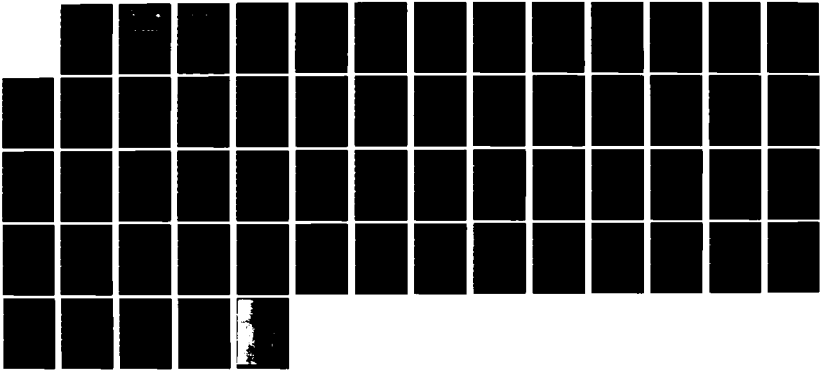
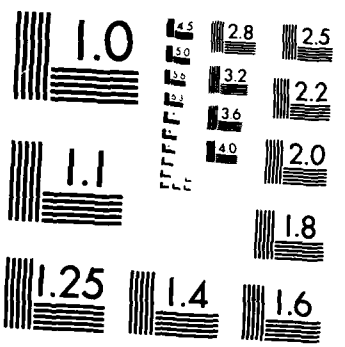
AD-A128 804 SURFACE SHIP DEMAND-BASED POLICY STUDY(U) NAVY FLEET MATERIAL SUPPORT OFFICE MECHANICSBURG PA OPERATIONS ANALYSIS DIV J L FOGLE 31 MAR 83 152 1/1

UNCLASSIFIED F/G 15/5 NL





SURFACE SHIP DEMAND-BASED POLICY STUDY

OPERATIONS ANALYSIS DEPARTMENT

NAVY FLEET MATERIAL SUPPORT OFFICE
Mechanicsburg, Pennsylvania 17055

Report 152

SURFACE SHIP DEMAND-BASED POLICY STUDY

Report 152

SUBMITTED: James L Fogle
J. L. FOGLE
OPERATIONS RESEARCH ANALYST

APPROVED: G Angelopoulos
G. J. ANGELOPOULOS, CDR, SC, USN
DIRECTOR, OPERATIONS ANALYSIS DEPARTMENT

J. B. Whittaker
J. B. WHITTAKER, CAPT, SC, USN
COMMANDING OFFICER, NAVY FLEET MATERIAL SUPPORT OFFICE

DATE: MAR 31 1983

ABSTRACT

This study evaluates alternative Selected Item Management (SIM)/Demand-Based Item (DBI) criteria using historical demand data and a computer simulation model. The alternatives are evaluated in terms of: (1) gross requisition effectiveness, (2) dollar investment in on-hand plus due-in stock and (3) volatility of the SIM/DBI stock battery. Volatility refers to the size of the SIM/DBI battery and to the rate of adds/deletes to the SIM battery. The study is based on historical demand data taken from six different types of ships; FF, DD, LST, AD, LPD, and AFS. The objective of this study is to evaluate various SIM/DBI qualifying and retention criteria and to determine which criteria best minimizes dollar investment without any loss of effectiveness.

The SIM/DBI criteria of two demands in six months to qualify and one demand in six months to remain a part of the SIM/DBI stock record battery was considered the benchmark for this study. The SIM/DBI benchmark generally had the highest gross effectiveness, dollar investment, resupply orders, and volatility for each test ship.

This study showed that there was no single policy which was best for all ships. There were, however, four SIM/DBI criteria without a decrease in effectiveness from the benchmark. Three of these policies employ a retention criteria that could produce significant SIM/DBI battery size growth. The fourth policy, two hits in six months to qualify and two hits in 12 months to remain, has comparable investment to the benchmark but shows a reduction in battery volatility, hence reducing shipboard workload. Therefore, it is recommended that the policy of two hits in six months to qualify and two hits in 12 months for retention be adopted as the Navy SIM/DBI policy.

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1. Problem and Background. Selected Item Management (SIM) is an inventory control technique which, in nonautomated ships, focuses management attention on the small percentage of items that experience the majority of on-board demands for material. There is a similar technique on automated ships to identify the faster moving items and to compute stock levels based on historical demand. These items are called Demand-Based Items (DBI).

A recent General Accounting Office (GAO) report noted that Commander, Naval Surface Force, Atlantic Fleet (COMNAVSURFLANT) is using a SIM/DBI qualifying criteria of four demand requisitions in 12 months and a SIM/DBI retention criteria of four demand requisitions in 12 months (4/12 - 4/12) (Freq)). GAO recommends a SIM/DBI qualifying criteria of recurring demands in two separate months over a six month period and a retention criteria of recurring demands in two separate months over a 12 month period (2/6 - 2/12 (Months)). Chief of Naval Operations (CNO) has opted to implement the policy of two hits in six months and two hits in 12 months to remain (2/6 - 2/12 (Freq)) for submarine tenders and agreed to have the Navy Fleet Material Support Office (FMSO) review the SIM/DBI qualifying and retention criteria for surface ships.

2. Objective. The study objective is to evaluate various SIM/DBI criteria and to determine which criteria best minimizes investment and SIM/DBI battery volatility without decreasing effectiveness with respect to a benchmark policy. The designated benchmark policy is two hits in six months to qualify and one hit in six months to remain (2/6 - 1/6 (Freq)) stated in reference (1) (APPENDIX A).

3. Methodology. A computer simulation model, using historical demand data from six types of ships was used in the study. The Pacific and Atlantic Fleets were represented in the study. The 10 test ships consisted of two AFSs, two

ADs, two FFs, two DDs, one LST, and one LPD. The variations in supply environment and inventory rules used by each ship type were adhered to in the computer simulation. The simulation was run using various SIM/DBI qualification/ retention rules. The effects of these various policies were measured in terms of: (1) gross requisition effectiveness, (2) dollar value investment in terms of on-hand plus due-in stock, (3) frequency of orders, and (4) size and volatility of the SIM/DBI stock record battery.

Two different techniques of looking at an item's demand history were considered for SIM/DBI qualification and retention. The frequency of demand technique is the one currently in use. Under this technique, each separate demand was counted towards meeting the stated criteria. The months of demand method was the second technique. In using this technique, one or more demands placed within the same month were only counted once towards meeting the stated frequency criteria.

4. Findings. While the study showed that there is no single policy that is best for all ships, there were four policies that bracketed or were slightly higher than the benchmark in gross requisition effectiveness. These policies are:

Policy	Criteria
2	2/12-1/12 (Mos.)
4	2/12-1/12 (Freq)
7	2/6-1/12 (Freq)
8	2/6-2/12 (Freq)

Three of the four policies (2, 7, and 8) demonstrated potential decrease in investment from the benchmark while Policy 4 was always more expensive. The three policies (2, 4, and 7) which employ the most lenient retention criteria of one in 12 (either frequency or months method) show the potential for growth in the SIM/DBI battery size. This could pose significant problems with respect to SIM/DBI battery size management over time. The other workload factor is the number of add and delete actions. The workload associated with

maintaining the SIM/DBI battery is less for Policy 8 than for the benchmark even though the core battery itself is slightly larger. Therefore, based upon the above evaluation, it is recommended that the SIM/DBI policy of two hits in six months to qualify and two hits in 12 months to remain be adopted as the Navy SIM/DBI criteria.

I. INTRODUCTION

Selected Item Management (SIM) is an inventory control technique used on nonautomated ships. SIM focuses management attention on the small percentage of items experiencing the majority of on-board demands. Inventory management of items designated as SIM requires close and continuing attention with quarterly stock status review and stock replenishment based on historical demand. Inventory management of non-SIM items requires attention only upon receipt and issue of material, with stock replenishment on a one-for-one basis. There is a similar technique on automated ships to identify the faster moving items and to compute stock levels based on historical demand. These items are called Demand-Based Items (DBI).

The current criteria for nonautomated ships specified by reference (1), (APPENDIX A), designated "benchmark" policy for this study, requires two demand requisitions in six months to qualify for SIM and one demand in six months to remain a SIM item. The current technique for automated ships specified in reference (2), (APPENDIX A) for classifying items as DBI are essentially the same, but the number of qualifying demands and the time period are variable parameters regulated by the Type Commanders (TYCOMs) for surface ships under their command. However, different criteria are being employed by some surface Fleet TYCOMs for various reasons.

A recent General Accounting Office (GAO) report (reference (3), APPENDIX A) noted that Commander, Naval Surface Force, Atlantic Fleet (COMNAVSURFLANT) is using a SIM/DBI criteria of four demands in 12 months to qualify and four demands in 12 months to remain. GAO recommends a SIM/DBI criteria of two months of demand in 12 months to qualify and two months of demand in 12 months to remain. CNO has opted to implement the policy of two hits in six months to qualify and two hits in 12 months to remain SIM/DBI for

submarine tenders and has agreed to have the Navy Fleet Material Support Office (FMSO) review the SIM/DBI qualifying and retention criteria for surface ships. The policies to be tested in this study include currently implemented criteria, proposed criteria, and criteria tested in the past. The objective of the study, therefore, is to evaluate various SIM/DBI criteria and determine which criteria best minimizes investment and SIM/DBI battery volatility without decreasing effectiveness as measured against the benchmark criteria.

