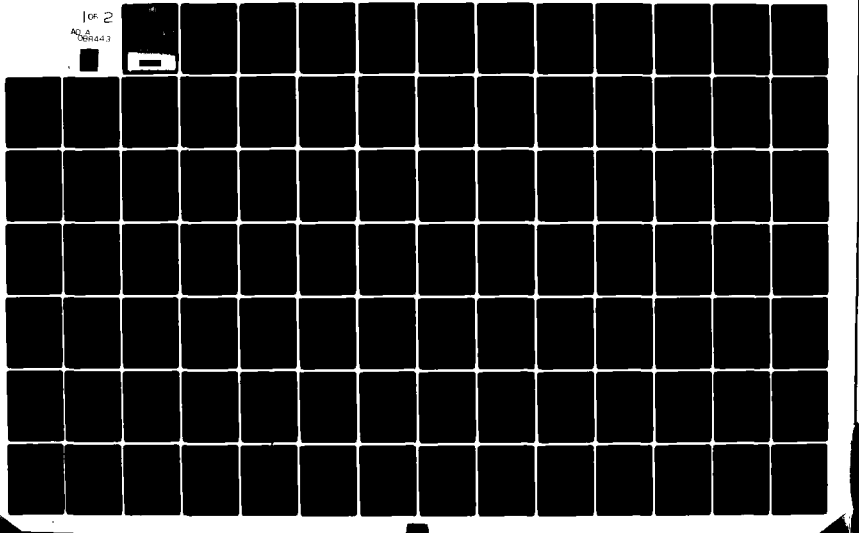
AD-A088 443 ARINC RESEARCH CORP ANNAPOLIS MD F/G 13/10
TRENDS AND ASSOCIATED CAUSAL FACTORS FOR COSTS OF WORK PERFORME--ETC(U)
JUN 80 J CASO N00014-79-C-0018
UNCLASSIFIED 1669-01-TR-2186 NL



LEVEL II

Publication 1669-01-TR-2186

(2)

AD A088443

FINAL REPORT

TRENDS AND ASSOCIATED CAUSAL FACTORS FOR COSTS OF WORK PERFORMED DURING NAVAL SHIP OVERHAULS FOR SELECTED EQUIPMENTS

June 1980

Prepared for
OFFICE OF NAVAL RESEARCH AND
THE CHIEF OF NAVAL OPERATIONS
(OP-964)
WASHINGTON, D.C. 20362
under Contract N00014-79-C-0018

ARINC RESEARCH CORPORATION

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

14

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

REPORT NUMBER: 1669-01-TR-2186	2. GOVT ACCESSION NO.: AD A088443
3. RECIPIENT'S CATALOG NUMBER	
4. TITLE (and Subtitle): Trends and Associated Causal Factors For Costs of Work Performed During Naval Ship Overhauls For Selected Equipments	5. TYPE OF REPORT & PERIOD COVERED: Final Rept.
	6. PERFORMING ORG. REPORT NUMBER: 1669-01-TR-2186
7. AUTHOR(s): J. Caso	8. CONTRACT OR GRANT NUMBER(s): N00014-79-C-0018 New
9. PERFORMING ORGANIZATION NAME AND ADDRESS: ARINC Research Corp. 2551 Riva Road Annapolis, Md. 21401	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE: April 1980
	13. NUMBER OF PAGES: 97p.
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Ships Overhaul
Cost Trends

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report presents the results of a study conducted to review cost trends during ship overhauls for selected equipments on the DDG-2 ship class from 1970 to 1979.

The objective of the study was to analyze observed cost growth (or lack of growth) for like systems or components having representative and simple bounded work efforts. Contributory factors such as direct labor productivity, changes in production support activities, and the effects of program and policy changes were analyzed and, when possible, quantified.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

400 247

FINAL REPORT

TRENDS AND ASSOCIATED CAUSAL FACTORS FOR COSTS OF WORK PERFORMED DURING NAVAL SHIP OVERHAULS FOR SELECTED EQUIPMENTS

April 1980

Prepared for

Office of Naval Research and
The Chief of Naval Operations
(OP-964)
Washington, D.C. 20362

under Contract N00014-79-C-0018

by

J. Caso

ARINC Research Corporation
a Subsidiary of Aeronautical Radio, Inc.
2551 Riva Road
Annapolis, Maryland 21401

Prepared under Contract N00014-79-C-0018,
which grants to the U.S. Government a license
to use any material in the publication for
Government purposes.

CONTENTS

EXECUTIVE SUMMARY

This report presents the results of a study conducted to review cost trends during ship overhauls for selected equipments on the DDG-2 ship class from 1970 to 1979.

The objective of the study was to analyze observed cost growth (or lack of growth) for like systems or components having representative and simply bounded work efforts. Contributory factors such as direct labor productivity, changes in production support activities, and the effects of program and policy changes were analyzed and, when possible, quantified.

The data used in the analysis were obtained from departure reports, ship alteration and repair packages (SARPs), and the shipyards' management information systems (MIS).

Fifty-one equipments and tasks were initially considered for study. This list was reduced to 20 equipments and tasks which were selected because they were determined to be representative of all ship systems and had experienced little or no design changes during the 1970-1979 time period. Data-related problems eventually reduced the number to 17. Table S-1 lists these 17 equipments and tasks and summarizes the results of the analysis of growth.

The results of the analysis provided the following conclusions and observations:

- Growth in cost of overhaul appears to be a general trend for most equipments and tasks. The sample considered in the study proved representative of the total population. The 11 equipments and tasks showing a significant growth in man-days represent approximately nine percent of the 1975-1979 ship class average (65,101 man-days) and account for approxi mately nine percent of the ship class growth (31,872 man-days) between the two time periods.

- There were no positive indications of decrease in direct labor productivity in the shipyards. Seven of the 11 equipments and tasks showing man-day growth also show a statistically significant increase in average adjusted (1980 dollars) material costs. This indicates possible increases in the range (new work) and scope (expanded effort) of repair work.

Table S-1. SUMMARY OF OVERHAUL LABOR COSTS FOR DDG-2 CLASS EQUIPMENTS AND TASKS

Equipment or Task	1970-1974 Average Labor (In Man-Days)	1975-1979 Average Labor (In Man-Days)	Growth (In Man-Days)	Growth (In Percentage)
STATISTICALLY SIGNIFICANT GROWTH				
Lagging	131	650	519	396
Refrigeration System	101	258	157	155
Main Feed Booster Pump	260	649	389	150
Lube Oil Purifiers*	55	133	78	142
Main Fuel Oil Service Pump	327	748	421	129
Sea Valves	323	656	333	103
Main Condensate Pump	159	316	157	99
Fire Pumps	282	550	268	95
Propellers	214	380	166	78
Docking	735	1,142	407	55
Gyro Compass	350	425	75	21
GROWTH NOT STATISTICALLY SIGNIFICANT				
ASROC Launcher	454	290	-	-
Surface Search Radar	129	189	-	-
Anchor and Chains	58	93	-	-
400 HZ Motor Generator Sets	816	666	-	-
Sea Chest	234	298	-	-
H.P. Air Compressor	220	207	-	-

*All work on this equipment was observed after 1974. For this reason it was included as a significant contributor to overhaul growth.

- One of the driving factors for the observed increases appears to be the policy and program changes and related events affecting overhaul during this time period. Table S-2 presents a chronological list of the major events and changes. Throughout this period many program and policy changes have resulted in an expanded maintenance requirement. In addition, less visible influences such as changes in reporting procedures, environmental concerns, modernization programs, and added safety-related requirements have obscured possible causes of growth in overhaul cost.

Table S-2. EVENTS AND CHANGES

Year	Event or Change
1964-1973	Ship Availability Changes Relevant to Viet Nam War Requirements
1969	"Thorough ROH" Concept
1971	1200 PSI Improvement Project
1973	Propulsion Examining Board
1973	CNO Objective to Improve Ship Material Condition (#3)
1973	1200 PSI Standards for Overhaul Program
1974	Complete Ship Inspection via POT&I
1975	Heat-Stress Program
1975	Stabilized Man-Day Rate
1975	Use of Technical Repair Standards
1976	Shipyard Surface Quality Assurance Program
1976	Total Ship Test Program
1970-1979	Legislation (OSHA, EPA, EEOC)

- There were positive indications that three of the programs of Table S-2 could have caused a large portion of the observed overhaul cost growth. These programs are the 1200 psi standards for overhaul, the propulsion examining board, and the use of technical repair standards. Policy and program changes of a general nature (e.g., "Thorough ROH" concept, stabilized man-day rate) were assumed to have affected all ship systems equally. Analysis of the eleven equipments which showed growth indicates that seven of these would have been greatly affected by some combination of the propulsion system related improvement programs. In most cases, the timing of the observed growth coincides with a program implementation date.

For the six equipments not showing overhaul cost growth during the 1970-1979 time period, five of these would not have been affected by propulsion system related improvement programs.

Additional support for this conclusion is provided by the observation that the majority of the equipments showing man-day growth also experienced a significant growth in average adjusted (1980 dollars) material cost which is indicative of an expanded or intensified maintenance requirement.

- Differences in shipyard performance were observed. Analysis of these data for individual shipyards generally supported the previous conclusions which were based on data aggregated over two time periods (1970-1974, 1975-1979). Two shipyards varied significantly from the overall average performance. The Norfolk Naval Shipyard was, on the average, 28.0 percent below the overall 1975-1979 average for each equipment or task. The Charleston Naval Shipyard was 21.4 percent over the overall 1975-1979 average for each equipment or task.

Detailed analysis of most equipments and tasks generated more questions than answers. This was particularly true for docking, for which there was a significant increase in both man-days and material costs. Presumably this task should be stabilized at a constant level when analyzed over a sufficiently long time period. Such stabilization was not found. In addition, many more man-days were documented at Long Beach than at the other shipyards. The scope of this study did not allow thorough evaluation to explain this difference. If it were possible to determine the reasons for differences between shipyards and the effect of growth-inducing programs and policies, if any, on this task, then this area could provide data from which labor productivity measures could be developed.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND

The cost of overhauling U.S. Navy ships has increased dramatically over the last ten years. The rate of increase has been far in excess of the rate of inflation. A recent study showed that between 1963 and 1978, the average overhaul repair man-days for the DDG-2 class of ships increased at a compounded annual growth rate of 17.5 percent.* This is significant, since the unit of work measurement is basically inflation free. Even a cursory analysis of overhaul data indicates that units of work, duration, and costs of overhauls have been increasing over the last ten years. The AMS study identified an overhaul cost growth problem for the DDG-2 class of ships. This study was undertaken to provide further refinement and analysis of the observed growth for selected equipments and tasks for the DDG-2 class of ships and to investigate possible causal factors.

This growth has resulted in obviously higher budget requirements and increasing concern over costs. To reduce this growth and make the best use of existing resources will require a better understanding of the causes of the growth.

1.2 OBJECTIVE

It is the objective of this study to analyze ship overhaul cost growth for like systems or components which are representative of the general overhaul effort for the DDG-2 class and whose design has remained relatively stable throughout the 1970-1979 time period. Cost growth (or lack of it) was studied to determine, where possible, any contributory factors such as changes in production support requirements or direct labor productivity.

1.3 REPORT FORMAT

This report is divided into four chapters and three appendixes. Chapter Two describes the investigative approach used for data collection and analysis of trends. The results of the analysis are presented in Chapter Three. For the equipments and tasks identified as having valid data, detailed analyses are provided. Causes and trends are quantified if possible. Conclusions and recommendations are provided in Chapter Four. Supportive data appear in the appendixes.

---

*American Management Systems, Inc. (AMS), Report No. 2152, Overhaul Repair Man-Day Work Growth, USS CHARLES F. ADAMS (DDG-2) Class Ships, 13 August 1979.

CHAPTER TWO

TECHNICAL APPROACH

2.1 OVERVIEW

The objective required that a class of ships be selected capable of providing the necessary framework for the study. The DDG-2 class was chosen primarily because of its size (23 ships) and its years of commissioned service (20). In addition, the DDG-2 contains systems and equipments whose basic design has remained relatively unchanged over the years. The DDG-2 has also been the subject of other recent overhaul and maintenance related studies.* The study was divided into three phases:

- o Selection of equipments and tasks for study
- o Data base developent and collection
- o Analysis of growth trends

2.2 SELECTION OF EQUIPMENTS AND TASKS FOR STUDY

The statement of work for this study required that at least 15 equipments and tasks be selected for analysis. The uncertainties of data collection for this type of effort dictated that a larger number be considered initially. Table 2-1 provides a list of the 51 candidate equipments and tasks, of which the first 20 items were initially considered for analysis. The 20 were selected because they were assumed to be representative of the population of overhauled equipments. Additionally, these equipments and tasks were selected because they had not experienced any major design changes or extensive modifications during the 1970-1979 time period. The remarks column in Table 2-1 indicates problems in the form of the data. In the early phases of data collection the following changes were made to the list of 20 items:

- o Main condensate pumps (Item 21) replaced auxiliary condensate pumps (Item 4). The data for the main pumps were found to be more easily traceable through the ten years of departure reports.
- o Lagging (Item 22) was added because its growth was already a source of concern.
- o Bilge and tank cleaning and painting (Item 18) was dropped. The available data were not defined sufficiently for use in the analysis.

---

*See List of References.

Table 2-1. ITEMS FOR ANALYSIS OF NAVAL SHIP OVERHAUL COST GROWTH

Item Number	Equipment or Task	Ships Work Authorization Boundary	Remarks
1	Sea Chests	163-1	
2	Propellers	245-1	
3	Main Feed Booster Pumps	255-3	
4	Auxiliary Condensate Pumps	255-6	
5	Main Fuel Oil Service Pumps	261-2	
6	Lube Oil Purifiers	264-3	
7	400 Hz Motor Generator Set	314-2	
8	Gyro Compass		
9	Surface Search Radar (AN/SPS-10[ ])	451-1	Job includes antenna and waveguide.
10	Gun Fire Control System	481-1	
11	Ventilation System (Blowers)	512-1	Job orders (JOs) could include system repairs.
12	Refrigeration System	516-1	JOs could include piping repair.
13	Sea Valves	520-1	
14	Fire Pumps	521-1	
15	High-Pressure Air Compressors	551-5	
16	Anchors and Chains	581-1	
17	Antisubmarine Rocket (ASROC) Launcher	721-2	
18	Bilge and Tank Cleaning and Painting	992-3	
19	Contamination Holding Tanks	992-3	Two shipalts date back to 1972-73.
20	Docking	997-1	
21	Main Condensate Pump	255-5	
22	Lagging	505-1	
23	Hull Structural Closures	167-1 167-2	
24	Propulsion Boiler	221-1	
25	Light Off Forced Draft Blowers	251-2	
26	Forced Draft Blowers	251-1	
27	Main Steam Piping	253-1	Job includes main steam valves, piping, air motors, hangers.
28	Main Feed Pumps	255-2	
29	Main Lube Oil Service Standby Pumps	262-4	
30	Rectifiers	314-4	
31	Switchboard Breakers and Meters	324-1	
32	Pit Log		
33	Electrical Navigation System	426-2	One JO usually covers variety of equipments (e.g., the dead-reckoning tracer).
34	Radio System	441 Series	One JO usually covers variety of equipments.
35	Teletype Systems	445-1	One JO usually covers variety of equipments.
36	Radar Displays	450-1	
37	Air Search Radar	452-1	Job includes antenna and waveguide.
38	Sonar	463-1	Does not include domes.
39	Antisubmarine Warfare Fire Control System	483-1	
40	Potable Water Pumps	533-1	
41	Fresh Water Drain System Pumps	534	Sometimes job includes feed and condensate JOs.
42	Rudder	562-1	
43	Boat Davits and Winches	583-1	
44	Nonstructural Closures	624-1	
45	Paint Underwater Body Hull	631-1	
46	Deck Covering	634-1	Square foot basis.
47	Galley Equipment	651-1	Job could include ovens, ranges, and dishwashers.
48	Laundry Equipment	653-1	
49	Trials and Tests	982-3	
50	Drydock Inspection	986-1	
51	Develop and Conduct Pre-overhaul Test and Inspection	986-1	

- o Gun fire control system (Item 10), ventilation system (Item 11), and contamination holding tanks (Item 20) were also dropped, because of data problems caused by man-hour accounting and other data-related problems.

These changes resulted in a final list of 15 equipments and two tasks, docking and lagging, for which data would be compiled.

2.3 DATA BASE DEVELOPMENT AND COLLECTION

The first step was to determine exactly what data would be used to measure growth in overhaul costs. The obvious primary choice in this case was man-days, since as a work unit the man-day is relatively free of inflationary bias or distortion. The secondary data choice was cost in dollars. Costs of material and labor were collected separately when possible.

The data period established in the contract statement of work is from 1970 to 1979.

Early data acquisition efforts identified a total of 57 overhauls with the potential of providing data from the departure reports, the ship alteration and repair package (SARP), and the individual shipyard management information system (MIS). Table 2-2 identifies the ships of the DDG-2 class and the overhauls that occurred from 1970 to 1979.

Table 2-2. DDG-2 CLASS OVERHAULS, 1970-1979

Hull No.	UIC	Fleet	Commissioning Date	Overhauls Considered			
				2nd	3rd	4th	5th
DDG-2	04668	A	9/60		X	X	X
DDG-3	04669	A	2/61		X	X	
DDG-4	04670	A	1/62		X	X	
DDG-5	04671	A	1/62	X	X	X	
DDG-6	04672	A	6/61	X	X	X	
DDG-7	04673	P	12/60		X	X	X
DDG-8	04674	P	6/61			X	X
DDG-9	04675	P	6/61		X	X	X
DDG-10	04676	A	6/61		X	X	
DDG-11	04677	A	10/61	X	X	X	
DDG-12	04678	P	12/61		X	X	X
DDG-13	04679	P	6/62		X	X	
DDG-14	04680	P	2/62		X	X	
DDG-15	04681	P	12/62		X	X	
DDG-16	04682	P	4/63	X	X	X	
DDG-17	04683	A	7/63	X	X		
DDG-18	04684	A	12/62	X	X	X	
DDG-19	04685	A	4/63	X	X		
DDG-20	04686	P	12/61		X	X	
DDG-21	04687	P	3/64	X	X	X	
DDG-22	04688	P	9/64	X	X		
DDG-23	04690	A	3/64	X	X		
DDG-24	04691	P	8/64	X	X	X	

Aggregation of data on man-days and on the dollar cost of materials by fiscal year presented a small problem because of the long duration of the overhauls. To gather cost data as of the start or the end of the overhaul could inaccurately bias the information when applying inflationary escalation factors.* It was decided that choosing the mid-point (month and year) of the overhaul for assignment of the costs would be the best compromise.

Early data acquisition efforts were facilitated by the availability of the PMS-306 (Ship Support Improvement Program) DDG-2 class departure report file. Other departure reports for 1978 and 1979 overhauls, SARPs, and shipyard MIS records were used to complete the data collection. The 23 ships underwent 57 overhauls from 1970 to 1979. At the time of this study three overhauls were still in progress, six had been completed too recently for departure reports to have been published, and one departure report was unobtainable in a readable copy, leaving 47 usable departure reports. SARPs exist only for overhauls since 1976. They were used only when two recent SARPs from the same shipyard for similar work existed and one of the SARP estimates was augmented by a second data source for confirmation. These requirements limited to 10 the SARPs usable for this study. Only MIS data which would appear on the departure report was used; man-day return data were used only for completed jobs. Five MISs were useful to this study. These sources were augmented by contacts with the shipyards when required.

Table 2-3 presents the aggregate overhaul data compiled from departure report summaries.

Review of the data sources for man-days and material costs for the equipments and tasks listed in Table 2-1 revealed some serious problems and gave rise to some important observations:

- Departure reports were the most useful source of information.
- Most departure reports did not indicate man-day charges or material charges significantly different (greater than 1 percent) from those of the shipyard MIS.
- Appropriation purchase account (APA) material costs are documented only in the departure report.
- It was not possible to determine variability in the scope of work by examining departure reports. When equipment classifications contained more than one unit, it was not possible to determine how many units were repaired. It was also not possible to determine positively which jobs involved only inspection and minor repair.

---

*Between 1970 and 1979 the fiscal year changed from July 1 through June 30 to October 1 through September 30; thus any constant time base would have some bias.

Table 2-3. DEPARTURE REPORT SUMMARY DATA ON DDG-2 CLASS OVERHAULS*

Hull	Unit Identification Code (UIC)	Fleet	Location of Overhaul	Mid-Point of Overhaul (Month and Year)	Duration of Overhaul (in Days)	Repair Man-Days	Total Cost in Dollars†
DDG-12	04678	P	San Francisco Bay	1/70	140	16396	1,711,106
DDG-09	04675	P	Long Beach	4/70	158	12976	1,356,046
DDG-11	04677	A	Charleston	6/70	145	27627	2,915,643
DDG-21**	04687	P	Pearl Harbor	5/70	150	16687	Unavailable
DDG-05	04671	A	Norfolk	6/70	195	28249	2,329,552
DDG-07	04673	P	Long Beach	10/70	163	22693	2,473,271
DDG-06	04672	A	Norfolk	3/70	179	27776	Unavailable
DDG-18	04684	A	Charleston	12/70	225	29068	4,115,473
DDG-16	04682	P	Pearl Harbor	1/71	149	23561	2,660,858
DDG-17	04683	A	Norfolk	1/71	158	29169	3,036,641
DDG-19	04685	A	Charleston	1/71	202	32541	3,576,242
DDG-24**	04691	P	**Hunters Point**	4/71	104	19178	Unavailable
DDG-02	04668	A	Charleston	3/71	195	34818	4,134,681
DDG-03	04669	A	Norfolk	4/71	150	27847	2,463,887
DDG-14	04680	P	Hunters Point	7/71	134	26041	3,392,963
DDG-22	04688	P	Pearl Harbor	7/71	123	21209	2,651,111
DDG-23	04690	A	Norfolk	9/71	163	28932	3,211,724
DDG-13	04679	P	Long Beach	10/71	162	29200	3,572,241
DDG-04	04670	A	Norfolk	12/71	152	39638	4,837,374
DDG-10	04676	A	Charleston	4/72	120	26065	3,690,309
DDG-08	04674	P	Long Beach	10/72	192	32732	4,253,323
DDG-15**	04681	P	Puget Sound	6/73	294	43890	Unavailable
DDG-12	04678	P	Long Beach	8/73	303	48086	6,424,302
DDG-21	04687	P	Pearl Harbor	11/73	277	37300	5,699,432
DDG-09	04675	P	Long Beach	1/74	365	53980	7,263,739
DDG-07	04673	P	Long Beach	3/74	327	50284	7,344,247
DDG-05	04671	A	Norfolk	3/74	267	48639	6,690,273
DDG-18	04684	A	Charleston	3/74	334	36513	5,345,728
DDG-06	04672	A	Philadelphia	3/74	315	41786	6,344,417
DDG-20	04686	P	Pearl Harbor	3/74	381	47424	7,553,088
DDG-11✓	04677	A	Charleston	12/74	320	43797	7,239,816
DDG-16	04682	P	Puget Sound	1/75	349	85845	11,278,777
DDG-17	04683	A	Norfolk	4/75	317	39562	7,306,830
DDG-13	04679	P	Long Beach	6/75	303	47674	7,745,502
DDG-24	04691	P	Long Beach	7/75	298	43792	7,202,228
DDG-02*	04668	A	Philadelphia	8/75	360	50115	Unavailable
DDG-14	04680	P	Long Beach	8/75	344	55107	8,458,000
DDG-03**	04669	A	Norfolk	10/75	294	54857	Unavailable
DDG-08	04674	P	Long Beach	2/76	293	65017	9,[illegible]
DDG-23	04690	A	Norfolk	2/76	263	50527	13,[illegible]
DDG-19	04685	A	Philadelphia	3/76	303	67749	11,321,[illegible]
DDG-22	04688	P	Pearl Harbor	3/76	298	54888	15,[illegible]
DDG-04*	04670	A	Norfolk	3/76	335	68453	Unavailable
DDG-10	04676	A	Philadelphia	3/76	423	64021	12,[illegible]
DDG-05	04671	A	Philadelphia	6/77	76	49132	[illegible]
DDG-12	04678	P	Long Beach	6/77	344	[illegible]	[illegible]
DDG-21	04687	P	Pearl Harbor	10/77	341	[illegible]	[illegible]
DDG-07	04673	P	Long Beach	12/77	342	[illegible]	[illegible]
DDG-18	04684	A	Charleston	3/78	367	[illegible]	[illegible]
DDG-15	04681	P	Puget Sound	3/78	316	[illegible]	[illegible]
DDG-11*	04677	A	Charleston	11/78	338	[illegible]	[illegible]
DDG-16*	04682	P	Pearl Harbor	11/78			
DDG-06*	04672	A	No Data	1/79			
DDG-09*	04675	P	No Data	[illegible]/79			
DDG-20	04686	P	Pearl Harbor	1/79			
DDG-24*	04691	P	No Data	12/79			
DDG-13*	04679	P	Long Beach	11/79			

*All data from ship departure reports.
**Source was AMS study (see p. 1).
*No departure report available.

††Total cost represents the sum of repair labor and material costs and an overhead charge. No alteration costs are included. All costs are expressed in unadjusted dollars.

- The SARPs analyzed were those published just prior to the start of the overhaul.

- The SARPs provided a less accurate indication than the departure reports of the final costs documented by the departure reports. This would be expected from a budget-planning document.

- Shipyard accounting systems are not uniform. They do not provide information directly traceable to the departure reports because of the manner in which the data are aggregated.

- The shipyard MIS indicates that there are differences between shipyards in the manner in which budgets are allocated to shop organizations on equivalent work packages. This fact complicates the determination of the work done by each shop on a particular job, and negates any attempt to use MIS data to investigate growth in support organization effort (e.g., quality control and inspection).

These considerations helped shape the following approach to the construction of the data base.

Departure reports were used as the base reference. When they were not available, shipyard MIS return man-days were used when these values were comparable to the SARP estimates (within 15 percent) or when differences could be explained. In some cases SARP estimates were used when shipyard confirmation of scope of work and number of man-days could be orally or otherwise verified.

The resultant data base was constructed for the 17 equipments and tasks. Approximately 98 percent of the data were obtained from the departure reports. The remainder were collected from shipyard MIS returns (1.5 percent) and estimates validated by shipyard personnel (.5 percent). The detailed data used in the analysis are provided in Appendix A.

2.4 ANALYSIS OF OVERHAUL GROWTH TRENDS

The data-collection effort resulted in the establishment of a chronological data file containing the following information:

- Ship identification -- hull and UIC

- Date of overhaul -- assigned as mid-point of overhaul period

- Man-day

- Direct labor

- Material cost

- Appropriation purchase account material cost
- Total cost

This information was gathered for total overhaul and for each selected equipment and task. Each selected equipment and task is treated in Chapter Three in the following manner:

- A graphical presentation of the man-days worked is plotted for the 1970-1979 period. Each graph presents the maximum, minimum, and average man-days expended for each year and the 1970-1974 and 1975-1979 averages. Those programs and events shown in Table 3-1 which directly affected an equipment or task are also identified. Programs of a general nature (e.g., CNO Objective #3, "Thorough ROH, concept, stabilized man-day rate) were assumed to have an equal impact on all equipments and tasks and are not identified on the graphs.

- Comments accompany each graph. These include estimates of the frequency of occurrence of the specific equipment or task in overhauls from 1970 to 1979 and notation of any observed data irregularities.

- Results of statistical confidence tests performed on the difference between the 1970-1974 and 1975-1979 averages are presented.

- A mathematical ratio of material costs to man-days worked in the 1970-1974 and 1975-1979 periods is presented.

- A graphical presentation of man-days documented for five shipyards for each equipment and task over the 1970-1979 time period is provided. Only five of the eight shipyards had a sufficient number of observations to provide meaningful information.

- A comparison of average performance of each shipyard relative to the overall 1975-1979 average is provided.

- Comments on observed trends in the data and probable causes of the trends are presented.

The data were aggregated into the 1970-1974 and 1975-1979 periods to establish a better estimate of any trend over the total period. The year-to-year variations in the data points made single-year comparisons unrealistic, often providing a distorted picture of the situation. The comparison of data averaged over these periods will still provide indications of trends over time. They will not, however, be as affected by bad data points or an abnormal maintenance action.

The material cost and the man-days worked were compared to test the thesis of increased work effort (i.e., expanded scope or range) vis-a-vis decreased productivity, the premise being that material costs (in 1980 dollars) should be functionally related to man-day expenditure. A five-year period was used for each ratio to allow for

variations in the scope of the work (i.e., low man-day -- high material cost, low man-day -- low material cost, high man-day -- high material cost, etc.). All material costs were adjusted to 1980 dollars. The escalation factors used are contained in Appendix B.

The details of a statistical test used to determine differences between the 1970-1974 and the 1975-1979 periods are contained in Appendix C. The test was used to determine if there was a significant difference between the 1970-1974 and the 1975-1979 averages. A confidence level of 90 percent was chosen, and a simple "t" test was used to test the null hypothesis of no difference between the averages. This confidence level will allow only a 10 percent chance of rejecting the null hypothesis (i.e., the averages differ) when they do not differ in consideration of the total population. The analyses of the individual equipments and tasks are grouped in the following chapter according to the results of this test for difference between the averages.

CHAPTER THREE

RESULTS OF ANALYSIS

3.1 SUMMARY OF DDG-2 CLASS OVERHAUL GROWTH

The DDG-2 Class experienced a marked growth in overhaul expenditures from 1970 to 1979. This fact has been documented in other studies (e.g., the AMS study already cited in this report). As stated earlier, overhaul growth has been analyzed in this study in terms of man-days per overhaul. This growth was caused by one or more of the following:

- o Increased scope of work (frequency, extent)
- o Decreased productivity in the shipyard
- o Effects of policy and program changes

These hypothesized causes were approached analytically, with various attempts at quantification. Table 3-1 lists some of the events and the policy and program changes with impacted the 1970-1979 time period.

