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**DESTROYER ENGINEERED OPERATING CYCLE
(DDEOC)**

System Maintenance Analysis

FF-1052 CLASS

5-INCH 54-CALIBER MARK 42 MOD 9 GUN MOUNT

SMA 202-711

REVIEW OF EXPERIENCE

October 1976

Prepared for

**Director, Cruiser-Destroyer
Ship Logistic Division
Naval Sea Systems Command
Washington, D. C.**

under Contract N00024-76-C-4319



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DESTROYER ENGINEERED OPERATING CYCLE
(DDEOC)

SYSTEM MAINTENANCE ANALYSIS

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GUN MOUNT
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FOREWORD

The System Maintenance Analysis Report for the 5"/54 Caliber MK 42 MOD 9 Gun Mount System (APLs 006030001 through 006030021, 006800026, and 006021111) consists of a single volume, the Review of Experience. This report presents an analysis of maintenance experience for the system, and provides recommendations for improving system material condition through the implementation of material modifications, changes in routine maintenance programs, and development of new or revised testing and assessment procedures.

SUMMARY

1. INTRODUCTION

System Maintenance Analyses (SMAs) are being conducted on selected systems and subsystems of FF-1052 Class ships as part of the Destroyer Engineered Operating Cycle (DDEOC) program. This document, the Review of Experience for the 5"/54 Caliber MK 42 MOD 9 Gun Mount System, has been developed for NAVSEA 934X under Navy Contract N00024-76-C-4319.

2. PURPOSE OF THE REVIEW OF EXPERIENCE

The Review of Experience is an analysis of existing and potential problems that affect the operational performance and maintenance program of the 5"/54 Caliber MK 42 MOD 9 Gun Mount System. This document assesses the significance and consequences of the problems identified, and recommends courses of action to support an extended (54 month) operating cycle. Implementation of the proposed solutions is recommended to achieve the DDEOC program goal for the Gun Mount System, which is to effect an early improvement in the material condition of the system, at an acceptable cost, while maintaining or increasing its operational availability during an extended operating cycle.

3. APPROACH

The documented maintenance experience of the Gun Mount System was reviewed primarily through a detailed analysis of Maintenance Data Collection Subsystem (MDCS) records, narratives, and summary data. In addition, the Casualty Reports (CASREPTs), Detection Action Response Technique (DART) reports, Deficiency Corrective Action Program (DCAP) reports, system alterations, and system technical manuals were used in identifying problems and ongoing corrective actions. Ship surveys and liaison with appropriate technical codes were conducted to validate identified problem areas, define undocumented maintenance problems, and determine the status of current or planned actions affecting the Gun Mount System. Recommendations were then formulated to implement newly defined (or emphasize existing) corrective actions designed to minimize the occurrence of identified problems and their impact on the Extended Operating Cycle.

4. CONCLUSIONS AND RECOMMENDATIONS

The major conclusions and recommendations resulting from this Review of Experience are summarized as follows:

- The 5"/54 Caliber MK 42 MOD 9 Gun Mount System is capable of operating throughout an Extended Operating Cycle (54 months) using the current maintenance programs and procedures, provided that the Gun Mounts requiring replacement are replaced and the Water-Tight Integrity Group of alterations are accomplished during Baseline Overhaul (BOH).
- NAVSEA needs to determine the extent of the MK 42 MOD 9 replacement program requirements and the capability of the Naval Ordnance Station, Louisville, to support the FF-1052 Class FY 77 Baseline Overhauls. This will require:
 - Completion of the Ship Condition Overhaul/Repair Evaluation (SCORE) manual for use in evaluating the Gun Mounts for replacement.
 - Obtaining a spare Mount and spare parts to meet the Replacement Program needs.
 - Coordination of conjunctive ORDALTs and ShipAlts, i.e., a ShipAlt required to support an ORDALT being installed.
 - Funding the overhaul of the Mounts.
 - Identifying the Mount components not being replaced, and providing Technical Repair Standards for shipyard repair and testing of these items.
- Because of the length of Baseline Overhauls (12 or more months), it is recommended that an interim package of "Inactive Equipment Maintenance" actions be developed by NAVSEA 049 or designated activities in order to prevent costly deterioration during this period.
- Alterations determined to have a good potential for solving problems highlighted and supported by this analysis are recommended for mandatory accomplishment during BOH. They include:
 - Weapons Group 2395 - Switch Actuator O/As
 - Weapons Group 1151 - Watertight Integrity O/As; in particular, ECP 42.9.0043 (Improvement of Gun Port Shield and Seal)
 - Weapons Group 1850 - Cradle Buffer O/As
 - Weapons Group 2345 - Piping/Fastener Improvement
 - Weapons Group 1195 - Cup Seal O/As
 - ORDALT 7651 - Modify Rammer Liquid Spring

- ORDALT 8097 - Firing Pin Safety Latch
- ECP 77.2-397 - Redesign of Firing Pin Assembly
- ECP 711-089 - Install Cooling Fan in EPl Panel
- Due to the extent of the alterations involved and the variety of overhaul facilities that will be used for the FF-1052 Class Baseline Overhauls, it is recommended that NAVSEA 6531 coordinate the accomplishment and tracking of the recommended alterations to ensure uniform accomplishment within the class.
- Condition monitoring and assessment procedures and tests are adequately covered by the completion of the SCORE manual, the development of Post Overhaul Combat Systems tests, and the installation of the Gun Mount System portion of the Total Ship Test Program. It is therefore recommended that no further efforts be taken in this direction for the Gun Mount by the DDEOC program.
- A number of minor recommendations are also offered, which include the following:
 - Five changes to the PMS requirements for the Gun Mount System
 - Five specific repair items to be accomplished on the Gun Mounts during BOH
 - Two changes to the items or quantities of items on the Gun Mount Allowance Parts Lists (APLs)
 - Two items for entry into the Deficiency Corrective Action Program (DCAP) data bank for use with future problem analyses

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CHAPTER ONE

INTRODUCTION

1.1 PURPOSE

The Review of Experience is an analysis of existing and potential problems that affect the operational performance and the maintenance program of the 5"/54 Caliber MK 42 MOD 9 Gun Mount System, hereafter referred to as the Gun Mount. This document assesses the significance and consequences of the problems identified and recommends courses of action to support an extended (54 month) operating cycle. Accomplishment of these recommended actions will support the DDEOC program goal for the Gun Mount, which is to effect an early improvement in the material condition of the system, at an acceptable cost, while maintaining or increasing the operational availability of the system during an extended operating cycle.

1.2 SCOPE

The Gun Mount appears in two basic designs on the FF-1052 Class; the 5"/54 MARK 42 MOD 9, which is common to hulls FF-1053 through FF-1097; and the 5"/54 MARK 42 MOD 10, which is installed only on the FF-1052. The MOD 10 is not addressed in this analysis, but will be included in the DDG-37 Class System Maintenance Analysis. For analysis purposes, all 45 5"/54 Caliber MARK 42 MOD 9 Mounts were considered to be identical, except for the telescopes and the fuze setters, each of which have one of two MODs installed throughout the Class as shown in Table 1-1.

This analysis is specifically applicable to the 5"/54 Caliber MK 42 MOD 9 Gun Mount System of the FF-1052 Class, and considers only system components that have been onboard or are onboard as of the fourth quarter of Fiscal Year 1976.

1.2.1 System Function

Gun Mount MARK 42 MOD 9 is a single gun, dual purpose mount for the main gun battery of the FF-1052 Class. The ships use the Gun Mount as a tactical weapon against both surface and air targets.

Table 1-1. COMPONENTS OF 5"/54 CALIBER MK 42 MOD 9 GUN MOUNT SYSTEM

Item	APL/CID	Noun Name	No.per Ship	Applicable NAVORD OP	Applicable Hulls
1	006030001	Stand Assembly, MK 21 Mod 2	1	3851, Vol. 1	FF 1053-1097
2	006030002	Carriage Assembly, MK 35 Mod 3	1	3851, Vol. 3	FF 1053-1097
3	006030003	Ammo Hoist Assy Upper, MK 2 Mod 4, 5	2	3851, Vol. 3	FF 1053-1097
4	006030004	Firing Cutout Assembly, MK 1	1	3851, Vol. 3	FF 1053-1097
5	006030005	Train Power Drive Assembly, MK 19 Mod 2 (Incl: transmission and receiver regulator, MK 53)	1	3851, Vol. 5	FF 1053-1097
6	006030006	Elevation Power Drive Assembly - MK 19 Mod 2 (Incl: transmission and receiver regulator, MK 54)	1	3851, Vol. 5	FF 1053-1097
7	006030007	Slide Assembly, MK 31 Mod 2	1	3851, Vol. 4	FF 1053-1097
8	006030008	Fuze Setter Assy, MK 27 Mod 0, 1	2	3851, Vol. 4	FF 1053-1064, 1066-1068, 1070-1080
	006030020	Fuze Setter Assy, MK 29 Mod 1	2	3851, Vol. 4	FF 1065, 1069, 1081-1097

(continued)

Table 1-1. (continued)

Item	APL/CID	Noun Name	No. per Ship	Applicable NAVORD OP	Applicable Hulls
9	006030009	Rammer Assembly, MK 2 Mod 2	1	3851, Vol. 4	FF 1053-1097
10	006030010	Empty Case Ejector Assembly, MK 2	1	3851, Vol. 4	FF 1053-1097
11	006030011	Gas Ejector Assy, MK 13 Mod 1	1	3851, Vol. 4	FF 1053-1097
12	006030012	Housing Assembly, MK 11 Mod 2	1	3851, Vol. 1	FF 1053-1097
13	006030013 (Incl. OMC)	Shield Assembly, MK 61 Mod 10	1	3851, Vol. 1	FF 1053-1097
		One Man Control (OMC) Station	1	3851, Vol. 5	FF 1053-1097
14	006800026	Telescope, MK 116 Mod 0	1	3851, Vol. 5 (MK 116 only)	FF 1053-1097
	006021111	Telescope, MK 102 Mod 6	or 1	3851, Vol. 5 and OP 2531	FF 1053-1097
15	006030014	Ammo Hoist Assy Lower, MK 5 Mod 0, 1	2	3851, Vol. 2	FF 1053-1097
16	006030015	Control Panels MK 114 Mod 0,1; Power Panels, MK 81 Mod P9,P10	2	3851, Vol. 5	FF 1053-1097
17	006030019	Gun Barrel Assy, MK 18	1	3851, Vol. 5	FF 1053-1097 (Plus 1052)

The Gun Mount has a dual-hoist loading system that automatically hoists rounds of ammunition to the Gun and rams them into the breech. The entire loading operation is automatic after the loading crew in the ammunition handling room manually inserts the rounds into the hoist loaders. The loaders hold 40 rounds of ammunition. In automatic firing, the Gun Mount is rated at \approx 35 rounds per minute using both hoists, and \approx 17 rounds per minute using one hoist.

The Gun Mount normally receives gun train and elevation orders, fuze-setting orders (when the Gun is firing projectiles with mechanical time fuzes) and firing orders from the MK 68 Gun Fire Control System. The Gun Mount train, elevation, and firing orders may also be provided from the One Man Control (OMC) Station inside the gun house; and lastly, these same orders may come from the control panel in the carrier room.

1.2.2 System Boundaries

There is one Gun Mount installed forward in FF-1052 Class vessels, with the gun and part of its loading system enclosed in a shielded gun house on the main deck. Ammunition hoists extend downward from the gun and terminate beneath it in the ammunition handling room.

Figure 1-1 was extracted from Part 1 of the Illustrated Parts Breakdown (IPB) for the 5"/54 MK 42 MOD 9 Gun Mount Technical Manual, OP 3851, and illustrates the physical boundaries of the Gun Mount System. The original numbering was modified to refer to the components that make up the system as listed by APL/CID in Table 1-1.

1.3 REPORT FORMAT

This report contains four chapters and five appendixes. Chapter Two describes the approach taken in the analysis. Chapter Three describes the results and observations of the analysis, including discussions of identified component or equipment problem areas. Chapter Four summarizes the overall conclusions derived from the System Maintenance Analysis (SMA) and resulting recommendations.

NAVORD OP 3851 IPB

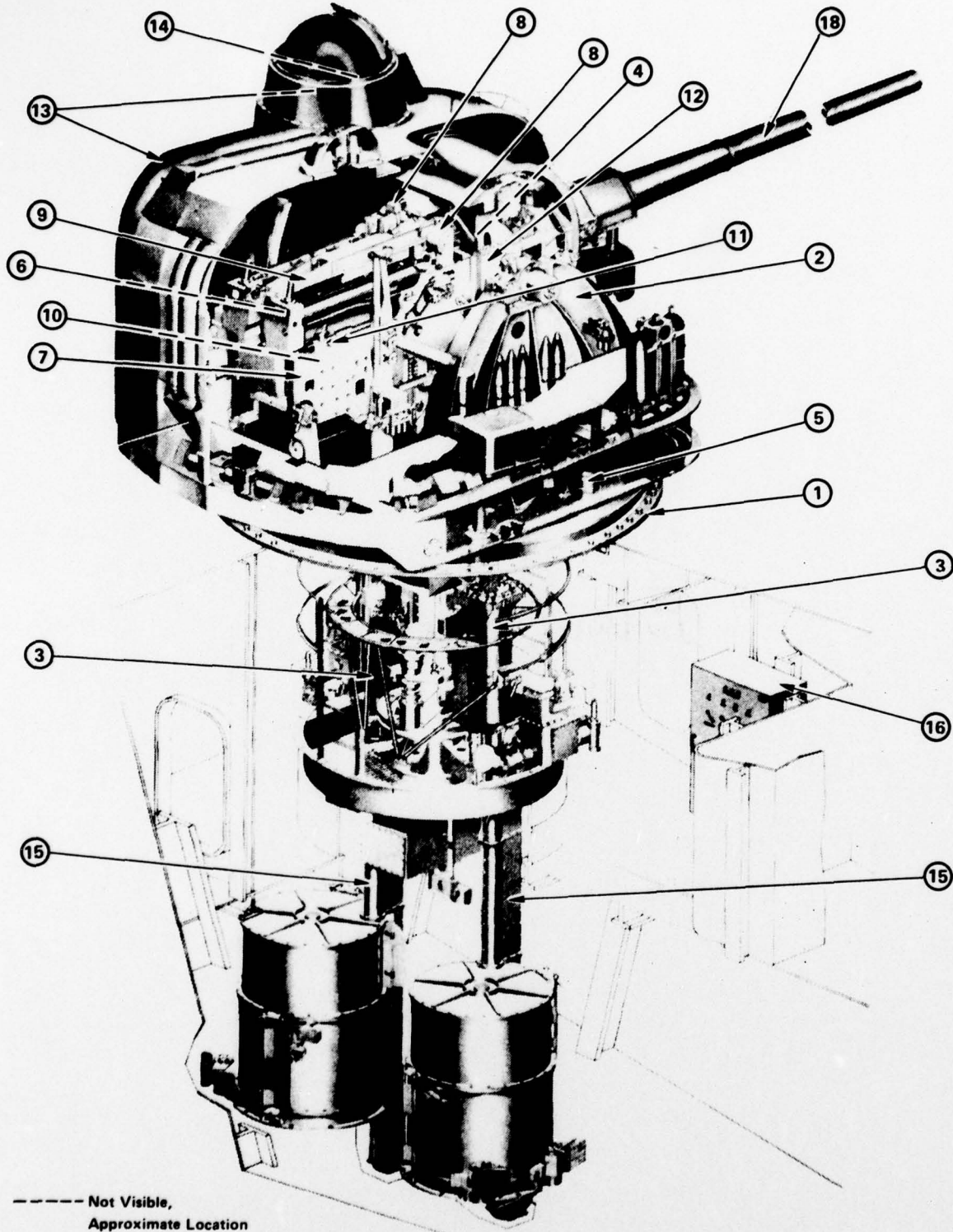


Figure 1-1. 5-INCH, 54-CALIBER SINGLE GUN MOUNT MARK 42 MOD 9 ASSEMBLY
(Reproduced from NAVORD OP 3851 IPB)

CHAPTER TWO

ANALYSIS APPROACH

The Gun Mount System was analyzed from an overall viewpoint by investigating four major functional groups: the Structural Group, the Gun Loading System, the Gun Laying System, and the Gun Mount Control. Within these functional groups, individual analyses were made for each major component, i.e., those components having a separate APL.

2.1 CASREPT ANALYSIS

The Gun Mount performs several specific ship missions on the FF-1052 Class. Since the Mount is a single-system installment, it is by definition critical to those missions and thus is likely to be the subject of CASREPTs more frequently than other systems. The CASREPT narratives were extracted in sufficient detail to indicate the cause of the casualty. They were then grouped by APL or logical component if the APL was not designated. These groupings were reviewed to identify failure modes of the various components and to determine if there were trends or patterns in the reported failures. A summary was prepared by APL to show the relative criticality of the components to the availability of the Gun Mount. The CASREPT data for the Gun Mount is included as Appendix A.

2.2 MDCS DATA SCREENING AND ANALYSIS

FF-1052 Class data for the period 1 January 1970 through 31 December 1974 were utilized in this analysis. All corrective-action maintenance data for the FF-1052 Class ships were obtained from the Maintenance Support Office (MSO) in Mechanicsburg, Pennsylvania. The MDCS data were sorted, and all data reported with the Gun Mount Equipment Identification Code (EIC), or with an APL listed in Table 1-1, were separated and listed. These data were then reviewed.

Criteria were established to screen the thousands of line items reported against the Gun Mount to identify those significant to the maintenance of the system. These parts, because of their repetitive replacements,

allow analysis of the factors affecting their replacement, e.g., wear, failure, routine Planned Maintenance, or TYCOM direction. The basic screening criteria were (1) number of ships in which a given part was replaced, (2) quantity of parts replaced, and (3) cost of the part. A part was considered significant if it cost:

- More than \$10 and was replaced on 10 ships or more
- Less than \$10 and was replaced on 15 ships or more
- More than \$500 and gave indication of a potential maintenance problem (i.e., was mentioned in DCAP reports, CASREPTs, TYCOM or NAVSEA instruction/messages)

In reviewing the data, two assumptions were made concerning the effect of the increasing number of ships* in the data base on part usage trends:

- a. It was assumed that the total usage of mechanical parts should decline toward the end of the 5-year data period (1970-1974). Reasons for this decline are primarily because the early years reflect new equipment "bugs", training problems, and intense firing missions in support of the Vietnam War; while the latter part of the data period, although it includes more ships, encompasses the period of fuel shortages and curtailment of much underway time. As a result, the Gun Mount firing operations were greatly reduced during this later period.
- b. It was assumed that a sharp decline in part usage (under 20 percent of 5-year total usage) during the last year of the data indicates a declining maintenance problem; a slight increase (20+ percent of 5-year total) in the last year was interpreted as a normal result of more ships in the data base; and a sharp increase (30+ percent of 5-year total replaced in the last year) was taken as an increasing maintenance problem.

These assumptions were used in conjunction with the last year's data, and plots of parts replacements from time of commissioning, to indicate patterns in replacement as a function of time after commissioning. Results of the study formed the basis for recommending any action needed relative to the parts determined to be significant by the above criteria.

2.3 PROBLEM IDENTIFICATION

An analysis was made of MDCS part usage summaries, part replacement data as a function of time after commissioning, and CASREPT data summaries. Visits were then made to NAVSEA 6531 and 04321, to the Gun System Engineering Center (GSEC) at the Naval Ordnance Station, Louisville, and to several ships for purposes of discussing the preliminary findings and identifying problems not readily apparent from the data. Discussions with NAVSEA 6531

*FF-1052 Class ships were commissioned from 1969 through 1974 as they were built.

and GSEC personnel identified Deficiency Corrective Action Program reports as a source of data that should be reviewed to (1) gain knowledge of Gun Mount problems and solutions already identified by the ordnance community, and (2) become cognizant of the current activities working on these problems.

In general, the analysis showed that while high-CASREPT components correlated well with components having high man-hour and cost burden, analysis of CASREPT data did not usually identify the parts of the components causing the maintenance burden. The analysis also did not show a correlation between CASREPT rate and high-burden components not critical to the system (e.g., where there are two hoists, and the loss of one only reduces capability). The analysis of CASREPT data does serve as a good cross-check to the parts analysis, but it does not by itself identify areas where maintenance programs and procedures can or should be changed.

