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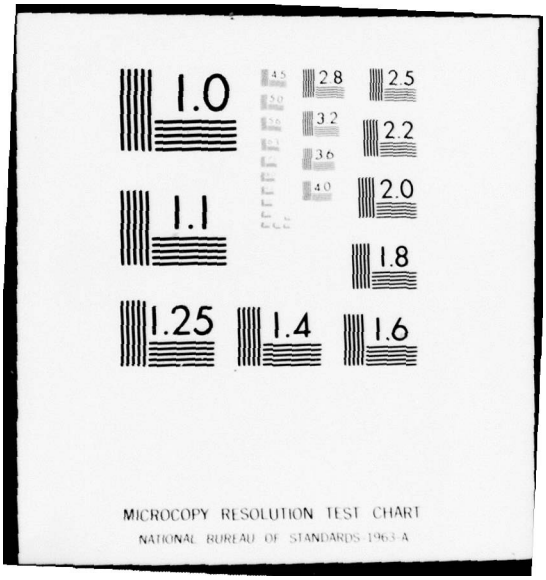
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DESTROYER ENGINEERED OPERATING CYCLE (DDEOC)

System Maintenance Analysis

FF-1052 CLASS WEAPONS HANDLING SYSTEMS

SMA 216-722

REVIEW OF EXPERIENCE

April 1978

Prepared for
Director, Escort and Cruiser
Ship Logistic Division
Naval Sea Systems Command
Washington, D. C.
under Contract N00024-78-C-4062

ARINC RESEARCH CORPORATION

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by

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FOREWORD

This report, the Review of Experience, documents the historical maintenance experience for the FF-1052 Class Weapons Handling Systems, presents an analysis of the problems encountered, and recommends actions to improve system material condition. It has been developed for NAVSEA 934X, the sponsor of the Destroyer Engineered Operating Cycle (DDEOC) Program, under Navy Contract N00024-78-C-4062.

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SUMMARY

This goal of the Destroyer Engineered Operating Cycle (DDEOC) Program is to effect an early improvement in the material condition of ships, at an acceptable cost, while maintaining or increasing their operational availability during an extended operating cycle. In support of this goal, System Maintenance Analyses (SMAs) are being conducted for selected systems and subsystems of designated surface combatants. The principal element of an SMA is the Review of Experience (ROE). This report documents the ROE for the FF-1052 Class Weapons Handling Systems.

An ROE is an analysis of existing and anticipated problems that affect the operational performance or maintenance program of a ship system. The ROE report serves as a vehicle for assessing the significance and consequences of identified maintenance problems. It also presents specific recommendations and a system maintenance policy for preventing or reducing the impact of problem occurrence, while improving material condition and maintaining or increasing system availability throughout an extended operating cycle.

All available maintenance data were analyzed in the Weapons Handling Systems' ROE. The documented maintenance experience of the systems were reviewed through analysis of Maintenance Data System (MDS) data, Casualty Reports (CASREPs), and system overhaul records. Initial findings from these sources were correlated with Planned Maintenance System (PMS) requirements, system alterations, and system technical manuals to identify maintenance problems. Discussions were held with appropriate technical codes to validate identified problem areas, identify undocumented maintenance problems, and determine the status of current and planned actions affecting the system. All findings were evaluated, and appropriate conclusions were developed. Recommendations were then formulated to (1) implement existing and newly defined corrective actions, (2) minimize the occurrence of identified problems and their impact on the extended operating cycle, and (3) identify the maintenance required throughout the operating cycle.

The major findings and conclusions resulting from the Review of Experience for the Weapons Handling Systems are summarized as follows:

- Major restorative maintenance of the Weapons Handling Systems will not be required during Baseline Overhaul (BOH) or during the Engineered Operating Cycle (EOC).
- Ship's Force personnel are normally capable of maintaining these systems with occasional Intermediate Maintenance Activity assistance.
- Current PMS procedures, as modified by recommendations of this report, are adequate to maintain the Weapons Handling Systems throughout the EOC.
- The determination of specific repairs to be accomplished on the ASROC Direct Loader System during BOH, intra-cycle SRAs, and follow-on ROHs should be made on the basis of the System Operability Test (SOT) results (as defined in NAVSECPHILADIV Publication T-1821-4). Post-repair testing should be accomplished by using the same procedure.
- Continued reliable operation of the Weapons Handling Systems can be expected with the performance of the recommended maintenance actions listed in Table S-1.

Table S-1. SUMMARY OF ROE RECOMMENDATIONS FOR THE FF-1052 CLASS WEAPONS HANDLING SYSTEMS

Component	Recommendation
Baseline Overhaul Requirements	
ASROC Direct Loader System	1. Replace all flexible hydraulic hoses. 2. Replace ASROC blast door seals. 3. Accomplish additional repairs as shown to be necessary as a result of the System Operability Test (NAVSECPHILADIV Publication T-1821-4). 4. Accomplish post-repair testing by using the System Operability Test (SOT).
All Hoists, Cranes, and Over-the-Side Handling Booms	Accomplish the following during the last month of BOH: • Inspection • *No-load operability* tests • 200 percent rated-load static tests • 150 percent rated-load dynamic tests • 100 percent rated-load tests
All Beams, Slings, and Carriers	Accomplish the following during the last month of BOH: • Inspection • 200 percent static load tests in accordance with OD 44941 procedures. (Testing to be accomplished at NWS, Earle, N.J. or NWS, Concord, CA., as appropriate).
Ammunition Whip Hoist, Torpedo Handling Equipment (No. 1 Magazine), ASROC and Torpedo Over-the-Side Handling Equipment, and MK 13 Mod 0 BPDSMS Loader	Accomplish repairs as shown to be necessary by pre-overhaul inspection *and ship's CSMP.*
All Portable and Installed Air Hoses Used in the Weapons Handling Systems	Visually inspect and hydrostatically test to 150 psig. Replace hoses as necessary.
Intra-Cycle Maintenance Requirements	
ASROC Direct Loader System	1. Replace ASROC blast door seals 36 to 40 months after BOH. 2. Accomplish repairs during SRA 1 and SRA 2 as shown to be necessary by the pre-SRA System Operability Test results.
All Hoists, Cranes, and Over-the-Side Handling Booms	Perform 200 percent rated-load static test, 150 percent rated-load dynamic test, and 100 percent rated-load test at 48-month intervals.
All Beams, Slings, and Carriers	Perform 200 percent rated-load static tests at 18-month intervals in accordance with OD 44941 procedures. Testing to be accomplished at NWS, Earle, N.J. or NWS, Concord, CA., as appropriate.)
All Weapons Handling Equipment	1. Accomplish existing PMS requirements as modified by recommendations of this report. 2. Schedule all required static and dynamic load tests on a hard-time basis in the FF-1052 Class Maintenance Plan.
Follow-On ROH Requirements	
All Weapons Handling System Components	Requirements are identical to those for BOH.
PMS Changes	
Portable and Installed Air Hoses Used in the Weapons Handling Systems	Develop an annual PMS requirement to "visually inspect and hydrostatically test to 150 psig, all flexible air hoses used in the Weapons Handling Systems".
Reliability and Maintainability Improvements -- none identified	
Depot Level Improvements -- none identified	
IMA Level Improvements -- none identified	
Integrated Logistic Support Improvements	
ASROC Direct Loader System	1. Specify the System Operability Test (SOT) of NAVSECPHILADIV Publication T-1821-4 as the required pre-overhaul and pre-SRA test. Specific repairs should be identified on the basis of these test results. 2. Specify the SOT as the required post-repair acceptance test.
ASROC Handling System	Advise all FF-1052 Class ships that APL 581060018 is currently applicable for the ASROC Handling System, and ensure that a copy is on board.
Torpedo Handling Equipment (No. 1 Magazine)	1. Advise all FF-1052 Class ships that APL 581090001 is applicable for the ARO Model 7776C pneumatically operated hoist. 2. Revise APL 854420022 to reflect the applicable APLs for all peripheral equipments that support the Torpedo Handling Equipment, including those components added by ShipAlt FF-1052-438K.