Table 3-1. EVENTS AND CHANGES

Year	Event or Change
1964-1973	Ship Availability Changes Relevant to Viet Nam War Requirements
1969	"Thorough ROH" Concept
1971	1200 PSI Improvement Project
1973	Propulsion Examining Board
1973	CNO Objective to Improve Ship Material Condition (#3)
1973	1200 PSI Standards for Overhaul Program
1974	Complete Ship Inspection via POT&I
1975	Heat-Stress Program
1975	Stabilized Man-Day Rate
1975	Use of Technical Repair Standards
1976	Shipyard Surface Quality Assurance Program
1976	Total Ship Test Program
1970-1979	Legislation (OSHA, EPA, EEOC)

Other hypothesized contributors to overhaul cost growth are even more difficult to assess, such as development of dedicated organizations that augment overhaul repair requirements definition and the possible migration of maintenance to the shipyards from other maintenance levels. There was no attempt to investigate the effect of ship aging in this study. This factor was investigated rather extensively in the AMS study previously cited, and the results indicated that the effect of ship aging on overhaul growth was minimal.

Man-days for DDG-2 class overhauls from 1970 to 1978 (there were no available data points for 1979) are depicted in Figure 3-1. The data were collected from all sources for 47 overhauls. They show a growth of about 17 percent per year. The figure is substantiated by analysis of the 1970-1974 and 1975-1978 averages.

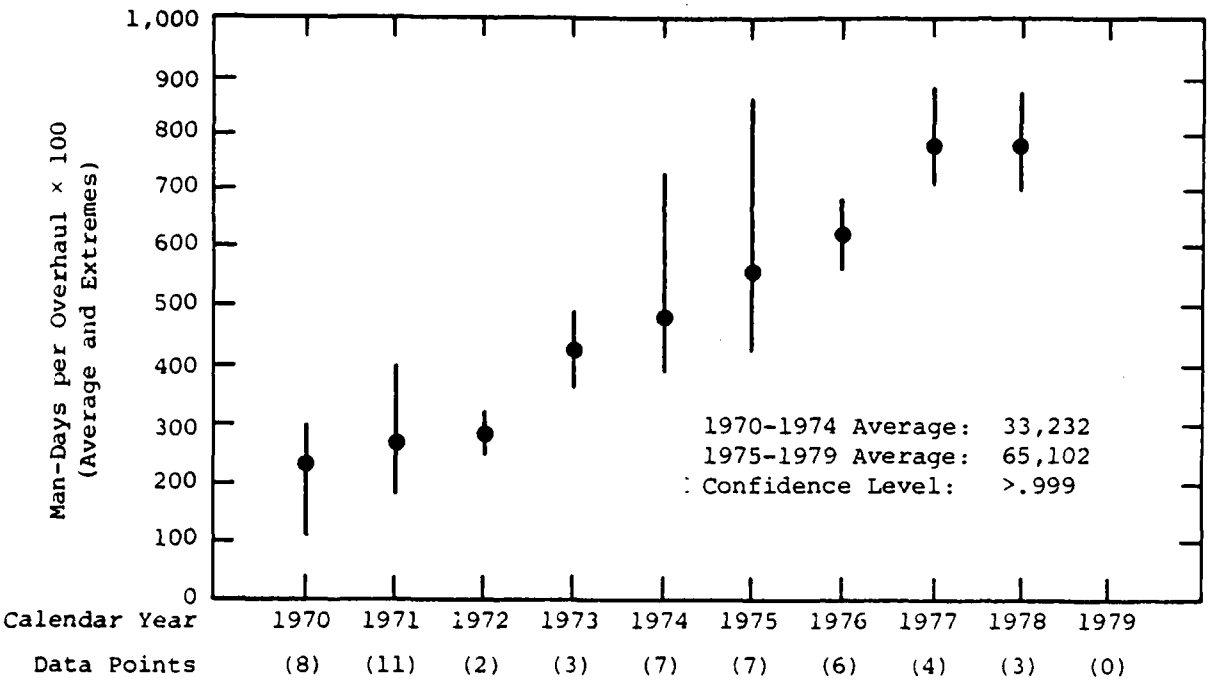


Figure 3-1. DDG-2 CLASS MAN-DAYS PER OVERHAUL

A ratio of adjusted material costs to man-days is presented in Table 3-2. The table shows that while man-days per overhaul have risen significantly (96 percent), so have material costs, and at an almost identical rate. Both time periods had an almost identical rate of about $57 worth of material used for each man-day worked. This indicates that while the trend is definitely upward, it does not appear to be related to shipyard productivity. This conclusion is valid only if the amount of labor expended can be directly related to the amount of material used in the labor.

Table 3-2. RATIO OF AVERAGE ADJUSTED MATERIAL COSTS TO MAN-DAYS PER OVERHAUL			
Period	Material Costs (in 1980 Dollars)	Man-Days	Material Costs per Man-Day
1970-1974	1,917,150	33,232	$57.7
1975-1978	3,770,918	65,102	57.9

The most likely causes of the growth are the changes shown in Table 3-1. If they increased the scope of the work by requiring more thorough overhaul of selected equipments or an increase in the number of equipments overhauled, they would more than likely have required an increase in both material costs and man-days.

Related to the increase in man-days per overhaul, there has been an increase in the length of the overhauls in days. This observation, which may seem trivial, could be important if some factor other than repair man-days were affecting the length of the overhaul. Table 3-3 presents a comparison of average overhaul lengths and the growth in ship alteration man-days. The man-days worked on ship alterations have not been included in the previous repair man-day calculations.

Table 3-3. AVERAGE OVERHAUL LENGTH AND AVERAGE SHIP ALTERATION MAN-DAYS		
Period	Length (.995*)	Man-Days (.995*)
1970-1974	211 days	18,077
1975-1978	338 days	34,515
*Confidence level for difference of means.		

Analysis of Table 3-3 reveals an interesting possibility. If the increase in ship alteration man-days (91 percent) caused the increase in length (60 percent), then it is possible that some of the increase in repair man-days could be attributed to the fact that more calendar time for repair work was available, resulting in an example of Parkinson's Law. The possibility could be further studied.

3.2 EQUIPMENTS AND TASK SHOWING SIGNIFICANT MAN-DAY GROWTH

The following 11 equipments and task showed a statistically significantly difference (.90) between the averages for the 1970-1974 and 1975-1979 periods.

3.2.1 Lagging

Twenty-three reviewed overhauls identified jobs involving lagging. Figure 3-2 shows that man-day growth for lagging has been significantly increasing since 1973.

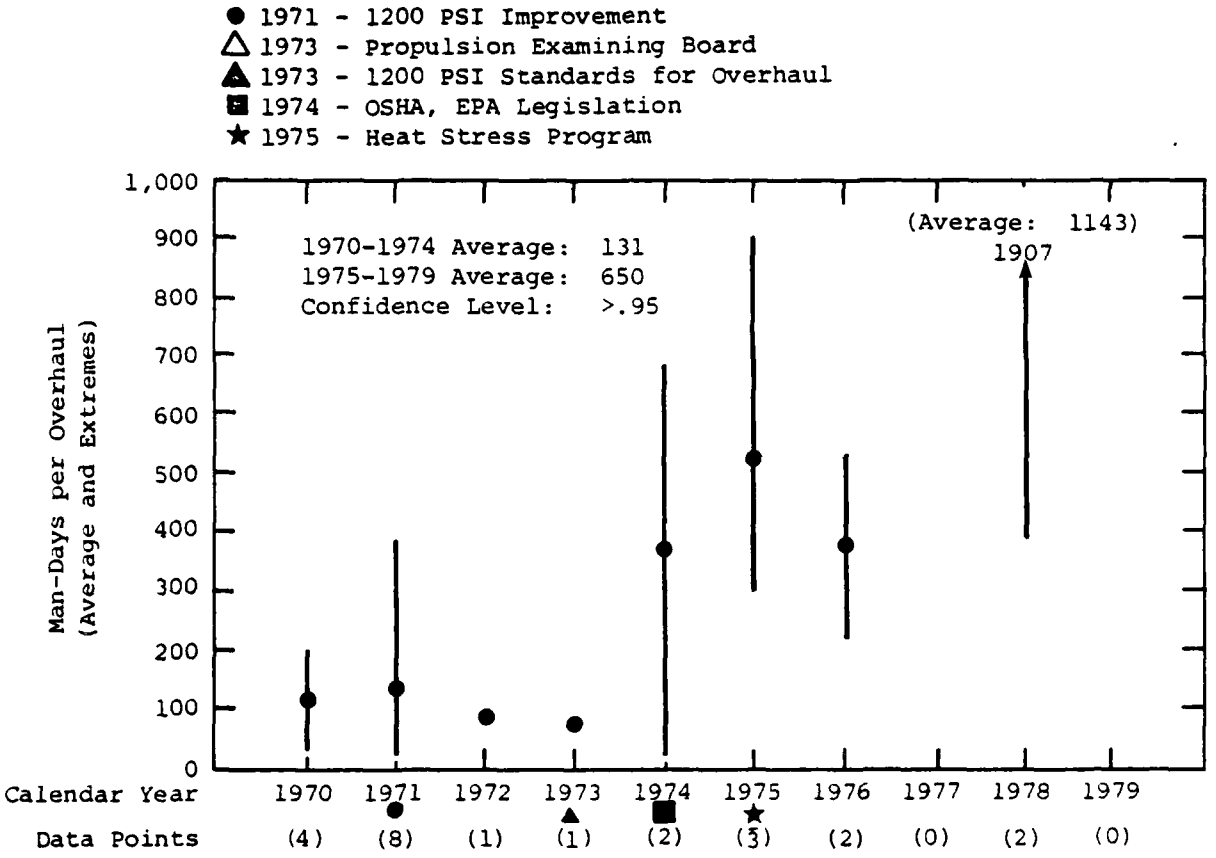


Figure 3-2. LAGGING

Table 3-4 shows the ratio of adjusted material costs to man-days. It shows a decrease in the ratio, indicating less material cost per man-day. This is especially significant when considered in light of the fact that there is no statistically significant difference between the average adjusted material costs. (The lack of significance can be partially attributed to the small number of observations and the dispersion of the data.) The number of overhauls recording work for lagging was limited to 16 for the 1970-1974 period and 7 for the 1975-1979 time period.

Table 3-4. RATIO OF LAGGING AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS			
Period	Material Costs* (in 1980 Dollars)	Man-Days	Material Costs per Man-Day
1970-1974	13,114	131	$100
1975-1979	26,091	650	40
*Difference not statistically significant.			

These data indicate a general increase for the 1975-1979 time period which coincides with implementation of programs and legislation such as the 1200 psi overhaul standards, the heat stress program, and the OSHA and EPA requirements. This is not conclusive, however, due to the limited number of data points.

The increasing trend in man-days is more apparent when the data are presented by shipyard as in Figure 3-3. The man-day cost comparison presented in Table 3-5 is of limited use for analysis due to the small amount of data after 1974.

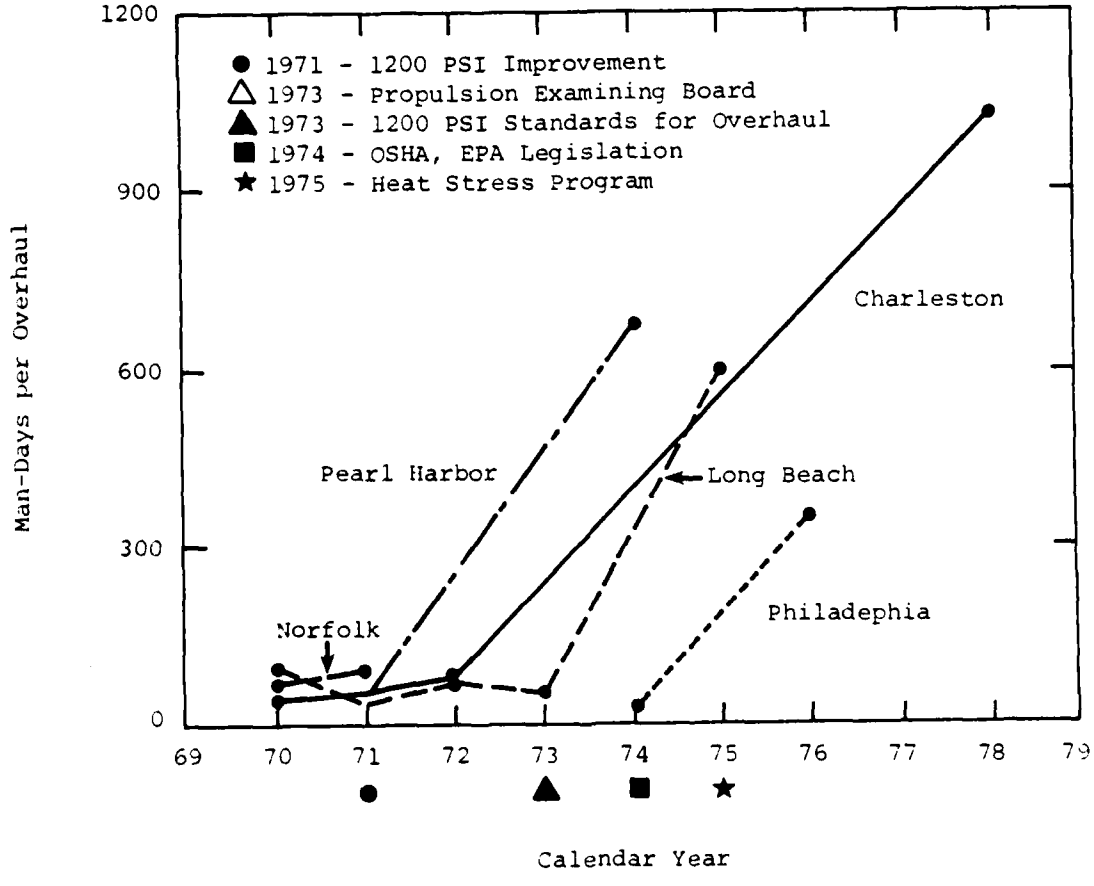


Figure 3-3. LAGGING (SHIPYARD)

Table 3-5. LAGGING: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON

Shipyard	1975-1979 Average	Percentage Above (Below) Overall 1975-1979 Average	Percentage of Observations Above 1975-1979 Average
Long Beach*	893	37	100
Pearl Harbor**	-	-	-
Charleston	1,143	76	50
Norfolk**	-	-	-
Philadelphia	376	(42)	0

*Single Observation
**No Observations

3.2.2 Refrigeration System

Overhaul work on the refrigeration system was documented in 36 of the reviewed overhauls. The difference between the 1970-1974 and 1975-1979 man-day averages (Figure 3-4) is statistically significant, as is the difference in adjusted material costs shown in Table 3-6.

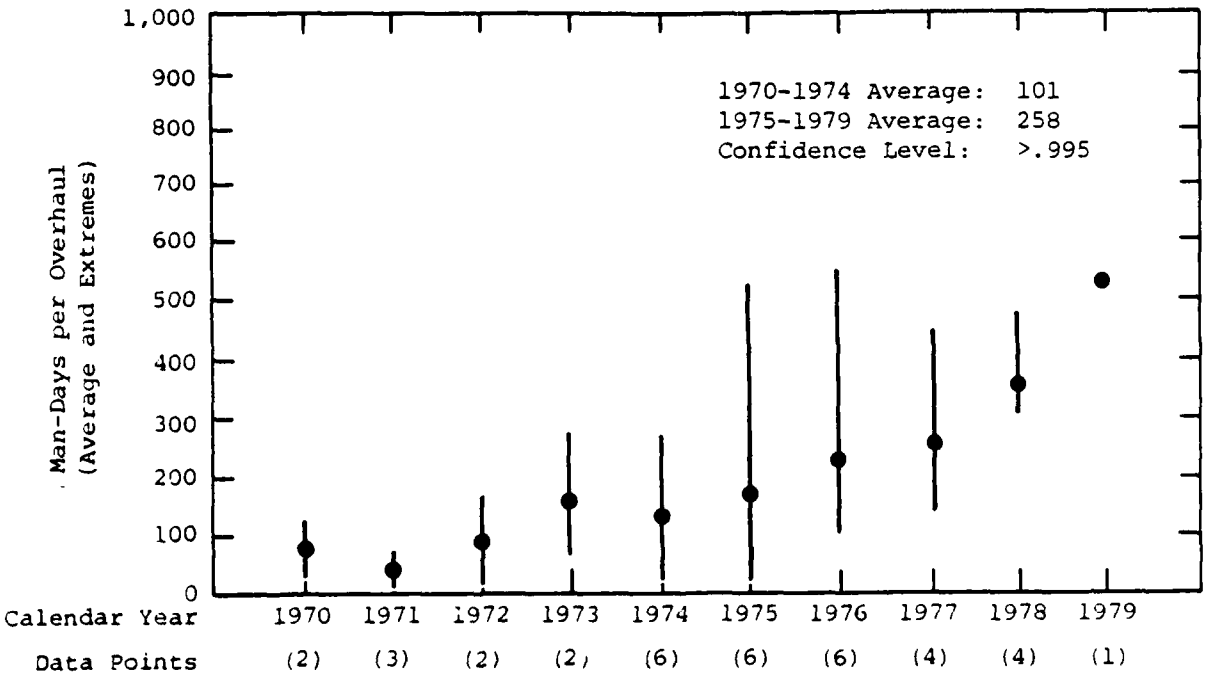


Figure 3-4. REFRIGERATION SYSTEM

Table 3-6. RATIO OF REFRIGERATION SYSTEM AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS

Period	Material Costs (in 1980 Dollars)	Man-Days	Material Costs per Man-Day
1970-1974	2,550	101	$25
1975-1979	9,622	258	37

This system displays a marked increase in frequency of overhaul work and a corresponding post-1975 decrease in the low man-day data points that normally indicate inspection and minimal work. These facts and the significant increase in material cost strongly indicate a shift to intensified maintenance requirements.

It was difficult to hypothesize concerning the cause of the observed growth for this equipment. There are no technical repair standards for this equipment and the propulsion system improvement efforts should not directly affect the refrigeration system. There may have been some indirect effect, however, since this equipment is the responsibility of the engineering section who experienced the greatest impact of the propulsion examining board. Another possibility could be the impact of the 1976 quality assurance initiatives. The man-day effort has increased 155 percent. The associated average adjusted material costs have only risen 48 percent. This fact could be supportive of the hypothesis of increased quality assurance initiatives. Contact with the Pearl Harbor Naval Shipyard indicates that additional components have been added to recent overhauls as well as preliminary testing of the piping systems.

Analysis of the shipyard data presented in Figure 3-5 shows that while all yards have been experiencing growth, Pearl Harbor and Charleston have been consistently higher than the other shipyards over the 1970-1979 time period.

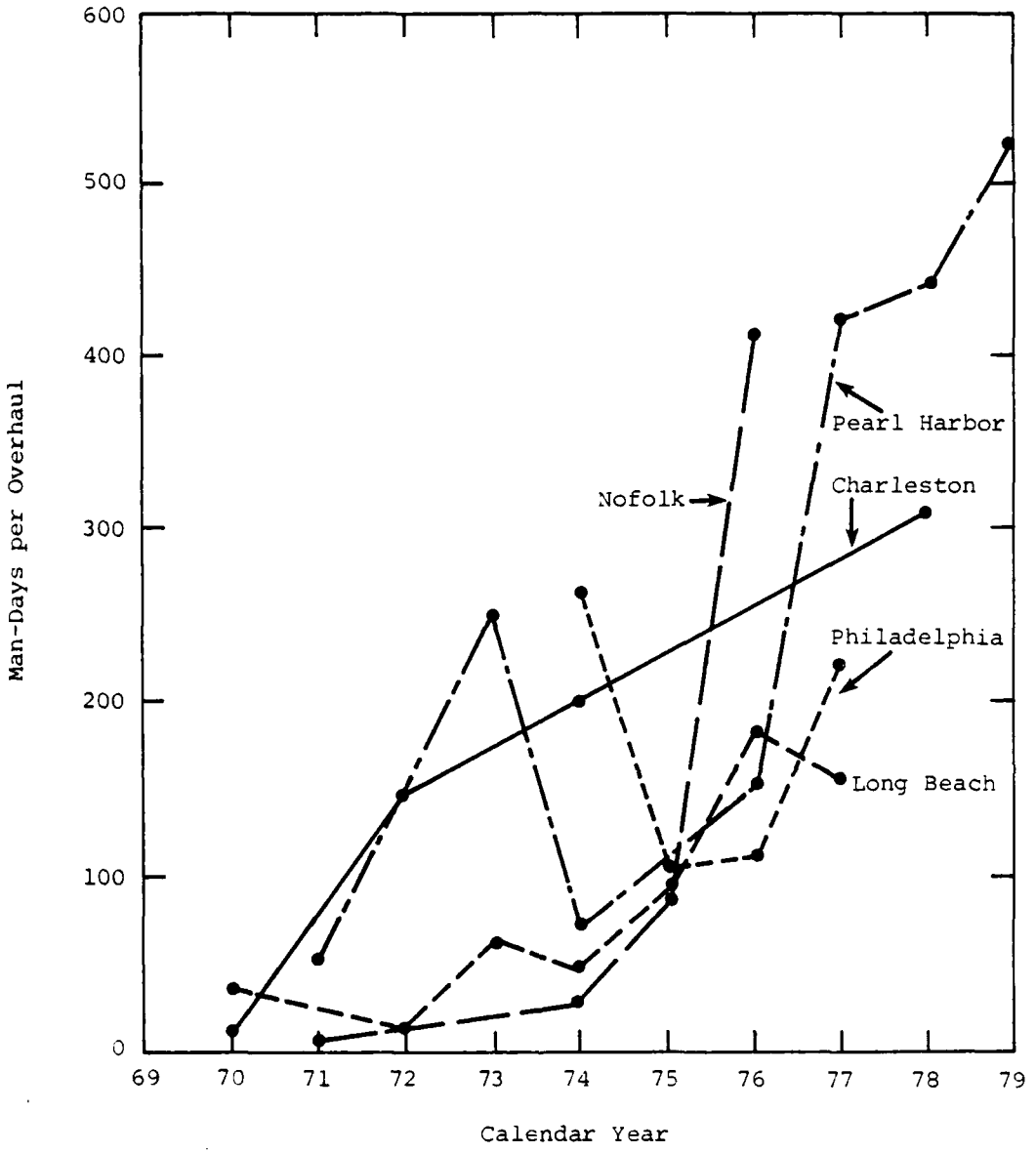


Figure 3-5. REFRIGERATION SYSTEM (SHIPYARD)

Table 3-7 shows that Pearl Harbor, Charleston, and to a lesser degree Norfolk, were all much higher than the 1975-1979 overall average. A possible explanation for this occurence could be an added emphasis on creature comforts in the warmer climates resulting in an expanded maintenance requirement.

Table 3-7. REFRIGERATION SYSTEM: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON

Shipyard	1975-1979 Average	Percentage Above (Below) Overall 1975-1979 Average	Percentage of Observations Above 1975-1979 Average
Long Beach	130	(50)	0
Pearl Harbor	390	51	75
Charleston	316	23	100
Norfolk	306	19	67
Philadelphia	139	(46)	0

3.2.3 Main Feed Booster Pump

Main feed booster pump work was identified in 33 of the reviewed overhauls. These data are presented in Figure 3-6. The difference between the 1970-1974 and 1975-1979 average man-days is statistically significant. Analysis of the material cost information, however, reveals no statistically significant difference between the two time periods. This is shown in Table 3-8.

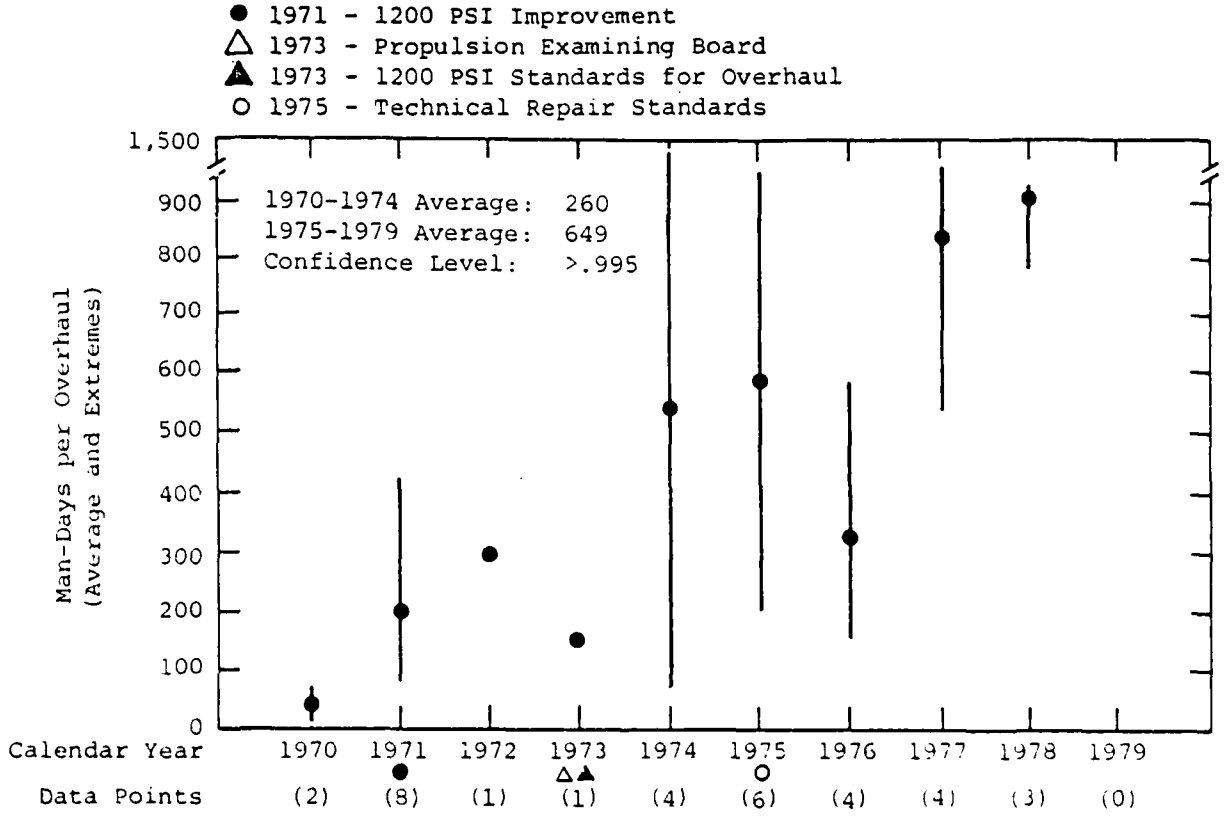


Figure 3-6. MAIN FEED BOOSTER PUMP

Table 3-8. RATIO OF MAIN FEED BOOSTER PUMP AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS			
Period	Material Costs* (in 1980 Dollars)	Man-Days	Material Costs per Man-Day
1970-1974	28,669	260	$110
1975-1979	26,342	649	41
*Difference not statistically significant.			

The data for this equipment presented a problem. Included within the job package are six pumps, four motor-driven and two turbine driven. In the majority of the cases it was not possible to determine which or how many of the pumps' turbines or motors were worked during overhaul.

During four overhauls at Pearl Harbor all six pumps were repaired on three of the four overhauls. One overhaul accomplished work on only two of the pumps. It was observed, however, that average man-days recorded per pump assembly was approximately 200.

The data in Table 3-8 does not totally support the premise that the growth would have resulted from repairing a greater number of pumps. The material cost per man-day did not show a similar escalation which would have been anticipated under this hypothesis.

The significant man-day increase over the two time periods appears to be directly related to the propulsion system related improvement efforts identified on Figure 3-6. This conclusion is suggested by the timing of the increase and the maintenance related implications of these programs.

Analysis of Figure 3-7, the plot by shipyard, indicates an increasing but erratic growth trend. The Pearl Harbor Naval Shipyard is primarily responsible for the large man-day increase between the two time periods. Pearl Harbor had three overhauls during the 1975-1979 time period which exceeded 1,000 man-days. One overhaul at Puget Sound of over 1,400 man-days is not shown in Figure 3-7 but is included in the 1975-1979 overall average of 649 man-days.

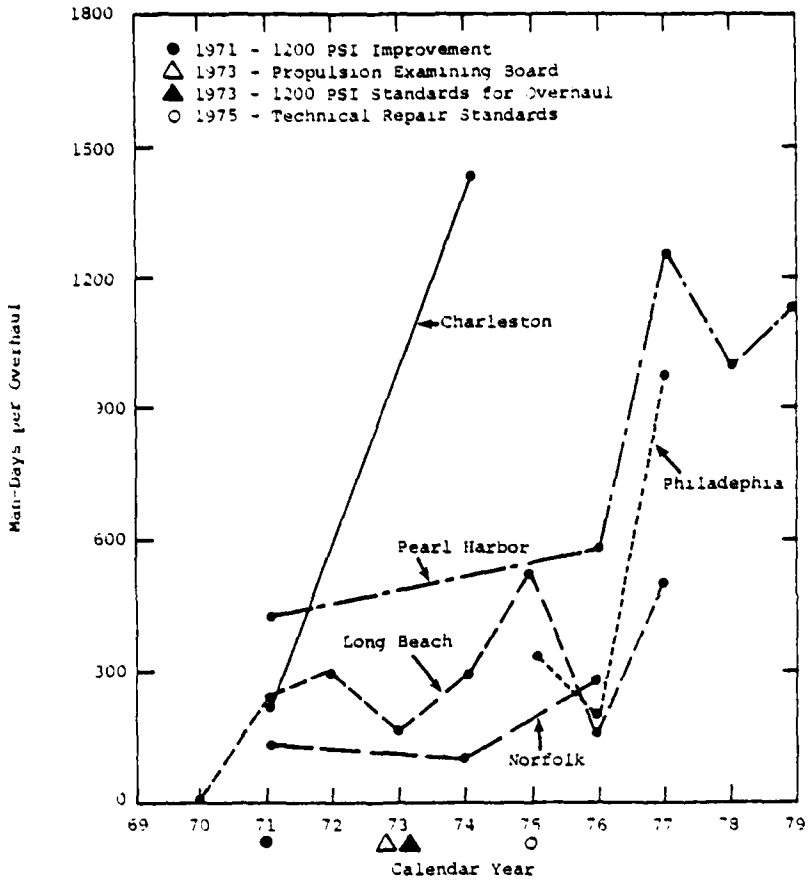


Figure 3-7. MAIN FEED BOOSTER PUMP (SHIPYARD)

Table 3-9 also shows that all of the shipyards except Pearl Harbor were below the 1975-1979 overall average.