Review of the DCAP reports confirmed the results of the SMA data analysis in identifying the main problem areas; and, where applicable, the conclusions and recommendations of the SMA reference the applicable DCAP problem number. As with the CASREPT data, the DCAP reports identified only with the highest-usage parts identified by the screened MDCS data and not necessarily with the majority of parts identified as significant. This review shows that multiple data sources are needed in analyzing the overall system maintenance requirements.

The identified problems were reviewed to determine if there was any correlation between the identified problems and the current Planned Maintenance Subsystem (PMS) requirements, and to determine if additional preventive maintenance could be incorporated into PMS to rectify those problems. The application (and inclusion into PMS) of performance or material condition assessment techniques was considered as a means for predicting equipment and system maintenance.

Ship Alteration and Repair Package (SARP) documents and Overhaul Departure Reports were reviewed to determine what major system maintenance had previously been accomplished during regular overhauls, i.e., maintenance that would most likely have to be deferred or integrated into the maintenance periods of the extended cycle. These reviews, coupled with the data analysis, identified the repairs or overhauls to be accomplished during Baseline Overhaul.

Throughout the analysis, NAVSEA Codes 06531 and 04321 were consulted to ensure data accuracy and to gather additional detailed information concerning the entire Gun Mount System.

CHAPTER THREE

ANALYSIS RESULTS

Historically, as gun weapon systems become more capable, they also tend to become more sophisticated, requiring the incorporation of advanced electronic and electrohydraulic subsystems. It has also been observed that the ability of all levels of maintenance personnel to diagnose and solve problems relating to gun systems has tended to lag behind the needs of the Fleet. This problem has led to an increased dependence on personnel from specialized support organizations, such as the Naval Ordnance System Support Offices (now part of the Naval Sea Centers), for technical assistance in problem solving and repair.

Maintenance and operational problems with 5"/54 caliber gun mounts (all MODs) were highlighted in September 1973, when the mounts were added to the DART List. Intensive management attention by NAVSEA technical codes and by GSEC personnel, aided by the information-gathering and feedback systems of both the Deficiency Corrective Action Program and the Semi-Annual Gun Weapon System Conferences sponsored by NAVSEA, have significantly reduced the problems associated with the mounts. The DCAP reports have been used to address not only technical and logistic problems, but also training and PMS corrective actions.

In the identification of potential problems of the gun mounts, the ARINC Research analysis used the DCAP reports and CASREPTs as a crosscheck to the review of high-burden components and high-usage parts shown in Appendix B. The following sections discuss the overall system maintenance considerations as they affect the DDEOC, and then the specific problems by component.

Recommendations that require actions during the Baseline Overhauls of the FF-1052 Class are presented in the component discussions, as well as separately in Appendix C.

The PMS for the Gun Mount is analyzed as it applies to each component. Resulting recommendations for change, deletion, or development of new requirements are summarized on the DDEOC MRC Evaluation Tables of Appendix D.

All recommendations made in this report require action by NAVSEA to ensure implementation or accomplishment. The actions necessary to support recommendations for the Gun Mount throughout the 54-month operating cycle are listed in the Action Tables in Appendix E. The tables include the name of the specific equipment addressed, the recommendation(s) concerning that equipment, the paragraph in this report that discusses the recommendation, the organization or technical code responsible for the recommended action, and pertinent remarks.

3.1 OVERALL SYSTEM MAINTENANCE CONSIDERATIONS

3.1.1 Gun Weapon System Replacement Program

The philosophy to date for major maintenance of these systems has been to provide technical assistance from specialized support groups; to replace components as they fail, with rework accomplished at Designated Overhaul Points (DOP) such as NOSL and the Ship Repair Facility, Subic Bay; and to replace the entire above-deck components of the Mounts on a selective basis when they are ready for "turnaround overhaul" (replacement).

According to projections made by NOSL, the MK 42 MOD 9 Gun Mount will require a Class A overhaul at NOSL between 7 and 13 years (or an average of 10 years) from the time of installation or since the last Class A overhaul. The oldest ships of the FF-1052 Class currently have 6 years service since time of commissioning; the majority of ships entering the Baseline Overhauls during FY 77 will have between 5 and 6 years service. Since the DDEOC Program will add another 4-1/2 to 5 years to the age of the Gun Mounts before they are next available for replacement during Regular Overhaul, the replacement/turnaround of the Mounts during the FF-1052 Class BOHs should be considered.

In addition to age, the problems encountered with the watertight integrity of the Mounts (explained fully in Section 3.2.3) have caused faster deterioration of the systems on some ships than had previously been anticipated. According to NAVSEA 04321, however, submittals of Gun Mount replacement requests by Type Commanders in accordance with NAVSEAINST 8300.2 have not indicated the need for replacement of any Gun Mounts in FY 77. Therefore, no priority for funding a replacement program has been established.

The replacement situation for the MOD 9 Gun Mount is further complicated by the lack of spare mounts to establish the rotatable pool that will be required if more than two replacements are needed in one year. One test mount is at the Naval Surface Weapon Laboratory (NSWL), Dahlgren, and a set of power drives is located at the Great Lakes Naval Training Center. Additionally, sufficient parts exist in the supply system to refurbish another

mount; however, using these parts could result in downtime of other operating units for lack of spare parts. The possibility may exist in the future to use other surface-ship weapon systems as a substitute for the Gun Mount in a turnaround program; however, this is only speculation and such a course of action would bring with it a number of its own compatibility problems. Therefore, neither the establishment of a rotatable pool nor the substitution of a different Gun Mount will provide an adequate solution for projected Gun Mount replacement during the FF-1052 Class Baseline Overhauls. The projection by GSEC personnel is that 5 of the 13 Gun Mounts on ships going into the Baseline Overhaul in FY 77 may need overhaul.

The FF-1052 Class Baseline Overhauls scheduled to begin in FY 77 are planned to be of sufficient length (12 or more months) to enable the turnaround of the same Gun Mount, from and back to the ship, provided that planning is started as soon as possible to:

- a. Identify which Mounts need overhaul
- b. Obtain or reprogram the funds required to support the overhaul of these Mounts at NOSL
- c. Authorize NOSL to proceed with tooling up for overhaul of the Gun Mounts
- d. Develop a list of high-cost, long-lead-time parts expected to be replaced during overhaul, and fund their procurement
- e. Review the need for conjunctive alterations*, and determine the availability of materials for these alterations.
- f. Identify Gun Mount parts that will not be returned to NOSL during turnaround, and develop Technical Repair Standards (TRSs) for use by the shipyard in repair of these components.

It is recommended that NAVSEA 043 determine the extent of the 5"/54 MK 42 MOD 9 Gun Mount replacements required during the Baseline Overhauls of the FF-1052 Class beginning with those in FY 77, and that immediate action be taken on the six planning steps listed above.

3.1.2 Test and Inspection Procedures

A variety of test procedures are being developed for use in testing the Gun Mount. The entire area of shipboard gun testing is covered in DCAP action item J0643 initiated by the NAVSEA/Fleet Gun Conference for NAVSEA 6531. Several of these tests are explained in the following paragraphs.

*Interrelated ORDALTs and ShipALts that must be accomplished together.

Pre-Overhaul Test and Inspection (POT&I) is performed by teams consisting of shipyard, NAVSEACEN, and contractor personnel, or some other combination of personnel from these activities. The inspection is conducted approximately 12 months prior to Regular Overhaul to evaluate the need for repairs to be accomplished during ROH. The POT&I is a very subjective process, entailing a material inspection and witnessing of the performance of PMS "Daily System Operability Test (MRC 44 DHSP D) and Prefiring Checks (MRC 44 DHTC R)" by the crew.

Another test is contained in the revised Material Inspection Manual, developed by GSEC for NAVSEA 043 as a documented means of evaluating the need for entry into the Gun Weapon System Replacement Program. This SCORE (Shipboard Condition Overhaul/Repair Evaluation) Manual is similar to those prepared for other weapon systems and provides a list of discrepancies found, recommendations for shipyard, Ship's Force, or NAVSEACEN maintenance, and the primary recommendation of whether or not to replace the Gun Mount. This test will normally be conducted by NAVSEACEN personnel 18 months prior to ROH. NAVSEA 043 is in the process of evaluating this manual.

In addition to the above two tests, NAVSEA 04 has requested that a series of tests be developed or selected for use as an overall "Post Repair Combat System Test and Certification Plan for Industrial Activities".* The inputs for the test plan will come from Test Development Managers (TDMs) for the Total Ship Test Program (TSTP), and may be incorporated as part of the TSTP for the ship. These tests will be performed by shipyard, Ship's Force, and NAVSEACEN personnel to certify system operability prior to leaving the shipyard. This type of test plan could also be used as a POT&I, if the status of alterations is taken into account. In addition to this recent requirement, new TSTP-developed test procedures are being incorporated into the PMS programs of FF-1052 Class ships for use by Ship's Force.

The current POT&I procedures are not sufficiently well defined to evaluate the need for Gun Mount replacement. Therefore, to eliminate duplication of effort and to satisfy the need for consistency, it is recommended that the SCORE manual for the MK 42 MOD 9 Gun Weapon System as updated by NOS, Louisville be incorporated into the POT&I plan by PERA (CRUDES) for use in both evaluating the need for Gun Mount replacement and determining the overhaul or repair items to be accomplished during BOH. In addition, the SCORE manual could also be incorporated into the Post Repair Test and Certification Plan for the MK 42 MOD 9 Gun Mount portion of the total Post Repair Combat System Test and Certification Plan.

3.1.3 Repair/Overhaul Standards

In FY 70, funds were available for the preparation of an Overhaul Manual for the Gun Mount. At the same time, however, an urgent request was made by the operating forces to improve the operation and maintenance

*NAVSEA 0484E/IE ltr Serial 331 of 6 October 1975.

manual (OP 3851) then in the fleet. Funds for the Overhaul Manual were diverted to the update of OP 3851, and consequently there are no technical repair/overhaul standards or procedures in existence other than those at NOSL (which are used for the Class A overhaul of the Gun Mounts being replaced) and the Installation Test Instructions in OP 4018.

In theory, this should not be a problem since the Gun Mounts will be returned sometime in their life for complete overhaul, and many of the major components of the Mounts are 2J or 6U cog items that should be replaced only and not be repaired anywhere but at a designated overhaul point. In practice, however, a portion of the Mount will be left onboard during turnaround, under the responsibility of the shipyard to repair or overhaul as necessary. Other Mounts will not be replaced, but will need repair or overhaul of selected components. In addition, the replacement and overhaul of some Mounts will tend to drain the supply system of parts, increasing the likelihood that components may need to be repaired at the ship or IMA level because there are no refurbished components available in stock. This situation further amplifies the need for the development of standardized repair procedures, a need which is strengthened by the wide variation of technical capability in the Combat System area at both Navy and private shipyards.

It is recommended that the 5"/54 MK 42 MOD 9 Gun Mounts be analyzed by NAVSEA or NOS, Louisville ordnance engineers to develop (1) a list of those components that should not be repaired/overhauled except under emergency circumstances by any other activity than the Designated Overhaul Point, and (2) repair/overhaul procedures and standards for all remaining components of the Mount.

3.1.4 Accomplishment of Daily In-Port PMS Actions

The performance of daily Gun Mount operability tests can be seriously hampered by a continuing problem of insufficient shore power to light-off the power drives of the system. Although much has been done to improve the power available to piers where the destroyers are usually berthed, the normal in-port electrical load of these and other ships has increased at a much faster rate. Compounding this situation is the recent reduction in operating time, which leaves a ship in port on shore power for a greater percentage of time. As a result, the inability to test systems thoroughly until shortly before a ship is to get underway can result in "panic type" maintenance at the last minute so that the ship can meet a scheduled exercise or commitment.

Although this problem is well known, it becomes more significant relative to the goals of the DDEOC Program. There is a need to limit the number of ships in a given berth, to weigh the electrical requirements of the different ships when making the berthing assignments, and to promote cooperation among ships in a nest in sharing available power in order to perform adequate daily testing. It is recommended that these procedures and directives be re-emphasized at the Type Commander level.

3.1.5 Inactive Equipment Maintenance

A new program has been established in NAVSEA 04 to develop Inactive Equipment Maintenance requirements that will incorporate the existing Planned Maintenance During Overhaul (PMDO) information and incorporate it into the regular MIPs and MRCs of the PMS. Unfortunately, the time frame for completion of this task is FY 78-79, too late for most ships entering DDEOC, and PMDO was never developed for the MARK 42 MOD 9 Mounts. Fleet personnel currently revise their own PMS requirements during the overhaul to meet the changing status of component work. They can continue to do so during the Baseline Overhauls; however, these overhauls will be 12 or more months, and deterioration due to inactivity (i.e., lack of lubrication to both metal parts and hydraulic seals) can be serious if the proper precautions are not taken. This problem is being addressed as a Gun Conference DCAP action item (J0632, 30 July 1974), under the cognizance of NAVSEA 0432. Because of the potentially serious effect of not utilizing the correct procedures during the Baseline Overhauls, it is recommended that NAVSEA 049 or designated activity perform an interim review of the PMS for the Gun Mount on the FF-1052 Class and prepare guidance for use by Type Commands and individual ships in revising the PMS during the Baseline Overhauls. This recommendation is particularly applicable to hydraulic systems.

3.1.6 ORDALT "Baseline Package"

NAVSEA 6531 is reviewing ORDALTs outstanding on the 5"/54 MK 42 MOD 9 Gun Mount to develop a Baseline Alteration Package similar to that established for the Basic Point Defense Missile System. In view of the length of BOH, and taking into account the desire of CNO to limit the accomplishment of alterations during the Selected Restricted Availabilities (SRAs) within the Extended Operating Cycle,* it is important that this review be tailored first to those alterations that must be accomplished during the Baseline Overhauls.

Alterations requiring NAVSEACEN personnel for proper completion and testing may present complications if attempted during BOH, where these Navy personnel are precluded from working in the shipyard unless the shipyard has requested their assistance. The review of proposed alterations for the Baseline Overhaul must take into consideration the technical expertise required to accomplish the alterations properly and safely, since approximately half of the FY 77 overhauls will take place in private shipyards, whose Combat/Gun System capability may be inadequate to do this work.

If private shipyards overhauling the FF-1052 Class do not have the requisite Gun System expertise to perform the Baseline ORDALTs, one of the

*OPNAV Letter Serial 431/5169 of 27 Aug '74, Subj: Reduced Annualized Maintenance Cost of Destroyer Type Ships; Section 4 - "FMP Impact".

following courses of action should be taken by the Type Commanders and personnel managing the overhaul planning:

- a. Set aside time for designated personnel to install Baseline ORDALTs prior to Baseline Overhaul.
- b. Set aside time for government personnel (NAVSEACEN or NOSL) to install the Baseline ORDALTs during ship BOH.
- c. Have the private shipyard contract the Baseline ORDALT installation work to subcontractors having the requisite knowledge and expertise in this area.

Since many of ORDALTs being grouped into the Baseline package for the MOD 9 Mounts can be accomplished by Ship's Force personnel with the help of technicians from the various IMA activities, it is not critical that all the alterations be accomplished during the actual BOH. It is important, however, that the alterations identified as mandatory by this report be accomplished by the end of these overhauls. These alterations are those considered to have the greatest impact on the reliability and maintainability of the Gun Mount, and are listed in Appendix C as part of the BOH requirements.

It is recommended that a central technical activity, such as NAVSEA 6531, assume responsibility for ensuring that these alterations, as well as those other alterations required to update the Mount's operational capability, be tracked through the overhaul planning process. Alternate provisions could then be made in a timely manner for those ships that enter shipyards where the alterations cannot or will not be accomplished.

3.2 STRUCTURAL GROUP

3.2.1 Stand Assembly MK 21 MOD 2 (APL 006030001)

The historical data used in performing the SMA (i.e., MDCS, CASREPTs, DCAP reports and SARPs) did not identify requirements for maintenance of the Stand Assembly beyond the lubrication and preservation specified in the PMS for the Gun Mount. The MDCS data show a number of parts being reported against the APL for the Stand, but investigation of these data revealed that 1) most of the reports should have been against a different APL, and 2) none of the remaining parts were either of major importance or reported in sufficient quantity to be considered maintenance-significant. No CASREPTs were reported against the Stand.

3.2.2 Carriage Assembly MK 35 MOD 3 (APL 006030002)

The Carriage Assembly has the highest maintenance burden among components of the Gun Mount in terms of the combined ranking of Ship's Force man-hours and parts costs (see Table B-1, Appendix B). That assembly ranks

first in the expenditure of Ship's Force man-hours, requiring 5,740 man-hours by all ships during the 5-year period. That total represents 15 percent of all corrective maintenance man-hours expended by Ship's Force on the Gun Mount.

In the analysis of MDCS data, the parts information was screened for significant part usage in accordance with criteria established in Section 2.2. Application of these criteria reduced the number of reported parts for evaluation from 314 to three "significant" items from the Carriage Assembly as listed in Appendix B (page B-5).

The first of these parts, the subminiature switch assembly (PN 2595054) has 18 separate applications (37 total switches) in the solenoid-operated control valve assemblies of the Gun Mount. Of these, the Carriage Assembly has two applications with a total component population of seven switches. This switch has been replaced 58 times in the Carriage Assemblies of 13 ships during the data period, at a cost of \$0.99 each. The overall system usage is 397 replacements on 39 ships. This usage represents a replacement of 18 percent of the switch population of the Carriage Assembly and 24 percent of the switch population of the entire Mount over the 5-year data period.

Based on a conservative estimate of switch cycles per Mount per year (exclusive of drive system components), the replacement rate of these switches is between 41,000 and 109,000 cycles per switch replacement (see calculations, Figure 3-1). These rates are comparable with those of similar switches in other applications*. Failure of this type of switch however, can prove to be more than a routine problem. When the switch fails, the mount is often placed in a reduced operating status until the switch is located and replaced; and locating the failed switch can sometimes be very time-consuming.

To make the system more reliable, ORDALT 8082 has been developed for installation of improved type switches and switch actuators. This alteration is part of Weapons Group 2395 (Switch Actuator O/As) consisting of O/As 8071, 8082 and 8098. ORDALTs 8071 and 8082 apply to ships FF-1053 through FF-1097. ORDALT 8098, which deals with Fuze Setter MK 27 MODS 0 and 1, is applicable only to FF-1053 through FF-1064, FF-1066 through FF-1068, and FF-1070 through FF-1080. It is recommended that ORDALT 8082 be accomplished during BOH. However, since Weapons Groups are being authorized as a package, it is recommended that Weapons Group 2395 be mandatory for completion during the Baseline Overhauls.

Two other parts identified as "significant" by the evaluation criteria are proximity switches, PNs LD 628646 and LD 628647. Their combined usage for all components of the Gun Mount was 174 and 197 replacements on 35 and 37 ships, respectively. This usage has been responsible for a considerable

*MIL-HDBK-217B, Table 2.10-6, "Prediction Procedures for Basic Sensitive Switches"

Average Switch Cycles per Switch Replacement

$$\frac{\text{Switches}}{\text{Mount}} \times \frac{\text{Cycles}}{\text{Mt. Op. Yr}} \times \text{Average Mt. Op. Years} \times \text{No. of Mts.} = \frac{\text{Avg. Switch Cycles}}{\text{Switch Replacement}}$$

Low Range:

$$\frac{37 \text{ Switches}}{\text{Mount}} \times \left(\frac{9 \text{ Cycles}}{\text{Op. Day}} \times \frac{312 \text{ Op. Days}}{\text{Mt. Op. Year}} + \frac{200 \text{ (Firing) Cycles}}{\text{Mt. Op. Year}} \right) \times 3.25 \text{ Avg. Mt. Op. Years} \times 45 \text{ Mounts} = 397 \text{ Switch Replacements}$$

$$= \frac{16.3 \times 10^6 \text{ Avg. Switch Cycles}}{397 \text{ Switch Replacements}} = \frac{41,000 \text{ Avg. Switch Cycles}}{\text{Switch Replacement}}$$

High Range:

$$\frac{37 \text{ Switches}}{\text{Mount}} \times \left(\frac{24 \text{ Cycles}}{\text{Op. Day}} \times \frac{312 \text{ Op. Days}}{\text{Mt. Op. Year}} + \frac{500 \text{ (Firing) Cycles}}{\text{Mt. Op. Year}} \right) \times 3.25 \text{ Avg. Mt. Op. Years} \times 45 \text{ Mounts} = 397 \text{ Switch Replacements}$$

$$= \frac{43.2 \times 10^6 \text{ Avg. Switch Cycles}}{397 \text{ Switch Replacements}} = \frac{108,879 \text{ Avg. Switch Cycles}}{\text{Switch Replacement}}$$

Assumptions:

1. Each switch cycles once during a mount cycle. (This is a conservative estimate; the true cycling rate could easily be twice that amount.)
2. Cycles per mount operating year assumes a low of 9 cycles per day (less-than-required PMS), and a high of 24 cycles per day (which equals the daily PMS).
3. Number of mount operating days per year is estimated at 6 days per week times 52 weeks per year.
4. The average mount operating years equals the total FF-1052 Class (less the FF-1052) operating years in the data base (146.4 years), divided by 45 mounts.