A computer simulation model described in Section II was used to conduct the study. Evaluations were made for the following 10 surface ships: USS CONCORD - AFS 5, USS NIAGARA FALLS - AFS 3, USS PIEDMONT - AD 17, USS SAMUEL GOMPERS - AD 37, USS PONCE - LPD 15, USS FRESNO - LST 1182, USS CONNOLE - FF 1056, USS GRAY - FF 1054, USS STUMP - DD 978, and USS JOHN YOUNG - DD 973. A full two year simulation was run for each of the ships.

There were two sources of data for the nonautomated ships (two FFs, two DDs, one LST, and one LPD). One was Navy Ships Parts Control Center's (SPCC) most recent COSAL (Coordinated Shipboard Allowance List) file. The COSAL file provided allowance quantities and unit prices for the items carried on these six ships. The other was the 3M (Maintenance and Material Management) file demand data which came from the Navy Material Support Office (NAMSO) 3M file. The 3M file provided issue dates and quantities for the items carried on these ships. The demand data covered the period of March 1980 to February 1982.

The ship's Master Record File (MRF) was the source of data for the automated ships (two ADs and two AFSs) for the simulation model. The MRF contains all necessary data, including allowance quantities, unit price, and demand data for processing the automated ships through a full two year simulation. The

period of demand data was February 1980 to January 1982 for AFS 5 and AD 17, and April 1980 to March 1982 for AFS 3 and AD 37.

The simulation was run using various SIM/DBI qualification/retention rules. For example, the rule employed by the benchmark policy requires at least two demands in six months for items to become SIM/DBI and one demand in the subsequent six month interval to remain SIM/DBI. Twelve additional policies (shown below) exemplifying various SIM/DBI qualification/retention rules were also tested.

Policy	Criteria
Benchmark	2/6-1/6 (Freq)
1	2/6-2/12 (Mos.)
2	2/12-1/12 (Mos.)
3	2/6-1/6 (Mos.)
4	2/12-1/12 (Freq)
5	2/6-1/12 (Mos.)
6	3/6;2/6-1/6 (Freq)
7	2/6-1/12 (Freq)
8	2/6-2/12 (Freq)
9	4/12-4/12 (Freq)
10	4/12-4/12 (Mos.)
11	4/12-2/12 (Freq)
12	4/12-2/12 (Mos.)

The techniques employed in the above criteria are described in detail in section IIB. Policy 6 applies separate qualifying criteria for allowance items (3/6) and nonallowance items (2/6) but use the same retention criteria both (1/6).

The impact on the ships as a result of changing the various rules was measured in terms of (1) gross requisition effectiveness, (2) dollar value of on-hand plus due-in stock, (3) the number of resupply orders, and (4) volatility of the SIM/DBI stock record battery which refers to the size of the SIM/DBI battery and the number of SIM/DBI additions and deletions. These statistics are defined below:

Gross Requisition Effectiveness (Partials Satisfied). This statistic is computed by dividing the number of requisitions satisfied plus the number of requisitions partially satisfied during the last year of the simulation by the number of requisitions placed during the same year of the simulation.

Dollar Value of On-Hand Plus Due-In Stock. This figure represents the investment or dollar value of the on-hand and on-order stock at the end of the simulation for all items that experienced any demand during the two year simulation.

Frequency of Orders. The number of resupply orders placed during the last year of the simulation is summed for all items. This statistic provides some measurement of the order and receipt workload.

Number of SIM/DBI Items, Additions and Deletions. The size of the SIM/DBI battery is the number of items in the SIM/DBI category at the end of the two year period. The number of SIM/DBI additions is the number of non-SIM/DBI items qualifying as SIM/DBI over the last year. The number of SIM/DBI deletions is the number of SIM/DBI items returning to a non-SIM/DBI state during the last year of the simulation. The item additions and deletions measure the volatility of the SIM/DBI battery.

Statistical measurements were also gathered for Gross Requisition Effectiveness (Partials Split), Gross Unit Effectiveness, and the dollar value of long supply plus excess. These measurements are defined and their results are shown in APPENDIX B.

II. TECHNICAL DESCRIPTION

A. SIMULATION MODEL. Evaluation of the various SIM/DBI criteria was accomplished through use of a computer simulation program modeling shipboard supply operations. The supply environment of each ship was incorporated in this program. The following description is a summary of the major events of the simulator.

- EVENT: READ. In this event, data is read from simulation input tapes and appropriate variables are initialized. This event will schedule the demand, inventory review, and snapshot events.
- EVENT: DEMAND. This event occurs whenever a requisition is placed against the ship's inventory. Two prerequisite data elements for processing are the date of the requisition within the simulation and the demand quantity. During this event material is issued, if available, and effectiveness statistics are gathered.
- EVENT: INVENTORY REVIEW. Initially, each item is designated non-SIM/DBI. During this event, an item's past demand history is reviewed to determine the SIM/DBI status. If the item is currently SIM/DBI, its demand record is compared with the specified SIM/DBI retention rule. If the item is currently non-SIM/DBI, a check is imposed to determine if the item meets the specified SIM/DBI qualification rule. This event takes place every 30 days on the automated ships. On the nonautomated ships, a non-SIM item is reviewed after every demand, while a SIM item is reviewed every 90 days.

  After ascertaining the item's SIM/DBI status, inventory levels are computed in accordance with the appropriate instructions. Specifically, the levels for the nonautomated ships are computed as follows: (1) for non-SIM items, the RO (Requisition Objective) equals the AQ (Allowance Quantity), and the RP (Reorder Point) is one less than the RO; (2) for SIM items, the

levels are computed as follows: (a) for a repair part FILL (Fleet Issue Load List) item, RO = 4 x AMD (Average Monthly Demand) and the RP = 3 x AMD; (b) for a consumable FILL item, RO = 2.5 x AMD and the RP = 1.5 x AMD; (c) for non-FILL repair items, RO = 6 x AMD and the RP = 5 x AMD; and (d) for a consumable FILL item, RO = 4.5 x AMD and the RP = 3.5 x AMD.

The levels for the automated ships are computed as follows: (a) for a non-DBI item, the RO equals the AQ and RP equals RO minus one; (b) for a DBI item, levels are derived using the current Shipboard Uniform Automated Data Processing System (SUADPS) rules. These rules include the following parameter setting to constraint the stock levels for ADs, the operating level multiplier factor is 6.0 for AD 17 and 2.5 for AD 37; the maximum months of the operating level equals 4.0 months for AD 17 and 10.5 months for AD 37; the minimum months of the operating level equals 1.0 month for AD 17 and 1.5 months for AD 37; the order and shipping time factor equals 2.5 months for AD 17 and 1.0 month for AD 37 and the safety level is constrained to be at least as large as the AQ. For the AFSs, the operating level multiplier factor equals 2.5 for AFS 3 and 10.0 for AFS 5; the maximum months of the operating level equals 10.5 months for AFS 3 and 5.0 months for AFS 5; the minimum months of the operating level equals 1.5 months for AFS 3 and 2.0 months for AFS 5; the order and shipping time factor equals 1.0 month for AFS 3 and 2.0 months for AFS 5; and the safety level is at least as large as the AQ. The parameter values used in this study were obtained from the appropriate TYCOM.

The aforementioned parameter values used in computing levels for the non-automated ships may vary slightly from the current operating levels used onboard the ships, but they fall within the range of recommended values. Therefore, it is felt that the trends established by the model are a valid indication of what would occur under each alternative criteria.

. EVENT: REVIEW OF ASSETS. This event occurs every 10 days for the automated ships, the ADs and AFSs. For nonautomated ships, it occurs after every "Demand" and "Inventory Review". It reviews the status of an item's assets based on the inventory levels computed during the event "Inventory Review". Whenever the assets are less than or equal to the reorder point, a resupply order is placed for that item.

. EVENT: RECEIPT. This event occurs upon the arrival of a resupply order placed in "Review of Assets". The receipt time depends upon the Order and Shipping Time (OST) recorded on the input tape. If OST is greater than zero, then Receipt Event occurs in OST days. If OST is equal to zero, then Receipt Event occurs in 30 days for FILL items and 90 days if non-FILL items.

. EVENT: SNAPSHOT. This event collects statistics so a review of the system can be taken at arbitrary points of time during the simulation.

B. ALTERNATIVE SIM/DBI TECHNIQUES. Two different techniques of reviewing an item's demand history were considered in defining alternative SIM/DBI criteria. The following describes each of the techniques:

FREQUENCY OF DEMAND TECHNIQUE. This is the technique currently in use. Each separate demand is counted towards the item's demand frequency. The demand frequency of an item in a specified time period is used to determine if a non-SIM/DBI item meets the qualification criteria or if a SIM/DBI item meets the retention criteria.

MONTHS OF DEMAND TECHNIQUE. In using this technique, one or more demands that are placed within the same month are only counted once. For example, if an item experiences two separate demands during month one, one demand in month two and no demands in months three through six, the item would then have only two months of demand in the six month period. The two demands placed in month one are only counted as one.

III. RESULTS

This section evaluates 12 alternative SIM/DBI criteria against a benchmark policy for AFS 3, AFS 5, AD 17, AD 37, FF 1054, FF 1056, LST 1182, LPD 15, DD 973, and DD 978. The SIM/DBI criteria of two hits in six months to qualify and one hit in six months to remain, which is listed in reference 1 (APPENDIX A), is considered the benchmark. Each ship goes through a two year simulation. The first year initializes the quantities, and statistics are gathered during the second year. Only items that experienced demand during the two year simulation were considered in the study and are shown for Navy Stock Account (NSA) items in TABLE I.