Table 3-9. MAIN FEED BOOSTER PUMP: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON

Shipyard	1975-1979 Average	Percentage Above (Below) Overall 1975-1979 Average	Percentage of Observations Above 1975-1979 Average
Long Beach	489	(25)	0
Pearl Harbor	1,018	57	75
Charleston*	-	-	-
Norfolk	241	(63)	0
Philadelphia	509	(21)	33

*No Observations

3.2.4 Main Fuel Oil Service Pumps

Overhaul work on main fuel oil service pumps was documented in 38 of the reviewed overhauls. These data, provided in Figure 3-8, show a significant difference between the 1970-1974 and 1975-1979 man-day averages. Analysis of material cost is shown in Table 3-10 and indicates a statistically significant difference in the material costs for the two periods.

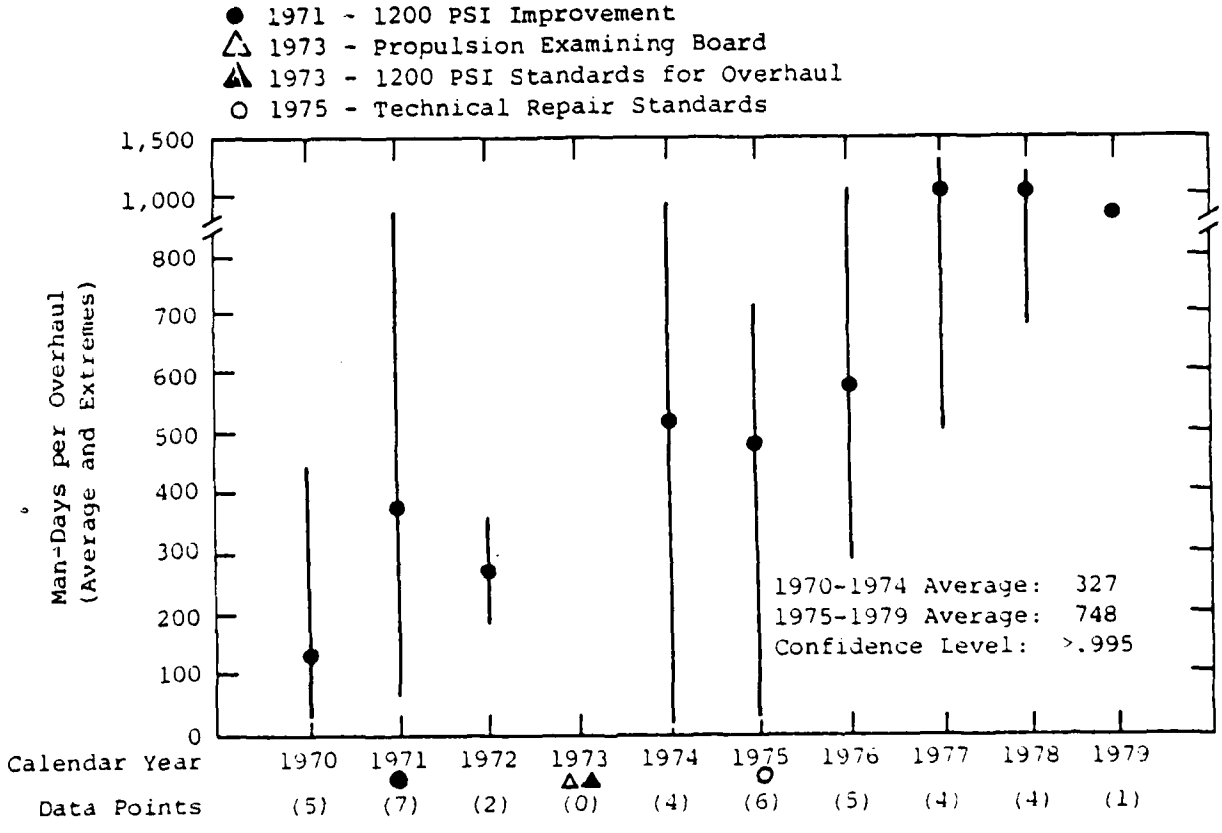


Figure 3-8. MAIN FUEL OIL SERVICE PUMP

Table 3-10. RATIO OF MAIN FUEL OIL SERVICE PUMPS AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS

Period	Material Costs (in 1980 Dollars)	Man-Days	Material Costs per Man-Day
1970-1974	14,635	327	$45
1975-1979	67,354	748	90

The frequency of overhaul work on these pumps has remained relatively constant from 1970 to 1979. The post-1975 period, however, does not reveal any jobs limited to inspection and minor repair such as would be indicated by low man-day data points. This fact and the significant rise in material costs again indicate a wider scope of effort precipitated by a shift to a more intensive form of maintenance resulting from the use of technical repair standards and as possible expansion of the effort to the repair of additional pumps. There were six pumps, four turbines, and 2 motors which could have been a part of the total work package. The propulsion system related improvement efforts and the expanded use of technical repair standards have directly impacted this equipment and are strong factors for the increase in scope and range of effort.

The trend to increased man-day effort for this equipment is also apparent in Figure 3-9. Except for Norfolk, all shipyards are increasing. However, Peal Harbor and Charleston are well above the overall 1975-1979 average as shown in Table 3-11.

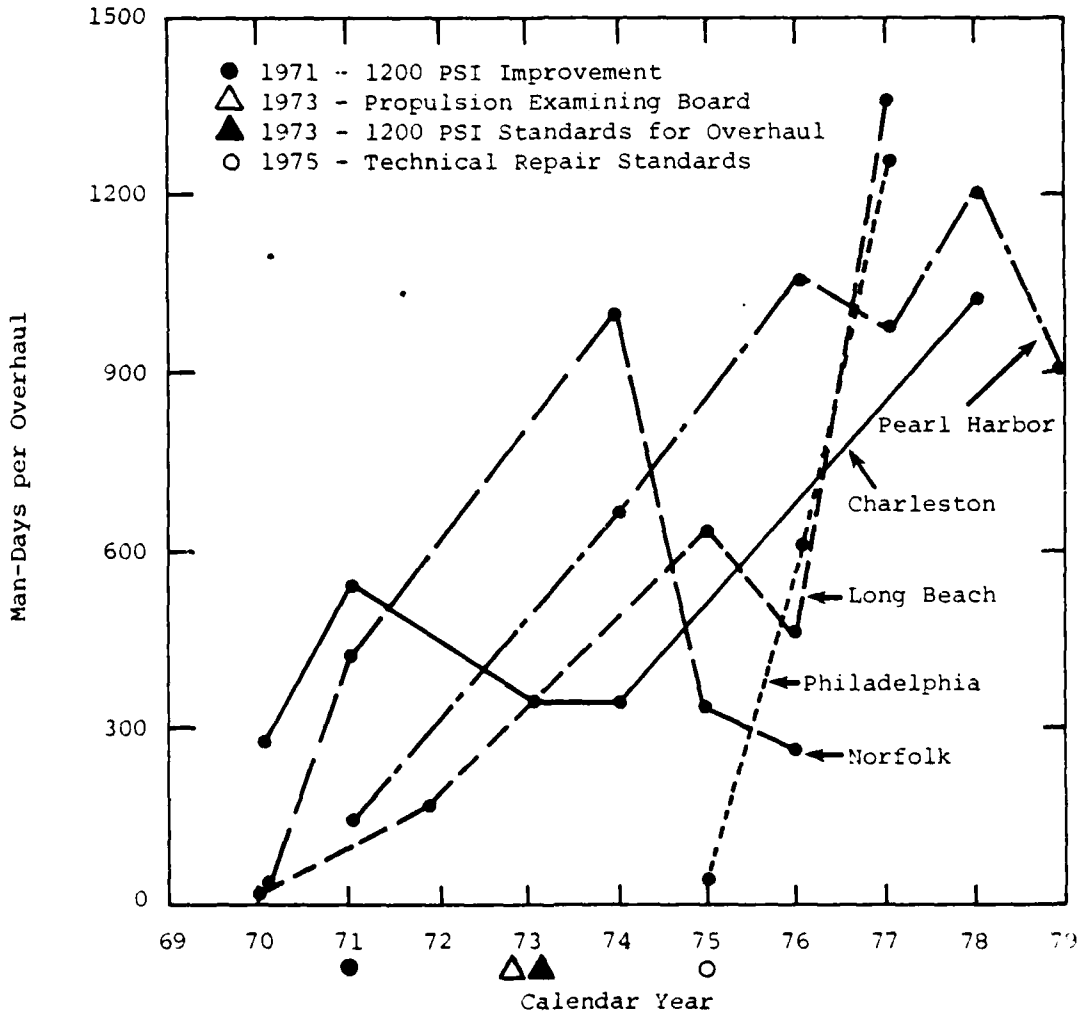


Figure 3-9. MAIN FUEL OIL SERVICE PUMP (SHIPYARD)

Table 3-11. MAIN FUEL OIL SERVICE PUMP: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON

Shipyard	1975-1979 Average	Percentage Above (Below) Overall 1975-1979 Average	Percentage of Observations Above 1975-1979 Average
Long Beach	711	(5)	17
Pearl Harbor	1,035	38	100
Charleston	1,089	46	100
Norfolk	297	(60)	0
Philadelphia	616	(18)	50

3.2.5 Sea Valves

Occurrences of sea valve work during overhaul were somewhat uniformly distributed throughout the ten years. Figure 3-10 graphs the data on man-days and shows a definite growth starting in 1974. The 1975-1979 average was 95 percent above the 1970-1974 average. There was also a big increase in the adjusted material costs, as shown in Table 3-12.

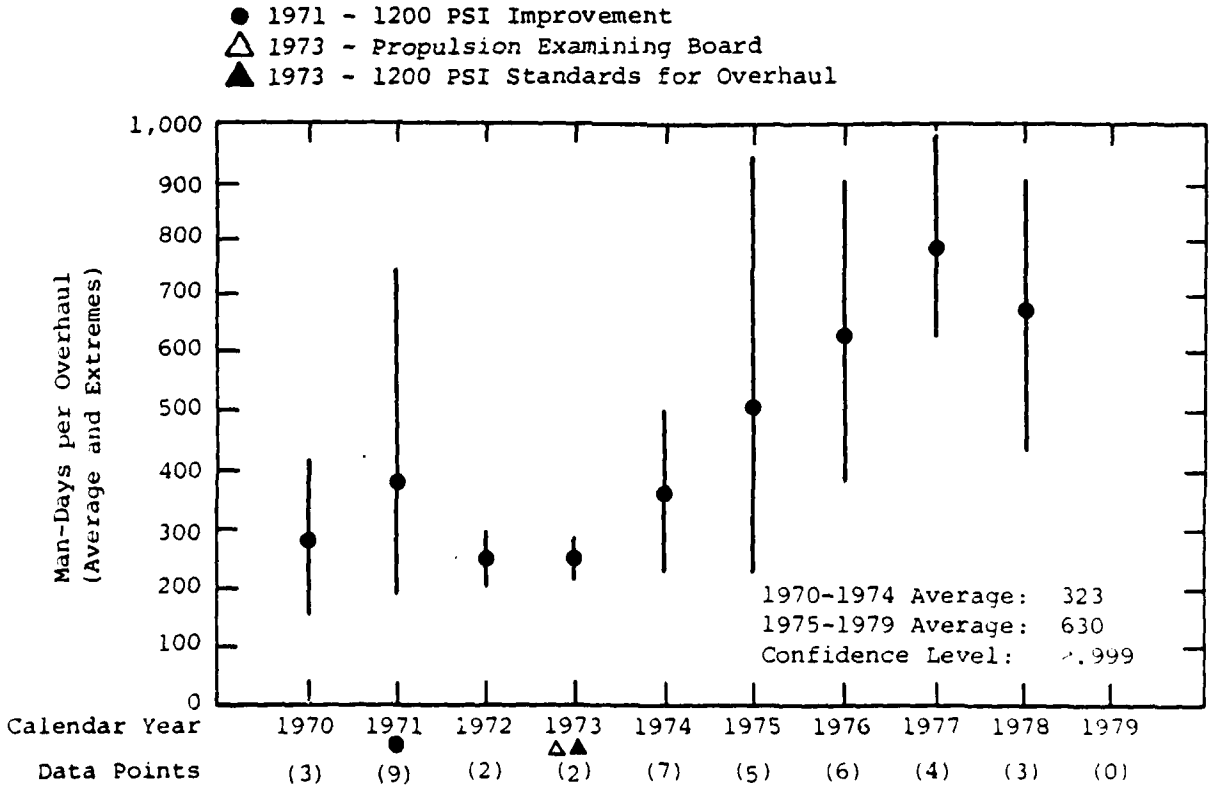


Figure 3-10. SEA VALVES

This comparison indicates that the scope of the work has increased. This inference can be partially substantiated by the fact that the shipyards were generally performing more valve repair and specifically were making more extensive effort in the refurbishment of valves of less than three inches in diameter. Analysis of several recent overhauls shows an increasing number of valves under three inches being repaired. Repair of these valves had previously been assigned to the ship's force.

This evidence of maintenance migration and the impact of several programs would have directly impacted the work on sea valves. Perhaps most important are the effects of the 1200 psi standards for overhaul program and the propulsion examining board. The implementation dates of these programs coincides with the observed man-day increase.

The graph of the individual shipyard man-days presented in Figure 3-11 shows that all five shipyards are increasing at approximately the some rate. Analysis of the data of Table 3-13 is supportive of this observation. Figure 3-11 shows very clearly that the timing of the growth coincides with the implementation of the propulsion system improvement efforts.

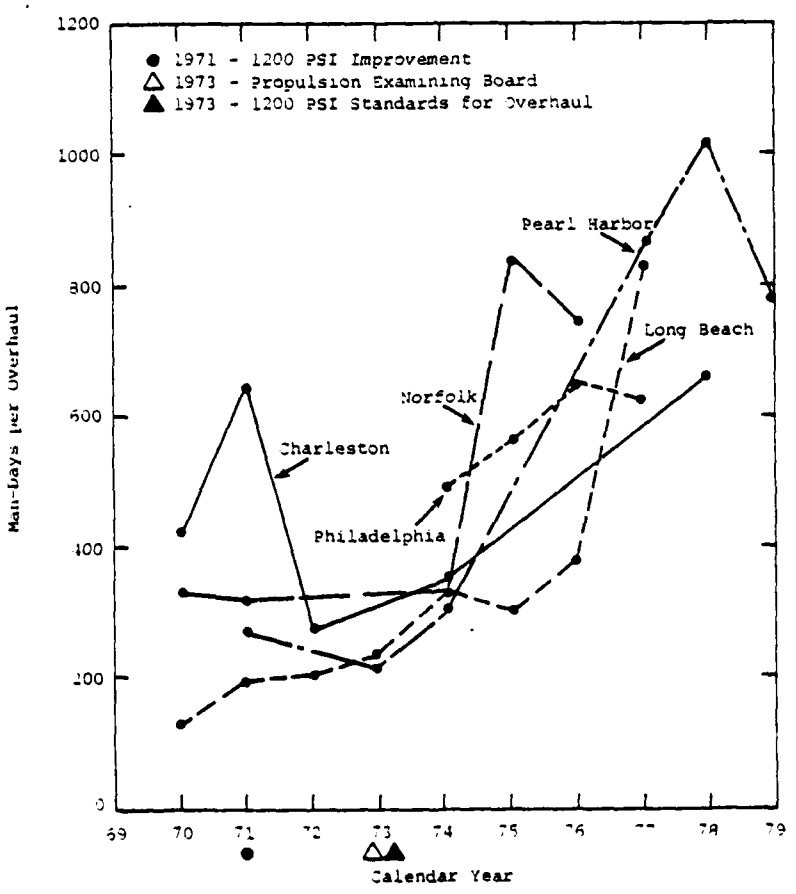


Figure 3-11. SEA VALVES (SHIPYARD)

Table 3-13. SEA VALVES: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON

Shipyard	1975-1979 Average	Percentage Above (Below) Overall 1975-1979 Average	Percentage of Observations Above 1975-1979 Average
Long Beach	503	(23)	33
Pearl Harbor	833	27	100
Charleston	665	1	50
Norfolk	773	18	67
Philadelphia	624	(5)	50

3.2.6 Main Condensate Pump

Overhaul work on the main condensate pump, turbine and motor, was documented on 25 of the reviewed overhauls. Figure 3-12 presents a graph of these data.

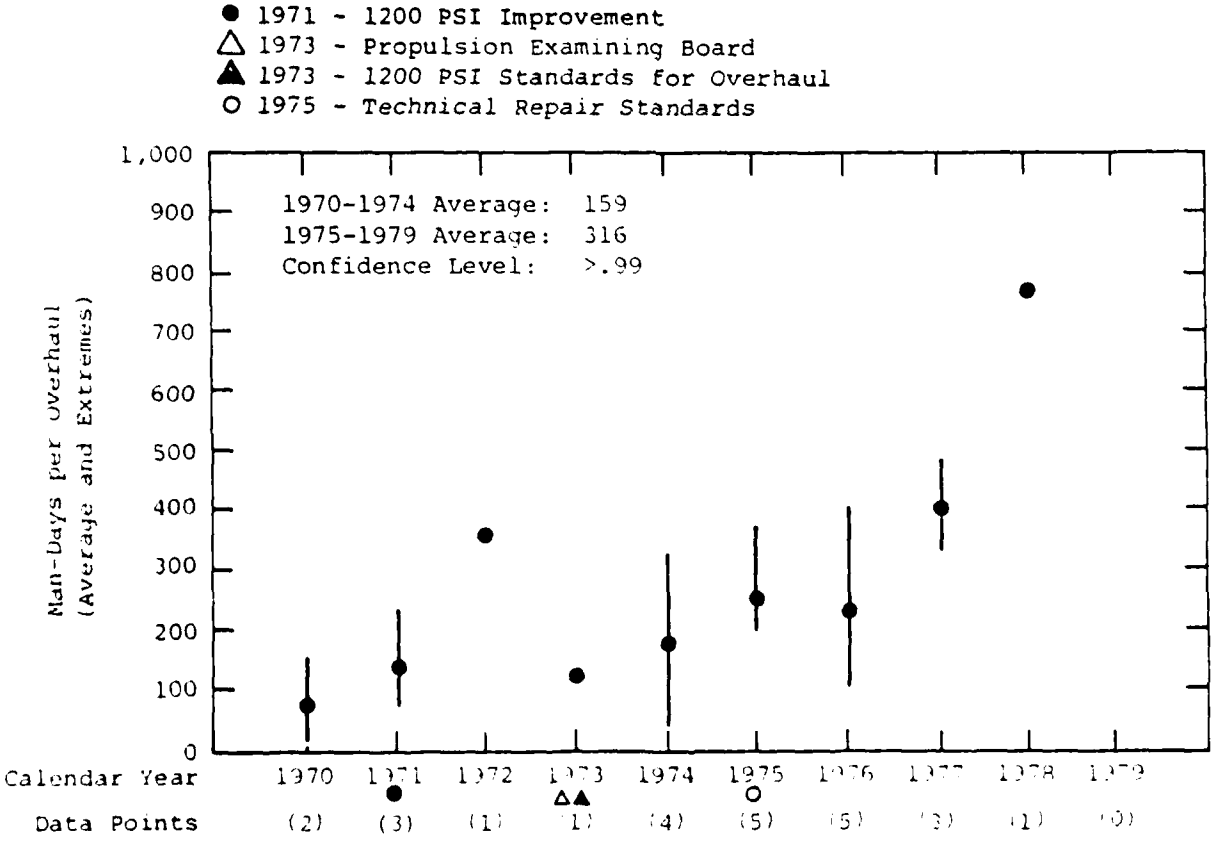


Figure 3-12. MAIN CONDENSATE PUMP, MOTOR AND TURBINE

The difference between the 1970-1974 and 1975-1979 man-day averages is statistically significant, as is the difference between the adjusted average material costs shown in Table 3-14.

Table 3-14. RATIO OF MAIN CONDENSATE PUMP AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS

Period	Material Cost (in 1980 Dollars)	Man-Days	Material Costs per Man-Day
1970-1974	13,926	159	$ 88
1975-1979	37,794	316	120

Data collection for this equipment was hampered by accounting and other problems. The repair man-days for this equipment were either combined with auxiliary condensate pumps, assigned to ship's force afloat, or not authorized.

The significant rise in material cost indicates a requirement for expanded work on this equipment (e.g., more pumps overhauled). In addition, the data in Figure 3-12 indicate that for three of the six overhauls from 1970 to 1972, low man-hour figures may possibly indicate only inspection and minor work, whereas for the remaining 19 overhauls, such low figures were observed only three times.

The increase in material use and time phasing of the increase strongly indicate additional requirements deriving from the *1200* psi improvement program, the *1200 psi* standards for overhaul, the propulsion examining board, and the extended application of technical repair standards.

Figure 3-13 shows a plot of these data for each shipyard. As stated previously the number of overhauls in which work on this equipment could be identified were few (25). The Long Beach data, however, do indicate an increasing trend. Table 3-15 provides the shipyard comparison with the overall 1975-1979 average.

Table 3-15. MAIN CONDENSATE PUMP: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON

Shipyard	1975-1979 Average	Percentage Above (Below) Overall 1975-1979 Average	Percentage of Observations Above 1975-1979 Average
Long Beach	308	(3)	50
Pearl Harbor *	69	(75)	0
Charleston**	-	-	-
Norfolk	229	(28)	33
Philadelphia	364	15	50

*Single Observation
**No Observations

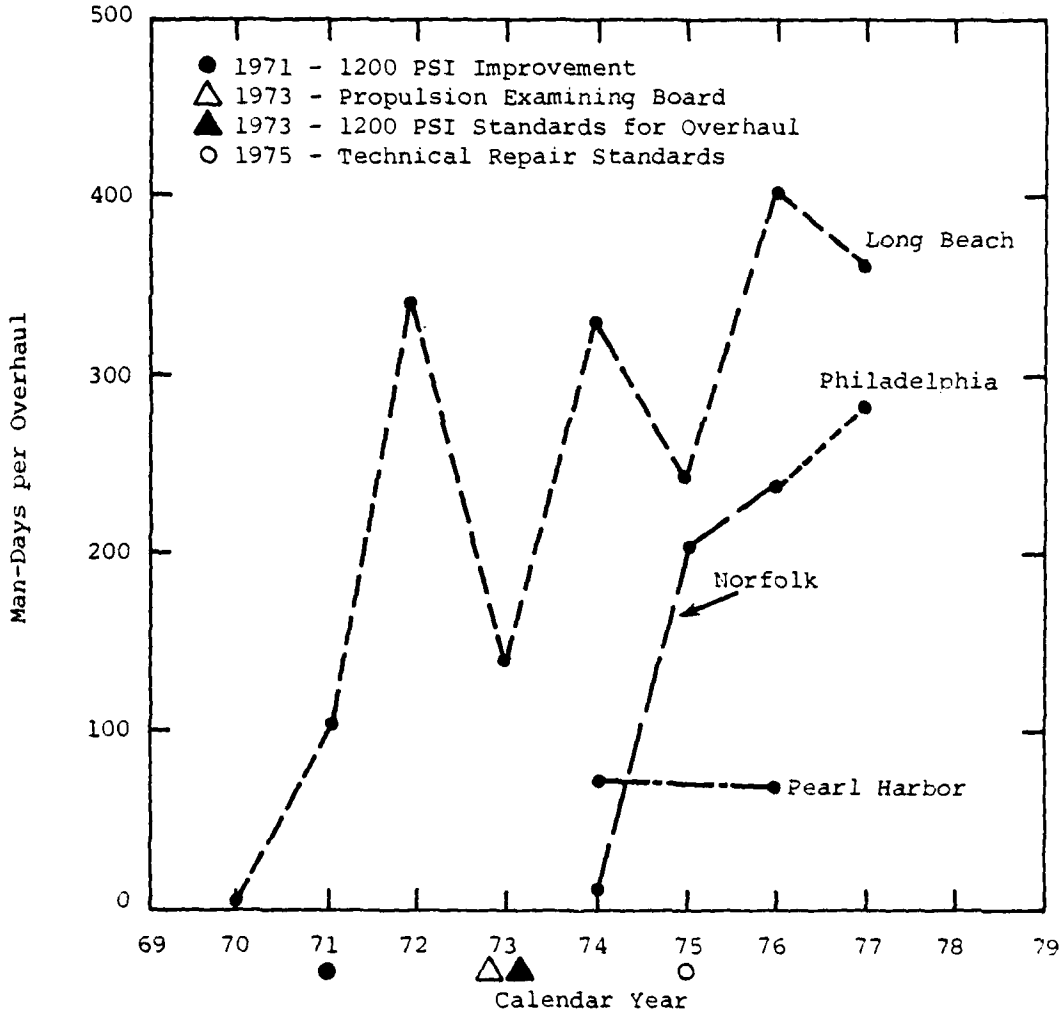


Figure 3-13. MAIN CONDENSATE PUMP (SHIPYARD)

3.2.7 Fire Pumps

Overhaul work on fire pumps was documented in 36 of the reviewed overhauls. The man-day data are presented in Figure 3-14. The difference between the 1970-1974 and 1975-1979 average man-days is significant, as is the material cost difference shown in Table 3-16.

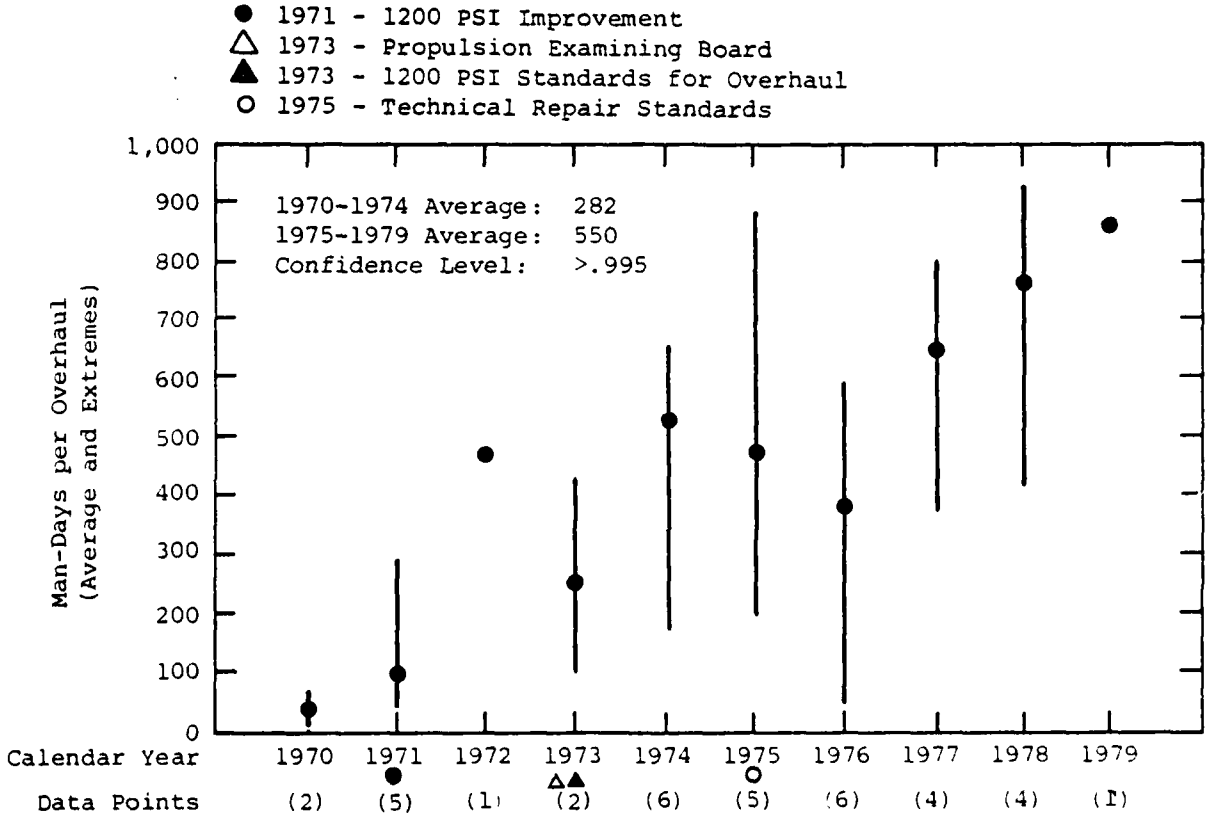


Figure 3-14. FIRE PUMPS

Table 3-16. RATIO OF FIRE PUMPS AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS

Period	Material Costs (in 1980 Dollars)	Man-Days	Material Costs per Man-Day
1970-1974	13,806	282	34
1975-1979	53,130	550	[illegible]

The frequency of overhaul work on fire pumps increased markedly after 1973. It was not possible, however, to determine how many of the pumps were overhauled. Investigation into several overhauls at Pearl Harbor indicated that in most cases the turbine pump assemblies were repaired. In more recent overhauls one or two motor driven pumps were also repaired. This indication of expanded scope is supported by the increase in average adjusted material costs. Additionally, from 1970 to 1979 there were major initiatives intended to reduce ship force maintenance on fire pumps (e.g., the transition to stainless steel housings and mechnical seals).* These initiatives probably are responsible for much of the man-day growth as well as the significant rise in adjusted costs. These facts coupled with the timing of the propulsion improvement programs and the application of technical repair standards (see Figure 3-14) are the most likely causes for the observed growth in overhaul costs.

Visual analysis of the individual shipyard data (Figure 3-15) provides further indication of the general growth in repair man-days. It appears to be growing at a steep rate. The two low data points for Norfolk in 1976 could be a function of the number of pumps which were overhauled. This fact could not be established. Table 3-17 provides the shipyard comparison relative to the 1975-1979 overall average.