Figure 3-1. CALCULATION OF CYCLES PER SWITCH REPLACEMENT

Ship's Force man-hour burden, and a cost of \$30,861 in replacement switches over the data period. The main problem experienced is the actuator repeatedly contacting and subsequently damaging the switch. This problem has resulted in the development of ORDALT 8071 for installing a new type of actuator and replacing some of the present proximity switches with a different type. Discussions with GSEC and NAVSEA Code 6531 personnel indicated that this ORDALT will effect a significant R&M improvement in these Mounts. This alteration is part of Weapons Group 2395 mentioned above, and is further justification for recommending that this Group be mandatory for accomplishment during BOH.

All other parts used on the Carriage Assembly are either random failures or the result of microswitch failures that cause false signals and allow an improper sequence of operation, resulting in broken or damaged parts and misalignment. Realignment of the system after such failures accounts for the high maintenance man-hour burden of this component, and should be reduced by accomplishment of the alterations of Weapons Group 2395.

3.2.3 Shield Assembly MK 61 MOD 10 (APL 006030013)

The Main Shield is an epoxy resin/fiberglass-laminated enclosure that houses the part of the rotating structure of the Gun Mount above the weather deck. The Shield is bolted to the base ring and rotates with the carriage. The Gun Port, through which the barrel protrudes, is an elongated slot in the Main Shield. The Gun Port is covered by a cylindrical Gun Port Shield attached to the slide. A teflon protective cover is bonded to the sealing surface of the Gun Port Shield to prevent corrosion and eliminate the need for lubrication of the surface. A polyurethane seal (the Gun Port seal) around the Gun Port opening contacts the teflon of the Gun Port Shield to form a seal against water and gas. Sealing pressure is created by finger springs pressing on the lip of the seal. A blister dome over the OMC Station protrudes from the top of the Main Shield.

The FF-1052 Class, in addition to being the first class of ships having this new lightweight fiberglass Gun Mount Shield, has a large bow-mounted sonar dome that causes the bow of the ship to continually ride through, rather than up and over, the waves. This design feature results in frequent heavy waveloading of the Main Shield and Gun Port Seal area.

The Main Shield and Gun Port Seal rank third to the Control Panels and Upper Hoist as the cause of Gun Mount CASREPTs, with 18 out of 149 reported as a result of damaged and leaking Gun Port Seals or cracked and leaking Main Shields. MDCS data reveal that the Shield APL ranks fifth in the combined man-hour/parts cost burden, and second in combined IMA and Ship's Force maintenance man-hours, with a total of 4,881 man-hours for the class during the data period (see Table B-1, Appendix B). It is also significant that the Shield and Gun Port Seal are responsible for the most outside assistance man-hours expended during the 5-year data period on the

Gun Mount. There were 983 outside assistance man-hours reported against the Shield, which represent 15 percent of the total reported for the entire Gun Mount.

Out of 249 parts reported against the Shield Assembly, only six (shown on page B-12 of Appendix B) were significant according to the criteria described in Section 2.2. Two of the parts showed minimum replacements to be considered significant; however, they both showed a majority of replacements occurring in the last year of the data period. One part, the retainer/crankshaft assembly (PN 730662) for the OMC telescope shutter retainer, was replaced six times in 1974 as compared with a combined nine times in the years 1970 through 1974. The flexible shaft (PN 964421 PC 1), which transmits elevation response inputs to the OMC Station, was replaced eight times by six ships during 1970-1974; four of these replacements occurred during 1974. Although neither of these parts is maintenance-significant in terms of number of replacements during the data period, each part has shown an increasing replacement trend that should be investigated to determine if improvements can be made in the maintenance procedures affecting these parts. The flexible shaft has appeared six times in the DCAP Data Bank and was assigned ECP 77-007 in order to determine what improvements should be made in the material or installation of this part. The lack of CASREPT or Commanding Officer Narrative (CONAR) reports causes this effort to have a low priority. Therefore, it is recommended as a short-term solution that these shafts be replaced during BOH and the subsequent ROH. To ensure that these parts are tracked through BOH, it is recommended that they be listed on the POT&I plan prior to the Baseline Overhaul.

The remaining four of the six parts considered significant because of the quantity and cost of replacements are located in the Gun Port Seal. Three of the parts are finger springs (PNs 2635046, 2635037 and 2635038) which hold the polyurethane seal attached to the Main Shield against the teflon coated Gun Port Shield. The seal itself (PN 2635833) is the last of these significant parts. All but one of these four parts indicated an increasing trend in replacement, with the number of replacements in 1974 approximating 50 percent of the total replaced during 1970 thru 1974. The replacement cost of these four parts has been \$24,200, or approximately \$200 per ship operating year.

During the interviews with Fleet personnel, the lack of watertight integrity of the Gun Mount was identified as its major problem. Several ORDALTs designed to prevent leakage of the Shield are included as part of Weapons Group W1151; however, until they reach the Fleet, salt water inside the Main Shield will remain a major problem. A 4-year-old ship cited this factor as the cause of shipyard rework in the amount of \$206,000 for the Gun Mount. Heavy seas tend to crack or break the Shield and fittings, forcing water into the working mechanisms of the Gun Mount with highly corrosive results. One ship* commissioned only a year ago is already showing the first signs of heavy corrosion around its weather fittings.

*FF 1097.

The Watertight Integrity Group of alterations (W1151) is programmed for installation on seven ships during FY 76, on two ships for FY 77, on six ships for FY 78, and on one ship for FY 79. The alterations have not yet been programmed for the remaining 30 ships. This group of alterations includes:

- a. O/A 8099 - Replacement of Gun Port Drain Line
- b. ECP 42.9.0043 - Modification of Gun Port Shield and Seal
- c. O/A 8394 - Weathershield Beam Addition*
- d. O/A 8538 - Improve Personnel Door Seal
- e. O/A 8420 - Modify Empty Case Ejection Pad
- f. ECP 771-049 - Weathershield Structural Modification
- g. O/A 8724 - Modify Case Ejector Port Assembly

Items c and f above are designed to strengthen the Shield sufficiently to withstand the waveloading and no longer crack under this stress. ECP 42.9.0043 (Item b) involves improvement of the current Shield and Seal by the development of new bonding techniques for the teflon coating on the Shield and by the installation of a pneumatically pressurized tube to replace the current Gun Port Seal and finger spring arrangement. The pressurization of the new Seal is currently provided by the ship's L.P. air system; however, other means of pressurization are also being studied.

The new Seal has been installed on one ship for test and evaluation for about one year, and GSEC is still in the process of evaluating it. This problem has been an action item of the DART Program, and is included in the Deficiency Corrective Action Program. It is assigned Problem Number X043, and is priority 6. In view of the magnitude of this problem, it is recommended that ECP 42.9.0043 be evaluated as soon as possible, and that an adequate fix be ensured in time for the FY 77 Baseline Overhauls of the DDEOC FF-1052 Class ships.

Repairs conducted during ROH on the Shield Assembly have averaged 24 man-days and \$225 in material cost on four of the first seven ships to undergo Regular Overhaul. On three of the first seven, there was an additional 20 man-days and \$500 in material cost spent on the OMC bubble and vent.

*O/A 8394 is planned to be independently accomplished by a private contractor, beginning on the first 20 ships in FY 76.

As a result of the maintenance burden caused by salt water entering the Mounts, it is recommended that the priority of Weapons Group W1151 be increased to ensure funding in FY 77; and that this group of alterations be made mandatory for accomplishment during the Baseline Overhauls of the FF-1052 Class.

Planned Maintenance for the Shield consists of cleaning and lubrication. The Gun Port Shield is cleaned daily, and the OMC blister is cleaned as required. The Gun Port Shield is to be inspected monthly, and all fittings on the OMC station, personnel door, and air vent are to be lubricated. Cleaning of the Gun Port Shield is critical to prevent abrasive deterioration of both the Seal and Gun Port Shield. This will be equally true with the new Gun Port Seal as altered by ECP 42.9.0043. However, the new Seal should not require the monthly inspection now required by MRC 7DJKQ M. The inspection periodicity should be based on the wear characteristics of the new Seal. A prediction for this requirement can be made by examining the replacement interval of the current Seal, which has averaged 26.1 months. A conservative inspection interval based on this figure would be every 18 months. The monthly lubrication requirements of this MRC are important to the proper operation of the OMC station, air vent and Main Shield door. The saltwater environment makes this the maximum interval that should be allowed between lubrication. Failure to perform this maintenance action is very likely the reason for the high replacement of the retainer crankshaft assembly (PN 730662) to the OMC telescope shutter. This action should be performed monthly, or more frequently if required (as in high sea spray conditions). Therefore, it is recommended that this MRC have a designated periodicity of "R" so as to have this action performed weekly if at sea and only monthly in port. This MRC must also be changed to reflect the requirements of the new Gun Port Seal Assembly when it is completed.

3.3 GUN LOADING SYSTEM

3.3.1 Upper Ammo Hoist Assembly MK 2 MODs 4 and 5 (APL 006030003)

The Upper Hoist and Cradle Assemblies are among the most critical areas of the Gun Mount as shown (see Appendix B) by the 21 CASREPTs attributed to APL 006030003 for 14 percent of the total for the gun mount. Despite the criticality, the complexity of the Hoist and Cradle mechanisms, and the interacting and critical timing requirements of these assemblies, relatively few of their parts have shown significant usage during the data period. Of 394 parts of all types reported against APL 006030003, only seven were considered "significant" by the criteria described in Section 2.2 (these are listed on page B-6 of Appendix B). These seven parts are discussed in the following paragraphs.

The shutter to the Cradle Assembly (PN 732943 PC 1) has been replaced seven times at a cost of \$1,640 each on six ships during the data period. The CASREPT and MDCS narratives indicate that the failure of this part was normally secondary to either an adjustment problem or the failure of an

actuator switch to function properly. Personnel from GSEC indicated that the procedures for installation and adjustment of the shutter have been updated. This, in addition to ORDALTs contained in Weapons Groups W2395 (which improves the reliability of the system) and W1850 (which will improve the function of the cradle buffer), should reduce the number of shutter replacements. It is recommended that accomplishment of Weapons Group W1850 be mandatory for Baseline Overhaul.

The filter element (PN AN6235-4A) is common to other hydraulic components of the system, and even though it appeared as a very significant item under the hoists, its usage is lower overall than the PMS requirements for filter replacement indicate it should be. Quarterly MRC C2 DEPW Q and semi-annual MRC 44 DHTA S together require that 64 filter elements be replaced each ship year. Approximately 146.4 ship years are represented in the data period. Based on these figures, 9,370 filters should have been replaced. The parts usage data for the entire system shows only 2,311 filters drawn from stock, or about 25 percent of the planned amount. Information obtained during the ship surveys indicated a problem with the number of filter elements carried in stock, in that there were insufficient elements to meet PMS replacement requirements. This may be the reason that the number of filters used over the data period was much less than the PMS-designated quantity. In order that all PMS-required filter element changes can be accomplished at the same time, it is recommended that the stocking level for these elements be increased (from 24 to at least 64 per ship) during the supply overhaul to be conducted during the Baseline Overhauls of FF-1052 Class ships.

Other significant parts include two actuators (PNs 1614375 and LD 628649) and two switches (LD 628646 and LD 628647), which are the same part types discussed in Section 3.2.2 under the Carriage Assembly. Accomplishment of ORDALT 8071 of Weapons Group W2395, which replaces these switches and actuators, will reduce the damage to the proximity switches that occurs when the existing actuators come in contact with the proximity switches. It is recommended that Weapons Group W2395 be mandatory for accomplishment during Baseline Overhaul.

The solenoid (PN 731383 PC 4) appeared as a significant item, with 18 used on 12 ships. Investigation revealed that this solenoid has six applications in the Gun Mount (a total of 12 solenoids), primarily as directional control for hydraulic valves. The replacement of the solenoid in the total system was 50 on 20 ships over the 5-year data period, but the last year's usage was only three. It should be noted that new ships were entering the Fleet during the entire data period, and if the solenoid were a continuing problem it should show a replacement rate greater than 20 percent during the last year. Because the replacement rate of this solenoid dropped in the last year to less than 10 percent of the total used over the entire period, it is no longer considered a significant problem in this system.

A clevis pin (PN 733745 PC1) used in the Upper Hoist shutter yoke assembly has been replaced 13 times on nine ships. However, like the solenoid discussed above, it has not had significant usage in the most current portion of the data period. For example the clevis pin has not been reported as being replaced during 1974. Therefore the clevis is not considered a maintenance problem. Section 2.2 discusses the reduction in operations, and other reasons that may account for some reduction in the usage of parts such as the clevis pin on the Hoists.

The final significant part reported against the Upper Hoist and Cradle Assembly is a hose (PN 2635305) located in the Above Stand Piping and Clamping System (see Figure 2, Volume 1, of the IPB, OP 3851). It is also reported against the Shield, APL 006030013. The combined usage is 23 on 10 ships, with 8 of those 23 occurring in the last year of the data period. This increase in usage may be a result of more ships in the data base, or it may be an indication of an oncoming deterioration problem. It is recommended that these hoses be listed on the BOH POT&I Plan to ensure that they are carefully examined prior to BOH, and that the hose part usage data be entered in the DCAP data bank for use with future information.

Hydraulic piping has been a constant source of problems in the Gun Mount, as has been pointed out in Gun Conferences and through DCAP reporting. The most frequently occurring failures have been in the hydraulic piping to the Cradle Assemblies. Engineers at both NAVSEA 0653 and GSEC stressed the importance of the Cradle Assembly hydraulic piping as a recurring problem which they were working on. Analyses of the hydraulic piping by GSEC have shown that sections of the piping are improperly supported and subject to fatigue failure. Results of these studies have been incorporated into ORDALTs 8078, 8723, and 8861, which are part of Weapons Group W2345 (Piping/Fastener Improvement). Accomplishment of the alterations in Weapons Group W2345 should provide a major improvement to this area of the system. The Weapons Group W2345 alterations are recommended as mandatory for accomplishment during Baseline Overhaul.

The PMS pertaining to the Hoist and Cradle Assemblies, other than the filter-changing mentioned previously, consists of weekly and monthly lubrication and quarterly adjustments if required. The importance of these actions cannot be overemphasized. It appears that the existing lubrication requirements are satisfactory and are usually being performed by the ships. However, the periodicity of the quarterly check of the Gun Loading System mechanical adjustment, MRC 54 DJKH Q, should be modified. The need for these adjustments is a function of the number of times the loading system cycles or the number of rounds fired, as well as time. It is recommended that this PMS requirement be changed to an "R-Q" (as required but no longer than quarterly), where the "R" is related to the number of cycles or the number of rounds fired.

The Upper Hoist and Cradle Assemblies have received consistent but fairly low-level repair or adjustment support from the shipyards during the first six Regular Overhauls of the Gun Mounts (four out of six ROHs at average of 16 man-days and \$125 material). The primary problem worked on by the shipyards is repair of leaking control valve blocks. The completion of ORDALTs contained in Weapons Group W1195, which change the O-ring type seal to a U-cup type in these valve blocks, should reduce the number of repairs needed in the future. It is recommended that the alterations of Weapons Group 1195 (Hydraulic Seals) be mandatory for accomplishment during the Baseline Overhaul.

3.3.2 Slide Assembly MK 31 MOD 2 (APL 006030007)

Of the 377 parts reported against the slide assembly, only 14 were considered potentially significant relative to the quantity of parts used and the number ships reporting. However, nine of these were O-rings, gaskets, filters, and other minor consumables. The usage data for the O-rings emphasize the benefit of changing O-rings to cup seals in accordance with ORDALT 8507, which is part of Weapons Group 1195 previously discussed. The remaining five parts (shown on page B-8 of Appendix B) are discussed in the following paragraphs.

The shutoff valve (PN 2528657) has four different applications in the Gun Mount. However, the countercoil cylinder charging shutoff valve has required the majority replacements, 10 of 13, during the data period. This part shows an increasing overall usage trend in that 5 of the 13 were replaced during the last year of the data period. The MDCS narrative comments indicate that two problems cause replacement: leaking valve stems and broken-off handwheels. Information from NAVSEA 6531 indicates that the problem with the valve is overtightening of the valve stem to prevent it from being jarred open through vibration experienced during firing. It is recommended that a valve with finer threads, which will better withstand vibration, be identified as a replacement valve; and that this problem and solution be written up and disseminated to the Fleet in a monthly DCAP Report.

The safety link (PN 731443 PC 3) has been replaced 14 times on 11 ships over the 5-year period. The replacement rate is increasing, as reflected by the four replacements in the last year of the data. This part is located just behind the gun port shield, in a difficult area to access. This difficulty has led to unattended corrosion, the primary reason for replacing this part. The installation of the Watertight Integrity alteration group should help resolve this problem.

A seal washer (PN 734914 PC 102) had shown significant usage with 18 replaced on 13 ships over the data period; however, this part was not replaced at all during the last year of the data period, and consequently does not seem to merit further investigation at this time.

The proximity switch (PN LD 628647), which has been discussed in Section 3.2.2 for the Carriage Assembly, also appears on the list of significant parts reported against the APL for the Slide Assembly. This provides additional justification for making mandatory during Baseline Overhaul the ORDALTs in Weapons Group W2395. The ORDALTs of this Group call for replacement of the actuators for these switches with a new type so as to prevent the damage to the switches now being experienced.

The 110 volt, 60 Hz solenoid (PN 733955 PC 4) has three applications in the Gun Mount, with a total of seven of these devices installed. The Slide to Cradle Latch Valve Assembly has two installations each, for a total of four devices; the Lower Hoist Loader Control Valve Assembly, where the device is used twice; and the Loader Door Locking Assembly, where it is used once. The first application has accounted for 15 of the 47 reported replacements during the data period. The quantity of solenoids replaced during the last year of the data period is 11 out of 47, for slightly more than 20 percent of the 5-year total. Interviews with GSEC engineering personnel did not reveal any indication that the solenoids were a significant maintenance or reliability problem. An explanation offered for the slight increase in the number of replacements of this solenoid in the last year of the data is that there were more ships in the data base, with a steady but not significant solenoid failure rate. In view of the lack of any other evidence, such as CASREPT or DCAP reports, to emphasize problems with these solenoids, it is concluded that these devices are not a significant maintenance problem.

The PMS maintenance actions affecting the Slide Assembly involve monthly lubrication, weekly checking of fluid and air pressure levels, and quarterly checking of mechanical adjustments. No evidence has been identified during this analysis that would indicate a reason to change either the weekly fluid and air pressure check (MRC 74 DJDP W) or the monthly lubrication (MRC 74 DJDQ M). The quarterly check of mechanical adjustments is for the entire Gun Loading System, and changes in the periodicity of this requirement are discussed in Section 3.3.1.

An evaluation of the work accomplished on the Gun Loading System during seven recurring FF-1052 Class Regular Overhauls did not identify any significant maintenance actions. Re-preservation of the slide area is the most common discrepancy noted by the POT&I teams. Accordingly, no specific repairs on a class-wide basis are required for the Slide Assembly during the BOH.

Several ORDALTs previously mentioned apply also to the Slide Assembly, and are considered mandatory for accomplishment during BOH if not already effected prior to that time. These ORDALTs are contained in Weapons Groups W1195 (Hydraulic Seals) and W2395 (Switch Actuator A/As).

3.3.3 Fuze Setter Assembly MK 27 MOD 0, 1; MK 29 MOD 0, 1
(APLs 006030008 and 006030020)

The MK 27 Fuze Setter Assembly is used on hulls FF-1053 through FF-1080. The MK 29 Fuze Setter Assembly is a modified version of the MK 27, and is used on the later hulls FF-1081 through FF-1097. The units are very similar, and many of the parts are the same.

