducted before depot level overhaul are the Material Condition Review within the GWSRP and Pre-Overhaul Test and Inspection within the DDEOC Program. The two inspections often duplicate efforts involving inspection scheduling, procedures, and personnel.

- The NAVSEACENs are currently involved with all major inspections of gun weapon systems. The NAVSEACENs personnel are most familiar with the detailed requirements of those inspections and in addition have technical expertise for inspecting these systems achieved by few activities other than the designated ISEAs.

- Gun Weapon System Bid Specifications

  - The guidance presently provided for preparation of gun weapon system bid specifications is adequate. Coordination of GWSRP review of existing Standard Items (SIs) and Standard Work Items (SWIs) with appropriate SUPSHIP planners is considered essential to the improvement of gun weapon system bid specifications.

  - Technical Repair Standards (TRSs) written and validated for gun weapon system component replacement become essential inputs for bid specification preparation. TRSs written by competent ordnance experts can be used to develop SWIs to be retained by the planning SUPSHIP for classes having the designated equipment.

    Preventive maintenance required to maintain the gun weapon system for the duration of the overhaul needs to be specified in the SI or SWI. This interim Preventive Maintenance System (PMS) package can be designated as either a Ship's Force or shipyard responsibility. When it is a shipyard responsibility, the bid specification must include the specific requirements.

- GWSRP/DDEOC Continuing Coordination Effort

  - NAVSEAINST 8300.2A needs revision to include the integration actions needed for the coordination of the GWSRP with the DDEOC Program.

  - The Total Ship Test Plan (TSTP) and Test and Certification (T&C) Program can provide provide both established testing procedures and valuable information for the GWSRP and DDEOC Programs.

  - Continuing engineering and management efforts to support the integration of special areas of interest between the GWSRP with the DDEOC Program appear to be worthwhile.

RECOMMENDATIONS

The recommendations resulting from the above conclusions are summarized in the following:

- Gun Weapon System Inspections

  - The GWSRP and DDEOC Program managers should jointly task and fund the development of standardized inspection procedures to be included in POT&I Plans for designated gun weapon systems.

  - Standardized GWS inspection procedures incorporated in the POT&I Plans should be conducted by the NAVSEACENs or combat systems departments of the Naval shipyards.

- Gun Weapon System Bid Specifications
  - The gun weapon system SI and SWI should be reviewed by designated technical experts within the GWSRP.
  - Technical Repair Standards being developed on various gun weapon system rotable pool items should be used as inputs for SWI.
  - Preventive maintenance packages should be included in gun weapon system bid specifications. Designated interim PMS should be developed and applied by the SUPSHIP Planner on the basis of inputs received from the GWSRP.
- GWSRP/DDEOC Continuing Coordination Effort
  - NAVSEAINST 8300.2A should be updated to include integration actions for the coordination of the GWSRP and the DDEOC Program.
  - The requirements for the interfaces among TSTP, the T&C Program, and the GWSRP should be determined; they will be subsequently coordinated with the DDEOC Program.
  - Coordination between the GWSRP and the DDEOC Programs should be continued.

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CHAPTER ONE

INTRODUCTION

1.1 GWSRP AND DDEOC HISTORICAL BACKGROUND

The Gun Weapon System Replacement Program (GWSRP) was originated in 1964 by the Bureau of Naval Weapons as the Ordnance Replacement Program. The mission of the program was to provide a source of replacement for guns, fire control, and related equipment, most of which had been installed in the mid to late 1940s and had reached a state of disrepair through extended service. Under the program, available gun mounts, computers, radars, and related equipment were overhauled in a depot assembly line operation and used to replace badly worn guns and related systems installed in the Fleet. Removed items were placed in a repair pipeline to keep the replacement cycle going.

Intensified use of gun mounts in the Southeast Asia conflict and a drastic reduction in rotable pool assets have contributed to increased maintenance requirements of the gun weapon systems and highlighted the need for an efficient GWSRP. To keep abreast of the increasing volume and complexity of maintenance in an era of tightening defense budgets, the GWSRP planning process requires coordination with other maintenance management programs. A principal requirement is to coordinate and integrate the activities of this established maintenance program with similar activities of the Destroyer Engineered Operating Cycle (DDEOC) Program.

The DDEOC Program was undertaken in August 1974 to develop a detailed maintenance strategy and implementation plan to support a 54 ± 6 months operating cycle for the FF-1052, DDG-37, and CG-16/26 classes of ships. As this and other maintenance-related programs concurrently evolved, CNO Project Red "E", now the Ship Support Improvement Project (SSIP), was created in January 1975 to draw together, coordinate, and integrate all maintenance-related programs for surface ships.

Part of the SSIP effort is to explore and exploit the substantial benefits from the use of established products, procedures, and organizations, common to EOC programs. Just as benefits are available from the similarities between EOC programs, benefits are also available from the similiarities of separate but interrelated maintenance programs. Several programs have been established in the past to solve particular maintenance

problems, improve material condition, or increase operational availability. The GWSRP is an established maintenance program working in parallel with and providing input to the DDEOC Program. The similarities and common goals of GWSRP and DDEOC need to be coordinated to minimize duplication of requirements and procedures and to maximize the effectiveness of the use of resources by both programs.

1.2 REPORT BACKGROUND

This report is the first analysis resulting from the initial study conducted under Contract N00174-78-C-0105. The initial study identified areas of common interest between the GWSRP and the DDEOC Program and made recommendations for integrating these interests. Two areas treated in the report of this study -- gun weapon system inspections and overhaul bid specifications -- were considered to be of highest priority, warranting immediate analysis.

The earlier effort performed was reported in ARINC Research Corporation Publication 1655-01-1-1779, dated June 1978. That effort was directed toward developing recommendations that would provide coordination to certain aspects of the Gun Weapon System Replacement Program and the Destroyer Engineered Operating Cycle Program. As a result of that study seven areas were identified as prime candidates for analyses in which further coordination of the GWSRP and DDEOC Programs would likely enhance the maintenance support of gun weapon systems. These areas were:

- Inspection procedures
- Bid specifications written for overhauls
- Baseline overhaul (BOH) requirements
- Management Information Systems data exchange
- Material Condition Assessment Procedures Conducted by DDEOC site teams
- Class Maintenance Plan requirements
- Program scheduling requirements

1.3 STUDY OBJECTIVE

The primary objective of this study is to define procedures by which two of the identified specific areas of interest to the GWSRP and DDEOC Program, gun weapon system inspections and gun weapon systems overhaul bid specifications, can be better integrated.. Included in this objective is the provision of support for improving overhaul coordination between the two programs. This study addresses the following tasks: (1) identification of the process by which gun weapon systems specification procedures can be improved and better integrated with the DDEOC Program, (2) identification of the process to improve current procedures by which bid specifications for GWSRP systems depot level maintenance are written and (3)

identification of existing and potential areas of interest between the GWSRP and the DDEOC Program implementation and making recommendations for integrating these interests.

1.4 STUDY APPROACH

The approach to Tasks One and Two of this study consisted of the following steps:

- Collect Information. The first step was to collect information concerning the specific procedures followed for gun weapon system inspection and development of gun weapon system bid specifications. The information consisted mostly of documents in the form of existing procedures, instructions, reports, inspection results, etc. We acquired data in three ways: (1) We requested known data from known sources; (2) we were provided additional data as a result of our interviews; and (3) we extracted data from internal ARINC Research files.
- Analyze Information. The second step was to analyze the available information. The analysis was directed toward determining (1) the gun weapon systems common to both programs, (2) the current procedures implemented in the two areas of specific interest, and (3) the similarities and differences between the currently implemented procedures. Upon completion of this step, opportunities for potential improvements and integration with existing procedures were identified.
- Conduct Interviews. The third step was to interview the responsible principals in the GWSRP and the DDEOC Program. The interviews were conducted for two purposes: (1) to gain further information and insight into the documentation and the interest areas in general and (2) to discuss the preliminary findings.
- Develop Tentative Integration Improvements. The fourth step was to develop tentative integration actions and procedural improvements for the two specific interest areas. To complete this step, we approached the principal activities a second time to present these improvements for their comments before developing final conclusions and recommendations.
- Develop Conclusions and Recommendations. The final step was to develop the conclusions and recommendations that resulted from the preceding analyses.

Task Three, conducting support for the overall coordination of the two programs, was a continuing effort accomplished concurrently with the analysis described above. The approach followed for this effort was to obtain additional information concerning aspects of both the GWSRP and the DDEOC programs in the course of conducting the Task One and Two analyses. In developing that approach we analyzed newly acquired information to identify future coordination actions. Additional information acquired which amplified or altered previous conclusions was documented. The final phase of this task was the presentation of updated Gun Weapon System Replacement Program Coordination Study conclusions and recommendations.

1.5 REPORT ORGANIZATION

Chapter Two of this report describes the results of the analysis of the gun weapon system inspections. Chapter Three gives the results of the analysis of bid specifications. Those two chapters have each been structured to be complete in themselves so that they could, if desired, be distributed as separate reports. Chapter Four documents the findings of the continuing coordination effort for the GWSRP and the DDEOC Program. Appendixes A through G present data supporting the analyses in Chapters Two and Three. Appendix H is a glossary of terms.

CHAPTER TWO

GUN WEAPON SYSTEM INSPECTIONS

2.1 INTRODUCTION

The gun weapon systems managed by the GWSRP within the guidance of Naval Sea Systems Command currently undergo several different inspections. These inspections have been established as responsibilities of various Naval commands with differing purposes. Initially this study was directed toward identifying interfaces between the Material Condition Review (MCR), conducted as part of the GWSRP, and the Pre-Overhaul Test and Inspection (POT&I), conducted as part of the DDEOC Program. Further investigation indicated that both the Combat System Readiness Review (CSRR) and the Combat Systems Readiness Test (CSRT) were of considerable merit and importance. Inclusion of some of their inspection procedures as part of the gun weapon systems inspection concept was warranted. The Shipboard Condition Overhaul/ Repair Evaluation (SCORE) and Board of Inspection and Survey (INSURV) inspection procedures and contents were also analyzed to determine their potential contributions to improving gun weapon systems maintenance support. Table 2-1 illustrates the gun weapon system inspections analyzed and presents some information concerning each.

Table 2-1. GUN WEAPON SYSTEM INSPECTIONS

Type of Visit	Convening Authority	Inspecting Agent	Purpose of Inspection	Duration of Visit	Type of Report
POT&I	PERA	SEACEN/Contractor	Overhaul Preparation	2 Weeks	OPNAV Form 4790/2K for each Item
CSRR	SURFLANT	SEACENLANT	Deployment Preparation	2 Weeks	Letter Summary
CSRT	SURFPAC	SEACENPAC	Deployment Preparation	3 Days	Letter Report
MCR	NAVSEA	SEACEN	Replacement Identification	3-5 Days	Manual with Summary Sheets
SCORE	TYCOM	Not Used	Overhaul Preparation	Not Available	Manual with Summary Sheets
INSURV	OPNAV	INSURV Board	Spot Check of Material/Operation Condition	3 Days	Letter Report

For purposes of this analysis it is important to identify the gun weapon systems that are the subject of this investigation because of their mutual management under the GWSRP and the DDEOC Program. The GWSRP is concerned with the management of the following gun weapon systems:

Gun Systems:	3"/50 Mk 33
	5"/54 Mk 42/Mk 45
	5"/38 Mk 30/Mk 38
Target Designation Systems:	Mk 5
Fire Control Systems:	Mk 56
	Mk 68
	Mk 86
	Mk 92

Of those systems, the following are also found on the DDEOC Program classes of ships and are the subject of this analysis:

Gun Systems:	5"/54 Mk 42 - principally Mods 9 and 10
Fire Control Systems:	Mk 68 - principally Mods 11, 12, and 13

Although some of the CG-16/26 classes still have 3"/50 guns aboard, they are to be removed during each ship's next major overhaul and replaced with either HARPOON or Close-In Weapon System (CIWS). Because they are due to be removed, the 3"/50 guns' inspection procedures were not specifically analyzed.

The Target Destination System (TDS) Mk 5 is specifically mentioned in the GWSRP and has an MCR booklet. Because the majority of DDEOC Program Class ships have a TDS Mk 1, for which no booklet has been prepared, we chose not to investigate the TDS in detail.

2.2 OBJECTIVE

The objective of this analysis of gun weapon system inspections is to identify the process by which these inspection procedures can be improved and better integrated with the DDEOC Program.

2.3 GUN WEAPON SYSTEM INSPECTIONS ANALYSIS APPROACH

Our analysis of gun weapon system inspections consisted of the following steps:

- Collect Information. The first step was to collect information concerning the specific procedures followed for gun weapon system inspections.

- Analyze Information. The second step was to analyze the available information. The analysis was directed toward determining (1) the gun weapon systems common to both programs, (2) the current procedures implemented for gun weapon system inspections, and (3) the similarities and differences between the currently implemented procedures. On completion of this step, opportunities for potential improvement and integration with existing procedures were identified.
- Conduct Interviews. The third step was to interview the responsible principals within the GWSRP and the DDEOC Program. The interviews were conducted for two purposes: (1) to gain further information and insight into the documentation and (2) to discuss the preliminary findings.
- Develop Tentative Integration Improvements. The fourth step was to develop tentative integration actions and procedural improvements on the gun weapon system inspection areas.
- Develop Conclusions and Recommendations. The final step was to develop the conclusions and recommendations that resulted from the preceding analyses.

2.4 COLLECTION OF INFORMATION

The initial step of this analysis was to collect information upon which decisions and appropriate recommendations could be made. We acquired both information and data from various sources; reports of inspection results, instructions, articles, manuals, personnel interviews, etc. The information was in three broad categories: (1) documented procedures, (2) procedures actually being implemented, and (3) recommended procedural improvements.

The study of the documents laid the foundation for understanding the magnitude of the similarities and differences between gun weapon systems inspections and ultimately determining whether existing procedures could be improved to the benefit of both programs. We acquired this information in three ways: (1) we requested known information from known sources; (2) we were provided additional information as a result of our interviews; and (3) we extracted it from internal ARINC Research information sources. The following references were used in formulating the conclusions and recommendations for this specific interest area:

1. NAVSEA Instruction 8300.2A of 24 March 1977, Gun Weapon System Replacement Program.
2. Attachment to NAVSEA Instruction 8300.2A (Advance Copy), Material Condition Review Program.
3. GWSRP Guidance Manual (Draft) dated January 1978.
4. Naval Ordnance Station Louisville Booklet for Depot Level Overhaul, Ordnance Systems -- Equipments to be Removed.
5. DDEOC Program Management Plan of November 1977.
6. PERA (CRUDES), Surface Ship Pre-Overhaul Planning Guide.

7. DDG-37 Class SARP Planning Document.

8. OPNAV Notice 4710 of 3 February 1978, Pacific and Atlantic Fleet Overhaul Schedules for Fiscal Years 1977-1983.

9. DDEOC Systems Maintenance Analyses for Appropriate GWSRP Systems and Ship Classes (Mk 42 Gun Mounts, Mk 68 Gun Fire Control Systems).

10. Reliability, Maintainability, and Availability Assessment, Mk 42 Mod 10 Gun Mount of 1 December 1977.

11. FF-1052 Class Post Repair Test and Calibration Plan, Combat System and Gun System Volumes.

12. GFCS Mk 68 SCORE Manual, NAVSEA OD 48182 of 1 October 1974.

13. 5"/54 Gun Mount Mk 42 Mod 9 Material Inspection, NAVSEA Form of 1 November 1974.

14. COMNAVSURFLANT INST 9093.1A of 11 April 1978, CSRR Plan

15. Gun Weapon Systems Repair Inspection Requirements from DDEOC Class POT&I Plans.

16. SARP Entries for USS PHARRIS (FF-1094).

17. DDEOC Class Maintenance Index Pages (MIPs) and Maintenance Requirements Cards (MRC) from Navy 3-M Planned Maintenance Subsystems for DDEOC Classes.

18. CSRR Plan for USS SIMS FF-1059 of 4 May 1978.

19. GWSRP MCR Forms of 1 October 1977 Gun Mount Mk 42 Mods 9/10, GFCS Mk 68 Mods 1-15.

The key activities within the GWSRP, DDEOC Program, and interfacing organizations responsible for planning and implementing gun weapon system inspections were interviewed. Table 2-2 lists the major interviews with a brief summary of the purpose of each. The contract period of performance limited the number of on-site interviews and required many to be conducted by telephone. Several of the primary management authorities at NOS Indian Head, NAVSEA-0432, and NAVSEA-934 were contacted regularly in addition to what is reflected in Table 2-2.

2.5 GUN WEAPON SYSTEMS INSPECTION DESCRIPTION

As stated in this chapter's introduction, various gun weapon system inspections were analyzed, the primary of these being the Material Condition Review and the Pre-Overhaul Test and Inspection. Primary importance was assigned to these inspections because their results essentially dictate the requirements for the regular overhauls (ROHs) and the baseline overhauls. When coordinating the gun weapon system inspections with the DDEOC Program, it is important to use the major planned maintenance activities -- 19th month SRA, 39th month SRA, and 54th-60th month ROH -- as fixed DDEOC Program scheduled maintenance activities which require repair inputs. Necessary gun weapon system repairs should be coordinated throughout the entire engineered

Table 2-2. INTERVIEWS CONDUCTED IN SUPPORT OF GWS INSPECTIONS ANALYSIS

Activity	Purpose
NOS Indian Head	Report preliminary findings and discuss desired format of recommendations and conclusions.
NAVSEA 0432	Discuss management and funding of rotable pools.
NOS Louisville	Discuss MCR format and objectives plus wide ranging issues concerning gun system overhaul procedures.
PERA (CD)	Investigate PERA requirements for POT&I reports and bid specifications.
NAVSEACENLANT	Establish technical differences between inspections conducted by SEACENs, including POT&I, MCR, and CSRR.
SURFLANT (Armament)	Determine operational effect and funding constraints of gun system inspections and overhauls.
SURFLANT FF Type Desk	Determine results of BOH on gun weapon systems of the FF-1052 Class.
SUPSHIPS Norfolk	Investigate procedures for bid specification preparation.
Bird Engineering	Discuss RMA aspects of gun system System Maintenance Analyses (SMAs) with G. Absher, an expert in the field. Conference with DDEOC SMA Engineer and Bird Engineering Analyst recommended by NAVSEA Gun Directorate.
PERA (CD), SURFPAC, NAVSEACENLANT/PAC, SURFLANT	Discuss final conclusions and recommendations.

operating cycle (EOC); the ROH is not the only period within the EOC when major repairs can be performed. These SRAs are planned to begin in the 20th and 39th month of the EOC, last for a duration of 6-8 weeks, and require depot level facilities; they appear in the OPNAV notice for Pacific and Atlantic Fleet overhaul schedules. SRAs are an important component of the DDEOC Program concept; therefore, the GWSRP should ensure required maintenance actions are planned and scheduled during these availabilities.

To prevent the creation of another inspection before the SRAs, it is essential that those inspections currently being held provide the requisite inputs to the SRAs. For this and other reasons, it was essential that the other inspections of the gun weapon systems also receive some degree of analysis in addition to that planned for the Material Condition Review and POT&I.

The inspections analyzed were:

- Material Condition Review
- Pre-Overhaul Test and Inspection
- Combat System Readiness Review/Test
- Shipboard Condition Overhaul/Repair Evaluation
- Board of Inspection and Survey

The major characteristics of those inspections will be addressed in the following paragraphs.

Material Condition Review. The MCR is coordinated by the GWSRP managers within the Naval Sea System Command. Its purpose is to ascertain the actual material condition of ordnance equipment in order to identify equipment to be replaced or extend the life of equipment where possible by unit or sub-unit replacement. The MCR is conducted by the NAVSEACENs. They use a comprehensive checkoff booklet for the system being inspected. A system inspection consists of a series of procedures for major components of each system. Procedures are subdivided into the elements of the components to be checked and the type of checks to be conducted. An MCR is required when (1) a ship is scheduled for a Regular Overhaul or Baseline Overhaul, (2) the ship has equipments that have never been reviewed, or (3) the previous MCR is over three years old. The results of this inspection are summarized on two MCR summary report sheets contained in each inspection manual. The ship is informed of all noted discrepancies before the team's departure and the ship's weapon officer is advised that all discrepancies noted on Summary Sheet #2 should be reported within the 3-M system, using the OPNAV 4790/2K forms.

Pre-Overhaul Test and Inspection. The POT&I is designed to help commanding officers prepare for overhaul. The POT&I provides a means of identifying and documenting deficiencies in ship's systems or equipments. It is designed to take advantage of and enhance the results of existing programs such as the Planned Maintenance Subsystem (PMS), Current Ship's Maintenance Project (CSMP), Ship Equipment Configuration Accounting System (SECAS), Coordinated Shipboard Allowance List (COSAL), Fleet Modernization Program (FMP), and others that assist in defining the Ship Alteration and Repair Package (SARP). Since the work items listed in the SARP, if satisfactorily completed, should ensure safe and reliable operation of the ship during the post-overhaul operating cycle, the necessity and importance of a thorough, vigorously executed POT&I is obvious. Planning and Engineering for Repairs and Alterations, Cruisers and Destroyers, Philadelphia Naval Shipyard [PERA (CD)] is responsible for the development of an approved plan for Pre-Overhaul Test and Inspection and the tasking of Planning Agents to implement the plan on DDEOC Program class ships. The POT&I plans divide the ship into systems for which Repair Inspection Requirements (RIR) are prepared. THe RIR documents all necessary test/inspection, maintenance,

and material historical data to provide a basis for making recommendations concerning:

- The necessity for overhaul of the system, equipment, or component
- The classification (in accordance with the NAVSEA Inst. 4790.1) of repairs and overhauls required to permit satisfactory performance throughout the operating cycle following the scheduled overhaul

For the gun weapon systems found on DDEOC Program class ships, the RIRs contain both visual and operational checks. The operational checks make up the greater portion of the tests and are taken from PMS Maintenance Requirement Cards. The POT&I is scheduled to precede every ROH and BOH. The results of the POT&I are contained in a report that will include (1) all applicable OPNAV 4790/2K forms describing the discrepancies and recommending repairs, (2) a marked-up copy of the Ship System Configuration Index (SSCI) indicating which items do not require repairs, and (3) applicable supplementary reports.

Combat Systems Readiness Review/Test. The CSRR is conducted by the NAVSEACENs for Atlantic Fleet ships and the CSRT is conducted by the NAVSEACENs for Pacific Fleet ships. The goal of the CSRR is to assist ships in preparing for fleet operations by:

- Determining the operational readiness of the systems and equipments received
- Determining the validity of the software support for the systems and equipments received
- Rectifying hardware and software problems
- Training the Ship's Force while accomplishing the above objectives

The CSRT's objectives are fundamentally stated in the first two goals described by the CSRR. The overall management of the CSRR/T lies with the TYCOMs as assisted by Naval Ship Weapons Systems Engineering Station (NAVSHIPWPNSYSENGSTA) for test plan assemblage and the NAVSEACENs for test implementation. The CSRR/Ts conducted on gun weapon systems consist primarily of checks taken from the MRCs for the ship. The tests are a blend of operational checks and checks of various fluid, pressure, and voltage requirements also taken from MRCs. NAVSEACEN personnel stated that these tests are supplemented by more comprehensive checks when problems are discovered during the CSRR. THe NAVSEACEN personnel are concerned primarily with enhancing system operations and crew experience, which often requires applying checks not specified in the MRCs. The CSRR is a 10 working day inspection conducted by a team of technicians from the NAVSEACENs assisted by the Ship's Force. The CSRT takes three days using the same team concept. After the tests, a final critique is held aboard. A message report is sent to the TYCOM listing inoperative or severely degraded equipment, action being taken, major explosives safety/magazine sprinkler discrepancies, major software discrepancies, tests not conducted, and the PMS feedback actions to be taken by the ship.

Shipboard Condition Overhaul/Repair Evaluation Manual. The SCORE program is no longer used to evaluate gun weapon systems. The SCORE inspection is important to this analysis because it was a predecessor to the MCR. The SCORE was managed within the Naval Sea Systems Command and the manuals published for each gun weapon system were developed at NOS Louisville. The objective of the evaluation was to help the Type Commander determine which systems required overhaul and which systems required shipyard repair. The inspection contained a detailed series of visual, operational, dynamic, and performance tape tests to be conducted on various components of the system. These tests were specified in much more detail than any of the other inspections analyzed. The NAVSEACEN technicians stated the tests were designed to meet factory acceptance standards. The results of the inspection were recorded on summary sheets providing both numerical scoring and narrative comments. These results listed: (1) the discrepancies, (2) OrdAlt status, and (3) comments.

Board of Inspection and Survey. The purpose of this total ship inspection is to determine a ship's fitness for further service and any physical condition that limits its capability to carry out its assigned mission. The Board of Inspection and Survey inspects all Naval vessels at least once every three years, if practicable. This material inspection consists of a physical examination of the ship, its spaces and installed equipments, including equipments and systems in operation, and an examination of appropriate records.

The inspections of Fleet, active Naval reserve, and district ships will be scheduled from the proposed schedules of cognizant commanders, giving due regard to the importance of ships nominated, intervals since last inspections, locations of ships, and the resources available. These inspections will not be conducted during a Regular Overhaul and will not normally be conducted during an overseas deployment.

Reports will be made by the Inspecting Board to the President, Board of Inspection and Survey, with copies to interested commands. The President reviews the reports and submits them to the Chief of Naval Operations. Each deficiency noted in the report of a material inspection that significantly degrades the ability of a ship to carry out its assigned general and primary missions will be reflected in an appropriate CASREP.

Table 2-3 shows which gun weapon system inspections support the GWRSP, the DDEOC Program, or both.

2.6 COMPARATIVE ANALYSIS OF GWSRP AND DDEOC INSPECTIONS

Our initial analysis was directed toward identifying the procedures to be included in an integrated gun weapon system pre-overhaul inspection. We began with the Material Condition Review and Pre-Overhaul Test and Inspection. Later, this analysis addressed other inspections and the importance of integrating their outputs into the two programs.

Table 2-3. GUN WEAPON SYSTEM INSPECTIONS SUPPORTING THE GWSRP/DDEOC PROGRAM

GWSRP	DDEOC Program
Material Condition Review (MCR)	Pre-Overhaul Test and Inspection (POT&I)
Material Inspection (MI)	
Shipboard Condition Overhaul/ Repair Evaluation (SCORE)	
Combat Systems Readiness Review/ Combat Systems Readiness Test (CSRR/T)	Combat Systems Readiness Review/ Combat Systems Readiness Test (CSRR/T)
Board of Inspection and Survey (INSURV)	Board of Inspection and Survey (INSURV)

2.6.1 Comparative Analysis of MCR and POT&I Scheduling

The POT&I and MCR inspections provide the TYCOMs with the primary inputs for developing the specific requirements for work to be performed on gun weapon systems during Baseline or Regular Overhaul. The POT&I, as its name suggests, was designed for one purpose -- to support a successful overhaul, and is, therefore, scheduled before the overhaul. The inspection usually is scheduled to be completed 18 months before the start of overhaul for ships entering private shipyards and 10 months before the start of overhaul for ships entering Naval shipyards.

Conversely, the MCR was intended to be conducted on ordnance equipments identified by the TYCOMs as requiring replacement. It is completed and reported for each equipment before that equipment is inducted into the GWSRP. This action gives the GWSRP managers, the replacement funding activity, a technical input specifying those equipments that actually require replacement. When scheduled in conjunction with a Regular Overhaul and, for purposes of this analysis, a Baseline Overhaul (although the BOH is not specifically cited in NAVSEAINST 8500.2A), the MCR is to be completed and reported six months before the ROH induction or before the Work Definition Conference (WDC), whichever comes first. For ships entering a private shipyard, the WDC is nominally scheduled eight months before the start date; for an overhaul in a Naval shipyard the WDC is scheduled six months before the start date.

The data shown in Table 2-4 agree with information from the field activities and the TYCOMs that the POT&I and MCR conducted on these systems are often scheduled within weeks or at most a few months of one another.

As Table 2-4 shows, the greatest margin that should be occurring between the completion of an MCR and a POT&I is about 120 days. This is not considered to be long enough to produce drastically varied inspection

Table 2-4. DIFFERING MCR AND POT&I PERFORMANCE DATES

Action	Private Shipyard	Naval Shipyard
POT&I	A-360 Days	A-300 Days
MCR*	A-240 Days	A-180 Days

*Conducted before WDC

A = ROH/BOH Start Date

results. Given that the DDEOC Program operating interval between overhauls is nominally 60 months, and during that period a minimum of three CSRR/Ts, two MCRs, and one POT&I will be conducted on the gun weapon systems, the need to eliminate nearly concurrent inspections becomes apparent. When combining the scheduled MCR and POT&I dates as depicted in Table 2-4 with the notional DDEOC maintenance schedules in Appendix B, for three of the four scheduled dates the inspection will occur during a forward deployment period. The last forward deployment will occur somewhere between 5 and 11 months before overhaul. This period encompasses all dates in Table 2-4 except the one at A-360, or 12 months before overhaul. Conducting either of these inspections overseas will incur additional expenses in travel and per diem to get the inspection teams to the ship and back. These costs would be beyond expenses incurred for ships inspected in U.S. ports.

The analysis points to the necessity for coordinating the scheduling of POT&I and MCR inspections before baseline and regular overhauls of DDEOC Program class ships. The best way to accomplish this would be with a single inspection of the gun weapon systems sufficiently in advance of the WDC using combined standardized procedures from both the POT&I and MCR inspections. This will be discussed later. If that approach is not used, either of the following could be undertaken:

- Scheduling the two inspections so that the MCR sufficiently precedes the POT&I to allow TYCOM/PERA (CD) to decide on the scope of the POT&I required
- Scheduling the two inspections simultaneously with the overlapping areas eliminated and the POT&I providing most of the operational checks and the MCR providing most of the material checks

The analysis and discussions suggest scheduling the MCR no less than six months before overhaul and the POT&I and MCR no more than 18 months before overhaul. Scheduling an MCR six months before overhaul, especially an overhaul conducted in a private shipyard, almost always leaves too little time for the results to be utilized by the TYCOMs at the WDC for final SARP development. Scheduling a POT&I or MCR inspection more than

about 18 months in advance of the overhaul tends to create a period of operations before overhaul during which specific overhaul requirements can significantly change. This results in needless changes to the SARP and the overhaul planning effort. Because of the importance of making maximum use of the maintenance periods assigned by the DDEOC Program, it is essential that the information on the gun weapon systems be technically correct and as current as possible to support the requisite planning.