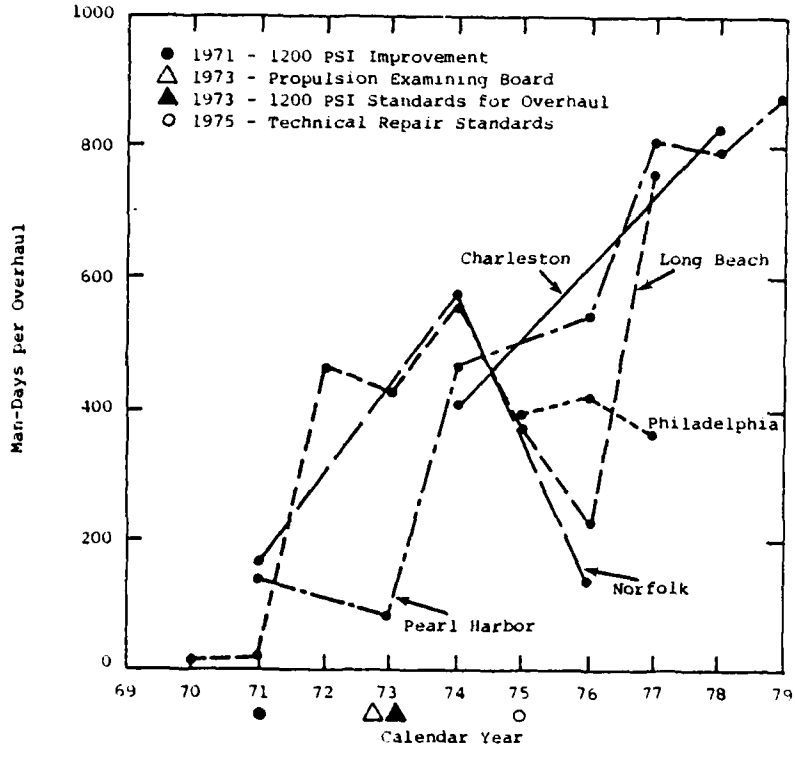


Figure 3-15. FIRE PUMPS (SHIPYARD)

*ARINC Research Corporation, DDEOC System Maintenance Analysis: DDG-37 Class Firemain and Auxiliary Machinery Cooling Water Systems, SMA 37-201-521, Publication 1652-03-10-1715, February 1978.

Table 3-17. FIRE PUMPS: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON

Shipyard	1975-1979 Average	Percentage Above (Below) Overall 1975-1979 Average	Percentage of Observations Above 1975-1979 Average
Long Beach	529	(4)	50
Pearl Harbor	755	37	100
Charleston	836	52	100
Norfolk	133	(76)	0
Philadelphia	395	(28)	0

3.2.8 Propellers

Overhaul work for propellers was documented on 40 of the reviewed overhauls. A graph of the man-day expenditures is presented in Figure 3-16. The difference between the 1970-1974 and 1975-1979 averages in man-days is statistically significant. Visual inspection of the data indicates that man-days may be leveling.

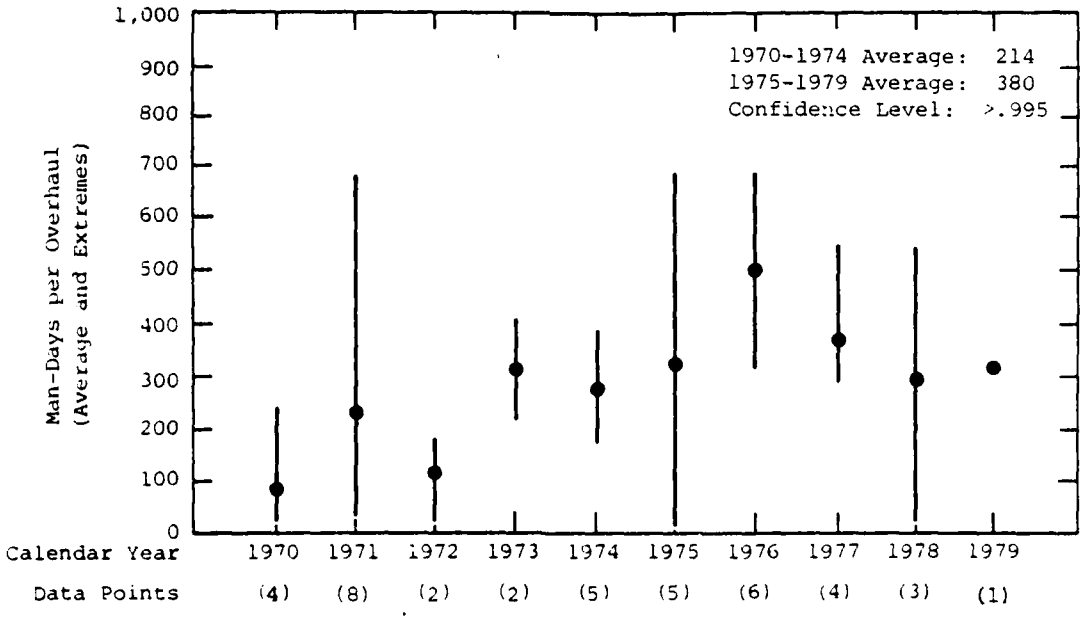


Figure 3-16. PROPELLERS

Table 3-18 shows the ratio of average adjusted material cost to man-days for this equipment. The table indicates that the man-day effort has grown while the adjusted material cost has remained approximately the same. This could be the result of either a decrease in productivity or a requirement for more labor to perform the same tasks. The latter case could be caused by a requirement for some sophistiated inspection and test techniques resulting in more frequent repairs.

Table 3-18. RATIO OF PROPELLERS AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS

Period	Material Cost* (in 1980 Dollars)	Man-Days	Material Costs per Man-Day
1970-1974	8,622	214	$40
1975-1979	7,734	380	20

*Difference not statistically significant.

While this equipment would have been affected by all those programs of a general nature in Table 3-1, it does not appear that any of the more specific programs would have had a direct affect.

One possible explanation for the observed man-day growth with no related increase in adjusted material costs could be the manner in which the repairs were accomplished. In some cases the propellers were repaired in place while in other they were removed. A correlation between this condition and the observed increase would provide an explanation. The form of the available data did not permit such an analysis.

Figure 3-17 shows the same data plotted by shipyard. It is not possible to detect a real trend from this graph. Pearl Harbor started the period high and remained relatively constant. Long Beach, Philadelphia, and Norfolk show a constant increase and the two overhauls at Charleston show virtually no effort on propellers. It is interesting to note, however, that Table 3-19 shows that the increase for Norfolk was much steeper and reached a higher maximum. The Norfolk average was 61% higher than the overall 1975-1979 average.

Table 3-19. PROPELLERS: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON

Shipyard	1975-1979 Average	Percentage Above (Below) Overall 1975-1979 Average	Percentage of Observations Above 1975-1979 Average
Long Beach	318	(16)	17
Pearl Harbor	337	(11)	75
Charleston*	9	(98)	0
Norfolk	611	61	100
Philadelphia	397	4	50

*Single Observation

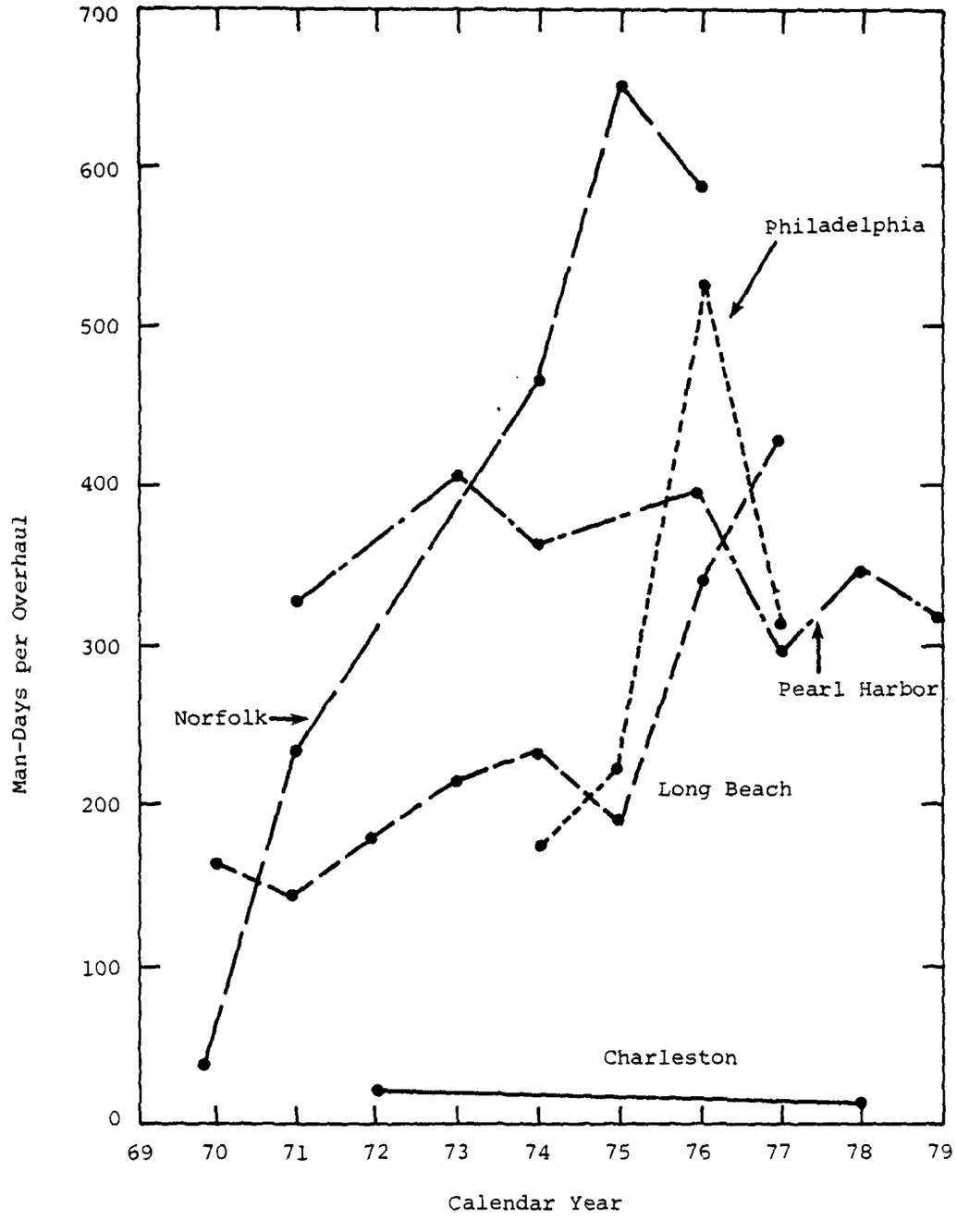


Figure 3-17. PROPELLERS (SHIPYARD)

3.2.9 Docking

Data for docking were identified in each departure report. Forty-six departure report line items were used in this study, plus two SARP estimates, which were substantiated by partial shipyard MIS returns. Figure 3-18 presents a graph of these data and indicates a wide variation between the extreme data points. A definite upward trend is shown, and it is verified by comparison of the 1970-1974 and 1975-1979 averages. The dispersion of the data, however, makes it difficult to get much information from this graph. The only event in Table 3-1 which have directly affected the docking task was the legislation (OSHA, EPA, EEOC) which was implemented during the 1970-1979 time period.

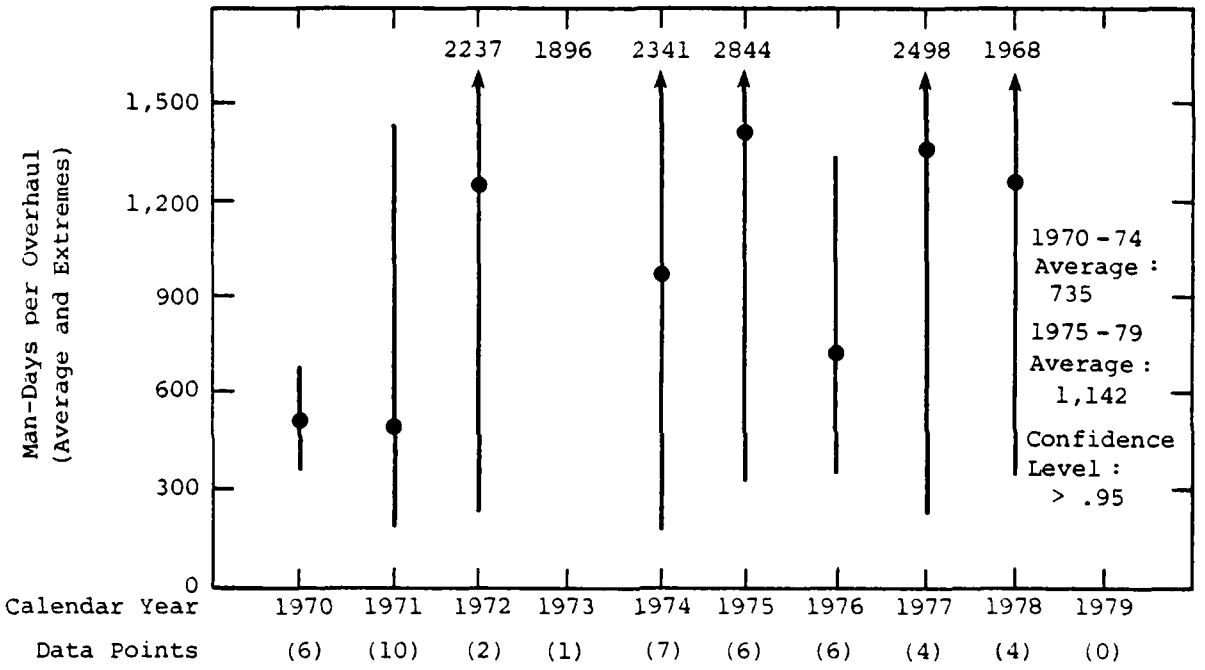


Figure 3-18. DOCKING (OVERHAUL)

Two key factors affecting the man-days recorded for docking are the number of days in dry dock and the effects of single or multiple ship docking. The fact that the length of overhaul for the two periods has increased 83 percent could account for a portion of the 55 percent increase in docking man-days. Also, if the incidence of multiple ship dockings had decreased, this could have accounted for some of the observed growth. Investigation of these factors was not possible with the data available.

Table 3-20 shows the average adjusted material cost per overhaul and the relationship to man-days.

Table 3-20. RATIO OF DOCKING AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS

Period	Material Costs (in 1980 Dollars)	Man-Days	Material Costs per Man-Day
1970-1974	3,589	735	$ 4.9
1975-1979	15,468	1,142	13.5

To determine the causes of this observed growth is very difficult, because many variable factors must be considered. The 55 percent increase in man-days is accompanined by a 331 percent increase in material costs. That these are adjusted costs implies that more material was used. This could be the result of increased productivity, increased length of overhauls, added work, changes in the accounting procedures, or some combination of all of these.

The difficulty involved in establishing any causal factors for the observed trend is apparent by inspection of Figure 3-19. When plotted by shipyard it is obvious that Long Beach is doing something different. Investigation of this apparent anomaly should be completed before any analysis of causes for growth could be attempted, with the Long Beach data removed, the man-day growth becomes even more pronounced (130 percent). Table 3-21 shows that Long Beach was 49 percent higher than the 1975-1979 overall average.

This task, however, by its very nature, should provide a fruitful subject for further investigation of any change in direct labor productivity.

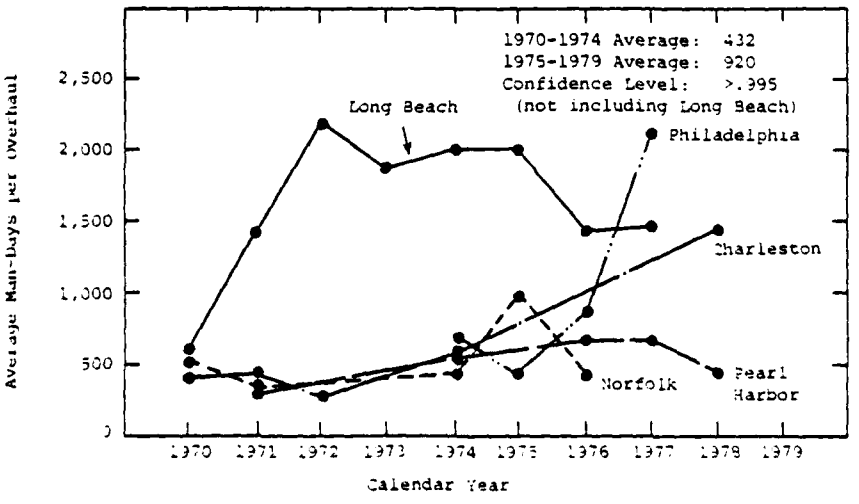


Figure 3-19. DOCKING (SHIPYARD)

Table 3-21. DOCKING: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON			
Shipyard	**1975-1979 Average**	**Percentage Above (Below) Overall 1975-1979 Average**	**Percentage of Observations Above 1975-1979 Average**
Long Beach	1,697	49	83
Pearl Harbor	550	(52)	0
Charleston	1,356	19	50
Norfolk	565	(51)	0
Philadelphia	1,047	(8)	75
This task, however, by its very nature, should provide a fruitful subject for further investigation of any change in direct labor productivity.			

3.2.10 Lube Oil Purifiers

Overhaul work on lube oil purifiers was documented for 21 of the reviewed overhauls. The graph of the man-day data is presented in Figure 3-20. As is shown, documented work during overhauls began in 1974, so any comparison of averages is meaningless.

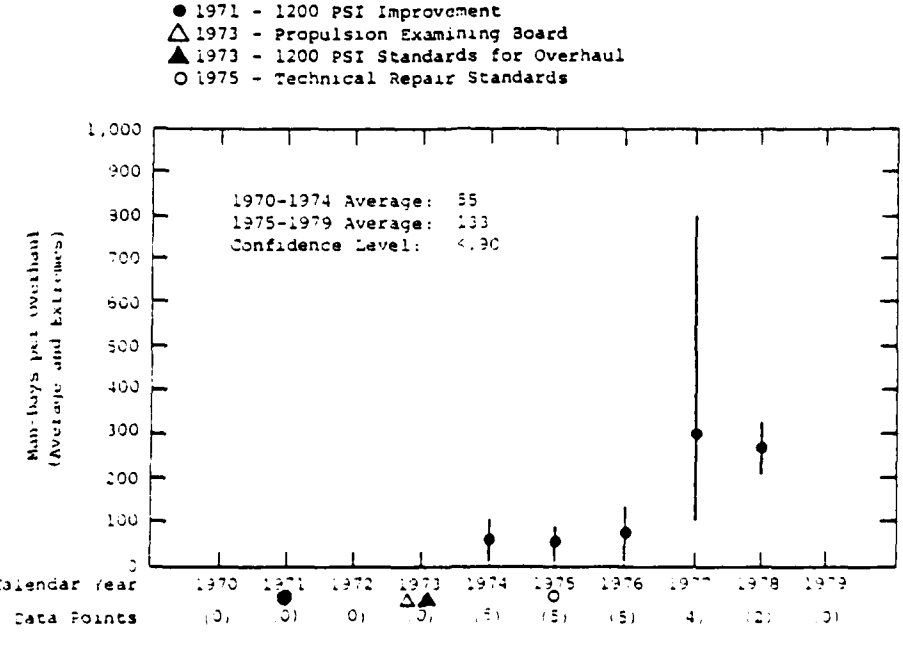


Figure 3-20. LUBE OIL PURIFIERS

The material cost comparison was also not statistically significant because of sample size and data dispersion. These figures are shown in Table 3-22. This equipment was included as being a contributor to growth between the two time periods even though it could not be established statistically.

Table 3-22. RATIO OF LUBE OIL PURIFIERS AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS

Period	Material Costs* (in 1980 Dollars)	Man-Days	Material Costs per Man-Day
1970-1974	4,595	55	$84
1975-1979	9,196	133	69

*Difference not statistically significant.

This equipment would be affected by all of the propulsion system improvement efforts and the expanded use of technical repair standards. It is very likely that work on this equipment has migrated to the depot-level from ship's force as a result of the increased emphasis on propulsion related components. This premise is supported by a check on the recent DDG-16 overhaul at Pearl Harbor which shows that this work is being done there by the ship's force.

Visual inspection of the shipyard data (Figure 3-21) shows a close grouping of all shipyards with one data point for Philadelphia (1976) showing an unusally large man-day expenditure.

Table 3-23 is provided for the sake of consistency but does not provide any useful information for the reasons previously explained.

Table 3-23. LUBE OIL PURIFIERS: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON

Shipyard	1975-1979 Average	Percentage Above (Below) Overall 1975-1979 Average	Percentage of Observations Above 1975-1979 Average
Long Beach	82	(40)	0
Pearl Harbor	111	(16)	33
Charleston*	203	53	100
Norfolk	30	(77)	0
Philadelphia	345	160	67

*Single Observation

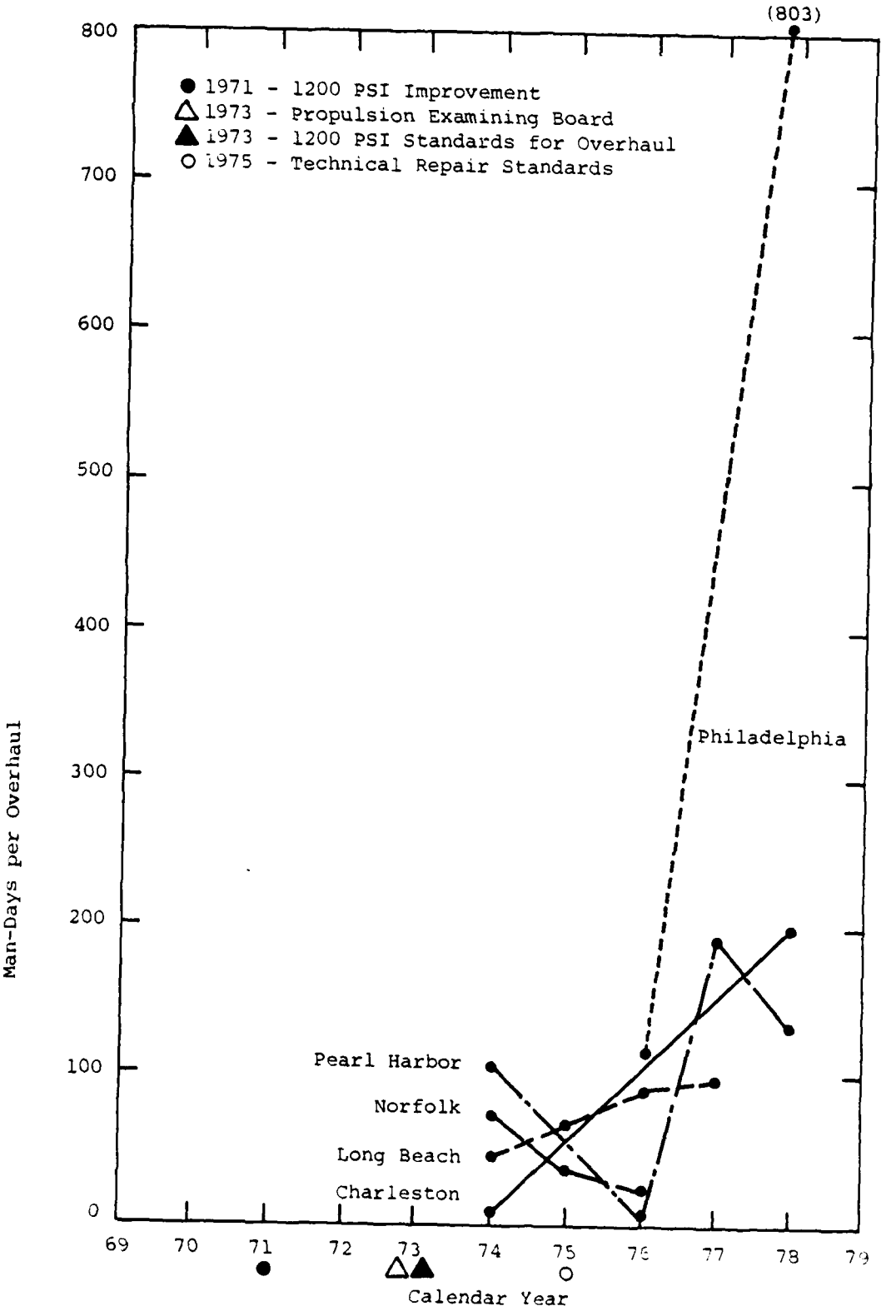


Figure 3-21. LUBE OIL PURIFIERS (SHIPYARDS)

3.2.11 Gyro Compass

Work on the gyro compass was documented in 44 of 51 overhauls. Figure 3-22 depicts the growth in man-days. This equipment displays a relatively stable average and data spread. The difference between the 1970-1974 and 1975-1979 averages is statistically significant: an increase of approximately 22 percent.

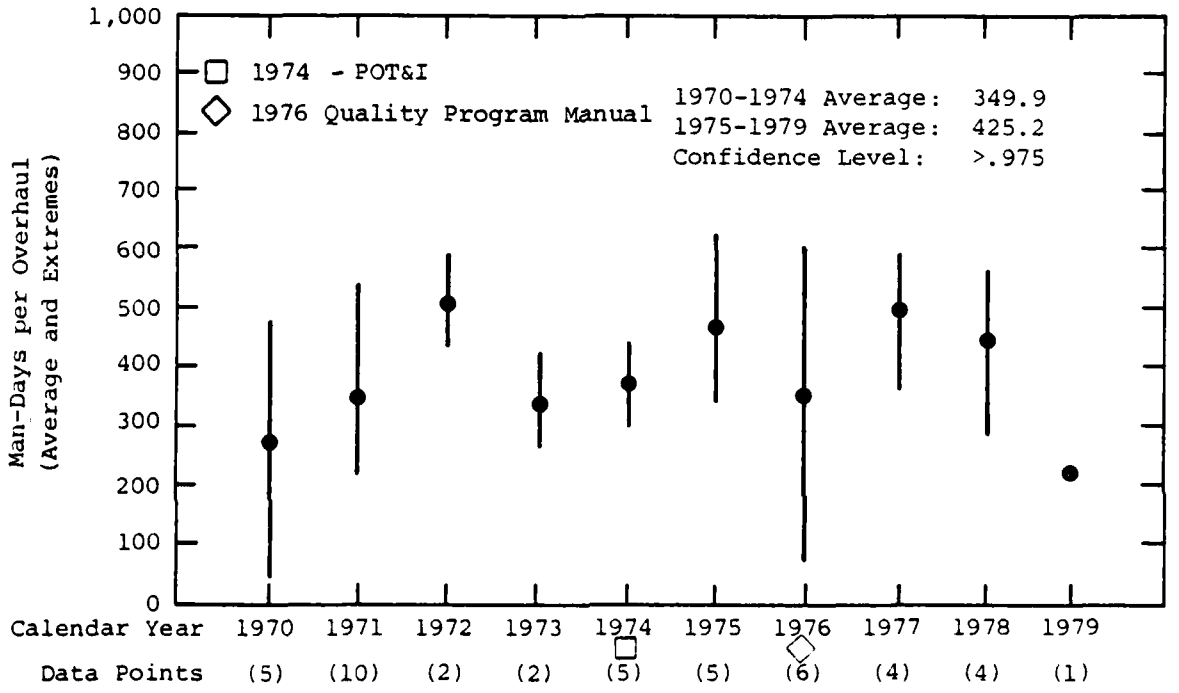


Figure 3-22. GYRO COMPASS

The system includes two gyro compasses, a synchro amplifier, and other miscellaneous electrical navigation equipment (Pit Log not included). For overhauls at Pearl Harbor, it appears that all electrical navigation equipments were included. This as difficult to substantiate, since there were problems in tracing work on job orders to the departure reports.

Material costs for this system exhibited little growth. Table 3-24 shows that the difference between the adjusted material costs for the 1970-1974 and 1975-1979 periods is not statistically significant. The lack of statistical significance results from data dispersion and sample size.

Table 3-24. RATIO OF GYRO COMPASS AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS			
Period	Material Costs* (in 1980 Dollars)	Man-Days	Material Costs per Man-Day
1970-1974	24,266	350	$69.5
1975-1979	32,540	425	76.5
*Difference not statistically significant.			

Since there is no significant difference between the average costs for the two periods and there is a significant difference between the average man-days, this would imply a decreased productivity in terms of material costs per man-day. In addition, the 1975-1979 average costs have been weighted by a 1978-1979 overhaul on the DDG-11 in Charleston exhibiting extreme material costs ($110,625). If this figure were reduced, the 1975-1979 ratio would be reduced significantly.

The alternative hypothesis to that of decreased productivity would be increased maintenance, which is heavily man-day-oriented.

The configuration of the gyro compass has not been changed. Additionally, the only events of Table 3-1 which would affect the gyro compass are inspection related. These observations indicate that the observed cost growth could be attributed to added inspection and quality control requirements.

Figure 3-23 shows a plot of the man-days recorded at five individual shipyards. There is no meaningful trend apparent and it is difficult to determine if any stabilization of the man-days expended is occurring. It is apparent, however, that the work at the Philadelphia Naval Shipyard has driven the 1975-1979 average up. Without the Philadelphia data the 1975-1979 average would be 392 man-days. This would not be a statistically significant increase with respect to the 1970-1974 time period.

Table 3-25 shows a comparison of each shipyard's performance with respect to the 1975-1979 man-day average.