The CASREPT analysis for both APLs showed the Fuze Setters to be critical components to Gun Mount operation, accounting for 14 of the 149 CASREPTs analyzed. However, each CASREPT cause was different, and no single part or failure mode was indicated as a recurring maintenance problem area - a fact also confirmed by review of the parts usage summaries for these components. Of 152 items reported against both APLs, only two parts showed significant replacement during the data period. Both of these parts were hydraulic filters and filter elements, which are expected to be frequently replaced due to PMS requirements.

PMS actions for the Fuze Setters consist of weekly operational checks and lubrication, and semiannual changing of the hydraulic filter elements. No changes are recommended to the PMS of the Fuze Setters as a result of this analysis. Neither is there any evidence of a need for specific overhaul actions on the Fuze Setter during Baseline Overhaul.

3.3.4 Rammer Assembly MK 2 MOD 2 (APL 006030009)

The Rammer Assembly has been reliable and relatively troublefree. Only five of 149 CASREPTs analyzed point to the Rammer as the cause of the report. Thus, although critical to the operation of the Gun Mount, this component has not been a primary cause of reduced availability.

The MDCS parts usage data show 203 items reported against the APL (006030009) for the Rammer Assembly. Eleven of these items were replaced on five or more ships, with eight items having significant usage. Three of these eight parts are packing or retaining rings, and are not considered maintenance-significant. Of the remaining five parts (shown on page B-9 of Appendix B), one item is a bearing assembly, PN 2814846, which was replaced 15 times on six ships. This part was not replaced during the last year of the data, and is not considered maintenance-significant. The remaining four parts are from the rammer spade liquid spring assembly. These parts are the lock ring, button retainer, rammer button, and button seat, PNs 730903-2 through 730903-5. These parts have been replaced an average of 30 times on 20 ships, not a serious problem but certainly a nuisance-type maintenance item. It is recommended that O/A 07651 (Modify Rammer Liquid Spring) be mandatory for accomplishment during Baseline Overhaul.

A maintenance problem indicated by the data is leaking hydraulic fluid around the hydraulic seals of the rammer piston rod and cylinders, as indicated by the quantity of packing replaced. This problem will be

significantly reduced by accomplishment of the alterations of Weapons Group W1195 which will change the O-ring packing to U-cup type seals, providing additional justification for making this group of alterations mandatory for the BOH.

The PMS maintenance actions pertaining to the Rammer Assembly are weekly and monthly lubrication. These actions are considered necessary to the proper working of this component.

No maintenance actions were required for the Rammer Assembly during the seven Regular Overhauls evaluated for FF-1052 Class ships. No class maintenance actions are recommended for this component during the Baseline Overhaul.

3.3.5 Empty Case Ejector Assembly MK 2 MOD 2 (APL 006030010)

The Empty Case Ejector Assembly accounted for 14 of the 149 CASREPTs analyzed. Nine of these failures were caused by the malfunctioning of various actuator switches, resulting in bent, broken or sheared parts. As in the case of most of the components of the Gun Mount, these failures appear to be random and are not concentrated in any one area or part. Accomplishment of the Switch Actuator ORDALTs in Weapons Group W2395 should significantly reduce these failures, further reinforcing the recommendation to make these ORDALTs mandatory for Baseline Overhaul.

Review of parts usage reported against the Empty Case Ejector Assembly revealed that nine parts out of a total of 184 items had significant replacements. Two of the nine parts are the case extractor cylinder (PN 731379 PC 1) and the piston (PN 731379 PC 2). These parts have been replaced seven and nine times, respectively, on five ships at a cost of \$1,210 for the cylinder and \$90 for the piston. For both items the replacement in the last year of the data was one each, which is interpreted as a steady, low-level-maintenance action probably related to the care paid to the cleanliness of the hydraulic system. Installation of the Weapons Group ORDALTs (W1195), which changes the hydraulic seals to polyurethane cups, will help reduce contamination of the hydraulic system by lessening the frequency with which the system is opened for replacement of the present O-ring type seals. This provides further justification for making accomplishment of the ORDALTs of Weapons Group W1195 (Hydraulic Seals) mandatory during Baseline Overhaul.

The valve (PN 731389 PC 2) that controls the ejection port door was replaced eight times on seven ships during the data period, at a cost of \$72 each. This part had only one replacement during the last year, which indicates a steady or decreasing problem area. Another significant part from the same area is the bushing (PN 731404 C1) to the door hinge. This part was replaced nine times on eight ships during the data period, at a cost of \$41 each; however, it has been replaced only once during the last year. Both of these parts will be modified or eliminated by the

accomplishment of ORDALTs 8420 and 8724 of Watertight Integrity Group, W1151. This group has already been recommended as a mandatory accomplishment item during the BOH.

The fifth significant part in the Empty Case Ejector Assembly is the proximity switch, PN LD 628647. These switches were reported against APL 006030010 as being replaced 14 times on nine ships. They are used extensively throughout the Gun Mount System, and their replacement - or the actuator replacement by ORDALT 8071 of Weapons Group W2395 - has been mentioned several times previously as a major reliability improvement (see Section 3.2.2).

The remaining four parts are associated with the door assembly of the empty case port. The door itself (PN 2815059) was replaced 10 times on six ships at \$237 each, but had no reported replacements in the last year. The ring seal assembly (PN 1469745) was replaced 12 times on 10 ships at \$80 each, but only once in the last year. The seal assembly (NIIN 7788613) was replaced 19 times on seven ships. However, that assembly does not appear on the APL for the Empty Case Ejector, nor in the IPB for the Gun Mount. A seal assembly is listed in the APL under the NIIN of what has been reported as the ring seal assembly (PN 1469745). There have been no reported replacements of the seal assembly in the last year, and it is assumed that this item is now a part of the ring seal assembly. The last part with significant usage is the door magnet, PN 2081082, for the Case Ejector port door. There have been 58 magnets used on nine ships; at six magnets per set, this reflects a total of nine sets used during the data period. Two of these sets were replaced in the last year of the data and, while these items are not expensive (\$2.30 each), these replacements point to this area as a continuing source of maintenance man-hour expenditure. This entire assembly (covering these last four significant parts) is being addressed by the redesign effort associated with the modification of the Ejector Port Assembly (O/A 8724). This ORDALT is part of Weapons Group W1151 (Watertight Integrity) which was previously recommended as mandatory for accomplishment during Baseline Overhaul; analysis of the above data further supports this recommendation.

During the Regular Overhauls of the first seven FF-1052 Class ships with 5"/54 Cal MOD 9 Gun Mounts, four had some work done on the Empty Case Ejector Assembly. Investigation revealed that two of the ships had work done on the case ejector door, and the other two had cleaning and lubrication performed during the overhaul. In view of the modification to the ejector port door assembly to be accomplished during Baseline Overhaul, no other overhaul work is considered necessary on a class-wide basis.

The PMS for the Empty Case Ejector Assembly consists of a monthly lubrication requirement. No change to this requirement is recommended.

3.3.6 Gas Ejector Assembly MK 13 MOD 1 (APL 006030011)

The Gas Ejector Assembly has been relatively maintenance-free during the data period. Reported against this component has been only one CASREPT, which addressed the air supply system rather than the Gas Ejector Assembly. Fifty-nine part replacements were identified against the assembly, but most of these parts were incorrectly reported and none were considered significant usage items.

The performance of the Gas Ejector Assembly is critical to maintaining an acceptable level of toxicity in the Mount; however, because of low maintenance burden, the assembly itself is not modified by the Toxicity Group of ORDALTs (W1220). No work on this component has been required during the first seven Regular Overhauls of FF-1052 Class ships. Accordingly, no changes to current maintenance procedures are necessary to extend this component of the Gun Mount to a 54-month cycle between overhauls.

3.3.7 Housing Assembly MK 11 MOD 2 (APL 006030012)

The Housing Assembly comprises several major subassemblies, including the Housing itself, the breech operating mechanism assembly, the breech-block and firing mechanism assembly, the recoil cylinder, and the extractor arm assembly. Even though this component is fairly complex, few problems have been identified.

Six of the 145 CASREPTs for the Gun Mount for the 5-year data period have been reported against the Housing Assembly, with two directly related to the firing pin and three to the hydraulic lines to the breechblock.

Of the 199 parts replaced during that interval, only two parts were considered significant. One is the electrical cable assembly (PN 2593807) to the firing pin, which has been replaced 10 times on nine ships. This is probably due to fatiguing of the wire from the continual stress of the recoil, according to the ship survey comments and discussions with NAVSEA. This cable assembly should be replaced during the Baseline Overhaul prior to an extended cycle. The other part showing significant usage has been the firing pin assembly (PN LD 616699-5). This part has been ordered 68 times by 33 ships, 19 of these during the last year of the data, at a cost of \$1870 each for a total of \$35,530. This total cost is the highest for any single item in the Gun Mount during the last year of the data period.

The practice of keeping a spare firing pin on hand in the event the installed pin fouls during firing operations can be assumed to account for one of the two parts ordered by each of the 33 ships. The second firing pin was most likely ordered because the original assembly had worn out, on an average of 27 months after commissioning. One problem, identified by the ship surveys, that could have added to the replacement of additional firing pins was that the bayonet locking arm (PN 731026-2) obtained through the supply

system did not fit. According to GSEC personnel, that problem has now been resolved. The high replacement rate of the firing pin assembly has prompted a redesign of the assembly under ECP 77.2-397. This effort is in addition to ORDALT 8097, which modifies the firing pin and safety latch. Accomplishment of O/A 8097 will help to lengthen the time between cleaning of the current firing pins, and should be accomplished during the Baseline Overhaul if not already completed. Efforts to complete design, manufacturing, and testing of the new firing pin should continue to receive priority attention in order to reduce the replacement costs currently being experienced.

The remaining parts reported against APL 006030012 were primarily one- or two-time replacement items, and did not indicate any patterns or trends that could be influenced by changes to current maintenance policies, practices, or procedures.

Repairs to the Housing Assembly were accomplished on only two of the first seven FF-1052 Class ships to go through Regular Overhaul. No specific repairs are recommended for this component on a class-wide basis during the Baseline Overhaul.

The PMS for the Housing Assembly consists of three weekly actions: cleaning the breechblock guides and lubricating the Housing (MRC 44 DHVN W); testing normal and emergency firing circuits and outputs (74 DJKM W); and checking air pressure in the counterrecoil cylinders (74 DJDP W). These maintenance actions are considered necessary to the effective operation of this component, and should be continued. Two other PMS requirements for the Gun Mount affecting the Housing are prefiring checks (44 DHTC R), and postfiring checks (A3 DDGR R). These actions are also vital to the successful operation of the Gun Mount, and should not be changed except as they are incorporated into the Total Ship Test Program MRC for the Gun Mount: MIP G-T001-W-3R and W-3Ra.

3.3.8 Lower Ammo Hoist Assembly MK 5 MODs 0 and 1 (APL 006030014)

The Lower Ammo Hoist Assembly has a relatively low maintenance burden among Gun Mount components, according to the combined man-hour and cost rating. At the same time, the assembly is third in the number of JCNs (Job Control Numbers) reported in the MDCS data. This points up the fact that the Lower Hoist Assembly area has evidenced a number of small, easily correctable maintenance problems. A total of 287 different parts were reported against this component. Only 19 of these were reported by five or more ships, and only 12 exhibited a part usage worthy of further investigation (see page B-13 of Appendix B). The following paragraphs discuss the significant items.

During the data period, 54 O-rings (PN AN 6230-22) were replaced on 15 ships in 26 events, or an average of two O-rings per event. This O-ring seals the bearings and brake discs of the brake assembly from the speed reducer assembly. No other associated parts of either the brake or speed

reducer assemblies have been replaced, and the reason for this O-ring replacement is not known. Fourteen of the replacements have occurred during the last year of the data, which indicates an increasing trend. These data should be entered into the DCAP data bank for correlation with other brake problem information, since a possible brake adjustment problem is indicated.

The switch assemblies (PN 2595054) were used 195 times on the Lower Hoist Assemblies of 31 ships at a cost of \$0.99 each during the data period, representing 45% of the total system usage. Added to this number of switches are 33 switch actuators replaced on 13 ships during the same period. For each part, the usage during the last year is approximately 20% of the total usage for the Gun System.

GSEC is aware of these problems. ORDALT 8082 has been developed to change the current actuators to spring-loaded types, and ECP 42.9.0007 to replace the switchettes. These alterations are part of the Switch Actuator ORDALT Group 2395. This group of alterations was recommended for mandatory accomplishment in connection with the Upper Hoist and Carriage components. The usage of these parts on the Lower Hoist Assembly reinforces the need to have these alterations completed during the Baseline Overhaul.

The bearing assembly (PN 73333000 PC 7) has experienced 20 replacements on five ships at a cost of \$80 each during the data period. These bearings are used on the projectile and powder-case loading shutters of the Loader Assemblies. In view of the quantity of bearings per Loader (16), and the small number of replacements (1) during the last year of the data period, it is probable that the replacement of these bearings could have been due to installation, loading procedures, or bad bearings. Misalignment of the shutters, causing the shutter to be struck by the loader drum, could also be the cause of some replacements. With only one replacement during the last year and no other indications of problems in this area from other data or survey input, these bearings are not considered a significant maintenance burden.

The gasket (PN 733367 PC1) that seals the cover of the loader assembly control valve was replaced 47 times on 13 ships over the data period, but was replaced only once during the last year. This indicates that initial leaking and adjustment problems with the valve occurred early in the life of the Gun Mount. No further investigation is considered necessary.

The pawl support (PN 734100.1) and pawl pin (PN 734100.3) were replaced 30 and 81 times, respectively, on 13 ships. The replacements during the last year of the data were two pawl supports and 11 pawl pins, which is less than 20 percent of the total used during the period. According to engineers from GSEC and NAVSEA, this reduced replacement rate can best be explained by (1) an increase in operator training, which reduces the number of accidents involving dropping a round down the hoist onto the pawls, and (2) a decrease in the amount of firing being conducted during the latter part of the data period. Discussions with technical personnel from GSEC, coupled with ship surveys, did not identify these parts as a current cause of significant maintenance burden.

The proximity switches (PNs LD 628646 and LD 628647) were replaced 37 and 33 times on 15 and 11 ships, respectively, during the 5-year data period. These switches are used extensively throughout the Gun Mount System and have already been identified for improvement through ORDALT 8071 of Weapons Group W2395 (Switch Actuator ORDALTs). This group of ORDALTs was previously recommended as mandatory for accomplishment during the Baseline Overhaul. The proximity switch data further support that recommendation, and indicate a specific need for accomplishment of these ORDALTs for the Lower Hoist Assembly if only a limited amount of switch replacements can be accomplished.

The solenoid (PN 1593073) was replaced 11 times on eight ships; however, since there are 16 of these parts per Mount, it is not considered a significant problem. Discussions with GSEC personnel, together with ship surveys, confirm that the solenoids are not a significant problem relative to the operation of the Gun Mount.

The filter element (PN 2635098) was replaced 12 times on eight ships during the data period; however, no replacements were reported during the last year. This element is a cartridge-type oil filter used in the lower accumulator valve block, and is identified as item 288-72 in the IPB for OP 3851. The filter is to be cleaned semiannually in accordance with MRC 44 DHTA S. No reason to change this requirement was indicated by this analysis, and no further action concerning this part is considered necessary.

The retaining ring (PN 2533400 PC 3) was replaced 125 times during the data period, but not at all during the last year of the data. Since there are 78 rings per Lower Hoist Assembly, the initial replacement rate is not as significant as the replacement quantity might suggest. The lack of final-year replacements is further indication that early adjustment problems with the Mounts were corrected, and the retaining ring is no longer regarded as a significant maintenance item.

The PMS for the Lower Hoist Assembly comprises lubrication, cleaning, and pre-firing checks. There has been no indication from this analysis that these maintenance requirements should be changed.

The Lower Hoist Assembly has been responsible for the highest average man-hour and material cost of Gun Mount components during the initial Regular Overhauls of the FF-1052 Class. For the four ships in which they were overhauled, the associated work averaged 33 man-days and \$475 in material costs. A review of the SARPs for these ships revealed that the primary repair items accomplished during these overhauls were replacement of the gaskets and O-rings of the control valve blocks of the Lower Hoist Assemblies. Accomplishment of the alterations of Weapons Group W1195 (Hydraulic Seals) should lessen the need for this type of repair in the future. No further action is recommended at this time.

3.3.9 Gun Barrel Assembly MK 18 (APL 006030019)

Although 125 parts were reported against the Gun Barrel Assembly during this data period, fewer than 10 of those parts were correctly reported and only two of the 10 had significant replacements. The Gun Barrel (PN 2580152) was replaced five times on five ships, and the Gun Barrel Liner (PN 2580150) was replaced four times on four ships. Adding the one barrel replaced during a Regular Overhaul makes a total of 10 times that the Mounts required regunning during the data period. This is not maintenance-significant, in that regunning is determined by the number of rounds fired or when the liner is 80 percent eroded. The MK 18 MOD 3 Barrel Assembly used on these ships, including both a liner and the barrel itself, are being replaced with MK 18 MOD 5 (monoblock) barrels as the supply system is depleted of the MOD 3s.

PMS requirements for the Gun Barrel Assembly include weekly cleaning and measurement of bore erosion after firing 50 equivalent service rounds. No changes in these maintenance actions are indicated. Further, no additional class-wide maintenance is recommended on the Gun Barrel Assembly during the Baseline Overhaul of ships entering the DDEOC.

3.4 GUN LAYING SYSTEM

3.4.1 Firing Cutout Assembly MK 1 (APL 006030004)

No significant part replacements have been associated with the Firing Cutout Assembly. PMS for this component consists of testing the operation of the cutouts weekly, and checking the oil level of the assembly monthly. No changes are indicated for either maintenance action. Further, no additional class-wide Baseline Overhaul requirements are recommended as a result of this analysis.

3.4.2 Train Power Drive Assembly MK 19 MOD 2 (APL 006030005)

The Train Power Drive Assembly is a low-maintenance-burden component of the Gun Mount and is not one of the top 10 components shown in Table B-1 of Appendix B. When it does fail, it is not readily repaired by the Ship's Force, as is indicated by the five CASREPTs resulting from failures of the assembly. Four of these CASREPTs are associated with the auxiliary pump (PN LD 616589), and account for nearly all the major maintenance actions during the entire data period. The only two parts that experienced a significant quantity of replacements (shown on page B-7 of Appendix B) were a gage (PN 2814839) to the pressure accumulator assembly, and a filter (PN AN6235-4A) widely used in the Gun Mount. Both of these items are expected to be replaced during the normal operation of the system, and are not considered maintenance significant.

Table 3-1 includes summaries of six PMS actions applying to both the train and elevation components, and three additional actions: MRC 74 DJKP M, check oil level of train response gear assemblies; MRC A3 DGSN A, lubricate train receiver regulator; and MRC A3 DGSP A, lubricate elevation receiver

Table 3-1. PMS REQUIREMENTS FOR TRAIN AND ELEVATION COMPONENTS		
Item	MRC Code	Maintenance Requirement Description
1	73 DFPG W	a. Lubricate training internal gear. b. Lubricate elevation arc.
2	74 DJDP W	a. Check train and elevation accumulator pressure.
3	74 DJKN M	a. Lubricate train and elevation power drives. b. Check oil level in train and elevation response gears.
4	74 DJKP M	a. Check oil level of firing cutout assembly. b. Check oil level of train response gear assemblies.
5	C2 DEPW Q	a. Replace filter elements in train and elevation auxiliary relief valve blocks.
6	44 DHVL S	a. Lubricate train power drive coupling. b. Lubricate train and elevation auxiliary relief valve assemblies.
7	A3 DGSN A	a. Lubricate train receiver regulator.
8	A3 DGSP A	a. Lubricate elevation receiver regulator.
9	44 DHTC R	a. Perform prefiring checks.

regulator. A review of these MRCs indicated that they are necessary to the proper operation of the train and elevation power assemblies, and no changes in procedure or periodicity were justified. However, several discrepancies in their content were found. MRC 74 DJKN M contains a requirement to "Check oil level in train and elevation response gears", which is nearly identical and overlaps the requirement of MRC 74 DJKP M, "Check oil level of train response gear assemblies." It is recommended that the requirement to check oil be deleted from MRC 74 DJKN M, and that MRC 74 DJKP M be expanded to cover checking oil in both the train and elevation response gear assemblies. It is further recommended that MRCs A3 DGSN A and A3 DGSP A be combined into a single MRC, as is the case with other MRCs that combine train and receiver requirements.