Therefore, we recommend that a single inspection, preferably an updated POT&I employing standardized inspection procedures, be conducted at about A-360. The ship should be in a U.S. port at that time. This schedule would allow sufficient time for the inputs to be utilized at the WDC and would be appropriate for ships going to either private or Naval shipyards.

2.6.2 Comparative Analysis of MCR and POT&I Content

The MCR and POT&I are conducted on the gun weapon systems to help the TYCOMs decide where to allocate repair dollars. It is in the TYCOMs' best interest to have an inspection conducted that is technically correct and sufficiently comprehensive. This is especially important for those DDEOC Program ships that will be overhauled in a private shipyard.

In comparing the procedures of the MCR and POT&I, the formats of both inspections were analyzed. Before proceeding with a discussion of the formats and their contents it is important to point out that the skill levels within the technical activity conducting the inspection can affect the quality of the inspection, regardless of the manner in which the inspection requirements are written. A series of procedures and checks is definitely required for inspecting equipment with the sophistication of the present gun weapon systems. In addition to specific inspection procedures, the utilization of technicians experienced on the systems/equipments maintenance and operations provides insight that often goes beyond written procedures. Analysis indicated that technicians currently having this type of experience are found at the NAVSEACENs, Naval Shipyard Combat Systems Departments, NAVSHIPWPNSTs and other In-Service Engineering Agents (ISEAs). Consideration should be given to which of these activities have: (1) gun weapon system inspection familiarity and (2) charters to regularly conduct these inspections. The selection of an activity that is not staffed to regularly conduct inspections may pose problems. This analysis supports having technicians with these skills, presently at the NAVSEACENs and Naval Shipyard Combat Systems Departments, conduct the inspections.

The MCR is conducted on a major system level using check-off booklets. For this analysis the MCR booklets on the 5"/54 Gun Mount Mk 42 Mod 9 and 10 and GFCS Mk 68 were studied. The 5"/54 Gun Mount Mk 42 and the GFCS Mk 68 are on 88 DDEOC Program class ships. The 5"/54 Gun Mount Mk 42 Mod 9 was used to compare the MCR and POT&I. The MCR booklets for each system are subdivided into the major components for which procedures and

inspection checks are provided. These booklets are used by the NAVSEACEN inspection team sent abroad to perform the procedural checks. The accomplishment of the MCR should be preceded by a discussion with Ship's Force concerning any problems. The sequence of the procedures is ordered to allow the inspectors to move efficiently from component to component.

The components specified in each procedure are further subdivided into the elements the inspectors are to check. The EP1 and EP2 panels are components inspected in the first procedure on the 5"/54 Gun Mount Mk 42 Mod 9 and 10. Within this procedure, the elements to be inspected are:

- Wiring
- Motor Contacts
- Terminal Boards
- Circuit Breakers
- Switches
- Lights
- External Cables
- Relays
- Fuze Holders
- Doors
- PC Boards
- Amplifier

For each of those elements, the inspection team will make the following checks:

- Corrosion or Rust -- Light or Excessive
- Missing Hardware -- Minor or Major
- Damage -- Minor or Major
- Dirt and Foreign Matter -- Light or Excessive
- Moisture, Water Entry -- Light or Excessive
- Lights -- Operation

The final check in this procedure is the determination for both the EP1 and EP2 panel of marginal or unsatisfactory operation. Although this is a check, no specific procedure to follow is given. An outside activity could not readily determine what constitutes this check or certify marginal or unsatisfactory operation. This area of the MCR requires improvement. Specific procedural actions for the various checks listed in the MCR should be documented. This would allow other activities to use the procedures and would provide for an exact identification of what constitutes a check. Multiplying the number of inspection elements for the EP1 and EP2 panels (12) by the required number of checks to be performed on each (6), results in 72 subchecks for this one component of the system. This level of detail provides for comprehensive identification of repair requirements at the Ship's Force, intermediate maintenance activity, and depot levels.

The elements of the remaining 23 procedures listed for the 5"/54 Gun Mounts Mk 42 Mods 9 and 10 are fundamentally the same as for Procedure One. The MCR inspections are comprehensive. They go into great detail and cover a cross section of testing: visual, dynamic, operational, etc.

The inspections of gun weapon systems required during the POT&I were compared with those inspections required during the MCR. POT&I Plans are developed on a ship-class basis. That is, a plan is developed for the class on the basis of the first ship of the class to be overhauled under this program. The class plan is then updated so that it is valid for each additional ship before its overhaul.

POT&I Plans are designed to be standard and interchangeable between activities with minimum adjustments for a particular hull. A plan is constructed from individual pages containing the necessary information to conduct specific tests or inspections and the assignment of the accomplishing activity--Forces Afloat or Shipyard. These individual pages are called Repair Inspection Requirements pages or sheets (see Appendix C).

Entries in the individual RIR forms, like entries in the MCR booklets, are written at a system level, i.e., 5"/54 Gun Mount Mk 42 Mod 9, and divided into major components in Block 14 of the RIR (see page C-6 of Appendix C). Both the POT&I and MCR require similar types of checks on the major components identified in Block 14.

A review of the RIR and MCR requirements for the 5"/54 Gun Mount Mk 42 Mod 9 indicated that both inspections required their designated components, essentially the same for both inspections, to be inspected for:

- Corrosion and Rust
- Missing Hardware
- Physical Damage
- Dirt and Foreign Matter
- Electrical Damage
- Moisture and Water Entry

Both procedures specified various inspections of required system fluids. They differed in that the MCR stressed a check of component fluid leakage, and the POT&I stressed a check of fluid levels.

The last aspect of the RIR for which checks were required was a table designating the system or component and applicable PMS checks to be conducted. For the 5"/54 Gun Mount Mk 42 Mod 9 this amounted to six checks from the Maintenance Requirement Cards. The following is a breakdown of what those six tests required:

W-14 Operate gun load system in Step Exercise and Simulate Mode

Q-1 Test elevation and depression buffers

Q-2 Check gun loading system mechanical adjustments

Q-3 Check operation of heating, lighting, and ventilating systems

Q-5 Check anti-icing system

R-1 Perform pre-firing checks

Further study of all MRCs listed for the SYSCOM Control Maintenance Index Page 6-31/9 for the 5"/54 Gun Mount Mk 42 Mod 9 disclosed that the RIR listed every test, inspection, or check called out in the MIP except three, one of which is the post-firing check. This indicates that the principal effort of the inspecting activity is to perform a series of PMS checks. The requirements state they need only witness the operational tests specified. The tests can be conducted by Ship's Force and require of the inspectors only an observer's role. Using PMS is not detrimental to the inspection, but using outside technical activities to perform a comprehensive preoverhaul inspection utilizing checks within the technical capability of the Ship's Force is not prudent. We recommend that this aspect of the inspections be strengthened by incorporating or developing more R (as required) MRCs that would not normally be employed by Ship's Force and would be primarily procedures for comprehensive inspections.

Review of the RIRs for the 5"/54 Gun Mount Mk 42 Mod 10 and Gun Fire Control Systems Mk 68 Mods 11, 12, and 13 revealed the same type of inspection requirements as specified above--simply a restatement of the requirements to test, inspect, and check given in the MIPs for the system being inspected. A potentially confusing statement is made for the operational tests listed on the GFCS Mk 68 Mods 13 and 14. A table lists the MCRs to be used on each equipment for the operational tests, but the instructions state "Use MRCs as required for Testing and Inspection". This creates confusion because it is not clear whether only the test and inpection portions of each designated MRC are to be used or those MRCs to be used for testing and inspection purposes are to be selected from the designated MRCs by the inspecting activity as it deems necessary. PERA (CD) stated that the RIR intended for all MRCs to be used unless unusual situations warranted otherwise. That RIR statement does not assure uniform inspections. It should be either stated more clearly or eliminated.

Further comparison of the MCR and POT&I revealed that all MCRs are conducted by the NAVSEACENs, whereas the POT&Is are conducted by various activities. For gun weapon systems, the primary POT&I inspectors have been NAVSEACENs, SUPSHIPS Boston, Naval Shipyard Combat Systems Department personnel, and private contractors.

The advantages of having a single activity conduct the inspections on these types of systems seem to outweigh the disadvantages. Central control, single point of contact, familiarity with requirements, etc., are but some of the advantages. The disadvantages of having several activities conducting the inspections include differing skill levels of the inspectors, differing operating procedures, and varying lines of communications. The MCR appears to deliver a more comprehensive inspection of the gun weapon systems in part because of its utilization of the NAVSEACENs to conduct all inspections.

Written instructions currently support the scheduling of the NAVSEACENs to conduct every POT&I on DDEOC Program class ships. We recommend that the NAVSEACENs conduct the gun weapon systems portion of every DDEOC Class Ship's POT&I. The NAVSEACENs are directed to conduct an MCR either six months before ROH or before the WDC, whichever comes first. Should the MCR become the standard for POT&I for gun weapon systems, the NAVSEACENs would essentially be fulfilling two requirements at the same time. The results of this new POT&I would go to both GWSRP and DDEOC Program personnel, satisfying the previous need for two inspections. This recommendation should be given the highest priority because having the NAVSEACENs conduct the POT&Is on all the DDEOC Program class ships would improve the results and continuity of these inspections. This is the first issue that should be resolved in the area of gun weapon system inspection improvement and integration.

Another factor that should be considered on this subject is the assigning of Naval Shipyard Combat System Department personnel to conduct POT&Is if NAVSEACENs are not to conduct all inspections. To avoid possible conflict of interest, shipyard personnel should not inspect ships they will be repairing.

A breakdown of the visual and operational inspection requirements on the 5"/54 Gun Mount Mk 42 Mod 9 is shown in Table 2-4. Two clear observations about the two kinds of inspections can be made from this information: both inspect the same components; and the MCR requires more material checks than the POT&I. The POT&I has been organized so that most of it can be conducted by the Ship's Force. To justify bringing an outside activity aboard to conduct the inspection, the activity should be assisting the ship and TYCOMs in areas largely beyond Ship's Force capability.

From analyses of these two kinds of inspections, we have concluded the POT&I Plans for gun weapon systems should be updated. The revised inspection should include material checks presently conducted by the MCR and the operational systems portions of the existing POT&I Plans. The MCRs should be written to specify the steps to be followed for each check and should be formatted to coincide with the MRC used within the 3-M System. This would allow them to be entered into the shipboard MIPs for use or reference by the Ship's Force. It is envisioned that these would be designated as R Cards. This effort should be coordinated beween PERA (CD) and NAVSEA-0432. It is recommended that the DDEOC Program, through PERA (CD) and the GWSRP, jointly task and fund the NAVSEACENs or other designated technical activities to develop standard procedures for incorporation into the POT&I Plans for gun weapon systems. These standard procedures should be formulated in MRC form for ease of implementation by PERA (CD) into the RIRs. If the NAVSEACENs do not have the technical capability in every instance, other technical activities such as the designated In-Service Engineering Agent (ISEA) for a system should be tasked with development of the procedures. Initiation of this effort should take place at the next semiannual GWSRP scheduling conference to be held early in FY 1979.

An aspect of gun weapon inspections that was the subject of discussion and recommendation was the requirement to properly establish ship configuration for the gun weapon systems. This is an element of the POT&I to

Table 2-4. 5"/54 GUN MOUNT MK 42 MOD 9 MCR/POT&I TEST REQUIREMENTS COMPARISON

MCR				POT&I			
Components Checked	Number of Sub Elements	Visual Checks	Operational Checks Specified	Components Checked	Number of Sub Elements	Visual Checks	Operational Checks Specified
EP1/EP2 Panels	12	6	Yes (P1)	EP1/EP2 Panels	0	6	Yes (R-1) (W-14)
EP3/EP4/EP5 Panels	10	5	Yes (P2)	EP3/EP4 Panels	0	6	No
Electrical Connection Boxes	11	5	No	Electrical Connection Boxes	0	6	No
Train Power Drive	15	8	Yes (P4)	Train and Elevation Power Drives	0	6	Yes (R-1) (W-14)
Elevation Power Drive	16	8	Yes (P5)				
Shield Assembly	8	4	Yes (P6)	Shield Assembly	0	6	No
Carriage/Stand Roller Path	8	6	No	Carriage/Stand Roller Path	0	6	No
Empty Case Ejector/ Empty Case Tray	13	9	Yes (P8, 21)	Empty Case Ejector/Empty Case Tray	0	6	Yes (Q-2) (R-1)
Gas Ejector	4	6	Yes (P9, 21)	Gas Ejector	0	6	No
Breech Mechanism	10	6	Yes (P10)	Breech Mechanism	0	6	Yes (Q-2) (R-1)
Rammer	7	8	Yes (P11, 21)	Rammer	0	6	No
Left/Right Transfer Trays	8	8	Yes (P12, 21)	Left/Right Transfer Trays	0	6	Yes (Q-2) (R-1)
Left/Right Fuze Setters	8	9	Yes (P13, 21)	Left/Right Fuze Setters	0	6	No
Left/Right Cradles	9	9	Yes (P14, 21)	Left/Right Cradles	0	6	Yes (Q-2)
Left/Right Upper Hoists	10	9	Yes (P15)	Left/Right Upper Hoists	0	6	No
Ammunition Carrier	7	9	Yes (P16, 21)	Ammunition Carrier	0	6	Yes (Q-2)
"C"/"D" Lower Hoists	7	9	Yes (P17, 21)	"C"/"D" Lower Hoists	0	6	Yes (Q-2)
"A"/"B" Loader Drums	9	8	Yes (P18, 21)	"A"/"B" Loader Drums	0	6	No
Lower Accumulator System	8	8	Yes (P19)	Upper and Lower Accumulator Systems	0	6	Yes (R-1) (W-14)
Upper Accumulator System	7	7	Yes (P20)				
Telescope/Sight	7	7	Yes (P22)	Telescope/Sights	0	6	No
Recoil/Counterrecoil-Slide Area	8	7	Yes (P23)	Recoil/Counterrecoil-Slide Area	0	6	Yes (R-1)
HP/LP Air System (Procedure Missing)				Air Supply Lubricator	0	6	No

be documented as a result of the inspection. To enhance the overall effectiveness of these inspections the configuration the ship is expected to have as a result of the overhaul should be identified before the POT&I. For instance, any entire system or equipment to be removed or replaced with new or updated systems or equipments should not be inspected. There would be no advantage in identifying requirements to repair systems or equipments that the ship will no longer have on board. The TYCOM, Ship's Force, and the inspecting activity will have to coordinate this effort before the POT&I.

2.6.3 Comparative Analysis of MCR and POT&I Documentation

The concerns for developing comprehensive, standardized gun weapon system inspection are many. One of the most important is to produce inspection results in a usable form. That is, the results should contain all the equipment nomenclature, description, and detailed comments related to repair requirements. Of equal importance is the proper distribution of the results to allow more effective maintenance management of gun weapon systems. To accomplish this, both the POT&I and MCR should include procedures that dictate standard reporting procedures and the distribution of results of interest to both kinds of inspections.

At present, the results of the MCR are documented on summary sheets (see Appendix E) by the inspecting activity. Those discrepancies noted on Summary Sheet 2 are to be reported to the 3-M system by Ship's Force on OPNAV Form 4790/2Ks. The OPNAV Form 4790/2K (see Appendix F) is the standard form used Navy-wide for reporting ship's maintenance needs that (1) require some type of assistance from an activity external to the ship, (2) are not expected to be accomplished by Ship's Force within 30 days or other prescribed time frame, and (3) are uncorrected deficiencies as reported by INSURV.

The POT&I reports now must be documented on OPNAV 4790/2K Forms and describe the discrepancies and recommend the repairs. We recommend that all discrepancies found in either the MCR or POT&I be reported on OPNAV Form 4790/2K. The inspecting activity, with Ship's Force assistance, should complete these forms before termination of the inspection. The information provided on the 4790/2K will be sufficient for the planning of maintenance requirements in either a Naval or private shipyard. Additionally this form provides information for the planning of intermediate maintenance activity level repairs that will be conducted throughout the DDEOC Program's operating cycle.

The MCR is presently distributed by having the NAVSEACENs submit summary reports to the appropriate TYCOM, NAVSEA-0432, and to Gun System Engineering Division, NOS Indian Head. The results of the POT&I are distributed to the appropriate PERA, the POT&I Planning Agent, and Ship's Force. These activities and the TYCOMs screen the POT&I results to form the preliminary SARP.

Neither the MCR nor POT&I results are presently distributed to the activities responsible for coordinating these inspections; i.e., NAVSEA-0432

does not receive POT&I results nor does PERA (CD) receive the MCRs. These inspection results should be distributed to those activities to support the POT&I. The purposes of the POT&I and MCR differ in such a way that it is important that MCR results are included in POT&I planning. It is recommended that PERA (CD) receive MCR results and that these results be submitted on the OPNAV 4790/2K. Further, the gun weapon system results generated from the POT&I should be made available to the GWSRP.

2.6.4 Comparative Analysis of MCR and POT&I Follow-Up Procedures

Follow-up procedures are important to the integration of the MCR and POT&I inspection. These procedures include the actions that are taken on completion of the actual inspection. The integration procedures will ensure that present follow-up procedures are integrated and that this integration provides for unspecified coordination requirements. We analyzed the inspection and post-inspection procedures for the MCR and POT&I. The analysis showed a need for follow-up action in relation to the following topics:

- Inspection Procedures. The recommendation to standardize the gun weapon system inspection procedures in the RIRs for POT&I plans will need to be followed up. If this recommendation is implemented, it will be necessary to assure that these procedures reflect the best inspection checks the systems should receive before major overhaul. In order to accomplish this, the activity designated to develop each gun weapon system standardized inspection procedure should be responsible for maintaining the quality of the standard. If this cannot be accomplished, the ISEA for that system should assume the responsibility. Feedback from forces afloat, inspecting activities, and TYCOMs should be directed to this responsible activity, the purpose of the feedback being to ensure inspection adequacy. The updating of the inspection procedures is envisioned as an iterative process. It will involve the inclusion of yet undiscovered inspection requirements. The follow-up procedures are required to ensure that both the MCR and POT&I are properly integrated and coordinated and should address undiscovered areas of required integration. As maintenance assets and funding support of the GWSRP and DDEOC Program change in the coming years, it will probably be necessary to adjust maintenance support accordingly. This change should be coordinated between the GWSRP and the DDEOC Program as required. It is recommended that NAVSEA 0432 and NAVSEA-934 work together on this issue. Open and direct lines of communication should be established between designated codes to ensure potential problems of mutual interest are identified, mutually approached, and resolved.
- Post-Inspection Procedures. Under the current inspection procedures for the MCR and POT&I, the GWSRP management does not receive copies of POT&I results on GWSRP systems and equipments and PERA (CD), responsible within the DDEOC Program for POT&I implementation, does not directly receive copies of MCRs. PERA (CD) often learns of MCR results at the WDC from the TYCOM, who has this information

and often utilizes it in conjunction with POT&I results. A follow-up procedure is needed, first, to ensure MCR and POT&I results become accessible to both GWSRP and DDEOC Program management, and second, to ensure feedback is generated by the TYCOM to these programs. The feedback should indicate the actions taken to resolve inspection-identified problems and include documentation for work remaining outstanding and explaining why it has not been done. In this process, it is important that the information specify requirements to be accomplished and the activity to perform the work. This will provide GWSRP and DDEOC Program management with more complete information about the repair level assigned (Ship's Force, IMA, or depot), the sector assigned (private or Navy), and scheduled availability period.

2.7 COMPARATIVE ANALYSIS OF OTHER GUN WEAPON SYSTEM INSPECTIONS

The Shipboard Condition Overhaul/Repair Evaluation Manual (SCORE), the Combat Systems Readiness Review/Test (CSRR/CSRT), and the INSURV were also reviewed and analyzed.

2.7.1 SCORE

The SCORE program was the forerunner of the Material Inspection which preceded the MCR. The SCORE manuals are no longer used for inspections but provide background to explain the development of the MCR.

The technical content of the procedures described in the SCORE inspection were also analyzed. The procedures of the SCORE may well serve as a basis for updating the MCRs. The level of detail of the SCORE may be greater than is desired in the MCR because the SCORE was designed to inspect to the Factory Acceptance Test levels. In spite of this, the SCORE could provide a considerable input for updating the MCR with substantial savings of time, effort, and money.

The purpose of the SCORE was essentially the same as that for the MCR, helping the Type Commander determine which systems require overhaul and which require shipyard repair. The inspection consisted primarily of a series of operational tests on various components with an overall system visual inspection.

The 5"/54 Gun Mount Mk 42 Mod 9 Inspection was divided into three specific areas: visual, operational, and performance tapes. Table 2-5 depicts these inspection groups and the corresponding components inspected.

Closer analysis of the present requirements of the existing MCR on this system showed component breakdowns to be very similar to that listed for the SCORE. The SCORE and the Material Inspection differed from the MCR in that each SCORE test was very specifically laid out, explaining step-by-step procedures to follow. Some of the procedures could be compared to the PMS MRCs used in the POT&I Plans, but on the whole SCORE's

Table 2-5. 5"/54 GUN MOUNT MK 42 MOD 9 SCORE INSPECTION REQUIREMENTS	
Inspection Group	Components
A Visual	General Condition
	Optics
	Indicators (Dial)
	Heating/Ventilation
B Operational	Electrical Limits
	Gas Ejector
	Brakes/Stow Devices
	Air Motors
	Buffers
	Local and OMC Control
	Firing/Firing Cut-Out
	Fuze Setters
	Bore Erosion
	Cycle Trim Test
C Performance Tapes	Train Power Drive
	Elevation Power Drive

sophistication was of a higher caliber and aimed at comparing a system's material/operational condition with standards established for new equipment.

The Material Inspection was very similar to the SCORE Program. It was usually conducted by the NAVSEACENs (previously known as NOSSOs), using procedures formulated by NOS Louisville. The procedures were virtually identical to those used by the SCORE Program. The term "Material Inspection" was changed to "MCR" in an effort to avoid the stigma attached to the term "inspection" and new inspection procedures were incorporated. The MCR procedures did not delineate step-by-step descriptions of what to accomplish and what readings to look for, but switched to the present booklets designating the areas to be checked and type of checks to be made but not describing the step-by-step procedures to follow. This basic change in inspection procedures from those initiated by SCORE allows the inspecting activity greater flexibility but does not document specific inspection actions. The MCRs do not appear to suffer because of the lack of procedural specificity, largely due to the technical competence of the NAVSEACEN personnel. If the MCRs were to be conducted by an activity other than the NAVSEACENs, the procedures would have to specified step by step. Since POT&Is are conducted by several activities and it is

desirable to incorporate MCR procedures into a standardized inspection to be utilized as the GWS portion of the POT&I, the MCRs should use step-by-step procedures. This recommendation is not an attempt to limit the NAVSEACEN personnel but should facilitate the merging of the MCR into the POT&I Plans.

2.7.2 INSURV

The INSURV was initially viewed as having the potential to provide significant additional information for the maintenance planning for gun weapon systems in the DDEOC Program. A closer look at the INSURV inspections conducted for Gun Weapon Systems and the INSURV philosophy indicates this is not the case. The INSURV inspection of these systems is essentially a three-day inspection -- one day alongside and two days under way. INSURVINST. 4730.18A designates the NAVSEACENs and NAVSHIPWPNSYSENGSTA as the technical activities to provide assistance to the Board of Survey and Inspection personnel in gun systems inspections. The under-way period is used to conduct operational tests and the in-port period is used for both operational and visual material inspections. INSURV procedures call for inspection until a discrepancy is found. This type of inspection gives a "snapshot" look into the ship's operational and material condition. Discrepancies found by INSURVs are presently used in the POT&I results to document repair requirements for all levels of maintenance activities. Major discrepancies are reported in an appropriate CASREP. This results in the highest priorities being assigned to ensure the discrepancies are corrected within a minimum time. Items not corrected at the time of POT&I are included in the SARP. There does not appear to be any requirement for further coordination to integrate these results into the DDEOC Program unless it is to ensure INSURV results can be incorporated into the designated SRAs as well as ROH/BOH.

2.7.3 Combat Systems Readiness Review/Test

The Combat Systems Readiness Review -- Atlantic Fleet -- and the Combat Systems Readiness Test -- Pacific Fleet -- are designed to assist ships in their preparation for deployment. The philosophies of the inspections differ, but their objectives are basically the same.

The Atlantic Fleet conducts a ten-working-day inspection that emphasizes crew training and corrective action for discovered discrepancies. The Pacific Fleet conducts a three-day inspection designed to identify discrepancies. Repair action requiring outside assistance for identified discrepancies must be requested by the ship through the TYCOM.

The CSRR and CSRT are important to the overall support of gun weapon systems on DDEOC Program class ships in two ways: (1) they identify required maintenance actions and (2) they provide justification for immediate repairs to gun weapon systems. In the Atlantic Fleet repairs are an integral part of the inspection, except those repairs that cannot be accomplished within the time available.

Analysis of the CSSR booklet used for the 5"/54 Gun Mount Mk 42 Mod 9 on the USS SIMS (FF-1059) (see Appendix D), shows that the CSRR contains every operational check presently called out in the corresponding RIR prescribed for this system's POT&I. Table 2-6 compares the CSRR operational requirements with those of the POT&I Plan for the 5"/54 Gun Mount Mk 42 Mod 9.

Because the CSRR and CSRT are as comprehensive as the inspection comparison in Table 2-6 indicates and nearly every DDEOC class ship will receive approximately one CSRR or CSRT a year, their results should be entered into DDEOC Program planning. Both the GWSRP management information system and the DDEOC Program Repair Maintenance Management System should enter outstanding repair requirements revealed during the CSRR/T inspections in their data banks. This information should be used for intermediate and depot level maintenance activity schedules and requirements planning.

2.8 GUN WEAPON SYSTEM INSPECTIONS CONCLUSIONS AND RECOMMENDATIONS

From the conclusions drawn from the analyses of gun weapon system inspection, we developed recommended improvements and integration procedures to these inspections. Considerable action will be required to implement the recommended procedures, including both technical engineering work and inter-program management coordination.

2.8.1 Conclusions

The following conclusions resulted from the study:

- The major gun weapon system inspections conducted before depot level overhaul are the Material Condition Review within the GWSRP and Pre-Overhaul Test and Inspection within the DDEOC Program. Between the two inspections, there is often duplication of efforts involving inspection scheduling, procedures, and personnel.
- The POT&I plans currently used by PERA (CD) for the inspection of gun weapon systems need revision to increase the comprehensiveness of both the operational and material condition inspection procedures.
- MCR and POT&I schedules are not presently coordinated to provide the TYCOMs with the most efficient and cost-effective inspection process for gun weapon systems. Gun weapon system inspections and pre-overhaul inspections for DDEOC class ships entering private shipyards have different schedules from ships entering Naval shipyards. GWS inspections must be scheduled in response to anticipated maintenance alternatives; comprehensive replacement repair at NOS Louisville, overhaul in place by Naval shipyards, or limited repairs with rotable items installed by private shipyards.
- The Material Condition Review and Pre-Overhaul Test and Inspection provide the TYCOMs with the primary information for planning gun weapon system overhaul repair requirements. Of the two, an MCR

Table 2-6. COMPARISON OF THE CSRR AND POT&I REQUIREMENTS FOR THE 5"/54 GUN MOUNT MK 42 MOD 9

CSRR Requirement		POT&I Requirement
W-13	Check train, elevation, and main header tank fluid levels. Check lower accumulator fluid level. Check cradle-to-slide buffer fluid level. Check differential piston. Check recoil cylinder fluid level. Check empty case buffer fluid level. Check lubricator fluid level. Check accumulator pressures. Check air pressure in counterrecoil cylinders.	Corresponding tests in Table 1 of RIR
M-2	Check oil level in train and elevation response gears.	Corresponding test in Table 1 of RIR
M-3	Check oil level of firing cutout assembly. Check oil level of train response gear assemblies.	Corresponding test in Table 2 of RIR
M-12	Check air pressure in anti-icing system.	Corresponding test in Table 2 of RIR
W-15	Test local and emergency firing circuits.	Not listed (listed Mod 10) Mod 9
Q-2	Check gun loading system mechanical adjustments.	Q-2 from Table 2 of RIR
Q-1	Test elevation and depression buffers.	Q-1 from Table 2 of RIR
Q-3	Check operation of heating, lighting, and ventilation system.	Q-3 from Table 2 of RIR
R-1	Perform pre-firing checks.	R-1 from Table 2 of RIR
R-2	Perform post-firing checks.	Not listed
W-14	Operate gun load system in Step Exercise and Simulate Mode.	W-14 from Table 2 of RIR
Q-5	Check anti-icing system.	Q-5 from Table 2 of RIR
A-4	Remove hydraulic fluid samples for testing.	Not listed
R-3	Measure projectile seating distance.	R-3

up dated by including detailed step-by-step procedures in 3-M format and conducted by experienced NAVSEACEN personnel can provide the best identification of overhaul requirements.

- The NAVSEACENs are currently involved with all major inspections of gun weapon systems. The NAVSEACENs personnel are most familiar with the detailed requirements of those inspections and in addition have technical expertise for inspecting these systems achieved by few activities other than the designated ISEAs.
- The CSRR and CSRT are comprehensive inspections that evaluate the operational condition of gun weapon systems in great detail and can identify material condition in satisfactory detail. Results of these inspections can add maintenance requirement information to the DDEOC Program.
- The inspection procedures currently used on the MCR, POT&I, and CSRR/T are not coordinated to provide the GWSRP and the DDEOC Program comprehensive inspection results. The inspection results of these three inspections currently are submitted only to one common management principal -- the TYCOMs.