Table 3-25. GYRO COMPASS: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON			
Shipyard	**1975-1979 Average**	**Percentage Above (Below) Overall 1975-1979 Average**	**Percentage of Observations Above 1975-1979 Average**
Long Beach	386	(9)	17
Pearl Harbor	417	(2)	75
Charleston	505	19	100
Norfolk	194	(54)	0
Philadelphia	556	31	100

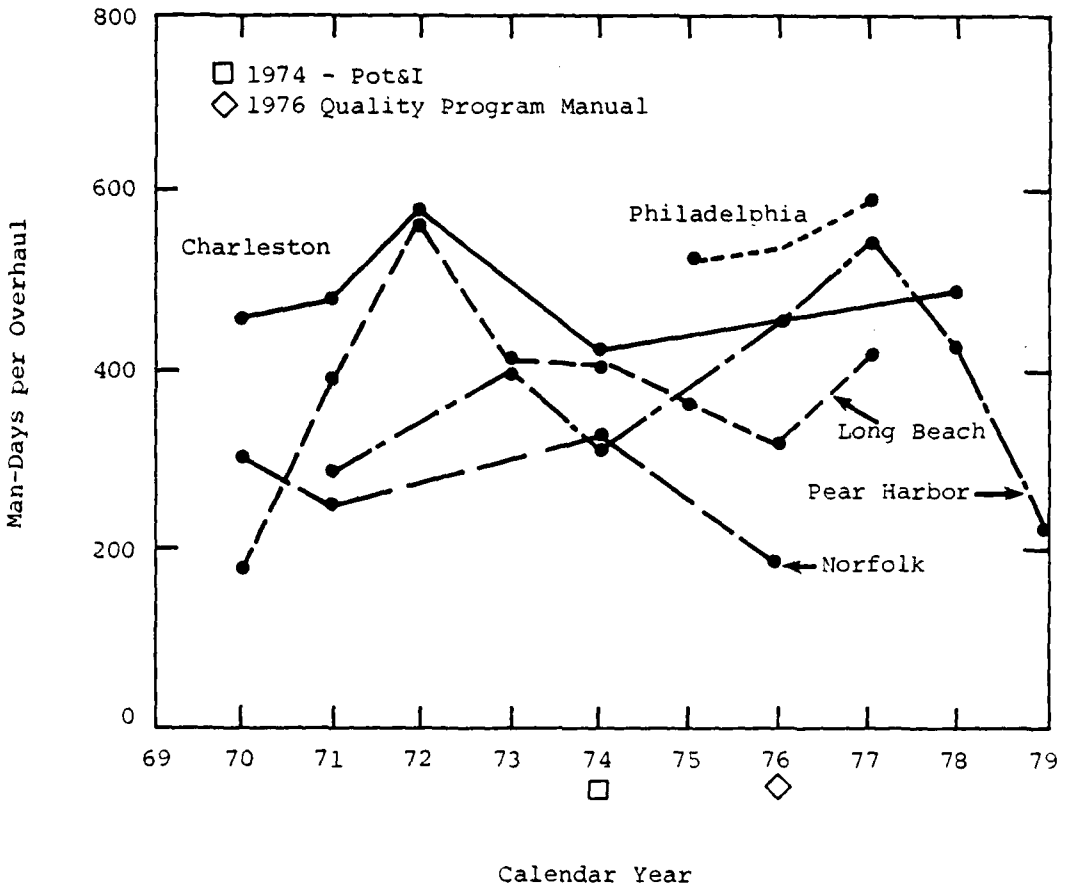


Figure 3-23. GYRO COMPASS (SHIPYARD)

The impact of the 1975-1979 average of the work performed at the Philadelphia yard is evident from these figures. There were no indications in the available data of the cause for this observation.

3.3 EQUIPMENTS AND TASKS NOT SHOWING SIGNIFICANT MAN-DAY GROWTH

The remainder of the equipments and tasks do not indicate a statistically significant difference between the 1970-1974 and 1975-1979 man-day averages. The graphs of the data and related material cost data are presented below, together with observations made during the analysis.

3.3.1 ASROC Launcher

Overhaul work on the ASROC launcher was documented in 39 of the reviewed overhauls. A graph of the man-day experience and the related 1970-1974 and 1975-1979 averages is presented in Figure 3-24. While it appears as if there was a decrease in man-days per overhaul, the data dispersion was so great as to nullify any statistical significance at the 90 percent level. The material cost comparison shown in Table 3-26 also does not indicate any statistical difference between material costs, primarily as a result of data dispersion.

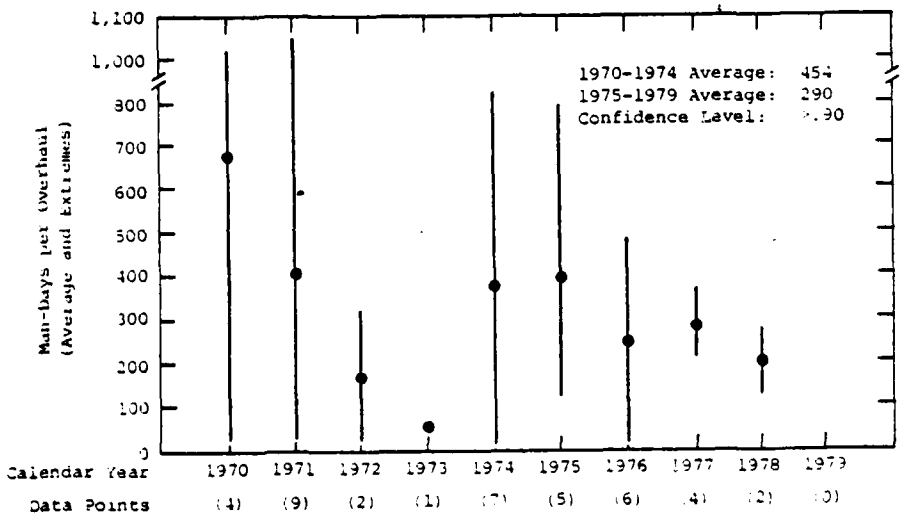


Figure 3-24. ASROC LAUNCHER

Table 3-26. RATIO OF ASROC LAUNCHER AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS			
Period	Material Costs* (in 1980 Dollars)	Man-Days *	Material Cost per Man-Day
1970-1974	14,017	454	$ 31
1975-1979	66,228	290	229
*Difference not statistically significant.			

During the period under study the method of refurbishing launchers changed considerably. Initially, much of the work done in the shipyards. Later, the item was refurbished under the rotatable-pool concept, with subsequent augmentation by shipyard test and inspection. The apparent decrease (not statistically significant) could be the result of the transfer of the refurbishment of this item from the overhaul account to a separate cost account Figure 3-25 and Table 3-27 provide the shipyard comparison and display a fairly consistent trend for all shipyards.

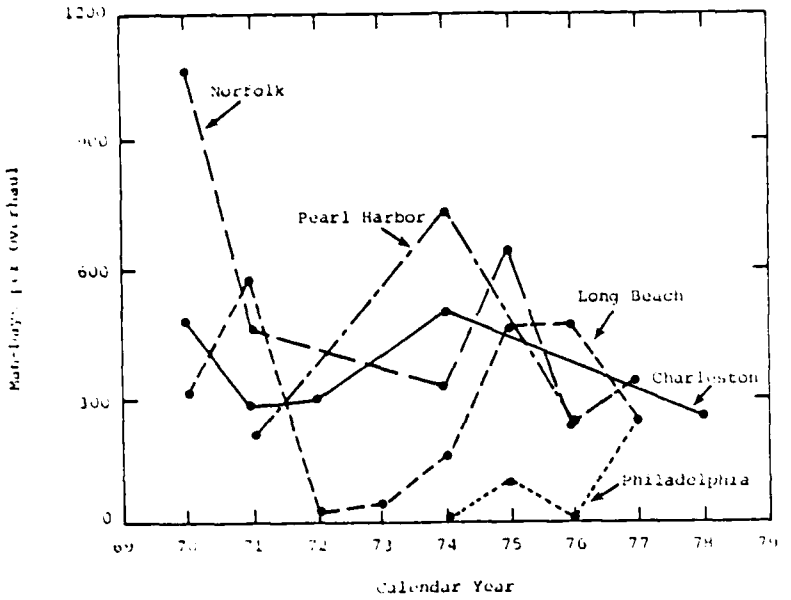


Figure 3-25. ASROC LAUNCERS (SHIPYARD)

Table 3-27. ASROC LAUNCHER: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON

Shipyard	1975-1979 Average	Percentage Above (Below) Overall 1975-1979 Average	Percentage of Observations Above 1975-1979 Average
Long Beach	366	26	100
Pearl Harbor	294	2	50
Charleston*	254	(12)	0
Norfolk	358	23	33
Philadelphia	121	(58)	0

*One Observation

3.3.2 Surface Search Radar AN/SPS-10

Overhaul work on the surface search radar was documented in 44 of the reviewed overhauls. A graph of the man-day data is presented in Figure 3-26. The material cost comparison is presented in Table 3-28 and does not show any statistically significant difference.

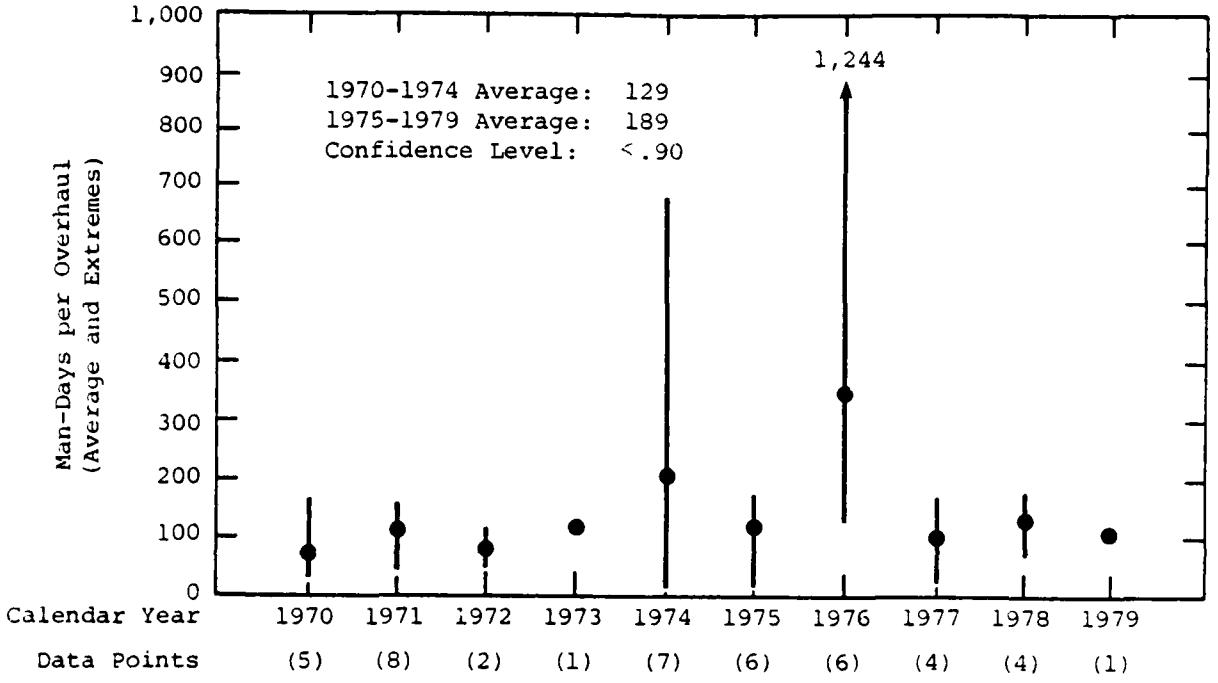


Figure 3-26. SURFACE SEARCH RADAR AN/SPS-10

Table 3-28. RATIO OF SURFACE SEARCH RADAR AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS

Period	Material Costs* (in 1980 Dollars)	Man-Days*	Material Costs per Man-Day
1970-1974	23,954	129	$186
1975-1979	22,985	189	121

*Difference not statistically significant.

There has been a change in the scope of the work done on the radar, from installation of a refurbished antenna to installation of both a refurbished antenna and related electronics. It is hypothesized that man-days now include added inspection, test, and quality control efforts that exceed the electronic overhaul work, which has migrated from overhaul to rotatable pools.

Analysis by shipyard (Figure 3-27 and Table 3-29) show a relatively constant man-day expenditure over the 1970-1979 time period with the exception of some extreme data points at Norfolk and Philadelphia.

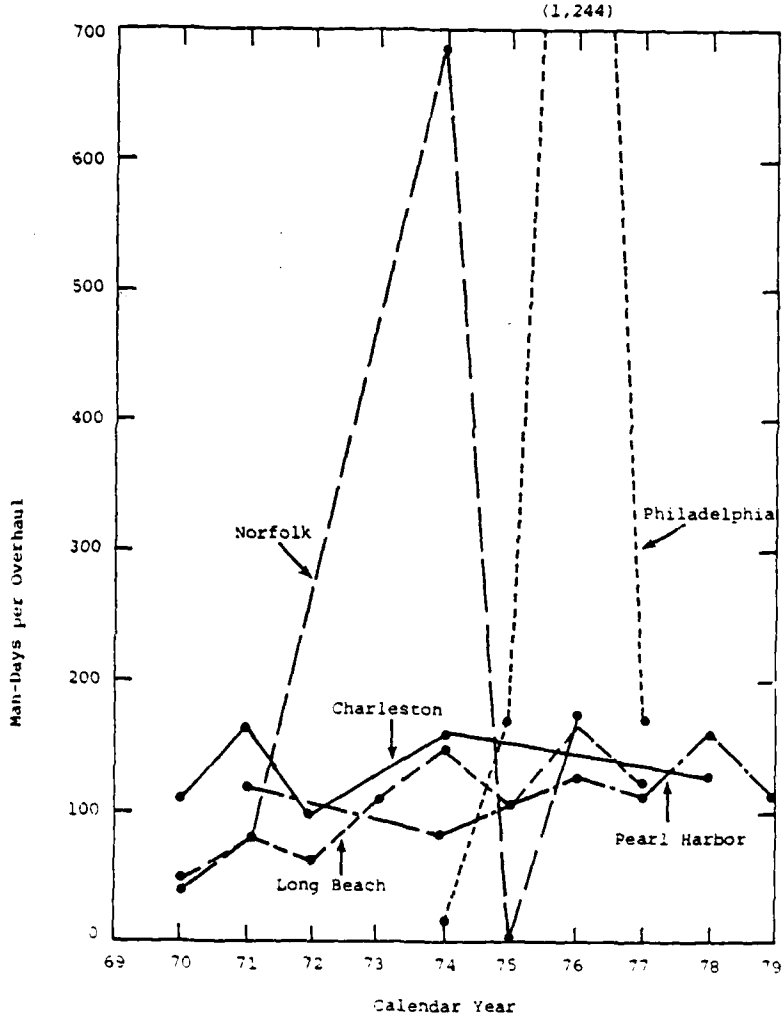


Figure 3-27. SURFACE SEARCH RADAR AN/SPS-10 (SHIPYARD)

Table 3-29. SURFACE SEARCH RADAR AN/SPS-10: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON

Shipyard	1975-1979 Average	Percentage Above (Below) Overall 1975-1979 Average	Percentage of Observations Above 1975-1979 Average
Long Beach	133	(30)	0
Pearl Harbor	127	(33)	0
Charleston	127	(33)	0
Norfolk	123	(35)	33
Philadelphia	452	139	50

3.3.3 Anchor and Chains

Overhaul work on anchor and chains was documented for 35 reviewed overhauls. A graph of the man-day data is provided in Figure 3-28. The material cost comparison for the 1970-1974 and 1975-1979 periods was statistically significant and is presented in Table 3-30.

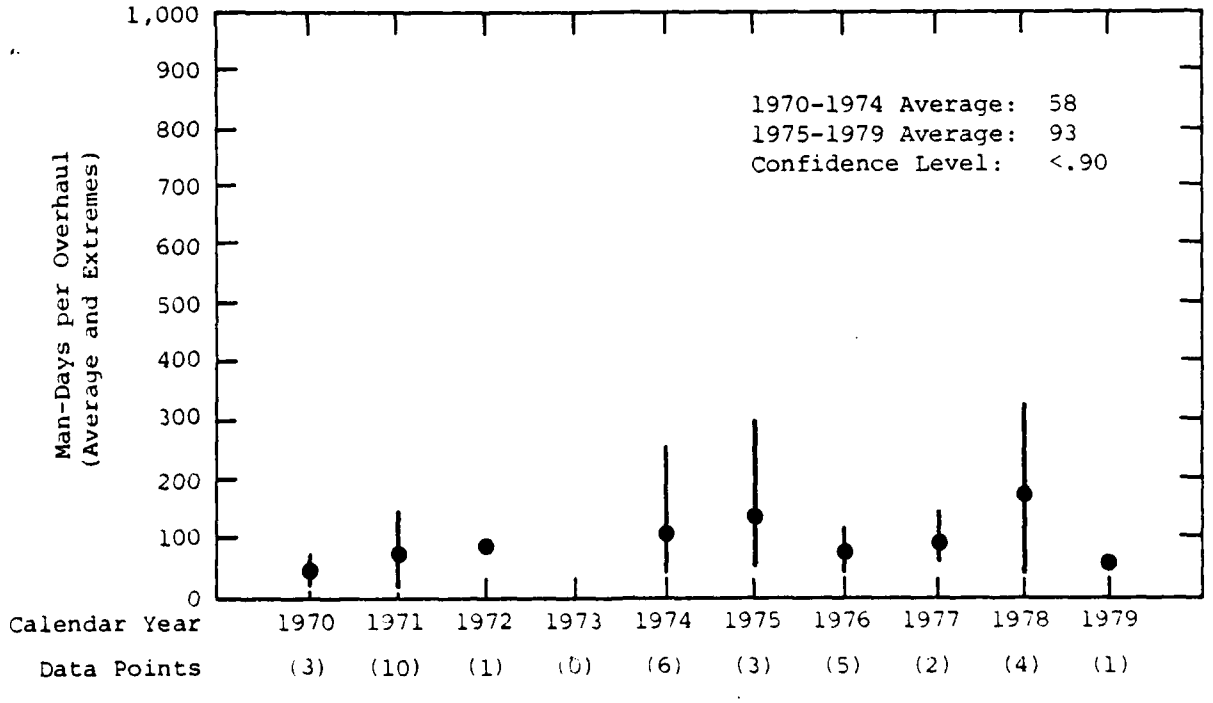


Figure 3-28. ANCHOR AND CHAINS

Table 3-30. RATIO OF ANCHOR AND CHAINS AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS			
Period	Material Costs (in 1980 Dollars)	Man-Days	Material Costs per Man-Day
1970-1974	875	58	$15
1975-1979	3,248	93	35

There were some relatively high man-day data points that did not seem to represent the majority of the data, possibly resulting from the inclusion of chain locker work in the job, as as indicated by some of the shipyard MIS and SARP data that were reviewed.

The rise in adjusted material costs is difficult to understand when considered in the context of a relatively constant man-day expenditure. A possible explanation could be based on the effects of ship aging (i.e., remove and replace vice remove and repair). This effect was not investigated in this report.

Analysis by shipyard (Figure 3-29 and Table 3-31) also shows a very consistent trend. The Charleston shipyard is higher than the other four for the 1970-1979 period and also weights the 1975-1979 overall average.

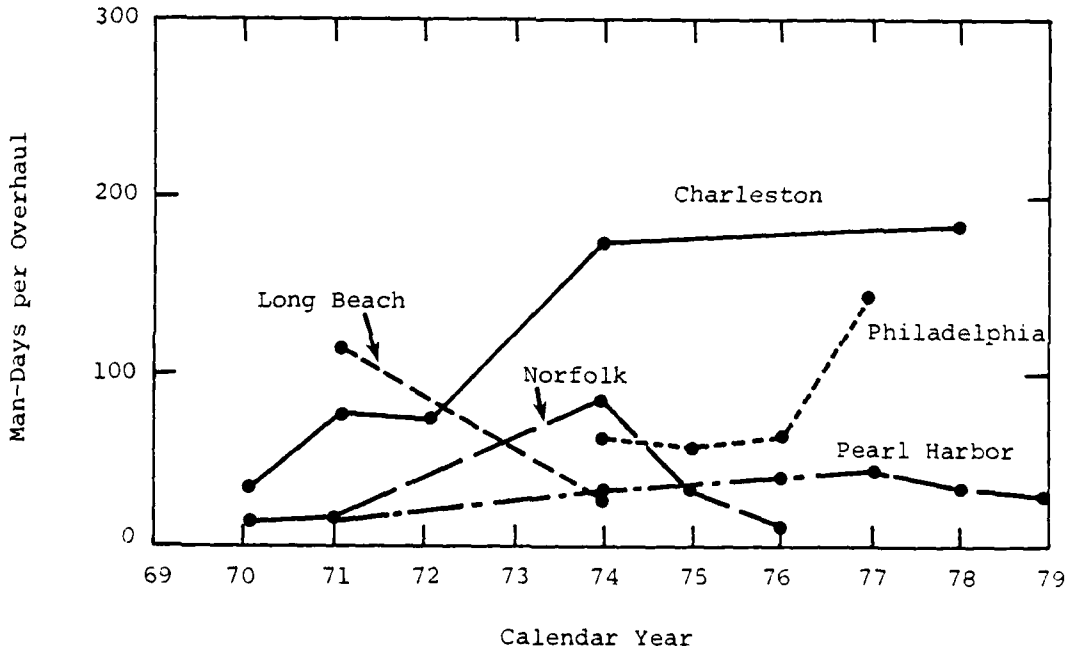


Figure 3-29. ANCHOR AND CHAINS (SHIPYARD)

Table 3-31. ANCHOR AND CHAINS: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON

Shipyard	1975-1979 Average	Percentage Above (Below) Overall 1975-1979 Average	Percentage of Observations Above 1975-1979 Average
Long Beach*	-	-	-
Pearl Harbor	37	(60)	0
Charleston	185	99	50
Norfolk	24	(75)	0
Philadelphia	84	(9)	25

*No Observations

3.3.4 400 Hertz Motor Generator Sets

Overhaul work on 400 Hertz motor generator sets was documented on 46 of the reviewed overhauls. A graph of the man-day data is provided in Figure 3-30. The material cost difference, presented in Table 3-32, was not statistically significant.

Both the statistical analysis and a visual analysis of the data in Figure 3-30 indicate that there has been no significant change in the cost growth factors for this equipment during this time.

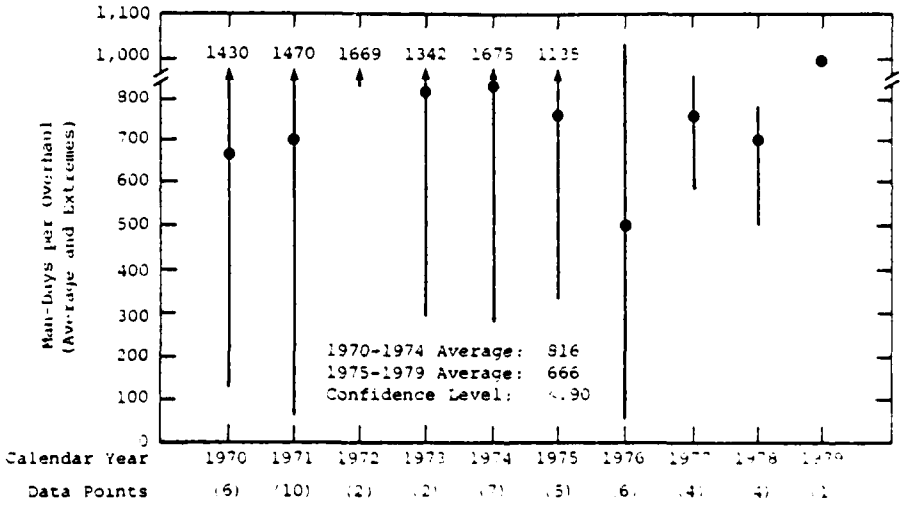


Figure 3-30. 400 HERTZ MOTOR GENERATOR SETS

Table 3-32. RATIO OF 400 HERTZ MOTOR GENERATOR SETS AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS			
Period	Material Costs* (in 1980 Dollars)	Man-Days*	Material Costs per Man-Day
1970-1974	33,541	816	$41
1975-1979	21,985	666	$33
*Difference not statistically significant.			

Analysis of Figure 3-31 and Table 3-33 for individual shipyards provides indications that there was a decrease over the 1970-1979 time period and an apparent stabilization in the 600-800 man-day range.

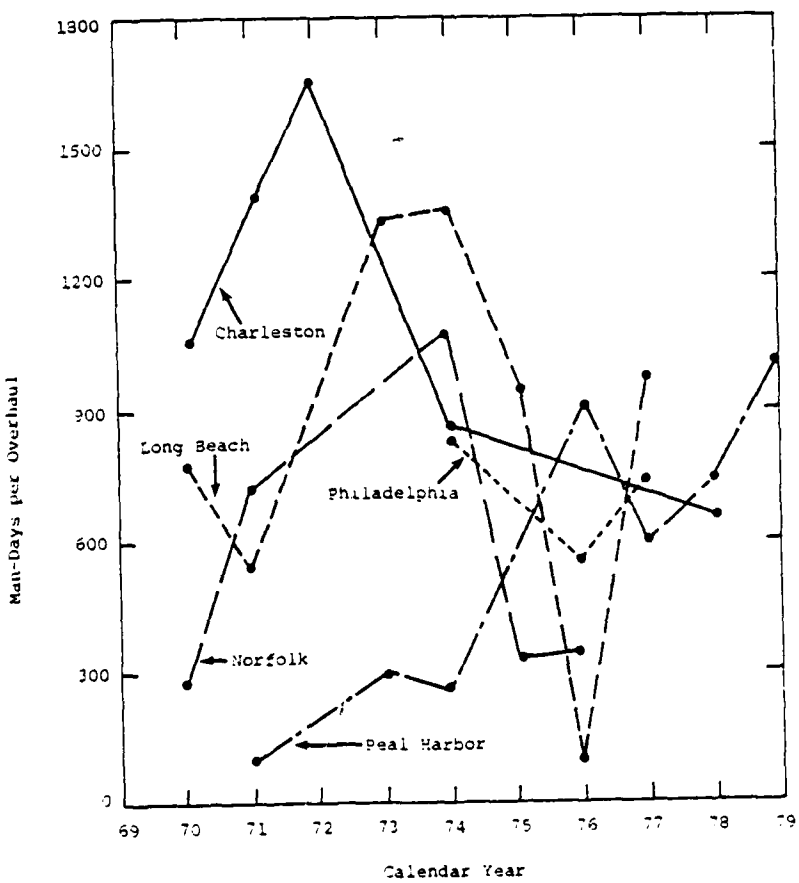


Figure 3-31. 400 HERTZ MOTOR GENERATOR SETS SHIPYARD

Table 3-33. 400 HERTZ MOTOR GENERATOR SETS: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON			
Shipyard	**1975-1979 Average**	**Percentage Above (Below) Overall 1975-1979 Average**	**Percentage of Observations Above 1975-1979 Average**
Long Beach	776	16	50
Pearl Harbor	830	25	75
Charleston	750	13	100
Norfolk	334	(50)	0
Philadelphia	623	(6)	67

This equipment experienced many maintenance related problems in the 1970-1971 time frame. At that time a large, well funded, improvement program was implemented (DART-TYCOM 400 HZ Motor Generator Power Systems Improvement Program) and the results achieved thus far can reasonably be assumed to be the influence shaping the data of Figure 3-31.

3.3.5 Sea Chest

Overhaul work on sea chest was documented in 22 of the reviewed overhauls. The graph of these data is presented in Figure 3-32.

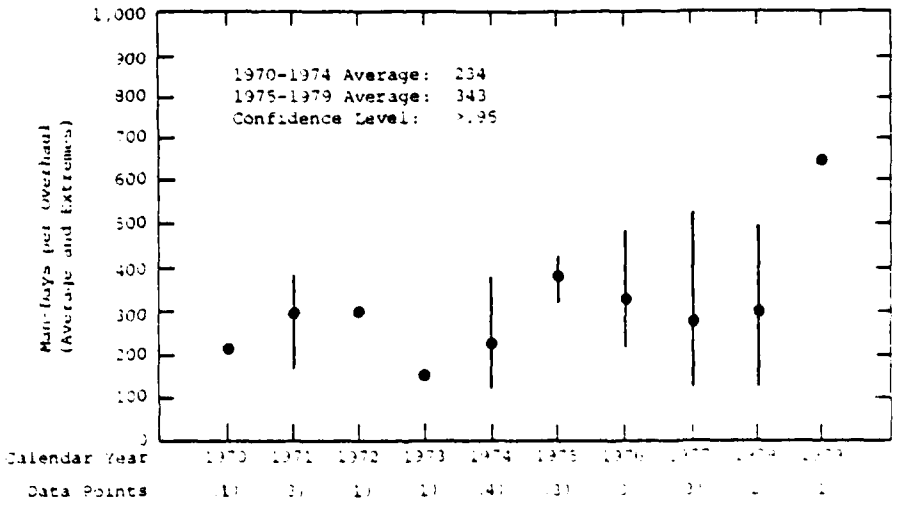


Figure 3-32. SEA CHEST

The difference between 1970-1974 and 1975-1979 man-day averages is statistically significant if all available data points are included. In this case, however, there were two overhauls at Pearl Harbor in 1978 and 1979 which were excluded because modifications to the sea chest lip and associated non-destructive testing was included in the documented man-days. These were excluded because they were not representative of repair man-days. This made the resulting difference not statistically significant as shown in Table 3-34.

Table 3-34. RATIO OF SEA CHESTS AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS

Period	Material Costs* (in 1980 Dollars)	Man-Days *	Material Costs per Man-Day
1970-1974	1,826	234	$9.7
1975-1979	2,234	298	6.5

*Difference not statistically significant.

The data points which were excluded have been plotted on Figure 3-32 and Figure 3-33 (man-days per shipyard). The data of Table 3-35 was calculated using an average of 297 (without the bad data).

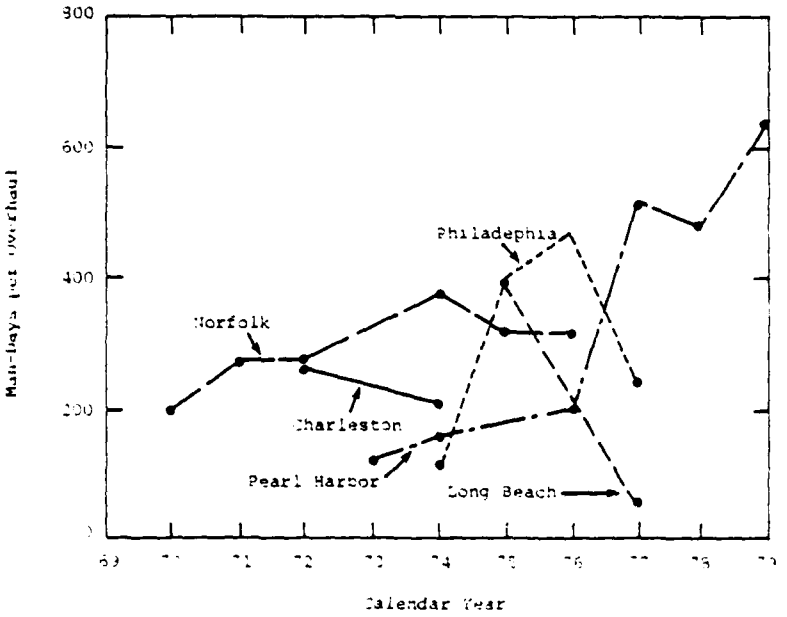


Figure 3-33. SEA CHEST SHIPYARD

Table 3-35. SEA CHESTS: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON

Shipyard	1975-1979 Average	Percentage Above (Below) Overall 1975-1979 Average	Percentage of Observations Above 1975-1979 Average
Long Beach	225	(24)	50
Pearl Harbor	358	20	50
Charleston *	-	-	-
Norfolk	319	7	100
Philadelphia	369	24	67

*No Observations

3.3.6 High-Pressure Air Compressor

Overhaul work on this equipment was identified for 43 of the reviewed overhauls. A graph of the data is provided in Figure 3-34. The material cost comparison provided in Table 3-36 showed no statistically significant difference.