Data from previous Regular Overhauls of the FF-1052 Class indicate that three of the seven ships required an average of 10 man-days of repair/adjustment work on these components. Information from this analysis does not support any class-wide repair recommendations for these components during Baseline Overhaul.

3.4.3 Elevation Power Drive Assembly MK 19 MOD 2 (APL 006030006)

The Elevation Power Drive Assembly is similar to the Train Power Drive described above. The Elevation Drive received four CASREPTs during the data period, but these did not point to any single cause or trend. The only significant part out of 80 items reported as replaced against the assembly was a filter (PN AN6235-4A), which is not considered maintenance significant.

The PMS for the Elevation Power Drive was discussed in Section 3.4.2. Although two minor changes to PMS procedures were recommended, no basic changes to the type or periodicity of routine maintenance were found necessary from this analysis.

No FF-1052 class-wide repair items are deemed necessary for the Elevation Power Drive Assembly during Baseline Overhaul.

3.4.4 One Man Control Assembly MK 4 MOD 12

The One Man Control Assembly (PN LD 613739) is located in the OMC Station with the telescope and sight. Since the OMC Station normally functions as a backup mode of operation, the criticality of this assembly will vary with the status of the EPI Control Panel and the ability of the Gun Mount System to receive orders from the Gun Fire Control System. Only one CASREPT was reported against the OMC during the data period, involving the sight port door, but should have been reported against the Shield rather than the OMC. No significant part replacement rates were reported against this assembly, and Regular Overhaul data indicated that no specific repairs to those units had been required during the seven Regular Overhauls of the FF-1052 Class. Further, this analysis identified no pending alterations to the OMC Assembly, and therefore it is concluded that no significant maintenance problems exist or can be anticipated during EOC for these units.

3.4.5 Telescope MK 116 MOD 0, MK 102 MOD 6 (APLs 006800026 and 006021111)

These two Telescopes are the same except for the makeup of their electronic elements. ORDALT 6745 converts the electronic units of the Telescope from tube-type (APL 006800026) to solid state (APL 006021111). No CASREPTs were reported against the Telescope itself, although one CASREPT involving the shorting of a synchro control transformer, which caused loss of the elevation servo system to the Telescope, was reported against the EPI Control Panel.

Shipyard overhaul repairs did show a relatively heavy maintenance burden for the Telescopes as compared with other components of the Gun Mount. An average of 33 man-days and \$310 was required on four of the first seven ships of the FF-1052 to undergo Regular Overhaul. Review of the SARPs from these ships indicated only two Class "B" repairs. Other common repair requirements included regassing, alignment, and repairs to the shutter assemblies.

From this analysis, there is no information to indicate any likely maintenance problems that would arise from extending the time between Regular Overhaul periods for these components. However, it is recommended that the Telescopes be regassed, sealed, and aligned during the Baseline Overhauls.

3.5 GUN MOUNT CONTROL

3.5.1 Control Panel MK 114 MOD 0, 1 and Power Panel MK 81 MOD 9, 10 (APL 006030015)

The Control and Power Panels are the highest-maintenance-burden component group of the Gun Mount in several categories: number of maintenance actions, number of CASREPTs, and cost. Compared with the next-highest-burden component of the system, these panels have had twice as many maintenance actions reported, twice as many parts requisitioned, and twice as many dollars expended in component costs. Although Ship's Force man-hours over the data period are also high (4345 man-hours), the panels rank second in this regard to the Carriage Assembly (APL 006030002). However, the outside assistance, or IMA-reported, man-hours are only 20 percent that of the Shield (APL 006030013), the highest Gun Mount component in the outside assistance category. These figures point to the Control and Power Panels as an area of many low-man-hour, high-part-cost repair maintenance actions by Ship's Force.

Analysis of the narratives of the 24 CASREPTs reported against the Control and Power Panels did not indicate any trend in the causes of inoperability of these components. A number of the circuit board failures were due to high-transient voltages, while other failures were the secondary result of other parts failing and causing an overloading of the boards. The 24 Vdc power supplies were the cause of six of these CASREPTs, with overheating cited as one of the causes of failure of these parts.

Three types of parts - lights, fuses, and circuit boards - contributed significantly to the high number of Job Control Numbers (JCNs) and part actions. Three other part types - circuit boards, power supplies, and relays - were responsible for most of the cost burden of the Control Panels. The latter three part types were collectively responsible for 71 percent of the part-replacement cost associated with the Control Panels, and 18 percent of the replacement cost for the entire Gun Mount.

Individually, the circuit boards listed in Table 3-2 are the most costly item, totaling \$252,306 during the data period, which represents 15 percent of the cost of parts for the entire Gun Mount.

The initial reaction to this cost information could be that something is seriously wrong with the circuit boards. This is not necessarily true, because part of the maintenance and troubleshooting philosophy of the Gun Mount calls for removing and replacing these boards when suspected of failure. To do so, however, the Gunner's Mate must turn in a set of boards to Supply before he can be issued a new set to perform his troubleshooting. This creates a situation wherein a number of good boards are pulled and sent to NOSL to be reworked without really being checked. A sample group of the boards being sent to NOSL in 1972 showed that while more than 50 percent of the "driver" type boards were bad, fewer than 50 percent of the "logic" type boards were defective. The overall proportion of good boards at that time was 51 percent.

Although the full price is recorded each time one of these boards is drawn from stock by the ship, it is not readily clear how much these boards cost and to what organization within the Navy the final charge is made, since many of the boards in stock are reworked rather than new. In view of the costs associated with the turnaround and rework of these boards and the time expended by Ship's Force in requisitioning them, it would appear to be cost-effective for the leading maintenance supervisor to have a spare set of these boards (those showing the highest percentage of false replacements) to use in troubleshooting.

It is recommended that NOSL continue its analysis of "good" versus "bad" circuit boards being returned for rework by the Fleet. If a high percentage of certain circuit boards are still being returned with no defects, NAVSEA should determine if it is feasible to provide spare boards to the maintenance personnel for troubleshooting purposes. This would theoretically eliminate the need for Ship's Force personnel to pull out and "turn in" to Supply a circuit board just to be able to draw another board from stock to use in troubleshooting.

The parts usage summary for the Control Panels (see Page B-14 of Appendix B) showed 282 items reported against this unit, of which 22 parts indicated significant usage. Five of the significant parts, which are Control Panel circuit boards, and their usage data are listed in Table 3-2. It appears from the part usage data that further analysis of the output driver board in particular could be cost-effective because of its high cost per board and high total cost. It is recommended that GSEC determine the need for (1) providing overload protection to the existing board or (2) redesigning the board to be less sensitive to high transient voltages.

Replacement rates of other parts on the Control and Power Panels are discussed in the following paragraphs.

Table 3-2. USAGE DATA, CONTROL PANEL CIRCUIT BOARDS								
PN	Noun Name	Replacements			QPC*	No. Ships Reporting	Cost per Unit (\$)	Total Cost (\$1000)
		Total	Last Yr	Ratio**				
LM 2527452	Inverter Circuit Board	226	43	0.19	19	33	93	21.0
LM 2527453	Logic Circuit Board	297	97	0.34	68	38	87	25.0
LM 2527454	Output Driver Circuit Board	223	51	0.23	10	34	459	110.4
LM 2527455	Latching Relay Circuit Board	114	29	0.25	3	31	481	55.0
LM 2527456	Light Driver Circuit Board	411	72	0.18	12	41	148	41.0
Total								252.4

*Quantity per component (EPI panel). **Ratio of last year to total.

The solenoid relay (PN LD 280281), a high-current relay contactor in the EP1 Control Panel, has been replaced 16 times on nine ships during the data period, at a cost of \$401 each. Comments obtained during ship surveys indicated that the contactors cannot be adjusted, and eventual arcing leads to contactor burning and failure. There are four of these contactors per ship. Even with the increased number of ships in the data base during the last year of the data, only three of these parts were replaced. GSEC has not received information from DCAP reports or other sources that identify these parts as significant maintenance problems. The solenoid relay does not appear to be a maintenance problem, and therefore merits no further investigation.

The switch assembly (PN LD 298153.1) was replaced 16 times on 11 ships at a cost of \$66 each; however, there are a total of 32 of these parts per Gun Mount, and none of these were reported as being replaced during the last year of the data. It is concluded that this part is not a significant maintenance problem at this time.

The boot (PN 1609611) was replaced 42 times on 11 ships at a cost of \$4 each. There are 48 of these items per ship, which would tend to indicate this replacement rate was not significant. However, all replacements occurred in the last year of the data period. The boots go over pushbutton switches of the EP2 Control Panel to provide a dust and moisture seal. It would appear from the data that the boots are beginning to deteriorate after approximately 4 years of life, and will be an increasing replacement item as the Gun Mounts become older. The major alterations recently accomplished on the EP1 and EP2 Panels to replace the type of switches used included replacement of any deteriorated boots, and this may delay the need for such an action by Ship's Force. It is recommended, however, that these boots be listed on the POT&I Plan for inspection prior to the Baseline Overhauls and every Regular Overhaul thereafter as a protective measure against moisture damage.

The power supply (PN 2530810) was replaced 22 times on nine ships at a cost of \$1,080 each. Only two of these items were replaced during the last year of the data, which indicates a decrease in the rate of usage, especially since there were more ships in the data base during that time. It is likely, however, that this decrease in replacement can also be attributed to the decrease in operations and gun firing by the Fleet during 1973 and 1974. Discussions with the Fleet and GSEC personnel have indicated that a ventilation problem around these power supplies causes overheating and subsequent failure. GSEC has assigned this a problem number (X087), and currently has personnel working on the design of a cooling fan for the EP1 Panel under ECP 771-089. Although the replacement rate of the power supplies is low, the critical function of these parts and the probable increase in failure under heavy gunfire missions leads to the recommendation that ECP 711-089 be completed and made part of the ORDALT package for the ships in Baseline Overhaul.

The power supply (PN 2530812), a 2.1 Vdc source in the EP1 Power Panel Assembly, was reported as being replaced 35 times on 11 ships at a cost of \$289 each. However, the part was not replaced in the last year of the data period, and further investigation is not considered necessary.

The last two significant parts connected with the EP2 Control Panel are miniature relays. PN 2635195 was replaced 43 times on 17 ships at a total cost of \$37.50, and PN 2635288 was replaced 31 times on 18 ships at a cost of \$121. The number of replacements during the last year, about 20 percent of total replacements for both parts based on a 5-year data base, indicates that the rate of replacement is decreasing slightly when the additional number of ships in the data base is considered. Since the first relay (PN 2635195) is used in 42 places in the Control Panels, the number of replacements is not significant in relation to the total population. The other relay (PN 2635288) is used in only two places in the EP2 Panel, and although the replacement rate is decreasing slightly at this time, it bears watching as a possible emerging problem in the Gun Mount. It is recommended that GSEC enter data on miniature relay PN 2635288 in the DCAP data bank so that it will be available for review if reported as a problem by other sources.

The only PMS requirement specifically written for the Control Panels is MRC 44 DHTB S, which calls for their semiannual cleaning, inspection and lubrication. No change is indicated from this analysis.

Only limited work was performed by the shipyard on the panels of three of the first seven ships to have Regular Overhauls. No requirements for depot level repair of these components during the Baseline Overhaul became apparent during this analysis.

CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

4.1 SYSTEM MAINTENANCE OVERVIEW

The design and underway "bowdown" characteristics of FF-1052 Class ships cause periodic excessive waveloading and subsequent accelerated corrosion of systems/equipments mounted forward on the main deck of the ship. The Gun Mount is one of the systems affected by these conditions, and some mounts have required extensive overhaul 2 to 5 years earlier than predicted. Other problems affecting the reliability of the Gun Mount are for the most part covered by alterations already being accomplished in the Fleet as ships become available. Generally, these alterations affect three major areas of the Mount: proximity and logic switches, hydraulic seals, and hydraulic system piping. Discussions of these and other alterations as they apply to various components of the system were presented in Chapter Three.

The philosophy to date for major maintenance of these systems has been to provide technical assistance from specialized support groups; to replace components as they fail, with rework accomplished at Designated Overhaul Points (DOP) such as NOSL and the Ship Repair Facility, Subic Bay; and to replace the entire above-deck components of the Mounts on a selective basis when they are ready for "turnaround overhaul" (replacement) at approximately 10-year intervals. This maintenance philosophy has provided adequate results to date, and should continue to do so through an extended operating cycle with the incorporation of the recommendations contained in this analysis.

The current philosophy has not provided, however, for the development of secondary repair capability as backup to the DOPs if such capability should become a future requirement of shipyards or tenders. Consequently, Technical Repair Standards to cover repairs other than at the DOPs do not exist; and test criteria are available only in the form of the Installation Test Procedures, NAVORD OD 8948, which cover only new Mounts. As a result, there is a need for the development of evaluation test procedures to determine which Mounts should be replaced, or which should have repairs accomplished by Navy or private shipyards. Likewise, the required TRSs must be specified for repairs being accomplished by shipyards. This documentation should be available prior to the Baseline Overhauls of the FF-1052 Class.

4.2 CONCLUSIONS AND RECOMMENDATIONS

The most significant conclusion reached as a result of this analysis is that some of the Mounts on ships entering Baseline Overhaul in FY 77 will have to be replaced because of their advanced state of deterioration, primarily due to watertight integrity problems. The principal recommendation for the Gun Mount is that NAVSEA 043 determine as soon as possible the magnitude and details of the 5"/54 Caliber MK 42 MOD 9 Gun Mount Replacement Program for the upcoming FF-1052 Class Baseline Overhauls. Additional recommendations associated with the decision to implement a MOD 9 Replacement Program are presented in Section 3.1.2.

As of the issuance of this report, no complete and validated document exists for selecting the MK 42 MOD 9 Replacement Program Mounts, nor are guidelines available for consistently determining the repairs to be accomplished during shipyard overhauls. It is therefore recommended that the Material Inspection (or SCORE) Manual being developed by NOSL be expedited for completion in time to support the Replacement Program evaluation and Baseline Overhaul POT&I Plan. It is further recommended that NAVSEA 043 develop TRSs to cover those Gun Mount components not included in the Replacement Program; also, those components of Gun Mounts not scheduled for replacement which will most likely require repair by IMAs or industrial facilities other than NOSL.

This study has indicated that certain alterations are of a mandatory nature for the Baseline Overhauls. It is recommended that NAVSEA authorize these alterations and fund them to the extent possible for the FY 77 Baseline Overhauls. The specific alterations and groups of alterations recommended as mandatory for completion during Baseline Overhaul as a result of the component analysis of this report (Chapter Three) are as follows:

- Weapons Group 2395 - Switch Actuator O/As
- Weapons Group 1151 - Watertight Integrity O/AS, in particular ECP 42.9.0043 (Improvement of Gun Port Shield and Seal)
- Weapons Group 1850 - Cradle Buffer O/As
- Weapons Group 2345 - Piping/Fastener Improvements
- Weapons Group 1195 - Cup Seal O/As
- ORDALT 7651 - Modify Rammer Liquid Spring
- ORDALT 8097 - Firing Pin Safety Latch
- ECP 77.2-397 - Redesign Firing Pin Assembly
- ECP 711-089 - Install Cooling Fan in EPI Panel

Because of the length of the Baseline Overhauls (12 or more months), another recommendation is to develop an interim package of "Inactive Equipment Maintenance Actions" to be performed in order to prevent deterioration of these equipments during BOH.

Other recommendations from this analysis are listed in the DDEOC Action Table forms of Appendix E. Included therein, in addition to those recommendations mentioned above, are:

- Five changes to the current PMS:
 - Delete from MRC 74 DJKQ M the instructions concerning inspection of the old Gun Port Seal. Change the periodicity of the lubrication requirement of this MRC to "M-R", where "R" denotes weekly while underway.
 - Develop a new MRC for the maintenance requirements of the new pneumatic Gun Port Seal to be installed during BOH.
 - Change the periodicity of MRC 54 DJKH Q, which requires checking of the entire Gun Loading System mechanical adjustment, to "Q-2R", where the "R" requirement is based on the number of cycles of the Loading System since the last adjustment.
 - Delete from MRC 74 DJKN M the requirement to check oil in the train response gears, and add this requirement to MRC 74 DJKP M.
 - Combine the requirements to lubricate both the train and elevation receiver-regulators on one MRC (A3 DGSN A). Delete MRC A3 DGSP A when the requirements are added to MRC A3 DGSN A.
- Two items to be included in the POT&I Plan for specific inspection prior to BOH:
 - Hydraulic hoses (PN 2635305) to the Upper Hoist Assembly
 - Boots (PN 1609611) to the EPl Panel
- Three specific repair items to be accomplished during ROH:
 - Replace the flexible shafts (PN 964421.1) in the Shield Assembly
 - Replace the electrical cable (PN 2593807) to the firing pin.
 - Regas, seal, and align telescopes.
- Two ILS changes to the APLs:
 - Increase the quantity of filter elements (PN AN 6235-4A) on all FF-1052 Class ships to 64 to allow accomplishment of required PMS.
 - Identify a replacement valve for the present recoil charging line shut-off valve (PN 2528657) that will withstand the required vibration levels without leaking. Modify the applicable APL.

- Three items for entry into the DCAP data bank for reference if problems are involving the subject parts:
 - Usage of 14 hoses (PN 2635305) in the Upper Hoist Assembly and 24 hoses in the entire Gun Mount, with an increasing rate of replacement.
 - Usage of 31 relays (PN 2635288) in the Control Panels, with an increasing replacement rate.
 - Usage of O-ring PN AN 6230-22 of the Lower Ammo Hoist Assembly APL 006030014 (54 replacements), for correlation with other brake problem information.

REFERENCES AND DATA SOURCES

1. NAVORD OP 3851, *5-Inch, 54-Caliber Gun Mount MK 42 MOD 9 (Vols 1-7)*
2. NAVORD OP 3851, *5-Inch 54-Caliber Gun Mount MK 42 MOD 9; Illustrated Parts Breakdown (Parts 1-3)*
3. NAVORD OD 8948, *5"/54 Cal Gun Mount MK 42 MOD 9 Shipboard Installation Test Instruction*
4. NAVORD ORDALT 00, 4th Revision
5. NAVSEA, *Programming AMT Plan*, Report FW-700-20, dated 13 September 1975
6. NAVSEA, *Ordnance Improvement Plan*
7. NAVSEA INST. 8300.2, *Gun Weapon System Replacement Program*
8. NAVSEA 0484E ltr. ser 331 of 6 October 1975, subject: "Post Repair Combat System Certification Plan for Industrial Activities; Cost Estimates for"
9. OPNAVINST 4790.4, *Ship's 3-M Maintenance Material Management Manual (Vols 1-3)*
10. OPNAV Letter Serial 431/5169 of 27 August 1974, subject: "Reduced Annualized Maintenance Cost of Destroyer Type Ships"; Section 4, "FMP Impact"
11. NOSL, *5"/50 Cal Gun Mount MK 42 MOD 9 Material Inspection (Preliminary)*, dated 1 November 1974
12. OMMIC, *999 MDCS Parts High Usage Summary*, File ID: A0041, dated 13 August 1975
13. OMMIC, *Surface Warfare Weapons System Reliability-Maintainability-Availabilty Summary Report*, April 1973 - March 1975
14. MDCS Records, FF-1052 Class, 1 January 1970 - 31 December 1974

15. CASREPT Narratives, FF-1052 Class, 1 January 1970 - 31 December 1974
16. MIPs and MRCs for FF-1063
17. Pre-Overhaul Test and Inspection Plan for FF-1072 Class
18. MIL-HDBK-217B, Table 2.10-6, "Prediction Procedures for Basic Sensitive Switches"
19. ARINC Research Corporation Trip Report of Ship Surveys to USS BLAKELEY (FF-1072), USS E. MONTGOMERY (FF-1082), and USS MOINESTER (FF-1097)
20. ARINC Research Corporation Technical discussions with MOTU-2, NWSL, Dalgren, NAVSEC 6531 and 04321, GSEC, NAVSUFLANT, NAVSURFPAC, and NAVSEACENLANT
21. DCAP Reports

APPENDIX A

CASREPT SUMMARY,
5"/54 CALIBER MARK 42 MOD 0 GUN MOUNT

CASREPTs for the FF-1052 Class, covering the period 1 January 1972 through 31 December 1974, were categorized by components of the 5"/54 Caliber MK 42 MOD 9 Gun Mount and the types of failures were listed by component. Table A-1 shows the percent of the total CASREPTs reported against the various components of the Mount. The table is based on 149 CASREPTs submitted on 45 ships, which operated for a total of 133.4 ship years. Therefore, the rate of CASREPT submission against the Gun Mount during this period is:

$$(149 \text{ CASREPTs}) \div (133.4 \text{ ship operating years})$$

$$= 1.12 \text{ CASREPTs per ship operating year}$$

or approximately one CASREPT per Gun Mount per year.