2.8.2 Recommendations

On the basis of the study conclusions, the following recommendations are offered:

- The GWSRP and DDEOC Program managers should jointly task and fund the development of standardized inspection procedures to be included in POT&I Plans for designated gun weapon systems. This action should be initiated at the next GWSRP semiannual scheduling conference. The DDEOC Program should be represented and inputs from NAVSEACENs, NAVSHIPWPNENGSTAs, NOS Louisville, SUPSHIPS, and the TYCOMs should be solicited. The initial efforts of this meeting would be to (1) agree on the systems requiring standard procedures to be developed for incorporation in POT&I Plans and (2) identify the technical activity to provide the standard procedures.
- The development of standard inspection procedures for the gun weapon system portion of the POT&I should include the following: (1) existing operational checks specified in POT&I, (2) material and operational checks specified in the MCR, (3) testing and certification procedures found in other programs, and (4) other procedures currently practiced but not documented.
- Until POT&I Plans are revised, GWSRP Material Condition Reviews should be scheduled to best coincide with the maintenance schedules of the DDEOC Program. The TYCOMs and GWSRP managers should coordinate scheduling of MCRs so that the inspection can be used as the primary input for overhaul planning until POT&I Plans are revised. This requires that careful consideration be given to the level of depot maintenance to be conducted -- ROH, BOH, or SRA -- and to the type of shipyard -- private or Naval -- that will conduct the overhaul.

- The Material Condition Review (to be incorporated into the POT&I) should be revised to include specific step-by-step procedures. These steps should state exact tolerances, where applicable. These procedures should be prepared in the format of the Planned Maintenance Systems Maintenance Requirement Cards, which can be made available for reference.
- Standardized GWS inspection procedures incorporated in the POT&I Plans should be conducted by the NAVSEACENs or combat systems departments of the Naval shipyards. Special MCRs and the CSRR/T should continue to be conducted by NAVSEACENs because only the NAVSEACENs have consistently displayed the technical capability and expertise to conduct these inspections.
- CSRR and CSRT results as provided by the NAVSEACENs should be used to support DDEOC Program maintenance planning, and should be provided directly to the GWSRP Management Information System (MIS) and the DDEOC Program Repair Maintenance Management System as inspections are completed.
- Inspection results for gun weapon systems should be exchanged directly between the GWSRP and DDEOC Program. Copies of the MCR should be made available to the DDEOC Program and PERA (CD) directly and copies of the POT&I and CSRR/T should be made available to the designated GWSRP manager directly.

CHAPTER THREE

GUN WEAPON SYSTEM BID SPECIFICATION

3.1 INTRODUCTION

Three levels of depot maintenance activities repair and refurbish gun weapon systems: the Naval Ordnance Station, Louisville, Kentucky (NOSL); Navy shipyards; and private (commercial) shipyards. Experience has shown that NOSL has the best capability to overhaul gun weapon systems. The Navy shipyards have the next best facilities. Private shipyards often have minimal ordnance capability and tend to be less able to perform the special work associated with depot-level maintenance of gun weapon systems.

Because DDEOC Program Class ships' gun weapon systems will be overhauled in any of the three levels of facility, gun weapon system material and operational condition may vary when the overhaul has been completed. TYCOM and GSWRP personnel have reported that private shipyard overhauls of gun weapon systems have been less than satisfactory. The objective of this analysis is neither to prove or disprove this generalized statement, but assuming it is true, the analysis is directed at investigating one of the potential causes of the problem.

This analysis assumes that gun weapon system overhauls conducted in private sector are not meeting required material, operational, and technical standards. The two reasons most commonly given by TYCOM and GWSRP personnel as the probable causes of poor overhauls are (1) managers and technicians in the private shipyards lacking technical expertise to conduct gun weapon systems overhauls, and (2) bid specifications not properly identifying exactly what work needs to be done.

This analysis is concerned only with analyzing the second reason -- gun weapon systems bid specifications. Evaluation of the current procedures by which bid specifications for GWSRP systems are written and identification of those procedures that can be improved within the framework of the DDEOC Program is the objective of this effort. No attempt has been made to analyze the skills of either the managers or the technicians.

Bid specifications are used only in contracting for private shipyard overhauls. They translate the work statement in the approved SARP into contractual terms requiring specific work to be accomplished and, in some cases, describing how the work will be inspected and tested for adequate accomplishment. For Navy shipyards and NOSL depot level maintenance or

repair requirements are translated into work specifications on other documentation. The bid specification is the legal description of work upon which private shipyards submit competitive bids. Contracts are awarded on the basis of price quotation and technical ability to perform work described in the bid specification package.

A fundamental element of the DDEOC Program maintenance philosophy is the development of Class Maintenance Plans (CMPs). Each DDEOC Class Maintenance Plan is intended to define and schedule anticipated maintenance requirements for systems and equipments of DDEOC Program class ships throughout the extended operating cycle. This means the gun weapon systems should be ready for an operating cycle of 54 ± 6 months. This assumes that every gun weapon system is refurbished in accordance with CMP overhaul requirements, achieving a material condition adequate to last at least through the next overhaul, five years hence, with supplemental work accomplished during SRAs and intermediate level maintenance availabilities. With the sophistication of modern gun weapon systems, this requires high quality work and test procedures to assure Fleet commanders that ships leaving overhaul will be ready for full operations. The results of every GWS overhaul must be independent of the method of refurbishment. To allow ship GWSs to vary in quality depending on the overhaul activity would cause significant problems in scheduling ships for operations and future overhauls.

In order to erase the apparent difference in GWS overhaul quality between private and Navy shipyards, bid specifications for GWS jobs must be carefully written to require private shipyards to perform the intended (e.g., specified) maintenance in a thorough manner and demonstrate compliance by testing the GWS after completion.

The analysis of the gun weapon systems inspections affects the development of the gun weapon system overhaul bid specification. As individual ships are inspected, the results of the inspection (POT&I, MCR, or both) become primary inputs from which the job planner will prepare the bid specification. Therefore it is essential to proper bid specification preparation that gun weapon system inspections be most comprehensive and technically correct.

3.2 OBJECTIVE

The objective of the analysis conducted on gun weapon system overhaul bid specifications is to identify the process to improve current procedures by which bid specifications for GWSRP systems depot level maintenance are written within the framework of the DDEOC Program.

3.3 GUN WEAPON SYSTEM BID SPECIFICATION ANALYSIS APPROACH

The approach to the analysis of gun weapon system bid specification consisted of the following steps:

- Collect Information. The first step was to collect information concerning the specific procedures followed for developing gun weapon system bid specifications.

- Analyze Information. The second step was to analyze the available information. The analysis was directed toward (1) determining the gun weapon systems common to both programs, (2) determining the current procedures implemented in the development of gun weapon system bid specifications, and (3) the similarities and differences between the currently implemented procedures. Upon completion of this step, opportunities for potential improvements to existing procedures were identified.
- Conduct Interviews. The third step was to interview the responsible principals within both programs. The interviews were conducted for two purposes: (1) to gain further information and insight into the documentation and (2) to discuss the preliminary findings.
- Develop Tentative Integration Improvements. The fourth step was to develop tentative procedural improvements for the development of gun weapon system bid specifications.
- Develop Conclusions and Recommendations. The final step was to develop the conclusions and recommendations that resulted from the preceding analyses.

3.4 COLLECTION OF INFORMATION

The preparation and use of bid specifications is an integral part of pre-overhaul planning, as described in Appendix A. The collection of information for the analysis of bid specifications is an integral part of the overall data gathering effort. Sources of information listed in Chapter Two formed the foundation for our study of the use of specifications in describing work to be bid upon by private shipyards.

In particular, three documents establish a fundamental understanding of bid specification procedure:

- The Ship Repair Contracting Manual (Repair Manual), NAVSEA 0900-LP-079-5010, 1976 edition, provided details of bid specification preparation and guidance.
- The Surface Ship Pre-Overhaul Planning Guide described the preparation and execution of overhaul plans from the perspective of the ship.
- The approved SARP for the USS PHARRIS (FF-1094) included class BOH specifications, standard work items, and locally prepared work items for gun weapon systems. These items are reproduced in part as Appendix G.

Although these three documents provided the background information and data for the ensuing analysis, discussions with key personnel in several Navy activities provided the impetus for our recommendations. Navy organizations contributing to this portion of the analysis include PERA (CD), SUPSHIP Brooklyn, SUPSHIP Portsmouth, NOS Louisville, and SURFLANT Staff. Table 3-1 describes the general subject matter ARINC Research discussed with specific offices within these organizations.

Table 3-1. TECHNICAL DISCUSSIONS CONCERNING BID SPECIFICATIONS

Organization Code	Subjects of Discussion
PERA (CD), Code 1850 and 1820.15	The schedule of pre-overhaul activity including POT&I and SARP; assignment of SUPSHIPS for developing class bid specifications; lack of gun mount Standard Work Items; the Standardization Committee in SUPSHIPS, Jacksonville.
SUPSHIP Brooklyn, Code 215	Package of Standard Items and Standard Work Items for GWSRP.
SUPSHIP Portsmouth, Specification Control Branch	Procedures for preparing bid specifications; making job item ship checks; using standard work items.
NOS Louisville GSED	Preparation of Technical Repair Standards for industrial replacement of rotable pool items.
SURFLANT Armament Desk	Fleet impressions of overhaul effectiveness and trend component replacement instead of total refurbishment; ORDSATs and industrial work for ships in private shipyards.
SURFLANT FF Type Desk	Status of DDEOC ships in BOH gun system procedures in BOH; trade-offs between GFE and CFE due to supply problems.
NAVSEA 074	Upcoming changes to Ship Repair Contracting Manual (Repair Manual).
NAVSEC 6179F	Test and Certification Manuals for Combatant Ships being developed and implemented for pre-overhaul, post-installation, and post-overhaul combat systems.

3.5 GUN WEAPON SYSTEM BID SPECIFICATION PREPARATION DESCRIPTION

Before discussing preparation and structure of bid specifications, it is necessary to introduce the general philosophy as stated in the Repair Manual, used in translating a job item from the SARP into a legal document that competing private shipyards can use as a basis for estimating prices and bidding.

Specifications are technical documents that convert work requirements to clear, concise, well defined, and contractually sound terms. Each becomes a legally binding contractual document that is the determining factor

as to what the Government will receive from the contractor performing the work. They must provide sufficient information to the contractor to define precisely the minimum requirements of the Government and be free of language open to diverse interpretations.

Specifications normally specify what to do rather than how to perform the work. There are instances when the Government desires that the work be accomplished in a specific manner. In these instances the procedures must be clearly defined, but should not be so worded that they unreasonably restrict competition. For example, in Appendix G the radar reflectors are to be repainted. A specific enamel is to be used and applied in a thin coat, preferably with a spray gun. Should a contractor develop an improved method of applying this enamel, he is free to use it providing it coats evenly in a thin layer.

Specifications must be written in a logical sequence of work operation whenever possible (i.e., remove, disassemble, inspect, report, repair, reassemble, reinstall, and test).

Each specification must clearly define the work requirements and be as self-contained as possible to enable the user to understand the requirements without having to research a myriad of reference data. The specification work requirements must include the minimum specific tests and inspections that must be performed by the contractor to ensure that the desired quality is achieved.

Specifications should be limited to the minimum requirements to achieve the desired result and should not upgrade equipments and installations to exceed original design requirements.

The sequence of events for preparation of bid specification packages and release of an invitation for bids (IFB) are depicted in Figure 3-1. This is a simplified picture of the milestones discussed in Appendix A and illustrates the time constraints placed on the job planner who prepares the bid specification package. By using some preliminary information available from the preliminary SARP, the job planner can begin collecting documents for preparing job order work items. When the final list of items becomes firm, with the authorized SARP, less than two months remain for completing the bid specifications. This does not allow the planner to spend a great deal of time researching the requirements that must be written into each specification.

3.5.1 Initial Bid Specification Input

Figure 3-1 shows that the initial input developed for preparation of bid specifications is the Current Ship's Maintenance Project. The Ship's Force will prepare rough copies of work requests as repair needs develop throughout the operating cycle. Each item of repair is noted and described on an individual Maintenance Action Form, OPNAV 4790/2K, used for this purpose.

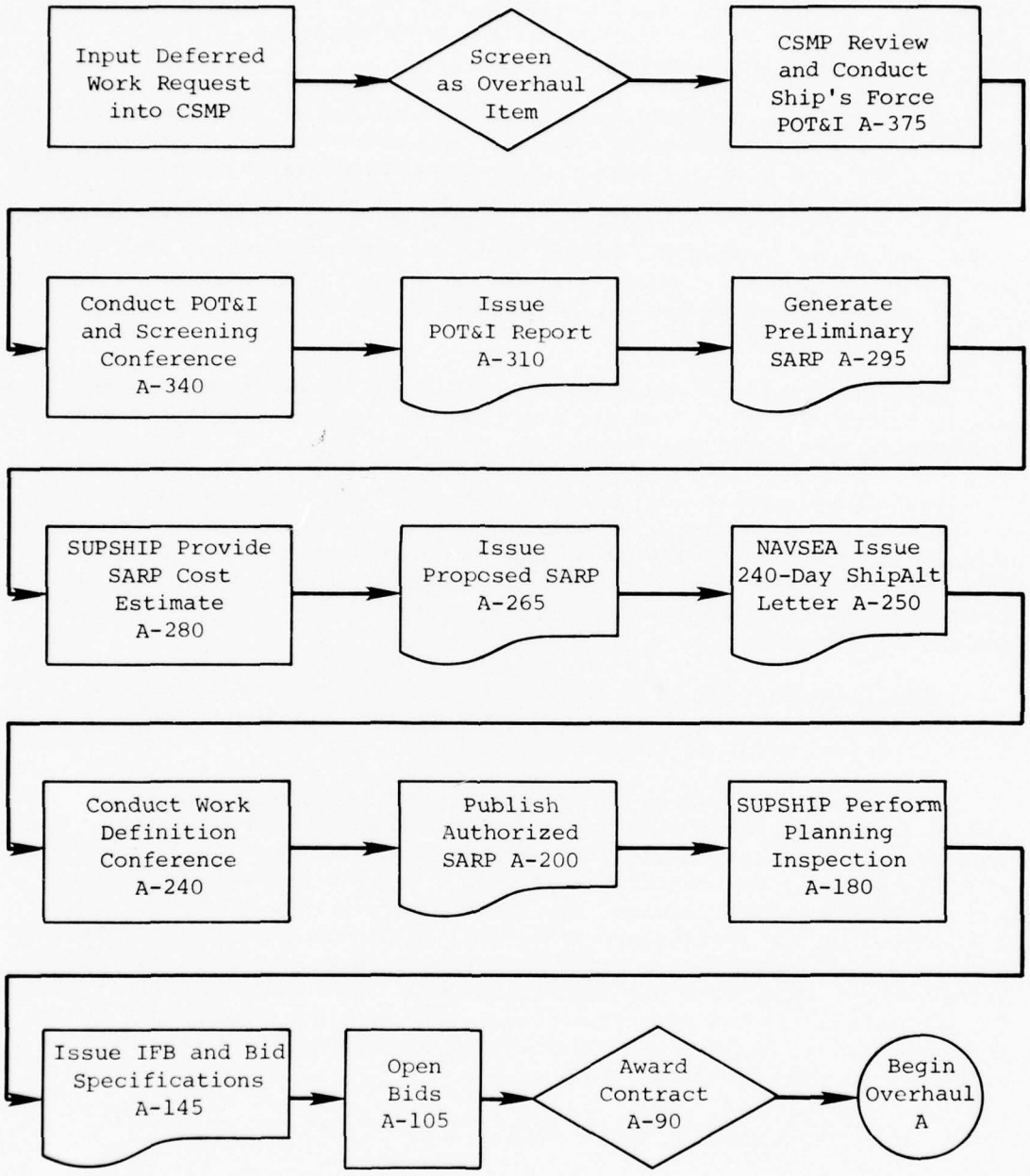


Figure 3-1. PRIVATE SHIPYARD WORK PACKAGE SEQUENCE

After preparation, each Maintenance Action Form is screened to determine whether it can be accomplished by the Ship's Force at that time. If it cannot, it will normally fall into one of three general categories: (1) items that may be accomplished by the Ship's Force at an "upkeep availability," (2) items that must be accomplished by a tender or repair ship, and (3) items that must be accomplished by a Naval shipyard or contractor under the cognizance of a SUPSHIP. The appropriate action will be indicated on each 2K (Maintenance Action Form) and a 2K copy will be placed in the ship's files (CSMP) for accomplishment at a later date (deferred maintenance).

The information documented in the CSMP and that generated by the POT&I will be screened by representatives from the TYCOM, Ship's Force, POT&I Planning Agent, and PERA and will be used in the preparation of the proposed SARP.

If the ship is scheduled into a private shipyard, the Ship's Force must prepare and distribute final copies of all work requests to the SUPSHIP for advance planning and to the TYCOM for screening action. All necessary information, including past difficulties, list of applicable drawings and technical manuals, and technical data must be included on the work requests.

The "package" of individual work requests is distributed in accordance with instructions issued by Commanders of the Atlantic and Pacific Fleets. In general, one copy of the 2K is screened by the cognizant TYCOM (at the screening conference) and a second copy is submitted to the cognizant SUPSHIP for advance planning.

As described above, the Ship's Force will distribute copies of its work request to both the SUPSHIP and the TYCOM. The reviewing authority, TYCOMs, will review all work items and indicate those items (1) to be accomplished by the Ship's Force, (2) to be accomplished by the ship's tender, (3) to be accomplished by the overhaul activity, and (4) to be deferred or canceled. He will next determine which of the items scheduled for overhaul can be performed within the limits of available funds. This is done by assigning a priority number to each. The reviewing authority will establish a planning estimate for the repair work approved that should include a contingency reserve for additional repair work that may be required during the overhaul period and that was not anticipated at the time the work requests were prepared. After completion of this process, the reviewing authority will forward copies of the screened work list to the Ship's Force and the SUPSHIP to include the items he has authorized.

3.5.2 Importance of Work Requests

Preparation of clear, comprehensive, and accurate work request by the Ship's Force is a prerequisite to successful overhaul and repair of the ship. On the basis of these work (or repair) requests, the SUPSHIP job planner prepares the work items for the work to be performed, estimates the costs and time required for the work, and determines and orders the necessary plans and material that the Government will furnish to the contractor. The

job planner, whenever possible, inspects the work to be accomplished on the ship, but inadequate preparation of work requests makes it impossible for him to perform advance planning functions, such as obtaining necessary drawings and technical manuals. Adequate work requests are particularly importtant when, because of operating commitments of the ship, it is necessary to postpone the SUPSHIP planning inspection or to omit it completely.

Planning prior to the availability period has become particularly important because the only supplementary work that can be requested after the start of the availability period is work necessary for the ship to operate. Any additional work that is not necessary for the ship to operate must be reserved until the next regularly scheduled overhaul. The Chief of Naval Operations (CNO) has concurred in this policy as recommended by the Government Accounting Office (GAO).

3.5.3 SUPSHIPs Planners

The major portion of SUPSHIP planning is carried out by job planners. They receive, evaluate, and prepare preliminary estimates for work requests and alteration documents; conduct planning inspections of the ship; initiate requests for drawings, Government Furnished Material (GFM), and technical information and required services; and prepare job order work items and cost estimates for assigned work within their trade cognizance. Job planners specialize in one of five major categories of trade cognizance:

- Hull, which includes structural work, ventilation, stowages, and furniture
- Mechanical, which includes main and auxiliary machinery, hull machinery, and piping systems
- Electrical, which includes electrical systems, lighting, interior communication, fire control, and power
- Ordnance, which includes guns, mounts, directors, and other ordnance equipment
- Electronics, which includes radio, radar, and sonar systems

According to SUPSHIPs Portsmouth, this specialization involves some very technically competent personnel and others with only a basic understanding of the systems involved. Discussions indicated that the planners rely very heavily on the results of pre-overhaul inspections and the Ship's Force input. Coupling this situation with the limited amount of time the planner has available to get the bid specification prepared (55 days) requires that gun weapon system inputs to the authorized SARP be accurately documented and technically correct. Dependence on the SUPSHIP planner to make specific work requests out of generalized ones can result in inadequate bid specifications.

3.5.4 SUPSHIPs Actions Upon Receipt of Work Requests

Upon receipt of work requests, the SUPSHIP Planning Officer or the individual designated as the coordinator will distribute copies to individual

job planners who have previously been assigned cognizance over repair and alteration work in specific trade categories for the specific ship.

SUPSHIP activities should initiate action at this time to acquire any drawings and other technical information necessary for the preparation of work item specifications or for inclusion in the job order "package". In many cases, of course, it will not be feasible to do this until after the SUPSHIP planning inspection, when the job planner determines the drawings or technical information that will be required on the basis of this inspection of the equipment.

When the scope of work can be anticipated with reasonable accuracy before the planning inspection, the SUPSHIP job planner may be able to initiate advance requisitions for GFM that he expects will be required for the work. As in the case of drawings and technical information, however, it will often be difficult to determine this until after the SUPSHIP planning inspection has been concluded.

3.5.5 SUPSHIP Planning Inspection

No matter how comprehensive the work requests prepared by the Ship's Force are, it is essential that SUPSHIP job planners personally inspect the ship before they prepare the work items for proposed overhaul and repair work. During this inspection -- commonly called the SUPSHIP planning inspection -- the job planners (1) inspect all work requests so that they may subsequently prepare work items as clearly, accurately, and completely as possible; (2) as appropriate, check drawings for ShipAlts and OrdAlts against the actual condition of the ship; and (3) conduct any general inspections of shipboard equipment that may be required by the TYCOM or other appropriate authority.

As a general rule, the SUPSHIP planning inspection should take place as soon as practicable after receipt of the work lists which, according to Appendix A, will be 80 days before the start of the ship's availability. This will permit SUPSHIP job planners:

- To review preliminary copies of all work requests.
- To initiate action to secure any drawings that may be required for performance of the overhaul and repair work.
- In many cases, to process additional work requests, or revisions to outstanding work requests, early enough for them to be included in the initial solicitation document for the proposed procurement. When feasible, arrangements should be made to have a representative of the Type Commander at the inspection with authority to approve work list items for accomplishment.

While the above scheduling is desirable, the operating commitments of the ship often make it difficult to attain, and it is common for the SUPSHIP to have to delay the inspection until immediately after receipt of the TYCOM's screened copies of the work requests. Further delay of the planning

inspection may not leave adequate time for the required planning and contracting functions. If delay cannot be avoided, and the planning inspection must be conducted late, SUPSHIP job planners must perform the following work to permit adequate timing for the contractual functions:

- Accomplish as much preliminary planning as possible before inspection, specifically preparation of rough or tentative work items on the basis of information contained in the work requests, and initiation of requisitions for drawings and GFM, if these requirements can be forecast with reasonable accuracy.
- Abbreviate and compress both the planning inspection itself and subsequent SUPSHIP planning functions.

The composition of the planning inspection team will vary according to the nature of the work anticipated and the type and size of ship involved.

For overhauls of a more substantial scope, it is necessary to assign a larger number of planners to the planning inspection team. Each of these planners should have trade cognizance over a major part of the proposed overhaul and repair work. Significant gun system work will usually call for a specialized planner. If the work includes a single "controlling job" of major scope or complexity, the job planner should have a specialized knowledge in the particular trade area involved. This planner may, of course, call on other SUPSHIP job planners or other specialized personnel for assistance in evaluating work outside his trade cognizance as necessary. For example, he may request the assistance of other job planners in inspecting and evaluating specific work items on board the ship, in furnishing him with general technical information and/or in preparing unusual or complex work items.

The SUPSHIP job planner should review previously prepared work items to ascertain if any work item is similar to the work requested by the ship. Also, if the ship was previously overhauled under SUPSHIP, a review of the work items accomplished during that availability could be of assistance in determining the extent of work that may be required to repair a system or a piece of equipment. Any standard work items applicable to this equipment should be reviewed to determine if they cover the scope of the task.

For the gun weapon systems it is very important that the bid specifications are technically correct and comprehensive. The greater the detail on "what is required" and "how to do it" included in gun weapon systems bid specifications, the more confident the responsible maintenance managers can be that the shipyard will know exactly what is required. Imprecise or vague bid specifications can lead to the poor quality workmanship that has been stated to result from private sector overhaul of gun weapon systems.

3.5.6 Specification Structure

All SUPSHIP specifications (referred to as bid specifications) adhere to the same basic format or organization and should comply with the

requirements and policies established by NAVSEA Instruction 9070.1. This instruction establishes the requirement for three types of specifications:

- Standard Items (SIs). Those work specification items that establish uniform methods and standards for routine requirements normally invoked in ship repair specifications. Appendix G lists the Standard Items enclosed in bid packages for FF-1052 Class ships. As the class planning agent, SUPSHIP Brooklyn maintains this package of SIs.
- Standard Work Items (SWIs). Those work specification items that are prepared to cover repair or alteration work frequently occurring in ship repair. These items are prepared or reviewed and approved by the Standardization Committee and must be locally reviewed for applicability.
- Locally Prepared Work Items (LPWI). Those work specification items that must be prepared to suit specific work requirements where applicable SWIs are not available.

Appendix G displays the format for SIs, SWIs, and LPWIs with specific examples of Gun Weapon System work items.

Specific advice regarding the writing of standard work items and locally prepared work items for gun weapon system bid specifications is given below:

- Removal and Shipment to Government Specified Facility. Work items may require the contractor to remove certain items of equipment and ship them to specific Government activities for accomplishment of necessary repairs. These procedures are frequently desirable in the case of highly technical equipment, such as gunsights and gyroscopes. They should be used, however, only when specific activities (i.e., NOS Louisville) have been designated to repair or service such equipments; they should not be used when equipments are to be shipped to subcontractors selected by the prime contractor for the performance of specialized work. Alternatively, the work items may require that the contractor is to provide the services of a manufacturer's field representative to supervise and instruct contractor personnel in the performance of repair work on a specific equipment produced by that manufacturer.
- Open and Inspect Type Work. In many cases it will be impossible to foresee accurately the exact nature of repair that will be required for a specific item of equipment until the item has been disassembled by contractor personnel and inspected. Subsequently, a job order modification will be necessary to cover any additional work found necessary. Unless carefully controlled, however, this practice can result in undesirably high prices for overhaul and repair work and in the extension of availabilities requiring TYCOM approval. Accordingly, where indefinite items of work are concerned, the work

items should be based on the scope of repair work that was found necessary in the past for similar equipments with comparable usage history, such as hours of operating time and conditions of use. In order to provide adequate time for the accomplishment of the additional work, the work item should establish scheduled dates for the contract to provide condition reports which may require corrective action.

- Qualified Products List. It is required that some materials of a specialized nature be procured only from suppliers who have been found qualified to produce or install these materials to Navy standards. The Qualified Products Lists (QPLs) contain lists of all items for which qualified suppliers are required, arranged by military specification number, and indicate the qualified suppliers for each item. In preparing descriptions for work items that will require use of materials shown on a QPL, the job planner should specify that the contractor is to obtain these materials from a supplier on the QPL, and should provide a list of the qualified suppliers from whom the contractor may obtain them.

- Equipment Tests. When tests will be required for equipments after they have been repaired, such tests should be fully described and set forth in the work items. Work items may provide that all tests are to be conducted during normal working hours. Where tests will be elaborate or complex, the job planner may obtain test memoranda from SUPSHIP or Naval shipyard design engineers describing the tests that are to be conducted. The job planner will then incorporate these memoranda in the appropriate work item.

- Dock and Sea Trials. The MSR Contract states that if dock or sea trials are required by SUPSHIP, they are to be specified in the job order. Accordingly, the specifications are to include requirements for such trials if they are considered necessary. Normally, for sea trials the ship is operated by the Ship's Force and the contractor provides a specified number of personnel by trade to be aboard the ship during the trial. SUPSHIP should provide the ship with the list of personnel who will be aboard for the trial. NAVSEA Technical Manual contains further information on dock and sea trials. The requirement for these trials is to specify a scheduled number of days before the completion of work. Normally, the sea trial should be scheduled from four to seven days before the job order completion date to allow for adequate adjustment and correction of defects found during the trial; the dock trial should be scheduled from two to three days before the sea trial for similar reasons.

- Split Responsibility During Equipment Repair. To avoid doubts as to responsibility for completed work and to minimize physical interference and safety hazards, ship's personnel should not work on any unit or system on which the contractor is also working. Therefore, work items should be written so as to require the performance of work by both the Ship's Force and the contractor on the same unit or system. Interim maintenance should be specified where appropriate to ensure that systems being repaired are not allowed to deteriorate while off limits to Ship's Force for preventive maintenance.

- Drawings or Data as Part of Work Item. The specifications must fully describe any requirements for the contractor to provide or revise the drawings and other data which SUPSHIP is responsible to provide.

3.6 ANALYSIS OF GUN WEAPON SYSTEM BID SPECIFICATION DEVELOPMENT

Analyses of the gun weapon system bid specifications prepared for DDEOC Program class ships must be concerned not only with the existing procedures specified to produce a bid specification but also with the enhancement of the overall maintenance support of these systems through better overhauls. The overhaul of DDEOC Program class ships in private shipyards can result in potentially serious maintenance problems for the ship over the extended operating cycle should the desired results not be met. It is widely accepted by those experienced in weapon systems maintenance that shipyards vary to a considerable degree in their gun weapon system depot level maintenance skills. Some shipyards have the experience and facilities to perform top quality weapon system repairs (primarily Navy shipyards) while others are not qualified or able to perform any gun weapon system maintenance or repair work. Many private yards fall into this second category.

The Navy in this case has several options:

- For private yards, choose ships that have small and easy work requirements on their gun weapon system.
- Have special assistance teams and IMA facilities perform as much GWS work as possible before or after the overhaul.
- Allow the private shipyard to bid the ship overhaul package with the GWS work subcontracted to gun system specialists.
- Allow the private shipyard to remove and install selected parts of the GWS that are supplied as rotable Government Furnished Equipment/Material.

