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OPERATING AND SUPPORT COST ESTIMATING GUIDE, SAMPLE
ANALYSIS NAVY SHIP AT DSARC II(U) COST ANALYSIS
IMPROVEMENT GROUP WASHINGTON D C 01 JAN 80

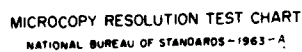
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OPERATING
and
SUPPORT

COST ESTIMATING GUIDE

SAMPLE ANALYSIS
NAVY SHIP AT DSARC II

Office of the Secretary of Defense
Cost Analysis Improvement Group

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1 January 1980

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FORWARD

DOD Directive 5000.4 "OSD Cost Analysis Improvement Group", provided the charter for the Cost Analysis Improvement Group (CAIG) to review and establish criteria, standards, and procedures concerning the preparation and presentation of cost estimates on defense systems to the DSARC and CAIG. In support of this objective, the CAIG has periodically issued guidance for development and presentation of Operating and Support (O&S) costs for OSD review. To date general draft guidance has been made available for aircraft, ships, and ground combat vehicles.

In consonance with that general guidance, the following sample of a CAIG Operating and Support Cost Estimate Report covering a hypothetical case has been developed to further assist the cost analyst in the preparation of cost estimating reports submitted to the DSARC and CAIG during the acquisition process of a new weapon system.

This sample is not intended to imply the existence of a specific acquisition program. Nor does it imply a preference for one analysis technique over another. The sample illustrates how Operating and Support costs can be developed for CAIG review with available data bases and one example of an appropriate format for presentation of cost estimates.

The existing DD963 and fictional class ship data were used only to illustrate the need to relate an estimate to an existing similar system and to ensure a consistent relationship between values and the Cost Element Structure. It is not used to promulgate the use of specific data bases. Each case should address those data which are the most complete and accurate for its purposes. Further, the level of detail depicted in this example may be greater or less than that which is available or appropriate to a specific case.

The sample is designed to complement the Cost Analysis Improvement Group's Ship Cost Development Guide. Jointly, these two documents can provide the basis for a program manager to develop a cost estimate that is acceptable for CAIG review.

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EXECUTIVE SUMMARY

Operating and Support (O&S) costs for the V/STOL and Spruance class destroyers (DD963) are shown below. These figures are compared to the figures presented to the DSARC at Milestone I. Annual operating and support costs of the Air Detachment are not included in this report

DSARC I to DSARC II Comparison
FY 80 \$ - Millions, 1 Ship/yr (less Air Detachment)

<u>Ship</u>	<u>DSARC I</u>	<u>Current Estimate</u>	<u>Remarks</u>
DD963	\$14.0	\$15.6	Increase in POL and reported data base
V/STOL	\$16.1	\$17.2	Increase in POL & manning costs and
Destroyer			increase in data base

The costs growth reflected in both the V/STOL and DD963 class destroyer is due mainly to the rise in POL costs from \$1.25 per gal. to \$1.32 per gal., plus a slight rise in manpower requirements

The Spruance class destroyer was selected as the baseline due to similarities of most ship systems and size. It does not reflect the system being replaced. The V/STOL destroyer is a new concept to meet expanding commitments, to

GUIDANCE: THE EXECUTIVE SUMMARY IS A SIMPLE ONE PAGE NARRATIVE PROVIDING THE BOTTOM LINE COSTS, FORCE SIZE AND MAJOR COSTS DRIVERS, AND ASSUMPTIONS. INCLUDE A BRIEF EXPLANATION OF DIFFERENCES PREDICTED FROM THE BASELINE SYSTEM AND THE DSARC MILESTONE I COST ESTIMATIONS.

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1. INTRODUCTION

The following cost analysis report is submitted in support of Defense Systems Acquisition Review Council (DSARC) Milestone II review of the V/STOL Destroyer program All values included in this report are in FY 80 dollars unless indicated otherwise The operating and support costs of the Air Detachment are not included in this report

GUIDANCE: IDENTIFY THE MILESTONE, MISSION ELEMENT NEEDS STATEMENT (MENS), AND DECISION COORDINATING PAPER (DCP) WITH DATE AND THE BASE YEAR FOR COSTS.

In consonance with the Sea-Based Air (SBA) Master Plan, development of a V/STOL capable destroyer, able to provide for the rapid dispersal of a naval force's close air support capability while offering full support and flexibility to the Navy's sea control and projection missions, is planned

GUIDANCE: INCLUDE A SHORT STATEMENT SUMMARIZING THE MENS/DCP AND ANY SIGNIFICANT DEVIATIONS THAT THE COST ANALYSIS MAKES FROM THE DOCUMENTS.

The objective of this program is to provide a V/STOL destroyer capable of performing sea control and projection missions, and able to survive in the combat environment of the 1990's and beyond

The program uses the basic hull and propulsion unit of the Spruance class destroyer with a V/STOL aircraft landing area and hangar on the ship's stern Use of a proven hull design and many existing ship's subsystems (See Table 3) provides a firm foundation on which to base the Operating and Support cost estimates

GUIDANCE: ALSO, OUTLINE THE PROGRAM, ITS STAGE OF DEVELOPMENT, MAJOR SYSTEM PARAMETERS, AND MAJOR POTENTIAL RISKS THAT IMPACT OPERATING AND SUPPORT (O&S) COSTS.