CONTENTS

CONTENTS (continued)

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

In support of the Destroyer Engineered Operating Cycle (DDEOC) Program sponsored by NAVSEA 934X, System Maintenance Analyses (SMAs) are being conducted on selected systems and subsystems of program-designated surface combatants. The principal element of an SMA is the Review of Experience (ROE). This report documents the ROE for the FF-1052 Class Weapons Handling Systems, which were selected for analysis because equipments of these systems are on the FF-1052 Class Maintenance Critical Equipment List.

1.2 PURPOSE AND SCOPE

An ROE is an analysis of existing and anticipated problems that affect the operational performance or maintenance program of a ship's system. The ROE report serves as a vehicle for assessing the significance and consequences of identified problems. It also presents specific recommendations and a system maintenance policy for preventing or reducing the impact of problem occurrence, while improving material condition and maintaining or increasing system availability throughout an extended operating cycle.

The analysis of the Weapons Handling Systems was concerned with only those system components that had been installed or were on board ship as of the fourth quarter of Fiscal Year 1976. A list of the major components considered is provided in Appendix A.

The analysis used all available documented data from which system maintenance problems could be identified and studied. These data were obtained from the Maintenance Data System (MDS), Casualty Reports (CASREPs), system overhaul records, Planned Maintenance System (PMS) requirements, system alteration documentation, and system technical manuals. Sources of undocumented data employed in this analysis included discussions with cognizant technical personnel.

1.3 SYSTEM FUNCTION AND DESCRIPTION

The Weapons Handling Systems of the FF-1052 Class ships consist of installed, mobile, and portable equipments. The installed equipments, such as the ASROC Direct Loader System and the Torpedo Handling System in Number One Magazine, are used to move weapons from their stowed position in chocks to the ASROC cell or torpedo tube from which they can be tactically employed. Mobile handling equipment, such as hand-lift trucks and dollies, are used to move weapons on deck from their boarding point to their respective magazines. Portable handling equipment consists of containers, pneumatically operated chain hoists, lifting slings, lifting beams, and over-the-side handling booms. These equipments are normally used to load weapons from either a pier or a small boat alongside; however, they may also be used to retrieve exercise shots from the water. The Weapons Handling Systems of the FF-1052 Class ships provide a safe and convenient means of boarding, moving, stowing, and loading all the types of ordnance normally carried on board.

1.4 REPORT FORMAT

The remaining chapters of this report describe the analysis approach utilized (Chapter Two), briefly define significant system maintenance problems encountered and discuss potential problem solutions (Chapter Three), and summarize the conclusions and recommendations derived from the analysis (Chapter Four). Specific analyses and evaluations supporting the results of this effort are included as appendixes to this report. A list of selected references precedes the appendixes.

CHAPTER TWO

APPROACH

2.1 OVERVIEW

This chapter describes the approach to the performance of the ROE for the Weapons Handling Systems. Primary data sources were identifed in Section 1.2. These data were used to identify, define, and analyze maintenance problems that will significantly affect the Weapons Handling Systems' maintenance program. A recommended course of action relative to the maintenance program was formulated on the basis of the analysis results.

For purposes of the analysis performed, the Weapons Handling System was divided into three main functional groups: installed handling equipment, mobile handling equipment, and portable handling equipment. The analysis was initiated at the component level at which Allowance Parts Lists (APL) numbers are assigned. Major steps of the analysis were as follows:

- Compiling relevant documented and undocumented maintenance history data
- Analyzing these data to identify and define maintenance problems expected to have a significant impact on system maintenance
- Recommending a specific course of action for solution of system maintenance problems

Each of these activities is described in the following sections.

2.2 DATA COMPILATION

The analysis began with the compilation of comprehensive data on the maintenance history of the system. The data file consisted of four key elements: an MDS data bank, a CASREP narrative summary, a system overhaul experience summary, and a system ShipAlt summary. A library of appropriate technical manuals, bulletins, and related documents were also assembled. The MDS data bank was compiled by examination of all MDS data reported for the FF-1052 Class from 1 January 1970 through 31 October 1976. Overhaul information was obtained from authorized Ship Alteration and Repair Packages (SARPs) for the FF-1052 Class.

2.3 MAINTENANCE PROBLEM DEFINITION

Potential maintenance problems associated with the systems and their components were identified by screening data obtained from the above-described sources as well as from ship surveys, discussions with Navy technical personnel, and, when appropriate, NAVSEA special-interest programs.

MDS data constituted the initial and primary source of information screened. The resulting data base includes all part and labor records, as well as narrative material, describing maintenance actions reported against system components. Maintenance actions are represented by Job Control Numbers (JCN). The purpose of the first step in the screening process was to identify the maintenance actions that had been reported against components of the system under investigation.

Computer-assisted analysis was next employed to quantify the man-hour and part-expenditure burdens incurred for each component, not only for the selected components individually but also, as appropriate, for each generic class of components. Individual components or component classes that had contributed significantly to the systems' maintenance burden were selected for the analysis described below. Components were also selected for analysis if they had generated a significant number of CASREPs or if other sources of information (e.g., ship surveys or overhaul experience) disclosed significant concern regarding maintenance problems or the maintenance programs for the components.

Detailed analysis of the selected components was directed toward defining each maintenance problem in terms of several specific factors: the effect of the problem on the component and system, the interval between occurrences of the problem, the redundancy of the affected component within the system, the criticality of the component to the system, the resources required to perform the maintenance necessary to correct the problem, and the expected component or system downtime.

2.4 ANALYSIS OF COMPONENT MAINTENANCE PROBLEMS AND DEFINITION OF SOLUTIONS

Once the component maintenance problems and their causes were identified, solutions were sought by examining each problem in relation to the extent to which it is recognized and its susceptibility to established types of corrective action. These analysis criteria can be expressed by the following questions:

- Is the problem known to the Navy technical community and has a solution been proposed or established?
- Will a design change reduce or eliminate the problem?
- Is the problem PMS-related? Can the problem be reduced or eliminated by changes to PMS? (These changes might include adding or deleting requirements, changing requirement frequency, or developing material condition assessment tests and procedures.)

- Can the problem be reduced or eliminated by improving the systems' Integrated Logistics Support (ILS)?
- Can the problem be reduced or eliminated by improving Ship's Force, Intermediate Maintenance Activity (IMA), or depot-level capabilities?
- Can the problem be reduced or eliminated by periodically performing restorative maintenance? Should this be accomplished at a Selected Restrictive Availability (SRA) by Ship's Force, IMA, or depot-level facilities?
- Is the run-to-failure concept a viable maintenance strategy for the associated equipment?

An affirmative answer to any question resulted in analysis of the effects of the solution. A negative answer prompted the analyst to go to the next question. After all the questions were answered, the alternative near-term and long-term solutions were evaluated and the most acceptable alternatives defined and documented as recommendations. "Near-term" recommended solutions, *as used in this report*, are those that should be, and are likely to be, accomplished before completion of the initial FF-1052 Class Baseline Overhaul (BOHs). "Long-term" recommended solutions are those that are not likely to be accomplished until some or all of the FF-1052 Class BOHs have been completed.

The historical overhaul experience for all installations of each selected component was then correlated with the recommended problem solutions. An evaluation was made to establish the Baseline Overhaul, intracycle, and follow-on Regular Overhaul requirements for each selected component.