The first option would not generally include the DDEOC Program class ships because the requirements and sophistication of the work would not fit it within this general description. The second option was discussed with the TYCOMs and NAVSEACENs. Although it is possible for special assistance teams to conduct some overhaul work, depot level maintenance usually requires depot facilities because of manpower, tooling, and logistic support requirements. The third option is presently being practiced on many ships being overhauled in private shipyards. The lack of resident combat systems technicians in the private shipyards almost mandates the hiring of skilled technicians for the overhaul duration or subcontracting this type of work to companies having the skilled personnel.

The fourth option spans a wide range of complexity and could allow the shipyard to perform some work in the GWS while major refurbishment is accomplished by the Government. The range of complexity extends from removing

and reinstalling the gun mount and GFCS to removing and replacing rotable pool components of such a relatively small size as the gun cradle. Significant technical expertise is still required by the shipyard in this case, but not nearly as much as for the total refurbishment task.

Several topics within the gun weapon system bid specifications preparation procedures were investigated in the course of this analysis. These topics were determined to provide the greatest potential for improving the bid specifications written for gun weapon systems. They are:

- Bid specification review
- Technical Repair Standards
- Gun Weapon System Refurbishment at NOS Louisville
- Test and Certification Requirements
- Government Furnished Material/Equipment

3.6.1 Bid Specification Review

The bid specifications prepared for gun weapon systems should be reviewed. The limited analysis conducted on the standard items and standard work items indicate that they appeared to be adequately specified in the written items. In-depth analyses of these standard items and standard work items should be initiated by the GWSRP. This review should address all sections of the SIs and SWIs, but the primary emphasis should be on references and requirements. These are potential contributors to poorly performed private shipyard work because the shipyards must know exactly what is required and often obtain the "how to accomplish" information from the accompanying references. It is recommended the Standard Items and Standard Work Items for gun weapon systems on DDEOC Program class ships be reviewed by GWSRP-designated technical experts in coordination with the appropriate SUPSHIPs activities.

3.6.2 Technical Repair Standards (TRSs)

Certain high priority components of the gun weapon systems are being planned for rotable pool support. The concept requires the Navy Supply System to stock these components, designated by a 2J Cog number, for issue, and requires the replaced component to be returned for refurbishment. The refurbished component is then retained in the supply system for issue upon request.

To support this rotable pool concept, Technical Repair Standards are being prepared. A TRS explains to a repairman, step by step, how to remove and install these 2J Cog selected components. Currently the cradle arm of the Mk 42 Gun Mount is the only component with a TRS Manual. TRS Manuals are being prepared for the other 2J candidate components of the Gun Weapon System. Under the cognizance of NAVSEA 0432, limited funding for establishing sufficient stocks of the rotable pools and preparing TRS Manuals will delay full implementation of this concept for several years.

The TRSs, if written in sufficient detail, could provide the input for developing new Standard Work Items. The current trend toward accomplishing more overhauls of gun weapon systems in the private shipyards could be significantly assisted by the use of more rotable repair work items. Should future bid specifications be able to reference TRS procedures for the removal, installation, and testing of 2J cog items, the necessity for the private shipyards to do repair work would be reduced. This should enable the private shipyards to perform the gun weapon system overhauls with better results. The rotable pool concept supported by TRSs written into bid specifications could better provide the private sector with the requisite "tools" to perform satisfactory work on gun weapon systems.

3.6.3 Gun Weapon System Refurbishment at NOS Louisville

In the GWSRP, two agencies split the gun system work. A shipyard, in this case private, removes and installs the ship's gun weapon systems and performs acceptance, continuity, and systems tests. The industrial refurbishment activity, NOS Louisville, has gun weapon systems shipped to its plant, inspects and disassembles them to the levels required, and refurbishes and reassembles components including build-up tests and a final system test. NOS Louisville either transports the assembled system/subsystems to the shipyard for installation or stores the refurbished system as a rotable pool item. If the gun weapon system is to be immediately installed in a ship, it is transported to the installing activity. If not, it must be preserved, maintained, and held ready for shipment when requisitioned.

The removal of gun mounts, directors, computers, stable elements, and radar sets for refurbishment at NOS, Louisville, Kentucky, is of particular importance to the GWSRP. Figure 3-2 illustrates this process in which an item specified for turn-around at NOSL is removed by the shipyard, packaged, and shipped to Louisville.

When NOSL receives an item, its procedure is to unpack and begin disassembly of the item. As each component is disassembled, it is inspected to determine if further disassembly is warranted by material condition or ordnance alterations designated for installation by the SARP. Disassembly continues until each remaining assembly is at the lowest level required for refurbishment (but not needlessly disassembled). Parts are replaced, refurbished, or ship altered, then reassembled making appropriate tolerance checks and component tests. In the process of disassembly, inspection, refurbishment, and reassembly, the technicians at NOSL utilize procedures which may or may not be presently incorporated in the SI or SWIs or similar work presently being assigned to the private shipyards. Often there are critical procedures that should be followed in any of the four previously described overhaul steps. These procedures should be incorporated in the "how to do a job" portion of the SIs and SWIs. Without this specificity the private shipyard personnel may overlook required repairs or unintentionally incur more damage to the system or equipment being repaired than originally existed. NOSL expertise and refurbishment procedures should be used to update and revise those gun weapon system SIs or SWIs determined to require this action.

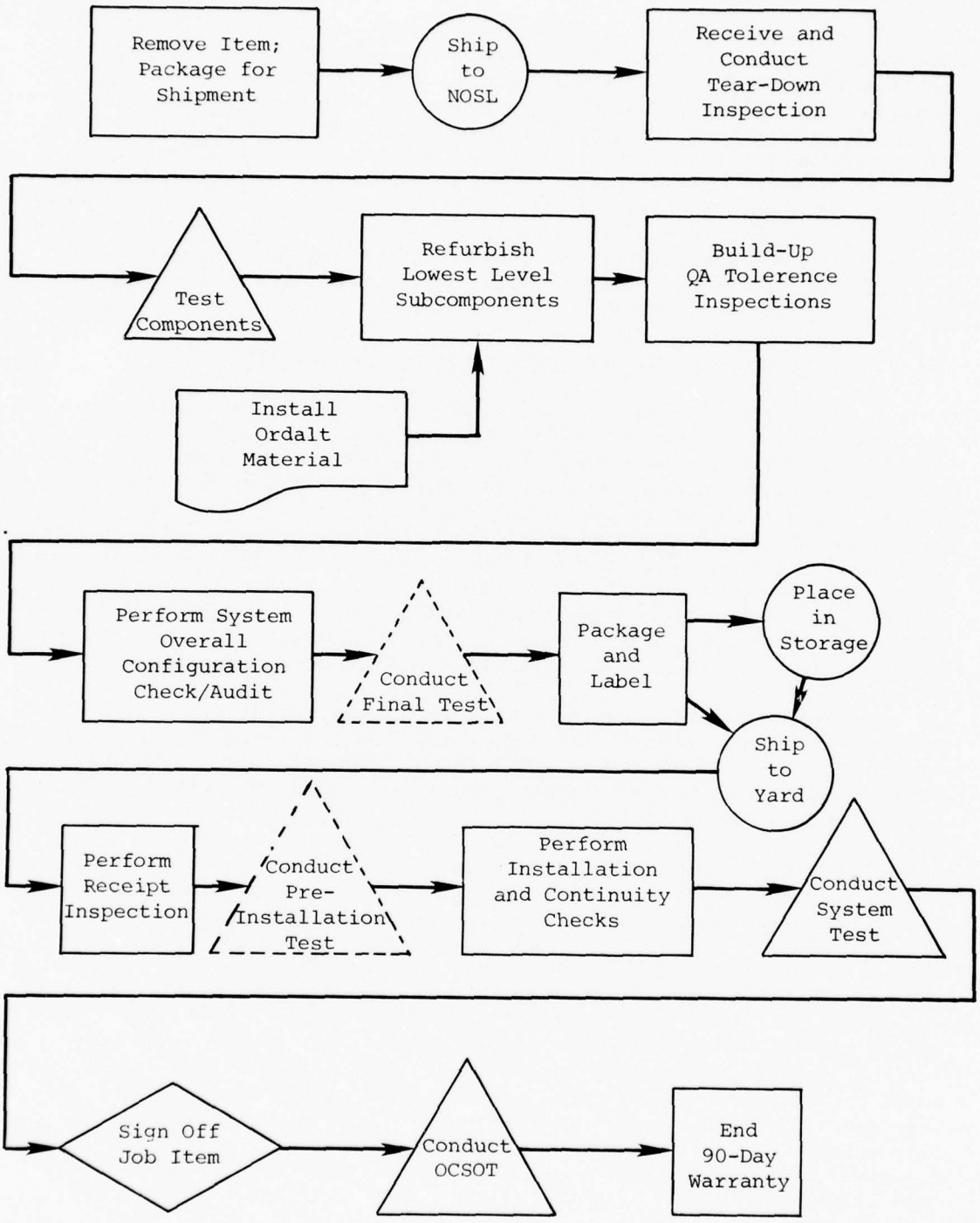


Figure 3-2. MAJOR GWSRP SYSTEM TURNAROUND

3.6.4 Interim Preventive Maintenance

Due to the unique characteristics of gun weapon systems, Navy private shipyards often find it necessary to subcontract all or portions of the gun weapon system to private ordnance specialists. As in shipping the gun system system to a Navy industrial facility (NOS Louisville), packaging, handling, storage, testing, and preventive maintenance procedures must be applied to prevent system damage or deterioriation. ARINC Research recommends that bid specifications require interim preventive maintenance on equipments being held for private shipyard work. The Repair Manual specifically calls for interim maintenance in connection with split responsibility during equipment repair. In spite of this guidance, gun weapon systems have largely been left unattended or to the wits of the Ship's Force during overhaul.

The responsibility for the care of equipments and structures remaining on the ship should be specifically assigned to either the shipyard (in the bid specification) or to the Ship's Forces Overhaul Management System. Although the system cannot be operated fully, certain precautions to prevent damage and deterioration must be taken. An interim PMS package and proper packing, handling, and storage requirements should be included in the bid specification. Packing, handling, and storage procedures at NOS Louisville must ensure that the refurbished system does not deteriorate.

Following delivery and installation of the system in the ship, the responsibility for preventive maintenance must continue. When the job is signed off by the Navy representative, the crew must recognize its immediate responsibility to maintain the system. This includes responsibility for PMS and general awareness of the other work being accomplished that may adversely affect the newly refurbished system, such as access openings being cut into the system's compartment or lack of normal protective systems such as cooling or filtering.

3.6.5 Gun Weapon System Test and Certification

The Mk 68 Gun Director Standard Work Item in Appendix G calls for removal and shipment to NOS Louisville. Notice that paragraph 3.6.3 requires the shipyard to conduct Post-Installation Testing in accordance with OP 3643 Gun Director Mk 68 Installation and NAVSHIP 0967-LP-611-6040 Test and Certification Manual, Test No. 481G11K3010I. The second manual has been superceded by NAVSEA Technical Manual 0967-LP-611-6040, Gun Weapon System Test and Certification Manual for Surface Combatant Ships (Volume 4). In the promulgation letter of this set of Test and Certification Manuals, The Commander, Naval Sea Systems Command, explained its purpose succinctly:

1. The Combat System Test and Certification Manual provides standard policy and direction for the conduct of combat system testing in surface combatant ships. Pre-Overhaul, Industrial Period, and Post-Overhaul testing will be conducted in accordance with the procedures set forth in this manual and associated volumes. The subject manual contains administrative and technical direction

for an orderly approach to the execution and evaluation of combat system tests to determine the condition of the combat system and its components prior to overhaul and to demonstrate material and operational system readiness upon completion of overhaul. Additional volumes provide standard test procedures for each major ship system addressed.

2. The Planning and Engineering for Repairs and Alterations Activity for Cruiser and Destroyers [PERA (CRUDES)] will specify use of the standard test procedures in POT&I Plans and the proposed Ship Alterations and Repair Packages (SARPs) for applicable ships.

Discussions with cognizant persons in the Naval Ship Engineering Command, Ship System Test Section of the Combat System Design and Integration Division, (NAVSEC 6179F) indicate that the Combat System Test and Certification Manual is being used on the FF-1052, DDG-37, and CG-26 Class ships with positive results. Conversations with Pacific Coast shipyards indicate a willingness to support the program because of its uniformity and specific well defined procedures. Final Overhaul Combat System Operability Test (OCSOT) is currently being run with "live" target services (AAW, SUW, and ASW) in Pearl Harbor. It is anticipated by NAVSEC 6179F that the high cost of these services may eventually require a less stringent OCSOT using simulators such as the T-3 trainer in the FF-1052 Class. The results from this philosophy of post-repair testing should provide the quality assurance (QA) needed to ensure the effectiveness of work performed under bid specifications.

3.6.6 Government Furnished Material/Equipment

Often bid specifications provided to the private shipyards will have accompanying tests of Government Furnished Material/Equipment (GFM/GFE) to be provided. For gun weapon systems much of this material is provided directly from NOS Louisville or as a result of NOS Louisville refurbishment actions.

Both TYCOM and GWSRP personnel have reported that contractual claims persist in connection with provided GFM/GFE. When the systems or equipments are installed and checked out, they fail to operate in accordance with specified requirements. Often the private shipyards contend the provided systems or equipment was the cause of the failure, and the government contends the shipyard did not perform the required work properly. This type of claim and counter-claim can be costly and time consuming to the Navy. More important, it does not resolve the basic problem of getting the system or equipment overhauled and operating properly.

Requiring more pre-receipt inspections of systems and equipment could help reduce these claims. There are several ways in which such inspections could serve to certify the material condition and operability of the equipment after completion of refurbishment and before shipping. The recognized alternatives are:

1. Require a shipyard representative to be in attendance during NOSL post-refurbishment testing.

2. Have a designated third party Naval activity (such as the NAVSEACENs) observe the testing and certify the system/equipment material condition and operability.

3. Have a designated third party from the private sector observe the testing and certify the system/equipment material condition and operability.

Each of the alternatives has distinct advantages and disadvantages. ARINC Research believes the first recommendation to be the best. It would require the private shipyard to send responsible and knowledgeable personnel to NOS Louisville to observe and certify the system/equipment to be shipped. This would provide the shipyard with on-site observation of all testing and could provide the observer with valuable information about the upcoming installation of the GFM/GFE. The private shipyards have not favored this procedure in the past, but it should be further reviewed as a possible alternative.

The second alternative would probably be the most easily implemented. The technical talent exists to observe post refurbishment tests at the NAVSEACENs and such other activities as the ISEAs or Naval Shipyards. These technical experts would be relatively unbiased because they are not directly subordinate to NOS Louisville. Additionally, notifying the private shipyards that a third party certification was to be made and would serve to contractually verify GFM/GFE material and operational condition, the private shipyards might be moved toward observing and certifying the GFM/GFE themselves. The one drawback the second method poses is the resistance the private sector might have to a Government activity (i.e., NAVSEACEN) offering impartial representation for the Government in this certification process.

The third alternative has basically the same merits as the second. In addition it would provide unquestionably unbiased representation, because the private concern would not appear to be subject to Navy interests. The disadvantage would be the potential objection from NOS Louisville. That organization has quality assurance personnel who might question the wisdom and cost-effectiveness of hiring private concerns to check up on their work.

In view of those advantages and disadvantages we recommend that an outside Navy activity observe the final NOSL test, in order to provide continuity with pre-installation tests at the shipyard. The system configuration should be verified (considering any OrdAlts that have been installed) and all name plates updated accordingly.

Once items have passed the final NOSL test and tolerances have been confirmed to meet the specifications of the shipyard work items, the items should be carefully packaged and shipped to the shipyard. Shipment should be scheduled to allow sufficient time for pre-installation tests as shown on the shipyard's schedules.

After the equipment has been delivered to the shipyard, a shipyard QA inspection will identify any damage occurring during shipment. The equipment's configuration will be verified and the item given a pre-installation

test, if feasible. This test must be specified in the bid specification to allow observation by the Navy activity observing the final NOSL test. Any discrepancies between the two tests must be resolved and the item repaired before installation, if feasible. Figure 3-2 depicts where these inspections would be included in the turnaround process. Corrective actions necessitated by the shipyard will be grounds for contract modifications. Shipyards that do not have the capability to conduct pre-installation tests on the GWS should conduct a comprehensive receipt inspection. If no evidence of damages from shipment are observed, the equipment should be considered to be in the condition verified upon testing completion at the overhauling activity. Failure of the equipment to operate in accordance with the bid specification package will result in a follow-up analysis by the Navy to determine cause and responsibility.

Items are reinstalled by the shipyard in the ship and checked for continuity, tolerance, alignment, and other interface criteria. The system is subjected to a test when all components and auxiliary services are available and signed off if the job item was satisfactorily completed. The Overall Combat System Operability Test is run in accordance with the contract specifications and may be required before sign-off of large work items. Following sign-off of a job, a warranty period covers the work as specified in the Master Ship Repair Contract.

The recommendation to have a separate Navy activity observe the final NOSL test and the pre-installation test should help reduce claims between the ordnance station and shipyard related to compliance with refurbishment specifications and the material and operating condition of GFE provided by the Navy to private shipyards.

3.6.7 Feedback for Specification Development

As each ship in the DDEOC Program completes an overhaul in a private shipyard, lessons will be learned. In cases where Standard Work Items were applied, they should be validated by the planning SUPSHIP. Suggestions for improvement must be solicited from both the shipyard and the ship, keeping in mind that both of these organizations will be more interested in future commitments. Due to this "what's next" philosophy, the planning SUPSHIP must not rely upon the yard or ship to provide detailed analysis. The follow-up should be formatted to allow timely and accurate evaluation not only of the work performed but of the job requirements and testing called out in the specification.

Twenty days before completion of the overhaul, the Completion/Lessons Learned Conference is scheduled. At this opportunity SUPSHIPs should solicit comments concerning the accuracy of the bid specification. Lines of communication established at this time will facilitate feedback. Comments that can be incorporated as improved procedures or better work items can be written in to subsequent bid specifications. Procedural changes can be documented as changes to the Repair Manual through submission to NAVSEA 074. Improvements in Standard Items and Standard Work Items should be submitted to the Standardization Committee for approval.

3.7 GUN WEAPON SYSTEM BID SPECIFICATION CONCLUSIONS AND RECOMMENDATIONS

Conclusions drawn from this analysis of gun weapon system bid specifications were developed to provide recommended improvements and recommended integration procedures to these specifications. The analysis indicated that the two activities have initiated most of the required integration procedures, but they still need the necessary interfaces.

3.7.1 Conclusions

The following conclusions were reached as a result of this study:

- The guidance provided for preparation of gun weapon system bid specifications is adequate. Coordination of GWSRP review of existing Standard Items and Standard Work Items with appropriate SUPSHIP planners is considered essential to the improvement of gun weapon system bid specifications.
- Technical Repair Standards written and validated for gun weapon system component replacement become essential inputs for bid specification preparation. TRSs written by competent ordnance experts can be used to develop SWIs to be retained by the planning SUPSHIP for classes having the designated equipment.
- Overhaul procedures practiced at NOSL during gun weapon system refurbishment and not presently practiced by the private shipyards but deemed necessary to satisfactory refurbishment are necessary inputs to SWIs. Identification of these maintenance techniques and their incorporation into the appropriate gun weapon system SWI is a method by which bid specifications can detail to private shipyards the exact work required.
- Preventive maintenance required to maintain the gun weapon system for the duration of the overhaul needs to be specified in the SI or SWI. This interim PMS package can be designated as either a Ship's Force or shipyard responsibility. When it is a shipyard responsibility, the bid specification must include the specific requirements.
- The test and certification procedures currently required of and practiced by the private shipyards when they have completed the overhaul of a gun weapon system need to be reviewed by competent GWSRP personnel. Existing programs, such as the Test and Certification Program, provide specific tests that are currently implemented and could be interfaced for bid specification improvement.
- Government furnished equipment and material have been the subject of many contractual claims by the private shipyards. Certification by a Government representative of GFE/GFM upon completion of refurbishment and upon acceptance by the private shipyard could reduce and help resolve these claims.

3.7.2 Recommendations

On the basis of the study conclusions, the following recommendations are offered:

- The gun weapon system SI and SWI should be reviewed by designated technical experts within the GWSRP. This action should be initiated by NAVSEA-0432 and coordinated with SUPSHIP.
- Technical Repair Standards being developed on various gun weapon system rotable pool items should be used as inputs for SWI. NAVSEA-0432 should coordinate this effort with Commanding Officer, SUPSHIP, Jacksonville, Chairman of the Standard Work Item Committee.
- The specific maintenance requirements that define "how to do a job" should be developed for incorporation into those gun weapon system SWIs that call for this information. NOSL experts and procedures should be used in specifying the exact wording to be incorporated in the SWI.
- Preventive maintenance packages should be included in gun weapon system bid specifications. Designated interim PMS should be developed and applied by the SUPSHIP Planner on the basis of inputs received from the GWSRP.
- Test and Certification procedures specified in gun weapon system bid specifications should be reviewed by the GWSRP and updated as necessary. Revised Test and Certification procedures should be interfaced with existing plans called out in programs as the Test and Certification Program.
- Procedures should be established for an independent Government observer (i.e., NAVSEACENs) to verify the operational and material condition of GFE/GFM supplied to private shipyards. Procedures should include the validation of the testing when the refurbishment has been completed at NOSL, the validation of material inspection when the private shipyard receives the equipment, and the corrective actions to be taken upon discovery of damaged or defective GFE/GFM.

CHAPTER FOUR

GUN WEAPON SYSTEM REPLACEMENT PROGRAM COORDINATION

4.1 INTRODUCTION

The objective of the first three-month analysis conducted under this contract was to identify existing and potential areas of interest to both the Gun Weapon System Replacement Program and the Destroyer Engineered Operating Cycle Program and make recommendations for integrating these interests. The principle objective of the second three-month effort was to define the procedures by which two of the highest priority specific areas of interest, gun weapon systems inspections and gun weapon systems overhaul bid specifications, could be improved and better integrated. A continuing objective was to investigate potential areas of further coordination of the two programs. The initial study effort conducted during April, May, and June of 1978 and reported by ARINC Research Publication 1655-01-1-1779 identified specific areas of interest that were recommended for further integration analyses. This chapter extends this study and provides an update on the previously identified specific areas of interest.

4.2 OBJECTIVE

The objective of the effort for the Gun Weapon System Replacement Program coordination was to identify existing and potential areas of interest to both the Gun Weapon System Replacement Program and the Destroyer Engineered Operating Cycle Program implementation and make recommendations for integrating those interests.

4.3 GUN WEAPON SYSTEM REPLACEMENT PROGRAM COORDINATION ANALYSIS APPROACH

The approach followed for this effort was to obtain information about all aspects of both programs while analyzing the two specific interest areas of Tasks One and Two. New information documented new areas of interest. The final phase of this task was the presentation of conclusions and recommendations to update the Gun Weapon System Replacement Program Coordination Study.

4.4 GWSRP COORDINATION EFFORT RESULTS

The analysis conducted during the initial three months of this contract developed several conclusions and recommendations that would be likely to enhance the maintenance management support of gun weapon systems if properly coordinated and integrated between the two programs. From the eight recommendations reached in that analysis GWSRP determined seven warranted continued special coordination efforts.

Additional information acquired during the second three-month effort supported the conclusions and recommendations amplified below:

- Gun Weapon System Inspections. GWSRP assigned a high priority integration effort to the study of these inspections. An analysis has been conducted in this interest area and is presented as Chapter Two of this report. The conclusions and recommendations presented in Chapter Two are subject to program review and possible revision as further engineering efforts are accomplished in support of Gun Weapon System Replacement Program coordination efforts.

- Gun Weapon System Bid Specifications. This study area was also assigned one of the highest priority integration efforts. Chapter Three of this report presents the analysis conducted in this area. The conclusions and recommendations presented in Chapter Three are subject to program review and possible revision as further engineering efforts are accomplished in support of Gun Weapon System Replacement Program coordination efforts.

- GWSRP Rotable Pool Requirements. NAVSEA-0432 is sponsoring efforts to identify GWSRP rotable pool requirements. This NAVSEA-0432 effort has been ongoing over the past two years. While the conclusions concerning GWSRP rotable pool requirements is valid, the recommendation for additional efforts in this area is no longer applicable. Although this interest area has been adjudged not to require additional coordination effort, the following information is offered for GWSRP utilization. Interviews with the GWS inspecting activities indicated a listing of rotable pool items associated with GWSRP managed systems and equipments did not exist at their levels. If such a list does exist updates should be made available to the inspecting activities. For those items that are maintained under a rotable pool, repair philosophy should be available to the inspector so he can indicate the proper maintenance action required for defective components. It is recommended that NAVSEA-0432 provide distribution of a listing of the rotable pool items found on GWSRP systems and equipments. This listing should be updated at least annually.

- Baseline Overhaul (BOH) Requirements. The analysis conducted on gun weapon system bid specification development reinforced the requirement for a well-defined assessment from the GWSRP of the mandatory repairs required during BOH. Definition of these requirements will affect the preparation of Bid Specifications for private shipyard overhaul as well as the requirements stated for overhauls conducted

in Naval shipyards. Feedback from DDEOC Class ships completing their overhauls is now available for utilization in this interest area analysis effort.

- Management Information Systems Data Exchange. Analysis conducted during the period of this report continued to support the finding that incorporation of existing software will provide increased maintenance planning and scheduling data for the management of gun weapon systems within each program. The incorporation of inspection results is but one area that would be encompassed in this information exchange. The results of the MCR, POT&I, and CSRR/T inspections would be submitted to the GWSRP MIS and the DDEOC Program RMMS.

- Material Condition Assessment Procedures Conducted by DDEOC Site Teams. During the period of this report information showed that the manning of the DDEOC site teams has already started on both coasts. As the site teams become fully staffed the implementation and development of MCA procedures will be initiated. Manning levels continued to indicate a paucity of gun weapon system experts within the site teams. This information indicates the time is right to initiate interface for the support, development, and conduct of the DDEOC site team gun weapon systems MCA procedures.

- Class Maintenance Plans. Analysis indicates that incorporation of information from gun weapon system inspections, especially the MCR and CSRR/T, would aid the updating of the DDEOC CMPs. The addition of coordinated GWSRP management and engineering information to DDEOC Class Maintenance Plans to enhance identification of anticipated class maintenance still requires further integration.

- Program Scheduling Requirements. Analysis of the GWSRP and DDEOC Program requirements revealed the desirability of coordinating and phasing the scheduling efforts of both programs. This was further reinforced by the analyses of the gun weapon system inspections and bid specification preparations. Both of these analyses revealed a need for coordination of existing scheduling efforts, especially in relation to pre-overhaul planning, overhaul maintenance actions, inspection procedures, and assignment of private shipyard gun weapon system overhaul actions.

The ongoing effort to investigate potential opportunities for further coordination between the two programs resulted in the identification of information that directly applied to this effort. This information was obtained in the course of analyzing the gun weapon system inspections and gun weapon system bid specifications.

Interviews and documentation analysis identified new requirements that have indicated a potential to enhance overall interface between GWSRP and DDEOC Programs should coordination efforts be initiated. The new integration requirements identified were to (1) update NAVSEAINST 8300.2A to include DDEOC Program coordination effort and (2) analyze the Total Ship

Test Plan (TSTP) and Test & Certification (T&C) Program for direct interface with the GWSRP and the DDEOC Program.

- Updated NAVSEAINST. 8300.2A. Discussions with NAVSEA-0432 revealed that the integration actions developed between the GWSRP and DDEOC Program should be incorporated in appropriate instructions. As integration procedures are developed identifying program participants' responsibilities, the required actions should appear in the appropriate NAVSEA instructions. For designated GWSRP participants, this action would require a revision of NAVSEAINST. 8300.2A. It is recommended that NAVSEAINST. 8300.2A should be revised to include the requirements dictated by the coordination effort between the GWSRP and the DDEOC Program. As other EOC programs are implemented and their maintenance management efforts encompass systems and equipment currently managed by GWSRP, these interfaces should also be incorporated in future revisions of the instruction.

- Analyze TSTP and T&C Program for Integration Published. Investigations of gun weapon system inspections indicated that two programs that may have a significant input on both the GWSRP and DDEOC Program maintenance management of gun weapon systems are: the Total Ship Test Plan and the Test and Certification Program. These two inspection procedures are primarily directed as being post-overhaul actions. There are provisions in both programs for some pre-overhaul inspections. These programs have been developed by NAVSEC and are currently being implemented on both coasts. The potential of these programs to provide augmented support to the GWSRP and DDEOC Programs should be investigated.

4.5 GWSRP COORDINATION STUDY CONCLUSIONS AND RECOMMENDATIONS

The analyses conducted for both portions of this contract confirmed that the coordination of the GWSRP and DDEOC Program would identify specific interest areas that would require integration. Additional new integration requirements should be analyzed to support the overall coordination between the GWSRP and DDEOC Program.

The following conclusions were reached as a result of this study:

- Duplicate similar inspections are being conducted before major overhaul of the Gun Weapon System Replacement Program systems and equipments.

- The complex nature of overhauling gun systems requires that the bid specifications be written with more specific requirements. Substantial reduction in rework should result from more precise bid specifications of the overhaul requirements.

- Baseline Overhaul requirements are designed to include the maintenance and supply actions necessary to restore a DDEOC ship to a condition in which, with a well-engineered and executed maintenance

and supply program, it can be expected to perform satisfactorily over an extended operating cycle. For gun weapon systems, this requires a well-defined assessment from the GWSRP of the repairs required during BOH.

- NAVSEAINST. 8300.2A needs revision to include the integration actions needed for the coordination of the GWSRP with the DDEOC Program.
- Preliminary analysis of the management information systems supporting both programs revealed that incorporation of existing software should provide increased maintenance planning and scheduling for the management of gun weapon systems within each program.
- Enhanced material condition and system readiness of gun weapons systems can be obtained through the application of material condition assessment procedures conducted by DDEOC site teams. GWSRP support of the DDEOC site teams for the development and conduct of MCA procedures could enhance gun weapon system maintenance assessment.
- The addition of GWSRP management and engineering information will enhance the continued accuracy of DDEOC Class Maintenance Plans.
- Procedures and actions required to coordinate the scheduling interfaces between the GWSRP and DDEOC Programs for support of GWSRP systems are needed.
- The TSTP and T&C Program can provide both established testing procedures and valuable information for the GWSRP and DDEOC Programs.
- Continuing engineering and management efforts to support the integration of special areas of interest between the GWSRP with the DDEOC Program appear to be worthwhile.