Table 1 presents the Operating and Support (O&S) costs from Appendix B (C) for the baseline ship (DD963) and the proposed V/STOL capable destroyer

In Table 2 the cost estimates presented at DSARC I are tracked to the current estimate and reasons for significant variances given

GUIDANCE: THE TABLE LISTING THE O&S ANNUAL COSTS FOR A TYPICAL SHIP SHOULD REFLECT THE COST ELEMENT STRUCTURE (CES)

ARRIVED AT THROUGH CONSULTATION WITH THE COST ANALYSIS
IMPROVEMENT GROUP (CAIG). THE COSTS SHOULD ALSO BE COM-
PARED TO THOSE PRESENTED TO THE DSARC AT MILESTONE I AND
THE COSTS DIFFERENTIALS EXPLAINED.

ARTIST'S
RENDITION

Figure 1. V/STOL Capable Destroyer

TABLE 1 ANNUAL OPERATING AND SUPPORT COST COMPARISON
(THOUSANDS, FY80\$)

DD963 CLASS AND V/STOL DESTROYER*

<u>Cost Element</u>	<u>DD963 Class</u>		<u>V/STOL Destroyer</u>	
Direct Unit Costs		\$9,294		\$10,946
Manpower	\$3,519		\$3,630	
TAD	6		6	
Ship POL	4,845		6,450	
Repair Parts	370		372	
Supplies	206		207	
Ammunition	214		107	
Other Expendable Stores	17		17	
Purchased Services	117		157	
Direct Intermediate Maint.		1		90
Afloat Inter. Maint. Activities	57		57	
Shore Inter. Maint. Activities	43		43	
Direct Depot Maintenance		5,374		3,744
Scheduled Ship Overhaul	3,168		3,168	
Non Scheduled Ship Repairs	1,326		1,326	
Fleet Modernization	368		368	
Other Depot	512		512	
Direct Recurring Investment				566
Organizational Exchanges	230		230	
Organizational Issues	336		336	
Depot Exchanges	0		0	
Indirect O&S Costs		269		245
Training	180		181	
Publications	23		23	
Engineering & Tech. Svcs	15		15	
Ammo Handling	51		26	
TOTAL		\$15,603		\$17,231

* Air Detachment costs are not included.

TABLE 2

DSARC I TO DSARC II COMPARISON
ANNUAL OPERATING AND SUPPORT COST
(THOUSANDS, FY80\$)

1 V/STOL DESTROYER (LESS AIR DETACHMENT SUPPORT)

<u>Cost Element</u>	<u>Current Est</u>	<u>DSARC I Est</u>	<u>Change</u>	<u>Comments</u>
Direct Unit Costs	\$10,946	\$9,836		
Manpower	\$3,630	\$3,297	+\$333	
TAD	6	6	-	
Ship POL	6,450	5,705	+ 745	
Repair Parts	372	272	-	
Supplies	207	187	+ 20	
Ammunition	107	107	-	
Other Expendable Stores	17	17	-	
Purchased Services	157	145	12	
Direct Intermediate Maint.	200	5		
Afloat Inter. Maint. Activities	57	55	+ 2	3
Shore Inter. Maint. Activities	143	1	+ 3	3
Direct Depot Maintenance	5,374	5,374		
Scheduled Ship Overhaul	1,168	1,168		
Non Scheduled Ship Repairs	1,326	1,326		
Fleet Modernization	368	368		
Other Depot	512	512		
Direct Recurring Investment	566	566		
Organizational Exchanges	230	230		
Organizational Issues	336	336		
Depot Exchanges	0	0		
Indirect O&S Costs	245	245		
Training	181	181		
Publications	23	23		
Engineering & Tech Svcs	15	15		
Ammo Handling	26	26		
TOTAL	\$17,231	\$16,116	+\$1,115	

1. Originally it was anticipated that the Air Detachment's and the ship's electronics technicians would be mutually supportive. However, this has proven impractical
2. Increase is due to a change in POL cost from \$1.25/gal to \$1.32/gal
3. Increase is due to a change in the FY79 VAMOSC data vice the FY78 data used for DSARC I

2. ASSUMPTIONS AND GROUND RULES

2.1 General

The V/STOL capable destroyer will incorporate a DD963 type hull with most of the ship's subsystems

Although the V/STOL capable destroyer is still under development, the use of the Spruance type hull is a well proven approach Experience has shown that O&S costs covering basic ship operations do not vary significantly with different missions or are accurately predictable. Therefore

GUIDANCE: INCLUDE A GENERAL DESCRIPTION OF SYSTEM CHANGES AND DISCUSS THEIR ANTICIPATED IMPACTS ON O&S COSTS INDICATING THE DEGREE OF CONFIDENCE THAT THE CHANGES ARE PRACTICAL AND COST IMPACTS ARE ACCURATE.

2.2 Baseline System

As in the DSARC I report, the DD963 weapon system is used as the reference system. However, the data base was updated to include the latest year's data. The proposed ship's characteristics and mission environment most closely resemble the Spruance class destroyer

GUIDANCE: IDENTIFY THE BASELINE SYSTEM AND EXPLAIN THE RATIONALE USED IN ITS SELECTION. IF THE BASELINE SYSTEM WAS CHANGED FROM DSARC I EXPLAIN FULLY WHY THE CHANGE WAS NECESSARY.