CHAPTER THREE

RESULTS

3.1 OVERVIEW

This chapter presents the results of the analysis of the Weapons Handling Systems installed in FF-1052 Class ships. Preliminary analysis identified six components* as the major maintenance burden contributors of the Weapons Handling Systems. Table 3-1 summarizes the MDS data reported against these six components and compares it with the total data reported for all components of the systems.

It was disclosed during analysis that many items of weapons handling equipment are provided to the ships as equipage under Allowance Equipage Lists (AELs). In some cases, the items provided also have associated Allowance Parts Lists (APLs), while in other instances the items only have National Stock Numbers (NSNs). In reviewing the MDS data, it was discovered that similar maintenance actions for an item of weapons handling equipment were randomly reported under either the AEL that provided it, the APL for the items, or as indeterminate items under such headings as "Not Listed" and "Unknown". The magnitude of this problem is demonstrated by the fact that 31.2 percent (or 654) of the total 2,098 JCNs reported against the Weapons Handling Systems (see Table 3-1) were reported as indeterminate items under "Not Listed" or "Unknown". These 654 JCNs accounted for 28.5 percent (or 3,098) of the 10,865 total Ship's Force man-hours, and 47.9 percent (or 2,463) of the 5,145 total IMA man-hours reported against the combination of all Weapons Handling Systems. As a result of this reporting phenomenon, the percentage of maintenance parameters (JCNs, Ship's Force, and IMA man-hours and parts costs) listed in Table 3-1 are low. They are low because many valid actions relating to the six components were reported under "Not Listed" or "Unknown" categories, and their numeric values are not included under the APL for the item.

To ensure that all maintenance actions were examined for periodic recurrence regardless of how they were reported, the narrative accompanying each of the 2,098 JCNs was examined. This examination led to the conclusion

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*In this report, the terms "component" and "equipment" are used interchangeably to refer to portions of the systems.

Table 3-1. MDS DATA SUMMARY FOR SELECTED APLs OF THE FF-1052 CLASS WEAPONS HANDLING SYSTEMS

APL	Nomenclature	Applicable Ships	Components per Ship	Total Component Population	Total Ship Operating Time (Ship-Years)*	Ships Reported	JCNs	Ship's Force Man-Hours	IMA Man-Hours	Total Man-Hours	Parts Cost (Dollars)	Average Man-Hours/ Component Operating Year
581060009**	ASROC Electrohydraulic Hoist	46	1	46	200	40	473	3,058	411	3,469	13,190	17.3
572380003**	ASROC Traveling Bridge Crane	46	1	46	200	32	261	1,984	320	2,304	3,952	11.5
854420022	Torpedo Handling Equip., No. 1 Magazine	46	1	46	200	33	105	340	352	692	1,921	3.5
580630057	Pneumatic Chain Hoist 1000 Lb. (Ammo. Whip Hoist)	46	2	92	200	34	132	789	504	1,293	727	3.2
005030008	Mk 42 OT2 Hand-Lift Truck	46	2 or 4†	152	200	41	161	528	365	893	77,340	1.4
006220063	Mk 13 Mod 0 BPDSMS Loader	28	1	28	102††	17	55	161	89	250	585	2.4
		Totals	-	-	-	-	1,187	6,860	2,041	8,901	97,715	
		Totals Reported for All System APLs/AELs					2,098	10,865	5,145	16,010	136,996	
		Percent of Total Accounted for by Selected System APLs					56.6	63.1	39.7	55.6	71.3	

*Total ship operating years = time since commissioning or system installation (whichever is later) less time in major availabilities, such as ROH.
**APL has been superseded by APL 581060019 for all FF-1052 Class ships having ShipAlts FF-1052-30 and FF-1052-73 installed. No maintenance data were reported under the new APL during the data period.
†Four hand-lift trucks are required on FF-1052 Class ships having BPDSMS installed. All other ships require only two (per NAVSEAINST 10490.2).
††Only 28 of 31 scheduled installations were completed during the data period.

that none of the six selected components listed in Table 3-1 had experienced any commonly recurring part failures beyond the routine replacement of hydraulic oil filter cartridges. The principal recurring maintenance disclosed by the review of narratives was for static and dynamic testing of the handling equipment and for routine calibration of tools and gages.

CASREP analysis supported the MDS data analysis, which was performed to define repetitive or significant maintenance actions. Table B-1 (Appendix B) summarizes the CASREP distribution for the equipments of the Weapons Handling Systems and indicates the percentage of total system CASREPs attributed to each equipment, as well as the types of failures experienced. Discussions with Navy technical personnel confirmed that the components of the Weapons Handling Systems had not experienced major maintenance problems. However, some system maintenance considerations were identified by the analysis as worthy of discussion, including the following: (1) static and dynamic load testing of handling equipment and tool and gage calibration, (2) flexible hydraulic and air hoses, (3) ASROC blast door seals, (4) mobile hand-lift trucks, (5) system operability tests of the ASROC Direct Loader System, and (6) three integrated logistic support (ILS) items. These six topics are discussed in subsequent sections of this report.

3.2 STATIC AND DYNAMIC LOAD TESTS

3.2.1 Discussion

Review of the MDS narratives revealed that 477 JCNs, involving a total expenditure of 2,206 Ship's Force man-hours and 1,808 IMA man-hours, were reported for various weight tests performed on Weapons Handling Equipments during the data period. Sixty-three of these JCNs, involving 178 Ship's Force and 170 IMA man-hours, were related to tool and gage calibration. All such testing and calibration is a part of the routine PMS and is not indicative of a maintenance problem. However, the magnitude of testing and calibration is such that it has accounted for 22.7 percent of the total reported JCNs for all systems, and 20.3 and 35.1 percent of the total reported Ship's Force and IMA man-hours, respectively. Thus static and dynamic testing of weapons handling equipment is a time-consuming task, and is also one with rigid frequency requirements. Table 3-2 lists the intervals at which various components of the Weapons Handling Systems must be tested and defines the maintenance level designated to accomplish the testing. All weight tests listed in Table 3-2 are currently covered by PMS and are reiterated here because the maximum allowable interval between tests is 48 months. This interval is less than the 60-month extended operating cycle currently envisioned for DDEOC ships. Therefore, it is important that Weapons Handling Systems weight tests be scheduled as hard-time actions in the FF-1052 Class Maintenance Plan (CMP) to ensure that the maximum test intervals are not exceeded.

Table 3-2. WEIGHT TEST REQUIREMENTS FOR THE WEAPONS HANDLING EQUIPMENT

Component	Requirement	Test Interval (Months)	Performed By
ASROC and HARPOON Handling System*	200% Static Test 150% Dynamic Test 100% Rated Load Test	48	Tender or Industrial Activity
Torpedo Handling Equipment, No. 1 Magazine	200% Static Test 150% Dynamic Test 100% Rated Load Test	48	Tender or Industrial Activity
Torpedo and ASROC Over-the-Side Handling Equipment	200% Static Test 150% Dynamic Test 100% Rated Load Test	48	Tender or Industrial Activity
Hand-Lift Trucks (Mk 42 Mods 1 and 2 or Mk 45 Mod 1)	200% Static Test	18	Tender
Handling Dolly (Mk 24 Mods 0 and 1)	200% Static Test	18	Tender
Sling, Mk 75** or Sling, Mk 99**	200% Static Test	18	NWS, Earle, N.J. or NWS, Concord, Ca.
Torpedo Sling (Mk 102 Mod 0**)	200% Static Test	18	NWS, Earle, N.J. or NWS, Concord, Ca.
Torpedo Sling (Mk 106 Mod 0**)	200% Static Test	18	NWS, Earle, N.J. or NWS, Concord, Ca.
Hoisting Bar (Aero 64-A** or Weapon Carrier Mk 57 Mod 0**)	200% Static Test	18	NWS, Earle, N.J. or NWS, Concord, Ca.
Container's Lifting Sling (Mk 120 Mod 0**)	200% Static Test	18	NWS, Earle, N.J. or NWS, Concord, Ca.