On the basis of the study conclusions, the following recommendations are offered:

- Develop an inspection procedure for GWSRP systems and equipments that eliminates present redundancy. (Chapter Two of this study presents details and further recommendations on this subject.)
- Develop comprehensive bid specifications for GWSRP systems/equipments that specify the repair requirements for system and equipment overhaul. (Chapter Three of this study presents details and further recommendations on this subject.)
- Develop procedures whereby GWSRP will directly interface with the DDEOC Program in the development and review of BOH requirements. (NAVSEA-0432 should initiate coordination actions.)
- Update NAVSEAINST. 8300.2A to include integration actions for the coordination of the GWSRP and the DDEOC Program. (NAVSEA-0432 should sponsor this effort.)

- Develop procedures to specify the exchange of software and data between the GWSRP and DDEOC management information systems. (NAVSEA-0432 should initiate the effort to be jointly sponsored by NAVSEA-934.)
- Develop procedures for including GWSRP expertise in support of DDEOC site teams. This interface should also include identification of potential gun weapon system candidates for MCA. NAVSEA-0432 should interface directly with NAVSEA-934 for the sponsorship of this effort.
- Establish procedures by which GWSRP can continuously provide support to the engineering efforts used in development and revision of DDEOC Class Maintenance Plans and BOH requirements. (NAVSEA-0432 should sponsor this effort.)
- Develop procedures and actions for the coordination of schedule planning between the GWSRP and DDEOC Programs for support of GWSRP systems. (NAVSEA-0432 should sponsor this effort.)
- Determine the requirements for the interfaces among the TSTP, the T&C Program, and the GWSRP; they will be subsequently coordinated with the DDEOC Program. (NAVSEA-0432 should sponsor this effort.)
- Continue coordination between the GWSRP and the DDEOC Programs. (NAVSEA-0432 should continue to initiate coordination with NAVSEA-934.)

Figure 4-1 projects a schedule of integration study efforts that would allow identified specific interest areas to be analyzed in phase with ongoing efforts within the DDEOC Program. Tasks are listed in approximate order of priority.

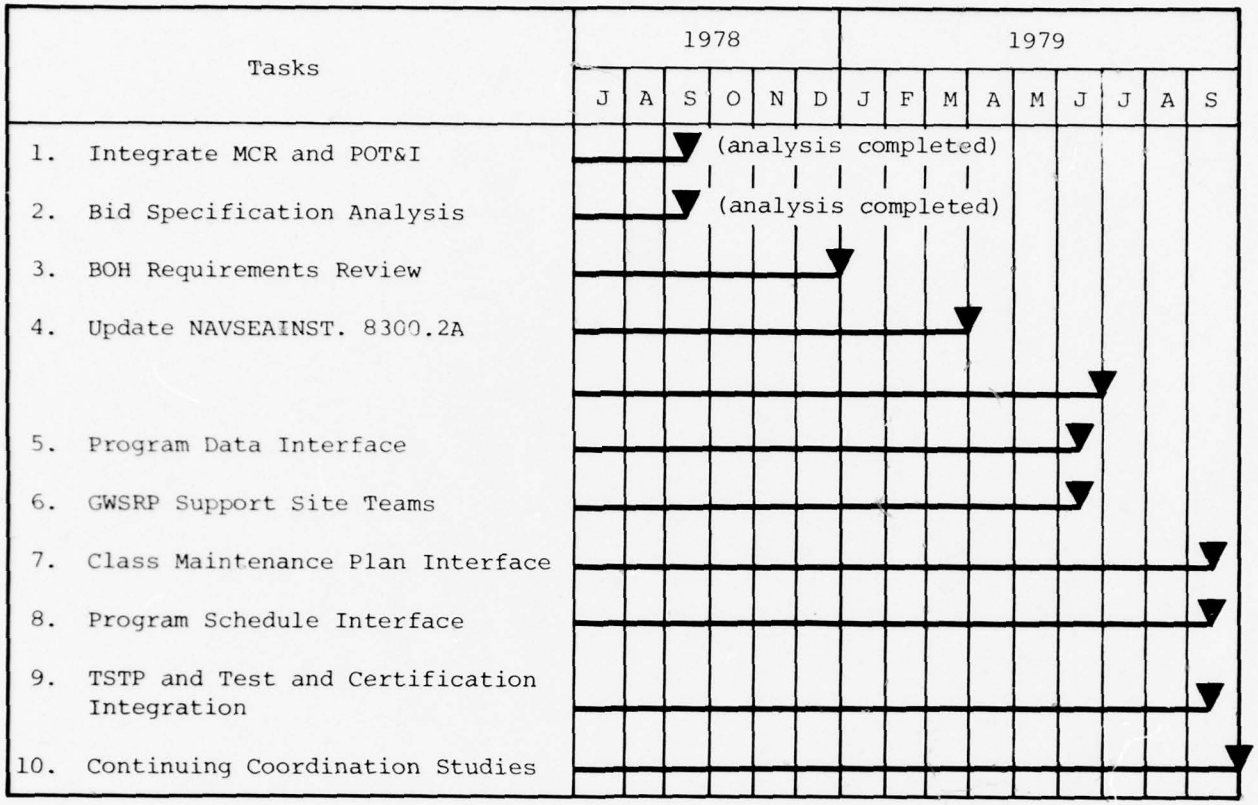


Figure 4-1. PROJECTED COORDINATION STUDY EFFORT SCHEDULE

APPENDIX A

OVERHAUL MILESTONES FOR PRIVATE SHIPYARDS

1. INTRODUCTION

Advance planning for ship overhaul in a private shipyard requires more lead time than one in a Navy shipyard. This appendix explains the critical points and lists in sequence action items beginning 18 months before entering a private shipyard.

2. ADVANCED PLANNING

Since an overhaul in a commercial shipyard (private sector) involves a legal contract with a civilian contractor, a complete and definitive set of work specifications must be prepared to allow competitive bidding, thereby assuring that a repair or alteration is accomplished in a specified time and at minimum cost to the Government. Information for the work specifications and contract is generated by following advance procedures comparable to those followed in preparing for an overhaul at a Naval shipyard. However, milestones listed below marking procedures in preparation for a private sector overhaul occur earlier in the planning cycle than the same milestones before an overhaul in a Naval shipyard.

- A POT&I is completed at about A - 360. The ship performs its portion of the POT&I, but those items designated as shipyard responsibilities will be inspected by a specialized contractor designated by PERA.
- The Preliminary SARP, based on the POT&I Report, is issued at about A - 295. Costs for the work items in the Preliminary SARP will be estimated by the Planning SUPSHIP. (The Planning SUPSHIP is the Supervisor of Shipbuilding, Conversion and Repair, having cognizance over a particular class of ships for construction or overhaul in the private sector. This SUPSHIP will not necessarily be the one who ultimately issues the Invitation For Bid or monitors the overhaul of a particular ship of that class.)
- The Proposed SARP showing the cost estimates associated with individual work items is issued for use at the Work Definition Conference (WDC).
- The WDC is held at about A - 240.

- The Authorized SARP defining the authorized work package is issued at about A - 205.

After the total work package is determined at the WDC and published in the Authorized SARP, Bid Specifications are prepared by the cognizant SUPSHIP and issued to the several contractors who qualify to bid on the work. Before their issuance, however, the ship will participate in a review of the specifications to identify any errors, duplications, or omissions that may have occurred during the translation of authorized work from the SARP to the specification items.

3. PROCEDURE FOR CONTRACT AWARD

The SUPSHIP overhaul work package normally will be made available for open, competitive bids from qualified contractors. A bid is a price submittal from a contractor for which he agrees to accomplish all work in the specification package without qualification. The work package is usually assigned to the lowest qualified bidder. The contractor bases his bid on the specifications and an inspection of the ship. The specifications are work requirements, carefully prepared by the SUPSHIP from the ship's work requests, or those authorized items from a SARP. The specifications and Invitation for Bid (IFB) or Request for Proposal (RFP) spell out what work is to be performed, how the job is to be done if specific procedures are required, and what quality assurance requirements and test procedures the contractor must meet.

If time does not permit a formal Invitation for Bids, Requests for Proposals or Requests for Quotes may be issued. Those requests provide for a negotiation process between the SUPSHIP and the contractor to arrive at a fair and reasonable price for the work to be accomplished.

The sole source award is a method of negotiating a work package directly with a single contractor without advertising. Such contracts can be awarded only when certain criteria are met that preclude competitive advertising or negotiations.

4. PLAN OF ACTION AND MILESTONES (POA&M)

Table A-1 lists the various milestones that apply to pre-overhaul inspections, Bid Specifications, or events that are otherwise germain to this report. Planning for the next overhaul actually begins during the current overhaul, in that items are (1) discovered continuously and placed on the CSMP, (2) ShipAlts and OrdAlts remain outstanding due to funding limitations, and (3) repairs sometimes do not correct problems as well as anticipated. Advanced planning formally begins with the NAVSEA Advance Planning Letter 18 months before the beginning of overhaul. This establishes the initial funding for alterations based on the Fleet Modernization Plan (FMP). Procedures for awarding the contract are based on the authorized SARP (A-205), although preparation of some Bid Specifications can begin sooner on the basis of the preliminary SARP (A-295).

Exact milestone times vary from ship to ship on the basis of ship commitments and other variables. The sequence of events does not allow very much slack in the schedule. Table A-1 was based on the Surface Ship Pre-Overhaul Planning Guide and internal schedules used by SUPSHIPS and PERA (CD) for a contract award 90 days before overhaul. PERA is currently attempting to alter this schedule as indicated by asterisks on Table A-1. The schedule for a 90-day award as given by the current Repair Manual and Change 1 being currently reviewed by NAVSEA 074 is reflected in Table A-1.

Table A-1. MILESTONES FOR PRIVATE SHIPYARD OVERHAULS

Time	Action Activity	Milestone
A - 540	NAVSEA	Provide advance planning letter with initial funding for ShipAlts based on FMP.
A - 480	PERA	Issue Repair Planning Letter with enclosures (POT&I Plan, Baseline SARP, Milestones).
A - 475	PERA	Provide repair planning funds.
A - 470	PERA/TYCOM	Commence identifying long-lead time items for TYCOM Alts and repairs.
A - 465	NAVSEA	Provide Planning Alterations funds to Planning SUPSHIP.
A - 450	TYCOM	Issue ShipAlt Authorization letter.
A - 440	PERA/Ship	Complete CSMP Review.
A - 400	SUPSHIP	Commence ordering material for all TYCOM/PERA identified LLTM for TYCOM Alts and repairs.
A - 375	Ship	Complete Ship's Force POT&I.
A - 360	PERA/Ship	Conduct Underway and Inport POT&I.
A - 340	All Concerned	Conduct POT&I Screening Conference.
A - 310	PERA	Issue POT&I Report (A-345*).
A - 295	PERA	Provide Preliminary SARP for cost estimating*.
A - 280	SUPSHIP	Provide SARP cost estimate*.
A - 265	PERA	Issue Proposed SARP (A - 305*).
A - 250	NAVSEA	Issue 240-day ShipAlt letter (A - 270*).
A - 240	NAVSEC	Issue TMDE SPETERL.
A - 240	PERA/Ship	Generate TMDE Excess/Deficiencies List.
A - 240	All Concerned	Conduct Work Definition Conference (WDC).
A - 232	SUPSHIP	Assign Trade Cog. Codes to WDC SARP.
A - 225	PERA	Publish WDC Report.
A - 205	PERA	Publish Authorized SARP.
A - 180	Planning SUPSHIP	Send complete specification package to Overhaul SUPSHIP for A - 90 day Award.
A - 165	SUPSHIP	Furnish type desk with estimate of funds required (ShipAlts, repairs, special funding).

*Currently being rescheduled by PERA in accordance with ( ) Directions.

(continued)

Table A-1. (continued)

Time	Action Activity	Milestone
A - 170 through A - 120	TYCOM	Provide screened supplementary repair requests. After A - 120 only mandatory emergent work requests will be accepted.
A - 140	TYCOM	Conduct Pre-Arrival Conference.
A - 145	SUPSHIP	Request updated funds amount to cover total cost estimate of overhaul package.
A - 135	SUPSHIP	Issue Invitation for Bid (IFB) and Bid Specifications.
A - 130	PERA/Ship	Review Bid Specifications.
A - 125	Contractor	Conduct Shipcheck.
A - 110	SUPSHIP	Open Bids, Conduct pre-award survey ShipAlts.
A - 90	SUPSHIP	Award contract and advise all concerned of overhaul site.
A - 000	All Concerned	Start Overhaul.
C - 020	All Concerned	Conduct ROH Completion/Lessons Learned Conference.
C - 000	All Concerned	Complete ROH.
C + 075	PERA	Issue Availability Completion SARP.

APPENDIX B

INSPECTION CYCLE

1. NOTIONAL SCHEDULES

The notional schedule is a tool used by COMNAVSURFLANT and COMNAVSURFPAC to plan the activity of the surface ships under their administrative control. It depicts the time span between regular ship overhauls and fits the various known requirements of the ship into the schedule. Figure B-1 represents the proposed Destroyer Engineered Operating Cycle (DDEOC) of 60 months between overhauls using a Pacific Fleet scenario. The top large scale strip schedule displays only major planned events such as overhauls, deployments, and eight-week Selected Restricted Availabilities. Providing a closer look at scheduled events, the smaller scale schedules detail events down to the one week level. Abbreviations used in Figure B-1 are explained in the Glossary (Appendix H).

The Notional Schedule serves as a planning guide; it usually cannot be followed exactly. It does, however, indicate the demands on each ship's time imposed by commitments of maintenance, training, and administration. Type Commander's schedules fit individual ship events into the actual schedule on the basis of many overriding factors, not the least of which is the contingency of real world operations.

The concept behind the 60-month DDEOC is the expectation of increased ship availability over the full life cycle of each ship by having less frequent overhauls. Selected Restricted Availabilities are expected to correct items needing attention during the extended gap between the industrial refurbishments of routine overhauls.

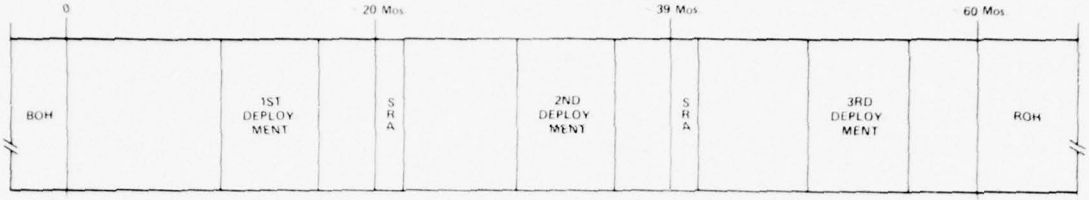
2. GUN SYSTEM INSPECTIONS

Ordnance Systems receive special attention within the Navy. Gun Systems within the DDEOC Program are also subjected to this special scrutiny as are the rest of the ship's combat systems. Special teams visit throughout the ship's life cycle. For the gun systems, these visits represent attempts to accomplish various limited objectives. Of particular interest in this appendix are three types of visits: MCR, CSRR/T, and POT&I.

- MCR. The Material Condition Review is a formal inspection designed to measure the material condition of the gun weapon system. The

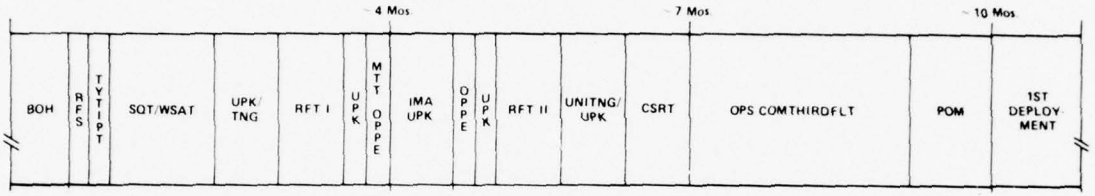
FF 1052 CLASS EOC MAINTENANCE SCENARIO

DDEOC MAINTENANCE SUMMARY



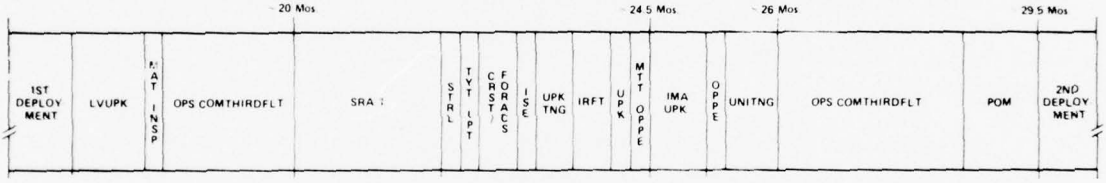
FF 1052 CLASS EOC MAINTENANCE SCENARIO

POST-BASELINE OVERHAUL



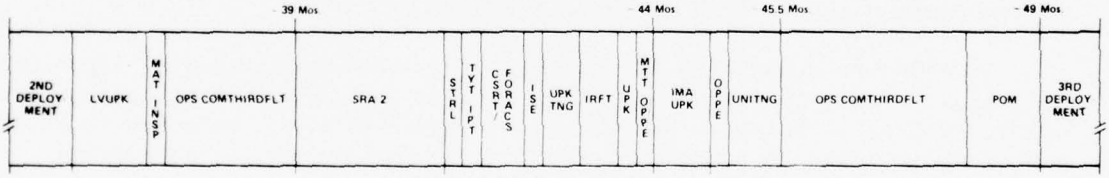
FF 1052 CLASS EOC MAINTENANCE SCENARIO

1ST INTER-DEPLOYMENT



FF 1052 CLASS EOC MAINTENANCE SCENARIO

2ND INTER-DEPLOYMENT



FF 1052 CLASS EOC MAINTENANCE SCENARIO

PRE-REGULAR OVERHAUL

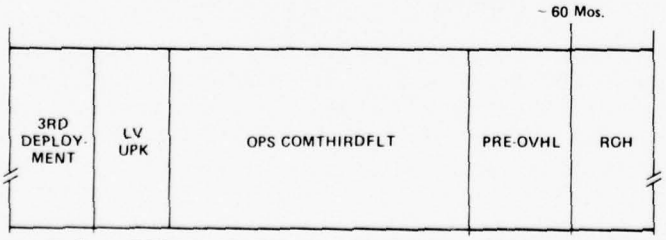


Figure B-1. DDEOC NOTIONAL SCHEDULE (SURFPAC EXAMPLE)

report grades designated portions of the gun weapon system and estimates their remaining service life. Any items requiring corrective maintenance before system refurbishment are also pointed out. An MCR takes from three to five days when accomplished by experienced NAVSEACEN personnel. Data obtained from MCRs are used to compile and update a data base within the GWSRP Management Information System (MIS).

- CSRR/T. A ship will receive either a Combat System Readiness Review (CSRR) in the Atlantic or a Combat System Readiness Test (CSRT) in the Pacific. The goals are similar for each of these inspections, but the philosophy is different.

- CSRR. In SURFLANT, ships are scheduled for two-week reviews, during which a team conducts extensive operational tests on the gun system and reviews and updates the publications (PUBSAT) and supply support (LOGSAT) needed for a deployment. The goals of a CSRR are twofold: (1) to train the ship's crew on these systems, and (2) to make the ship's combat system fully ready in time for an upcoming deployment.

- CSRT. In SURFPAC, ships are scheduled first for a three-day test of their combat system. If major discrepancies are found, it is left to the ship to correct the item. If assistance is needed, it must be requested officially. The goal of the CSRT and a possible follow-up assist visit is, like that of the CSRR, to ready the ship's combat system for an upcoming deployment.

- POT&I. Pre-Overhaul Test and Inspections are conducted in about two weeks by any of several groups. In the case of the DDEOC Program ships, PERA (CD) arranges for the inspection by either NAVSEACEN, shipyard experts, or commercial activities such as QED or Pacific Ordnance. The POT&I is compiled from Repair Inspection Requirements (RIRs) for each specific system. The RIR for Mk 68 GFCSs and Mk 42 Gun Mounts relies heavily on PMS-MRC checks and visual material inspection. POT&I results are submitted in OPNAV Form 4790/2K (2-Kilo) format and constitute a major portion of a ship's overhaul work package.

3. GUN WEAPON SYSTEM INSPECTION SCHEDULING

During each operating cycle, a ship is scheduled to receive three pre-deployment CSRRs and three post-deployment CSRRs. In addition, an MCR is planned for six months before ROH and every three years. The POT&I is conducted about one year before each overhaul. Some of these inspections nearly overlap and their frequency poses a serious burden on the Ship's Force. This problem involves scheduling liaison and inspection support by shipboard personnel and equipment. A CSRR/T requires significant assistance by the crew, and auxiliary services and power are required. Depending on the depth of an MCR, it may also require ships crew and power. Access to controlled spaces will at least require an initial escort aboard ship. The POT&I requires crew assistance and power as well. Performing these inspections simultaneously can save time and personnel resources. Figure B-2 depicts three approximate points in the employment schedule

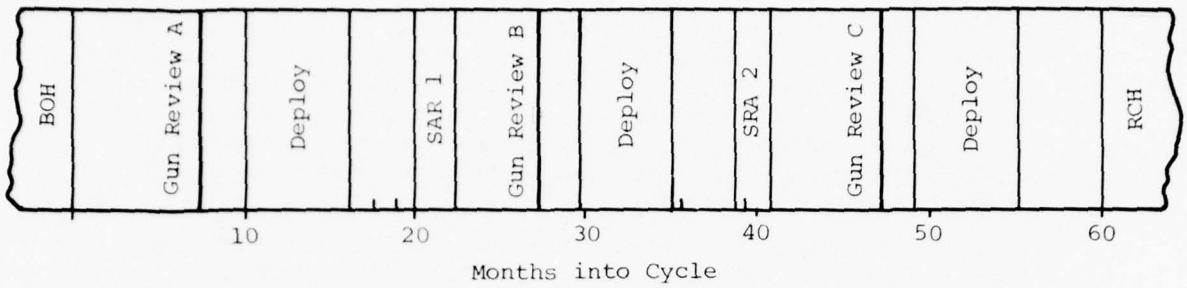


Figure B-2. EOC MAINTENANCE SCENARIO

when a gun weapon system review could occur. Combining the goals of the CSRR/T, MCR, and POT&I, and allowing a single assistance team to conduct the various reviews simultaneously could save resources. In addition, the resulting reports would be consistent, not produced by various private or shipyard activities. A central point of gun weapon system expertise could be maintained much as currently exists at the NAVSEACENs.

Review A - This review should occur at about six months into the cycle, following the BOH and before the first deployment. This Gun Weapon System Review, a CSRR/T, should (1) emphasize the evaluation of overhaul work just finished, (2) bring the system to a fully ready-for-deployment status, and (3) verify supply and technical documentation status. The identifiable work orders for SRA-1 should be entered into the CSMP for use in the notional schedule's Material Inspection (MI) upon return from deployment. Scores for long term GWSRP tracking in MCR format must be provided as well.

Review B - Occurring at 20 months into the EOC, this review is similar to review A, a CSRR/T, except it evaluates SRA work just finished (vice BOH), and corrects logistic problems that may have developed from two years use since Supply Operations Assistance Program and refresher training (REFTRA) assistance. Work Orders for SRA-2 can be formulated in anticipation of the Material Inspection shown in the 37th month of the notional schedule.

Review C - This review is similar to reviews A and B, with particular emphasis on material condition. This review must generate the work package for the upcoming ROH and feed the preliminary SARP. It therefore is most extensive and replaces the gun weapon system sections of the POT&I. This inspection should contain the standard procedures to be developed by the designated technical activities. In the interim, it should combine MCR and POT&I to avoid duplicate checks. Additionally it should carefully identify system configuration planned as a result of overhaul. Equipments to be permanently removed during overhaul should not be inspected.

APPENDIX C

REPAIR INSPECTION REQUIREMENTS FOR POT&I PLANS

1. INTRODUCTION

The POT&I Program provides a means of identifying and documenting deficiencies in ship's systems or equipments. It is designed to take advantage of and enhance the results of existing programs such as the Planned Maintenance System (PMS), Current Ship's Maintenance Project (CSMP), Ship Equipment Configuration Accounting System (SECAS), Coordinated Shipboard Allowance List (COSAL), Fleet Modernization Program (FMP), the Gun Weapon System Replacement Program (GWSRP), and others that assist in defining the Ship Alteration and Repair Package (SARP). The POT&I Report is the base document used to prepare the Proposed SARP, which is the working document of the WDC.

2. POT&I PLANS

POT&I Plans are developed on a ship-class basis. That is, a plan is developed for the class on the basis of the first ship of the class to be overhauled under this program. The class plan is then updated so that it is valid for each subsequent ship before its overhaul.

POT&I Plans are designed to be standard and interchangeable between activities with minimal adjustments for a particular hull. A plan is constructed from individual pages containing the necessary information to conduct a specific test or inspection and the assignment of the accomplishing activity -- Forces Afloat or shipyard. These individual pages are called Repair Inspection Requirements (RIR) pages or sheets (Figure C-1).

A POT&I Plan is developed to identify all tests and inspections, which, when executed and documented, provide inputs to a comprehensive repair work package for ready incorporation into the SARP.

Table C-1 gives a brief explanation of the fifteen elements of an RIR. The RIRs for the Mk 42 Mod 9 Gun Mount and Mk 68 Mod 13 Gun Fire Control System are shown in Figures C-2 and C-3. These systems are found in the FF-1052 Class ships.

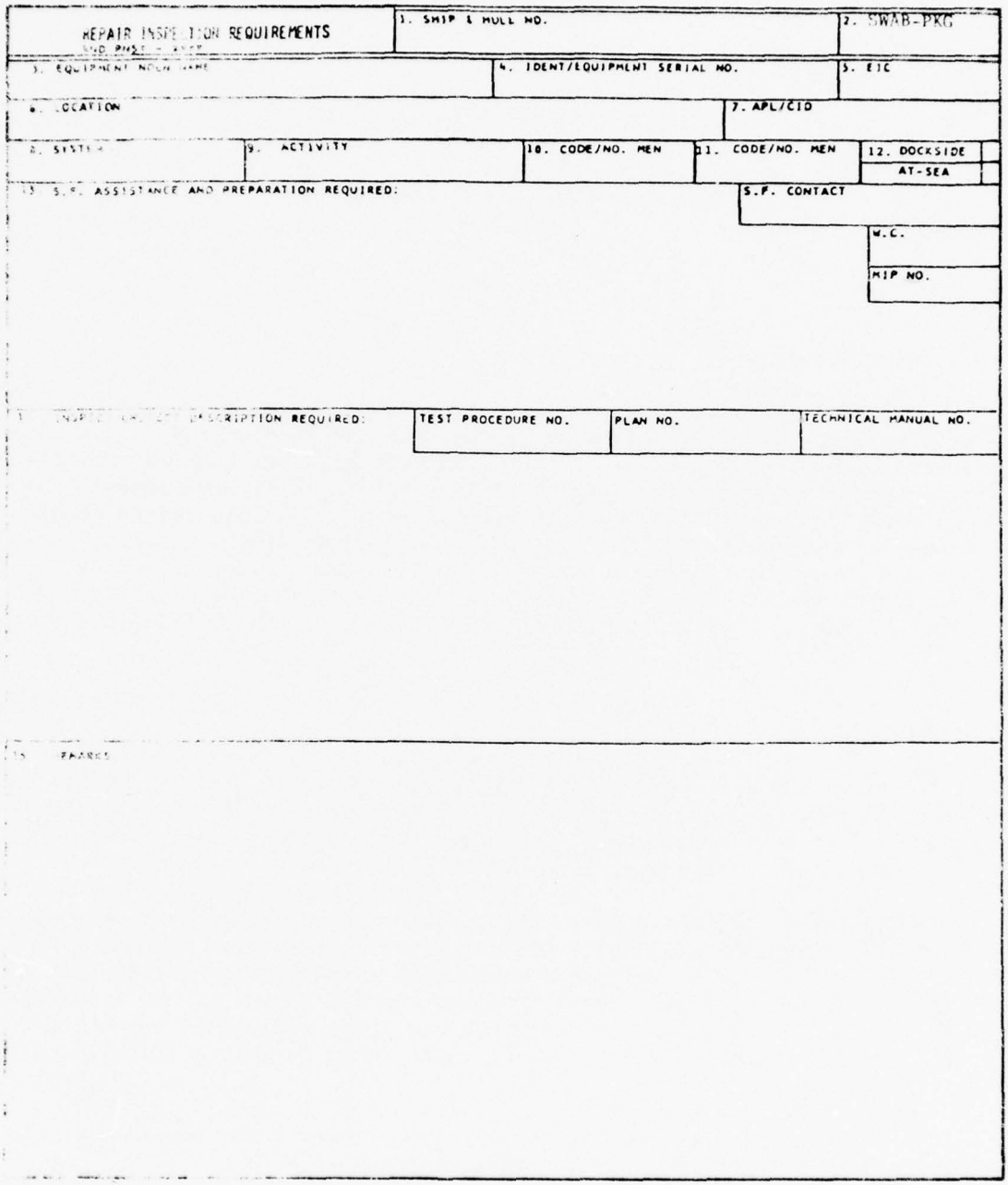


Figure C-1. REPAIR INSPECTION REQUIREMENTS (RIR) PAGE

Table C-1. REPAIR INSPECTION REQUIREMENTS (RIR) INSTRUCTIONS

The POT&I Plan divides the ship into systems for which Repair Inspection Requirements (RIR) are prepared corresponding to the system/equipment identification in the Index. Additional RIR sheets may be added where several similar systems/equipments are on the ship (e.g., Boiler 1A, Boiler 1B, Guided Missile Fire Control System 2, Guided Missile Fire Control System 5, etc.)