2.3 System and Program Characteristics

Table 3 illustrates system and program characteristics of the V/STOL capable destroyer and compares them to the baseline system

GUIDANCE: INCLUDE DETAILS OF THE PROPOSED SYSTEM.

TABLE 3. SHIP CHARACTERISTICS
(Typical)

Element	Baseline Spruance Class DD	Proposed Spruance Class DDV-1
Displ (lt)	5830 tons	8,000 tons
Displ (Full)	7810 tons	11,000 tons
Length	563 feet	564 feet
Beam	55 feet	68 feet
Draught	29 feet	30 feet
Aircraft	2 SH-2D (LAM)	2 V/STOL
Guns	2 ea 5 inch (MK 42)	ea 5 inch
A/S Weapons	ASROC tube 2 triple tube (MK 32)	n/c*
Main Engine	2 GE LM 2500 turbine 80,000 SHP 2 shafts	n/c
Speed	33 knots	28 knots
Range	6,000 mi @ 20 knots	4500 mi @ 20 knots
Manning	See Appendix A	See Appendix A
Fire Control	MK 116 (underwater) MK 86 (gunfire) MK 91 (missile FCS) SPQ-60 & SPQ-9 Radars	n/c n/c n/c n/c
Radar	SPS-40 & SPS-55	SPS-48, 55 & TACAN
Rockets	MK 36 Chaffroc	n/c
Sonar	SQS 53	n/c
. . .	. . .	. . .
. . .	. . .	
. . .		

* No change

2.4 Assumptions, Model Inputs, and Rates.

2.4.1 Design Sensitive Values. Table 4 lists the elements that are design-related and dissimilar to the baseline system.

TABLE 4. DESIGN SENSITIVE VALUES				
<u>Elements</u>	<u>Value</u>	<u>Source</u>	<u>Contact</u>	<u>Ext</u>
1. Displacement (lt)	8, 000 tons	PM Projection	Jim Smith	75124
2. Displacement (full)	11, 000 tons	PM Projection	Jim Smith	75124
3. Draught	34 feet	PM Projection	Jim Smith	75124
4. . . .	. . .	. . .	. . .	. . .

2.4.1.1 Displacement (lt). The addition of a flight deck/hanger deck is estimated to add xxxx tons to the basic DD963 displacement weight

2.4.1.2 Displacement (full). The addition of five V/STOL aircraft, the Air Detachment, and increase in fuel requirements, although somewhat offset by the elimination of two LAMPS craft, will

2.4.1.3

GUIDANCE: DIVIDE VALUES USED IN THE COST ESTIMATING MODEL OR ALGORITHMS INTO TABLES DEPENDING ON THE NATURE OF THE PARAMETER INVOLVED.
DESIGN SENSITIVE VALUES TABLE CONTAINS ELEMENTS WHICH ARE INHERENT TO THE SYSTEM DESIGN AND ARE DEPENDENT ON HARDWARE CONFIGURATION. FOLLOWING THIS TABLE IS A BRIEF EXPLANATION OF THE DERIVATION OF THE VALUE SELECTED FOR THE PARAMETER.

2.4.2 System Operational Standards

Table 5 identifies the values used in this analysis which reflect current Navy policy

TABLE 5. SYSTEM OPERATIONAL STANDARDS				
<u>Element</u>	<u>Value</u>	<u>Source</u>	<u>Contact</u>	<u>Ext</u>
1. Ships Complement	290 personnel	See Appendix A		
2. Acft per ship	5 V/STOL	PM Projection	John Doe	73124
3. Overhaul Interval	54 mo	OP 43F	Jack Smith	74189
4. Overhaul Duration	7 mo	OP 43F	Jack Smith	74189
5. Air Detachment	99 personnel	See Appendix A		
5a. Aircrew Ratio	2.0	. . .	. . .	

2.4.2.1 Ship's Complement. The basic DD963 class manning document was used, augmented by flight control personnel

2.4.2.2 Acft per Ship. Although the V/STOL capable destroyer can be designated with sufficient hanger space to accommodate more than 5 aircraft, the capacity for carrying consumable stores

2.4.2.3 . . .

GUIDANCE: LIST THOSE FACTORS ESTABLISHED BY THE USING COMMAND WHICH IMPACT O&S COSTS IN A TABLE. A BRIEF EXPLANATION AND DERIVATION OF THE VALUE SHOWN FOLLOWS THE TABLE.

2.4.3 Standard Values and Rates

Table 6 lists the standard values and rates used in the source

TABLE 6. STANDARD VALUES AND RATES				
<u>Element</u>	<u>Value</u>	<u>Source</u>	<u>Contact</u>	<u>Ext</u>
1. POL Costs (DFM)	\$1.32/gal	OPNAV-51C1	Mary Doe	51234
2. Officer Standard Composite Rate	\$27,000	ASD(COMP) Memo	-	-
3. Enlisted Standard Composite Rate	\$11,500	ASD(COMP) Memo	-	-
4. Escalation Factors	variable	ASD(COMP)	-	-
5. Base Year Dollars	FY 80	CAIG	Tom Mix	75631

GUIDANCE: HIGHLIGHT THOSE STANDARD VALUES WHICH ARE ESTABLISHED AND GENERALLY ACCEPTED IN A TABLE. THESE VALUES ARE NOT SUBJECT TO INFLUENCE BY THE SYSTEM UNDER CONSIDERATION OR THE USING COMMAND.