TABLE I

SUMMARY OF NSA ITEMS USED IN SIMULATION

	Number of Items with Demands	Allowance Dollar Value
*AFS 5	15,874	$4,611,573
AFS 3	11,393	6,514,787
*AD 17	9,421	861,023
AD 37	12,775	1,333,780
DD 973	3,703	198,326
*DD 978	3,633	250,813
FF 1054	2,927	128,691
*FF 1056	3,473	153,043
LST 1182	2,601	85,489
*LPD 15	3,412	76,523

*Atlantic Fleet Surface Ships

TABLE II displays statistics on NSA items that did not experience any demand during the time period used in the simulation. These items were not used in the study.

TABLE II

SUMMARY OF NSA ITEMS NOT USED IN SIMULATION

	Number of Items without Demand	Allowance Dollar Value
*AFS 5	7,253	$ 932,032
AFS 3	14,732	2,301,609
*AD 17	16,832	1,186,222
AD 37	22,783	2,598,979
DD 973	12,886	1,620,178
*DD 978	12,337	1,557,662
FF 1054	7,836	475,507
*FF 1056	8,684	522,112
LST 1182	4,379	207,761
*LPD 15	5,969	314,007

*Atlantic Fleet Surface Ships

Shown in TABLE III are statistics on DLR (Depot Level Repairable) items. Since DLRs are under the fixed allowance concept for surface ships and tenders, they are not affected by SIM/DBI criteria and they were not evaluated in this study.

TABLE III

SUMMARY OF DLR ITEMS

	Number of Items		Allowance Dollar Value	
	With Demand	Without Demand	Items W/Demand	Items W/O Demand
*AFS 5	556	458	$3,602,771	$2,699,703
AFS 3	478	624	5,067,628	4,163,668
*AD 17	75	307	168,695	986,831
AD 37	52	505	146,538	1,536,311
DD 973	305	1,076	829,851	2,854,641
*DD 978	267	1,077	1,069,207	2,617,625
FF 1054	147	242	351,905	516,192
*FF 1056	226	409	495,150	1,020,715
LST 1182	75	61	141,996	124,442
*LPD 15	139	77	225,420	116,745

*Atlantic Fleet Ships and Tenders

A. DLR ITEMS. There are several Navy programs that limit the application of SIM/DBI criteria for DLR items on surface ships and tenders. Specifically, range adds and depth increases are not permitted for DLRs. Changing of SIM/DBI criteria does not affect the statistics gathered because of the fixed DLR levels. The requisition objective will always be equal to the Allowance Quantity. The statistics for these fixed level DLR items are shown in APPENDIX B.

B. NSA ITEMS. TABLES IV through XIII present a comparison of the benchmark's NSA statistics with the corresponding values of the 12 alternative criteria in the area of effectiveness, investment and volatility. Each criteria was given a policy number for ease of reference. For example, the policy 2/6 - 2/12 (months) was assigned number 1. The assigned policy numbers referred to the same SIM/DBI criteria across all ships. The various criteria are labeled to indicate FREQ (Frequency of Demand Technique) or MOS (Months of Demand Technique). The actual figures from the simulation output appear on the benchmark line, where

the benchmark is two hits in six months to qualify and one hit in six months to remain. The effectiveness numbers for the 12 alternatives are the observed percent figure minus the benchmark's percent figure. The investment and workload numbers for the 12 policies represent the percent change from the benchmark to the given policy. The entries in the volatility columns of the SIM/DBI battery are the observed figures for the benchmark and 12 alternatives. The alternatives are ranked by gross requisition effectiveness (highest to lowest) and for the same effectiveness by investment (lowest cost to highest cost).

1. Results of NSA Items on FF 1054 and FF 1056. TABLES IV and V present the results of NSA items for FF 1054 and FF 1056. The benchmark is the current policy for FF 1054, while Policy 9 is the current policy for FF 1056.

Policy 9 for FF 1056 reduces gross requisition effectiveness by three percentage points. The GAO proposal (Policy 1) and Navy proposal (Policy 8) equal the benchmark gross requisition effectiveness for FF 1054, while for FF 1056, Policy 8 equals the benchmark and Policy 1 reduces gross requisition effectiveness by one percentage point. For all remaining policies, gross requisition effectiveness drops no more than one point for FF 1054 (Policy 4 increases one percentage point above benchmark) and three points for FF 1056.

Policy 2 for FF 1056 equals the benchmark dollar value of on-hand plus due-in. Policy 4 for FF 1054 and 4, 8, and 7 for FF 1056 increase dollar value of on-hand plus due-in above the benchmark. All remaining policies decrease the dollar value of on-hand plus due-in, with the current policy (Policy 9) for FF 1056 decreasing on-hand plus due-in 23% from the benchmark. Dollar value of on-hand plus due-in for the GAO proposal and Navy proposal decrease 5% and 1%, respectively, for FF 1054, and for FF 1056, the GAO proposal increases 3% and the Navy proposal decreases 3%.

The current policy for FF 1056 reduces resupply orders by 15%. The Navy

proposal increases resupply orders by 1% for FF 1054 and by 3% for FF 1056, while GAO proposal reduces resupply orders for FF 1054 and FF 1056 no more than 6%. Except for Policy 2 (FF 1056 only), 4, 7, and 8 for FF 1054 and FF 1056, all remaining policies reduce resupply orders from the benchmark.

Policies 2, 4, 5, 7, and 8 contain larger SIM battery than the benchmark total for both ships. The current policy (Policy 9) for FF 1056 shows a lower SIM battery of 61 items compared to 282 for the benchmark. All other policies produce a smaller SIM battery than the benchmark, except for the GAO proposal for FF 1056. All policies except Policies 4 and 8 (FF 1056 only) produce fewer additions to and deletions from the SIM battery.

TABLE IV

SIM Criteria Analysis - FF 1054*
NSA Items

Criteria	Policy	Gross Reqn Eff. Partials Satisfied	OH+DI	Resupply Orders	# SIM Items	# Adds	# Deletes
2/6-1/6 Freq	(Current Policy + Benchmark)	50%	170,934	1,270	239	301	300
2/12-1/12 Freq	4	+1	+4%	+4%	472	340	228
2/6-1/12 Mos.	5	0	-8%	-7%	283	182	162
2/6-2/12 Mos.	1 (GAO Proposal)	0	-5%	-6%	226	189	226
2/6-1/6 Mos.	3	0	-4%	-7%	165	199	251
2/6-1/12 Freq	7	0	-3%	0%	390	278	196
3/6;2/6-1/6 Freq	6	0	-3%	-9%	118	157	151
2/6-2/12 Freq	8 (Navy Proposal)	0	-1%	+1%	337	284	255
2/12-1/12 Mos.	2	0	-1%	-3%	367	244	197
4/12-2/12 Mos.	12	-1	-19%	-20%	59	51	22
4/12-4/12 Mos.	10	-1	-19%	-20%	30	55	55
4/12-4/12 Freq	9	-1	-18%	-19%	45	74	68
4/12-2/12 Freq	11	-1	-18%	-20%	39	70	25

*Pacific Fleet Ship

TABLE V

SIM Criteria - FF 1056*
NSA Items

Criteria	Policy	Gross Reqn Eff. Partials Satisfied	OH+DI	Resupply Orders	# SIM Items	# Adds	# Deletes
2/6-1/6 Freq	Benchmark	51%	$218,927	1,434	282	353	363
3/6;2/6-1/6 Freq	6	0	-2%	-3%	182	227	220
2/12-1/12 Mos.	2	0	0%	+1%	491	350	296
2/6-1/12 Freq	7	0	+2%	+2%	462	321	331
2/6-2/12 Freq	8 (Navy Proposal)	0	+3%	+3%	408	334	424
2/12-1/12 Freq	4	0	+5%	+5%	551	399	358
2/6-1/6 Mos.	3	-1	-6%	-4%	242	290	306
2/6-1/12 Mos.	5	-1	-4%	-2%	385	267	263
2/6-2/12 Mos.	1 (GAO Proposal)	-1	-3%	-2%	305	278	354
4/12-4/12 Mos.	10	-3	-26%	-17%	31	51	57
4/12-2/12 Mos.	12	-3	-26%	-16%	49	42	30
4/12-2/12 Freq	11	-3	-23%	-15%	90	77	58
4/12-4/12 Freq	9 (Current Policy)	-3	-23%	-15%	61	91	105

*Atlantic Fleet Ship

2. Results of NSA Items on DD 973 and DD 978. TABLES VI and VII display the findings on the NSA items for DD 973 and DD 978. The benchmark is the current policy for DD 973, while Policy 9 is the current policy for DD 978.

Policy 9 for DD 978 reduces gross requisition effectiveness by three percentage points. The GAO proposal (Policy 1) and the Navy proposal (Policy 8) provide the same gross requisition effectiveness as the benchmark for DD 978, while for the DD 973 there is a one percentage point decrease from the benchmark for both. For all remaining policies, gross requisition effectiveness drops no more than three points for DD 973 and four points for DD 978.

Policies 7 and 8 equal the benchmark dollar value of on-hand plus due-in for DD 973. Policies 2, 4, 7, and 8 for DD 978 and 4 for DD 973 increase dollar value of on-hand plus due-in no more than 3% above the benchmark. All remaining policies decrease dollar value of on-hand plus due-in, with the current policy for DD 978 decreasing 14% from the benchmark. Dollar value of on-hand plus due-in for the GAO proposal and Navy proposal decrease 11% and 0%, respectively, for DD 973, and decreases 3% and increases 1%, respectively, for DD 978.

The current policy for DD 978 reduces resupply orders by 16%. The GAO proposal reduces resupply orders for DD 973 and DD 978. The Navy proposal increases resupply orders 1% and 2% above the benchmark for DD 978 and DD 973, respectively. Except for policies 4, 7, and 8 for DD 973 and DD 978, all policies reduce resupply orders from the benchmark.