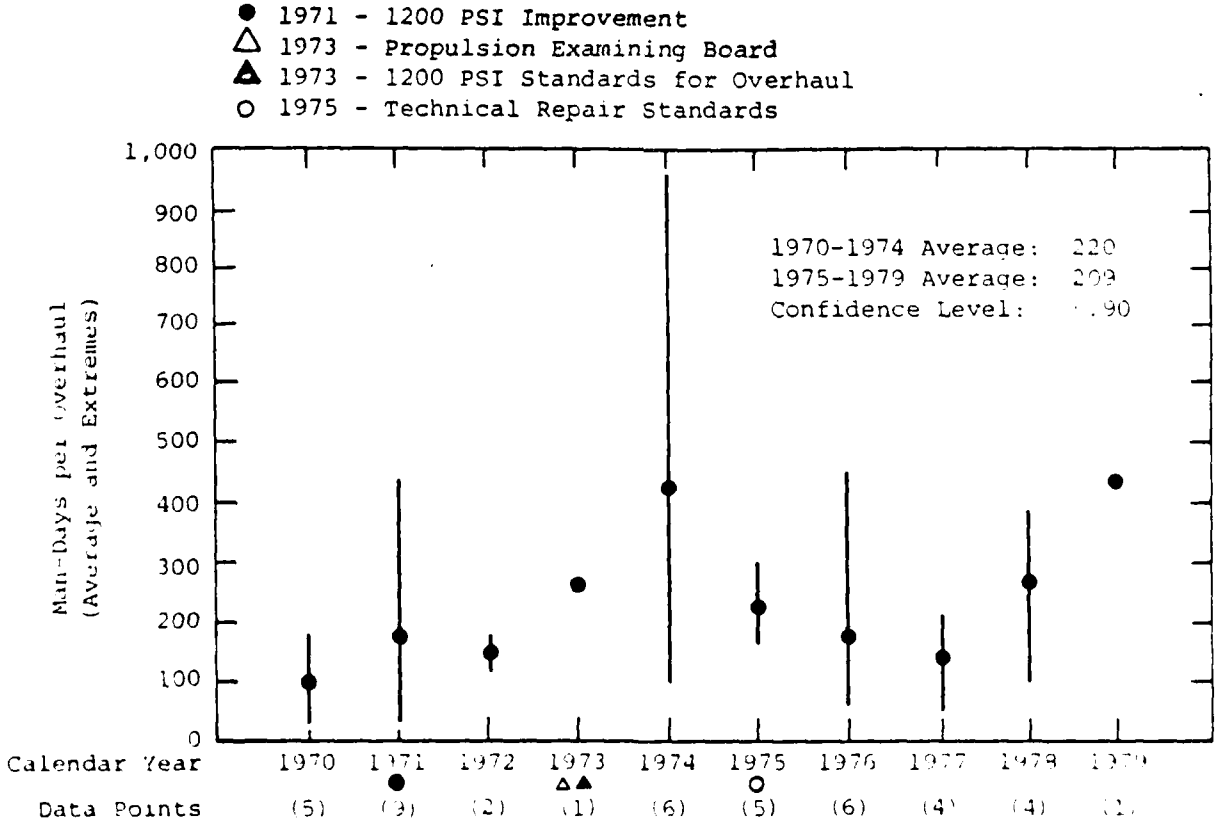


Figure 3-34. HIGH-PRESSURE AIR COMPRESSOR

Table 3-36. RATIO OF HIGH-PRESSURE AIR COMPRESSOR AVERAGE ADJUSTED MATERIAL COSTS TO AVERAGE MAN-DAYS			
Period	Material Costs* (in 1980.Dollars)	Man-Days	Material Costs per Man-Day
1970-1974	15,262	220	$ 69
1975-1979	21,694	207	104
*Difference not statistically significant.			

The lack of any noticeable growth was suprising for this equipment. This equipment would have been affected by the majority of the programs previously identified as causing growth in propulsion system related components. The programs are identified on Figure 3-34.

Review of four overhauls at Pearl Harbor provided a possible explanation for the observed lack of growth. For two of the four overhauls all repair work was subcontracted out of the shipyard. It is not known if this is a general trend but this could account for the lack of growth.

Analysis of the data for each shipyard (Figure 3-35 and Table 3-37) did not provide any additional information about the lack of observed growth. The trend for the 1970-1979 time period appears to be relatively constant.

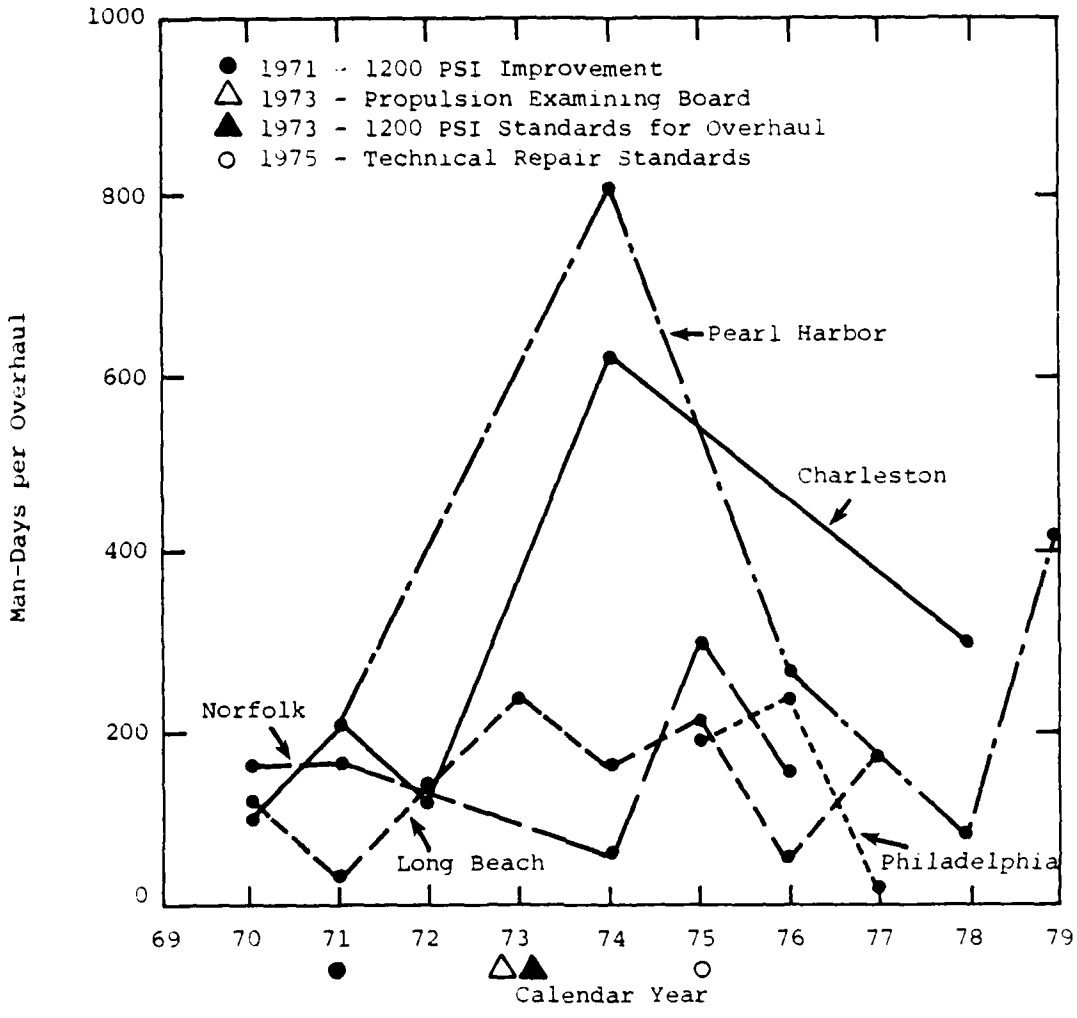


Figure 3-35. HIGH PRESSURE AIR COMPRESSOR (SHIPYARD)

Table 3-37. HIGH PRESSURE AIR COMPRESSOR: 1975-1979 SHIPYARD MAN-DAY COST COMPARISON

Shipyard	1975-1979 Average	Percentage Above (Below) Overall 1975-1979 Average	Percentage of Observations Above 1975-1979 Average
Long Beach	179	(13)	33
Pearl Harbor	220	6	50
Charleston	294	42	100
Norfolk	205	(1)	67
Philadelphia	172	(17)	25

CHAPTER FOUR

CONCLUSIONS

The data used for this study were considered a representative sample for the 17 equipments and tasks that were studied, and these 17 a representative sample of the total spectrum of overhaul effort.

Of the 17 equipments and tasks reviewed, 11 showed a significant increase. Table 4-1 provides a summary of the results of Chapter Three.

Analysis of the data provided the following conclusions:

- Overhaul cost growth appears to be a general trend for most equipment and tasks. The sample analyzed was judged representative of the total population. The 11 equipments and tasks that show a significant man-day growth represent approximately nine percent of the 1975-1979 ship class average (65,101). They also account for approximately nine percent of the ship class growth (31,872) over the two time periods.

- There were no positive indications of any decrease in direct labor productivity in the shipyards. Seven of the 11 equipments and tasks showing man-day growth also showed a statistically significant increase in the average adjusted (1980 dollars) material costs. This indicates possible increases in the range (new work) and scope (expanded effort) of repair work. Increases in the scope appear to be related to a general transition from Class C overhaul to Class B overhaul and an accompanying increase in type commander (TYCOM) routines, etc. Incidence of new work can often be attributed to a specific program or policy change or a related event. The conclusion that there has been no decrease in direct labor productivity is based on the premise that if all material costs are adjusted to a common base, then an increase in cost represents an increase in units or type of material.

- One of the driving factors for the observed increases appears to be the policy and program changes and related events affecting overhaul during this time period. Table 4-2 presents a chronological list of the major events and changes. Throughout this period many program and policy changes have resulted in an expanded maintenance requirement. In addition, less visible influences such as changes in reporting procedures, environmental concerns, modernization programs, and added safety-related requirements have obscured possible causes of growth in overhaul cost.

Table 4-1. SUMMARY OF OVERHAUL COSTS FOR DDG-2 CLASS EQUIPMENTS AND TASKS

Equipment or Task	1970-1974 Average Labor (in Man-Days)	1975-1979 Average Labor (in Man-Days)	Growth (in Percentage)	1970-1974 Average Cost of Materials (in 1980 Dollars)	1975-1979 Average Cost of Materials (in 1980 Dollars)	Growth (in Percentage)
Lagging	131	650	396	13,114	26,091*	*
Refrigeration System	101	258	155	2,550	9,622	277
Main Feed Booster Pump	260	649	150	28,669	26,342*	*
Lube Oil Purifiers	55	133*	*	4,595	9,196	100
Main Fuel Oil Service Pump	327	748	129	14,635	67,354	360
Sea Valves	323	656	95	4,984	13,373	168
Main Condensate Pump	159	316	99	13,926	37,794	171
Fire Pumps	282	550	95	13,806	53,130	285
Propellers	214	380	78	8,622	7,734*	*
Docking	735	1,142	55	3,589	15,468	330
Gyro Compass	350	425	21	24,266	32,540*	*
ASROC Launcher	454	290*	*	14,017	66,228*	*
Surface Search Radar	129	189*	*	23,954	22,985*	*
Anchor and Chains	58	93*	*	875	3,248	271
400 Hz Motor Generator Sets	816	666*	*	33,541	21,985*	*
Sea Chest	234	298	47	1,826	2,234*	*
H.P. Air Compressor	220	207*	*	15,262	21,694	44

*Difference not statistically significant at 90 percent level of confidence.

Table 4-2. EVENTS AND CHANGES	
Year	Event or Change
1964-1973	Ship Availability Changes Relevant to Viet Nam War Requirements
1969	"Thorough ROH" Concept
1971	1200 PSI Improvement Project
1973	Propulsion Examining Board
1973	CNO Objective to Improve Ship Material Condition (#3)
1973	1200 PSI Standards for Overhaul Program
1974	Complete Ship Inspection via POT&I
1975	Heat-Stress Program
1975	Stabilized Man-Day Rate
1975	Use of Technical Repair Standards
1976	Shipyard Surface Quality Assurance Program
1976	Total Ship Test Program
1970-1979	Legislation (OSHA, EPA, EEOC)

- There were positive indications that three of the programs of Table 4-2 could have caused a large portion of the observed overhaul cost growth. These programs are the 1200 psi standards for overhaul, the propulsion examining board, and the use of technical repair standards. Policy and program changes of a general nature (e.g., "Thorough ROH" concept, stabilized man-day rate) were assumed to have affected all ship systems equally. Analysis of the eleven equipments which showed growth indicates that seven of these would have been greatly affected by some combination of the propulsion system related improvement programs. In most cases the timing of the observed growth coincides with a program implementation date. The remaining four which did not appear to be directly affected by these three programs were docking, gyro compass, propellers, and the refrigeration system. While growth for the gyro compass was statistically significant, it was small (21 percent) relative to the other equipments showing growth. Analysis of the docking activity presented several problems. Presumably this task should be stabilized at a constant level when analyzed over a sufficiently long time period. Such stabilization was not found. In addition, many more man-days were documented at Long Beach than at the other shipyards. The scope of this study did not allow thorough evaluation to explain this difference. If it were possible to determine the reasons for differences between shipyards and the effect of growth-inducing programs and policies, if any, on this task, then this area could provide data from which labor productivity measures could be developed.

The factors causing overhaul cost growth for the refrigeration system and propellers could not be objectively established with the data available during this study.

For the six equipments not showing overhaul cost growth during the 1970-1979 time period, five of these would not have been affected by propulsion system related improvement programs. The high pressure air compressor did not show any overhaul cost growth as would have been expected in the context of this conclusion. As noted in Section 3.3.6 the possibility of subcontracting of the effort for this equipment could be the answer for the observed lack of growth, but this hypothesis needs to be tested quantitatively with the appropriate data.

Additional support for this conclusion is provided by the observation that the majority of the equipments showing man-day growth also experienced a significant growth in average adjusted (1980 dollars) material cost which is indicative of an expanded or intensified maintenance requirement.

o Differences in shipyard performance were observed. Analysis of those data for individual shipyards generally supported the previous conclusions which were based on data aggregated over two time periods (1970-1974, 1975-1979). Two shipyards varied significantly form the overall average performance. The Norfolk Naval Shipyard was, on the average, 28.0 percent below the overall 1975-1979 average for each equipment or task. Also, only 33.4 percent of the individual observations (overhauls) for each equipment or task exceedd the 1975-1979 average. The Charleston Naval Shipyard was 21.4 percent over the overall 1975-1979 average for each equipment or task and exceeded the 1975-1979 average for 64.3 percent of the individual observations. These results are presented in Table 4-3 along with the results for the other shipyards.

Table 4-3. SHIPYARD COMPARISON OF PERFORMANCE RELATIVE TO OVERALL 1975-1979 PERFORMANCE

	Average Percentage Above (Below) the 1975-1979 Overall Average	Average Percentage of Time an Individual Observation Exceeded the 1975-1979 Average
Charleston	21.4	64.3
Philadelphia	6.8	47.6
Pearl Harbor	0.6	53.6
Long Beach	(8.4)	37.5
Norfolk	(28.0)	33.4

LIST OF REFERENCES

American Management Systems, Inc., Overhaul Repair Man-Day Work Growth, USS CHARLES F. ADAMS (DDG-2) Class Ships, Report 2152, 13 August 1979.

General Accounting Office, The Navy Overhaul Policy -- A Costly Means of Insuring Readiness for Support Ships, LCD 78-434, 27 December 1978.

ARINC Research Corporation, DDEOC System Maintenance Analysis: DDG-37 Class Firemain and Auxiliary Machinery Cooling Water Systems, SMA 37-201-521, Publication 1652-03-10-1715, February 1978.

ARINC Research Corporation, Effect of Overhaul on Ship Material Condition, Publication 1808-01-0-1546, October 1976.

ARINC Research Corporation, An Analysis to Determine The Suitability of Incorporating the DDG-2 Class into DDEOC, Publication 1653-05-TR-1821, January 1979.

ARINC Research Corporation, Development of Equipment Behavior Measures for Selected Equipments in the Propulsion Plant of DDG-2 Class Ships, Publication 1623-01-1-1347, December 1974.

ARINC Research Corporation, An Analysis of Corrective - Maintenance - Resource Consumption for Seven Destroyer Classes, Publication 1225-01-1-1368, March 1975.

APPENDIX A

EQUIPMENT AND TASK DATA*

This appendix provides a tabulation of the man-day and cost data for each of the equipments and tasks analyzed. These data were extracted from the ship overhaul information available. The following is the table of contents of this appendix:

*Total cost shown in this appendix is the sum of labor and material cost plus an overhead charge not shown in the data.

SEA CHEST

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	**	**	--	--	--
2	DDG-09	04675	P	Long Beach	4/70	**	**	--	--	--
3	DDG-11	04677	A	Charleston	6/70	**	**	--	--	--
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	207	8,145	370	--	[illegible]
6	DDG-07	04673	P	Long Beach	10/70	**	**	--	--	--
7	DDG-06	04672	A	Norfolk	3/70	**	**	--	--	--
8	DDG-18	04684	A	Charleston	12/70	**	**	--	--	--
9	DDG-16	04682	P	Pearl Harbor	1/71	**	**	--	--	--
10	DDG-17	04683	A	Norfolk	1/71	349	14,648	497	--	[illegible]
11	DDG-19	04685	A	Charleston	1/71	**	**	--	--	--
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	**	**	--	--	--
14	DDG-03	04669	A	Norfolk	4/71	296	12,867	500	--	[illegible]
15	DDG-14	04680	P	Hunters Point	7/71	**	**	--	--	--
16	DDG-22	04688	P	Pearl Harbor	7/71	**	**	--	--	--
17	DDG-23	04690	A	Norfolk	6/71	179	7,717	396	--	15,450
18	DDG-13	04679	P	Long Beach	10/71	**	**	--	--	--
19	DDG-04	04670	A	Norfolk	12/71	288	13,345	445	--	26,264
20	DDG-10	04676	A	Charleston	4/72	273	12,297	2,869	--	29,886
21	DDG-08	04674	P	Long Beach	10/72	**	**	--	--	--
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	**	**	--	--	--
24	DDG-21	04687	P	Pearl Harbor	11/73	129	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	**	**	--	--	--
26	DDG-07	04673	P	Long Beach	3/74	**	**	--	--	--
27	DDG-05	04671	A	Norfolk	8/74	375	19,768	1,111	--	43,563
28	DDG-18	04684	A	Charleston	7/74	**	**	--	--	--
29	DDG-06	04672	A	Philadelphia	9/74	112	7,353	--	--	13,223
30	DDG-20	04686	P	Pearl Harbor	9/74	157	--	--	--	--

*No departure report.
**No data available.

(continued)

SEA CHEST (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	214	11,589	1,367	--	28,756
32	DDG-16	04682	P	Puget Sound	1/75	**	**	--	--	--
33	DDG-17	04683	A	Norfolk	4/75	317	17,852	4,939	--	45,781
34	DDG-13	04679	P	Long Beach	6/75	**	**	--	--	--
35	DDG-24	04691	P	Long Beach	7/75	**	**	--	--	--
36	DDG-02	04668	P	Philadelphia	8/75	398	27,469	757	--	54,582
37	DDG-14	04680	P	Long Beach	8/75	386	26,339	811	--	50,189
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	**	**	--	--	--
40	DDG-23	04690	A	Norfolk	2/76	321	19,712	6,281	--	51,541
41	DDG-19	04685	A	Philadelphia	3/76	472	32,638	807	--	67,905
42	DDG-22	04688	P	Pearl Harbor	3/76	199	15,358	1,723	--	32,140
43	DDG-04	04670	A	Norfolk	7/76	**	**	--	--	--
44	DDG-10	04676	A	Philadelphia	8/76	**	**	--	--	--
45	DDG-05	04671	A	Philadelphia	6/77	239	20,045	878	--	43,511
46	DDG-12	04678	P	Long Beach	6/77	**	**	--	--	--
47	DDG-21	04687	P	Pearl Harbor	10/77	517	48,579	3,097	--	94,959
48	DDG-07	04673	P	Long Beach	12/77	65	5,478	716	--	12,087
49	DDG-18	04684	A	Charleston	3/78	**	**	--	--	--
50	DDG-15	04681	P	Puget Sound	3/78	64	5,487	97	--	10,159
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	**	**	--	--	--
54*	DDG-16*	04682	P	Pearl Harbor	11/78	485	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	653	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

PROPELLERS

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	28	1,279	2,400	--	4,631
2	DDG-09	04675	P	Long Beach	4/70	105	5,042	285	--	8,192
3	DDG-11	04677	A	Charleston	6/70	**	**	--	--	--
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	30	1,213	--	--	2,194
6	DDG-07	04673	P	Long Beach	10/70	232	11,566	149	--	18,409
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	**	**	--	--	--
9	DDG-16	04682	P	Pearl Harbor	1/71	304	17,484	2,708	--	32,416
10	DDG-17	04683	A	Norfolk	1/71	38	1,624	198	--	3,272
11	DDG-19	04685	A	Charleston	1/71	**	**	--	--	--
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	**	**	--	--	--
14	DDG-03	04669	A	Norfolk	4/71	656	30,677	13,990	--	69,593
15	DDG-14	04680	P	Hunters Point	7/71	59	3,333	21,642	--	27,336
16	DDG-22	04688	P	Pearl Harbor	7/71	348	19,695	650	--	35,176
17	DDG-23	04690	A	Norfolk	6/71	180	8,878	15	--	15,784
18	DDG-13	04679	P	Long Beach	10/71	144	7,629	294	--	12,610
19	DDG-04	04670	A	Norfolk	12/71	61	2,773	102	--	22,444
20	DDG-10	04676	A	Charleston	4/72	20	1,071	29	--	2,248
21	DDG-08	04674	P	Long Beach	10/72	184	9,987	646	--	17,905
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	218	12,497	655	--	21,492
24	DDG-21	04687	P	Pearl Harbor	11/73	401	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	233	13,594	22,725	--	24,340
26	DDG-07	04673	P	Long Beach	3/74	245	15,169	1,743	--	28,479
27	DDG-05	04671	A	Norfolk	8/74	465	27,600	851	--	60,363
28	DDG-18	04684	A	Charleston	7/74	**	**	--	--	--
29	DDG-06	04672	A	Philadelphia	9/74	172	10,891	70,026	--	90,164
30	DDG-20	04686	P	Pearl Harbor	9/74	364	24,217	1,172	--	46,706

*No departure report.
**No data available.

(continued)

PROPELLERS (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	**	**	--	--	--
32	DDG-16	04682	P	Puget Sound	1/75	**	**	--	--	--
33	DDG-17	04683	A	Norfolk	4/75	655	40,799	3,396	--	90,443
34	DDG-13	04679	P	Long Beach	6/75	3	230	93	--	511
35	DDG-24	04691	P	Long Beach	7/75	377	28,080	9,171	--	59,351
36	DDG-02	04668	P	Philadelphia	8/75	219	14,812	720	--	29,907
37	DDG-14	04680	P	Long Beach	8/75	327	23,726	4,490	--	48,169
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	339	25,265	3,612	--	52,449
40	DDG-23	04690	A	Norfolk	2/76	657	43,450	3,080	--	99,236
41	DDG-19	04685	A	Philadelphia	3/76	476	33,051	1,322	--	69,868
42	DDG-22	04688	P	Pearl Harbor	3/76	394	30,484	1,006	--	60,366
43	DDG-04	04670	A	Norfolk	7/76	520	33,875	2,270	--	76,988
44	DDG-10	04676	A	Philadelphia	8/76	584	42,768	6,378	--	90,922
45	DDG-05	04671	A	Philadelphia	6/77	408	25,997	11,027	--	66,459
46	DDG-12	04678	P	Long Beach	6/77	326	27,676	1,818	--	56,596
47	DDG-21	04687	P	Pearl Harbor	10/77	291	23,948	2,588	--	53,301
48	DDG-07	04673	P	Long Beach	12/77	537	48,469	6,678	32,100	103,384
49	DDG-18	04684	A	Charleston	3/78	**	**	--	--	--
50	DDG-15	04681	P	Puget Sound	3/78	535	46,772	1,683	3,000	88,934
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	9	776	--	--	1,700
54*	DDG-16*	04682	P	Pearl Harbor	11/78	348	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	315	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

MAIN FEED BOOSTER PUMP, TURBINE AND MOTOR

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	23	1,043	294	--	2,127
2	DDG-09	04675	P	Long Beach	4/70	**	**	--	--	--
3	DDG-11	04677	A	Charleston	6/70	**	**	--	--	--
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	**	**	--	--	--
6	DDG-07	04673	P	Long Beach	10/70	3	110	102	--	294
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	**	**	--	--	--
9	DDG-16	04682	P	Pearl Harbor	1/71	423	11,588	2,842	--	23,992
10	DDG-17	04683	A	Norfolk	1/71	164	7,201	4,500	--	18,011
11	DDG-19	04685	A	Charleston	1/71	209	8,907	7,728	--	26,939
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	235	10,541	9,087	--	31,209
14	DDG-03	04669	A	Norfolk	4/71	**	**	--	--	--
15	DDG-14	04680	P	Hunters Point	7/71	91	4,827	1,453	--	10,197
16	DDG-22	04688	P	Pearl Harbor	7/71	--	--	9,418	--	9,418
17	DDG-23	04690	A	Norfolk	6/71	121	5,155	2,852	--	12,896
18	DDG-13	04679	P	Long Beach	10/71	247	12,335	18,455	--	38,884
19	DDG-04	04670	A	Norfolk	12/71	80	3,428	1,003	--	7,745
20	DDG-10	04676	A	Charleston	4/72	**	**	--	--	--
21	DDG-08	04674	P	Long Beach	10/72	293	15,309	37,927	--	66,020
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	156	8,641	19,919	--	34,721
24	DDG-21	04687	P	Pearl Harbor	11/73	--	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	510	29,170	20,821	--	56,459
26	DDG-07	04673	P	Long Beach	3/74	73	4,706	1,081	--	8,990
27	DDG-05	04671	A	Norfolk	8/74	98	5,464	2,256	--	14,261
28	DDG-18	04684	A	Charleston	7/74	1,428	81,963	30,465	--	207,051
29	DDG-06	04672	A	Philadelphia	9/74	**	**	--	--	--
30	DDG-20	04686	P	Pearl Harbor	9/74	**	**	--	--	--

*No departure report.
**No data available.

(continued)

MAIN FEED BOOSTER PUMP, TURBINE AND MOTOR (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	**	**	--	--	--
32	DDG-16	04682	P	Puget Sound	1/75	1,228	76,512	22,386	--	162,316
33	DDG-17	04683	A	Norfolk	4/75	194	13,695	10,943	--	22,055
34	DDG-13	04679	P	Long Beach	6/75	561	37,425	14,554	--	84,260
35	DDG-24	04691	P	Long Beach	7/75	515	13,781	17,197	--	42,577
36	DDG-02	04668	P	Philadelphia	8/75	331	22,096	9,764	--	54,979
37	DDG-14	04680	P	Long Beach	8/75	618	39,728	15,047	--	100,695
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	162	11,715	5,256	--	28,068
40	DDG-23	04690	A	Norfolk	2/76	288	18,282	16,198	--	57,613
41	DDG-19	04685	A	Philadelphia	3/76	**	**	--	--	--
42	DDG-22	04688	P	Pearl Harbor	3/76	581	44,837	35,308	--	122,060
43	DDG-04	04670	A	Norfolk	7/76	**	**	--	--	--
44	DDG-10	04676	A	Philadelphia	8/76	201	14,164	5,419	680	34,050
45	DDG-05	04671	A	Philadelphia	6/77	997	84,225	21,237	--	193,589
46	DDG-12	04678	P	Long Beach	6/77	531	43,255	26,163	8,320	111,680
47	DDG-21	04687	P	Pearl Harbor	10/77	1,252	--	--	--	--
48	DDG-07	04673	P	Long Beach	12/77	545	54,510	41,233	4,500	148,633
49	DDG-18	04684	A	Charleston	3/78	**	**	--	--	--
50	DDG-15	04681	P	Puget Sound	3/78	789	68,444	24,217	--	15,2134
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	**	**	--	--	--
54*	DDG-16*	04682	P	Pearl Harbor	11/78	1,088	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	1,150	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

MAIN CONDENSATE PUMP, MOTOR AND TURBINE

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	**	**	--	--	--
2	DDG-09	04675	P	Long Beach	4/70	**	**	--	--	--
3	DDG-11	04677	A	Charleston	6/70	**	**	--	--	--
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	**	**	--	--	--
6	DDG-07	04673	P	Long Beach	10/70	7	332	155	--	685
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	139	5,502	3,981	--	15,760
9	DDG-16	04682	P	Pearl Harbor	1/71	**	**	--	--	--
10	DDG-17	04683	A	Norfolk	1/71	**	**	--	--	--
11	DDG-19	04685	A	Charleston	1/71	**	**	--	--	--
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	211	9,383	5,779	--	25,495
14	DDG-03	04669	A	Norfolk	4/71	**	**	--	--	--
15	DDG-14	04680	P	Hunters Point	7/71	61	3,410	1,482	--	7,504
16	DDG-22	04688	P	Pearl Harbor	7/71	**	**	--	--	--
17	DDG-23	04690	A	Norfolk	6/71	**	**	--	--	--
18	DDG-13	04679	P	Long Beach	10/71	103	4,924	7,152	--	15,455
19	DDG-04	04670	A	Norfolk	12/71	**	**	--	--	--
20	DDG-10	04676	A	Charleston	4/72	**	**	--	--	--
21	DDG-08	04674	P	Long Beach	10/72	344	9,559	13,140	3,270	45,458
22*	DDG-15	04681	P	Puget Sound	6/73	**	**	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	138	7,489	4,210	--	17,056
24	DDG-21	04687	P	Pearl Harbor	11/73	--	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	345	19,603	12,991	--	47,512
26	DDG-07	04673	P	Long Beach	3/74	314	19,171	18,835	--	24,483
27	DDG-05	04671	A	Norfolk	8/74	11	639	37	--	1,401
28	DDG-18	04684	A	Charleston	7/74	**	**	--	--	--
29	DDG-06	04672	A	Philadelphia	9/74	**	**	--	--	--
30	DDG-20	04686	P	Pearl Harbor	9/74	73	4,520	1,897	--	13,950

*No departure report.
**No data available.