3. METHODOLOGY

3.1 General.

For this analysis the Navy O&S cost estimating model was used. A summary of this model is provided in Appendix C

GUIDANCE: IF A GENERALLY APPLICABLE COMPUTERIZED COST ESTIMATING MODEL IS USED INSTEAD OF THE SERIES OF ALGORITHMS LISTED IN APPENDIX B OF THIS REPORT, INCLUDE SUMMARY OF THE MODEL USED, AS WELL AS APPROPRIATE COMPUTER PRODUCTS, IN APPENDIX C AND OMIT APPENDIX B.

3.2 Data Sources.

The sources used in defining the baseline costs and the method used in estimating the proposed system's cost are listed in Table 7 for each of the cost elements

GUIDANCE: INCLUDE A MATRIX OF SOURCES AND METHODS IN THE REPORT.

3.3 Data Base.

The cost data for 13 Spruance class destroyers were averaged in determining baseline costs (See page B-2). . . . This minimizes the impact of a specific ship's commitment during the period of cost data collection and at the same time ensures that a cross section of the varied missions of this type ship was included in the cost data

GUIDANCE: IF THE DATA BASE OF THE BASELINE SYSTEM DOES NOT CONTAIN SUFFICIENT UNITS TO ENSURE THAT ALL TYPES OF SHIP'S OPERATIONS ARE CONSIDERED (I.E., UNDERWAY, ASHORE, UNDERGOING IMA, DEPOT OVERHAUL, WEAPONS FIRING, ETC), THE PROPOSED SHIP'S TOTAL OPERATION MUST BE BROKEN INTO ITS ELEMENTAL MISSIONS AND EACH ELEMENT CONSIDERED IN DEVELOPING O&S COST ESTIMATES.

TABLE 7. DATA SOURCE AND METHODOLOGY

DD963 CLASS			V/STOL DESTROYER	
Cost Element	Source	Method Existing Data:	Source	Method
DIRECT UNIT COSTS				
Manpower	OPNAVINST 5320.208 AST (COMP) Memo	Normalized to a ship/yr	Manpower Analysis: ASD (COMP) Memo	See Appendix A
TAD	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Scaled by enlisted population
POL	NEUPAS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Scaled by displacement
Repair Parts	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Less 5 inch gun, plus H,MAX repair
Supplies	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Scaled by total population
Ammunition	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Less one 5 inch gun
Other Expendable Stores	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
Purchased Services	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Scaled by manning differences
DIRECT INTERMEDIATE MAINTENANCE				
Afloat IMA	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
Shore IMA	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
DIRECT MAINTENANCE				
Scheduled Ship Overhaul	Fleet Ship Overhaul Funding Status Report (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
Non Scheduled Repair	N/A	N/A		Baseline figure used
Fleet Modernization	VANOSC-Ships TSS RPT (By type ship) (FY79)	DD class data used	Baseline	Baseline figure used
Other Depot	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
DIRECT RECURRING INVESTMENT				
Organizational Exchanges	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
Organizational Issues	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Scaled by Organizational Exchanges
Depot Issues	No cost reflected, see Organizational Exchanges			
INDIRECT O&S COSTS				
Training	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Scaled by enlisted population
Publications	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
Engineering & Tech Svcs	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used
AMMO Handling	VANOSC-Ships TSS RPT (FY79)	Ave normalized to a ship/yr	Baseline	Baseline figure used less support of one 5-inch gun

3.4 Derivation of Estimates.

In applying the baseline data to the V/STOL capable destroyer and projecting costs it was necessary to establish a proportional relationship between the two systems. These proportions are explained in the following paragraphs.

GUIDANCE: ESTABLISH SOME PROPORTIONAL RELATIONSHIP BETWEEN THE BASELINE SYSTEM AND THE ALTERNATIVES WHEN COST ANALYSIS DATA IS NOT DIRECTLY AVAILABLE FROM THE WEAPON SYSTEM UNDER CONSIDERATION. THIS RELATIONSHIP IS THEN USED TO SCALE THE BASELINE COSTS TO DETERMINE THE ESTIMATED COSTS OF THE ALTERNATIVE SYSTEMS. WHEN THE DERIVATION OF A VALUE USED IN THE COST ANALYSIS IS COMPLEX, PROVIDE A DETAILED EXPLANATION.

3.4.1 Displacement (lt). As a measure of depot overhaul costs, the ship displacement is The derivation of the scalars is as follows.

Scalar = V/STOL capable destroyer disp. ÷ DD963 disp.
Scalar = 8000 ÷ 5830
Scalar = 1.37

3.4.2 Displacement (full). Since the DD963 and the V/STOL capable destroyer have identical hull designs and power plants the operating fuel consumption while underway is directly related to displacement The derivation of the scalar follows

Scalar = V/STOL capable destroyer disp ÷ DD 963 disp.
Scalar = 11,000 ÷ 7810
Scalar = 1.41
....