The RIR shall document all test/inspection, maintenance and material historical data which is necessary to provide a basis for making recommendations concerning:

a. Whether the system, equipment or component should be overhauled, and

b. The classification (in accordance with NAVSEAINST 4790.1) of repair/overhauls required to permit satisfactory performance throughout the operating cycle following the scheduled overhaul.

Blocks 1-14 (less SF Contact and Work Center) is to be completed during preparation of the POT&I Plan.

The following is a block description of the RIR. Sample RIRs are included for the Gun Mount and Gun Fire Control as POT&I Plan samples.

BLOCK NO.	TITLE	BRIEF
1.	SHIP & HULL NO.	Name of ship & hull number.
2.	SWAB-PKG	Five digit number from Ship Work Authorization Boundaries for Surface Ships 0900-LP-098-6010.
3.	EQUIPMENT NOUN NAME	The noun name of equipment or system. For electronics/weapons equipments/systems use AN or MK/MOD designation.
4.	IDENT/EQUIPMENT SERIAL NUMBER	Identification or equipment serial number of equipment or system in accordance with OPNAV INST 4790.4, Volume II.
5.	EIC	First four (4) digits of the Equipment Identification Code of the equipment or system from the EIC Master Index (MSOD4790.E2579).
6.	LOCATION	Location of Components, Compartment, etc., if known.
7.	APL/CID	Enter APL/CID of equipment being inspected. Leave blank if not applicable.

(continued)

Table C-1. (continued)

BLOCK NO.	TITLE	BRIEF
8.	SYSTEM	The noun name of the SWAB System to which the component belongs.
9.	ACTIVITY	Agency conducting the test or inspection.
10.	CODE/NO. MEN	Code responsible for test or inspection and number of men required.
11.	CODE/NO. MEN	Assist codes and number of men required.
12.	PIERSIDE/AT SEA	Indicate where test or inspection will be accomplished.
13.	S.F. ASSISTANCE AND PREPARATION REQUIRED	Assistance required of Ship's Force during the POT&I, e.g., light off pump for two hours prior, provide machinery history, open manholes, etc.
	S.F. CONTACT/ W.C.	Filled in by Ship's Force during POT&I.
	MIP NO.	Applicable MIP, if any.
14.	INSPECTION/TEST DESCRIPTION REQUIRED (REFERENCES)	A brief description of the test/ inspection requirements. Preferably, the scope of the inspection and associated criteria is to be completely identified on the RIR. If this cannot be specified on the RIR, an attached supplemental checklist is to be used, with the final preference being the requirement of a specific test/inspection procedure. When a checklist or procedure is used, the RIR should state "Accomplish in accordance with attached checklist/plan/reference procedure/ technical manual". ENSURE CRITERIA COVERS CERTIFICATION CONSIDERATIONS IF APPLICABLE.
	TEST PROCEDURE NO./TECH. MAN. NO./PLAN NO.	Insert appropriate identifier in blocks provided for the equipment/ system Technical Manual, and POT&I Test Procedure Number and the Plan Number if applicable.
15.	REMARKS	Space for supplemental information.

PLATE NO. 84516

REPAIR INSPECTION REQUIREMENTS
AND PMSY 9310/8 (REV. 6-77)

1. SHIP & HULL NO.		2. SWAB PEG
		71111
3. EQUIPMENT NOUN NAME	4. IDENT/EQUIPMENT SERIAL NO.	5. EIC
MK 42/9 GUN MOUNT (5"/54)		GB19
6. LOCATION	7. APL/CID	

8. SYSTEM	9. ACTIVITY	10. CODE/NO. MEN	11. CODE/NO. MEN	12. DOCKSIDE	X
MK 68 GFCS				AT-SEA	

13. S.F. ASSISTANCE AND PREPARATION REQUIRED:

1. Provide referenced MRC's with listed tools and equipment.
2. Provide copies of 4790/2K that identify all known discrepancies.
3. Provide ORDALT Status.
4. Make necessary preparation to open and inspect equipment.
5. Assist in test and inspection.

14. INSPECTION/TEST DESCRIPTION REQUIRED:	TEST PROCEDURE NO.	PLAN NO.	TECHNICAL MANUAL NO.
			OP 3851

S. C. CONTACT

M. C.

MIP NO. G-31/9

1. Perform visual inspection of corrosion/rust, missing hardware, physical damage, dirt and foreign matter, electrical damage, moisture and water entry, on the following components:
   a. MK 287/0, MK 286/0 EP1/EP2 Panels (carrier room).
   b. MK 80/2, MK 78/2 EP3/EP4 Panels (gun house).
   c. Electrical connection boxes.
   d. MK 19/2 Train and elevation power drives.
   e. MK 61/10 Shield assembly.
   f. Carriage/stand roller path.
   g. Empty case ejector/empty case tray.
   h. MK 13/1 Gas ejector.
   i. MK 11/2 Breech mechanism.
   j. MK 2/2 Rammer.
   k. Left/right transfer trays.
   l. MK 29/1, MK 29/0 Left/right fuse setters.
   m. Left/right cradles.
   n. MK 2/5, MK 2/4 Left/right upper hoists.
   o. Ammunition carrier.
   p. MK 5/1, MK 5/0 "C"/"D" lower hoists.
   q. "A"/"B" loader drums.
   r. Upper and lower accumulator system.
   s. Telescope/sights.
   t. Recoil/counter recoil-slide area.
   u. Air supply lubricator.
2. Check carrier lower latch ring.
3. Measure gun bore erosion IAW procedures of MRC R-3.
4. Test operate gun loading system, cycle dummy rounds and operate power drives.
5. Check fluid levels and nitrogen/air pressure listed in Table 1.
6. Witness operational tests listed in Table 2.

Figure C-2. SAMPLE RIR [MK 42/9 GUN MOUNT (5"/54)]

PLATE 25300

REPAIR INSPECTION REQUIREMENTS AND PMSY 9910/8 CONT. SHEET	1. SHIP & HULL NO.	2. SWAB PKG 71111
3. EQUIPMENT NOUN NAME MK 42/9 GUN MOUNT (5"/54)	4. IDENT/EQUIPMENT SERIAL NO.	5. EIC GB19
6. LOCATION	7. APL/CID	

TABLE 1

DESCRIPTION
Check upper accumulator fluid level, upper accumulator nitrogen prssure, train and elevation header tank fluid level, and train and elevation accumulator nitrogen pressure.
Check fluid level in cradle-to-slide buffer, and in empty case tray buffer.
Check loader power drive accumulator fluid level, loader power drive accumulator nitrogen pressure, lower hoist power drive accumulator fluid level, and lower hoist accumulator nitrogen pressure.
Check fluid level of recoil cylinders, counterrecoil system air pressure, and counterrecoil system differential cylinder fluid level.
Check fluid levels of train and elevation components.
Check fluid levels of upper hoist gearbox.
Check oil level in fuze setter, and in OMC elevation response gear housing.
Check fluid level of elevation and depression buffers, and carrier control response gear.
Check air pressure in anti-icing system.

TABLE 2

EQUIPMENT	EIC	MIP	MRC	TECHNICAL MANUAL
MK 42/9 Gun Mount (5"/54)	GB19	G-31/9	W-14,Q-1,Q-2, Q-5, R-1, Q-3	OP 3851

Figure C-2. (continued)

PLATE NO. 24516

REPAIR INSPECTION REQUIREMENTS
SBD PMST 9310/8 (REV. 4-77)

1. SHIP & HULL NO.	2. SWAB PEG
	48111

3. EQUIPMENT NOUN NAME	4. IDENT/EQUIPMENT SERIAL NO.	5. CIC
MK 68/13 GFCS		G100

6. LOCATION	7. APL/CIB

8. SYSTEM	9. ACTIVITY	10. CODE/NO. WEN	11. CODE/NO. WEN	12. DOCKSIDE / AT-SEA
MK 68 GFCS				

13. S.F. ASSISTANCE AND PREPARATION REQUIRED:

S. F. CONTACT	0. C.	MIP NO.
		G-36/P1

1. Provide referenced MRC's with listed tools & equipment.
2. Provide copies of 4790/2K that identify all known discrepancies.
3. Make necessary preparation to open and inspect equipment.
4. Provide ORDALT Status.
5. Man required stations/consoles.
6. Assist in test and inspection.

14. INSPECTION/TEST DESCRIPTION REQUIRED:	TEST PROCEDURE NO.	PLAN NO.	TECHNICAL MANUAL NO.
			See Table 1

1. Perform visual inspection of equipments listed in Table 1 and note the following conditions:
   a. Seals and gaskets for deterioration and proper seal.
   b. Hydraulic, pneumatic, hydrostatic, operated components and piping for leaks.
   c. Electrical cables and wiring for deterioration of insulation, loose or broken terminals and connectors.
   d. All units for corrosion, electrolysis, broken, damaged, worn or missing parts.
   e. Verify that bonding and grounding of cabling and equipment have been accomplished IAW MIL-STD 1310( ).
   f. That operating instructions and warning signs are properly posted.
   g. That meters, gauges and test equipment have current calibration stickers.
   h. Missing or broken hardware, lamps and indicators.
   i. Signs of overheated, burned or damaged components.
   j. Interior of units for dirt, corrosion, moisture and wear.
   k. All moveable components for excessive wear, misalignment and lack of lubrication.
2. Metal sound and inspect foundations associated with equipment listed in Table 1 for cracks, deterioration and distortion. Check hold-down bolts for looseness and elongation.
3. Operate equipment as indicated and note any of the following:
   a. Unusual Sounds
      (1) Scraping
      (2) Thumping
      (3) Excessive Bearing Noise
      (4) Gear Chatter
   b. Sluggish Servo Response
   c. Servo Oscillations
4. Perform operational tests listed in Table 1. Use MRC's as required for Testing and Inspection. Delete lubrication and cleaning portion.

Figure C-3. SAMPLE RIR (MK 68/13 GFCS)

PLATE 25300

REPAIR INSPECTION REQUIREMENTS AND PMSY 9310/8 CONT. SHEET	1. SHIP & HULL NO.	2. SWAB PKG 48111
3. EQUIPMENT NOUN NAME MK 68/13 GFCS	4. IDENT/EQUIPMENT SERIAL NO.	5. EIC G100
6. LOCATION	7. APL/C1D	

BLOCK 14 CONTINUED

TABLE 1

EQUIPMENT	EIC	MIP	MRC	TECHNICAL MANUAL
MK 68/3 GUN DIRECTOR	G11K	G-36/P1	M-2,Q-2, S-4,S-5, Q-4	OP 3480
AN/SPG-53A RADAR	G12M	G-139/4	W-1,W-2,M-1, M-2,M-4,M-5 M-6R,M-8,M-9 M-11,M-12R, Q-1	OP 2782
MK 57 TARGET SIGNAL GENERATOR (O/A 6973 INSTALLED)		G-139/4	S-1,W-4,M-10	OP 2782
MK 1/1 RSPE	G142	G-91/2S	W-1,M-1,M-2, M-3,M-4,M-5, M-6,M-7,M-8	OP 2782
MK 47/11 COMPUTER	G17A	G-126/3	D-1,D-2,W-1, M-2,S-1,A-1	OP 3729
MK 154 COMPUTER (O/A 6894 INSTALLED)	G17N	G-139/4	W-3,W-5,M-3, M-7	OP 2782
MK 7/1 ERROR RECORDER	G1RA	G-36/P1	SEE NOTE (1)	OP 2571
MK 16/2 STABLE ELEMENT MK 156/2 CONTROL PANEL	G197	G-36/P1	W-1R,M-4R	OP 4082
MK 7/0 SLIP RING ASSY		G-36/P1	S-1	OP 2414
MK 100 TELESCOPE MK 41 & 75 RANGE FINDER		G-36/P1	M-1,M-5R	OP 1959 OP 2080
MK 2/3 DYNAMIC TESTER	G1R3	G-36/P1	A-1	OP 3297
MK 346/2 COMPUTER TEST SET	G1RB	5ORDO50/1	Q-1,Q-2,Q-3, Q-4,Q-5	OP 3218
MK 14/13 GFC SWBD	G1VE	5ORDOO1/1	S-1R	OP 3545

NOTE: (1) Refer to OP 2571 for Testing and Inspection

Figure C-3. (continued)

APPENDIX D

COMBAT SYSTEM READINESS REVIEW (CSRR)

The CSRR is conducted in accordance with COMNAVSURFLANT Instruction 9093.1. A sample of the Gun Systems Section of the CSRR conducted on the USS SIMS (FF-1059) is included.

Section Number 2

Section Title GUN SYSTEMS

Test Equipment Type	SCAT Code
Depth Micrometer NSN 9Q 5210-00-826-5368	
Multimeter AN/USM 311	4245
Depth Mircometer 0 - 12"	
Feeler gauge 0.010"	
Bore plug gauge SK 85108-90	
Oscilloscope AN/USM-281	4308
Radar Test Set TS-147	4523
Oscilloscope	4312
Test Cartridge	
Projectile Seating Distance Mk 9 Gage (DL3182933)	

2.0 5"/54 GUN MOUNT/MK 68 GUN FIRE CONTROL SYSTEM
(Numbers in parenthesis are test times)

2.1 5"/54 SINGLE MOUNT MK 42 MOD 9
MIP Control No. G-31/9-18

	MR Number:	Description:
a.	W-13 (0.7)	Check train, elevation and main header tank fluid levels. Check lower accumulator fluid level. Check cradle-to-slide buffer fluid level. Check differential piston. Check recoil cylinder fluid level. Check empty case buffer fluid level. Check lubricator fluid level. Check accumulator pressures. Check air pressure in counterrecoil cylinders.
b.	M-2 (0.6)	Check oil level in train and elevation response gears.
c.	M-3 (0.5)	Check oil level of firing cutout assembly. Check oil level of train response gear assemblies.
d.	M-12 (0.3)	Check air pressure in anti-icing system.
e.	W-15 (0.3)	Test local and emergency firing circuits.
f.	Q-2 (2.6)	Check gun loading system mechanical adjustments.
g.	Q-1 (0.2)	Test elevation and depression buffers.
h.	Q-3 (0.5)	Check operation of heating, lighting and ventilation system.
i.	R-1 (1.7)	Perform pre-firing checks.
j.	R-2 (1.0)	Perform post-firing checks.
k.	W-7 (0.5)	Operate gun load system in STEP EXERCISE and SIMULATE MODE.

l.	Q-5 (0.2)	Check anti-icing system.
m.	A-4 (1.0)	Remove hydraulic fluid samples for testing.
n.	R-3 (0.5)	Measure projectile seating distance.

2.2 GUN FIRE CONTROL SYSTEM MK 68 MODS 0 THROUGH 14
MIP Control No. G-36/P1-18

	MR Number:	Description:
a.	W-1R (1.0)	Test operation of stable element and stable element panel.
b.	M-1 (0.2)	Inspect director optics.
c.	M-2 (2.6)	Test regulation of amplifier voltages, align train/elevation pre-amplifiers and amplifiers, test and align cross level amplifiers, test equalizer and handwheel amplifier, test train and elevation velocity servo loops, test and align cross level velocity loop, test and adjust elevation and cross level brake supply voltage.
d.	M-5R (1.0)	Perform helium purity check.
e.	M-4R (4.0)	Perform mechanical and electrical level tests, amplifier test, drift test, midplane test, speed polarity and buckout test and latitude correction polarity test.
f.	Q-1 (1.4)	Inspect director power drives.
g.	Q-2 (0.9)	Check one man control excitation voltage, test transfer aid tachometer, and velocity output of train and elevation power drives.
h.	Q-4 (0.9)	Test operate heaters and defrosters.

i.	S-4 (1.0)	Test director mechanical and electrical stops.
j.	Q-5 (0.3)	Inspect ink and paper supplies.
k.	S-5 (0.3)	Perform TD search programmer pre-operational test, and TC search programmer operational test.
l.	A-1 (0.2)	Test dynamic tester.

2.3 RADAR SET AN/SPG-53A, 53D
MIP Control No. G-139/4-47

	MR Number:	Description:
a.	M-1 (2.3)	Inspect radar unit and Amplifier Mk 76 filters.
b.	M-12R (1.0)	Inspect antenna feedhorn.
c.	W-1 (1.2)	Test magnetron current, L.O. repeller, and tuner, AFC, signal crystal current, electronic control amplifier, A and B video amplifiers (adjust if required), range tracking circuits, range-angle of detector, and range tracking circuits.
d.	W-2 (0.3)	Test power supplies in Unit 4.
e.	M-2 (0.5)	Test and adjust receiver AFC circuits.
f.	M-3 (0.5)	Test 10KYD calibration, maximum AGC and zero range adjustments.
g.	M-4 (0.8)	Calibrate magnetron tuning dial meter and test manual tuning of receiver, beacon AFC operation, receiver anti-jam features.
h.	M-5 (1.1)	Check timing waveforms, linearity of phantastron pulse, and test sweeps.

i.	M-6R (2.0)	Test magnetron filament voltages, high voltage protective circuits, magnetron tuning dial, and measure RF power output and verify high voltage power supply (HVPS) and VSWR.
j.	W-4 (1.5)	Check power supply internal voltage and perform operational check of TSG.
k.	W-5 (0.3)	Perform general operational check.
l.	W-6 (0.3)	Check antenna scanner oil level.
m.	M-8 (0.5)	Measure receiver sensitivity.
n.	M-9 (0.2)	Test low voltage power supplies.
o.	M-11 (0.5)	Test radar interlock circuits, BATTLE SHORT switch.
p.	M-10 (2.0)	Align critical input tracking circuits.
q.	Q-1 (0.7)	Measure time delay of radiate relay and test range slew control, designated range, and main and precision sweep circuits.
r.	W-3 (0.2)	Check range circuits, velocity circuits, and perform auto threshold voltage checks.
s.	M-7 (0.5)	Test low voltage power supplies, VCO dead band adjustment, torque amp calibration, and GFCS synchro reference voltage.

2.4 COMPUTER MK 47 MOD 10 AND 11
MIP Control No. G-126/3-18

	MR Number:	Description:
a.	S-1 (8.0)	Inspect computer amplifier cards, test summing networks for proper grounding, and inspect power supplies.

b.	W-1 (0.8)	Verify calibration of power supplies, test computer time motor, and perform computer sensitivity test.
c.	W-2 (0.4)	Test range limit indicator circuit.
d.	D-1 (0.2)	Perform computer dynamic tests.
e.	D-2/D-2a (1.0)	Perform static A-tests.
f.	M-2 (0.3)	Test local control signal circuit.

2.5 RADAR SIGNAL PROCESSING EQUIPMENT MK 1 MOD 1
MIP Control No. G-91/2S-18

	MR Number:	Description:
a.	Q-1 (0.5)	Test drawer interlocks, and perform visual inspection of cabinet.
b.	W-1 (0.5)	Test all acquisition modes and operation of blanking, and RSPE designation mode.
c.	M-1 (1.0)	Test logic functions.
d.	M-2 (0.8)	Check jamming detector unit 12A4 waveforms and test RSPE A-video, log video, and dead time, RSPE B-video and verify proper video processing and FAST JAM detector.
e.	M-3 (0.8)	Check Third Detector Unit 12A5 waveforms, and test clutter detector, target detector, range acquisition, tracking and blanking.
f.	M-4 (0.2)	Check acquisition and track unit 12A6 waveforms.
g.	M-5 (0.6)	Check acquisition controller acquisition blanking waveforms, and hit counter circuit.

h.	M-6 (0.4)	Check video processor unit 12A8 waveforms, MINIMUM RANGE GATE.
i.	M-7 (0.2)	Check RSPE power supply unit 12A9 voltages.
j.	M-8 (0.7)	Measure radar minimum discernable signal, check active acquisition and tracking sensitivity, passive acquisition and tracking sensitivity, and range meter calibration.

2.6 GUN WEAPON SYSTEMS TEST
MIP Control No. G-T001/2-A7

	MR Number:	Description:
a.	D-1R (0.8)	Test operation of RSPE.
b.	W-4 (0.4)	Perform dynamic test using director, computer and gun mount.
c.	W-5 (0.2)	Test director in console, director officer's and tracker's OMC, and handwheel modes of operation.
d.	M-1 (1.0)	Perform transmission checks of stable element.
e.	M-2 (1.0)	Perform stable element and range-finder transmission tests.
f.	D-2 (0.2)	Test own ship's speed and own ship's course transmission to Computer Mk 47.
g.	Q-1R (1.0)	Test director stabilization.
h.	Q-2 (0.4)	Check alignment of director on its benchmark.
i.	S-1R (0.2)	Test cross-level alignment of trackers telescope.

j.	S-3R (0.5)	Test intra-alignment of director optics in train and elevation.
k.	S-4R (0.5)	Test alignment of tracker's telescope and antenna in train and elevation.
l.	S-5R (1.5)	Test elevation alignment between director and gun mount.
m.	R-7 (0.5)	Tram gun in elevation and train.
n.	S-6R (1.5)	Test train alignment between director and gun mount.
o.	R-6 (1.0)	Perform boresight alignment test.
p.	W-6 (0.3)	Test gas ejector system.
q.	W-2 (0.5)	Perform target designation system readiness test.
r.	W-1R/W-1Ra (0.8)	Perform system test in primary mode.

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A CONTINUATION OF THE GUN WEAPON SYSTEM REPLACEMENT PROGRAM COO--ETC(U)
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APPENDIX E

MATERIAL CONDITION REVIEW PROCEDURES FORMAT

The Material Condition Review (MCR) is conducted on designated gun weapon systems. Inspection booklets have been provided for each system. This appendix contains examples of the component index, procedure check sheet, summary sheet 1, and summary sheet 2. Examples of the component index and upon their check sheets are provided for the Gun Fire Control System Mk 68.

INDEX

PROCEDURE	COMPONENT
1	Director, Mk 68
2	Amplifier, Mk 76
3	Control Panel, Mk 146
4	Amplidyne, Train Elevation Ctrl.
5	Stable Element, Mk 16
6	Stable Element Control Panel
7	Computer, Mk 47
8	Computer, Mk 116
9	Dynamic Tester
10	Error Recorder
11	Dummy Director
12	RSPE Cabinet
13	RSPE Control Panel
14	Radar Console
15	Low Voltage Power Supply
16	High Voltage Power Supply
17	Control Amplifier
18	Transmitter/Receiver
19	Relay Transmitter
20	Rate Transmitter, Mk 36
21	Regulating Transformer
22	Test Set Mk 346
23	Computer Mk 155
24	Line of Fire Monitor (LOFM)
25	Static Test Panel
26	Bearing/Range Indicator (BRI Mk 1)
27	Sychro Sig. Amp. (Range) (SSA Mk 1)

Figure E-1. SAMPLE COMPONENT INDEX

DIRECTOR MK 68 PROCEDURE NO. 1

	CABLE RUNS	ELECTRICAL TEST	CORROSION	DAMAGE, PHYSICAL	DIALS & CONTROLS	EXCESSIVE NOISE	EXCESSIVE VIBRATION	EXCESSIVELY DIRTY	GASKETS & SEALS	HARDWARE	LUBRICATION	OIL LEAKAGE	SWITCHES & RELAYS	TERMINAL BOARDS	WARPED	WATER TIGHT	WEAR EXCESSIVE	WIRING BROKEN
1. SHIELD ASSY																		
2. ANTENNA ASSY																		
3. DEROSYN																		
4. TELESCOPE PARTS																		
5. BASE & CARRIAGE																		
6. TRUNNIONS																		
7. BUFFERS & STOPS																		
8. SLEW DEVICES																		
9. CROSS LEVEL GEARING																		
10. TRAIN DRIVE GEARING																		
11. MK 100 TELESCOPES																		
12. TRANSMIT CABINET																		
13. RANGEFINDER																		
14. [illegible]																		
15. [illegible] CONTROL																		
16. BLOWER																		
17. DRIVE MOTION																		
18. REV RECEIVER REGULATOR																		
19. TRAIN RECEIVER REGULATOR																		
20. CROSS LEVEL R VR REGULATOR																		
21. BRAKES																		
22. SLIP RING ASSY																		
23. TRAIN GEAR BOX																		
24. CROSS LEVEL GEAR BOX																		

Figure E-2. SAMPLE PROCEDURES CHECK SHEET

PROCEDURE 1 (continued)

26. Slip ring electrical contact Marginal _____ Unsat. _____

27. Operation (Composite Director) Marginal _____ Unsat. _____

REMARKS

Figure E-2. (continued)

GFCS MK 68 MOD_____
SUMMARY SHEET 1

SHIP _____ HULL _____ DATE INSPECTED _____

FCS/POSITION/LOCATION NO. _____ FCS SERIAL _____

PROCEDURE NO. & IDENTIFICATION	MATERIAL CONDITION LEVEL				COMPONENT ESL	SERIAL NO.
	1	2	3	4		
1. Director Mk 68						
2. Amplifier Mk 76						
3. Control Panel Mk 146						
4. Amplidyne, TE&C						N/A
5. Stable Element Mk 16						
6. Stable Element Control Panel						N/A
7. Computer Mk 47						
8. Computer Mk 116						
9. Dynamic Tester						N/A
10. Error Recorder						N/A
11. Dummy Director						
12. RSPE Cabinet						
13. RSPE Control Supply						N/A
14. Radar Console						
15. Low-Voltage Power Supply						N/A
16. High-Voltage Power Supply						N/A
17. Control Amplifier						N/A
18. Transmitter/Receiver						
19. Relay Transmitter						N/A
20. Rate Transmitter Mk 36						N/A
21. Regulating Transformer						N/A
22. Test Set Mk 34						N/A
23. Computer Mk 155						
24. Line of Fire Monitor						N/A
25. Static Test Panel						N/A

Figure E-3. SAMPLE SUMMARY SHEET 1

GFCS MK 68 MOD _____
SUMMARY SHEET 1 (CONTINUED)

SHIP _____ HULL _____ DATE INSPECTED _____

FCS POSITION/LOCATION NO. _____ FCS SERIAL _____

PROCEDURE NO. & IDENTIFICATION	MATERIAL CONDITION LEVEL				COMPONENT ESL
	1	2	3	4	
26 Bearing/Range Ind. Mk 7 (TDS Mk 1)					
27 Syncho Signal Amp (Range) (TDS Mk 1)					

REMARKS:

Figure E-3. (continued)

GFCS MK 68 MOD _____
SUMMARY SHEET 1 (CONTINUED)

SHIP _____ HULL _____ DATE INSPECTED _____

FCS POSITION/LOCATION NO. _____ FCS SERIAL _____

SYSTEM MATERIAL CONDITION LEVEL (MCL) _____ (CURRENT CONDITION)

SYSTEM-LEVEL EQUIPMENT STATUS (BASED ON ADEQUATE MAINTENANCE, INCLUDING RECOMMENDED SUBASSEMBLY REPAIR/REPLACEMENT). ESTIMATED SERVICE LIFE (ESL) _____

REMARKS:

RECOMMENDED SUBASSEMBLY REPLACEMENT (INCLUDE MK & MOD)

UNIT	FSN	APL

RECOMMENDED NEXT INSPECTION DATE _____

COMPLETED BY _____ DATE _____

Figure E-3. (continued)

GFCS MK 68 MOD ____
SUMMARY SHEET 2

SHIP _____ HULL _____ DATE INSPECTED _____

FCS POSITION/LOCATION NO. _____ FCS SERIAL _____

SUMMARY OF NECESSARY REPAIRS:

COMPLETED BY _____ DATE _____

SHIPS POINT OF CONTACT _____

RANK _____ TITLE _____

Figure E-4. SAMPLE SUMMARY SHEET 2

APPENDIX F

NAVY 3-M DOCUMENTATION

1. INTRODUCTION

The Navy Material Maintenance Management (3-M) System is crucial to the pre-overhaul inspection process. Three elements of the 3-M System of particular interest in this report are (1) the OPNAV Form 4790/2K Ship Maintenance Action Form (2-Kilo), (2) OPNAV Form 4700-3 Maintenance Index Pages (MIP), and (3) the OPNAV 4700-1 Maintenance Requirement Card (MRC).

Examples of these documents are provided in this appendix for pertinent systems.

2. SHIP MAINTENANCE ACTION FORM (2-KILO)

Explanation of the various elements of this form can be found in OPNAVINST 4790.4. The form is the basic document for reporting corrective maintenance and deferred maintenance. It is widely used by the Navy and is mandatory format for submitting POT&I discrepancies for inclusion in the POT&I Report and subsequent SARPs. A sample 2-Kilo is provided as the first figure in this appendix.