*Accomplish weight testing in accordance with NAVSECPHILADIV Publication T-1821-3. This testing is recommended because ShipAlt FF-1052-114-K, which installs the HARPOON weapon capability, will be accomplished on FF-1052 Class ships prior to or during BOH.

**Return to NWS, Earle, N.J., or NWS Concord, Ca., for static testing in accordance with OD 44941.

3.2.2 Recommendations

For the near term, it is recommended that all required weight tests for the Weapons Handling Systems be accomplished during the last month of BOH.

The following long-term actions are recommended:

- The DDEOC program should schedule IMAs and industrial facilities to accomplish all required intra-cycle weight testing on a hard-time basis for ensuring that maximum allowable test intervals are not exceeded.
- Accomplish all required weight tests for the Weapons Handling Systems during the last month of each follow-on ROH.

3.3 FLEXIBLE HYDRAULIC AND AIR HOSES

3.3.1 Discussion

During review of the MDS narratives, a significant number of maintenance actions were identified relating to hydraulic hose damage and failure and hydraulic system leaks. In addition, five CASREPs of the ASROC electro-hydraulic hoist, two CASREPs of the ASROC traveling bridge crane, and one CASREP of the ASROC hand pump were attributed to hydraulic problems. Most hydraulic leaks were not critical in nature and did not require a large number of man-hours to correct. Only three of the eight CASREPs associated with hydraulic problems were attributed to leaks. However, a total of 34 hydraulic hoses were replaced on the ASROC Direct Loader System during the data period. The parts usage did not reflect frequent recurring usage of a particular hose assembly but rather an infrequently recurring usage of several different hoses within the system.

Review of applicable APLs and discussions with cognizant Navy technical personnel revealed that the hydraulic hoses used in the ASROC Handling System are not normally stocked on board as ready-for-issue spares. In the event of a hose failure, the normal procedure is to have a replacement fabricated by an IMA or industrial facility. Since Ship's Force personnel do not have the capability of fabricating and testing replacement hydraulic hoses, an operational failure can lead to an inoperative handling system until outside assistance can be provided to fabricate a replacement hose assembly. To prevent such operational failures, it is recommended that all ASROC Handling System hoses be replaced at five-year (±6 months) intervals.

Review of the Naval Ship Technical Manual, Chapter 9480.165, indicated that rubber and reinforced rubber hoses, used as flexible connectors between resiliently mounted pumps and rigid piping or equipments, should be replaced every five years (±6 months). The hydraulic hoses used in the ASROC Direct Loader System fall into this category. The periodic replacement of hydraulic hoses should minimize in-service failures and reduce CASREPs.

The flexible hoses, which are used as air supply lines to portable pneumatic chain hoists and the installed torpedo hoist, operate from ship's service air pressure at a nominal 100 (±10) psig. Since these hoses are not permanently installed and are not used on a daily basis, routine replacement at five-year intervals is not warranted. These hoses should be visually inspected on an annual basis and hydrostatically tested to 150 percent of the nominal working pressure or 150 psig. The hoses should be replaced only if they fail this annual test and inspection.

3.3.2 Recommendations

The following near-term actions are recommended:

- Replace all flexible hydraulic hoses in the ASROC Direct Loader System during BOH.
- Develop an annual PMS requirement to "visually inspect and hydrostatically test to 150 psig all flexible air hoses used in the Weapons Handling Systems". Hose replacement should be on the basis of the results of these inspection and test requirements.

For the long-term, it is recommended that the replacement of all flexible hydraulic hoses in the Weapons Handling Systems should be accomplished during follow-on overhauls.

3.4 ASROC BLAST DOOR SEALS

3.4.1 Discussion

Review of MDS data and narratives revealed that the blast door seals were replaced as an item of corrective maintenance on at least 16 different ships during the intra-cycle period. Of 21 FF-1052 Class SARPs reviewed, 13 showed replacement of the blast door seals during ROH. The most frequently reported reason for the replacements was attributed to leakage and general deterioration. This particular failure is not critical to the ASROC Handling and Loading Systems but does contribute to the overall maintenance burden by moisture causing corrosion and deterioration of other components. On the basis of historical experience reported in MDS data and FF-1052 Class SARPs, it has been determined that these seals will not maintain their integrity over an extended operating cycle of 60 months. Therefore, it is recommended that a replacement interval of 36 to 40 months be established.

3.4.2 Recommendations

The following near-term actions are recommended:

- Replace the ASROC blast door seals during BOH.
- Establish a replacement interval of 36 to 40 months for ASROC blast door seals.

3.5 MOBILE HAND-LIFT TRUCKS

Mobile hand-lift trucks, such as the Mk 42 Mods 1 and 2 and the Mk 45 Mod 0, require periodic return to a tender or repair facility for inspection, repair, and load-lift mechanism testing. This is required by MIP 8-175/1-75 at 18-month intervals. Review of MDS data revealed that it is common practice to report the total cost of these equipments when they are sent to the tender for repair and testing, rather than reporting the actual cost of any repair parts used. Table 3-3 presents the reported costs associated with replacement of the mobile handling equipment.

Table 3-3. REPORTED HAND TRUCK AND TORPEDO DOLLY REPLACEMENT COSTS

Component	Average Reported Unit Cost (Dollars)	Number Replaced	Total Reported Cost (Dollars)
Aero 22A Torpedo Dolly	5,585	3	16,755
Mk 42 Mod 1 Hand Truck	1,573	30	47,190
Mk 42 Mod 2 Hand Truck	800	14	11,200
Mk 42 Mod 0 Hand Truck	1,170	13	15,210
Total			90,355

Review of the MDS narratives indicates that most of these reported replacements were only reports of returning these equipments to a tender for maintenance, in accordance with PMS requirements. The major point to be made is that $90,355, or 66 percent, of the $136,996 reported against the total Weapons Handling Systems is attributed to these mobile handling equipments. Reducing the total reported maintenance parts cost to the Weapons Handling Systems by $90,355 results in a total reported maintenance parts cost of $46,641 for the system over the entire data period. This corresponds to approximately $233 per ship operating year (assuming 200 ship operating years for all systems) for the corrective maintenance cost associated with the Weapons Handling Systems. This small dollar value tends to confirm the previous conclusion that equipments of the Weapons Handling Systems have not been a major burden in terms of corrective maintenance, and the total dollars reported against equipments of the FF-1052 Class Weapons Handling Systems are not a reliable indicator of the magnitude of past corrective maintenance.

3.6 ASROC SYSTEM OPERABILITY TESTING

3.6.1 Discussion

ShipAlt FF-1052-114-K provides for the installation of the HARPOON Surface to the Surface Weapons System on FF-1052 Class ships and is being

accomplished on ships of the class as they undergo Baseline Overhaul. To provide standardized guidance for the installation, alignment, weight testing, System Operability Testing, and final check-out of the HARPOON installation, NAVSECPHILADIV has prepared Publication T-1821-1, -2, -3, -4, and -5. Publication T-1821-4 specifies the System Operability Test (SOT) procedures, which are devised such that all electrical, mechanical, and hydraulic components of the ASROC System are tested to a full working load. The test can only be fully conducted when all weapons have been off-loaded. Since this analysis has not indicated any significant recurring corrective maintenance actions, no specific repairs beyond replacement of hydraulic hoses and blast door seals can be identified as being periodically required. Therefore, it is recommended that the SOT provided in NAVSECPHILADIV Publication T-1821-4 be used as a pre-BOH, pre-SRA, and pre-ROH testing procedure for the identification of necessary system repairs. The same test conducted following system repair would function as an acceptance test.