3.4.3 Depot Scheduled Overhaul Costs

Since the first DD963 is not scheduled for depot overhaul until FY 1982, the baseline costs used the DDG2 Adams class

. . . . The DDG2, Adams class, destroyer was selected as representative rather than the DD931, Forrest Sherman class, because

FY79 COSTS (FY80\$)

DDG - \$12.854M	DDG - \$23.245M	DDG - \$12.777M	DDG - \$13.778M	DDG - \$14.470M	DDG - \$16.395M
DDG - \$17.472M	DDG - \$17.857M	Ave \$16.106M			

Note: The FY79 costs contain a 28% inflation factor for the fleet upgrade overhaul, over and above normal overhaul costs; therefore, the FY79 data reflected has been deflated to compensate

Interval between overhaul	- 54 months
Overhaul duration	- <u>7 months</u>
Overhaul cycle	<u>61 months</u>

annual costs = (overhaul costs + overhaul cycle) x 12 months
annual costs = (\$16.106M ÷ 61 mo) x 12 mo = \$3,168K/ship/yr

4. SENSITIVITY/RISK ANALYSIS

Although the V/STOL capable destroyer is still undergoing development, there is sufficient detail known to provide accurate predictions It is still necessary to provide some sensitivity of the O&S costs to significant programmatic and design parameters

GUIDANCE: INCLUDE AN INDICATION OF THE SENSITIVITY OF THE COSTS AND, WHERE POSSIBLE, CONFIDENCE OF THE ESTIMATES.

4.1 General.

Manpower and POL are the major cost drivers

GUIDANCE: DEVELOP A FURTHER, DETAILED ANALYSIS OF THE COST IMPACT OF EACH COST DRIVER ESPECIALLY THOSE OF WHICH THE VALUE COULD VARY WIDELY. IDENTIFY THE RANGE OF VALUES SELECTED FOR SENSITIVITY ANALYSIS AND THE RATIONALE FOR SELECTION. PRESENT THE RESULTS OF DIFFERENT SENSITIVITIES USING THE SAME GRAPHICAL SCALE WHENEVER POSSIBLE TO FACILITATE A COMPARISON.

4.2 Manning.

The potential for cost avoidance by reducing manning is very slight Manning of the DD963 class, on which the V/STOL destroyer manning is based, reflects minimums predicated on existing Navy ship manning policy. . . . Personnel support facilities on the V/STOL destroyer will not allow significant increases . . .

4.3 POL.

The potential for cost variations in POL costs is caused by two independent variables: unit cost of fuel and consumption Figure 2 depicts the potential POL costs for various consumption rates and unit costs