Policies 1, 2, 3 (DD 978 only), 4, 5, 7, and 8 contain larger SIM batteries than the benchmark for DD 973 and DD 978. The current policy for DD 978 and all remaining policies have a smaller SIM battery than the benchmark. Similar to FF 1054 and FF 1056, Policy 4 increases the number of additions to the SIM

battery for DD 973 and DD 978, while all the remaining policies reduce additions and deletions.

TABLE VI

SIM Criteria Analysis - DD 973*
NSA Items

Criteria	Policy	Gross Reqn Eff. Partials Satisfied	OH+DJ	Resupply Orders	# SIM Items	# Adds	# Deletes
2/6-1/6 Freq	(Current Policy + Benchmark)	54%	$287,001	1,973	344	512	411
2/12-1/12 Mos.	2	0	-7%	-1%	627	441	239
2/12-1/12 Freq	4	0	+3%	+3%	749	556	295
2/6-1/12 Mos.	5	-1	-11%	-4%	489	332	206
2/6-2/12 Mos.	1 (GAO Proposal)	-1	-11%	-3%	392	349	320
2/6-1/6 Mos.	3	-1	-11%	-6%	280	376	315
3/6;2/6-1/6 Freq	6	-1	-3%	-6%	219	302	219
2/6-1/12 Freq	7	-1	0%	0%	627	454	266
2/6-2/12 Freq	8 (Navy Proposal)	-1	0%	+2%	540	475	372
4/12-2/12 Freq	11	-2	-25%	-15%	158	120	54
4/12-4/12 Freq	9	-2	-25%	-16%	103	137	126
4/12-2/12 Mos.	10	-3	-27%	-18%	51	85	89
4/12-4/12 Mos.	12	-3	-26%	-18%	92	70	33

*Pacific Fleet Ship

TABLE VII

SIM Criteria Analysis - DD 978*
NSA Items

Criteria	Policy	Gross Reqn Eff. Partials Satisfied	OH+DI	Resupply Orders	# SIM Items	# Adds	# Deletes
2/6-1/6 Freq	Benchmark	58%	$345,157	2,812	502	673	642
2/6-2/12 Mos.	1 (GAO Proposal)	0	-3%	-3%	724	544	364
2/12-1/12 Mos.	2	0	+1%	-1%	981	647	259
2/6-1/12 Freq	7	0	+1%	+1%	955	624	324
2/6-2/12 Freq	8 (Navy Proposal)	0	+1%	+1%	797	631	443
2/12-1/12 Freq	4	0	+3%	+2%	1,069	713	339
2/6-1/6 Mos.	3	-1	-4%	-3%	605	569	531
2/6-1/12 Mos.	5	-1	-3%	-3%	842	536	238
3/6;2/6-1/6 Freq	6	-1	-1%	-6%	309	355	313
4/12-4/12 Mos.	10	-3	-18%	-20%	220	208	201
4/12-2/12 Freq	11	-3	-15%	-17%	311	205	67
4/12-4/12 Freq	9 (Current Policy)	-3	-14%	-16%	185	250	238
4/12-2/12 Mos.	12	-4	-18%	-20%	233	161	41

*Atlantic Fleet Ship

3. Results of NSA Items on LPD 15 and LST 1182. TABLES VIII and IX compare alternative SIM criteria for NSA items on the LPD 15 and LST 1182. LST 1182 currently uses the benchmark policy for this SIM/DBI criteria while LPD 15 uses Policy 9.

Policies 2 and 4 increase gross requisition effectiveness one percentage point for LPD 15. The GAO proposal (Policy 1) and the Navy proposal (Policy 8) equal the benchmark for LPD 15; for LST 1182 the GAO proposal falls one percentage point below the benchmark, while the Navy proposal equals it. For LPD 15, their current policy reduces gross requisition effectiveness two percentage points. The remaining policies for LPD 15 and LST 1182 either equal or reduce gross requisition effectiveness no more than three percentage points from the benchmark.

The GAO proposal reduces dollar value of on-hand plus due-in by 8% and 9% for LPD 15 and LST 1182, respectively. The Navy proposal had a one percentage point increase in dollar value of on-hand plus due-in for the LPD 15 and equalled the benchmark for LST 1182. The current policy for the LPD 15 fails 35% below the benchmark. Except for policies 2 (LPD 15 only), 4, 7, and 8, which equal or were above the benchmark for LPD 15 and LST 1182, all remaining policies fall below the benchmark's dollar value of on-hand plus due-in.

Policy 8 increases resupply orders 2% for LPD 15 and LST 1182 from the benchmark. Policy 1 decreases were 2% and 6% for LPD 15 and LST 1182, respectively. The current policy reduces resupply orders 15% below the benchmark for LPD 15. Except for policies 2 (LPD 15 only), 4, 7, and 8, all remaining policies decrease the total number of resupply orders. Policies 1, 2, 4, 5, 7, and 8 contain a higher SIM battery than the benchmark at the end of the two year period for LPD 15 and LST 1182. Policy 9 reduces the benchmark figure of 331 SIM items to 140 SIM items for LPD 15. Policy 4 has the highest increase above the benchmark SIM battery, and it also increases the number of additions to the

SIM battery for LPD 15 and LST 1182. The number of additions to and deletions from the SIM battery decrease for all remaining policies

TABLE VIII

SIM Criteria Analysis - LPD 15*
NSA Items

Criteria	Policy	Gross Reqn Eff. Partials Satisfied	OH+DI	Resupply Orders	# SIM Items	# Adds	# Deletes
2/6-1/6 Freq	Benchmark	52%	$161,811	2,061	331	509	505
2/12-1/12 Mos.	2	-1	+1%	+2%	767	493	204
2/12-1/12 Freq	4	+1	+8%	+5%	841	547	256
2/6-1/6 Mos.	3	0	-9%	-4%	330	436	436
2/6-2/12 Mos.	1 (GAO Proposal)	0	-8%	-2%	486	421	363
2/6-1/12 Mos.	5	0	-8%	-2%	640	410	188
3/6;2/6-1/6 Freq	6	0	-4%	-4%	250	287	303
2/6-2/12 Freq	8 (Navy Proposal)	0	+1%	+2%	754	484	412
2/6-1/12 Freq	7	0	+1%	+2%	735	470	241
4/12-4/12 Freq	9 (Current Policy)	-2	-35%	-15%	140	152	159
4/12-2/12 Freq	11	-2	-35%	-15%	217	131	61
4/12-4/12 Mos.	10	-3	-38%	-19%	80	128	134
4/12-2/12 Mos.	12	-3	-37%	-19%	152	103	37

*Atlantic Fleet Ship

TABLE IX

SIM Criteria Analysis - LST 1182*
NSA Items

Criteria	Policy	Gross Reqn Eff. Partials Satisfied	OH+DI	Resupply Orders	# SIM Items	# Adds	# Deletes
2/6-1/6 Freq	(Current Policy + Benchmark)	54%	$140,912	1,432	204	335	445
3/6;2/6-1/6 Freq	6	0	-5%	-7%	119	203	302
2/6-1/12 Freq	7	0	-0%	+2%	463	308	244
2/6-2/12 Freq	8 (Navy Proposal)	0	0%	-2%	366	316	349
2/12-1/12 Freq	4	0	+7%	+5%	537	372	250
2/6-1/12 Mos.	5	-1	-10%	-5%	369	236	112
2/6-1/6 Mos.	3	-1	-9%	-7%	173	253	282
2/6-2/12 Mos.	1 (GAO Proposal)	-1	-9%	-6%	264	243	224
2/12-1/12 Mos.	2	-1	-2%	-1%	463	316	119
4/12-2/12 Freq	11	-2	-23%	-2%	116	99	54
4/12-4/12 Freq	9	-2	-23%	-18%	70	110	112
4/12-4/12 Mos.	10	-3	-28%	-22%	35	61	49
4/12-2/12 Mos.	12	-3	-28%	-22%	63	54	14

*Pacific Fleet Ship

4. Results of NSA Items on AFS 3 and AFS 5. TABLES X and XI compare alternative DBI criteria for NSA items on the AFS 3 and AFS 5. AFS 3 currently uses the Navy proposal, Policy 8, as its DBI criteria, while AFS 5 uses Policy 11. The AFS 5 has a larger number of items with demand than any other test ship. This is reflected in the higher inventory, workload, and DBI battery values.

Policy 8 (Navy proposal) which is the current policy for AFS 3, equals the benchmark effectiveness. The current policy (Policy 11) for AFS 5 falls one percentage point from the benchmark. Note that no policy reduces gross effectiveness more than one percentage point from the benchmark for AFS 3 or AFS 5.

Except for policies 2 and 4, those which equalled the benchmark for gross requisition effectiveness showed no change in on-hand plus due-in dollar value for AFS 3. The largest decrease in investment from the benchmark was 3% for AFS 3 and 8% for AFS 5. Also, for AFS 5, the current policy reduces the on-hand plus due-in dollar value 4% from the benchmark. The GAO proposal decreases on-hand plus due-in dollar value 1% while the Navy proposal increases 1% for AFS 5.

Policies 2, 4, 7, and 8 for AFS 3 and AFS 5 increase resupply orders no more than 4% and 2%, respectively. Policy 5 equals the benchmark resupply orders while in all other cases, the total number of resupply orders decreases from the benchmark values for AFS 3 and AFS 5. Also, the GAO and Navy proposal more than double the size of the DBI battery for AFS 3 and AFS 5. Except for policies 3, 6, and 10 for AFS 3, all remaining policies increase the size of the DBI battery. The current policy for AFS 5 almost doubles the size of the DBI battery. All remaining policies increase the DBI battery above the benchmark. Except for Policy 4 for AFS 3, the number of additions to and deletions from the DBI battery decrease for all policies for AFS 3 and AFS 5.