3.6.2 Recommendations

The following near-term actions are recommended:

- Specify the SOT NAVSECPHILADIV Publication T-1821-4 as the required pre-overhaul and pre-SRA test. Specific repairs should be identified on the basis of these test results.
- Specify the SOT as the required post-repair acceptance test.

3.7 LOGISTIC SUPPORT IMPROVEMENTS

3.7.1 Discussion

During this analysis it was discovered that the installation of ShipAlts FF-1052-30K and FF-1052-73-K, which provides a full-power ram capability for the ASROC Direct Loader System and provides maximum operational safety and maintenance standards by modification to ASROC Direct Loader System, respectively, results in a change in the APL number assigned to the ASROC Direct Loader System. Installation of these two ShipAlts has been reported as complete on all but one FF-1052 Class ship, but all maintenance actions during the data period were reported using the old APL numbers. As indicated in Table 3-1, all maintenance reported against the ASROC electrohydraulic hoist and the traveling bridge crane was under APLs 581060009 and 572380003, respectively. Completion of ShipAlts FF-1052-30-K and FF-1052-73-K results in these APLs being superseded by APL 581060019. Since many of these ShipAlt installations were completed during the data period used in preparation of this report, some maintenance actions should have been reported using the new APL; however, none were reported. It is assumed that the ships are not aware that the applicable APL number has been changed. It is therefore suggested that all FF-1052 Class ships be advised of the change in APL numbers for the ASROC Handling Equipment, and that copies of the new APL be provided.

APL 854420022 for the Torpedo Handling Equipment in Number 1 Magazine does not list any associated APLs and does not provide spares information for the ARO model 7776C chain hoist or its associated lubricators. Discussions with NAVSEC technical personnel indicated that ships frequently call for information on how to obtain repair parts for the chain hoist since it is not covered under APL 854420022. NAVSEC personnel stated that they have customarily referred the ships to the manufacturer of the chain hoist for that information since they were unaware of an applicable APL. During this analysis, APL 581090001 was identified as being applicable to the ARO model 7776C pneumatically operated chain hoist installed as part of the Torpedo Magazine Handling Equipment. It is suggested that APL 854420022 for the Torpedo Handling Equipment, Number 1 Magazine be revised to reflect the associated APLs, including the ARO chain hoist previously identified, the lubricators, and any other installed equipment associated with the Torpedo Handling Equipment, Number 1 Magazine. In addition, ShipAlt FF-1052-438-K has been issued, which improves safety by adding powered traversing and manual hoisting capabilities and by modifying the manual traversing installation. The addition of a second pneumatically powered hoist, as well as the other modifications implemented by this alteration, will introduce additional revisions into APL 854420022. It is recommended that the impact of ShipAlt FF-1052-438-K be considered during the suggested revision of APL 854420022. Installations are scheduled to commence in FY 78 and continue through FY 79 and FY 80.

3.7.2 Recommendations

The following near-term actions are recommended:

- Advise all FF-1052 Class ships that APL 581060019 is currently applicable for the ASROC Handling System and ensure that a copy is on board.
- Advise all FF-1052 Class ships that APL 581090001 is applicable for the ARO model 7776C pneumatically operated chain hoist installed in Torpedo Number 1 Magazine.

For the long term, it is recommended that APL 854420022 for the Torpedo Handling Equipment, Number 1 Magazine be revised to reflect the applicable APLs of all peripheral equipments supporting the Torpedo Handling Equipment, including those equipments added by ShipAlt FF-1052-438-K.

3.8 MAINTENANCE STRATEGY

Results of this analysis have shown that the components of the FF-1052 Class Weapons Handling Systems have not generally required a large amount of corrective maintenance and have given no indication of a requirement for major overhaul on a periodic basis. It is concluded that current PMS requirements, including those for weight testing, are adequate to maintain the Weapons Handling Systems in a satisfactory state of material condition during an extended operating cycle and can be used to identify the need for corrective maintenance. All expected corrective maintenance during the

operating cycle can be accomplished by Ship's Force personnel assisted, as necessary, by an IMA. The periodic conduct of weight testing for the weapons handling equipment should be scheduled for accomplishment on a hard-time basis in the FF-1052 Class Maintenance Plan. Specific repairs required during the Baseline Overhaul and follow-on ROH should be identified on the basis of system testing. The System Operability Tests described in NAVSECPHILADIV Publication T-1821-4 should be used to identify specific repair requirements for the ASROC and HARPOON handling system prior to Baseline Overhaul, intra-cycle SRAs, and follow-on ROHs.

3.9 BASELINE OVERHAUL REQUIREMENTS

The Baseline Overhaul (BOH) concept is designed to accomplish the maintenance actions that are necessary to restore a ship to a condition in which, with a well engineered and executed maintenance program, it can be expected to perform satisfactorily over an extended operating cycle. In keeping with this policy, the following maintenance actions should be added to the Baseline SARP for Baseline Overhaul (BOH) of FF-1052 Class ships, dated 1 March 1978.

- Add the following actions to SWLINs 722A01A and 722A02A:
  - Replace all flexible hydraulic hoses.
  - Accomplish additional repairs as shown to be necessary as a result of the System Operability Test (SOT) (NAVSECPHILADIV Publication T-1821-4).
  - Accomplish post-repair testing by using the SOT of NAVSEC-PHILADIV Publication T-1821-4.
- Add the following actions to SWLIN 169A01A: replace ASROC blast door seals.

A complete listing of the Baseline Overhaul Requirements is given in Table 4-1.

3.10 INTRA-CYCLE MAINTENANCE REQUIREMENTS

The primary maintenance to be accomplished during the operating cycle is described in the PMS for the Weapons Handling Systems, as modified by recommendations of this report. The only additional maintenance action identified as being required routinely during the operating cycle is replacement of the ASROC blast door seals (NSN 9Z-5330-4938237) at 36- to 40-month intervals. The System Operability Test for the ASROC Direct Loader System, described in NAVSECPHILADIV Publication T-1821-4, should be accomplished prior to each SRA. Necessary repairs of this system should be determined from the test results.

3.11 FOLLOW-ON ROH REQUIREMENTS

The results of this analysis indicate that the follow-on ROH requirements are identical to those for the Baseline Overhaul. Installation of the HARPOON Weapons System provided for by ShipAlt FF-1052-114-K may present unique problems in weapons handling not currently evident. However, the System Operability Test, previously discussed and recommended as the basic test for determining the need for corrective maintenance for the ASROC Direct Loader System, was developed to include HARPOON handling; therefore, no major problems are expected.

CHAPTER FOUR

CONCLUSIONS AND RECOMMENDATIONS

4.1 CONCLUSIONS

Significant conclusions resulting from this Review of Experience are as follows:

- The Weapons Handling Systems of FF-1052 Class ships have not been major contributors to the corrective maintenance burden.
- Major restorative maintenance for the Weapons Handling Systems will not be required during the Baseline Overhaul (BOH) or during the Engineered Operating Cycle (EOC).
- Ship's Force personnel are normally capable of maintaining these systems with occasional Intermediate Maintenance Activity (IMA) assistance.
- Current PMS procedures, as modified by recommendations of this report, are adequate to maintain the Weapons Handling Systems throughout the EOC.
- The determination of specific repairs to be accomplished on the ASROC Direct Loader System during BOH, intra-cycle SRAs, and follow-on ROHs should be made on the basis of the System Operability Test (SOT) results (as defined in NAVSECPHILADIV Publication T-1821-4). Post-repair testing should be accomplished by using the same procedure.
- Continued reliable operations of the Weapons Handling Systems can be expected with the performance of the recommended maintenance actions listed in Table 4-1.