(continued)

MAIN CONDENSATE PUMP, MOTOR AND TURBINE (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	**	**	--	--	--
32	DDG-16	04682	P	Puget Sound	1/75	341	20,040	17,118	--	54,678
33	DDG-17	04683	A	Norfolk	4/75	204	11,435	108,379	--	134,510
34	DDG-13	04679	P	Long Beach	6/75	314	21,171	13,857	--	52,989
35	DDG-24	04691	P	Long Beach	7/75	202	13,781	17,197	--	42,577
36	DDG-02	04668	P	Philadelphia	8/75	**	**	--	--	--
37	DDG-14	04680	P	Long Beach	8/75	192	12,599	5,171	--	29,287
38*	DDG-03	04669	A	Norfolk	10/75			--	--	--
39	DDG-08	04674	P	Long Beach	2/76	408	23,234	18,279	--	63,370
40	DDG-23	04690	A	Norfolk	2/76	154	9,774	30,984	--	53,131
41	DDG-19	04685	A	Philadelphia	3/76	**	**	--	--	--
42	DDG-22	04688	P	Pearl Harbor	3/76	69	5,547	221	--	10,665
43	DDG-04	04670	A	Norfolk	7/76	329	20,610	56,275	--	103,370
44	DDG-10	04676	A	Philadelphia	8/76	239	17,137	1,355	347	43,745
45	DDG-05	04671	A	Philadelphia	6/77	489	41,326	25,094	--	110,883
46	DDG-12	04678	P	Long Beach	6/77	379	30,672	37,892	--	98,770
47	DDG-21	04687	P	Pearl Harbor	10/77	**	**	--	--	--
48	DDG-07	04673	P	Long Beach	12/77	351	28,767	52,523	--	110,899
49	DDG-18	04684	A	Charleston	3/78			--	--	--
50	DDG-15	04681	P	Puget Sound	3/78	754	66,052	26,592	--	149,855
51	DDG-06	04672	A	**	1/78			--	--	--
52	DDG-09	04675	P	**	5/79			--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	**	**	--	--	--
54*	DDG-16*	04682	P	Pearl Harbor	11/78			--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79			--	--	--
56*	DDG-24*	04691	P		12/79			--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79			--	--	--

*No departure report.
**No data available.

MAIN FUEL OIL SERVICE PUMP

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	82	3,290	372	--	6,015
2	DDG-09	04675	P	Long Beach	4/70	**	**	--	--	--
3	DDG-11	04677	A	Charleston	6/70	423	17,208	11,918	--	46,377
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	18	738	208	--	1,589
6	DDG-07	04673	P	Long Beach	10/70	14	644	283	--	1,299
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	115	5,810	204	--	11,489
9	DDG-16	04682	P	Pearl Harbor	1/71	279	13,898	3,005	--	28,646
10	DDG-17	04683	A	Norfolk	1/71	189	7,966	5,515	--	20,805
11	DDG-19	04685	A	Charleston	1/71	570	25,387	13,612	--	66,702
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	525	23,468	10,323	--	59,676
14	DDG-03	04669	A	Norfolk	4/71	85	3,385	1,738	--	8,363
15	DDG-14	04680	P	Hunters Point	7/71	**	**	--	--	--
16	DDG-22	04688	P	Pearl Harbor	7/71	47	3,052	158	--	5,150
17	DDG-23	04690	A	Norfolk	6/71	958	43,572	10,219	--	92,007
18	DDG-13	04679	P	Long Beach	10/71	**	**	--	--	--
19	DDG-04	04670	A	Norfolk	12/71	**	**	--	--	--
20	DDG-10	04676	A	Charleston	4/72	348	16,061	5,553	--	40,690
21	DDG-08	04674	P	Long Beach	10/72	182	9,728	749	1,000	17,601
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	**	**	--	--	--
24	DDG-21	04687	P	Pearl Harbor	11/73	--	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	**	**	--	--	--
26	DDG-07	04673	P	Long Beach	3/74	**	**	--	--	--
27	DDG-05	04671	A	Norfolk	8/74	1,006	55,392	31,627	--	148,768
28	DDG-18	04684	A	Charleston	7/74	10	639	--	--	1,383
29	DDG-06	04672	A	Philadelphia	9/74	**	**	--	--	--
30	DDG-20	04686	P	Pearl Harbor	9/74	665	41,177	11,308	--	90,003

*No departure report.
**No data available.

(continued)

261 MAIN FUEL OIL SERVICE PUMP (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	369	21,717	24,532	--	47,368
32	DDG-16	04682	P	Puget Sound	1/75	701	42,625	18,971	--	98,238
33	DDG-17	04683	A	Norfolk	4/75	327	18,364	24,051	--	66,001
34	DDG-13	04679	P	Long Beach	6/75	655	44,784	21,431	--	103,474
35	DDG-24	04691	P	Long Beach	7/75	702	48,419	19,802	2	108,745
36	DDG-02	04668	P	Philadelphia	8/75	14	798	252	--	2,157
37	DDG-14	04680	P	Long Beach	8/75	564	37,547	12,067	--	81,737
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	466	33,620	18,884	--	83,587
40	DDG-23	04690	A	Norfolk	2/76	268	18,230	50,189	1	90,195
41	DDG-19	04685	A	Philadelphia	3/76	761	55,324	44,047	--	154,190
42	DDG-22	04688	P	Pearl Harbor	3/76	1,057	81,832	33,169	--	191,202
43	DDG-04	04670	A	Norfolk	7/76	**	**	--	--	--
44	DDG-10	04676	A	Philadelphia	8/76	396	28,836	12,806	--	71,269
45	DDG-05	04671	A	Philadelphia	6/77	1,254	104,120	71,714	--	284,313
46	DDG-12	04678	P	Long Beach	6/77	1,362	115,502	77,782	--	303,757
47	DDG-21	04687	P	Pearl Harbor	10/77	967	116,945	85,560	30,640	308,031
48	DDG-07	04673	P	Long Beach	12/77	516	42,405	76,649	--	161,623
49	DDG-18	04684	A	Charleston	3/78	1,039	81,863	134,157	--	316,596
50	DDG-15	04681	P	Puget Sound	3/78	663	56,646	45,953	--	151,130
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	1,139	94,610	82,336	--	280,932
54*	DDG-16*	04682	P	Pearl Harbor	11/78	1,209	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	909	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

LUBE OIL PURIFIERS

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	--	--	550	--	550
2	DDG-09	04675	P	Long Beach	4/70	**	**	--	--	--
3	DDG-11	04677	A	Charleston	6/70	**	**	--	--	--
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	**	**	--	--	--
6	DDG-07	04673	P	Long Beach	10/70	**	**	--	--	--
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	
8	DDG-18	04684	A	Charleston	12/70	**	**	--	--	--
9	DDG-16	04682	P	Pearl Harbor	1/71	**	**	--	--	--
10	DDG-17	04683	A	Norfolk	1/71	**	**	--	--	--
11	DDG-19	04685	A	Charleston	1/71	**	**	--	--	--
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	**	**	--	--	--
14	DDG-03	04669	A	Norfolk	4/71	**	**	--	--	--
15	DDG-14	04680	P	Hunters Point	7/71	**	**	--	--	--
16	DDG-22	04688	P	Pearl Harbor	7/71	**	**	--	--	--
17	DDG-23	04690	A	Norfolk	6/71	**	**	--	--	--
18	DDG-13	04679	P	Long Beach	10/71	**	**	--	--	--
19	DDG-04	04670	A	Norfolk	12/71	**	**	--	--	--
20	DDG-10	04676	A	Charleston	4/72	**	**	--	--	--
21	DDG-08	04674	P	Long Beach	10/72	**	**	--	--	--
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	**	**	--	--	--
24	DDG-21	04687	P	Pearl Harbor	11/73	--	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	65	4,088	2,583	--	9,724
26	DDG-07	04673	P	Long Beach	3/74	27	1,544	1,945	--	4,759
27	DDG-05	04671	A	Norfolk	8/74	76	4,267	4,784	--	13,930
28	DDG-18	04684	A	Charleston	7/74	5	354	--	--	746
29	DDG-06	04672	A	Philadelphia	9/74	**	**	--	--	--
30	DDG-20	04686	P	Pearl Harbor	9/74	100	6,601	2,829	--	15,465

*No departure report.
**No data available.

(continued)

LUBE OIL PURIFIERS (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	**	**	--	--	--
32	DDG-16	04682	P	Puget Sound	1/75	7	361	166	--	882
33	DDG-17	04683	A	Norfolk	4/75	36	2,015	10,271	--	14,790
34	DDG-13	04679	P	Long Beach	6/75	57	3,739	5,582	--	12,592
35	DDG-24	04691	P	Long Beach	7/75	80	5,209	5,324	--	15,142
36	DDG-02	04668	P	Philadelphia	8/75	**	**	--	--	--
37	DDG-14	04680	P	Long Beach	8/75	65	4,044	5,409	--	13,239
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	90	6,846	4,185	--	17,044
40	DDG-23	04690	A	Norfolk	2/76	**	**	--	--	--
41	DDG-19	04685	A	Philadelphia	3/76	95	7,026	145	--	14,001
42	DDG-22	04688	P	Pearl Harbor	3/76	2	175	23	-	350
43	DDG-04	04670	A	Norfolk	7/76	25	1,491	6,300	--	9,673
44	DDG-10	04676	A	Philadelphia	8/76	138	9,939	4,615	4,720	24,326
45	DDG-05	04671	A	Philadelphia	6/77	803	71,302	11,674	3,379	150,343
46	DDG-12	04678	P	Long Beach	6/77	98	8,117	12,661	2,950	28,562
47	DDG-21	04687	P	Pearl Harbor	10/77	199	17,649	5,654	5,900	39,587
48	DDG-07	04673	P	Long Beach	12/77	105	9,268	7,862	--	26,183
49	DDG-18	04684	A	Charleston	3/78	203	15,571	7,559	--	42,497
50	DDG-15	04681	P	Puget Sound	3/78	**	**	--	--	--
51	DDG-06	04 '2	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	**	**	--	--	--
54*	DDG-16*	04682	P	Pearl Harbor	11/78	133	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	--	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

400 HERTZ MOTOR GENERATOR SETS

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	125	6,170	1,257	--	11,724
2	DDG-09	04675	P	Long Beach	4/70	666	31,056	3,926	--	56,164
3	DDG-11	04677	A	Charleston	6/70	1,430	59,227	23,459	--	135,497
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	274	10,340	2,238	--	21,736
6	DDG-07	04673	P	Long Beach	10/70	895	45,125	18,787	23,608	91,105
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	674	29,218	5,280	--	62,423
9	DDG-16	04682	P	Pearl Harbor	1/71	123	6,601	1,390	--	12,891
10	DDG-17	04683	A	Norfolk	1/71	652	27,799	8,226	--	59,571
11	DDG-19	04685	A	Charleston	1/71	1,407	51,525	8,903	--	111,402
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	1,356	44,272	24,905	1,144	147,032
14	DDG-03	04669	A	Norfolk	4/71	720	31,905	6,464	--	64,405
15	DDG-14	04680	P	Hunters Point	7/71	247	13,414	1,870	--	25,610
16	DDG-22	04688	P	Pearl Harbor	7/71	69	3,653	122	--	6,639
17	DDG-23	04690	A	Norfolk	6/71	541	23,649	4,043	--	48,083
18	DDG-13	04679	P	Long Beach	10/71	887	47,768	11,051	--	46,131
19	DDG-04	04670	A	Norfolk	12/71	979	40,636	14,071	--	90,370
20	DDG-10	04676	A	Charleston	4/72	1,669	76,300	21,592	1,229	183,121
21	DDG-08	04674	P	Long Beach	10/72	968	53,622	14,667	3,318	107,093
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	1,342	80,064	11,979	9,141	144,227
24	DDG-21	04687	P	Pearl Harbor	11/73	306	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	1,675	102,549	35,223	--	208,372
26	DDG-07	04673	P	Long Beach	3/74	1,037	65,992	30,485	3	143,856
27	DDG-05	04671	A	Norfolk	8/74	1,181	59,073	16,789	--	141,176
28	DDG-18	04684	A	Charleston	7/74	514	28,067	5,832	--	64,421
29	DDG-06	04672	A	Philadelphia	9/74	834	54,230	13,643	90,006	113,125
30	DDG-20	04686	P	Pearl Harbor	9/74	264	18,562	1,292	--	36,591

*No departure report.
**No data available.

(continued)

400 HERTZ MOTOR GENERATOR SETS (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	1,206	69,113	18,090	3	169,293
32	DDG-16	04682	P	Puget Sound	1/75	509	32,208	2,954	--	59,583
33	DDG-17	04683	A	Norfolk	4/75	324	18,853	5,334	--	45,299
34	DDG-13	04679	P	Long Beach	6/75	1,135	77,340	21,152	--	169,779
35	DDG-24	04691	P	Long Beach	7/75	490	34,212	3,750	--	71,177
36	DDG-02	04668	P	Philadelphia	8/75	--	--	488	--	488
37	DDG-14	04680	P	Long Beach	8/75	1,310	100,458	39,552	--	212,432
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	90	6,442	1,917	--	14,816
40	DDG-23	04690	A	Norfolk	2/76	596	37,588	8,594	--	90,369
41	DDG-19	04685	A	Philadelphia	3/76	43	3,448	--	--	6,362
42	DDG-22	04688	P	Pearl Harbor	3/76	935	78,776	12,972	--	161,378
43	DDG-04	04670	A	Norfolk	7/76	81	5,163	351	--	11,546
44	DDG-10	04676	A	Philadelphia	8/76	1,075	79,351	28,347	34,950	187,244
45	DDG-05	04671	A	Philadelphia	6/77	752	64,615	10,689	--	142,151
46	DDG-12	04678	P	Long Beach	6/77	995	80,813	8,087	--	169,030
47	DDG-21	04687	P	Pearl Harbor	10/77	591	6,395	1,512	--	13,640
48	DDG-07	04673	P	Long Beach	12/77	634	54,998	12,358	--	120,523
49	DDG-18	04684	A	Charleston	3/78	740	58,677	9,415	--	236,390
50	DDG-15	04681	P	Puget Sound	3/78	477	41,909	2,488	--	77,903
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	760	62,650	98,432	--	225,938
54*	DDG-16*	04682	P	Pearl Harbor	11/78	755	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	1,038	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

GYRO COMPASS

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	312	15,529	9,739	1,570	35,065
2	DDG-09	04675	P	Long Beach	4/70	294	13,833	6,033	14,669	29,320
3	DDG-11	04677	A	Charleston	6/70	466	20,754	8,618	--	47,006
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	301	12,069	10,202	16,519	32,385
6	DDG-07	04673	P	Long Beach	10/70	39	1,973	--	--	3,132
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	**	**	--	--	--
9	DDG-16	04682	P	Pearl Harbor	1/71	322	1,386	--	--	2,152
10	DDG-17	04683	A	Norfolk	1/71	309	13,791	6,296	7,865	31,052
11	DDG-19	04685	A	Charleston	1/71	518	24,358	11,850	--	58,908
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	450	22,305	12,509	406	54,603
14	DDG-03	04669	A	Norfolk	4/71	240	10,782	11,837	6,420	31,208
15	DDG-14	04680	P	Hunters Point	7/71	369	21,333	7,231	--	44,059
16	DDG-22	04688	P	Pearl Harbor	7/71	295	16,956	5,210	--	34,047
17	DDG-23	04690	A	Norfolk	6/71	238	10,219	14,332	13,740	33,397
18	DDG-13	04679	P	Long Beach	10/71	391	19,894	8,114	2,758	41,158
19	DDG-04	04670	A	Norfolk	12/71	249	11,515	8,683	390	30,329
20	DDG-10	04676	A	Charleston	4/72	561	29,747	6,484	691	64,931
21	DDG-08	04674	P	Long Beach	10/72	460	24,793	7,301	726	49,853
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	411	23,957	7,718	1,193	47,341
24	DDG-21	04687	P	Pearl Harbor	11/73	265	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	392	23,643	3,771	69	44,001
26	DDG-07	04673	P	Long Beach	3/74	416	25,489	11,044	--	55,319
27	DDG-05	04671	A	Norfolk	8/74	336	19,150	6,921	--	45,071
28	DDG-18	04684	A	Charleston	7/74	**	**	--	--	--
29	DDG-06	04672	A	Philadelphia	9/74	**	**	--	--	--
30	DDG-20	04686	P	Pearl Harbor	9/74	319	19,016	2,239	--	38,455

*No departure report.
**No data available.

(continued)

GYRO COMPASS (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	420	27,919	15,521	1	71,703
32	DDG-16	04682	P	Puget Sound	1/75	614	37,917	10,738	--	84,615
33	DDG-17	04683	A	Norfolk	4/75	**	**	--	--	--
34	DDG-13	04679	P	Long Beach	6/75	347	25,158	3,999	--	50,233
35	DDG-24	04691	P	Long Beach	7/75	401	29,279	3,076	2	57,216
36	DDG-02	04668	P	Philadelphia	8/75	534	35,956	12,042	7,318	86,119
37	DDG-14	04680	P	Long Beach	8/75	399	28,606	7,707	--	61,637
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	319	26,054	11,048	--	59,541
40	DDG-23	04690	A	Norfolk	2/76	327	21,440	37,745	--	84,928
41	DDG-19	04685	A	Philadelphia	3/76	492	35,505	5,225	--	77,782
42	DDG-22	04688	P	Pearl Harbor	3/76	458	4,766	377	--	9,355
43	DDG-04	04670	A	Norfolk	7/76	61	3,803	4,485	--	12,832
44	DDG-10	04676	A	Philadelphia	8/76	600	44,166	7,123	16,936	89,352
45	DDG-05	04671	A	Philadelphia	6/77	597	49,945	13,565	11,625	119,060
46	DDG-12	04678	P	Long Beach	6/77	393	35,524	10,419	35,446	77,608
47	DDG-21	04687	P	Pearl Harbor	10/77	547	5,197	715	2,440	10,603
48	DDG-07	04673	P	Long Beach	12/77	458	43,427	21,986	31,840	103,808
49	DDG-18	04684	A	Charleston	3/78	564	51,510	28,719	8,179	132,767
50	DDG-15	04681	P	Puget Sound	3/78	281	24,419	6,727	--	53,581
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	446	40,605	90,105	20,520	167,425
54*	DDG-16*	04682	P	Pearl Harbor	11/78	436	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	230	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

SURFACE SEARCH RADAR AN/SPS-10

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	51	2,174	543	--	4,520
2	DDG-09	04675	P	Long Beach	4/70	**	**	--	--	--
3	DDG-11	04677	A	Charleston	6/70	168	7,347	1,539	--	15,403
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	46	2,067	220	--	4,238
6	DDG-07	04673	P	Long Beach	10/70	49	2,368	7,073	200	11,360
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	55	2,403	256	--	5,090
9	DDG-16	04682	P	Pearl Harbor	1/71	137	5,272	1,607	--	10,502
10	DDG-17	04683	A	Norfolk	1/71	50	2,182	776	--	4,866
11	DDG-19	04685	A	Charleston	1/71	**	**	--	--	--
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	168	7,757	4,670	560	20,408
14	DDG-03	04669	A	Norfolk	4/71	70	3,299	1,599	--	7,641
15	DDG-14	04680	P	Hunters Point	7/71	177	9,839	4,083	--	21,442
16	DDG-22	04688	P	Pearl Harbor	7/71	109	6,028	2,929	--	13,728
17	DDG-23	04690	A	Norfolk	6/71	115	5,176	1,534	177	11,537
18	DDG-13	04679	P	Long Beach	10/71	80	3,921	2,727	773	9,641
19	DDG-04	04670	A	Norfolk	12/71	**	**	--	--	--
20	DDG-10	04676	A	Charleston	4/72	98	5,253	2,812	--	13,398
21	DDG-08	04674	P	Long Beach	10/72	64	3,381	6,721	72,758	12,922
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	113	6,637	4,670	7,030	16,277
24	DDG-21	04687	P	Pearl Harbor	11/73	**	**	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	186	9,698	5,365	--	23,102
26	DDG-07	04673	P	Long Beach	3/74	127	7,536	7,144	--	21,272
27	DDG-05	04671	A	Norfolk	8/74	681	39,723	12,121	--	93,866
28	DDG-18	04684	A	Charleston	7/74	158	9,730	3,942	--	24,075
29	DDG-06	04672	A	Philadelphia	9/74	18	1,312	--	9,181	2,466
30	DDG-20	04686	P	Pearl Harbor	9/74	83	5,557	2,281	--	13,040

*No departure report.
**No data available.

(continued)

SURFACE SEARCH RADAR AN/SPS-10 (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	163	10,611	4,402	--	26,716
32	DDG-16	04682	P	Puget Sound	1/75	160	9,806	2,587	--	20,996
33	DDG-17	04683	A	Norfolk	4/75	6	339	89	--	843
34	DDG-13	04679	P	Long Beach	6/75	71	5,255	4,002	--	15,353
35	DDG-24	04691	P	Long Beach	7/75	147	10,758	4,721	--	26,967
36	DDG-02	04668	P	Philadelphia	8/75	170	11,160	3,823	7,537	27,649
37	DDG-14	04680	P	Long Beach	8/75	102	7,543	3,267	--	18,916
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	169	12,505	4,436	1	29,249
40	DDG-23	04690	A	Norfolk	2/76	156	11,278	5,880	--	29,327
41	DDG-19	04685	A	Philadelphia	3/76	1,244	92,057	33,727	18,667	211,952
42	DDG-22	04688	P	Pearl Harbor	3/76	125	10,640	7,161	--	27,950
43	DDG-04	04670	A	Norfolk	7/76	208	14,407	4,877	--	35,093
44	DDG-10	04676	A	Philadelphia	8/76	226	16,930	6,023	20,910	40,675
45	DDG-05	04671	A	Philadelphia	6/77	169	13,932	3,067	--	32,604
46	DDG-12	04678	P	Long Beach	6/77	122	10,401	1,225	57,831	21,193
47	DDG-21	04687	P	Pearl Harbor	10/77	109	24,466	4,791	786	57,340
48	DDG-07	04673	P	Long Beach	12/77	188	16,467	3,365	88,860	37,155
49	DDG-18	04684	A	Charleston	3/78	114	10,032	374	9,180	23,657
50	DDG-15	04681	P	Puget Sound	3/78	74	6,195	227	10,870	11,965
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	140	12,878	1,948	19,380	28,049
54*	DDG-16*	04682	P	Pearl Harbor	11/78	163	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	113	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

LAGGING

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	197	9,204	1,978	--	17,293
2	DDG-09	04675	P	Long Beach	4/70	**	**	--	--	--
3	DDG-11	04677	A	Charleston	6/70	48	2,201	5,054	--	9,264
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	79	3,739	1,119	--	7,934
6	DDG-07	04673	P	Long Beach	10/70	101	4,695	4,254	--	11,645
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	**	**	--	--	--
9	DDG-16	04682	P	Pearl Harbor	1/71	36	1,792	2,077	--	5,356
10	DDG-17	04683	A	Norfolk	1/71	88	3,834	4,179	--	11,667
11	DDG-19	04685	A	Charleston	1/71	60	2,684	3,941	--	9,567
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	**	**	--	--	--
14	DDG-03	04669	A	Norfolk	4/71	74	3,196	1,413	--	7,692
15	DDG-14	04680	P	Hunters Point	7/71	362	21,274	14,670	--	51,003
16	DDG-22	04688	P	Pearl Harbor	7/71	41	2,157	2,701	--	6,580
17	DDG-23	04690	A	Norfolk	6/71	**	**	--	--	--
18	DDG-13	04679	P	Long Beach	10/71	44	2,244	4,715	--	8,275
19	DDG-04	04670	A	Norfolk	12/71	136	6,047	2,766	--	14,535
20	DDG-10	04676	A	Charleston	4/72	66	2,700	5,167	--	11,587
21	DDG-08	04674	P	Long Beach	10/72	**	**	--	--	--
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	58	3,526	5,353	--	10,835
24	DDG-21	04687	P	Pearl Harbor	11/73	--	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	**	**	--	--	--
26	DDG-07	04673	P	Long Beach	3/74	**	**	--	--	--
27	DDG-05	04671	A	Norfolk	8/74	**	**	--	--	--
28	DDG-18	04684	A	Charleston	7/74	**	**	--	--	--
29	DDG-06	04672	A	Philadelphia	9/74	33	2,188	--	--	4,028
30	DDG-20	04686	P	Pearl Harbor	9/74	678	47,750	19,876	--	104,554

*No departure report.
**No data available.

(continued)

LAGGING (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	**	**	--	--	--
32	DDG-16	04682	P	Puget Sound	1/75	306	20,075	4,882	--	39,674
33	DDG-17	04683	A	Norfolk	4/75	**	**	--	--	--
34	DDG-13	04679	P	Long Beach	6/75	893	74,063	44,910	--	169,107
35	DDG-24	04691	P	Long Beach	7/75	**	**	--	--	--
36	DDG-02	04668	P	Philadelphia	8/75	**	**	--	--	--
37	DDG-14	04680	P	Long Beach	8/75	312	24,846	2,928	--	46,598
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	**	**	--	--	--
40	DDG-23	04690	A	Norfolk	2/76	**	**	--	--	--
41	DDG-19	04685	A	Philadelphia	3/76	525	37,189	4,871	--	79,952
42	DDG-22	04688	P	Pearl Harbor	3/76	**	**	--	--	--
43	DDG-04	04670	A	Norfolk	7/76	**	**	--	--	--
44	DDG-10	04676	A	Philadelphia	8/76	227	16,541	6,393	--	39,498
45	DDG-05	04671	A	Philadelphia	6/77	**	**	--	--	--
46	DDG-12	04678	P	Long Beach	6/77	**	**	--	--	--
47	DDG-21	04687	P	Pearl Harbor	10/77	**	**	--	--	--
48	DDG-07	04673	P	Long Beach	12/77	**	**	--	--	--
49	DDG-18	04684	A	Charleston	3/78	380	27,695	17,187	--	72,582
50	DDG-15	04681	P	Puget Sound	3/78	**	**	--	--	--
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	1,907	176,238	64,572	--	393340
54*	DDG-16*	04682	P	Pearl Harbor	11/78	--	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	--	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

REFRIGERATION SYSTEM

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	114	5,164	664	--	9,516
2	DDG-09	04675	P	Long Beach	4/70	**	**	--	--	--
3	DDG-11	04677	A	Charleston	6/70	**	**	--	--	--
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	**	**	--	--	--
6	DDG-07	04673	P	Long Beach	10/70	37	1,625	227	--	2,963
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	**	**	--	--	--
9	DDG-16	04682	P	Pearl Harbor	1/71	**	**	--	--	--
10	DDG-17	04683	A	Norfolk	1/71	**	**	--	--	--
11	DDG-19	04685	A	Charleston	1/71	**	**	--	--	
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	13	566	22	--	1,171
14	DDG-03	04669	A	Norfolk	4/71	**	**	--	--	--
15	DDG-14	04680	P	Hunters Point	7/71	**	**	--	--	--
16	DDG-22	04688	P	Pearl Harbor	7/71	49	2,498	2,061	--	6,589
17	DDG-23	04690	A	Norfolk	6/71	**	**	--	--	--
18	DDG-13	04679	P	Long Beach	10/71	**	**	--	--	--
19	DDG-04	04670	A	Norfolk	12/71	3	325	3	--	368
20	DDG-10	04676	A	Charleston	4/72	150	6,987	3,482	--	18,732
21	DDG-08	04674	P	Long Beach	10/72	15	693	897	--	2,096
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	61	3,696	213	--	6,604
24	DDG-21	04687	P	Pearl Harbor	11/73	252	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	48	2,607	2,607	--	7,212
26	DDG-07	04673	P	Long Beach	3/74	**	**	--	--	--
27	DDG-05	04671	A	Norfolk	8/74	28	1,487	24	--	3,293
28	DDG-18	04684	A	Charleston	7/74	264	14,023	6,436	--	37,587
29	DDG-06	04672	A	Philadelphia	9/74	265	16,171	1,890	--	32,444
30	DDG-20	04686	P	Pearl Harbor	9/74	73	4,561	980	--	9,854

*No departure report.
**No data available.