TABLE X

DBI Criteria Analysis - AFS 3
NSA Items

Criteria	Policy	Gross Reqn Eff. Partials Satisfied	OH+DI	Resupply Orders	# DBI Items	# Adds	# Deletes
2/6-1/6 Freq	Benchmark	92%	$8,799,087	14,559	1,856	2,215	4,112
2/6-1/6 Mos.	3	0	0%	-1%	1,792	2,047	3,688
2/6-2/12 Mos.	1 (GAO Proposal)	0	0%	-1%	3,775	1,947	1,626
2/6-1/12 Mos.	5	0	0%	0%	4,757	1,925	622
2/6-1/12 Freq	8 (Navy Proposal + Current Policy)	0	0%	+1%	4,165	2,068	1,688
2/6-1/12 Freq	7	0	0%	+1%	5,055	2,043	773
2/12-1/12 Mos.	2	0	+1%	+3%	5,337	2,430	647
2/12-1/12 Freq	4	0	+1%	+4%	5,526	2,455	795
4/12-4/12 Mos.	10	-1	-3%	-10%	1,504	1,543	1,352
4/12-2/12 Mos.	12	-1	-3%	-10%	2,456	1,416	273
4/12-4/12 Freq	9	-1	-2%	-8%	3,129	1,489	1,357
4/12-2/12 Freq	11	-1	-2%	-8%	2,861	1,385	403
3/6;2/6-1/6 Freq	6	-1	-2%	-7%	1,528	1,339	2,327

*Pacific Fleet Ship

TABLE XI

DBI Criteria Analysis - AFS 5*
NSA Items

Criteria	Policy	Gross Reqn Eff. Partials Satisfied	OH+DI	Resupply Orders	# DBI Items	# Adds	# Deletes
2/6-1/6 Freq	Benchmark	80%	$10,932,835	24,483	3,730	4,697	5,667
3/6;2/6-1/6 Freq	6	0	-2%	-3%	5,031	3,058	4,124
2/6-1/6 Mos.	3	0	-2%	-2%	5,560	3,773	5,085
2/6-2/12 Mos.	1 (GAO Proposal)	0	-1%	-1%	8,099	2,733	2,832
2/6-1/12 Mos.	5	0	-1%	0%	9,462	2,418	1,154
2/12-1/12 Mos.	2	0	+0%	+1%	10,047	2,633	1,293
2/6-2/12 Freq	8 (Navy Proposal)	0	+1%	+1%	9,137	3,247	2,900
2/6-1/12 Freq	7	0	+1%	+2%	10,227	2,861	1,424
2/12-1/12 Freq	4	0	+1%	+2%	10,579	2,969	1,525
4/12-4/12 Mos.	10	-1	-8%	-4%	3,731	2,726	3,724
4/12-2/12 Mos.	12	-1	-8%	-3%	5,583	1,732	962
4/12-4/12 Freq	9	-1	-4%	-3%	5,818	3,006	3,400
4/12-2/12 Freq	11 (Current Policy)	-1	-4%	-2%	7,140	2,131	1,200

*Atlantic Fleet Ship

5. Results of NSA Items on AD 17 and AD 37. TABLES XII and XIII compare alternative DBI criteria for NSA items on AD 17 and AD 37, respectively. Policy 11 is the current policy for AD 17 and Policy 8 (Navy proposal) is the current policy for AD 37.

The current policy for AD 17 decreases gross requisition effectiveness by two percentage points, while the current policy for AD 37 increases it by one percentage point. The GAO proposal (Policy 1) equals the benchmark for both ships. The Navy proposal also equals the benchmark for gross requisition effectiveness for AD 17. Except for Policy 3 on AD 37, policies 2 through 8 either equal the benchmark or increase it by one percentage point for AD 17 and AD 37. All remaining policies decrease no more than three percentage points for AD 17 and four percentage points for AD 37.

Except for policies 2 (AD 37 only), 4, 7, and 8 decreases in dollar value of on-hand plus due-in range from 3% to 27% for AD 17 and from 2% to 14% for AD 37. The GAO proposal decreases 9% and 2% from the benchmark for AD 17 and AD 37, respectively, while the Navy proposal increases 1% for both ships. The current policy for AD 17 decreases 18% while the current policy for AD 37 increases 1% from the benchmark dollar value of on-hand plus due-in.

The current policy (Policy 11) for AD 17 reduces the total number of resupply orders by 13%, while the current policy (Policy 8) for AD 37 increases 2%. The GAO proposal decreases 1% from the benchmark for AD 17 and equals the benchmark for AD 37. The Navy proposal increases 3% and 2% from the benchmark for AD 17 and AD 37, respectively. Except for policies 2, 4, 5, 7, and 8, the total number of resupply orders decrease for all remaining policies for AD 17 and AD 37.

Policies 1, 2, 4, 5, 7, and 8 contain a larger DBI battery at the end of two years than the benchmark total for AD 17 and AD 37. All other policies have a smaller DBI battery. Except for Policy 4, all remaining policies lower the number of additions to and deletions from the DBI battery for AD 17 and AD 37.

TABLE XII

DBI Criteria Analysis - AD 17*
NSA Items

Criteria	Policy	Gross Reqn Eff. Partials Satisfied	OH+DI	Resupply Orders	# DBI Items	# Adds	# Deletes
2/6-1/6 Freq	Benchmark	74%	$1,654,660	8,532	1,797	1,858	1,727
2/12-1/12 Mos.	2	+1	-3%	+6%	3,047	1,612	607
2/12-1/12 Freq	4	+1	+4%	+9%	2,986	1,858	806
2/6-1/6 Mos.	3	0	-10%	-4%	1,613	1,479	1,355
3/6;2/6-1/6 Freq	6	0	-10%	-5%	1,388	1,189	986
2/6-2/12 Mos.	1 (GAO Proposal)	0	-9%	-1%	2,088	1,308	1,033
2/6-1/12 Mos.	5	0	-8%	0%	2,529	1,229	513
2/6-2/12 Freq	8 (Navy Proposal)	0	+1%	+3%	2,514	1,615	1,242
2/6-1/12 Freq	7	0	+1%	+4%	2,933	1,523	731
4/12-4/12 Freq	9	-2	-18%	-14%	1,023	774	770
4/12-2/12 Freq	11 (Current Policy)	-2	-18%	-13%	1,289	557	287
4/12-4/12 Mos.	10	-3	-27%	-16%	902	652	614
4/12-2/12 Mos.	12	-3	-26%	-15%	1,064	446	156

*Atlantic Fleet Tender

TABLE XIII

DBI Criteria Analysis - AD 37*
NSA Items

Criteria	Policy	Gross Reqn Eff. Partials Satisfied	OH+DI	Resupply Orders	# DBI Items	# Adds	# Deletes
2/6-1/6 Freq	Benchmark	71%	$1,669,243	9,541	2,185	2,239	2,474
2/6-2/12 Freq	8 (Navy Proposal + Current Policy)	+1	+1%	+2%	2,936	1,968	2,152
2/6-1/12 Freq	7	+1	+1%	+3%	3,583	1,871	1,408
2/12-1/12 Freq	4	+1	+3%	+8%	4,172	2,304	1,560
3/6;2/6-1/6 Freq	6	0	-5%	-6%	1,531	1,375	1,509
2/6-2/12 Mos.	1 (GAO Proposal)	0	-2%	0%	2,604	1,795	1,736
2/6-1/12 Mos.	5	0	-2%	+1%	3,276	1,703	972
2/12-1/12 Mos.	2	0	+1%	+7%	3,956	2,186	1,159
2/6-1/6 Mos.	3	-1	-3%	-2%	2,002	2,000	2,128
4/12-4/12 Freq	9	-3	-11%	-15%	999	998	1,162
4/12-2/12 Freq	11	-3	-11%	-14%	1,446	753	470
4/12-4/12 Mos.	10	-4	-14%	-17%	707	858	971
4/12-2/12 Mos.	12	-4	-14%	-16%	1,151	614	283

*Pacific Fleet Tender

IV. SUMMARY AND CONCLUSIONS

In comparing the alternative policies, the preferable policy is the one that would reduce dollar investment and volatility with no decrease in gross requisition effectiveness. TABLE XIV is a verbal summary across all ships of the results presented in the previous section.