4.2 RECOMMENDATIONS

Corrective actions and planning activities identified by this ROE are categorized as follows:

- Baseline Overhaul Requirements
- Intra-Cycle Maintenance Requirements

- Follow-On ROH Requirements
- Planned Maintenance System (PMS) Changes
- Reliability and Maintainability Improvements
- Depot-Level Improvements
- IMA-Level Improvements
- Integrated Logistic Support Improvements

Specific recommendations are summarized in Table 4-1. A detailed listing of PMS changes is included in the DDEOC MRC Evaluation Table of Appendix C. All recommendations resulting from this analysis are summarized in the *DDEOC* Action Table presented in Appendix D.

Figure 4-1. SUMMARY OF ROE RECOMMENDATIONS FOR THE FF-1052 CLASS WEAPONS HANDLING SYSTEMS

Component	Recommendation
Baseline Overhaul Requirements	
ASROC Direct Loader System	1. Replace all flexible hydraulic hoses. 2. Replace ASROC blast door seals. 3. Accomplish additional repairs as shown to be necessary as a result of the System Operability Test (NAVSECPHILADIV Publication T-1821-4). 4. Accomplish post-repair testing by using the System Operability Test (SOT).
All Hoists, Cranes, and Over-the-Side Handling Booms	Accomplish the following during the last month of BOH: • Inspection • No-load operability tests • 200 percent rated-load static tests • 150 percent rated-load dynamic tests • 100 percent rated-load tests
All Beams, Slings, and Carriers	Accomplish the following during the last month of BOH: • Inspection • 200 percent static load tests in accordance with OD 44941 procedures. (Testing to be accomplished at NWS, Earle, N.J. or NWS, Concord, CA., as appropriate).
Ammunition Whip Hoist, Torpedo Handling Equipment (No. 1 Magazine), ASROC and Torpedo Over-the-Side Handling Equipment, and MK 13 Mod 0 BPDSMS Loader	Accomplish repairs as shown to be necessary by pre-overhaul inspection and ship's CSMP.
All Portable and Installed Air Hoses Used in the Weapons Handling Systems	Visually inspect and hydrostatically test to 150 psig. Replace hoses as necessary.
Intra-Cycle Maintenance Requirements	
ASROC Direct Loader System	1. Replace ASROC blast door seals 36 to 40 months after BOH. 2. Accomplish repairs during SRA 1 and SRA 2 as shown to be necessary by the pre-SRA System Operability Test results.
All Hoists, Cranes, and Over-the-Side Handling Booms	Perform 200 percent rated-load static test, 150 percent rated-load dynamic test, and 100 percent rated-load test at 48-month intervals.
All Beams, Slings, and Carriers	Perform 200 percent rated-load static tests at 18-month intervals in accordance with OD 44941 procedures. Testing to be accomplished at NWS, Earle, N.J. or NWS, Concord, CA., as appropriate.)
All Weapons Handling Equipment	1. Accomplish existing PMS requirements as modified by recommendations of this report. 2. Schedule all required static and dynamic load tests on a hard-time basis in the FF-1052 Class Maintenance Plan.
Follow-On BOH Requirements	
All Weapons Handling System Components	Requirements are identical to those for BOH.
PMS Changes	
Portable and Installed Air Hoses Used in the Weapons Handling Systems	Develop an annual PMS requirement to "visually inspect and hydrostatically test to 150 psig, all flexible air hoses used in the Weapons Handling Systems".
Reliability and Maintainability Improvements -- none identified	
Depot Level Improvements -- none identified	
IMA Level Improvements -- none identified	
Integrated Logistic Support Improvements	
ASROC Direct Loader System	1. Specify the System Operability Test (SOT) of NAVSECPHILADIV Publication T-1821-4 as the required pre-overhaul and pre-SRA test. Specific repairs should be identified on the basis of those test results. 2. Specify the SOT as the required post-repair Acceptance test.
ASROC Handling System	Advise all FF-1052 Class ships that APL 581060018 is currently applicable for the ASROC Handling System, and ensure that a copy is on board.
Torpedo Handling Equipment (No. 1 Magazine)	1. Advise all FF-1052 Class ships that APL 581090001 is applicable for the ARO Model 7776C pneumatically operated hoist. 2. Revise APL 854420022 to reflect the applicable APLs for all peripheral equipments that support the Torpedo Handling Equipment, including those components added by ShipAlt FF-1052-438K.

SELECTED SOURCES OF INFORMATION

The following sources of information were used as the basis for the Review of Experience of the Weapons Handling Systems:

1. Generation IV MDS Part and Maintenance Data for DE/FF-1052 Class for the period 1 January 1970 through 31 October 1976.

2. CASREPs for the FF-1052 Class for the period 1 January 1972 through 30 June 1976.

3. Technical Manual - NAVSHIPS 0901-470-0002, Chapter 9480.

4. Technical Manual - NAVSEA 0901-LP-700-0000, Chapter 700.

5. Type Commander's COSAL, SURFLANT, 25 May 1976 and SURFPAC, 23 June 1976.

6. NAVSHIPS 0975-000-2010, Type I Equipment Manual for Torpedo Handling Equipment, dated 1 May 1968.

7. NAVSHIPS 0975-00-4010, Type I Equipment Manual for ASROC Missile Handling Equipment, dated July 1970.

8. NAVSEAINST 1049.2, Portable Ordnance Handling Equipment Allowance for AAW and ASW Ships, dated 25 March 1975.

APPENDIX A

BOUNDARIES OF THE WEAPONS HANDLING SYSTEMS

This appendix presents the boundaries of the Weapons Handling Systems as defined for this analysis. Table A-1 lists the major components, and quantity of each, found on each ship. In developing this table, an attempt was made to resolve inconsistencies among Type Commander's COSAL and MDS reporting data, but all such inconsistencies could not be resolved. This configuration is the best estimate from all available data sources.

Table A-1. COMPONENTS OF THE FF-1052 CLASS WEAPONS HANDLING SYSTEMS

Nomenclature	SWBS	EIC	APL/CID	Hull Numbers FF 1052	FF 1053	FF 1054	FF 1055	FF 1056	FF 1057	FF 1058	FF 1059	FF 1060	FF 1061	FF 1062	FF 1063	FF 1064	FF 1065	FF 1066	FF 1067	FF 1068	FF 1069	FF 1070	FF 1071	FF 1072	FF 1073	FF 1074	FF 1075	FF 1076	FF 1077	FF 1078	FF 1079	FF 1080	FF 1081	FF 1082	FF 1083	FF 1084	FF 1085	FF 1086	FF 1087	FF 1088	FF 1089	FF 1090	FF 1091	FF 1092	FF 1093	FF 1094	FF 1095	FF 1096	FF 1097
INSTALLED HANDLING EQUIPMENT																																																
Hoist Electrohydraulic ASROC Handling			581060009	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
*Crane, Bridge Traveling ASROC Handling			572380003	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
*ASROC Handling Equipment			581060019	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pump Hydraulic, Hand			016240035	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pump Reciprocating, Hand			016690006	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pump Axial Piston 6.5 GPM, 3600 RPM, 2500 PSI VDEL			016750004	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Motor Axial Piston 1.29 Cir., 270.0 inlb/100 PSI			019160391	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Motor Axial Piston			019160612	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Starter Motor MAG LVP, 440V			15120R661	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Motor, AC 440V, 10HP			174752597	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Switch, Limit C4JD2			210310059	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Light, Indicating			212102993	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Filter Fluid Pressure MDL 811162-2500-S310			480500049	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Filter Fluid Pressure MDL M2912			480500075	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Filter Fluid Pressure MDL 4813-6			480540006	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Filter Fluid Pressure MDL TF255(2)			481320002	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Panel, Indicating			500850002	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Panel, Indicating			500850003	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cylinder ACT LIN 1.5 BORE 97.0 STRK, 1000 PSI			853160140	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cylinder ACT LIN 1.5 BORE 1.0 STRKM 2500 PSI			853160141	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Cylinder ACT LIN .750 BORE .7 STRK, 2500 PSI			853390001	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Cylinder ACT LIn 2.50 BORE 26.0 STRK, 2500 PSI			854420026	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cylinder ACT LIn .50 BORE 1.0 STRK, 2500 PSI			854440021	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cylinder ACT LIN .75 BORE 2.0 STRK, 2500 PSI			854440022	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cylinder ACT LIN 2.0 BORE 5.0 STRK			854440024	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cylinder ACT LIN 1.5 BORE 12.0 STRK			854440025	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Valve, DRNTL Cont.			882232546	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Valve, CHK HYD			882233469	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Valve, CHK, HYD			882233470	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Valve, SOL DMPG			882233472	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Valve, Oper 4-Way			882280363	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

*ASROC Handling Equipment (APL 581060019) superseded APLs 581060009 and 572380003 when ShipAlts FF-1052-30 and FF-1052-73 were completed.