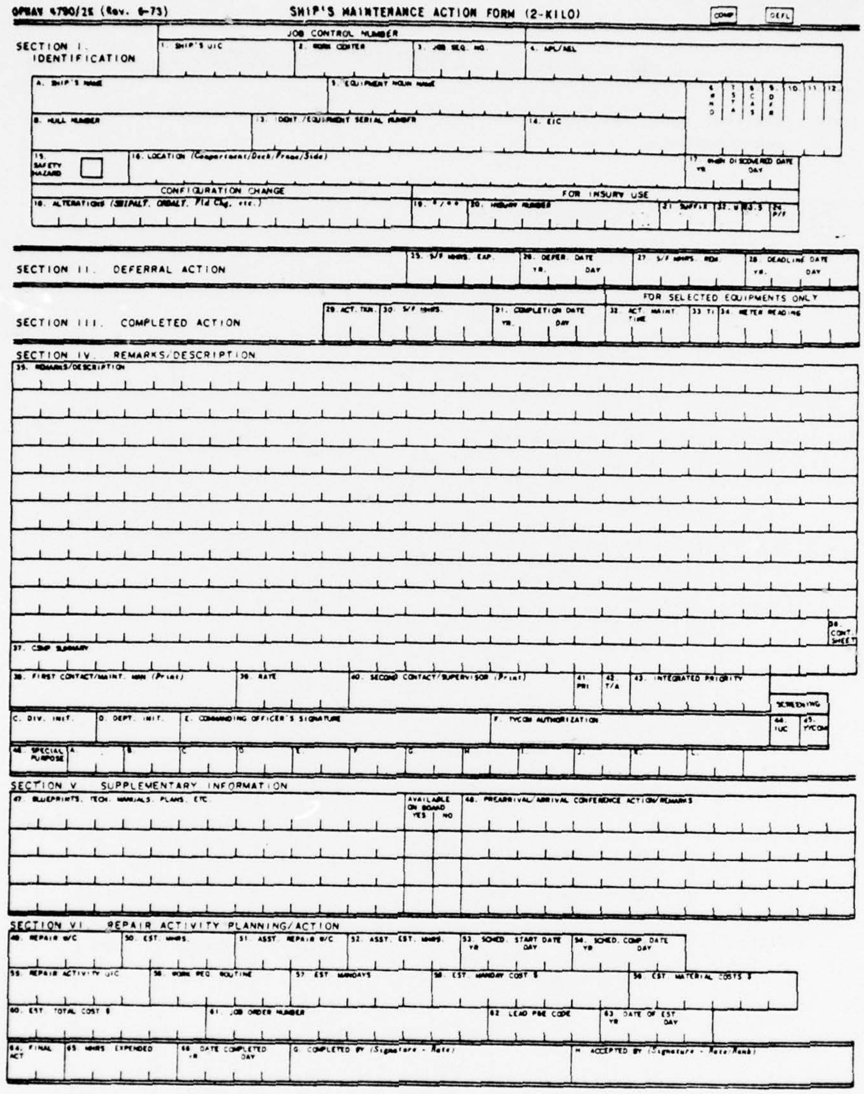
3. MAINTENANCE INDEX PAGES

Each system, subsystem, or component under the 3-M System has a MIP which lays out the Preventive Maintenance System (PMS) for that item. MIPs reference MRCs by control number, describe the maintenance action required, assign periodicity of performance, establish the general skill level by rating, estimate expected man-hours per rating, and reference any related MRCs. The MIPs for two major gun weapon systems in the FF-1052 Class ships are included in this appendix with each one followed immediately by a selected MRC from the MIP.

4. MAINTENANCE REQUIREMENT CARD

For each maintenance action assigned on the MIP, an MRC is filed in the work center. Each MRC gives the information listed on the MIP plus safety precautions, tools, parts, materials, test equipment, and the

detailed procedure for performing the maintenance action. This appendix includes: (1) the MIP for the Mk 42 Mod 9 Gun Mount plus the MRC for the fifteenth weekly requirement (W-15) test firing circuits, and (2) the MIP for the Mk 68 GFCS plus the MRC for the fifth semi-annual requirement S-5 test TD Search Programmer of the Mk 68 director. These two tests were selected to provide examples of both gun mount and fire control procedures using the MRC format. These tests are also called out in the CSRR Plan and POT&I Plan and are good examples of duplication of pre-overhaul inspections.



OPNAV 4790/2K (Rev. 6-73) SHIP'S MAINTENANCE ACTION FORM (2-KILO) COMP DEFL

SECTION I. IDENTIFICATION

JOB CONTROL NUMBER

1. SHIP'S UIC | 2. WORK CENTER | 3. JOB SEQ. NO. | 4. APL/AEL

A. SHIP'S NAME | 5. EQUIPMENT NOUN NAME | 6. WHEN DISCOVERED | 7. STATUS | 8. CAS | 9. DEFER | 10. | 11. | 12.

B. HULL NUMBER | 13. IDENT./EQUIPMENT SERIAL NUMBER | 14. EIC

15. SAFETY HAZARD | 16. LOCATION (Compartment/Deck/Frame/Side) | 17. WHEN DISCOVERED DATE YR DAY

CONFIGURATION CHANGE | FOR INSURV USE

18. ALTERATIONS (SHIPALT, ORDALT, Fld Chg, etc.) | 19. S/O/C | 20. INSURV NUMBER | 21. SUFFIX | 22. U | 23. S | 24. P/F

SECTION II. DEFERRAL ACTION

25. S/F MHRS. EXP. | 26. DEFER. DATE YR. DAY | 27. S/F MHRS. REM. | 28. DEADLINE DATE YR. DAY

SECTION III. COMPLETED ACTION

FOR SELECTED EQUIPMENTS ONLY

29. ACT. TKN. | 30. S/F MHRS. | 31. COMPLETION DATE YR. DAY | 32. ACT. MAINT. TIME | 33. TI | 34. METER READING

SECTION IV. REMARKS/DESCRIPTION

35. REMARKS/DESCRIPTION

36. CONT. SHEET

37. CSMP SUMMARY

38. FIRST CONTACT/MAINT. MAN (Print) | 39. RATE | 40. SECOND CONTACT/SUPERVISOR (Print) | 41. PRI | 42. T/A | 43. INTEGRATED PRIORITY

SCREENING

C. DIV. INIT. | D. DEPT. INIT. | E. COMMANDING OFFICER'S SIGNATURE | F. TYCOM AUTHORIZATION | 44. IUC | 45. TYCOM

46. SPECIAL PURPOSE | A. | B. | C. | D. | E. | F. | G. | H. | I. | J. | K. | L.

SECTION V. SUPPLEMENTARY INFORMATION

47. BLUEPRINTS, TECH. MANUALS, PLANS, ETC. | AVAILABLE ON BOARD YES NO | 48. PREARRIVAL/ARRIVAL CONFERENCE ACTION/REMARKS

SECTION VI. REPAIR ACTIVITY PLANNING/ACTION

49. REPAIR W/C | 50. EST. MHRS. | 51. ASST. REPAIR W/C | 52. ASST. EST. MHRS. | 53. SCHED. START DATE YR DAY | 54. SCHED. COMP. DATE YR DAY

55. REPAIR ACTIVITY UIC | 56. WORK REQ. ROUTINE | 57. EST. MANDAYS | 58. EST. MANDAY COST $ | 59. EST. MATERIAL COSTS $

60. EST. TOTAL COST $ | 61. JOB ORDER NUMBER | 62. LEAD PBE CODE | 63. DATE OF EST YR DAY

64. FINAL ACT | 65. MHRS. EXPENDED | 66. DATE COMPLETED YR DAY | G. COMPLETED BY (Signature - Rate) | H. ACCEPTED BY (Signature - Rate/Rank)

Figure F-1. OPNAV 4790/2K, SHIPS MAINTENANCE ACTION FORM

SYSTEM SUBSYSTEM OR COMPONENT	REFERENCE PUBLICATIONS	DATE
Mount, 5/54 Sgl RF Mk 42 Mod 9	OP 3347 OP 3851 OD 3000 OD 45531 SURWARSYSTECHBUL GUNM-34	April 1976

CONFIGURATION (THESE MAINTENANCE REQUIREMENTS ARE APPLICABLE TO EQUIPMENT IN WHICH THE FOLLOWING CHANGES HAVE BEEN ACCOMPLISHED)

NOTE: See last entry for applicable ORDALTs covered in this and previous developments.

SYSCOM MRC CONTROL NO.	MAINTENANCE REQUIREMENT	PERIODICITY CODE	SKILL LEVEL	MAN HOURS	RELATED MAINTENANCE
75 DLDN W	MOUNT 1. Clean, inspect, and lubricate training internal gear. 2. Clean, inspect, and lubricate elevating arc. 3. Inspect gun house for water accumulation.	W-1 **	GMG3 GMGSN	1.6 1.6	None
44 DHSQ W	HOIST MK 5 MODS 0 and 1 1. Lubricate lower sprocket housing and loaders. 2. Lubricate carrier lower latch.	W-2 **	GMG3 GMGSN	0.5 0.5	None
74 DLXD W	SLIDE MK 31 MOD 2 1. Lubricate transfer trays.	W-3 **	GMG3 GMGSN	0.5 0.5	W-6
74 DJFQ W	CARRIAGE MK 35 MOD 3 1. Lubricate carrier and center column.	W-4 **	GMG3 GMGSN	1.0 1.0	W-9
	NOT USED	W-5			
A3 DGFP W	RAMMER MK 2 MOD 2 1. Lubricate rammer.	W-6 **	GMG3 GMGSN	0.4 0.4	W-3
	NOT USED	W-7			
75 DLDQ W	MOUNT 1. Lubricate fuze setter. 2. Clean breechlock guides. 3. Lubricate housing.	W-8 **	GMG3 GMGSN	0.5 0.5	W-10
73 DFPK W	HOIST MK 2 MODS 4 and 5 1. Lubricate upper hoists, cradles, and cradle control cylinders.	W-9 **	GMG3 2GMGSN	1.0 2.0	W-4

(Page 1 of 6)

MAINTENANCE INDEX PAGE — SYSCOM MIP CONTROL NUMBER G-31/9-46

OPNAV FORM 4790-3 (A) (REV. 6-71)

(continued)

Figure F-2. SAMPLE MIP (MOUNT, 5/54 SGL RF, MK 42 MOD 9)

SYSCOM MRC CONTROL NO.	MAINTENANCE REQUIREMENT	PERIODICITY CODE	SKILL LEVEL	MAN HOURS	RELATED MAINTENANCE
A3 DGFT W	GUN BARREL MK 18 MOD 1 1. Clean, inspect, and lubricate gun bore and chamber. 2. Clean, inspect and lubricate empty case ejector door linkage.	W-10 **	GMG3 GMGSN	0.5 0.5	W-8
	NOT USED	W-11			
	NOT USED	W-12			
46 DNTW W	MOUNT 1. Check train, elevation, and main header tank fluid levels. 2. Check lower accumulator fluid level. 3. Check cradle-to-slide buffer fluid level. 4. Check differential piston. 5. Check recoil cylinder fluid level. 6. Check empty case buffer fluid level. 7. Check lubricator fluid level. 8. Check accumulator pressures. 9. Check air pressure in counterrecoil cylinders.	W-13 **	GMG1 GMG3 GMGSN	0.7 0.7 0.7	None
46 DNTX W	MOUNT 1. Clean gun port shield. 2. Operate gun load system in STEP EXERCISE and SIMULATE MODE.	W-14 **	GMG2 GMG3 GMGSN	0.3 0.5 0.5	None
46 DNTY	MOUNT 1. Test local and emergency firing circuits.	W-15 **	GMG2 GMG3 GMGSN	0.3 0.3 0.3	None
46 DNTZ M	MOUNT 1. Lubricate slide components and trunnions. 2. Lubricate housing. 3. Lubricate fuze setter fuze pots. 4. Lubricate rammer.	M-1 **	GMG2 GMG3 GMGSN	4.0 4.0 4.0	W-6 W-8 W-10
74 DJKN M	MOUNT 1. Lubricate train and elevation power drives. 2. Check oil level in train and elevation response gears.	M-2 **	GMG3 GMGSN	0.6 0.6	M-3

(Page 2 of 6)

(continued)

Figure F-2. (continued)

SYSCOM WRC CONTROL NO.	MAINTENANCE REQUIREMENT	PERIODICITY CODE	SKILL LEVEL	MAN HOURS	RELATED MAINTENANCE
75 DLDU M	FIRING CUTOUT MK 1 MOD 1 1. Check oil level of firing cutout assembly. 2. Check oil level of train response gear assemblies.	M-3 **	GMG3 GMGSN	0.5 0.5	M-2
46 DNUA M	HOIST MK 5 MODS 0 and 1 1. Lubricate lower hoists and loaders. 2. Lubricate carrier lower latch. 3. Clean and lubricate lower hoist air motor latch release valve.	M-4 **	GMG3 GMGSN	1.0 1.0	W-2
46 DNUB M	MOUNT 1. Lubricate right and left upper hoists. 2. Lubricate carriage.	M-5 **	GMG2 GMG3 GMGSN	1.0 1.0 1.0	W-4 W-9
46 DNUC M	SHIELD MK 61 MOD 10 1. Inspect gun port seal assembly. 2. Lubricate OMC station components. 3. Lubricate shield door hinges. 4. Lubricate ventilation components.	M-6 **	GMG2 2GMGSN	0.8 1.2	W-14
73 DFPT M	CARRIAGE MK 35 MOD 3 1. Lubricate base ring and trunnion support components.	M-7 **	GMG3 GMGSN	0.5 0.5	None
46 DNUD M	MOUNT 1. Lubricate transfer trays and empty case tray. 2. Lubricate case ejector.	M-8 **	GMG3 GMGSN	0.5 0.5	W-3 W-6
75 DLDX M	HOIST (UPPER) MK 5 MODS 4 and 5 1. Lubricate cradles.	M-9 **	GMG3 GMGSN	0.4 0.4	W-9
75 DLDY M	STAND MK 2 MOD 2 1. Lubricate water seal shield, thrust, and radial bearings.	M-10 **	GMG2 GMG3 GMGSN	1.5 1.5 1.5	W-1
75 DLDZ M	MOUNT 1. Check air pressure in anti-icing system.	M-11 **	GMG3	0.3	None
75 DLEA M	MOUNT 1. Lubricate center plate of loader drums.	M-12 **	GMG3 2GMGSN	0.3 0.6	None

(Page 3 of 6)

MAINTENANCE INDEX PAGE (MIP) SYSCOM MIP CONTROL NO. G-31/9-46
OPNAV FORM 4790-3 (C) (REV. 6-71)

(continued)

Figure F-2. (continued)

SYSCOM MRC CONTROL NO.	MAINTENANCE REQUIREMENT	PERIO-DICITY CODE	SKILL LEVEL	MAN HOURS	RELATED MAINTE-NANCE
46 DNUE Q	MOUNT 1. Test elevation and depression buffers.	Q-1 **	GMG3 GMGSN	0.2 0.2	None
75 DLEB Q	MOUNT 1. Check gun loading system mechanical adjustments.	Q-2 **	GMG2 GMG3	2.6 2.6	None
75 DLEC Q	MOUNT 1. Check operation of heating, lighting, and ventilating systems.	Q-3 **	GMG3 GMGSN	0.5 0.5	None
75 DLED Q	MOUNT 1. Replace filter elements in train and elevation auxiliary relief valve blocks.	Q-4 **	GMG1 GMG3 GMGSN	0.8 0.8 0.8	None
75 DLJY Q	MOUNT 1. Check anti-icing system.	Q-5 **	GMG3	0.2	M-11
75 DLEE Q	MOUNT 1. Lubricate Thomas flexible couplings and shaft splines.	Q-6 **	GMG3 GMGSN	1.0 1.0	None
44 DHVL S	MOUNT 1. Lubricate train power drive coupling. 2. Lubricate train and elevation auxiliary relief valve assemblies.	S-1 **	GMG3 GMGSN	0.8 0.8	M-2 M-3
46 DNUF S	MOUNT 1. Clean, inspect, and adjust air supply lubricator on upper and lower gun loading systems. 2. Lubricate OMC station components.	S-2 **	GMG3 GMGSN	1.2 1.2	None
75 DLEG S	MOUNT 1. Replace filter elements in main accumulator (PA & PS). 2. Replace filter elements in fuze setters. 3. Clean filter elements in lower accumulator systems.	S-3 **	GMG1 GMG3 GMGSN	1.6 1.6 1.6	Q-4

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MAINTENANCE INDEX PAGE (MIP) SYSCOM MIP CONTROL NO. G-31/9-46
OPNAV FORM 4700-3 (C) (REV. 6-71)

(continued)

Figure F-2. (continued)

SYSCOM WRC CONTROL NO.	MAINTENANCE REQUIREMENT	PERIODICITY CODE	SKILL LEVEL	MAN HOURS	RELATED MAINTENANCE
46 DNUG S	MOUNT 1. Clean, inspect, and lubricate control panels.	S-4 **	GMG3 GMGSN	1.0 1.0	None
	NOT USED	S-5			
C2 DEQB A	MOUNT 1. Remove hydraulic fluid samples for testing.	A-1 **	GMG3 GMGSN	0.5 0.5	None
75 DLXF A	TRAIN RECEIVER-REGULATOR MK 53 MOD 0 1. Lubricate train receiver-regulator.	A-2 **	GMG1 GMGSN	0.5 1.0	None
75 DLXG A	ELEVATION RECEIVER-REGULATOR MK 54 MOD 0 1. Lubricate elevation receiver-regulator.	A-3 **	GMG1 GMGSN	0.5 1.0	None
46 DNUH R	MOUNT 1. Perform prefiring checks. NOTE: Perform this MR to determine mount readiness for firing.	R-1 **	FTG3 GMG1 2GMG2 GMG3 GMGSN	0.3 1.7 3.4 1.7 1.7	None
A3 DGGR R	MOUNT 1. Perform post-firing checks. NOTE: Perform this MR after firing.	R-2 **	GMG3 2GMGSN	1.0 2.0	None
A3 DGGS R	MOUNT 1. Measure bore erosion. NOTE: Perform this MR as required or after firing 50 equivalent service rounds, or when it is anticipated that the next firing will bring the total rounds fired since last measurement to more than 50.	R-3 **	GMG3 GMGSN	0.5 0.5	None
C2 DEQH R	SHIELD MK 61 MOD 10 1. Clean OMC blister. NOTE: Perform this MR as required.	R-4 **	GMGSN	1.0	None
	** A management aid: All GM rated personnel performing this MR should be qualified in accordance with NEC Code GM-0876 as defined in NAVPERS 15105-VI.				

MAINTENANCE INDEX PAGE (MIP) SYSCOM MIP CONTROL NO. G-31/9-46
OPNAV FORM 4700-3 (C) (REV. 4-71)

(continued)

Figure F-2. (continued)

SYSCOM MIP CONTROL NO.	MAINTENANCE REQUIREMENT	PERIODICITY CODE	SKILL LEVEL	MAN HOURS	RELATED MAINTENANCE
	ORDALTS: 6062, 6730, 6745, 6939, 7475, 7566, 7651, 7659A, 7682, 7828, 7828A, 7843, 7844, 7845, 7846, 7857, 7944, 8041, 8044, 8046, 8071, 8078, 8080, 8081, 8082, 8085, 8087, 8089, 8091, 8097, 8098, 8099, 8100, 8101, 8107, 8158, 8244.				

MAINTENANCE INDEX PAGE (MIP) SYSCOM MIP CONTROL NO. C-31/9-46
OPNAV FORM 4700-8 (C) (REV. 6-71)

Figure F-2. (continued)

SYSTEM	COMPONENT	MRC CODE
Gun	Mount, 5/54 Sgl RF Mk 42	G-31 W-15

SUBSYSTEM	RELATED MAINTENANCE	RATES	M/H
Mount, 5/54 Sgl RF Mk 42	None	GMG2	0.3
		GMG3	0.3
		GMGSN	0.3

MAINTENANCE REQUIREMENT DESCRIPTION

1. Test local and emergency firing circuits.

TOTAL M/H 0.9
ELAPSED TIME 0.3

SAFETY PRECAUTIONS

1. Observe safety precautions as contained in OP 3851.
2. Dangerous voltage is present in EP2 panel.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

1. 6" Light duty screwdriver
2. Sound-powered phone (3)
3. Alligator clip jumper
4. Multimeter, AN/USM 311 (SCAT 4245)

PROCEDURE

NOTE 1: Report all discrepancies to maintenance group supervisor.

Preliminary

a. Verify breechblock is up.
b. Position the following switches to SAFE; remove and retain switch handles during maintenance.
   (1) LOWER ACCUMULATOR MOTOR SAFETY SWITCH (SMX 15) on EP1 panel.
   (2) UPPER ACCUMULATOR MOTOR SAFETY SWITCH (SMX 16) on EP1 panel.
c. At EP2, establish communications with gun mount safety observer and OMC operator.

1. Test Local and Emergency Firing Circuits.

WARNINGS: Dangerous voltage is present in EP2 panel.

a. Test firing circuit electrical resistance:
   (1) At EP2, connect multimeter, set to ohms, between EP2-56-7 and EP2-56-8.

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DMTY

LOCATION	DATE	MC
	April 1976	

MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4790-1 (A) (REV. 3-73)

(continued)

Figure F-3. SAMPLE MRC (GUN MOUNT, 5/54 SGL RF, MK 42)

(2) At breechblock, connect jumper wire from firing pin cable connector to firing ground connection on slide.
(3) Verify multimeter reads less than 1 ohm.
(4) Remove multimeter.

b. At breechblock, connect multimeter, set to AC volts, between firing pin cable connector and firing ground connection on the slide.

c. Test local firing circuit from OMC station:
(1) At EP2:
(a) Position SMZ4 to LOCAL FIRING.
(b) Verify FIRING ZONE CLEAR and READY TO FIRE indicators come on.
(2) At OMC, close firing key.
(3) At EP2, verify FIRING ORDERED and MISFIRE indicators come on.
(4) At breechblock, verify multimeter reads between 18 and 22 VAC.
(5) At OMC, release firing key.

d. Test emergency firing from EP2:
(1) At breechblock, set multimeter to read DC volts.
(2) At EP2:
(a) Position SMZ4 to EMERG FIRING.
(b) Verify FIRING ZONE CLEAR and EMERGENCY FIRING READY indicators come on.
(c) Press EMERGENCY FIRING SWITCH and hold depressed.
(d) Verify MISFIRE indicator comes on.
(3) At breechblock, verify multimeter reads between 13 and 17 VDC.
(4) At EP2, release EMERGENCY FIRING SWITCH.
(5) At breechblock, disconnect multimeter.
(6) Return safety switch handles to control panels.

e. Return equipment to normal condition in accordance with ship doctrine.

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DNTY

W

MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4700-1 (E) (REV. 3-69)

Figure F-3. (continued)

FCS, Gun Mk 68 Mods 0, 1, 3, 4, 5, 6, 8, 9, 10, 11, 13, 14,	OP 1[illegible], OP 2208, OP 2[illegible], OP 2571, OP 2648, OP 2649, OP 3480, OP 3643, OP 3644, OP 3836, OP 4081, OD 3000	January 19[illegible]

NOTE: See last entry for applicable ORDALTs covered in this and previous developments.

SYSCOM MRC CONTROL NO.	MAINTENANCE REQUIREMENT	PERIODICITY CODE	SKILL LEVEL	MAN HOURS	DELAYED MAINTENANCE
16 DNCL W	STABLE ELEMENT MK 16 STABLE ELEMENT PANEL MK 156 1. Test operation of stable element panel. 2. Test operation of stable element. NOTE: Perform these maintenance requirements only when ship is at dockside or in calm water.	W-1R	FTG2 FTGSN	1.0 1.0	None
16 DNCM M	TELESCOPE MK 100 RANGE FINDER MK 41 and 75 1. Inspect director optics.	M-1	FTGSN	0.2	None
16 DNCN M	DIRECTOR MK 68 1. Test regulation of amplifier Mk 76 voltages. 2. Test and align train and elevation preamplifiers. 3. Test and align elevation and train aplifiers. 4. Test and align cross level amplifiers. 5. Test equalizer and handwheel amplifier. 6. Test train velocity servo loop. 7. Test elevation velocity servo loop. 8. Test and align cross level velocity loop. 9. Test and adjust elevation and cross level brake supply voltage.	M-2	FTG2 FTGSN	2.6 2.6	None

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MAINTENANCE INDEX PAGE — SYSCOM MIP CONTROL NUMBER G-36/P1-16

OPNAV FORM 4700-3 (A) (REV. 6-71)

(continued)

Figure F-4. SAMPLE MIP (FCS, GUN, MK 68 MODS 0,1,3,4,5,6,8,9,10,11,13,14)

SYSCOM MIP CONTROL NO.	MAINTENANCE REQUIREMENT	PERIODICITY CYCLE	SKILL LEVEL	MAN HOURS	REMARKS
16 DRCP M	DIRECTOR MK 68 1. Clean and lubricate ports, hatches, and open sight. 2. Clean and lubricate rubbing strips, cross-level gear segment, and output pinion. 3. Lubricate antenna mount. 4. Lubricate director train pinion and rack. NOTE: Perform this maintenance requirement monthly and at lesser periodicity when ship is underway.	M-3R	FTG3	2.5	None
	NOT USED	M-4			
	NOT USED	M-5			
	NOT USED	M-6			
	NOT USED	M-7			
	NOT USED	M-8			
	NOT USED	M-9			
75 DKYA M	RANGEFINDER MK 75, MK 41 1. Perform helium purity check. NOTE: Perform this MR monthly and immediately after recharging rangefinder.	M-10R	FTG3 FTGSN	1.0 1.0	None
	NOT USED	M-11			
	NOT USED	M-12			
	NOT USED	M-13			
	NOT USED	M-14			
	NOT USED	M-15			
	NOT USED	M-16			

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MAINTENANCE INDEX PAGE (MIP) SYSCOM MIP CONTROL NO. G-36/P1-16
OPNAV FORM 4790-3 (C) (REV. 6-71)

(continued)

Figure F-4. (continued)

16 DNCQ M	STABLE ELEMENT MK 16 STABLE ELEMENT PANEL MK 156 RATE TRANSMITTER MK 36 1. Perform mechanical level test. 2. Perform amplifier test. 3. Perform electrical level test. 4. Perform drift test. 5. Perform midplane test. 6. Perform speed polarity and buckout test. 7. Perform latitude correction polarity test. NOTE: Perform these maintenance requirements only when ship is at dockside or in calm water.	M-17R	FTG2 FTGSN	2.0 2.0	None
16 DNCR Q	DIRECTOR MK 68 1. Inspect and lubricate director amplidynes. 2. Inspect director power motors and tachometers. 3. Lubricate defroster blower motor.	Q-1	FTG2	1.5	None
16 DNCS Q	DIRECTOR MK 68 1. Check one-man control excitation voltage. 2. Test transfer aid tachometer. 3. Test velocity output of train and elevation power drives.	Q-2	FTG2 2FTG3	0.9 1.8	None
16 DNCT Q	DIRECTOR MK 68 1. Clean, inspect and lubricate director components.	Q-3	FTG3 FTGSN	2.1 2.1	None
16 DNCU Q	DIRECTOR MK 68 1. Inspect and clean defroster blower filters. 2. Inspect and clean radar transmitter exhaust duct and screen. 3. Test operate heaters and defrosters. 4. Check illumination circuits.	Q-4	FTGSN	1.0	None
75 DKXP S	SLIP RING ASSEMBLY MK 7 1. Clean, inspect, and test slip ring assembly.	S-1	FTG2 FTG3	8.0 8.0	None

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MAINTENANCE INDEX PAGE (MIP) SYSCOM MIP CONTROL NO. G-36/P1-16
OPNAV FORM 4790-3 (C) (REV. 6-71)

(continued)

Figure F-4. (continued)

SYSCOM MIP CONTROL NO	MAINTENANCE REQUIREMENT	FEPTC DILITY CODE	SKILL LEVEL	MAN HOURS	
16 DNCV S	STABLE ELEMENT PANEL MK 156 STABLE ELEMENT MK 16 RATE TRANSMITTER MK 36 1. Clean, inspect and lubricate stable element panel and stable element. 2. Clean, inspect and lubricate rate transmitter.	S-2	FTG3 FTGSN	1.0 1.0	None
72 DDBR S	ERROR RECORDER MK 7 1. Clean and lubricate error recorder.	S-3	FTG3	0.3	None
16 DNCW S	DIRECTOR MK 68 1. Test elevation mechanical stops. 2. Test cross-level mecahnical stops. 3. Test elevation electrical limit stops. 4. Test cross-level electrical limit stops.	S-4	FTG3 2FTGSN	1.0 1.0	None
P1 DNTB S	DIRECTOR MK 68 1. Perform TD search programmer pre-operational test. 2. Perform TC search programmer operational test. NOTE: Delete this MRC if ORDALT 4251A is not installed.	S-5	3FTG3	0.9	None
75 DKXS S	DIRECTOR MK 68 1. Lubricate antenna mount gear housing. 2. Lubricate director train gearbox. 3. Lubricate director cross-level gearbox.	S-6	FTG3	4.0	None
75 DMAG S	DYNAMIC TESTER MK 2 1. Clean, inspect, and lubricate dynamic tester. 2. Test dynamic tester.	S-7	FTG3 FTGSN	1.0 0.2	None
	NOT USED	A-1			

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MAINTENANCE INDEX PAGE (MIP) SYSCOM MIP CONTROL NO. G-36/P1-16
OPNAV FORM 6700-3 (C) (REV. 6-71)

(continued)

Figure F-4. (continued)

SYSCOM MIP CONTROL NO	MAINTENANCE REQUIREMENT	PERIODICITY CODE	SKILL LEVEL	MAN-HOURS	SPECIAL SUPPORT REQUIRED
75 DMAH A	DIRECTOR MK 68 1. Inspect access covers to cross-level gearbox 2. Inspect cross-level gearbox compartment. NOTE: Perform this MR annually or at lessor preiodicity when ship has experienced heavy seas or heavy rain.	A-2R	FTGSN	1.0	None
16 DNCX C	DIRECTOR MK 68 1. Lubricate director elevation gearing. 2. Clean, inspect, and lubricate train brake unit. 3. Lubricate director officer's one-man control. 4. Lubricate director officer's handwheel bracket. 5. Lubricate tracker's one-man control. 6. Lubricate tracker's handwheel bracket. 7. Inspect, clean, lubricate, and test cross-level stowing device assembly.	C-1	FTG3 FTGSN	4.0 4.0	None
	NOT USED	C-2			
16 DNCY C	TELESCOPE MK 100 1. Clean and lubricate telescope port closure latch handles.	C-3	FTGSN	1.0	None
16 DNDK R	ERROR RECORDER MK 7 1. Inspect ink and paper supply. 2. Clean the ink pens. 3. Calibrate the error recorders. NOTE: Perform this MR before use of the recorder. ORDALTS: 1461, 3608, 3867, 4215, 4227, 4233, 4251, 4251A, 4276, 4409, 4476, 4685A, 4730, 5036, 5752, 6012, 6317, 6336, 6672, 6672A1, 7650, 7946, 7969	R-1	FTG3	0.5	None

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MAINTENANCE INDEX PAGE (MIP) SYSCOM MIP CONTROL NO. G-36/P1-16
SPWAY FORM 4700-3 (C) (REV. 6-71)

(continued)

Figure F-4. (continued)

SYSTEM	COMPONENT	MRC CODE
Gun	Gun Director Mk 68	G-36 S-5

SUBSYSTEM	RELATED MAINTENANCE	RATES	M/H
FCS, Gun Mk 68 All Mods.	None	3FTG3	0.9

TOTAL M/H 0.9
ELAPSED TIME 0.3

MAINTENANCE REQUIREMENT DESCRIPTION

1. Perform TD Search Programmer pre-operational test.
2. Perform TD Search Programmer operational test.

SAFETY PRECAUTIONS

1. Observe safety precautions contained in Safety Summary of OP 3480.

TOOLS, PARTS, MATERIALS, TEST EQUIPMENT

1. Stopwatch
2. Sound-powered phones (3)
3. 6" Normal duty screwdriver
4. 7/16" Spintite wrench
5. Safety tag

PROCEDURE

NOTE 1: Delete this MRC if ORDALT 4251A is not installed.