TABLE XIV
SIM/DBI Summary Chart Across All Ships (NSA Items)

Criteria	Policy	Gross Reqn. Fit.	OH + DI (Cost)	Volatility
3/6-1/6 (Freq)	Benchmark	Generally has highest effectiveness	Generally has highest investment	SIM/DBI battery avg.; # adds & deletes highest in most cases.
2/6-2/12 (Mos.)	1 (GAO Proposal)	0-1% decrease from benchmark	0-11% decrease from benchmark	# SIM/DBI items w/exception of 1 ship higher than benchmark; # adds & deletes lower than benchmark.
2/12-1/12 (Mos.)	2	1% decrease to 1% increase from benchmark	7% decrease to 1% increase from benchmark	# SIM/DBI items always higher than benchmark; # adds & deletes w/exception of 1 ship lower than benchmark.
3/6-1/6 (Mos.)	3	0-1% decrease from benchmark	0-11% decrease from benchmark	# SIM/DBI items w/exception of 2 ships lower than benchmark; adds & deletes lower than benchmark.
2/12-1/12 (Freq)	4	0-1% increase from benchmark	1-8% increase from benchmark	# SIM/DBI items higher than benchmark; # adds & deletes either higher or lower than benchmark.
2/6-1/12 (Mos.)	5	0-1% decrease from benchmark	0-11% decrease from benchmark	# SIM/DBI items higher than benchmark; # adds & deletes lower than benchmark.
3/6 2/6-1/6 (Freq)	6	0-1% decrease from benchmark	1-10% decrease from benchmark	# SIM/DBI items generally lower than benchmark; # adds & deletes always lower than benchmark.
2/6-1/12 (Freq)	7	1% decrease to 1% increase from benchmark	3% decrease to 2% increase from benchmark	# SIM/DBI items higher than benchmark; # adds & deletes lower than benchmark.
2/6-2/12 (Freq)	8 (Navy Proposal)	1% decrease to 1% increase from benchmark	1% decrease to 4% increase from benchmark	# SIM/DBI items always higher than benchmark; # adds & deletes generally lower than benchmark.
4/12-4/12 (Freq)	9	1 to 3% decrease from benchmark	2-35% decrease from benchmark	# SIM/DBI items lower or higher than benchmark; # adds & deletes lower than benchmark.
4/12-4/12 (Mos.)	10	1-4% decrease from benchmark	3-38% decrease from benchmark	# SIM/DBI items lower than benchmark; # adds & deletes lower than benchmark.
3/12-2/12 (Freq)	11	1-3% decrease from benchmark	2-35% decrease from benchmark	# SIM/DBI items lower or higher than benchmark; # adds & deletes significantly lower than benchmark.
3/12-2/12 (Mos.)	12	1-4% decrease from benchmark	3-26% decrease from benchmark	# SIM/DBI items higher or lower than benchmark; # adds & deletes lower than benchmark.

As can be seen from TABLE XIV, as well as the previous tables, there are several policies that significantly reduce dollar investment, resupply orders, and volatility. However, each of these alternative criteria caused a decrease in gross effectiveness. Also note that, in general, criteria which increase gross effectiveness also increase dollar investment, resupply orders, and volatility from the benchmark. Furthermore, when gross effectiveness equals the benchmark, dollar investment, resupply orders, and volatility can either equal, increase, or decrease from the benchmark. So the determination of the best SIM/DBI cirteria, therefore, depends upon the relative importance attached to gross effectiveness, dollar investment, and volatility.

The policies that employ the months of demands techniques would require programming changes to SUADPS for automated ships and may increase the manual workload on nonautomated ships until automation is introduced via SNAP II implementation. Either or both of these eventualities may pose implementation problems and make the months of demand schemes less desirable. A unique SIM/DBI criteria is Policy 6 which has different qualifying criteria for allowance and nonallowance items with the same retention criterion for both. While this policy utilizes the current frequency of demand technique, it also may pose implementation problems on manual ships until automation occurs.

Policies 2, 4, 7, and 8 bracketed or were strictly higher than the benchmark in gross requisition effectiveness. Policy 4, however, showed an increase in investment, resupply orders, and overall higher volatility than the benchmark. Policies 2, 7, and 8 were anywhere from 7% less to 3% more in investment from the benchmark and all had a larger SIM/DBI battery but fewer add and delete actions.

The gross requisition effectiveness for Policies 1, 3, 5, and 6 ranged from no difference with the benchmark to a 1% decrease. All four policies resulted in decreased investment of up to around 11%. In general, all the

policies reduced the resupply order quantities below the benchmark's. All the policies reduced the number of adds and deletes to the SIM battery while Policies 1 and 5 had a larger battery and 3 and 6 had smaller batteries than the benchmark.

Policies 9, 10, 11, and 12 showed gross requisition effectiveness decreases from 1% to 4%, but exhibited investment decreased ranging from 2% to 38% and a decrease in resupply orders ranging from 2% to 22% below the benchmark. All four policies resulted in fewer adds and deletes to the SIM/DBI battery. Policy 10 also resulted in a smaller battery, while Policies 9, 11, and 12 batteries ranged both above and below that of the benchmark.

In summary, there is no SIM/DBI criteria that emerges as being best for all ships. Only the Policies 2, 4, 7, and 8 which bracketed or were strictly higher than the benchmark in gross requisition effectiveness are considered to have met the decision restriction of no decrease in effectiveness. There were a number of policies where gross requisition effectiveness ranged from zero to one percent below the benchmark criteria. While a one percentage point decrease may not be statistically significant, the fact that this range was demonstrated over a variety of ship types indicates a relative effectiveness decrease vis-a-vis all the policies examined. Three of the four policies (2, 7, and 8) demonstrated potential decreases in investment from the benchmark while Policy 4 was always more expensive.

Workload or volatility is the other key consideration and is addressed in TABLE XV where SIM/DBI battery adds are shown as a fraction of deletes by policy for each ship tested. The three policies (2, 4, and 7) which employ the most lenient retention criteria of one in 12 (either frequency or months technique) show the potential for growth in the SIM/DBI battery size as reflected by the higher battery growth ratios (BGR) for these policies in comparison to the benchmark and Policy 8. This could pose significant problems with respect to

SIM/DBI battery size management over time. The other workload factor is the number of add and delete actions. TABLE XV shows this statistic for Policy 8 as a fraction of the benchmark policy. In all but one case, the actual workload associated with maintaining the SIM/DBI battery is less for Policy 8 than for the benchmark even though the core battery itself is slightly larger.

TABLE XV
SIM/DBI Volatility and Workload Statistics

Ship/Policy	Battery Growth Ratio (BGR) (Note 1)					Workload Ratio (Note 2)
	Benchmark	2	4	7	8	
DD 973	1.246	1.845	1.885	1.707	1.277	.918
DD 978	1.048	2.499	2.103	1.926	1.424	.817
LPD 15	1.008	2.417	2.137	1.950	1.175	.884
LST 1182	.753	2.655	1.488	1.262	.905	.853
AFS 5	.829	2.036	1.947	2.009	1.120	.593
AFS 3	.539	3.756	3.088	2.643	1.275	.594
AD 17	1.076	2.656	2.305	2.083	1.300	.797
AD 37	.905	1.886	1.477	1.329	.914	.874
FF 1054	1.003	1.239	1.491	1.418	1.113	.897
FF 1056	.972	1.182	1.115	.970	.787	1.059

NOTE 1: $BGR_i = \frac{ADDS_i}{DELETES_i}$ for Policy i

NOTE 2: Workload Ratio = $\frac{\text{Policy 8 (ADDS + DELETES)}}{\text{Benchmark (ADDS + DELETES)}}$

Therefore, based upon the above evaluation, it is recommended that the SIM/DBI policy of two hits in six months to qualify and two hits in 12 months to remain be adopted as the Navy SIM/DBI criteria.

APPENDIX A: REFERENCES

1. NAVSUP PUB 485 (Afloat Supply Procedures)

2. NAVSUP PUB 522 (SUADPS-207 Support Procedures)

3. GAO Report PLRD-81-59 of 11 Sep 1981, "Improved Management of Fleet Supplies and Spare Parts Can Save Millions Without Affecting Readiness"

APPENDIX B: ADDITIONAL STATISTICS

1. The tables in this APPENDIX show the following statistics: gross requisitions effectiveness (partials split and partials satisfied), gross units effectiveness, dollar value of on-hand plus due-in, number of resupply orders, and dollar value of long supply plus excess. These statistics are defined below:

. Gross Requisitions Effectiveness.

.. Partials Split. This statistic is computed by dividing the numbers of requisitions satisfied during the last year of the simulation by the number of requisitions placed during the same year of the simulation. Partially satisfied requisitions were counted as two requisitions -- one satisfied and one not satisfied.

.. Partials Satisfied. This statistic is computed by dividing the number of requisitions satisfied plus the number of requisitions partially satisfied during the last year of the simulation by the number of requisitions placed during the same year of the simulation. The handling of partially satisfied requisitions is the distinguishing factor that differentiates the previous definition. Partial Split was the method used aboard ships and in past reports. Partials Satisfied is similar to the present method used aboard tenders and these statistics are also shown in the main report. They are shown here only for comparison purposes.

.. Gross Units Effectiveness. This statistic results from dividing the number of units satisfied during the second year of the simulation by the number of units required for the same year.

.. Dollar Value of Long Supply Plus Excess. Long supply stock is inventory on-hand above the allowance quantity that is not required

nor supported by current demand. Long supply is applicable only to items with a nonzero allowance quantity that qualified as SIM/DBI at some time during the simulation, and by the end of the simulation the item reverted to a non-SIM/DBI state. This statistic is computed by multiplying the difference between the on-hand stock and the allowance quantity by the end item unit price for applicable items. Excess is applicable only to items with a zero allowance quantity that qualified as SIM/DBI at some time during the simulation and thus become authorized range adds, but by the end of the simulation, the item reverted to a non-SIM/DBI state. This statistic is computed as the value of on-hand stock for the applicable items. The comparative statistics of the dollar value of long supply plus excess should be interpreted carefully. Long supply plus excess are functions of the qualification and retention criteria. For example, a very lenient SIM/DBI retention criterion will most likely result in a small amount of excess/long supply. Demand-based assets would have been built up but since the item remains as SIM/DBI, no excess/long supply would be recorded for this item. Since the long supply/excess dollar value does not always represent true inventory reduction, this statistic is considered in a secondary role.

2. Alternative SIM/DBI Technique. Two different techniques of reviewing an item's demand history were considered for SIM/DBI qualification and retention. The frequency of demand technique (FREQ) is the one currently in use. Under this technique, each separate demand was counted towards meeting the stated criteria. The months of demand method (MOS) was the second technique. In using

this technique, one or more demands placed within the same month were only counted once towards meeting the stated frequency criteria.