(continued)

REFRIGERATION SYSTEM (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	148	8,642	9,773	--	28,845
32	DDG-16	04682	P	Puget Sound	1/75	531	31,431	6,778	--	64,237
33	DDG-17	04683	A	Norfolk	4/75	85	4,664	572	--	11,190
34	DDG-13	04679	P	Long Beach	6/75	130	8,740	3,330	--	19,758
35	DDG-24	04691	P	Long Beach	7/75	146	9,214	4,954	--	22,183
36	DDG-02	04668	P	Philadelphia	8/75	106	7,224	1,874	--	16,769
37	DDG-14	04680	P	Long Beach	8/75	5	280	592	--	1,072
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	185	13,388	5,699	--	30,842
40	DDG-23	04690	A	Norfolk	2/76	573	33,918	21,362	--	98,712
41	DDG-19	04685	A	Philadelphia	3/76	145	10,736	2,432	--	23,543
42	DDG-22	04688	P	Pearl Harbor	3/76	151	15,988	8,921	--	40,187
43	DDG-04	04670	A	Norfolk	7/76	261	15,535	8,735	--	44,566
44	DDG-10	04676	A	Philadelphia	8/76	76	5,414	2,032	--	13,061
45	DDG-05	04671	A	Philadelphia	6/77	230	18,907	13,296	--	52,185
46	DDG-12	04678	P	Long Beach	6/77	146	11,532	5,751	--	29,057
47	DDG-21	04687	P	Pearl Harbor	10/77	426	36,967	11,009	25	82,794
48	DDG-07	04673	P	Long Beach	12/77	169	14,561	2,718	23	30,732
49	DDG-18	04684	A	Charleston	3/78	308	23,517	8,240	2,690	60,236
50	DDG-15	04681	P	Puget Sound	3/78	370	30,689	10,765	--	67,794
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	325	26,822	13,632	--	67,749
54*	DDG-16*	04682	P	Pearl Harbor	11/78	445	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	537	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

SEA VALVES

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	**	**	--	--	--
2	DDG-09	04675	P	Long Beach	4/70	103	4,309	195	--	7,360
3	DDG-11	04677	A	Charleston	6/70	**	**	--	--	--
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	322	12,617	2,549	0%	25,716
6	DDG-07	04673	P	Long Beach	10/70	151	6,563	1,060	--	12,077
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	417	18,770	6,021	--	44,532
9	DDG-16	04682	P	Pearl Harbor	1/71	341	17,304	1,532	--	32,375
10	DDG-17	04683	A	Norfolk	1/71	274	12,007	861	--	23,259
11	DDG-19	04685	A	Charleston	1/71	735	33,861	5,308	--	73,567
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	583	28,064	4,988	255	59,482
14	DDG-03	04669	A	Norfolk	4/71	345	14,684	3,742	--	31,553
15	DDG-14	04680	P	Hunters Point	7/71	**	**	--	--	--
16	DDG-22	04688	P	Pearl Harbor	7/71	193	7,601	487	--	18,510
17	DDG-23	04690	A	Norfolk	6/71	428	18,691	2,519	--	37,895
18	DDG-13	04679	P	Long Beach	10/71	194	9,731	521	--	16,262
19	DDG-04	04670	A	Norfolk	12/71	257	11,672	1,133	--	23,208
20	DDG-10	04676	A	Charleston	4/72	273	12,298	2,869	--	29,887
21	DDG-08	04674	P	Long Beach	10/72	203	10,575	1,250	--	19,420
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	237	12,733	4,578	--	26,131
24	DDG-21	04687	P	Pearl Harbor	11/73	214	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	288	15,940	1,862	--	28,888
26	DDG-07	04673	P	Long Beach	3/74	362	22,320	5,234	--	44,327
27	DDG-05	04671	A	Norfolk	8/74	344	17,240	5,057	--	43,540
28	DDG-18	04684	A	Charleston	7/74	486	25,916	3,519	--	59,916
29	DDG-06	04672	A	Philadelphia	9/74	493	30,405	273	--	57,080
30	DDG-20	04686	P	Pearl Harbor	9/74	291	16,956	272	--	35,050

*No departure report.
**No data available.

(continued)

SEA VALVES (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	215	11,590	1,367	--	28,757
32	DDG-16	04682	P	Puget Sound	1/75	**	**	--	--	--
33	DDG-17	04683	A	Norfolk	4/75	841	47,919	23,683	--	130,831
34	DDG-13	04679	P	Long Beach	6/75	218	16,183	470	--	30,160
35	DDG-24	04691	P	Long Beach	7/75	370	25,056	6,302	--	51,953
36	DDG-02	04668	P	Philadelphia	8/75	565	37,059	4,175	--	77,950
37	DDG-14	04680	P	Long Beach	8/75	375	25,204	2,045	--	49,287
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	379	26,942	2,719	--	54,912
40	DDG-23	04690	A	Norfolk	2/76	905	58,182	22,404	--	152,346
41	DDG-19	04685	A	Philadelphia	3/76	866	60,536	13,817	--	13,937
42	DDG-22	04688	P	Pearl Harbor	3/76	679	51,013	5,376	--	109,521
43	DDG-04	04670	A	Norfolk	7/76	573	36,652	30,529	--	112,435
44	DDG-10	04676	A	Philadelphia	8/76	448	32,619	6,281	--	70,595
45	DDG-05	04671	A	Philadelphia	6/77	619	49,912	8,168	--	116,127
46	DDG-12	04678	P	Long Beach	6/77	978	76,921	22,210	--	184,996
47	DDG-21	04687	P	Pearl Harbor	10/77	863	75,260	13,807	--	162,249
48	DDG-07	04673	P	Long Beach	12/77	697	60,400	14,964	--	137,286
49	DDG-18	04684	A	Charleston	3/78	455	35,732	4,820	--	84,536
50	DDG-15	04681	P	Puget Sound	3/78	626	51,899	6,198	--	101,643
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	876	70,342	7,940	--	154,324
54*	DDG-16*	04682	P	Pearl Harbor	11/78	1,022	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	770	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

FIRE PUMPS

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	**	**	--	--	--
2	DDG-09	04675	P	Long Beach	4/70	27	1,238	1,512	--	3,587
3	DDG-11	04677	A	Charleston	6/70	**	**	--	--	--
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	**	**	--	--	--
6	DDG-07	04673	P	Long Beach	10/70	5	181	--	--	300
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	**	**	--	--	--
9	DDG-16	04682	P	Pearl Harbor	1/71	280	12,977	3,540	--	27,337
10	DDG-17	04683	A	Norfolk	1/71	**	**	--	--	--
11	DDG-19	04685	A	Charleston	1/71	**	**	--	--	--
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	--	--	384	--	384
14	DDG-03	04669	A	Norfolk	4/71	**	**	--	--	--
15	DDG-14	04680	P	Hunters Point	7/71	27	1,420	789	--	3,298
16	DDG-22	04688	P	Pearl Harbor	7/71	16	--	--	--	--
17	DDG-23	04690	A	Norfolk	6/71	**	**	--	--	--
18	DDG-13	04679	P	Long Beach	10/71	19	875	2,085	--	3,564
19	DDG-04	04670	A	Norfolk	12/71	154	6,718	4,936	--	10,825
20	DDG-10	04676	A	Charleston	4/72	**	**	--	--	--
21	DDG-08	04674	P	Long Beach	10/72	462	24,920	11,793	--	55,079
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	418	24,156	8,162	--	48,789
24	DDG-21	04687	P	Pearl Harbor	11/73	82	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	545	31,629	11,099	--	65,443
26	DDG-07	04673	P	Long Beach	3/74	606	36,294	11,899	--	76,652
27	DDG-05	04671	A	Norfolk	8/74	568	31,792	23,813	--	91,057
28	DDG-18	04684	A	Charleston	7/74	178	10,046	2,175	--	24,321
29	DDG-06	04672	A	Philadelphia	9/74	**	**	--	--	--
30	DDG-20	04686	P	Pearl Harbor	9/74	468	31,181	4,747	--	65,479

*No departure report.
**No data available.

(continued)

FIRE PUMPS (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	653	38,691	38,691	2	130,930
32	DDG-16	04682	P	Puget Sound	1/75	851	52,945	9,570	--	107,786
33	DDG-17	04683	A	Norfolk	4/75	**	**	--	--	--
34	DDG-13	04679	P	Long Beach	6/75	309	22,522	4,155	--	44,757
35	DDG-24	04691	P	Long Beach	7/75	589	40,548	21,983	--	96,749
36	DDG-02	04668	P	Philadelphia	8/75	382	25,465	26,759	659	79,685
37	DDG-14	04680	P	Long Beach	8/75	194	12,794	11,039	--	35,373
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	547	40,243	41,978	--	118,679
40	DDG-23	04690	A	Norfolk	2/76	225	13,648	220,593	--	251,631
41	DDG-19	04685	A	Philadelphia	3/76	502	36,416	19,284	1,318	92,084
42	DDG-22	04688	P	Pearl Harbor	3/76	563	45,732	40,831	--	127,349
43	DDG-04	04670	A	Norfolk	7/76	41	2,418	248	--	5,751
44	DDG-10	04676	A	Philadelphia	8/76	333	24,290	34,670	1,318	82,867
45	DDG-05	04671	A	Philadelphia	6/77	365	31,152	29,655	--	92,637
46	DDG-12	04678	P	Long Beach	6/77	870	73,038	69,294	--	212,063
47	DDG-21	04687	P	Pearl Harbor	10/77	798	61,052	70,178	52,650	184,857
48	DDG-07	04673	P	Long Beach	12/77	665	55,121	56,167	--	166,532
49	DDG-18	04684	A	Charleston	3/78	736	57,674	20,966	--	147,807
50	DDG-15	04681	P	Puget Sound	3/78	432	36,704	10,411	--	79,206
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	936	74,984	36,973	2,590	196,749
54*	DDG-16*	04682	P	Pearl Harbor	11/78	779	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	882	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

HIGH-PRESSURE AIR COMPRESSOR

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	14	651	8	--	1,102
2	DDG-09	04675	P	Long Beach	4/70	**	**	--	--	--
3	DDG-11	04677	A	Charleston	6/70	99	3,781	5,164	--	12,883
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	162	6,602	5,049	--	17,182
6	DDG-07	04673	P	Long Beach	10/70	128	5,734	3,900	--	13,375
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	114	4,650	880	--	10,370
9	DDG-16	04682	P	Pearl Harbor	1/71	11	627	5	--	1,084
10	DDG-17	04683	A	Norfolk	1/71	355	15,359	6,889	--	35,875
11	DDG-19	04685	A	Charleston	1/71	285	13,089	6,272	--	33,176
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	136	6,045	5,156	--	17,798
14	DDG-03	04669	A	Norfolk	4/71	134	5,698	4,508	--	15,342
15	DDG-14	04680	P	Hunters Point	7/71	189	10,279	6,151	--	24,747
16	DDG-22	04688	P	Pearl Harbor	7/71	425	22,002	6,873	--	46,819
17	DDG-23	04690	A	Norfolk	6/71	**	**	--	--	--
18	DDG-13	04679	P	Long Beach	10/71	37	1,716	49	--	2,954
19	DDG-04	04670	A	Norfolk	12/71	5	189	569	--	165
20	DDG-10	04676	A	Charleston	4/72	124	5,421	7,307	223	19,604
21	DDG-08	04674	P	Long Beach	10/72	149	7,771	6,479	1,559	19,881
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	241	13,742	12,184	--	34,483
24	DDG-21	04687	P	Pearl Harbor	11/73	--	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	208	11,620	10,137	--	30,144
26	DDG-07	04673	P	Long Beach	3/74	115	6,807	5,532	--	17,650
27	DDG-05	04671	A	Norfolk	8/74	61	3,555	7,523	--	14,931
28	DDG-18	04684	A	Charleston	7/74	292	15,146	20,587	--	54,775
29	DDG-06	04672	A	Philadelphia	9/74	**	**	--	--	--
30	DDG-20	04686	P	Pearl Harbor	9/74	822	52,130	12,072	--	113,659

*No departure report.
**No data available.

(continued)

HIGH-PRESSURE AIR COMPRESSOR (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	952	54,246	50,235	--	178,608
32	DDG-16	04682	P	Puget Sound	1/75	**	**	--	--	--
33	DDG-17	04683	A	Norfolk	4/75	306	17,173	11,191	--	49,346
34	DDG-13	04679	P	Long Beach	6/75	171	11,644	7,424	--	18,593
35	DDG-24	04691	P	Long Beach	7/75	277	19,499	18,833	--	54,789
36	DDG-02	04668	P	Philadelphia	8/75	185	12,520	7,411	--	33,665
37	DDG-14	04680	P	Long Beach	8/75	209	14,129	11,506	--	37,997
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	55	4,186	3,753	--	11,558
40	DDG-23	04690	A	Norfolk	2/76	276	17,599	45,084	--	84,144
41	DDG-19	04685	A	Philadelphia	3/76	444	27,832	11,613	--	60,097
42	DDG-22	04688	P	Pearl Harbor	3/76	264	21,997	15,107	--	56,262
43	DDG-04	04670	A	Norfolk	7/76	34	2,138	29,753	--	34,547
44	DDG-10	04676	A	Philadelphia	8/76	38	2,855	--	--	5,714
45	DDG-05	04671	A	Philadelphia	6/77	20	1,802	543	--	4,110
46	DDG-12	04678	P	Long Beach	6/77	158	12,945	9,984	--	35,539
47	DDG-21	04687	P	Pearl Harbor	10/77	100	46,188	43,830	--	134,448
48	DDG-07	04673	P	Long Beach	12/77	202	17,887	23,349	--	59,229
49	DDG-18	04684	A	Charleston	3/78	214	16,986	25,711	--	62,358
50	DDG-15	04681	P	Puget Sound	3/78	330	27,913	6,947	--	59,893
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	374	31,743	30,619	--	96,129
54*	DDG-16*	04682	P	Pearl Harbor	11/78	88	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	427	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

AD-A088 443 ARINC RESEARCH CORP ANNAPOLIS MD F/G 13/10
TRENDS AND ASSOCIATED CAUSAL FACTORS FOR COSTS OF WORK PERFORME--ETC(U)
JUN 80 J CASO N00014-79-C-0018
UNCLASSIFIED 1669-01-TR-2186 NL

2 OF 2
AD A088443

END
DATE FILMED
9-80
DTIC

ANCHOR AND CHAINS

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (*Month and Year*)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	**	**	--	--	--
2	DDG-09	04675	P	Long Beach	4/70	**	**	--	--	--
3	DDG-11	04677	A	Charleston	6/70	34	1,233	308	--	2,651
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	16	548	61	--	1,091
6	DDG-07	04673	P	Long Beach	10/70	**	**	--	--	--
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	26	1,132	162	--	2,310
9	DDG-16	04682	P	Pearl Harbor	1/71	18	862	152	--	1,624
10	DDG-17	04683	A	Norfolk	1/71	15	563	80	--	1,233
11	DDG-19	04685	A	Charleston	1/71	78	3,042	660	--	6,741
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	79	3,137	357	--	6,628
14	DDG-03	04669	A	Norfolk	4/71	29	579	1	--	1,122
15	DDG-14	04680	P	Hunters Point	7/71	62	3,232	343	--	5,979
16	DDG-22	04688	P	Pearl Harbor	7/71	17	864	267	--	1,723
17	DDG-23	04690	A	Norfolk	6/71	15	555	80	--	1,235
18	DDG-13	04679	P	Long Beach	10/71	118	6,005	589	--	10,377
19	DDG-04	04670	A	Norfolk	12/71	13	552	82	--	1,196
20	DDG-10	04676	A	Charleston	4/72	72	3,086	177	--	6,783
21	DDG-08	04674	P	Long Beach	10/72	**	**	--	--	--
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	**	**	--	--	--
24	DDG-21	04687	P	Pearl Harbor	11/73	--	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	35	2,012	62	--	3,604
26	DDG-07	04673	P	Long Beach	3/74	**	**	--	--	--
27	DDG-05	04671	A	Norfolk	8/74	85	4,280	507	--	10,167
28	DDG-18	04684	A	Charleston	7/74	102	5,859	577	--	13,169
29	DDG-06	04672	A	Philadelphia	9/74	64	3,762	672	--	8,146
30	DDG-20	04686	P	Pearl Harbor	9/74	33	2,230	13	--	4,130

*No departure report.
**No data available.

(continued)

ANCHOR AND CHAINS (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	255	14,102	7,114	--	40,100
32	DDG-16	04682	P	Puget Sound	1/75	294	17,403	2,464	--	35,140
33	DDG-17	04683	A	Norfolk	4/75	35	1,899	103	--	4,352
34	DDG-13	04679	P	Long Beach	6/75	**	**	--	--	--
35	DDG-24	04691	P	Long Beach	7/75	**	**	--	--	--
36	DDG-02	04668	P	Philadelphia	8/75	59	3,681	48	--	7,663
37	DDG-14	04680	P	Long Beach	8/75	**	**	--	--	--
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	**	**	--	--	--
40	DDG-23	04690	A	Norfolk	2/76	17	1,039	106	--	2,484
41	DDG-19	04685	A	Philadelphia	3/76	62	4,087	2,445	--	11,453
42	DDG-22	04688	P	Pearl Harbor	3/76	40	3,260	662	--	6,827
43	DDG-04	04670	A	Norfolk	7/76	19	1,246	213	--	2,875
44	DDG-10	04676	A	Philadelphia	8/76	69	4,817	1,959	--	11,887
45	DDG-05	04671	A	Philadelphia	6/77	147	11,735	11,179	--	37,384
46	DDG-12	04678	P	Long Beach	6/77	**	**	--	--	--
47	DDG-21	04687	P	Pearl Harbor	10/77	45	3,915	1,030	--	8,352
48	DDG-07	04673	P	Long Beach	12/77	**	**	--	--	--
49	DDG-18	04684	A	Charleston	3/78	329	25,191	6,944	--	61,827
50	DDG-15	04681	P	Puget Sound	3/78	167	13,071	748	--	25,821
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	42	3,337	1,095	--	7,464
54*	DDG-16*	04682	P	Pearl Harbor	11/78	34	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	30	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

ASROC LAUNCHER

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	**	**	--	--	--
2	DDG-09	04675	P	Long Beach	4/70	52	2,425	34	433	4,302
3	DDG-11	04677	A	Charleston	6/70	980	42,439	12,670	--	93,445
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	1,068	43,952	6,442	3,688	87,624
6	DDG-07	04673	P	Long Beach	10/70	577	26,413	12,235	3,421	58,992
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	31	1,525	406	--	3,649
9	DDG-16	04682	P	Pearl Harbor	1/71	210	11,071	4,568	--	24,341
10	DDG-17	04683	A	Norfolk	1/71	239	12,091	740	--	22,495
11	DDG-19	04685	A	Charleston	1/71	287	12,905	12,972	--	39,417
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	**	**	--	--	--
14	DDG-03	04669	A	Norfolk	4/71	43	1,983	115	--	3,783
15	DDG-14	04680	P	Hunters Point	7/71	552	30,377	6,372	--	59,655
16	DDG-22	04688	P	Pearl Harbor	7/71	**	**	--	--	--
17	DDG-23	04690	A	Norfolk	6/71	214	10,106	5,959	--	24,722
18	DDG-13	04679	P	Long Beach	10/71	597	29,335	17,915	3,401	71,654
19	DDG-04	04670	A	Norfolk	12/71	1,345	58,388	30,729	8,958	144,543
20	DDG-10	04676	A	Charleston	4/72	299	14,655	887	2,200	31,820
21	DDG-08	04674	P	Long Beach	10/72	28	1,459	59	--	2,641
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	34	1,746	36	408	3,223
24	DDG-21	04687	P	Pearl Harbor	11/73	--	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	207	12,468	700	--	23,649
26	DDG-07	04673	P	Long Beach	3/74	110	6,274	727	--	12,519
27	DDG-05	04671	A	Norfolk	8/74	320	19,155	5,280	--	45,226
28	DDG-18	04684	A	Charleston	7/74	578	30,844	28,786	--	96,850
29	DDG-06	04672	A	Philadelphia	9/74	2	125	18,322	4,716	18,575
30	DDG-20	04686	P	Pearl Harbor	9/74	855	61,086	36,402	--	155,910

*No departure report.
**No data available.

(continued)

ASROC LAUNCHER (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	438	27,167	26,857	--	86,306
32	DDG-16	04682	P	Puget Sound	1/75	**	**	--	--	--
33	DDG-17	04683	A	Norfolk	4/75	655	39,204	12,322	--	98,363
34	DDG-13	04679	P	Long Beach	6/75	378	25,712	4,510	--	56,352
35	DDG-24	04691	P	Long Beach	7/75	577	40,007	16,751	--	96,970
36	DDG-02	04668	P	Philadelphia	8/75	105	7,129	4,649	12,773	19,272
37	DDG-14	04680	P	Long Beach	8/75	240	16,908	99,772	--	133,875
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	484	34,241	13,077	1	83,525
40	DDG-23	04690	A	Norfolk	2/76	203	13,713	22,369	--	51,701
41	DDG-19	04685	A	Philadelphia	3/76	**	**	--	--	--
42	DDG-22	04688	P	Pearl Harbor	3/76	238	20,329	21,835	1	60,996
43	DDG-04	04670	A	Norfolk	7/76	216	14,420	2,917	--	34,435
44	DDG-10	04676	A	Philadelphia	8/76	2	146	11	--	299
45	DDG-05	04671	A	Philadelphia	6/77	255	22,816	3,550	485,500	47,151
46	DDG-12	04678	P	Long Beach	6/77	301	25,627	1,763	2,400	51,657
47	DDG-21	04687	P	Pearl Harbor	10/77	351	34,542	1,936	2,400	70,220
48	DDG-07	04673	P	Long Beach	12/77	218	19,713	2,684	156,188	42,082
49	DDG-18	04684	A	Charleston	3/78	**	**	--	--	--
50	DDG-15	04681	P	Puget Sound	3/78	156	13,173	2,374	--	27,078
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	254	21,909	3,003	1,710	47,794
54*	DDG-16*	04682	P	Pearl Harbor	11/78	--	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	--	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

DOCKING

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
1	DDG-12	04678	P	San Francisco Bay	1/70	388	18,584	459	--	30,755
2	DDG-09	04675	P	Long Beach	4/70	662	31,277	2,513	--	55,112
3	DDG-11	04677	A	Charleston	6/70	431	18,976	409	--	34,219
4*	DDG-21	04687	P	Pearl Harbor	5/70	--	--	--	--	--
5	DDG-05	04671	A	Norfolk	6/70	550	23,931	714	--	43,872
6	DDG-07	04673	P	Long Beach	10/70	657	33,493	1,336	--	36,154
7	DDG-06	04672	A	Norfolk	3/70	--	--	--	--	--
8	DDG-18	04684	A	Charleston	12/70	373	16,805	2,412	--	33,326
9	DDG-16	04682	P	Pearl Harbor	1/71	279	14,426	1,341	--	26,788
10	DDG-17	04683	A	Norfolk	1/71	193	9,310	6	--	16,604
11	DDG-19	04685	A	Charleston	1/71	439	22,683	11	--	40,537
12*	DDG-24	04691	P	Hunters Point	4/71	--	--	--	--	--
13	DDG-02	04668	A	Charleston	3/71	439	21,929	896	--	40,844
14	DDG-03	04669	A	Norfolk	4/71	293	7,296	93	--	13,101
15	DDG-14	04680	P	Hunters Point	7/71	642	37,381	1,523	--	66,097
16	DDG-22	04688	P	Pearl Harbor	7/71	274	14,055	1,353	--	27,076
17	DDG-23	04690	A	Norfolk	6/71	372	16,381	458	--	29,838
18	DDG-13	04679	P	Long Beach	10/71	1,410	72,216	2,439	--	125,686
19	DDG-04	04670	A	Norfolk	12/71	570	29,690	219	--	52,285
20	DDG-10	04676	A	Charleston	4/72	248	15,386	934	--	30,034
21	DDG-08	04674	P	Long Beach	10/72	2,237	127,642	1,235	--	220,733
22*	DDG-15	04681	P	Puget Sound	6/73	--	--	--	--	--
23	DDG-12	04678	P	Long Beach	8/73	1,896	116,138	2,102	--	210,581
24	DDG-21	04687	P	Pearl Harbor	11/73	--	--	--	--	--
25	DDG-09	04675	P	Long Beach	1/74	1,691	110,778	3,940	--	197,568
26	DDG-07	04673	P	Long Beach	3/74	2,341	156,433	4,351	--	262,266
27	DDG-05	04671	A	Norfolk	8/74	435	28,387	1,070	--	57,731
28	DDG-18	04684	A	Charleston	7/74	177	10,263	481	--	22,661
29	DDG-06	04672	A	Philadelphia	9/74	631	38,125	15,812	--	85,193
30	DDG-20	04686	P	Pearl Harbor	9/74	514	34,913	2,257	--	70,773

*No departure report.
**No data available.

(continued)

DOCKING (continued)

Number	Hull	UIC	Fleet	Location of Overhaul	Mid Point of Overhaul (Month and Year)	Total Man-Days	Labor Cost	Material Cost	Appropriation Purchase Account Material	Total Cost
31	DDG-11	04677	A	Charleston	12/74	962	67,707	7,192	--	140,141
32	DDG-16	04682	P	Puget Sound	1/75	1,037	68,709	38	--	118,542
33	DDG-17	04683	A	Norfolk	4/75	914	64,241	1,271	--	126,298
34	DDG-13	04679	P	Long Beach	6/75	1,785	137,533	5,160	--	260,208
35	DDG-24	04691	P	Long Beach	7/75	1,474	115,133	3,605	--	213,460
36	DDG-02	04668	P	Philadelphia	8/75	435	29,382	3,673	--	60,749
37	DDG-14	04680	P	Long Beach	8/75	2,844	230,874	6,319	--	423,134
38*	DDG-03	04669	A	Norfolk	10/75	--	--	--	--	--
39	DDG-08	04674	P	Long Beach	2/76	1,342	105,045	21,701	--	217,050
40	DDG-23	04690	A	Norfolk	2/76	392	25,394	515	--	48,635
41	DDG-19	04685	A	Philadelphia	3/76	588	40,663	12,040	--	92,906
42	DDG-22	04688	P	Pearl Harbor	3/76	680	56,308	4,420	--	115,435
43	DDG-04	04670	A	Norfolk	7/76	389	25,819	64	--	49,261
44	DDG-10	04676	A	Philadelphia	8/76	1,052	92,799	20,040	4,857	207,173
45	DDG-05	04671	A	Philadelphia	6/77	2,112	195,043	23,924	11,830	385,715
46	DDG-12	04678	P	Long Beach	6/77	2,498	229,113	16,365	3,776	455,327
47	DDG-21	04687	P	Pearl Harbor	10/77	665	63,238	16,530	--	138,013
48	DDG-07	04673	P	Long Beach	12/77	238	21,392	4,145	--	44,210
49	DDG-18	04684	A	Charleston	3/78	1,007	96,134	10,018	939	192,336
50	DDG-15	04681	P	Puget Sound	3/78	1,968	195,402	14,223	268,991	92,786
51	DDG-06	04672	A	**	1/78	--	--	--	--	--
52	DDG-09	04675	P	**	5/79	--	--	--	--	--
53*	DDG-11*	04677	A	Charleston	11/78	1,706	158,231	22,444	--	313,582
54*	DDG-16*	04682	P	Pearl Harbor	11/78	396	--	--	--	--
55*	DDG-20*	04686	P	Pearl Harbor	1/79	459	--	--	--	--
56*	DDG-24*	04691	P		12/79	--	--	--	--	--
57*	DDG-13*	04679	P	Long Beach	11/79	--	--	--	--	--

*No departure report.
**No data available.

APPENDIX B

HISTORICAL INFLATION RATES

Table B-1 contains the historical inflation rates used in the study to adjust material costs to 1980 dollars.

Table B-1. HISTORICAL INFLATION RATES (Obtained from Naval Sea Systems Command O1G)

Year (Sept. to Sept.)	Material Increase*	Labor Increase**	Annual Inflation Rate+	Multiplier for 1980 $
1970	6.2	4.2	5.2	2.112
1971	5.6	2.4	4.0	2.031
1972	2.2	8.2	5.2	1.931
1973	4.5	8.7	6.6	1.811
1974	34.0	5.2	19.6	1.514
1975	6.1	11.1	8.6	1.394
1976	7.4	4.4	5.9	1.317
1977	7.0	5.8	6.4	1.237
1978	8.4	9.8	9.1	1.134
1980			6.2	

*Material increase rate is based on the change in ship construction material cost.
**Labor increase rate is based on Bureau of Labor Statistics data.
+Annual inflation rate is the average of the material and labor rate.

APPENDIX C

TEST FOR DIFFERENCE BETWEEN TWO MEANS

The Student "t" distribution was used to perform the tests reported in this appendix. The results of each test are shown in Table C-1. For both periods, 1970-1974 and 1975-1979, a normal distribution was assumed for the population. The "t" statistic was chosen primarily because of the small sample sizes used. The assumption of equal variance is implicit in this test.

$$H_0: \quad u_1 - u_2 = 0$$

Define

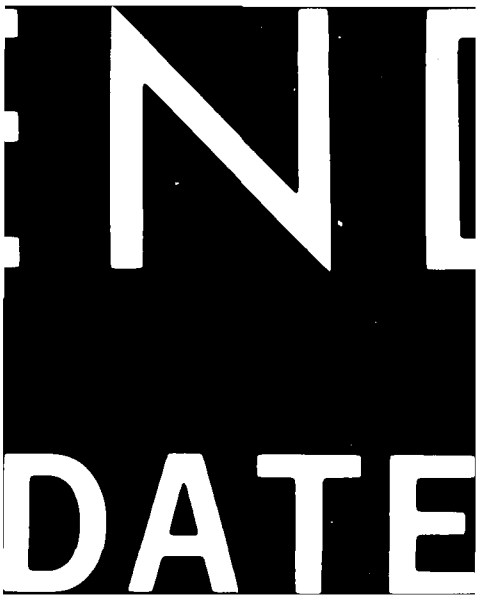
$$\bar{x} = \frac{1}{N_1} \sum_{i=1}^{N_1} x_i \qquad\qquad \bar{y} = \frac{1}{N_1} \sum_{i=1}^{N_2} y_i$$

then

$$t = \frac{\bar{x} - \bar{y}}{\sqrt{\frac{1}{N_1} + \frac{1}{N_2}} \quad \sqrt{\frac{\sum x_i^2 - N_1 \bar{x}^2 + \sum Y_i^2 - N_2 \bar{Y}^2}{N_1 + N_2 - 2}}}$$

Table C-1. RESULTS OF "t" TEST

Equipment or Task	"t" Value (Degrees of Freedom)	
	Man-Days	Material Costs
DDG-2 Class Overhaul	8.37 (40)	2.41 (7)
Docking (Overhaul)	2.01 (45)	3.12 (7)
Docking (Shipyard)	3.46 (32)	
Fire Pumps	3.15 (34)	2.50 (7)
Refrigeration System	3.19 (34)	3.41 (7)
Main Condensate Pump, Motor & Turbine	2.56 (23)	3.44 (7)
Main Feed Booster Pump, Motor & Turbine	3.13 (31)	.16 (7)
Propellers	3.02 (38)	.13 (7)
Lagging	3.28 (21)	1.29 (6)
Sea Valves	5.37 (40)	3.12 (7)
Gyro Compass	2.03 (42)	.51 (7)
HP Air Compressor	.19 (41)	1.43 (7)
Lube Oil Purifiers	.92 (19)	1.43 (7)
400 Hertz Motor Generator Sets	1.17 (45)	1.38 (7)
Anchor and Chains	1.30 (33)	1.48 (6)
Surface Search Radar AN/SPS-10	1.03 (42)	.05 (7)
ASROC Launcher	1.09 (36)	1.27 (7)
Sea Chest	1.81 (21)	.03 (6)
Main Fuel Oil Service Pump	3.81 (36)	2.42 (6)


N
DATE