Table A-1. CASREPTS REPORTED AGAINST MK 42 MOD 9 GUN MOUNT
FROM 1 JANUARY 1972 THROUGH 31 DECEMBER 1974

Component	CASREPTS Reported	
	Number	Pct. of Total
1. General Gun Mount	6	4.0
2. Lower Hoist	12	8.0
3. Carriage	10	6.7
4. Upper Hoist/Cradle	21	14.1
5. Shield, Weather Fittings, Gun Port	18	12.1
6. Case Ejector	14	9.4
7. Slide Assembly	7	4.7
8. Rammer Assembly	6	4.0
9. Firing Pin/Breech Block Assembly	6	4.0
10. Gas Ejection Subsystem	1	0.7
11. Fuze Setter	14	9.4
12. Control Panels	21	14.1
13. One Man Control Station	1	0.7
14. Train Subsystem	7	4.7
15. Elevation Subsystem	5	3.4
Total	149	100.0

The following are abbreviated narratives of the CASREPTs reported by the 45 ships with MK 42 MOD 9 Mounts during the period 1 January 1972 to 31 December 1974

General Gun Mount

<u>Hull No.</u>		<u>Reported APL 00603 (XXXX)</u>
76	Gun Mount inoperative.	20130
75	Gun Mount inoperative.	30015
76	Complete loss of capability to engaged tgts w/Naval gunfire.	0007
76	" " " " " " " " " " " "	0003
78	Gun Mount inoperative.	0010
92	Operating below designed standards.	0015
Total		<u>6</u>

Lower Hoist

54	B drum cannibalization by USS LANG (broken switch-lever).	None
69	Cover plate on B drum not properly installed, chain jammed in rapid fire.	0014
72	Intermittant casualty in A powder case drum.	0014
76	B drum cycles erratically, loose connection.	0008
77	Broken push rod in lower accumulator prevents operation of lower loading system.	0003
78	A loader drum switch lever contacted microswitch and broke lever arm. Possible misalignment.	0010
79	B loader drum shutter lock solenoid burned out.	0007
81	Microswitch from LHB4-S-1-1, cracked when hitting switch assembly.	0014
83	C and D lower hoist brakes do not transmit release indication to EP2, 10 pin connection boxes corroded.	0014
84	Bearing failure and damaged spline gear in lower accumulator speed reducer.	0014
68	Lower hoist inoperative due to broken support pawl.	0014
68	Scoring outer edge of adjusting clutch half and inner edge of valve block cover of solenoid assembly on loader drum.	0014
Total		<u>12</u>

Carriage

97	Carrier control valve block causing an overshoot of 1/2 inch at lower hoist.	0015
64	Pressure control valve in carrier control valve block inoperative.	0002
68	Carrier cycle for lower hoist to upper hoist erratic. Suspect valve block assembly failure.	0002
82	Carrier tube NRL twisted and ring brace broken due to overheated printed circuit board.	0002
84	Carrier tube #1 and #2 ring bases given to DE 1082.	0002
54	Unable to operate gun loading system, tray clamp adjustment spring bent.	0019

<u>Hull No.</u>		<u>Reported APL</u> <u>00603XXXX</u>
69	Carrier spider has 4 cracks in each of two largest arms	None
73	Carrier will not return to lower position.	None
71	Carrier ejector control valve UVH-2 damaged	0003
85	Spring 281536 slipped off switch interlock S1F9, mounting plus linkage struck and damaged by Carrier.	None
		<u>Total 10</u>

Upper Hoist/Cradle

75	Cable WM239 given to USS BOWEN .	0003
75	Hydraulic MTR has bad metallic seal; bent and scored shaft.	0003
77	Sheared clutch synchronizing pin plus damage to spur gear in upper hoist clutch assembly .	0003
84	Spring guide fractured preventing loading of left cradle.	0003
86	Stud at top of actuating plunger in R interlocking mechanism dislodged and damaged actuating plunger. Valve block cracked.	0015
91	Plunger of accum. control valve assembly is warped, valve sleeve is scored. ORDALT 8107 plus pre-ORDALT pressure may have been the cause.	NO APL
95	Recurring casualty in upper gun loading system .	0003
56	Unable to light-off upper and lower accumulators .	0003
56	R and L cradles fail to latch to upper hoist S1F21 temporarily fixed with wire.	None
58	Gasket failure in deceleration cylinder .	0003
59	R. cradle failed to eject round into transfer tray due improper round alignment in cradle, shutter failed .	0003
61	Cradle ejectors deformed when gun elevated.	0003
67	Retaining ring broke allowing connection ball socket to fall out of the deceleration cam, broken cradle shutter resulted.	0003
68	Right cradle buffer assembly bent. Hyd hose improperly installed. Personnel error.	None
69	Scrape marks on slide and bent cradle ejectors. Cradle ejectors partially extended while cradle was being raised in simulation mode .	0003
73	Buffer yoke in cradle assembly bent. Buffer yoke piston stuck in cylinder and securing pins sheared, with possible damage to cradle ejector pivot shaft. Suspect elec. ground.	0003
76	Two leaks in left trunnion hyd. bases; steady leak in hoses for trunion to left cradle.	No APL
80	Right cradle ejector broken.	0003
80	Cradle frame out of alignment. Improper operation of cradle shutters during raising/lowering in step exercise mode .	0002
83	Recurring casualty in left cradle assembly causes upper loading system to stop.	0003
87	Right cradle yoke assembly and shaft bent.	0007
		<u>Total 21</u>

<u>Hull</u> <u>No.</u>		Reported APL <u>00603XXXX</u>
<u>Shield, Weather Fittings, Gun Port</u>		
72	Teflon protective cover torn and separated from gun port shield during heavy weather .	0013
73	Cracks in fiberglass shield .	0002
76	Torn Teflon shield reworked, required new seal and spacers.	0007
78	G.P. shield removed, reworked Teflon coating, hydraulic contamination and flaws in Teflon rework.	0003
78	Teflon coating on G.P. shield has longitudinal score possibly caused by damaged seal spring finger.	No APL
74	Seal on shield deeply scratched due to excess chalking compound under seal. Seal and all 6 finger springs require replacement .	0013
80	Heavy seas peeled off GP shield rubber covering. Gun limited in elev. 4320 min and 2000 min of depression.	0013
80	Teflon covering of gun port shield; scratched and bubbled. Folded over spring fingers.	0013
81	Teflon shield bubbled, patch for previous repair has torn loose.	0007
83	Gun shield assembly ruptured and buckled due storm damage.	0003
84	Deteriorated GP seal allows water into mount.	0013
86	Teflon patch-on GP shield peeled back in state 8 seas.	0007
88	Teflon coating peeling, signs of rust under coating.	0013
61	Upright stowage projectile securing straps frayed and broken.	None
65	Storm damage to gun house allows sea water into GM, carrier room and projectile magazine.	0013
66	Rip in gun port seal and deteriorated G.P. shield lamination due storm damage .	0003
68	G.P. shield teflon peeling due heavy seas, resulting in rust.	0007
68	GP shield teflon covering peeling and exposing bare metal, resulting in rust.	0014
		Total 18

Case Ejector

69	Slide assembly inoperative due to over travel of case ejector op. rod allowing rack bar cross head to impact assembly anchor bracket.	0010
75	Empty case ejector port door assembly valve block leaks hydraulic oil. Assembly not operable; scoring of operating valve has damaged washer and "O" ring.	0010
75	Empty case tray loaded switch cable EBX3 to SIS1 (out of adjustment). Rear cover for right transfer tray detent broken. Transfer/access elongated. Mt inoperative.	0010
79	Flap seal side of ammo passing scuttle warped; solved with aluminum putty one year later .	No APL

<u>Hull No.</u>		Reported --- 00603 (XXXX)
80	Switch S1S malfunctioned causing the sliding pivot to move to the top of the ejector with a resulting cracked yoke shaft bearing and bent pivot link pin to the sliding pivot.	0001
83	Extractors remain extended after case ejection.	0012
84	Empty case eject. position latch broken.	0007
87	Actuator for switch S1S-5 sheared off (empty shell casing tray).	0010
95	Recurring casualty in empty Case Ejector.	0010
56	Broken valve on empty Case Ejector.	0003
56	E.C.E. assembly leaking hydraulic fluid. ECE housing scratched and gouged. O/A 9744 will modify ECE and hopefully correct casualty.	0010
64	Operating valve in case ejector port door assembly snapped and caused failure of valve seals.	0010
64	Case ejector operating shaft warped and inoperative	0010
72	UCW2 piston for powder case extractors extended. Installed new valve block.	0010
	Total	<u>14</u>

Slide/Assembly

86	Intermittent problem in gun loading system resulted from lost motion in transfer tray.	None
86	Transfer trays failed to cycle properly, remaining in lowered position when gun was loaded for firing.	None
76	Tailgate assembly transfer tray loosened; lip of powder case jammed into transfer tray by Rammer.	0003
77	Hydraulic leak in counter recoil system charging piston.	0015
56	Unable to hold air pressure in counter recoil cylinder; due to worn threads.	0007
59	Air fill valve frozen.	0007
54	Unable to safely operate accumulator due to system hyd. leaks. Transfer and empty case operating valve block, differential piston and counter recoil cylinder leaking and worn.	0015
	Total	<u>7</u>

Rammer Assembly

85	Switch lever broken; personnel error.	0009
88	Rammer pad retainer and seat damaged due to contact with metal extension on extractor unit.	0009
59	Rammer will not ram in auto load position.	0009
60	Piston rod scored and bent.	
67	Actuator rod for rammer forward and up, switch broken, breaking firing circuit.	0003
68	Rammer button lost to B ring last gun shoot.	0009
	Total	<u>6</u>

<u>Hull Number</u>	<u>Firing Pin/Breech Block Assembly</u>	<u>Reported APL 00603XXXX</u>
81	Firing pin shattered. Suspect pivot link fracture due to stress and deterioration .	0012
58	Install safety wires on breech block; and housing cap screws to hold firing pin.	0012
96	Breech control valve block mechanism requires manual resetting. Key found to be missing from assembly.	0019
64	Breech hyd. line failed due to stress and vibration.	0012
82	Hairline crack in hyd. line to manual operating breech block pump at UVW13.	0002
83	Broken h.p. line to manual breech block pump.	0012
		<hr/> Total 6

<u>Gas Ejection System</u>		
93	Gas ejection air will not maintain 175 psi.	0011
		<hr/> Total 1

FUZE SETTER

Hull Number		Reported APL 00603XXXX
55	Relays in GFCS SWBD defective causing subsequent failure in panels aboard. Unable to set fuze time on both Mk 27 fuze setters intermittently.	0008
69	Time fuzes cannot be set in step or auto load.	0020
74	Unable to fuze mechanically fuzed projectiles (piano wire actuators bend/slip).	0008
76	Hyd. valve block for breech assembly faulty.	0008
85	Left fuze setter extended damaging cable assembly on mechanical linkage.	0020
89	Left fuze setter servo control valve cable assembly caught in breech block actuating linkage, tearing cable and damaging connectors.	0020
95	Circuit board controlling left fuze setter does not enable left trays to function; bad board.	0020
95	Circuit board controlling left fuze setter failed. Transfer tray inop due this bad circuit board.	0020
56	Gear teeth on synch zero ring are broken causing right fuze setter to oscillate.	0008
58	R. Fuze Setter unable to set mechanical time fuzes, due to transfer tray misalignment.	0008
61	Fuze setters are oscillating around desired fuze order.	0008
64	Energizing fuze setters in run causes overload of 115V 60 Hz synchro power to mount. Wire between TPL1 and JE10716 shorted.	0008
66	Left side electro-hydro. control valves is faulty and does not allow proper fuze setting.	0008
68	Salt water damage to switch housing, left fuze setter will not retract from projectile.	0008
		<hr/> Total 14

CONTROL PANELS

Hull Number	EP1	Reported APL <u>00603xxxx</u>
54	Unable to provide power to upper and lower gun loading system.	None
55	Emergency firing battery PS3 inoperative.	0015
86	Power Supply PS4 failed.	None
87	Emergency firing Circuit Nickel-Cadmium battery transferred to DDG-8 IAW CCD PAC Msg.	0015
61	440V 60 Cycle contactor assembly and overload relays burned out due short circuit.	None
	EP2	
72	Ground in power supply to EP2; resistor grounded and shorted resulting in power supply burning out .	0015
75	Violent oscillation in train (remote) prevents synchronization with GFCS.	0015
77	24V power supply overheats and causes indicator lights on EP2 to fluctuate.	No APL
77	Replacing power supply due to random cycling of loading system and EP2 erroneous ind. lights.	0015
78	Switch 6 remained in NR2 position. Cable WM463 corroded at connect or assy. and defective 24 Vdc power supply.	0015
80	Rectifiers CR26, CR27 are bad causing shorts and preventing lightoff.	0015
80	Battery failure, emergency firing circuit inop.	0015
81	Wire broken at EP2 electrical jack.	0019
82	Emerg. firing batteries will not hold charge.	0002
88	Bad relay resulting from mis-wiring which may be caused by installation of ORDALT 7857.	0015
95	Relays that affect carrier cycle and bore clear will not allow EP2 to show same.	0015
57	Voltage feedover from control circuit #1 to #4 have burned transistors on 4 boards.	J015
61	Triacs on PC 102 shorted.	0015
67	Light driver boards failed due to faulty 24 Vdc power sup., causing T&E mtrs. to drop out.	0015
67	T&E power drives drop out when gun is fired.	0015
67	B6 one speed control synchros transformer shorted causing loss of elev. servo system to telescope .	0015
		<hr/> Total 21

Hull
Number

Reported
APL
00603xxxxx

ONE MAN CONTROL STATION

75 Sight port door will not open and close due to misalignment, deterioration and wear of gears, shafts, etc.. 0016

Total 1

Train

53 Train electric motor drive shaft, replaced. 0005
55 Train motor shuts off erratically, noise and vibration in Train aux. gear pump. Stub shaft found broken off at flange. 0005
88 Overload relay KPT-3 shorted to ground no overload protection for train motor. 0015
95 Train motor drops out intermittently when switching from local to remote 0015
96 Train power drive A end fails to return to neutral. RAT-I remains in full stroke position with train brake engaged. Wires broken internally in RAT-1 stroke response pot. 0005
61 Brass shavings in train aux. relief valve block filters from supercharger and servo pump. 0005
69 Helical gears scraped sq. plate cyl. contaminating h. sys. with brass filings. 0005

Total 7

Elevation

74 Loss of gun elevation due to failure of connector in the elev. receiver - regulator. 0006
84 Loss of non-pointing zone #3 (bridge) solenoid causes full tilt on elev. rec'vr. regulator and cab unit. Solenoid shorted causing loss of control ckt #1. 0006
86 Elevation motor contactor KPE1 overheating and arcing. 0015
58 Elevation receiver regulator failure. 0006
62 Cracked tooth in elevation pinion. 0002

Total 5

APPENDIX B

PARTS USAGE SUMMARY

This appendix contains (1) a ranking by maintenance burden of the top 10 APLs in the Gun Mount System and (2) a listing of the significant parts in APL sequence resulting from the screening of MDCS data in accordance with the procedure described in Chapter Two. The ranking of the APLs in Table B-1 is based on the combined maintenance burden associated with each APL in terms of Ship's Force man-hours, IMA man-hours, and parts costs.

Table B-1. TOP 10 RANKING 5"/54 CALIBER MARK 42 MOD 9 GUN MOUNT APLS BY MDCS BURDEN

APL/CID	Description	Applicable Ships	Number of Ships Reported	Number of JCNs Reported	Ship's Force Man-Hours	IMA Man-Hours	Total Man-Hours	Parts Cost (Dollars)	Rank by Total Burden*
006030002	Carriage Assembly	45	41	695	5,739	458	6,197	188,626	1
006030015	Control Panels	45	45	1,524	4,346	201	4,547	389,579	2
006030003	Ammo Hoist, Upper	45	42	647	2,499	167	2,666	214,122	3
006030007	Slide Assembly	45	43	551	3,589	106	3,695	180,814	4
006030013	Shield Assembly	45	41	464	3,898	983	4,881	88,852	5
006030012	Housing	45	43	321	2,123	506	2,629	120,362	6
006030010	Empty Case Ejector	45	39	260	1,838	62	1,900	68,038	7
006030009	Rammer Assembly	45	40	253	2,098	192	2,290	45,839	8
006030014	Ammo Hoist, Lower	45	42	664	2,077	173	2,250	40,765	9
006030019	Gun Barrel, MK 18	45	31	282	1,302	736	2,038	49,516	10
Subtotal				5,661	29,509	3,611	33,120	1,386,513	
Total Reported				8,272	37,705	6,503	44,208	1,565,212	

*The ranking was accomplished by (1) ranking each component by total man-hours and by parts costs separately, (2) adding the two rankings, and (3) ordering the components from the lowest to the highest by the combined number. The total man-hours ranking was given more weight in the case of components with equal combined rankings.