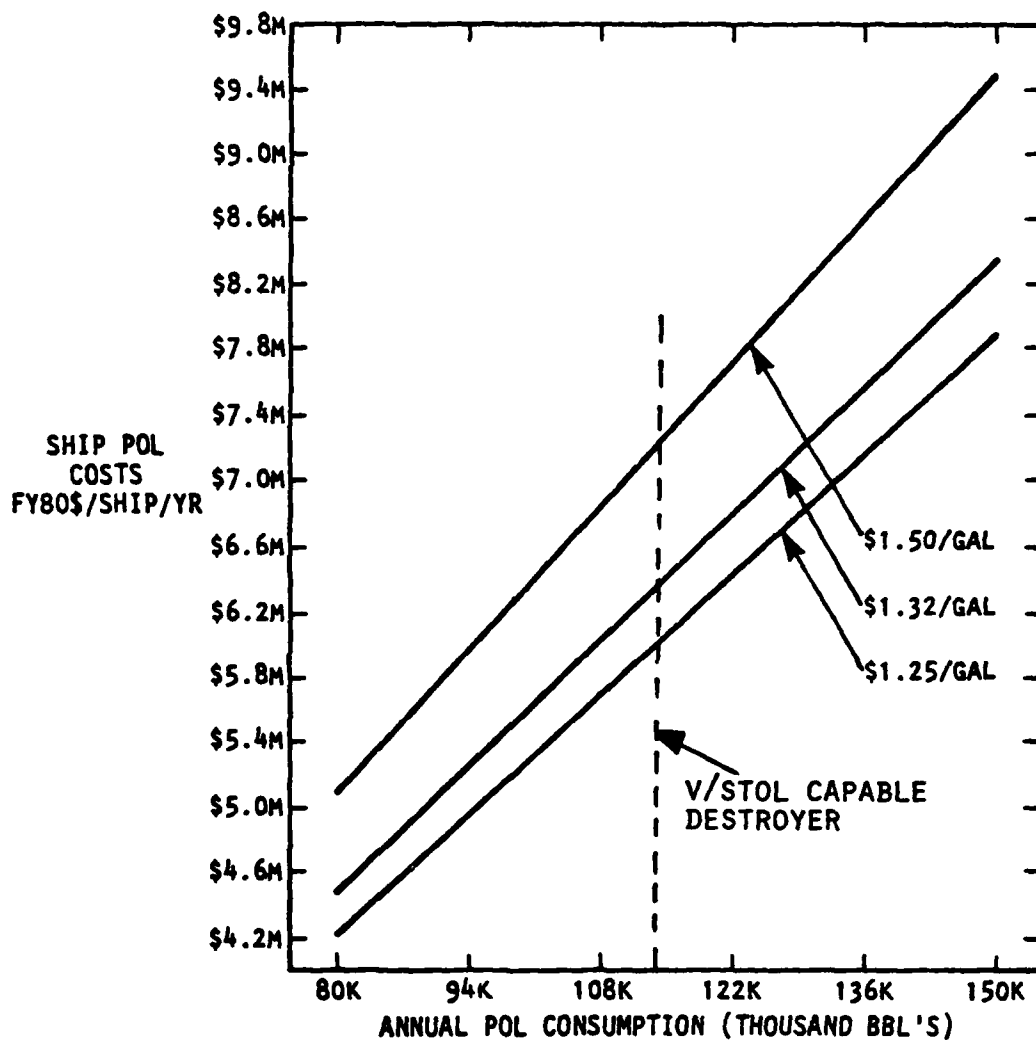


FIGURE 2. POL SENSITIVITY GRAPH

5. SUMMARY

Still to be resolved are the separation of major system repairs from the Other Depot costs

Although the V/STOL destroyer utilizes the existing hull, propulsion and many subsystems of the Spruance class destroyer, the DD963 class, as a whole, has yet to undergo depot overhaul. Therefore

GUIDANCE: INDICATE ISSUES LEFT UNRESOLVED OR THOSE WHICH WILL RECEIVE CLOSE SCRUTINY IN THE FUTURE. IDENTIFY ANTICIPATED REFINEMENTS AND NEW APPROACHES TO THE COST ESTIMATING TECHNIQUES.

APPENDIX A. SHIP'S PERSONNEL

A.1 General.

The V/STOL capable destroyer will have the basic Spruance class destroyer hull and offensive/defensive systems Therefore, the Ship Manpower Document, DD963 Class, was used as the V/STOL destroyer manning document

A.2 5 inch gun.

Within the CA Division there is a reduction of three Gunner's Mates. This is due to the outfitting of one less 5 inch gun

A.3 OA Division.

The OA Division (Air Operations) was added to the V/STOL capable destroyer manning to accommodate the ship operations/flying operations interface. The additional officer and four enlisted personnel will provide the manning in the Combat Information Center

A.4 Air Detachment.

The 99 personnel in the Air Detachment will provide for a 2.0 flight crew ratio and limited aircraft maintenance (Note: These personnel are not costed in this report.)

GUIDANCE: EXPLAIN THE RATIONALE BEHIND MANNING CHANGES TO THE BASELINE SYSTEM. WHEN THE ALTERNATIVE SYSTEM INCORPORATES NEW CONCEPTS OR A RADICAL DEPARTURE FROM EXISTING SYSTEMS/METHODS, EXPLAIN IN DETAIL THE CHANGE AND ITS EXPECTED IMPACT ON MANNING.

A.5 Facilities.

The 101 additional billets will be accommodated by the increase in the ship's size. However, the added space and capacity will not provide for conventional organizational and intermediate level aircraft maintenance or extensive increases in operating spares

GUIDANCE: INCLUDE A DETAILED NARRATION OF FACTORS THAT IMPINGE ON MAINTENANCE MANNING AS A WHOLE, SUCH AS CAPACITY OF FACILITIES, THROWAWAY VS. REPAIR IMPACT, AND MAINTENANCE CONCEPT.

A.6 Personnel Facilities

In order to compensate for the net gain in embarked personnel (Air Detachment on board) berthing space has been increased and habitability standards have been reduced slightly. These reductions include

TABLE A.1 SHIP'S COMPLEMENT

Manning Element -	DD963		V/STOL Destroyer	
	Officer	Enlisted	Officer	Enlisted
Executive Department	2	7	2	7
CO Afloat	1	0	1	0
XO Afloat	1	0	1	0
Executive Division	0	7	0	7
Navigation Department	1	7	1	7
Ship NAVIGAGEN	1	0	1	0
N Division	0	5	0	5
H Division	0	2	0	2
Operations Department	4	84	4	84
Ops Aft NTDS	1	0	1	0
OC Division	1	19	1	19
OI Division	1	25	1	25
OD Division	1	2	1	2
V Division	0	2	0	2
OA Division	0	0	0	0
Combat Systems Department		75		72
Weapons Gen		0		0
CD Division	0	7	1	0
CE Division	1	11	0	7
CI Division	0	6	1	11
CO Division	1	11	0	6
CF Division	1	12	1	11
CA Division	1	28	1	12
Engineering Department	4	65	4	65
Ship Eng CASTBN	1	0	1	0
A Division	0	10	0	10
E Division	1	11	1	11
R Division	1	13	1	13
MP Division	1	31	1	31
Supply Department	2	32	2	32
General Supply	1	0	1	0
S-1 Division	0	5	0	5
S-2 Division	0	19	0	19
S-3 Division	0	6	0	6
S-4 Division	1	2	1	2
Total Ships Complement	18	270	19	271
Air Detachment*	-	-	-	-
Aircrew	-	-	10	-
Maintenance	-	-	0	71
Other	-	-	0	18

*Not included in O&S costs

APPENDIX B. MATHEMATICAL COMPUTATIONS

(All results in thousands)

GUIDANCE: MATHEMATICAL COMPUTATIONS AND FORMULAS/ALGORITHMS LISTED IN APPENDIX B SHOULD NOT BE DUPLICATED IN APPENDIX C. NORMALLY, WHEN APPENDIX B IS USED APPENDIX C IS OMITTED.