(continued)

Table A-1. (continued)

Nomenclature	SWBS	EIC	APL/CID	Hull Numbers: FF-1052	FF-1053	FF-1054	FF-1055	FF-1056	FF-1057	FF-1058	FF-1059	FF-1060	FF-1061	FF-1062	FF-1063	FF-1064	FF-1065	FF-1066	FF-1067	FF-1068	FF-1069	FF-1070	FF-1071	FF-1072	FF-1073	FF-1074	FF-1075	FF-1076	FF-1077	FF-1078	FF-1079	FF-1080	FF-1081	FF-1082	FF-1083	FF-1084	FF-1085	FF-1086	FF-1087	FF-1088	FF-1089	FF-1090	FF-1091	FF-1092	FF-1093	FF-1094	FF-1095	FF-1096	FF-1097
Torpedo Handling Equipment, No. 1 Magazine			854420022	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
ARO Model 7776C Air Hoist			581090001	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mobile Handling Equipment																																																
Hand Lift Truck, Mk 42 Mods 1 and 2			005030008	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	2	4	4	4	4	4	4	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Hand Lift Truck, Mk 45 Mod 1			004320311	(ANY COMBINATION OF MK 42 MODs 1 AND 2 AND MK 45 MOD 1 IS ACCEPTABLE. MK 45 1 WILL REPLACE ALL MK 42 MODs 1 AND 2)																																										
Missile Container Mk 183			NSN AT 8140 00-788-1904	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Hand Lift Truck Adapter, 25 Mod 1, (MK 46 Torp)			NSN 4925 000784371	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Handling Dolly Mk 24 Mod 2 (MK 46 TORP & LAMPS)			859990161	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
** Dolly Adapter (Lamps)			6RX 1730-C01691917	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Portable Handling Equipment																																															
ASROC and Torpedo Over-the Side Handling	DWG# DE-1052-701-2439365			1	1	1	1			1	1		1			1	1	1	1	1			1	1	1			1																				
	DWG# DE-1056-701-1995712							1					1								1			1			1		1																			
	DWG# DE-1056-701-4771421																													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Hoist, Chain Air Operating 2000 lb, MDL ML-20	+		580540022	INDIVIDUAL HULL CONFIGURATIONS UNKNOWN																																												
Hoist Chain Pneumatic Operated 2000 lb, MDL 862V20LPC	+		580630142																																													
Hoist, Chain, Pneumatic Operated, 2000 lb, MDL ML-20	+		580540032																																													
Hoist, Chain, Air Operated, 2000 lb, MDL HLA 20-A	+		58054004R																																													
Hoist, Chain, Pneumatic Operated, 2000 lb, MDL ML-20	+		580540054																																													
Hoist, Chain, Air Operated, 2000 lb, MDL 86R20LPC	+		580630053																																													
Hoist, Chain, Pneumatic Operated, 2000 lb, MDL 862V20LPC	+		580630116																																													
Hoist, Chain, Pneumatic Operated, 2000 lb, MDL 862R2-20	+		580630128																																													
Ammunition Whip Hoist 1b, MDL 86R 10BL			580630057																																													
Lubricator MDL 3502-4			650230002	INDIVIDUAL HULL CONFIGURATIONS UNKNOWN																																												
Lubricator MDL 3002-4M			650230005																																														
Lubricator MDL 3502-061			650230009																																														
Lubricator MDL L02-04-000			650230011																																													
Missile Container Sling Mk 75 or	NSN 4N 4925-00-677-3941			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Mk 99	NSN-1A 1350-00-477-8853			(EITHER IS ACCEPTABLE)																																												
Torpedo Sling Mk 102 Mod 0 (Overside Handling)	NSN 4N 4925-00-018-5846			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Torpedo Sling, Mk 106 Mod 0 (Torpedo Magazine)	NSN 4N 4925-00-923-9089			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cradle Mk 21 Mod 0 (BPDSMS)	NSN 1A-8140-00-443-1286			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1												
++ Hoisting Bar, Aero-64A (BPDSMS)	1RM 1730-00-724-0751			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2			2	2	2	2	2	2	2	2	2	2	2	2												

**Equipment to be replaced by Mk 137 Mod 0 or 1.
+2000-pound air hoists will be replaced with one of the following Gardner-Denver hoist models during HARPOON installation -- Models 862V40L, 862V40, 862V30L-S, 862V30-S.
++Hoisting bar (AERO-64A) will be replaced by Weapon Carrier Mk 57 Mod 0.

(continued)

Table A-1. (continued)

Nomenclature	SWBS	EIC	APL/CID	FF 1052	FF 1053	FF 1054	FF 1055	FF 1056	FF 1057	FF 1058	FF 1059	FF 1060	FF 1061	FF 1062	FF 1063	FF 1064	FF 1065	FF 1066	FF 1067	FF 1068	FF 1069	FF 1070	FF 1071	FF 1072	FF 1073	FF 1074	FF 1075	FF 1076	FF 1077	FF 1078	FF 1079	FF 1080	FF 1081	FF 1082	FF 1083	FF 1084	FF 1085	FF 1086	FF 1087	FF 1088	FF 1089	FF 1090	FF 1091	FF 1092	FF 1093	FF 1094	FF 1095	FF 1096	FF 1097
Container Lifting Sling, Mk 126 Mod 0 (BPDSMS)	NSN 4N To Be Assigned			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1														
Loader, Mk 13 Mods 0 and 1 (BPDSMS)			006220063	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1														

APPENDIX B

CASREP SUMMARY

Fifty-two CASREPs for the FF-1052 Class Weapons Handling Systems, covering the period from 1 July 1973 through 30 June 1976, were analyzed to determine the types of critical failures experienced. These results are shown in Table B-1, categorized by type of failure.