NOTE 2: All switch and lamp references are located on Control Panel Mk 47 unless otherwise specified.

NOTE 3: Report all discrepancies to maintenance group supervisor.

Preliminary

a. At Control Panel Mk 146, position 440 VAC circuit breaker to ON.
b. Place stable element rate transmitter power switch to OFF and tag.
c. Open chassis of rate transmitter, remove dust cover, and insert zeroing pins.
d. Establish phone communications between director, plot, and Target Designation Station. (TDS, WDE or NTDS as installed.)
e. Energize director and radar to STANDBY condition.

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P1

DNTB

S

LOCATION	DATE
	January 1976

MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4700-1 (8) (REV. 3-69)

(continued)

Figure F-5. SAMPLE MRC (FCS, GUN, MK 68, ALL MODS)

1. Perform TD Search Programmer Pre-Operational Test.
   a. Place SEARCH PATTERN switch to NORMAL.
   b. Turn PROGRAMMER POWER switch to ON and verify:
      (1) POWER ON lamp is lit.
      (2) NORMAL PROGRAM lamp is lit.
      (3) SEARCH PROGRAM ZEROED lamp will light within 10 sec.

NOTE 4: Read completely next step before performing.

   c. Depress test switch. Release after SEARCH PROGRAM ZEROED lamp goes out and verify:
      (1) NORMAL ROTATION lamp is lit.
      (2) After 10±0.1 sec SEARCH PROGRAM ZEROED lamp is lit and NORMAL ROTATION lamp goes out.
   d. Depress and release TEST switch as in previous step.
   e. Push PROGRAM STOP switch down to the STOP position then release and verify PROGRAM STOPPED lamp is not lit.
   f. Depress and hold programmer test switch.

NOTE 5: Programmer Test switch should remain depressed during the rest of the programmer pre-operational tests.

   g. After 2 sec have elapsed push PROGRAM STOP switch to the STOP position. Release and verify:
      (1) PROGRAM STOPPED lamp is lit.
      (2) NORMAL ROTATION lamp is not lit.
   h. Push PROGRAM STOP switch upward to the RESTART position and verify:
      (1) PROGRAM STOPPED lamp is not lit.
      (2) NORMAL ROTATION lamp is lit.
   i. Push SEARCH ROTATION switch to REVERSE and hold. Then verify:
      (1) NORMAL ROTATION lamp is not lit.
      (2) REVERSE ROTATION lamp is lit.
   j. Release SEARCH ROTATION lever which will return to NORMAL and verify:
      (1) NORMAL ROTATION lamp is lit.
      (2) REVERSE ROTATION lamp is not lit.
   k. Depress PROGRAM STOP switch then release.
   l. Push SEARCH ROTATION switch to REVERSE and hold. Then verify:
      (1) REVERSE ROTATION lamp is lit.
   m. Release SEARCH ROTATION lever and verify:
      (1) REVERSE ROTATION lamp is not lit.
      (2) PROGRAM STOPPED lamp is lit.
   n. Release programmer TEST switch and verify:
      (1) PROGRAM STOPPED lamp goes out.
      (2) NORMAL ROTATION lamp is lit.
      (3) Within 10 sec SEARCH PROGRAM ZEROED lamp is lit.

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MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV [illegible] (REV. 9-69)

(continued)

Figure F-5. (continued)

o. Position SEARCE PATTERN switch to ELLIPSE and verify:
(1) NORMAL PROGRAM lamp is not lit.
(2) ELLIPSE PROGRAM lamp is lit.
p. Return SEARCH PATTERN switch to NORMAL.
q. Turn PROGRAMMER POWER switch to OFF.

2. Perform TD Search Programmer Operational Test.
a. At target designation station designate to Gun Director Mk 68.
b. At director, energize train and elevation power drives.
c. At director, accept target designation.
d. At director and radar console, verify director synchronizes to TD in train and elevation.
e. Record train and elevation angles.
f. Push PROGRAM STOP switch to STOP and hold.
g. Turn PROGRAMMER POWER switch to ON position.
h. After 5 sec, position PROGRAM STOP switch to RESTART and verify the following maximum director displacement around TD point.
(1) Train - 8 to 9 deg on either side of target designation.
(2) Elevation - 13 to 14 deg above target designation.
i. Position PROGRAM STOP switch to STOP and verify:
(1) PROGRAM STOPPED lamp is lit.
j. Position SEARCH PATTERN switch to ELLIPSE.
k. Position PROGRAM STOP switch to RESTART and verify:
(1) ELLIPSE PROGRAM lamp is lit.
(2) Director searches at a maximum of 4 to 6 deg each side of target designation point in train.
(3) Director searches at a maximum displacement of 13 to 15 deg above and 3 to 5 deg below the target designation point in elevation.
l. Position SEARCH ROTATION switch to REVERSE. Hold and verify:
(1) NORMAL ROTATION lamp is not lit.
(2) REVERSE ROTATION lamp is lit.
(3) Director's search pattern reverses direction.
H m. Release SEARCE ROTATION lever and verify:
(1) Director returns to normal rotation.

NOTE 6: If equipment will not meet MRC test requirements, refer to OP 3480, Chap.-5, for adjustment procedures.

n. At director, release target designation. Return director to stow position and de-energize power drives.
o. Turn PROGRAMMER POWER switch to OFF.
p. Again accept target designation at director.

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P1 DNTB S

MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4700-1 (E) (REV. 3-69)

(continued)

Figure F-5. (continued)

q. Turn PROGRAMMER POWER switch to ON and verify PROGRAM STOPPED lamp is lit, then goes out within 5 sec.
r. Turn PROGRAMMER POWER switch to OFF.
s. De-energize radar and director.
t. Return director and associated equipment to normal condition in accordance with ship doctrine.

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P1 | DNTB | S

MAINTENANCE REQUIREMENT CARD (MRC)
OPNAV 4700-1 'E' (REV. 3-69)

Figure F-5. (continued)

APPENDIX G

JOB ORDER WORK ITEMS

The preparation of various types of job order work items is based on SARP entries. This appendix gives several examples of work items on closely related gun weapon systems from the approved SARP of the USS PHARRIS (FF-1094), dated August 1977. The enclosures of this appendix include:

- Gun Mount page from POT&I Report as included in the SARP
- Corresponding (two-page) locally prepared work item on the Gun Mount
- Class BOH Spec (Standard Work Item) for AN/SPG-53 GFCS Radar (three pages)
- Standard Work Item (SWI) for removing the Mk 68 Gun Director, sending it to NOS Louisville for refurbishment, shipyard refurbishment of the antenna reflector, reassembly, and installation of GFM Director (four pages)
- Standard Items for FF-1052 Class ships bid specification packages
- Standard Item Format
- Standard Work Item Format

SHIP SYSTEM WORK DESCRIPTION

HULL NUMBER	SYSTEM	JCN INDICATED BELOW	TITLE
FF-1094	MK 42 MOD 9 GUN MOUNT		MAINTENANCE AND REPAIR
SWLIN	**TOTAL SHIPYARD COST**	**EIC GROUP**	
711A01A		GB00	

JCN	ITEM #	DESCRIPTION	M/D	MATL $	COST $	ASSIGMT	PRI
	1.	MK 42 MOD 9 Gun Mount - Accomplish the following repairs:					
WG01 0012	1.1	Replace connector and socket on cable WM 121.				FA	3
WG01 A109	1.2	Disassemble, free-up, reinstall and check for proper operation of empty case ejector door. Check for watertight seal.				FA	3
WG01 0013	1.3	Procure and install missing deck plate screws in gun house.				FA	3
WG01 0014	1.4	Check alignment of "D" hoist pawl.				FA	3
WG01 0015	1.5	Disassemble valve, inspect for worn parts, clean, reassemble and adjust to required five (5) second blast.				FA	3
WG01 M029	1.6	Replace hydraulic line for empty case (part has been on order for almost 1 yr.)			1000	SY	3
WG01 A102	1.7	Hydro test seven (7) H.P. air hoses.			1200	SY	3
		NOTE: SHIPALT DE1052-215K-Adds additional ventilation 5"/54 handling room See SWLIN 512D02*.					

Figure G-1. SAMPLE GUN MOUNT PAGE FROM POT&I REPORT

USS PHARRIS (FF-1094)
COAAR: 16-004

ITEM NO: 711-75
SWLIN: 711A01A
1.6, 1.7

1. SCOPE:

1.1 Title: 5"/54 Cal Gun Mount Repair and Test

1.2 Location of Work: 5"/54 Gun Mount Main Deck Fwd.

1.3 Identification:

1.3.1 Breech Operating Piping Assembly

1.3.2 Aeroquip Hoses #1509-4

2. REFERENCES:

a. Standard Items
b. NAVSEA OP 3851 5"/54 Cal Gun Mount Vol. 1 through 7
c. Aeroquip Catalogue #305

3. REQUIREMENTS:

3.1 Remove and reinstall interferences necessary to accomplish work required by this item. Comply with the requirements in 009-23 of 2.a.

3.2 Drain Hydraulic oil from breech operating assembly on Page 25-90 Fig. 6 Vol 7 First Rev. of 2.b.

3.2.1 Remove ruptured piping assembly, Figure Index No. 24 Page 25-90 Vol. 7 of 2.b.

3.2.2 Fabricate new pipe assembly Part No. 2856198, Alt. 2481275-9 ¼ IPS X 5'7" Page 25-90 Vol. 7 of 2.b.

3.2.3 Reinstall new section of hydraulic piping using new seals, gaskets, O-Rings and fasteners, flush out system and refill with new service oil in accordance with 2.b.

3.2.4 Conduct operational test on breech operating hydraulic system in accordance with 2.b. Submit a copy of test results to the SUPERVISOR.

CHECK POINT

3.3 Receive from Gunnery Division of Ships Force seven Aeroquip Hoses No. ¼" 1509-4 to be hydrostatically tested using 2.c for guidance.

(continued)

Figure G-2. SAMPLE LOCALLY PREPARED GUN MOUNT WORK ITEMS

3.3.1 Visually inspect hoses for the following:

3.3.1.1 Frayed or cracked reinforcing wire coils.

3.3.1.2 Missing or worn parts.

3.3.1.3 Inspect ground surfaces for scratches, nicks gauges and other damage that would prevent proper sealing and locking.

3.3.2 Hydrostatically test the seven Aeroquip Hoses in accordance with 2.b.

3.3.3 Submit a report of inspection and test results to the SUPERVISOR.

4. QUALITY ASSURANCE REQUIREMENTS:

4.1 None additional

5. NOTES:

5.1 Government furnished material and services: None

Figure G-2. (continued)

USS PHARRIS (FF 1052)
COAAR: 16-004

FF1052 CLASS BOH SPEC
(FF1052 THRU 1097)

ITEM NO: 481-01
SWLIN: 481A01A
1.1.1,1.1.2,1.1.3,
1.1.5,1.1.6

1. SCOPE:

1.1 Title of Work: Radar AN/SPG-53, Repair

1.2 Location of Work: MK-68 GFCS Control Room (3-41-0-C)

1.3 Identification

1.3.1 AN/SPG-53A Radar (FF1052 thru 1055, 1055, 1057 thru 1067, 1069 thru 1071, 1073, 1074, 1076, 1077, 1082 thru 1085, 1088 thru 1090, 1093, 1096, 1097)

1.3.2 AN/SPG-53D Radar (FF1068, 1072, 1075 thru 1080)

1.3.3 AN/SPG-53F Radar (FF1056, 1081, 1086, 1087, 1091, 1092, 1094, 1095)

1.4 Security Classification of Spaces.

1.4.1 MK-68 GFCS Control Room is a RESTRICTED area in accordance with Industrial Security Manual DOD-5220-22M. When area is posted by Ship's Force, a clearance will be required for access.

2. REFERENCES:

a. Standard Items
b. NAVORD OP2782 Volume 1, Change 4, Radar Set AN/SPG-53A and D, Description, Installation, Operation and Maintenance (Available SUPSHIP)
NAVSEA OP4169, Radar Set AN/SPG-53F Description, Installation, Operation and Maintenance. (Available SUPSHIP)
c. MIL-STD-1310C
d. NAVSHIPS 0967-000-0110, Electronics Installation Maintenance Book Installation Standards, Section 4 (Available SUPSHIP).
e. Maintenance Index Page G-139/4, Maintenance Requirement Card (MRC) W-1, W-2, M-3, M-4, M-5, M-6R, M-8, M-11, Q-1, S-2

(continued)

Figure G-3. SAMPLE CLASS BOH SPECIFICATION

3. REQUIREMENTS:

3.1 Interferences

3.1.1 Remove and reinstall interferences necessary to accomplish work required by this specification. Comply with the requirements of 009-23 of 2.a.

3.2 Removal

3.2.1 Develop wire breakdown/hookup cards. Disconnect and remove from ship drawers and components. Drawers and components that present a problem to remove or require cutting of access openings need not be removed and shall be overhauled in place. Protect cable ends from physical and environmental damage.

3.3 Repair

3.3.1 Accomplish repair of equipments of 1.3 in accordance with 009-33 of 2a. Use 2.b, for guidance.

3.3.2 Examine all waveguide and conduct VSWR tests. Submit a copy of conditions found and test results to the SUPERVISOR.

3.4 Clean and paint antenna reflectors.

3.4.1 Mask the dielectric feed horn.

3.4.2 Wipe the reflector surface free of chalked paint, dust, or other foreign material with a soft cloth, dampened with mineral spirits TT-T-291 or equivalent. Use care not to damage the concave surface. Do not use a wire brush, sand paper or other abrasive material when cleaning the reflector surface.

3.4.3 Apply one coat of haze gray enamel number 27 Federal Specification TT-E-490. Apply the coating thin and even, preferably with a spray gun.

3.4.4 Air dry and remove masking from the dielectric feed horn.

3.5 Reinstallation

3.5.1 Reinstall equipment on ship using 2b as a guide.

3.5.1.1 Use new mounting fasteners of same type and size removed.

481-01

(continued)

Figure G-3. (continued)

3.5.1.2 Ground equipment in accordance with 2.c.

3.5.1.3 Connect ship's cabling, replace any damaged connectors, lugs or wire markings. Conform to the requirements of 2.d.

3.5.1.4 Mechanically and electrically align equipment.

3.6 Tests

3.6.1 Energize equipment, make adjustments, alignments, and calibrations to achieve operational characteristics in accordance with 2.b.

CHECK POINT:

3.6.2 Conduct tests in accordance with 2e. to demonstrate satisfactory performance.

3.7 Reports

3.7.1 Submit filled in MRC data sheets to SUPERVISOR.

3.7.2 Submit report indicating the name, part number and price of individual parts and materials installed to the SUPERVISOR.

4. QUALITY ASSURANCE REQUIREMENTS:

4.1 None additional.

5. NOTES:

5.1 Government furnished material and services: None.

5.2 The contractor will be reimbursed for repair parts in excess of $1,500 total. Any parts required above this figure shall be reported to the SUPERVISOR before proceeding. Reimbursement for excess costs will be made by contract amendment. A repair part is defined as an integral part, used to replace a worn, damaged, or defective part.

481-01

Figure G-3. (continued)

USS PHARRIS (FF-1094) ITEM NO: 481-76
COAAR: 16-004 SWLIN: 481A01A
1.2

1 SCOPE:

1.1 Title: Mark 68 Gun Director, Replacement and Checkout.

1.2 Location of Work:

1.2.1 03-54-0

1.2.2 Barbette (02-54-0)

1.2.3 Mark 68 GFCS Control Room (3-41-0-C)

1.3 Identification:

1.3.1 Mark 68 Director

1.3.2 Control Panel, MK 146

1.3.3 Radar Mount Subassembly (less reflector)

1.3.4 Amplifier, MK 76

1.3.5 Motor-Amplidyne, Cross Level

1.3.6 Motor-Amplidyne, Elevation

1.3.7 Motor-Amplidyne, Train

1.3.8 Box Assembly, Search Programmer Control

1.3.9 Slip Ring Assembly, MK 7

1.3.10 Housing & Arm Subassembly, DO's Sight

1.3.11 Telescope, MK 100

1.3.12 Radar Transmitter

1.3.13 Rangefinder

1.3.14 Antenna Reflector

1.4 Security Classification of Spaces and Documents

1.4.1 MK 68 GFCS Control Room is a RESTRICTED area in accordance with Industrial Security Manual DOD-5220-22M. When area is posted by Ship's Force, a clearance will be required for access.

481-76

(continued)

Figure G-4. SAMPLE SWI

2. REFERENCE:

a. Standard Items
b. O.P. 3643 Gun Director Mk 68 Installation
c. O.P. 3480 Gun Director Mk 68 Operation
d. General Specification for Ships of the U.S. Navy
e. O.P. 2414 Slip Ring Assembly, Mk 7
f. NAVSHIP 0967-LP-611-6040, Test and Certification Manual, Test No. 481G11K3010I.

3. REQUIREMENTS:

3.1 Remove and reinstall interferences necessary to accomplish work required by this specification. Comply with the requirements of 009-23 of 2.a.

3.2 Removals

3.2.1 Disconnect ship's cabling from items listed in 1.3.1 through 1.3.13.

3.2.1.1 Tag conductors for connection during reinstallation.

3.2.2 Remove antenna reflector (1.3.14) from gun director.

3.2.3 Prepare items listed in 1.3.1 through 1.3.13 for shipment to NAVORDSTA Louisville, Ky.

3.2.3.1 Request shipping instructions from the SUPERVISOR.

3.3 Refinish antenna reflector (1.3.14)

3.3.1 Wipe the reflector surface free of chalked paint, dust, or other foreign material with a soft cloth, dampened with mineral spirits TT-T-291 or equivalent. Use care not to damage the concave surface. Do not use a wire brush, sand paper or other abrasive material when cleaning the reflector surface.

3.3.2 Apply one coat of haze gray enamel number 27 Federal Specification TT-E-490. Apply the coating thin and even, preferably with a spray gun, air dry.

3.4 Receive replacement Mk 68 Gun Director and loose detail material, unload from transporting carrier.

3.4.1 Place Director on a suitable stand to facilitate assembly.

481-76

(continued)

Figure G-4. (continued)

3.5 Assemble Gun Director in accordance with 2.b.

3.5.1 Install range finder, slip ring assembly and antenna assembly in accordance with 2.b and 2.e.

3.5.2 Make all electrical, mechanical, and wave guide connections. Lubricate Director in accordance with 2.b and 2.c.

3.5.3 Clean and lubricate ships foundation and Director foundation in accordance with 2.b and 2.c. Prepare foundation surfaces in accordance with 2.b.

3.6 Install Gun Director on ships foundation in accordance with 2.b.

3.6.1 Secure Gun Director to foundation with new fitted hold down bolts and securing hardware in accordance with 075d and 075e of 2.d.

3.6.2 Accomplish electrical hook-up requirements, complete installation requirements, alignment, and calibration instructions listed in 2.b.

3.6.3 Conduct Post Installation Test in accordance with 2.b and 2.f.

3.6.4 Submit a copy of installation tests results to the SUPERVISOR in accordance with 2.f.

3.7 Clean, prepare, prime and paint all disturbed surfaces to match surrounding areas.

3.8 Notify SUPERVISOR when shipping fixtures are available for disposal and request disposition.

4. QUALITY ASSURANCE REQUIREMENTS:

4.1 None Additional

5. NOTES:

5.1 Government furnished material and services:

5.1.1 MK 68, Gun Director

5.1.2 Control Panel, MK 146

5.1.3 Radar Mount Subassembly (less reflector)

5.1.4 Amplifier, MK 76

481-76

(continued)

Figure G-4. (continued)

5.1.5 Motor-Amplidyne, Cross Level

5.1.6 Motor-Amplidyne, Elevation

5.1.7 Motor-Amplidyne, Train

5.1.8 Box Assembly, Search Programmer Control

5.1.9 Slip Ring Assembly, MK 7

5.1.10 Housing and Arm Subassembly, DOs Sight

5.1.11 Telescope, MK 100

5.1.12 Range Finder Assembly

5.1.13 Range Finder Assembly Shipping Container

5.1.14 MK 68, Gun Director Shipping Jig

Figure G-4. (continued)

Item Number	Title	Item Number	Title
009-01	General Criteria	009-23	Interferences
009-02	Industrial Compressed Gases: Requirements for Cylinders	009-24	Isolation/Blanking and Tagging Requirements
009-03	Inspection System Requirements	009-25	Structural Boundary Test Requirements
009-04	Inspection System Requirements	009-26	Teletype Equipment; inspect, repair, and test
009-05	Temporary Access Cuts and Closure Plates	009-27	Material Identification and Control (MIC) for Piping Systems
009-06	Contamination Prevention During Abrasive Blasting	009-28	Relief Valve; repair and test
009-07	Safety and Fire Prevention	009-29	Globe, Gate, Angle, Check, Plug, and Butterfly Valves; repair and test
009-08	Fire Protection at Contractor's Facility	009-30	High Pressure, High Temperature Valve; repair and test
009-09	Process Control Procedure Requirements	009-31	Regulating Valve; repair and test
009-10	Control of Asbestos Material	009-32	Painting Requirements
009-11	Machinery and Piping; insulate and lag	009-33	Rotating Electrical Equipment; rewind
009-12	Welding and Brazing Requirements	009-34	Fire Protection of Unmanned Vessels at Contractor's Facility
009-13	Meters; repair and calibrate	009-35	Requirements for Manufacturer's Representative
009-14	Gages and Thermometers; repair and calibrate	009-36	Controller; repair
009-15	Procedures and Acceptance Criteria for Balancing Rotating Machinery	009-37	General Procedures for Accomplishment of Woodwork
009-16	Electronic Equipment; inspect, repair, and test	009-58	General Inspection Requirements and Criteria
009-17	Rotating Electrical Equipment; repair	009-59	General Repair Requirements and Criteria
009-18	Magnetic Material Controls		
009-20	Government Property		
009-21	Nameplate Date		
009-22	Shipboard Electric Cable; test		

Figure G-5. SAMPLE INDEX OF STANDARD ITEMS (NAVSEA AND BROOKLYN SUPSHIP)

ITEM NO: _____

DATE: _____

1. SCOPE:

1.1 Title:

2. REFERENCES:

a.

b.

c.

3. REQUIREMENTS:

3.1

3.2

3.2.1

3.2.2

3.3

3.3.1

3.3.1.1

3.3.1.2

1 of 1

ITEM NO: _____

Normally Standard Items are limited to the above three basic paragraphs. However, a paragraph 4 QUALITY ASSURANCE REQUIREMENTS and a paragraph 5 NOTES may be added if necessary. If paragraph 4 QUALITY ASSURANCE REQUIREMENTS is not required and NOTES are appropriate, the paragraph listing NOTES will be number 4.

STANDARD ITEMS (SIs) are distributed by SUPSHIP to all holders of MSR Contracts. Subsequently, they are incorporated in the solicitation by reference.

Figure G-6. STANDARD ITEM FORMAT

SHIP:_____ ITEM NO:_____

COAAR:_____ PCN:_____

PLANNER:_____

1. SCOPE:

1.1 Title:

1.2 Location of Work: (Omit when not applicable)

1.3 Identification: (Omit when not applicable)

1.4 Security Classification of Equipment/Components, Spaces and Documents: (Omit when not applicable)

2. REFERENCES:

a. Standard Items (Normally first)

b.

3. REQUIREMENTS:

3.1

3.1.1

3.1.1.1

3.1.1.2

4. QUALITY ASSURANCE REQUIREMENTS:

4.1

4.1.1

4.1.2

4.2

5. NOTES:

5.1

5.2

5.2.1

5.2.2

FILE NO: 721-01
9-25-78

ITEM NO:_____

Figure G-7. STANDARD WORK ITEM AND LOCALLY PREPARED WORK ITEM FORMAT

APPENDIX H

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

This appendix lists commonly used abbreviations and acronyms.

A	Milestone denoting the beginning of an Overhaul
AAW	Anti-Air Warfare
ADP	Automatic Data Processing
AEL	Allowance Equipage List
Alt	Alteration
APL	Allowance Parts List
ASW	Anti-Submarine Warfare
BOH	Baseline Overhaul
CD (or CRUDES)	Cruisers/Destroyers
CG	Guided Missile Cruiser
CID	Component Identification Number
CIWS	Close-In-Weapon System
CMP	Class Maintenance Plan
CNO	Chief of Naval Operations
COG	Cognizance
COMNAVSEASYSCOM	Commander, Naval Sea Systems Command
COSAL	Coordinated Shipboard Allowance List
CSMP	Current Ship's Maintenance Project
CSRR	Combat Systems Readiness Review
CSRT	Combat Systems Readiness Test
CY	Calendar Year
D Alt	Alteration authorized and funded by the TYCOM
DD	Destroyer
DDEOC	Destroyer Engineered Operating Cycle
DDG	Guided Missile Destroyer

ECR	Equipment Condition Report
EIC	Equipment Identification Number
EOC	Engineered Operating Cycle
EP	Electronic Panel
ESL	Estimated Service Life
F Alt	Alteration funded by TYCOM and accomplished by forces afloat
FAR	Functions, Assignments, and Responsibilities
FF	Frigate
FMAG	Fleet Maintenance Assistance Group
FMP	Fleet Modernization Program
FMSO	Fleet Material Support Office
FROGS	Fleet Report of Gun Systems
FY	Fiscal Year
GAO	Government Accounting Office
GFCS	Gun Fire Control System
GFE	Government Furnished Equipment
GFM	Government Furnished Material
GSED	Gun System Engineering Department NOSL
GWS	Gun Weapon System
GWSRP	Gun Weapon System Replacement Program
HM&E	Hull, Machinery, and Electrical
ICP	Inventory Control Point
IFP	Invitation for Bid
ILS	Integrated Logistic Support
IMA	Intermediate Maintenance Activity
IMMP	Integrated Maintenance and Modernization Planning
INSURV	Inspection and Survey
ISEA	In-Service Engineering Agent
K Alt	An alteration authorized and funded by NAVSEA
LOGSAT	Logistics Special Assistance Team
LPWI	Locally Prepared Work Item
MCA	Material Condition Assessment
MCL	Material Condition Life
MCR	Material Condition

MDS	Maintenance Data System
MI	Material Inspection
MIP	Maintenance Index Page
MIS	Management Information System
Mk	Mark
Mod	Modification
MRC	Maintenance Requirement Card
MSR	Master Ship Repair (Contract)
NAVORDSTA	Naval Ordnance Station
NAVSEA	Naval Sea Systems Command
NAVSEACEN	Naval Sea Support Center
NAVSEC	Naval Ship Engineering Command
NAVSUPSYSCOM	Naval Supply Systems Command
NOS	Naval Ordnance Station
NOS/L	Naval Ordnance Station Louisville
NSWSES	Naval Ship Weapons System Engineering Station, Port Hueneme, California
OA	Ordnance Alteration (OrdAlt)
OCSOT	Operational Combat System Operability Test
O&MN	Operations and Maintenance, Navy (Appropriation)
O&MNR	Operations and Maintenance, Naval Reserve (Appropriation)
OP	Ordnance Publication
OPNAV	Office of the Chief of Naval Operations
OrdAlt	Ordnance Alteration
ORDSAT	Ordnance Special Assistance Team
ORI	Ordnance Replacement Index
OVHL (or O/H)	Overhaul
PC&H	Packing, Crating and Handling
PERA	Planning and Engineering for Repairs and Alterations: (ASC) - Amphibious Ships and Craft, Norfolk NSYD (CD) - Cruisers/Destroyers, Philadelphia NSYD (CSS) - Combat Support Ships, NAVSEA Industrial Support Office (NISO) San Francisco (CV) - Aircraft Carriers, etc., Puget Sound NSYD (SS) - Submarines, Portsmouth NSYD
PMDO	Planned Maintenance During Overhaul

PMS	Planned Maintenance System
POA&M	Plan of Action and Milestones
POM	Program Objectives Memorandum
POT&I	Pre-Overhaul Test and Inspection
PUBSAT	Publication Special Assistance Team
QA	Quality Assurance
QPL	Qualified Products List
RAV	Restricted Availability
REFTRA	Refresher Training
RIR	Repair Inspection Requirement
RMMS	Repair Maintenance Management System
ROH	Regular Overhaul
RSPE	Radar Signal Processing Equipment
SARP	Ship Alteration and Repair Package
SCORE	Shipboard Condition Overhaul/Repair Evaluation Manual
SFOMS	Ship's Force Overhaul Management System
ShipAlt	Ship Alteration
SI	Standard Item
SIMA	Shore Based Intermediate Maintenance Activity
SMA	System Maintenance Analysis
SOAP	Supply Operations Assistance Program
SPCC	Ships Parts Control Center
SRA	Selected Restricted Availability
SSIP	Ship Support Improvement Project
SUPSHIP	Supervisor of Shipbuilding, Conversion and Repair
SURFLANT	Surface Force Atlantic
SURFPAC	Surface Force Pacific
SUW	Surface Warfare
SWI	Standard Work Item
SWLIN	Ship Work List Item Number
SYSCOM	Systems Command
TAV	Technical Availability
T&C	Test and Certification Manual
TDS	Target Designation System

3-M	Maintenance and Material Management
TRS	Technical Repair Standard
2-Kilo (2K)	Maintenance Action Form (OPNAV 4790/2K)
TYCOM	Type Commander
WDC	Work Definition Conference