The following computations support the cost figures contained in the main body of this report

INVEST

* Figure omitted in average.

DD 963 CLASS

V/STOL DESTROYER

DIRECT UNIT COSTSManpower

Officer x rate = officer costs
18 x \$27,000 = \$486K
Enlisted x rate = enlisted costs
270 x \$11,500 = \$3,105K
Total costs = officer + enlisted costs
\$486K + \$3,105K = \$3,591K/ship/yr

TAD

FY79 costs x escalation = FY80 costs
\$6K x 1.0604 = \$6K/ship/yr

Officer x rate = officer costs
19 x \$27,000 = \$513K
Enlisted x rate = enlisted costs
271 x \$11,500 = \$3,116.5K
Total costs = officer + enlisted costs
\$513K + \$3,117K = \$3,630K/ship/yr

Baseline V/STOL destroyer enlisted
population ÷ DD963 enlisted population
\$6K (271 ÷ 270) = \$6K/ship/yr

Ship POL

DD 963 CLASS

SOURCE: NAVY ENERGY USAGE PROFILE AND ANALYSIS SYSTEMS (NEUPAS, FY 79)

Ship Consumption (bbls) FY79

HULL	UNDERWAY	NOT UNDERWAY	AUXILIARY	TOTAL
96-	87,800	22,800	33	110,633
96-	46,700	14,200	36	60,936
96-	89,800	12,600	5	102,405
96-	102,100	12,700	9	114,809
96-	125,000	9,900	1	134,901
96-	112,300	17,300	27	129,627
97-	85,500	23,800	42	109,342
97-	72,400	27,100	18	99,518
97-	54,300	5,600	5	59,905
97-	38,600	11,400	30	50,030
97-	48,400	15,000	8	63,407
97-	27,000	22,300	17	50,707
97-	31,000	18,000	18	50,105
Total	99,808	16,410	126	116,344
Average (AVG)	70,864	16,410	126	87,400

Ave annual consumption unit cost = ship POL cost
 $87,400 \text{ bbls} \times 42 \text{ gal/bbl} \times \$1.32/\text{gal} = \$4,845K/\text{ship/yr}$

V/STOL DESTROYER

Baseline underway x (V/STOL destroyer displacement (full) + DD963 displacement (full)) = bbls underway

bbls underway + baseline bbls not underway + baseline bbls auxiliary = total bbls

total bbls x 42 gal/bbls x \$1.32/gal = POL costs

$70,864 \times (11,000 \text{ tons} + 7810 \text{ tons}) = 99,808 \text{ bbls}$

$99,808 \text{ bbls} + 16,410 \text{ bbls} + 126 \text{ bbls} = 116,344 \text{ bbls}$

$116,344 \text{ bbls} \times 42 \times \$1.32 = \$6,450K/\text{ship/yr}$

DD 963 CLASS

V/STOL DESTROYER

Repair Parts

FY 79 costs x escalation = FY80 costs
 $\$349K \times 1.0604 = \$370K/\text{ship/yr}$

Supplies

FY79 costs x escalation = FY80 costs
 $\$194K \times 1.0604 = \$206K/\text{ship/yr}$

Ammunition (5 inch gun)

FY79 cost x escalation = FY80 costs
 $\$202K \times 1.0604 = \$214K/\text{ship/yr}$

Other Expendable Stores

FY79 costs x escalation = FY80 costs
 $\$16K \times 1.0604 = \$17K/\text{ship/yr}$

Purchased Services

Service	FY79	FY80
Printing	\$1K	\$1K
ADP & contract svc	0	0
Rent & utilities	0	\$81K

Communications	0	0
Other	\$33K	\$35K

Total \$117K/ship/yr

Baseline - (cost of one 5 inch gun
 plus increase cost of H, M & E parts)
 $\$370K - (\$1K + \$3K) = \$372K/\text{ship/}$
 year

Baseline x (V/STOL destroyer manning
 + DD 963 class manning)
 $\$206K \times (290 + 288) = \$206K/\text{ship/}$

Baseline x (no. of guns on V/STOL
 Destroyer + no. of guns on DD963 class
 Destroyer)
 $\$214K (1+2) = \$428K/\text{ship/year}$

Baseline equipment = V/STOL destroyer
 equipment
 $7K/\text{ship/yr}$

No change = \$1K

No change = 0

Baseline x (V/STOL destroyer manning
 + Air detachment manning) + DD963
 manning
 $\$81K \times (290 + 99) + 288 = \$109K$

No change = 0

Baseline x (V/STOL destroyer manning
 + Air detachment manning) + DD963
 manning
 $\$35K \times (290 + 99) + 288 = \$47K$

\$157K/ship/yr

DIRECT INTERMEDIATE MAINTENANCEAfloat IMA

FY79 costs x escalation = FY80 costs
 $\$53K \times 1.0604 = \$57K/\text{ship/yr}$