To determine the rate of CASREP submission against the systems, the total number of CASREPs was divided by the total ship operating years during the CASREP data period. Thus

$$\frac{\text{CASREPs}}{\text{Ship Operating Years}} = \frac{52}{114.4}$$

$$= 0.45 \text{ CASREPs per Ship Operating Year}$$

Table B-1. CASREP SUMMARY FOR THE WEAPONS HANDLING SYSTEMS

Reason for CASREP	Number of CASREPs	Percent of Total CASREPs	Number of Ships Reporting
ASROC Electrohydraulic Hoist (APL 581060009)		48.1	15
Faulty Part	6		
Hydraulic Problem	5		
Initial Installation	2		
Electrical	3		
Miscellaneous	1		
Alignment	2		
Cannibalization	1		
Personnel	2		
Unknown	3		
Subtotal	25		
ASROC Traveling Bridge Crane (APL 572380003)		30.8	14
Faulty Part	6		
Hydraulic Problem	2		
Initial Installation	2		
Electrical	2		
Alignment	1		
Personnel	1		
Unknown	2		
Subtotal	16		
Mk 13 Mod 0 BPDSMS Loader (APL 006220063)		5.8	3
Faulty Part	1		
Initial Installation	1		
Design	1		
Subtotal	3		
ASROC Hand Pump (APL 016240035)		3.8	2
Faulty Part	1		
Hydraulic Problem	1		
Subtotal	2		
ASROC Over-the-Side Handling Air Hoist (APL 580540022)		5.8	2
Failed Parts	3		
Subtotal	3		
5"/54 Ammunition Pneumatically Operated Whip Hoist (APL 580630057)		3.8	1
Failed Parts	2		
Subtotal	2		
ASROC Loader System Hydraulic Power Unit (APL 016750004)		1.9	1
Burned Up	1		
Subtotal	1		
Grand Total	52	100.0	

APPENDIX C

DDEOC MRC EVALUATION

The DDEOC MRC Evaluation form in this appendix specifies all recommended additions, changes, and deletions to the existing PMS requirements resulting from this analysis.

The column headings of the DDEOC MRC Evaluation form are explained 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 (self-explanatory)
- 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, Q = Quarterly, C = Once every cycle, R = As required, etc.
- Type - Perform maintenance (P), or survey material condition of component (S)
- Who Performs Test - Maintenance action or test to be performed by tender, DDEOC Site Team, or Ship's Force personnel
- Where Performed (self-explanatory)
- Data - Indicates whether data are recorded during performance of maintenance action

DDEOC MRC EVALUATIO

MRC TITLE	MRC NUMBER	RESPONSIBILITY		CURRENT STATUS			MAN HOURS		FREQUENCY	
		NAVSEA	DDEOC	OLD WITH NO CHANGE	OLD WITH REVISION	NEW	PRE-DDEOC M/H	POST-DDEOC M/H	PRE-DDEOC	POST-DDEOC
Inspection and Hydrostatic Test of Installed and Portable Flexible Air Hoses Used in the Weapons Handling Systems	TBD		X			X	-	TBD	-	A

*P = PERFORM MAINTENANCE; S = SURVEY INSPECTION

1

SHIP CLASS: FF-1052

SMA NO: 216-722

SYSTEM: Weapons Handling Systems

DC MRC EVALUATION

MAN HOURS		FREQUENCY		TYPE*	WHO PERFORMS TEST			WHERE PERFORMED	DATA	REMARKS
EOC	POST DDEOC M/H	PRE DDEOC	POST DDEOC	P-PERF. S-SURV.	TENDER	DDEOC	SHIP	I-IN PORT S-AT SEA	YES NO	
-	TBD	-	A	P,S			X	I,S	No	Develop an annual PMS requirement to visually inspect and hydrostatically test to 150 psig all installed and portable flexible air hoses used in the Weapons Handling Systems. Individual ships are to prepare equipment guide lists.

APPENDIX D

DDEOC ACTION TABLE

DDEOC action items are presented in the table of this appendix. The table is formatted to provide the implementation status of changes through completion of the Class Maintenance Plan and to serve as a ready reference to specific sections in Chapter Three that address in detail the problem involved.

DDEOC ACTION TABL

1 ACTION ITEM*		2 DDEOC EVALUATION**	3 ACTION ITEM DESCRIPTION	4 REPORT REFERENCE (PARA.)	5 RESP
a NO.	b TITLE				
	STATIC AND DYNAMIC LOAD TESTING		1. Accomplish all static and dynamic load tests (identified in Table 3-2) during the last month of BOH and follow-on ROHs.	3.2	NAVSE
			2. DDEOC Program schedule IMAs and industrial facilities to accomplish all required intra-cycle load testing on a hard-time basis.	3.2	NAVS
	FLEXIBLE HYDRAULIC AND AIR HOSES		1. Replace all flexible hydraulic hoses in the ASROC Direct Loader System during BOH and each succeeding ROH.	3.3	NAVS
			2. Develop an annual PMS requirement to visually inspect and hydrostatically test to 150 psig, all flexible air hoses used in the Weapons Handling Systems.	3.3	NAVS
	ASROC BLAST DOOR SEALS		1. Replace ASROC blast door seals at BOH and at 36- to 40-month intervals thereafter.	3.4	NAVS
	ASROC SYSTEM OPERABILITY TEST		1. Specify the System Operability Test of NAVSECPHILADIV Publication T-1821-4 for use as a pre-BOH, pre-SRA, and pre-ROH testing procedure to identify necessary repairs.	3.6	NAV
			2. Specify the system operability test as the required post-repair acceptance test.	3.6	NAV
	LOGISTIC SUPPORT IMPROVEMENTS		1. Advise all FF-1052 Class ships that APL 581090001 is currently applicable for the ASROC Handling Systems and ensure that a copy is on board.	3.7	NAV
			2. Advise all FF-1052 Class ships that APL 581090001 is applicable for the ARO model 7776C pneumatically operated hoist installed in Torpedo Number 1 Magazine.	3.7	NAV

* NOTE 1: DEVELOPING ACTIVITY FILL IN THE FOLLOWING BLOCKS: 1a, b; 3; 4; 5 (IF KNOWN); 6a, IF REQUIRED FOR CONTINUATION C

** NOTE 2: DDEOC EVALUATION – APPROVED, FURTHER STUDY REQ'D, ETC.

† NOTE 3: RESPONSIBILITY – ACTIVITY RESPONSIBLE FOR TAKING THE ACTION.

SHIP CLASS: FF-1052
SMA NO: 216-722
SYSTEM: Weapons Handling Systems

DDEOC ACTION TABLE

	4 REPORT REFERENCE (PARA.)	5 RESPONSIBILITY †	6 SCHEDULING DATES a REQD.	b START	c COMP.	7 REMARKS, FUNDING IMPLICATIONS, ETC.	8 ACTUAL ACTION TAKEN
load uring cn	3.2	NAVSEA 934					
sh ting	3.2	NAVSEA 934					
ses H.	3.3	NAVSEA 934					
to lly r g	3.3	NAVSEA 04					
BOH	3.4	NAVSEA 934					
st of -4 pre-	3.6	NAVSEC					
st as nce	3.6	NAVSEC					
at able d	3.7	NAVSEC					
at he r-	3.7	NAVSEC					

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

DDEOC ACTION TABLE

1 ACTION ITEM *		2 DDEOC EVALUATION **	3 ACTION ITEM DESCRIPTION	4 REPORT REFERENCE (PARA.)	5 RESPONS
a. NO.	b. TITLE				
	LOGISTIC SUPPORT IMPROVEMENTS (continued)		3. Revise APL 854420022 for the Torpedo Handling Equipment, Number 1 Magazine to reflect the applicable APLs of all peripheral equipments supporting torpedo handling equipment, including those components added by ShipAlt FF-1052-438-K.	3.7	NAVSEC

* NOTE 1: DEVELOPING ACTIVITY FILL IN THE FOLLOWING BLOCKS: 1a, b; 3; 4; 5 (IF KNOWN); 6a, IF REQUIRED FOR CONTINUATION O

** NOTE 2: DDEOC EVALUATION – APPROVED, FURTHER STUDY REQ'D, ETC.

† NOTE 3: RESPONSIBILITY – ACTIVITY RESPONSIBLE FOR TAKING THE ACTION.

SHIP CLASS: FF-1052

SMA NO: 216-722

SYSTEM: Weapons Handling Systems

EOC ACTION TABLE

4 REPORT REFERENCE (PARA.)	5 RESPONSIBILITY †	6 SCHEDULING DATES a. REQD.	b. START	c. COMP.	7 REMARKS, FUNDING IMPLICATIONS, ETC.	8 ACTUAL ACTION TAKEN
3.7	NAVSEC					

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