3. Results. TABLE B-I shows statistics on gross requisitions effectiveness gross units effectiveness, dollar value of on-hand plus due-in, and number of orders for DLR (Depot Level Repairables) items.

There are several Navy programs that limit the application of SIM/DBI criteria for DLR items on surface ships and tenders. Specifically, additional demand-based levels are not permitted for DLRs. The RO (Requisition Objective) will always equal the AQ (Allowance Quantity). Therefore, change of alternative SIM/DBI criteria does not alter the statistics for DLR items.

TABLE B-I
Criteria Analysis - All Ships
DLR Items

Ship Class	Fleet	Gross Regn Eff.		Unit Eff.		Resupply
		Partials Sat.	Partials Split	Gross	OH+DI	Orders
AFS 3	PAC	89	90	86	4,909,726	325
AFS 5	ATL	65	68	53	3,465,890	723
AD 17	ATL	42	43	33	154,745	45
AD 37	PAC	53	54	39	146,538	23
FF 1054	PAC	53	54	53	351,905	65
FF 1056	ATL	45	45	44	495,150	89
LST 1182	PAC	55	56	49	141,996	50
LPD 15	ATL	49	49	48	225,420	49
DD 973	PAC	61	62	46	829,851	161
DD 978	ATL	61	62	55	1,069,207	149

The following tables (B-II through B-X) display the NSA items gross requisition (partials satisfied) plus aditional statistics not shown in the main report, including gross requisition effectiveness (partials split), gross units effectiveness, and dollar value of long supply and excess.

TABLE B-II

SIM Criteria Analysis - FF 1054*
NSA Items

Criteria	Policy	Gross Reqn Eff.		Unit Eff. Gross	Long Supply + Excess
		Partials Split	Partials Satisfied		
2/6-1/6 Freq	(Current Policy + Benchmark)	43%	50%	36%	$22,120
2/6-2/12 Mos.	1 (GAO Proposal)	0	0	-1	-32%
2/12-1/12 Mos.	2	0	0	+1	-43%
2/6-1/6 Mos.	3	0	0	-1	-20%
2/12-1/12 Freq	4	0	+1	+1	-33%
2/6-1/12 Mos.	5	0	0	-1	-52%
3/6;2/6-1/6 Freq	6	0	0	-3	-13%
2/6-1/12 Freq	7	0	0	0	-41%
2/6-2/12 Freq	8 (Navy Proposal)	0	0	0	-19%
4/12-4/12 Freq	9	-1	-1	-4	-63%
4/12-4/12 Mos.	10	-2	-1	-4	-69%
4/12-2/12 Freq	11	-1	-1	-4	-82%
4/12-2/12 Mos.	12	-2	-1	-4	-87%

*Pacific Fleet Ship

TABLE B-III

SIM Criteria - FF 1056*
NSA Items

Criteria	Policy	Gross Reqn Eff.		Unit Eff. Gross	Long Supply + Excess
		Partials Split	Partials Satisfied		
2/6-1/6 Freq	Benchmark	45%	51%	22%	$43,788
2/6-2/12 Mos.	1 (GAO Proposal)	-1	-1	-2	-18%
2/12-1/12 Mos.	2	-1	0	0	-38%
2/6-1/6 Mos.	3	-1	-1	-2	-26%
2/12-1/12 Freq	4	0	0	0	-24%
2/6-1/12 Mos.	5	-1	-1	-2	-47%
3/6;2/6-1/6 Freq	6	-1	0	-1	-6%
2/6-1/12 Freq	7	-1	0	0	-29%
2/6-2/12 Freq	8 (Navy Proposal)	0	0	0	-1%
4/12-4/12 Freq	9 (Current Policy)	-2	-3	-2	-90%
4/12-4/12 Mos.	10	-3	-3	-4	-88%
4/12-2/12 Freq	11	-2	-3	-2	-90%
4/12-2/12 Mos.	12	-3	-3	-4	-94%

*Atlantic Fleet Ship

TABLE B-IV

SIM Criteria Analysis - DD 973*
NSA Items

Criteria	Policy	Gross Reqn Eff.		Unit Eff. Gross	Long Supply + Excess
		Partials Split	Partials Satisfied		
2/6-1/6 Freq	(Current Policy + Benchmark)	48%	54%	44%	$46,952
2/6-2/12 Mos.	1 (GAO Proposal)	0	-1	-2	-46%
2/12-1/12 Mos.	2	0	0	0	-59%
2/6-1/6 Mos.	3	0	-1	-2	-34%
2/12-1/12 Freq	4	0	0	0	-34%
2/6-1/12 Mos.	5	0	-1	-2	-62%
3/6;2/6-1/6 Freq	6	0	-1	0	-11%
2/6-1/12 Freq	7	0	-1	-1	-36%
2/6-2/12 Freq	8 (Navy Proposal)	0	-1	0	-24%
4/12-4/12 Freq	9	-1	-2	-2	-85%
4/12-4/12 Mos.	10	-2	-3	-1	-84%
4/12-2/12 Freq	11	-1	-2	-2	-89%
4/12-2/12 Mos.	12	-2	-3	-1	-86%

*Pacific Fleet Ship

TABLE B-V

SIM Criteria Analysis - DD 978*
NSA Items

Criteria	Policy	Gross Reqn Eff.		Unit Eff. Gross	Long Supply + Excess
		Partials Split	Partials Satisfied		
2/6-1/6 Freq	Benchmark	52%	58%	47%	$56,258
2/6-2/12 Mos.	1 (GAO Proposal)	0	0	0	-49%
2/12-1/12 Mos	2	0	0	0	-55%
2/6-1/6 Mos.	3	0	-1	0	-14%
2/12-1/12 Freq	4	0	0	0	-50%
2/6-1/12 Mos.	5	0	-1	0	-60%
3/6;2/6-1/6 Freq	6	0	-1	0	-9%
2/6-1/12 Freq	7	0	0	0	-52%
2/6-2/12 Freq	8 (Navy Proposal)	0	0	0	-43%
4/12-4/12 Freq	9 (Current Policy)	-2	-3	-1	-54%
4/12-4/12 Mos.	10	-2	-3	-1	-64%
4/12-2/12 Freq	11	-2	-3	-1	-84%
4/12-2/12 Mos.	12	-3	-4	-1	-90%

*Atlantic Fleet Ship

TABLE B-VI

SIM Criteria Analysis - LPD 15*
NSA Items

Criteria	Policy	Gross Reqn Eff.		Unit Eff. Gross	Long Supply + Excess
		Partials Split	Partials Satisfied		
2/6-1/6 Freq	Benchmark	45%	52%	25%	$56,233
2/6-2/12 Mos.	1 (GAO Proposal)	0	0	0	-36%
2/12-1/12 Mos.	2	0	+1	0	-50%
2/6-1/6 Mos.	3	0	0	0	-15%
2/12-1/12 Freq	4	+1	+1	0	-39%
2/6-1/12 Mos.	5	0	0	0	-53%
3/6;2/6-1/6 Freq	6	0	0	0	-8%
2/6-1/12 Freq	7	0	0	0	-42%
2/6-2/12 Freq	8 (Navy Proposal)	0	0	0	-24%
4/12-4/12 Freq	9 (Current Policy)	-1	-2	-1	-67%
4/12-4/12 Mos.	10	-2	-3	-2	-69%
4/12-2/12 Freq	11	-1	-2	-1	-91%
4/12-2/12 Mos.	12	-2	-3	-2	-94%

*Atlantic Fleet Ship

TABLE B-VII

SIM Criteria Analysis - LST 1182*
NSA Items

Criteria	Policy	Gross Reqn Eff.		Unit Eff. Gross	Long Supply + Excess
		Partials Split	Partials Satisfied		
2/6-1/6 Freq	(Current Policy + Benchmark)	45%	54%	28%	$30,239
2/6-2/12 Mos.	1 (GAO Proposal)	-1	-1	-1	-51%
2/12-1/12 Mos.	2	-1	-1	-1	-86%
2/6-1/6 Mos.	3	-2	-1	-1	-38%
2/12-1/12 Freq	4	0	0	0	-62%
2/6-1/12 Mos.	5	-1	-1	-1	-86%
3/6;2/6-1/6 Freq	6	0	0	-1	-15%
2/6-1/12 Freq	7	0	0	0	-66%
2/6-2/12 Freq	8 (Navy Proposal)	0	0	0	-34%
4/12-4/12 Freq	9	-3	-2	-1	-80%
4/12-4/12 Mos.	10	-3	-3	-2	-92%
4/12-1/12 Freq	11	-2	-2	-1	-91%
4/12-2/12 Mos.	12	-3	-3	-1	-98%

*Pacific Fleet Ship

TABLE B-VIII

DBI Criteria Analysis - AFS 3*
NSA Items

Criteria	Policy	Gross Reqn Eff.		Unit Eff. Gross	Long Supply + Excess
		Partials Split	Partials Satisfied		
2/6-1/6 Freq	Benchmark	86%	92%	86%	$702,716
2/6-2/12 Mos.	1 (GAO Proposal)	-1	0	0	-78%
2/12-1/12 Mos.	2	-1	0	0	-88%
2/6-1/6 Mos.	3	-1	0	0	-5%
2/12-1/12 Freq	4	0	0	0	-86%
2/6-1/12 Mos.	5	-1	0	0	-88%
3/6;2/6-1/6 Freq	6	-1	-1	0	-18%
2/6-1/12 Freq	7	0	0	0	-86%
2/6-2/12 Freq	8 (Navy Proposal + Current Policy)	0	0	0	-78%
4/12-4/12 Freq	9	-1	-1	0	-72%
4/12-4/12 Mos.	10	-1	-1	-1	-67%
4/12-2/12 Freq	11	-1	-1	0	-90%
4/12-2/12 Mos.	12	-1	-1	-1	-93%