Baseline = V/STOL destroyer
 $\$57K/\text{ship/yr}$

Shore IMA

FY79 costs x escalation = FY80 costs
 $\$41K \times 1.0604 = \$43K/\text{ship/yr}$

Baseline = V/STOL destroyer
 $\$43K/\text{ship/yr}$

DIRECT DEPOT MAINTENANCE

DD 963 CLASS

V/STOL DESTROYER

Scheduled Ship Overhaul

FY80 costs (see para 3.5) = \$3168K/
ship/yr

Baseline figure used

Non Scheduled Repair

FY79 costs (see table 7) x escalation
\$1,250K x 1.0604 = \$1326K/ship/yr

Baseline figure used

Fleet Modernization

FY79 cost x escalation = FY80 costs
\$347K (DD class) x 1.0604 =
\$368K/ship/yr

Baseline figure used

Other Depot

(Other depot + ord rework) x escalation = DD 963 cost = V/STOL destroyer cost
(\$480K + \$3K) x 1.0604 = \$512K/ship/yr \$512K/ship/yr
Note: H, M & E and electronic rework breakout available

DIRECT RECURRING INVESTMENT

Organizational Exchanges

FY79 costs x escalation = FY80 costs
\$217K x 1.0604 = \$230K/ship/yr

DD 963 costs = V/STOL destroyer costs
\$230K/ship/yr

Organizational Issues

FY 79 costs x escalation = FY80 costs
\$317K x 1.0604 = \$336K/ship/yr

DD963 costs x (V/STOL destroyer organi-
zational exchanges + DD963 organizational
exchanges)
\$336K x (230 ÷ 230) = \$336K/ship/yr

Depot Exchanges

Figures reflected under organizational
exchanges

INDIRECT O & S COSTS

Training

FY79 costs x escalation = FY80 cost
\$170K x 1.0604 = \$180K/ship/yr

Baseline cost x (V/STOL destroyer
enlisted population ÷ DD963 enlisted
population)
\$180K x (271 ÷ 170) = \$181K/ship/yr

DD963

V/STOL DESTROYER

Publications

FY79 cost x escalation = FY80 cost
 $\$22K \times 1.0604 = \$23K/\text{ship/yr}$

DD963 cost = V/STOL destroyer cost
 $\$23K/\text{ship/yr}$

Engineering and Technical Services

FY79 cost x escalation = FY80 cost
 $\$14K \times 1.0604 = \$15K/\text{ship/yr}$

DD963 cost = V/STOL destroyer cost
 $\$15K/\text{ship/yr}$

Ammo Handling

FY79 cost x escalation = FY80 cost
 $\$48K \times 1.0604 = \$51K/\text{ship/yr}$

Baseline (no of guns on V/STOL
destroyer ÷ no of guns on DD963 class
destroyer)
 $\$51K \times (1 \div 2) = \$26K/\text{ship/yr}$

APPENDIX C. O&S COST ESTIMATING MODEL

C.1 General.

For this analysis the Navy . . . model was used This model is a deterministic mathematical model which is preprogrammed and modularly structured

C.2 Use & Application

This model has been in use since . . . calculates annual ships operating costs

C.3 Model Logic.

Table C-1 lists the algorithms used in the model logic

C.4 Results.

Tables C.2.A through C.2. () are the computer products identifying both input values and results for each alternative

GUIDANCE: WHEN APPENDIX C IS USED APPENDIX B WILL BE OMITTED,
THE FORMAT USED AND THE INFORMATION PROVIDED IN
APPENDIX C DEPEND ON THE COMPUTER MODEL USED.

TABLE C.1. O&S COST ESTIMATING MODEL ALGORITHMS

Direct Unit Costs

Manpower

$$A = \text{Officer} \times \text{officer rate} + \text{enlisted} \times \text{enlisted rate} + \text{civilian} \times \text{civilian rate}$$

Temporary Additional Duty

B = Baseline x proposed enlisted manning ÷ Baseline enlisted manning

POL

B = Underway consumption mix x steaming hours mix x scalar + not underway and auxillary

C = Results of B x unit costs

Repair Parts

D = 000

O O

Engineering and Technical Services

TT =

Ammo Handling

UU = ...

TABLE C.2.A. (CONTINUED) ANNUAL SHIP OPERATION AND SUPPORT ANALYSIS
 TIME: 1719.0 Fri 01/08.80 DATA FILE:

RUN RESULTS:

Direct Unit Costs		\$10,946
Manpower	3630	
TAD	6	
Ship POL	6450	
Repair Parts	372	
Supplies	207	
Ammunition	107	
Other Expendable Stores	1	
Purchased Services		
Direct Intermediate Maint.		\$ 100
Afloat Inter. Maint. Activities		
Shore Inter. Maint. Activities		
Direct Depot Maintenance		\$ 5,374
Scheduled Ship Overhaul	328	
Non-scheduled Ship Repairs	326	
Fleet Modernization	368	
Other Depot	512	
Direct Recurring Investment		\$ 566
Organizational Exchanges	230	
Organizational Issues	336	
Depot Exchanges	0	
Indirect O & S Costs		\$ 245
Training	181	
Publications	23	
Engineering and Tech. Svcs.	15	
Ammunition Handling	26	
TOTAL		\$17,231

DATE
ILME