PARTS USAGE SUMMARY

1. Stand Assembly - MARK 2 MOD 2

APL/CID <u>006030001</u>	APL QTY/SYS <u>1</u>	SYS QTY SHIP <u>1</u>	NO. OF SHIPS <u>45</u>
137 line items			
No significant parts			

2. Carriage Assembly - MARK 35 MOD 3

APL/CID <u>006030002</u>	APL QTY/SYS <u>1</u>	SYS QTY SHIP <u>1</u>	NO. OF SHIPS <u>45</u>						
NIIN	Part No.	Nomenclature	QPC	U/I	COST	Total Replaced		No. Ships Reporting	
						Per APL	Per System	Per APL	Per System
0593100	2595054	Switch Assy., Sub Miniature	7	ea.	.99	58	431	13	40
4972239	LD 628646	Switch, Proximity	9	ea.	79.00	28	174	8	32
1972240	LD 628647	Switch, Proximity	9	ea.	122.00	18	197	7	37
314 line items									
3 significant									

3. Hoist, Ammo, Upper - MARK 2 MODs 4 & 5

APL/CID <u>006030003</u>		APL QTY/SYS. <u>2</u>		SYS QTY/SHIP <u>1</u>		NO. OF SHIPS <u>45</u>			
NIIN	Part No.	Nomenclature	QPC	U/I	COST	Total Replaced		No. Ships Reporting	
						Per APL	Per System	Per APL	Per System
2101407	732829 Pc. 3	Shutter, Upper Cradle	1	ea.	1640.00	7	7	6	6
2773274	AN 6235-4A	Filter Element		ea.	.47	693	2311	22	39
5045744	731383 Pc. 4	Solenoid, Cradle Eject. Cont. Vlv.	2	ea.	26.80	18	50	9	20
5978654	733475.1	Clevis Pin, Adjustable shutter	2	ea.	4.00	13	13	9	9
7750737	2635305	Hose		ea.	33.50	14	23	6	10
4972238	LD 628649	Actuator, Switch	5	ea.	172.50	5	5	5	5
4972239	LD 628646	Switch, Proximity	2	ea.	41.50	26	174	6	32
4972240	LD 628647	Switch, Proximity	2	ea.	120.00	36	197	14	37
5789301	1614375	Actuator, Switch	10	ea.	.18	18	84	6	22

394 line items

9 significant

4. Firing Cutout Assembly - MARK 1

APL/CID <u>006030004</u>	APL QTY/SYS <u>1</u>	SYS QTY/SHIP <u>1</u>	NO. OF SHIPS <u>45</u>
No significant parts			

5. Train Power Drive Assembly - MARK 19 MOD 2

APL/CID <u>006030005</u>		APL QTY/SYS <u>1</u>	SYS QTY/SHIP <u>1</u>	NO. OF SHIPS <u>45</u>					
NIIN	Part No.	Nomenclature	QPC	U/I	COST	Total Replaced		No. Ships Reporting	
						Per APL	Per System	Per APL	Per System
0608414	2814839	Gage	2	ea.	13.50	16	27	13	18
2773274	AN 6235-4A	Filter	6	ea.	.60	282	2311	15	39
80 line items 2 significant									

6. Elevation Power Drive - MARK 19 MOD 2

APL/CID 006030006		APL QTY/SYS 1		SYS QTY/SHIP 1		NO. OF SHIPS 45			
NIIN	Part No.	Nomenclature	QPC	U/I	COST	Total Replaced		No. Ships Reporting	
						Per APL	Per System	Per APL	Per System
2773274	AN 6235-4A	Filter	2	ea.	.60	251	2311	14	39
80 line items 1 significant									

7. Slide Assembly - MARK 31 MOD 2

APL/CID 006030007		APL QTY/SYS 1		SYS QTY/SHIP 1		NO. OF SHIPS 45			
NIIN	Part No.	Nomenclature	QPC	U/I	COST	Total Replaced		No. Ships Reporting	
						Per APL	Per System	Per APL	Per System
0212968	2528657	Valve, Shutoff	2	ea.	45.50	10	13	5	8
3341351	731443 Pc. 3	Link, Safety	1	ea.	81.00	14	14	11	11
3800437	734914PC102	Washer, Seal	1	ea.	.10	18	34	13	15
4972240	LD628647	Switch, Proximity	2	ea.	122.00	11	197	8	35
5016809	733955 Pc. 4	Solenoid	4	ea.	30.24	15	47	8	37
377 line items 5 significant									

8. Fuze Setter Assembly - MARK 27 MODs 0 & 1, MARK 29 MOD 1

APL/CID 006030008 and 006030020		APL QTY/SYS 2		SYS QTY/SHIP 1		NO. OF SHIPS 45			
NIN	Part No.	Nomenclature	QPC	U/I	COST	Total Replaced		No. Ships Reporting	
						Per APL	Per System	Per APL	Per System
2773274	AN 6235-4A	Filter	2	ea.	.47	189	2311	9	39
4205332		Filter Element	2	ea.	20.50	21	21	11	11
152 line items 2 significant									

9. Rammer Assembly - MARK 2 MOD 2

APL/CID 006030009		APL QTY/SYS 1		SYS QTY/SHIP 1		NO. OF SHIPS 45			
NIN	Part No.	Nomenclature	QPC	U/I	COST	Total Replaced		No. Ships Reporting	
						Per APL	Per System	Per APL	Per System
2100641	730903 Pc. 2	Retainer, Button	1	ea.	15.50	29	29	20	23
2100642	730903 Pc. 3	Seat, Button	1	ea.	19.50	32	32	17	21
2100643	730903 Pc. 4	Button	1	ea.	11.00	29	29	21	24
2822389	730903 Pc. 5	Ring, Lock	1	ea.	.10	41	51	26	27
7750777	21814846	Bearing Assy	1	ea.	100.00	15	15	6	6
203 line items 5 significant									

10. Empty Case Ejector Assembly - MARK 2 MOD 2

APL/CID 006030010		APL QTY/SYS 1		SYS QTY/SHIP 1		NO. OF SHIPS 45	
NIIN	Part No.	Nomenclature	QPC	U/I	COST	Total Replaced Per APL Per System	No. Ships Reporting Per APL Per System
3341331	731379 Pc. 1	Cylinder, Case Ejector	1	ea.	1,210.00	7	5
3341332	731379 Pc. 2	Piston	1	ea.	90.00	9	5
3341343	731389 Pc. 2	Valve, Ejector Port Door	1	ea.	72.00	8	7
3341349	731404	Bushing, Door Hinge	1	ea.	41.00	9	8
4972240	LD 628647	Switch, Proximity	2	ea.	122.00	14	37
7068350	2815059	Door Assy	1	ea.	237.00	10	6
7068351	1469745	Ring Assy	1	ea.	80.00	12	10
7788613		Seal Assy	1	ea.	200.00	19	8
9288255	2081082	Magnet	6	ea.	2.30	58	3

184 line items

9 significant

11. Gas Ejector Assembly

APL/CID <u>006030011</u>	APL QTY/SYS <u>1</u>	SYS QTY/SHIP <u>1</u>	NO. OF SHIPS <u>45</u>
No significant parts			

12. Housing - MARK 11 MOD 2

APL/CID <u>006030012</u>		APL QTY/SYS <u>1</u>		SYS QTY/SHIP <u>1</u>		NO. OF SHIPS <u>45</u>			
NIIN	Part No.	Nomenclature	QPC	U/I	COST	Total Replaced		No. Ships Reporting	
						Per APL	Per System	Per APL	Per System
9050033	LD616699Pc. 5	Firing Pin Assy	1	ea.	1,870.00	68	68	33	33
9050045	2593807	Cable Assy	1	ea.	83.00	10	10	9	9
199 line items 2 significant									

13. Shield Assembly - MARK 61 MOD 10

APL/CID <u>006030013</u>		APL QTY/SYS <u>1</u>		SYS QTY/SHIP <u>1</u>		NO. OF SHIPS <u>45</u>			
NIIN	Part No.	Nomenclature	QPC	U/I	COST	Total Replaced		No. Ships Reporting	
						Per APL	Per System	Per APL	Per System
3341259	730662 Pc. 2	Shaft, Retainer Crank Assy	1	ea.	57.00	9	9	8	8
3886259	964421 Pc. 1	Shaft, Flex.	1	ea.	150.00	8	8	6	6
8131600	2635036	Spring, Finger	6	ea.	63.00	80	80	22	22
8131613	2635037	Spring, Finger	6	ea.	51.00	52	52	17	17
8131614	2635038	Spring, Finger	7	ea.	26.50	56	56	19	19
8131676	2635833	Seal, Gun Port	1	ea.	455.00	33	33	25	25

249 line items
6 significant

14. Hoist, Ammo, Lower - MARK 5 MODS 0 & 1

APL/CID 006030014		APL QTY/SYS 2			SYS QTY/SHIP 1			NO. OF SHIPS 45	
NIIN	Part No.	Nomenclature	QPC	U/I	COST	Total Replaced Per APL	Per System	No. Ships Reporting Per APL	Per System
0546880	AN 6239-22	"O" Ring	6	ea.	.10	54	80	15	19
0593100	2595054	Switch Assy	31	ea.	.99	195	431	31	40
2101588	7333000 Pc. 7	Bearing Assy	16	ea.	80.00	20	23	10	10
2101611	7333367 Pc. 1	Gasket	4	ea.	2.60	47	52	13	15
2101950	734100 Pc. 2	Paul, Support	10	ea.	38.00	24	30	13	13
2101952	734100 Pc. 3	Pin, Pawl	40	ea.	.75	49	81	13	14
4972239	LD628646	Switch, Proximity	19	ea.	79.00	37	174	15	32
4972240	LD628647	Switch, Proximity	14	ea.	122.00	33	197	11	39
5789301	1614375	Actuator, Switch	42	ea.	2.16	33	84	13	22
6107999	1593073	Solenoid	16	ea.	20.50	11	33	8	15
4795425	2635098 Pc. 1	Filter Element	1	ea.	111.00	12	13	8	9
9822559	2533400 Pc. 3	Ring, Retaining	78	ea.	.01	125	382	16	28

287 line items
12 significant

15. Control Panels - MARK 114 MODs 0 & 1 and Power Panels - MARK 81 MODs 0 & 1

NIIN	Part No.	Nomenclature	QPC	U/I	COST	SYS QTY/SHIP 1		NO. OF SHIPS 45	
						APL QTY/SYS 1	APL QTY/SHIP 1	No. Ships Reporting Per APL	No. Ships Reporting Per System
8131509	LM 2527452	Inverter Circuit Board	19	ea.	93.00	226	226	35	35
8131511	LM 2527453	Logic Circuit Board	68	ea.	87.00	287	287	39	39
8151515	LM 2527454	Output Driver Circuit Board	10	ea.	459.00	223	223	35	35
8131522	LM 2527455	Latching Relay Circuit Board	3	ea.	481.00	114	114	33	33
8131528	LM 2527456	Light Driver Circuit Board	12	ea.	148.00	411	411	42	42
5393149	LD 280281	Relay, Solenoid	4	ea.	401.00	16	16	9	9
6589620	LD 298153.1	Switch Assy	32	ea.	66.00	16	16	11	11
6589626	1609611	Boot	48	ea.	4.00	42	42	11	11
7795665	2530810	Power Supply	1	ea.	1,080.00	22	22	9	9
7795670	-	Power Supply	-	ea.	289.00	35	35	11	11
7795721	2527483	Rectifier	5	ea.	12.00	23	23	12	12
8139709	2635195	Relay, Armature	42	ea.	37.50	43	43	17	17
8139710	2635288	Relay	2	ea.	121.00	31	31	18	18
282 line items									
13 significant									

16. Miscellaneous Hardware

APL/CID	006030016, 17, 18 & 21	APL QTY/SYS	Various	SYS QTY/SHIP	1	NO. OF SHIPS	45
330 line items No significant parts							

17. Gun Barrel - MARK 18

APL/CID		006030019	APL QTY/SYS	1	SYS QTY/SHIP	1	NO. OF SHIPS	45	
NIIN	Part No.	Nomenclature	QPC	U/I	COST	Total Replaced		No. Ships Reporting	
						Per APL	Per System	Per APL	Per System
8776908	2580150	Liner	1	ea.	9000.00	4	4	4	4
8776945	2580152	Barrel	1	ea.	16,000.00	5	5	5	5
125 line items 2 significant									

APPENDIX C

RECOMMENDATIONS FOR BASELINE OVERHAUL OF FF-1052 CLASS SHIPS

REPAIRS

The following repairs were identified in this study for accomplishment during BOH or POT&I for FF-1052 Class ships:

- Replace the flexible shafts (PN 964421.1) in the Shield Assembly during BOH.
- Replace the electrical cable (PN 2593807) to the firing pin during BOH.
- List the hydraulic hoses (PN 2635305) to the Upper Hoist Assembly on the POT&I Plan for specific inspection prior to BOH. Replace as required.
- Regas, seal, and align telescopes during BOH.
- List the boots (PN 1609611) to the EP1 Panel on the POT&I Plan for specific inspection prior to BOH. Replace as required.

ALTERATIONS

Alterations determined to have a good potential for solving problems identified during this analysis are recommended for mandatory accomplishment during BOH. They include:

- Weapons Group 2395 - Switch Actuator O/As
- Weapons Group 1151 - Watertight Integrity O/As, in particular ECP 42.9.0043 (Improvement of the Gun Port Shield and Seal)
- Weapons Group 1850 - Cradle Buffer O/As
- Weapons Group 2345 - Piping/Fastener Improvements
- Weapons Group 1195 - Cup Seal O/As
- ORDALT 7651 - Modify Rammer Liquid Spring
- ORDALT 8097 - Firing Pin Safety Latch
- ECP 77.2-397 - Redesign of Firing Pin Assembly
- ECP 711-089 - Install Cooling Fan in EP1 Panel

APPENDIX D

MRC EVALUATION

The planned maintenance requirements for the 5"/54 Caliber MARK 42 MOD 9 Gun Mount System are specified on the following pages. The enclosed Maintenance Index Pages (MIPs) list all the Maintenance Requirement Cards (MRCs) that detail the maintenance actions and required periodicities for minimum maintenance on Gun Mount components. MRCs preceded by a Δ are listed on the MRC evaluation forms following the MIPs as those maintenance actions that need to be changed, deleted, or developed to support an extended operating cycle as determined by this analysis.

The column headings of the evaluation table are as follows:

- MRC Title - Description of maintenance specified by MRC
- MRC Number - Identification number of MRC
- Responsibility - Organizations responsible for change (if any)
- Current Status - Old with revision, or new
- Man-Hours - Personnel-time burden allotted to complete maintenance action
- Frequency - When the MRC maintenance action is to be performed, e.g., D=Daily, W=Weekly, M=Monthly, C=Once every cycle (36 month cycle), etc.
- Type - Perform maintenance (P), or survey material condition of component (S)
- Who Performs Test - Maintenance action or test to be performed by tender, or DDEOC field site team, or Ship's Force personnel.
- Where Performed - In port or at sea
- Data - Indicates whether data are recorded during performance of maintenance action.

SYSTEM, SUBSYSTEM, OR COMPONENT Mount, 5" /54 Single RF Mk 42 Mod 9	REFERENCE PUBLICATIONS OP 3851 OD 3000 OD 45531	DATE July 1974
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CONFIGURATION (THESE MAINTENANCE REQUIREMENTS ARE APPLICABLE TO EQUIPMENT IN WHICH THE FOLLOWING CHANGES HAVE BEEN ACCOMPLISHED)

NOTE: See last page for applicable ORDALTS covered in previous developments.

SYSCOM MRC CONTROL NO.	MAINTENANCE REQUIREMENT	PERIODICITY	SKILL LEVEL	MAN HOURS	RELATED MAINTENANCE
44 DHSP D	MOUNT 1. Clean gun port shield. 2. Operate gun load system in STEP EXERCISE and SIMULATE MODE. 3. Cycle MODIFIED BL & P rounds in AUTOMATIC. 4. Operate train and elevation power drives.	D-1 **	GMG1 GMG2 GMG3 GMGSN	0.8 0.8 0.9 0.9	None
73 DFIG W	MOUNT 1. Lubricate training internal gear. 2. 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 DJFP 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
A3 DGFM W	CARRIAGE MK 35 MOD 3 1. Check operation of fuze setter. NOTE: Repeat this MRC bi-weekly alternating fuze setting, step 1c. and 1.f., from 30 to 45 seconds each time it is performed.	W-5R **	GMG2 GMG3 FTGSN	0.6 0.6 0.6	D-1 W-12 W-11
A3 DGFP W	RAMMER MK 2 MOD 2 1. Lubricate rammer.	W-6 **	GMG3 GMGSN	0.4 0.4	W-3
A3 DGFR W	GAS EJECTOR MK 13 MOD 0 1. Test gas ejector.	W-7 **	GMG3 GMGSN	0.5 0.5	None

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MAINTENANCE INDEX PAGE
 CPNAV FORM 4700-3 (A) REV 7-71

SYSCOM MIP CONTROL NUMBER G-31/9-74



SYSKOM MRC CONTROL NO.	MAINTENANCE REQUIREMENT	PERIODICITY	SKILL LEVEL	MAN HOURS	RELATED MAINTENANCE
44 DHVN W	MOUNT 1. Lubricate fuze setter. 2. Clean the breechblock 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
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
74 DJKM W	MOUNT 1. Test normal and emergency firing circuits and firing cutout.	W-11 **	GMG2 GMG3 FTGSN GMGSN	0.5 0.5 0.5 0.5	D-1 W-5R W-12
A3 DGFV W	MOUNT 1. Check sight setting. 2. Inspect OMC plexiglass dome.	W-12 **	GMG2 GMG3 FTG3	0.2 0.2 0.2	D-1 W-5R W-11
74 DJDP W	MOUNT 1. Check fluid levels. 2. Check accumulator pressures. 3. Check air pressure in counterrecoil cylinders.	W-13 **	GMG1 GMG3 GMGSN	0.7 0.7 0.7	None
74 DJDQ M	MOUNT 1. Lubricate slide components and trunnions. 2. Lubricate housing. 3. Lubricate rammer.	M-1 **	GMG2 GMG3 GMGSN	0.4 0.8 0.8	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
△ 74 DJKP 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
54 DJKG 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

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SYSCOM MRC CONTROL NO.	MAINTENANCE REQUIREMENT	PERIODICITY	SKILL LEVEL	MAN HOURS	RELATED MAINTENANCE
74 DJFR 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
△ 74 DJKQ M	SHIELD MK 61 MOD 10 1. Inspect gun port seal assembly. 2. Lubricate OMC station. 3. Lubricate shield door hinges. 4. Lubricate air vent.	M-6	GMG2 2GMGSN	0.8 1.2	D-1
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
74 DJFS 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
C2 DEPQ M	HOIST (UPPER) MK 5 MODS 4 and 5 1. Lubricate cradles.	M-9 **	GMG3 GMGSN	0.4 0.4	W-9
44 DHSV M	STAND MK 21 MOD 2 1. Lubricate water seal shield, thrust, and radial bearings.	M-10 **	GMG2 GMG3 GMGSN	1.5 1.5 1.5	W-1
C2 DEPS M	MOUNT 1. Check air pressure in anti-icing system.	M-11	GMG3	0.3	None
A3 DGGE M	MOUNT 1. Lubricate center plate of loader drums.	M-12 **	GMG3 2GMGSN	0.3 0.6	None
C2 DEPT Q	MOUNT 1. Test elevation and depression buffers.	Q-1 **	GMG3 GMGSN	0.2 0.2	W-11
△ 54 DJKH Q	MOUNT 1. Check gun loading system mechanical adjustments.	Q-2 **	GMG2 GMG3	2.0 2.0	None
A3 DGGG Q	MOUNT 1. Check operation of heating, lighting, and ventilating systems.	Q-3 **	GMG3 GMGSN	0.5 0.5	None
C2 DEPW Q	MOUNT 1. Replace filter elements in train and elevation auxiliary relief valves.	Q-4	GMG1 GMG3 GMGSN	0.8 0.8 0.8	None

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SYSCOM MRC CONTROL NO.	MAINTENANCE REQUIREMENT	PERIODICITY	SKILL LEVEL	MAN HOURS	RELATED MAINTENANCE
A3 DUGJ Q	MOUNT 1. Check anti-icing system.	Q-5 **	GMG3 GMGSN	0.3 0.3	M-11
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
73 DFPX S	MOUNT 1. Clean, inspect and adjust air supply lubricator on upper and lower gun loading systems.	S-2 **	GMG3 GMGSN	0.6 0.6	None
44 DHTA 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
44 DHTB S	MOUNT 1. Clean, inspect, and lubricate control panels.	S-4 **	GMG3 GMGSN	1.0 1.0	None
C2 DEQB A	MOUNT 1. Remove hydraulic fluid samples for testing.	A-1 **	GMG3 GMGSN	0.5 0.5	None
△ A3 DGSN A	TRAIN RECEIVER-REGULATOR MK 53 MOD 0 1. Lubricate train receiver-regulator.	A-2 **	GMG1 GMGSN	0.5 1.0	None
△ A3 DGSP A	ELEVATION RECEIVER REGULATOR MK 54 MOD 0 1. Lubricate elevation receiver-regulator.	A-3 **	GMG1 GMGSN	0.5 1.0	None
44 DHTC R	MOUNT 1. Perform prefiring checks. NOTE: Perform this MRC 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 MRC after firing.	R-2 **	GMG3 2GMGSN	1.0 2.0	None

(Page 4 of 5)

MAINTENANCE INDEX PAGE (MIP)
OPNAV FORM 4700/3 (C) (REV. 4/71)

SYSCOM MIP CONTROL NO.