*Pacific Fleet Ship

TABLE B-IX
DBI Criteria Analysis - AFS 5*
NSA Items

Criteria	Policy	Gross Reqn Eff.		Unit Eff. Gross	Long Supply + Excess
		Partials Split	Partials Satisfied		
2/6-1/6 Freq	Benchmark	76%	80%	37%	$1,513,570
2/6-2/12 Mos.	1 (GAO Proposal)	0	0	0	-59%
2/12-1/12 Mos.	2	0	0	0	-77%
2/6-1/6 Mos.	3	0	0	0	-5%
2/12-1/12 Freq	4	0	0	0	-75%
2/6-1/12 Mos.	5	0	0	0	-78%
3/6;2/6-1/6 Freq	6	-1	0	0	-10%
1/6-1/12 Freq	7	0	0	0	-76%
2/6-2/12 Freq	8 (Navy Proposal)	0	0	0	-62%
4/12-4/12 Freq	9	-1	-1	0	-55%
4/12-4/12 Mos.	10	-2	-1	0	-74%
4/12-2/12 Freq	11 (Current Policy)	-1	-1	0	-75%
4/12-2/12 Mos.	12	-2	-1	0	-78%

*Atlantic Fleet Ship

TABLE B-X

DBI Criteria Analysis - AD 17*
NSA Items

Criteria	Policy	Gross Reqn Eff.		Unit Eff. Gross	Long Supply + Excess
		Partials Split	Partials Satisfied		
2/6-1/6 Freq	Benchmark	68%	74%	67%	$388,267
2/6-2/12 Mos.	1 (GAO Proposal)	0	0	-1	-54%
2/12-1/12 Mos.	2	+1	+1	0	-68%
2/6-1/6 Mos.	3	0	0	-2	-30%
2/12-1/12 Freq	4	+1	+1	+1	-55%
2/6-1/12 Mos.	5	0	0	-1	-72%
3/6;2/6-1/6 Freq	6	-1	0	-2	-25%
2/6-1/12 Freq	7	+1	0	0	-56%
2/6-2/12 Freq	8 (Navy Proposal)	+1	0	0	-38%
4/12-4/12 Freq	9	-2	-2	-3	-51%
4/12-4/12 Mos.	10	-3	-3	-5	-71%
4/12-2/12 Freq	11 (Current Policy)	-2	-2	-3	-86%
4/12-2/12 Mos.	12	-3	-3	-5	-86%

*Atlantic Fleet Tender

TABLE B-XI

DBI Criteria Analysis - AD 37*
NSA Items

Criteria	Policy	Gross Reqn Eff.		Unit Eff. Gross	Long Supply + Excess
		Partials Split	Partials Satisfied		
2/6-1/6 Freq	Benchmark	66%	71%	71%	$170,163
2/6-2/12 Mos.	1 (GAO Proposal)	-1	0	-1	-26%
2/12-1/12 Mos.	2	0	0	0	-52%
2/6-1/6 Mos.	3	-1	-1	-1	-19%
2/12-1/12 Freq	4	0	+1	0	-37%
2/6-1/12 Mos.	5	-1	0	-1	-56%
3/6;2/6-1/6 Freq	6	-1	0	-1	26%
2/6-1/12 Freq	7	0	+1	0	-40%
2/6-2/12 Freq	8 (Navy Proposal + Current Policy)	0	+1	0	-21%
4/12-4/12 Freq	9	-3	-3	-2	-58%
4/12-4/12 Mos.	10	-4	-4	-2	-70%
4/12-2/12 Freq	11	-3	-3	-2	-75%
4/12-2/12 Mos.	12	-4	-4	-2	-88%

*Pacific Fleet Tender

Distribution List

Commander
Naval Supply Systems Command
Washington, DC 20376
Attn: SUP 04A (2)
Library

Commanding Officer
Navy Aviation Supply Office
Code SDB4-A
Philadelphia, PA 19111

Commander
Naval Surface Forces
U. S. Atlantic Fleet
Attn: Code N7
N713
Norfolk, VA 23511

Commanding Officer
Naval Supply Center
Code 50.1
Norfolk, VA 23512

Commanding Officer
937 North Harbor Drive
Naval Supply Center
Code 41
San Diego, CA 92132

Commanding Officer
Naval Supply Center
Puget Sound (Code 40)
Bremerton, WA 98314

Commanding Officer
Naval Supply Center
Code 40C
Charleston, SC 29408

Commanding Officer
Naval Supply Center
Box 300, Code 41
Pearl Harbor, HI 96860

Commanding Officer
U. S. Naval Supply Depot
Code 51
FPO San Francisco 96630

Commanding Officer
U. S. Naval Supply Depot
Code 51
FPO San Francisco 96651

Commanding Officer
U. S. Naval Supply Depot
Box 11 (Code 51)
FPO Seattle 98762

Chief of Naval Operations
Navy Department (OP-96)
Washington, DC 20350

Chief of Naval Operations
Navy Department (OP-41)
Washington, DC 20350

Commander-in-Chief
U. S. Pacific Fleet, Code 4121
Pearl Harbor, HI 96860

Commander-in-Chief
U. S. Atlantic Fleet
Attn: Supply Officer
Norfolk, VA 23511

Commander Naval Air Force
U. S. Pacific Fleet
Attn: Code 44
NAS, North Island
San Diego, CA 92135

Commander Naval Air Force
U. S. Atlantic Fleet
Attn: Code 40
Norfolk, VA 23511

Commander
Naval Surface Forces
Code N7
Naval Amphibious Base
Coronado, CA 92155

Commander Submarine Force
U. S. Pacific Fleet, Code 41
Pearl Harbor, HI 96860

Commander Submarine Force
U. S. Atlantic Fleet
Attn: Code N411E
Norfolk, VA 23511

Chief of Naval Research
800 North Quincy Street
Arlington, VA 22217

Director
Defense Logistics Agency
Operations Research and
Economic Analysis Office
(DLA-LO)
Cameron Station
Alexandria, VA 22314

Mr. Bernard B. Rosenman
U. S. Army Inventory Research Office
Room 800, Custom House
2nd and Chestnut Sts
Philadelphia, PA 19106

Commanding General
Attn: P820
Marine Corps Logistics Base
Albany, GA 31704

Headquarters
Air Force Logistics Command
Wright Patterson AFB
Attn: Code XRSL
Dayton, OH 45433

Commandant
Industrial College of the Armed Forces
Fort Leslie J. McNair
Washington, DC 20376

Kneale J. Marshall, Chairman
Department of Operations Research
Naval Postgraduate School
Monterey, CA 93940

Commandant
Armed Forces Staff College
Norfolk, VA 23511

Commanding Officer
Naval Supply Corps School
Attn: Code 40B
Athens, GA 30606

Defense Documentation Center
Cameron Station (2)
Alexandria, VA 22314

U. S. Army Logistics Management Center
Defense Logistics Studies Information
Exchange (2)
Fort Lee, VA 23801

Naval Ship Research and Development
Center
Attn: NSRDC 1867
Bethesda, MD 20034

Alan W. McMasters (3)
Associate Professor, Code 54 Mg
Naval Postgraduate School
Monterey, CA 93940

Department of the Air Force
Air Force Logistics Management Center
(AU)
Gunter Air Force Station
Gunter, ALA 36114

Navy Personnel Research and Development
Center
Code P303
San Diego, CA 92152

Security Classification

DOCUMENT CONTROL DATA - R & D

Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified

1. ORIGINATING ACTIVITY (Corporate author) Navy Fleet Material Support Office Operations Analysis Department (93) 5450 Carlisle Pike, P.O. Box 2010 Mechanicsburg, PA 17055	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP

3. REPORT TITLE

Surface Ship Demand-Based Policy Study

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

5. AUTHOR(S) (First name, middle initial, last name)

James L. Fogle

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
	50	3

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
b. PROJECT NO. 9321-E82	152
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	

10. DISTRIBUTION STATEMENT

Distribution of this document is unlimited.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY

13. ABSTRACT

This study evaluates alternative Selected Item Management (SIM)/Demand-Based Item (DBI) criteria using historical demand data and a computer simulation model. The alternatives are evaluated in terms of: (1) gross requisition effectiveness, (2) dollar investment in on-hand plus due-in stock and (3) volatility of the SIM/DBI stock battery. Volatility refers to the size of the SIM/DBI battery and to the rate of adds/deletes to the SIM battery. The study is based on historical demand data taken from six different types of ships; FF, DD, LST, AD, LPD, and AFS. The objective of this study is to evaluate various SIM/DBI qualifying and retention criteria and to determine which criteria best minimizes dollar investment without any loss of effectiveness.

The SIM/DBI criteria of two demends in six months to qualify and one demand in six months to remain a part of the SIM/DBI stock record battery was considered the benchmark for this study. The SIM/DBI benchmark generally had the highest gross effectiveness, dollar investment, resupply orders, and volatility for each test ship.

This study showed that there was no single policy which was best for all ships. There were, however, four SIM/DBI criteria without a decrease in effectiveness from the benchmark. Three of these policies employ a retention criteria that could produce significant SIM/DBI battery size growth. The fourth policy, two hits in six months to qualify and two hits in 12 months to remain, has comparable investment to the benchmark but shos a reduction in battery volatility, hence reducing shipboard workload. Therefore, it is recommedned that the policy of two hits in six months to qualify and two hits in 12 months for retention be adopted as the Navy SIM/DBI policy.

END

FILMED

6-83

DTIC