G-31/9-74

SYSCOM MRC CONTROL NO.	MAINTENANCE REQUIREMENT	PERIODICITY	SKILL LEVEL	MAN HOURS	RELATED MAINTENANCE
A3 DGGG R	MOUNT I. Measure bore erosion. NOTE: Perform this MRC 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 I. Clean OMC blister. NOTE: Perform this MRC as required. ** A management aid: All GM rated personnel performing this MRC shall be qualified in accordance with NEC Code GM-9076 as defined in NAVPERS 15105-VI. 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.	R-4 **	GMGSN	1.0	None

(Page 5 of 5)

MRC TITLE	MRC NUMBER	RESPONSIBILITY		CURRENT STATUS			PRE
		NAVSEA	DDEOC	OLD WITH NO CHANGE	OLD WITH REVISION	NEW	
<u>MOUNT, 5"/54 SINGLE RF MK 42 MOD 9; MIP G-031/009-74</u> 1. Inactive Equipment Maintenance Requirements for 5"/54 Caliber MARK 42 MOD 9 Gun Mount	To be assigned		X		X		50 M week
<u>SHIELD MK 61 MIP G-031/009-74</u> 2. Inspect gun port seal assembly. Lubricate OMC Station Lubricate shell door hinges Lubricate air vent	74 DJKQ M		X		X		2.0
3. Inspect gun port seal assembly	To be assigned	X				X	1.6
<u>MOUNT, 5"/54 SINGLE RF MK 42 MOD 9; MIP G-031/009-74.</u> 4. Check gun loading system mechanical adjustments	54 DJKH Q		X		X		4.0

* P = PERFORM MAINTENANCE; S = SURVEY INSPECTION

D-8(a)

DDEOC MRC EVALUATION

CURRENT STATUS		MAN-HOURS		FREQUENCY		TYPE*	WHO PERFORMS TEST			WHERE PERFORM
OLD WITH REVISION	NEW	PRE-DDEOC M/H	POST-DDEOC M/H	PRE-DDEOC	POST-DDEOC	P-PERF. S-SURV.	TENDER	DDEOC	SHIP	I-IN POR S-AT SEA
X		50 M/H per week	To be Determined	Various	To be Determined	P&S	To	be Determined		I
X		2.0	To be Determined	M	To be Determined	P&S			X	I&S
	X	1.6	To be Determined	M	To be Determined	S			X	I&S
X		4.0	4.0	Q	Q-R	P			X	I

D-8(b)

N

OC	TYPE* P-PERF. S-SURV.	WHO PERFORMS TEST			WHERE PERFORMED	DATA	REMARKS
		TENDER	DDEOC	SHIP	I-IN PORT S-AT SEA	YES NO	
	P&S	To	be	Determined	I	No	It is recommended that an interim package of Inactive Equipment Maintenance Requirements be developed for the Gun Mount to be used during the year long Baseline Overhauls starting in FY 77.
	P&S			X	I&S	No	Remove instructions on inspecting the gun port seal. This seal will be changed and new procedures will need to be developed. Change the periodicity of the lubrication requirements to include an "R" (Weekly when underway) requirement. Insert note (1) under "PROCEDURE" to state "Accomplish Lubrication Weekly when Underway."
	S			X	I&S	No	Development of a new MRC will be required for the new pneumatic seal being developed by ECP 42.9.0043 for installation under Weapons Group 1151 during Baseline Overhauls.
	P			X	I	Yes	The periodicity should be changed to "Q"-2R and a Note (1) should be added under "PROCEDURE" to state "Accomplish Quarterly, or when the mount has been cycled (No. to be determined) times since the last adjustment, whichever is sooner."

D-8(c)

MRC TITLE	MRC NUMBER	RESPONSIBILITY		CURRENT STATUS		
		NAVSEA	DDEOC	OLD WITH NO CHANGE	OLD WITH REVISION	
5. Lubricate train and elevation power drives. Check oil level in train and elevation response gears. <u>FIRING CUTOOUT MK 1</u> MIP G-031/009 74	74 KJKN M	X			X	
6. Check oil level of firing cutout assembly. Check oil level of train response gear assemblies. <u>TRAIN RECEIVER-REGULATOR MK 53</u> MIP G-031/009 74	74 KJKP M	X			X	
7. Lubricate train receiver-regulator A3 DGSN A <u>ELEVATION RECEIVER - REGULATOR MK 54</u> MIP G-031/009 74	A3 DGSN A	X			X	
8. Lubricate elevation receiver-regulator	A3 DGSP A	X			X	

* P = PERFORM MAINTENANCE; S = SURVEY INSPECTION

D-9(a)

DDEOC MRC EVALUATION

CURRENT STATUS			MAN-HOURS		FREQUENCY		TYPE*	WHO PERFORMS TEST			WH PERFO
WITH HANGE	OLD WITH REVISION	NEW	PRE-DDEOC M/H	POST-DDEOC M/H	PRE-DDEOC	POST-DDEOC	P-PERF. S-SURV.	TENDER	DDEOC	SHIP	I-IN S-AT
	X		1.2	0.6	M	M	P			X	Is
	X		1.0	1.6	M	M	P			X	I
	X		1.5	3.0	A	A	P			X	I
	X		1.5	0	A	None	P			X	I

D-9(b)

TYPE* P-PERF. S-SURV.	WHO PERFORMS TEST			WHERE PERFORMED	DATA	REMARKS
	TENDER	DDEOC	SHIP	I-IN PORT S-AT SEA	YES NO	
P			X	I&S	NO	Delete the requirement to check oil in the train and response gears from this MRC (74 DJKN M) and expand MRC 74 DJKP M to include the requirement to check oil in the train and response gears. Subtract the time required (0.6M/H) from MRC 74 DJKN M and add it to MRC 74 DJKP M.
P			X	I&S	NO	Add the requirement to this MRC to also check oil in the <u>elevation</u> response gear assembly. Increase the time required from 1.0 M/H to 1.6 M/Hs.
P			X	I&S	No	Combine the requirements to lubricate both the train and elevation receiver - regulators on one MRC (A3 DGSN A). Add the manhours required to this MRC from MRC A3 DGSP A. Add "MK 54" to the component title.
P			X	I&S	No	Delete this MRC when the requirement to lubricate the elevation receiver-regulator has been added to MRC A3 DGSN A.

D-9(c)

APPENDIX E

DDEOC ACTION TABLE

This appendix summarizes action information for each of the recommendations discussed in this report.

1. ACTION ITEM		2. DDEOC EVALUATION		3. ACTION ITEM DESCRIPTION	4. REFERENCE (PART)	
a. NO.	b. TITLE	a. APPROVED YES	NO			b. FURTHER STUDY
1.	5"/54 Caliber MK 42 MOD 9 Gun Mount System. General				<p>1. Determine the extent of MK 42 MOD 9 replacements required during the FF-1052 Class Baseline Overhauls.</p> <p>a. Obtain funding for the required replacements.</p> <p>b. Authorize NOS, Louisville to proceed with tooling for the MK42 MOD 9 Mounts.</p> <p>c. Identify parts expected to be replaced and fund their procurement.</p> <p>d. Identify conjunctive alterations and determine availability.</p> <p>e. Identify non-replacement components for shipyard repair. Develop repair standards for these components.</p> <p>2. Complete evaluation and update of the SCORE manual for use in the Replacement Program screening and POT&T Plan for the MK 42 MOD 9 Mounts.</p> <p>3. Develop Tech. Repair Standards for components likely to be repaired other than at a Designated Overhaul Point.</p> <p>4. Emphasize the electrical load requirements when berthing ships and the sharing of electrical power with in a next of ships in order to accomplish Weapon System Testing.</p> <p>5. Develop <u>interim</u> Inactive Equipment Maintenance requirements for the gun mount for use during the Baseline Overhauls.</p> <p>6. Coordinate the authorization, scheduling and tracking of the baseline and mandatory alterations to be accomplished during BOH.</p>	3.1 3.1 3.1 3.1 3.1 3.1

NOTE: DEVELOPING ACTIVITY FILL IN THE FOLLOWING BLOCKS: 1a, b; 3; 4; 5b,c,d IF KNOWN; 6a, IF REQUIRED FOR CONTINUATION OF DEVELOPMENT

E-2(a)

DDEOC ACTION TABLE

DESCRIPTION	4. REPORT REFERENCE (PARA.)	5. NAME/CODE OF PERSON HAVING RESPONSIBILITY				6. SCHEDULING DATES			7. FUNDING IMPLICATIONS
		a. DDEOC	b. NAVSEC	c. NAVSEA	d. OTHER	a. REQD.	b. START	c. COMP.	
ht of MK 42 MOD 9 red during the line Overhauls, for the required Louisville to ooling for the MK42 expected to be re- d their procurement, nctive alterations availability, eplacement components epair. Develop ds for these compo-	3.1.1			043					
n and update of the se in the Replace- ning and POT&I Plan 9 Mounts,	3.1.2			043					
ir Standards for- to be repaired other ed Overhaul Point.	3.1.3			043					
trical load require- g ships and the cal power with in a rder to accomplish ing.	3.1.4	X			TYCOMS				
active Equipment ements for the gun g the Baseline	3.1.5			04	TYCOMS				
horization, cking of the base- alterations to be g BOH.	3.1.6			6531					

ED FOR CONTINUATION OF DEVELOPING ACTIVITY TASK; 7; 8, AS NECESSARY.

E-2(b)

OTHER	6. SCHEDULING DATES			7. FUNDING IMPLICATIONS	8. REMARKS	9. ACTUAL ACTION TAKEN
	a. REQD.	b. START	c. COMP.			
					<p>Items a through e are dependent on the actual scope of the replacement program.</p> <p>Completion due October 1976.</p> <p>Planned Maintenance during Overhaul (PMDO) was never developed for the 5"/54 gun and the Inactive Equipment Maintenance Package will not be developed in time for BOH.</p>	

AD-A063 912

ARINC RESEARCH CORP ANNAPOLIS MD
DESTROYER ENGINEERED OPERATING CYCLE (DDEOC). SYSTEM MAINTENANC--ETC(U)
OCT 76

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1. ACTION ITEM		2. DDEOC EVALUATION			3. ACTION ITEM DESCRIPTION
a. NO.	b. TITLE	a. APPROVED YES	NO	b. FURTHER STUDY	
2.	Carriage Assembly, MK 35 MOD 3 - APL 006030002				1. Accomplish Weapons Group #239 (Switch Actuator O/As) during Baseline Overhauls.
3.	Shield Assembly, MK 61 MOD 10 - APL 006030013				1. Replace the flexible shafts (PN 964421.1) during BOH. En in the Maintenance Plan for t FF-1052 and the POT&I Plan. 2. Complete the evaluation of EC 42.9.0043 (Improvement of the Port Shield and Seal) and the development of an appropriate 3. Accomplish Weapons Group #115 (Water Tight Integrity O/As) FF-1052 Baseline Overhauls, 4. Change MRC 74 DJKQM from a pe city of monthly to monthly an
4.	Ammo, Hoist Assembly, Upper MK 2, MODs 4 & 5 APL 006030003				1. Accomplish Weapons Group #185 Cradle Buffer O/As during FF- Baseline Overhauls. 2. Increase the quantity of filt elements (PN AN 6235-4A) carr board to 64 during the supply haul portion of the BOH. 3. Enter the usage data of the h (PN 2635305) in the DCAP for reference, and add to the BOH for specific inspection. 4. Accomplish Weapons Group #234 (Piping/fastner Improvement C during Baseline Overhauls,

NOTE: DEVELOPING ACTIVITY FILL IN THE FOLLOWING BLOCKS: 1a, b; 3; 4; 5b,c,d IF KNOWN; 6a, IF REQUIRED FOR CONTINU

DDEOC ACTION TABLE

ACTION ITEM DESCRIPTION	4. REPORT REFERENCE (PARA.)	5. NAME/CODE OF PERSON HAVING RESPONSIBILITY				6. SCHEDULING DATES			7. FUNDING IMP
		a. DDEOC	b. NAVSEC	c. NAVSEA	d. OTHER	a. REQD.	b. START	c. COMP.	
ish Weapons Group #2395 Actuator O/As) during FF-1052 e Overhauls.	3,2,2			6531	TYCOMS				
e the flexible shafts 421.1) during BOH. Enter Maintenance Plan for the and the POT&I Plan.	3,2,3	X			PERA				
e the evaluation of ECP 043 (Improvement of the Gun ield and Seal) and the oment of an appropriate O/A.	3,2,3			6531	GSEC				
ish Weapons Group #1151 Tight Integrity O/As) during 2 Baseline Overhauls,	3,2,3			6531	TYCOMS				
MRC 74 DJKQM from a periodic E monthly to monthly and "R"	3,2,3	X		04					
ish Weapons Group #1850 Buffer O/As during FF-1052 e Overhauls.	3,3,1			6531	TYCOMS				
e the quantity of filter ts (PN AN 6235-4A) carried on- to 64 during the supply over- ortion of the BOH,	3,3,1	X			SPCC				
e the usage data of the hose 35305) in the DCAP for future nce, and add to the BOH POT&I ific inspection.	3,3,1	X		6531	GSEC				
ish Weapons Group #2345 g/fastner Improvement O/As) Baseline Overhauls,	3,3,1			6531	TYCOMS				

R	6. SCHEDULING DATES			7. FUNDING IMPLICATIONS	8. REMARKS	9. ACTUAL ACTION TAKEN
	a. REQD.	b. START	c. COMP.			
					<p>This ECP is part of Weapons Group #1151, WT Integrity O/As,</p> <p>The "as required" lubrication will be accomplished weekly when at sea.</p> <p>Required to accomplish PMS requirements.</p> <p>Possible emerging problem,</p> <p>Vibration fatigues the piping causing failure.</p>	

1. ACTION ITEM		2. DDEOC EVALUATION		3. ACTION ITEM DESCRIPTION	4. REPORT REFERENCE (PARA.)
a. NO.	b. TITLE	a. APPROVED YES	b. FURTHER STUDY NO		
4.	Upper Hoist Assy. (cont'd)			5. Develop a criteria for performing the mechanical adjustment function on the loading system components. Based on the number of mount cycles. Change MRC 54 DJKH Q from just "Quarterly" to an "as required" action based on the number of mount cycles and no longer than quarterly to satisfy the time requirements of this action. 6. Accomplish Weapons Group #1195 (Cup Seal O/As) during FF-1052 Baseline Overhauls.	3.3.1 3.3.1
5.	Slide Assembly - MK 31 MOD 2, APL - 006030007			1. Identify a replacement valve with finer threads to withstand vibration to replace the shutoff valve (PN 2528657) from the counter recoil charging line. Change applicable APLS and notify fleet personnel via the monthly DCAP reports.	3.3.2
6.	Rammer Assembly, MK 2 MOD 2, APL - 006030009			1. Accomplish Ordalt #7651 (Modify Rammer Liquid Spring) during FF-1052 Baseline Overhauls.	3.3.4
7.	Housing Assembly - MK 11 MOD 2, APL - 006030012			1. Replace electrical cable assembly to firing pin (PN 2593807) during FF-1052 Baseline Overhauls. 2. Accomplish Ordalt #8097 (Firing Pin Safety Latch) during FF-1052 Baseline Overhauls. 3. Continue a high priority on ECP 77.2-397 (Redesign of Firing Pin Assembly)	3.3.7 3.3.7 3.3.7

NOTE: DEVELOPING ACTIVITY FILL IN THE FOLLOWING BLOCKS: 1a, b; 3; 4; 5b,c,d IF KNOWN; 6a, IF REQUIRED FOR CONTINUATION OF DEVELOPING A

E-4(a)

DDEOC ACTION TABLE

DESCRIPTION	4. REPORT REFERENCE (PARA.)	5. NAME/CODE OF PERSON HAVING RESPONSIBILITY				6. SCHEDULING DATES			7. FUNDING IMPLICATIONS	8.
		a. DDEOC	b. NAVSEC	c. NAVSEA	d. OTHER	a. REQD.	b. START	c. COMP.		
performing ment function components. mount cycles. from just required" action mount cycles arterly to irements of this	3.3.1	X		049	GSEC					The r syste adju dete
oup #1195 (Cup 1052 Baseline	3.3.1			6531	TYCOMS					The be mo agai leak
t valve with stand vibration f valve counter recoil e applicable personnel via rts.	3.3.2			6531	SPCC					Orig with tigh
51 (Modify during FF-1052	3.3.4			6531	TYCOMS					
ble assembly to 7) during hauls.	3.3.7	X			PERA					Fati
97 (Firing Pin FF-1052 Baseline	3.3.7			6531	TYCOMS					Exte clea
ity on ECP 77.2- ng Pin Assembly)	3.3.7			6531						Exte repl

The number of loading system cycles between adjustments must be determined.

The cup type seals will be more effective against hydraulic oil leaks.

Original valve will not withstand the over-tightening.

Fatigue

Extends the time between cleaning.

Extends the time between replacement

8.	Ammo, Hoist, Assembly, Lower MK 5 MOD 0 & 1, APL - 006030014				1. Enter the Lower Hoist brake assembly "O" ring, PN AN 6230-22, data (54 replacements) in the DCAP data base.
9.	Train and Elevation Power Drive Assys MK 19 MOD 2 APL 006030005 and 006030006				1. Delete the requirement to "check level in train and elevation receiver gears" from MRC 74 DJKN M and expand MRC 74 DJKP M to cover checking of level in both train and elevation receiver gear assemblies.
10.	Telescope - MK 116 MOD 0, MK 102 MOD 6; APL - 006800026, and 006021111				2. Combine the requirements of MRC A DGSN A with those of MRC A3 DGSP so that a single MRC covers both train and elevation receiver - regulators.
11.	Control Panels - MK 114, MOD 0 & 1 and Power Panels - MK 81, MOD 9 & 10; APL 006030016				1. Add the requirement to regass, seal and align telescopes to the FF-10 Maintenance Plan and BOH POT&I Plan.
					1. Determine the feasibility of providing overload protection for the Control Put Driver Circuit Board (PN LM 2527454) or redesign of the board.
					2. Analyze the "good" versus "bad" circuit boards being returned for rework. If a high percentage of boards are still being returned "good" make provisions for maintenance personnel to retain a spare set of good boards for trouble shooting and develop local (IMA) test facilities to test and collect boards for rework.
					3. List the boots (PN 1609611) on the POT&I Plan for inspection prior to the BOH and every ROH thereafter as a protective measure against moisture damage.

DDEOC ACTION TABLE

DESCRIPTION	4. REPORT REFERENCE (PARA.)	5. NAME/CODE OF PERSON HAVING RESPONSIBILITY				6. SCHEDULING DATES			7. FUNDING IMPLICATIONS
		a. DDEOC	b. NAVSEC	c. NAVSEA	d. OTHER	a. REQD.	b. START	c. COMP.	
loist brake assembly 230-22, data (54 the DCAP data rank.	3.3.8	X			GSEC				
ement to "check oil d elevation response 14 DJKN M and expand cover checking oil l elevation response	3.4.2	X		049					
irements of MRC A3 e of MRC A3 DGSP A MRC covers both ion receiver - re-	3.4.2	X		049					
ent to regass, seal opes to the FF-1052 and BOH POT&I Plan.	3.4.5	X			PERA				
asibility of provid- tection for the Out- it Board (PN LM sign of the board.	3.5.1			6531					
d" versus "bad" eing returned for re- percentage of boards returned "good" make aintenance personnel e set of good boards ting and develop facilities to test ds for rework.	3.5.1	X		6531	GSEC TYCOMS				
PN 1609611) on the nspection prior to y ROH thereafter as sure against moisture	3.5.1	X			PERA				

OTHER	6. SCHEDULING DATES			7. FUNDING IMPLICATIONS	8. REMARKS	9. ACTUAL ACTION TAKEN
	a. REQD.	b. START	c. COMP.			
C					<p>Possible brake adjustment problem.</p> <p>Overlapping requirements</p> <p>After combining requirements delete MRC A3 DGSP A.</p> <p>High usage</p> <p>Possible change to maintenance procedures.</p>	
RA						
EC COMS						
RA						

E-5(c)

1. ACTION ITEM		2. DDEOC EVALUATION		3. ACTION ITEM DESCRIPTION	4.
a. NO.	b. TITLE	a. APPROVED YES NO	b. FURTHER STUDY		RE
11.	Control Panels (Cont'd)			<p>4. Enter the usage data on relay (PN 2635288) in the DCAP data bank in order that it be available for review in the future.</p> <p>5. Accomplish ECP 711-089 (Install cooling Fan in EP1 Panel)</p>	

NOTE: DEVELOPING ACTIVITY FILL IN THE FOLLOWING BLOCKS: 1a, b; 3; 4; 5b,c,d IF KNOWN; 6a, IF REQUIRED FOR CONTINUATION OF DEV

DDEOC ACTION TABLE

ACTION ITEM DESCRIPTION	4. REPORT REFERENCE (PARA.)	5. NAME/CODE OF PERSON HAVING RESPONSIBILITY				6. SCHEDULING DATES			7. FUNDING IN
		a. DDEOC	b. NAVSEC	c. NAVSEA	d. OTHER	a. REQD.	b. START	c. COMP.	
the usage data on relay (35288) in the DCAP data bank so that it be available for use in the future.	3.5.1			6531	GSEC				
Install ECP 711-089 (Install cool- ing in EPI Panel)	3.5.1			6531					

NOTE: 6a, IF REQUIRED FOR CONTINUATION OF DEVELOPING ACTIVITY TASK; 7; 8, AS NECESSARY.

2

6. SCHEDULING DATES				7.	8.	9.
OTHER	a. REQD.	b. START	c. COMP.	FUNDING IMPLICATIONS	REMARKS	ACTUAL ACTION TAKEN
C					Increasing usage indicated	