

SYSTECON UK LIMITED**THE USE OF OPUS IN MARITIME SCENARIOS****1. Introduction**

OPUS is a well established logistics program that has been developed in Sweden by Systecon over a 25 year period. During this development, many studies have been conducted using the model by companies throughout the world. Its capability has changed through 10 versions of the model to support the evolving role of logistics in the systems development process.

The ability of the OPUS model to create significant support cost savings is universally accepted and this paper does not attempt to justify that reputation; it concentrates on specific techniques that enable the model to address the unique problems encountered with maritime/naval scenarios.

2. Historical Development

OPUS 0 was conceived in 1970 to support the spares requirement of the SPICA class torpedo vessel with ARTE 722 Radar and TORPE 696 Fire Control System. This involved the special problem to develop a support concept to fit ARTE and TORPE which had a high degree of commonality and new design concept based on a standard set of Line Replaceable Units (LRU's). This resulted in a single stock of LRU's that supported all systems and a minimum investment to achieve a given Probability of Stock Shortage. This gave rise to issues such as how the decision on the funds to spend is made. This had an impact on the SPICA mission and the effect that changing investment level would have.

Additional Naval Support Analysis the following year led to the development of OPUS 1. Some of the many questions that arose from OPUS 0 were addressed by implementing modified algorithms with no objective function constraint. Running and sorting data gave the Cost Effectiveness (C/E) Curve capability. Unfortunately, mission impact was not immediately visible.

In 1972 as a result of Submarine Support Studies and the Viggen AJ-37 avionics support analysis, OPUS 2 was released. These projects gave rise to several problems:-

- AJ-37 avionics have LRU's and SRU's to be supported by a three echelon organisation.

- Submarines have very long missions and carry limited onboard stock, being mainly supported from bases.

This resulted in OPUS 2 having a simple two echelon, symmetric organisation (LRU-LRU or LRU-SRU). Off-Line models were used to provide data to the OPUS model.

Further AJ-37 System and Support Studies led to the release of OPUS 3 in 1973. This resulted from the fact that the current OPUS capability did not come close to the study requirements. OPUS 3 used a dynamic programming approach to the concepts of OPUS 0. It also included three optional measures of effectiveness - Availability (A), Waiting Time (Tw) and Risk of Shortage (Q) in optimisation, all of which are computed for output. There were also no constraints and an intelligent choice and sorting to produce the C/E Curve. In addition, the release included full LRU/SRU capability with system and LRU commonalty and a false echelon (full two significance level) non-symmetric support organisation.

OPUS 4 was developed in 1974 for two studies, a naval radar and fire control system and further analysis of the AJ-37 sub-systems. OPUS 3 was modified to allow four modes of operation which resulted from the need to add to existing stocks and also to possibly reallocate these stocks:

- Initial Provision.
- Reallocation of Existing Stocks.
- Reallocation and Replenishment.
- Effective Analysis of a given support organisation.

In 1975, Howitzer 77 and other army applications required an increase in the number of echelons, units and the complexity of the support organisation. This requirement led to the development of OPUS 5, which firstly restructured the software and modularised the algorithms to enable an unlimited number of significance levels and hence the number of echelons to be modelled. Unfortunately, no Probability of Stock Shortage optimisation left naval application studies still being conducted using OPUS 3 and OPUS 4.

Since Naval Applications and AJ/JA/S 37 System Support Analysis could not be undertaken using OPUS 5, in 1976, OPUS 6 was developed. This version included the provision of Probability of Stock Shortage as an optimisation criteria to satisfy the naval applications together with an internal model to add the Probability Of Mission Success as a criteria.

In 1977, OPUS 7 was released for Submarine Support Analysis and AJ/JA/S 37 provisioning. This issue of the program addressed the following issues:

- Submarines call on different bases for support.
- Focus on repair and stock policies.
- Non-Repairable Items included in the analysis.

OPUS 7 therefore introduced a new support flow modelling principal leading to the following:-

- No support problem constraints apart from "No Return" of flows.
- Individual unit repair and stocking policies.
- Individual unit computed waiting times.

OPUS 8 was introduced in 1986 and contains the model structure of the present version.

OPUS 9 was released in 1990.

The current version, OPUS 10, which comprises all the functionality of OPUS9, but now implemented as a full Microsoft Windows Version 3.1 application, was introduced in 1995.

3. **Maritime Worked Example Scenario**

A fleet of two fast patrol vessels are to be operated from a defined port, where the main support base is collocated. This base is at a remote location from the UK and is in turn supported by a UK contractor. This simple support scenario is modelled in OPUS as three stations, one to represent the UK Contractor, a second to represent the support base and a third to represent the Patrol Vessels. This scenario is shown in Figure 1.

Each vessel is on average 24 hours away from its base. Its average mission time is 10 days, while the Average Time spent In Base is 20 Days. This mission profile is repeated throughout the period under investigation.

The problem being considered is to evaluate the spares requirement for one sub-system on the vessel which we will assume for the purposes of this example to be a generator. This sub-system comprises 24 LRU's each of which is repaired by direct repair only - they have no component parts. No repair to failed LRU's is possible on-board the vessel.

There is also a limited capability to repair the LRU's that can be held on-board at the main support base. The turnaround time for such repairs is 10 weeks (1680 Hours) and there is a 80% recovery rate. The 20% that cannot be repaired at the Main Support Base, together with the remaining LRU's that can only be repaired by the UK contractor have turnaround time of 1 year (8760 Hours). The transportation time for these components is 2 weeks (336 Hours) in either direction.

The target availability of the generator (ie the system in this case) is 90% over the evaluation period of 5 years.

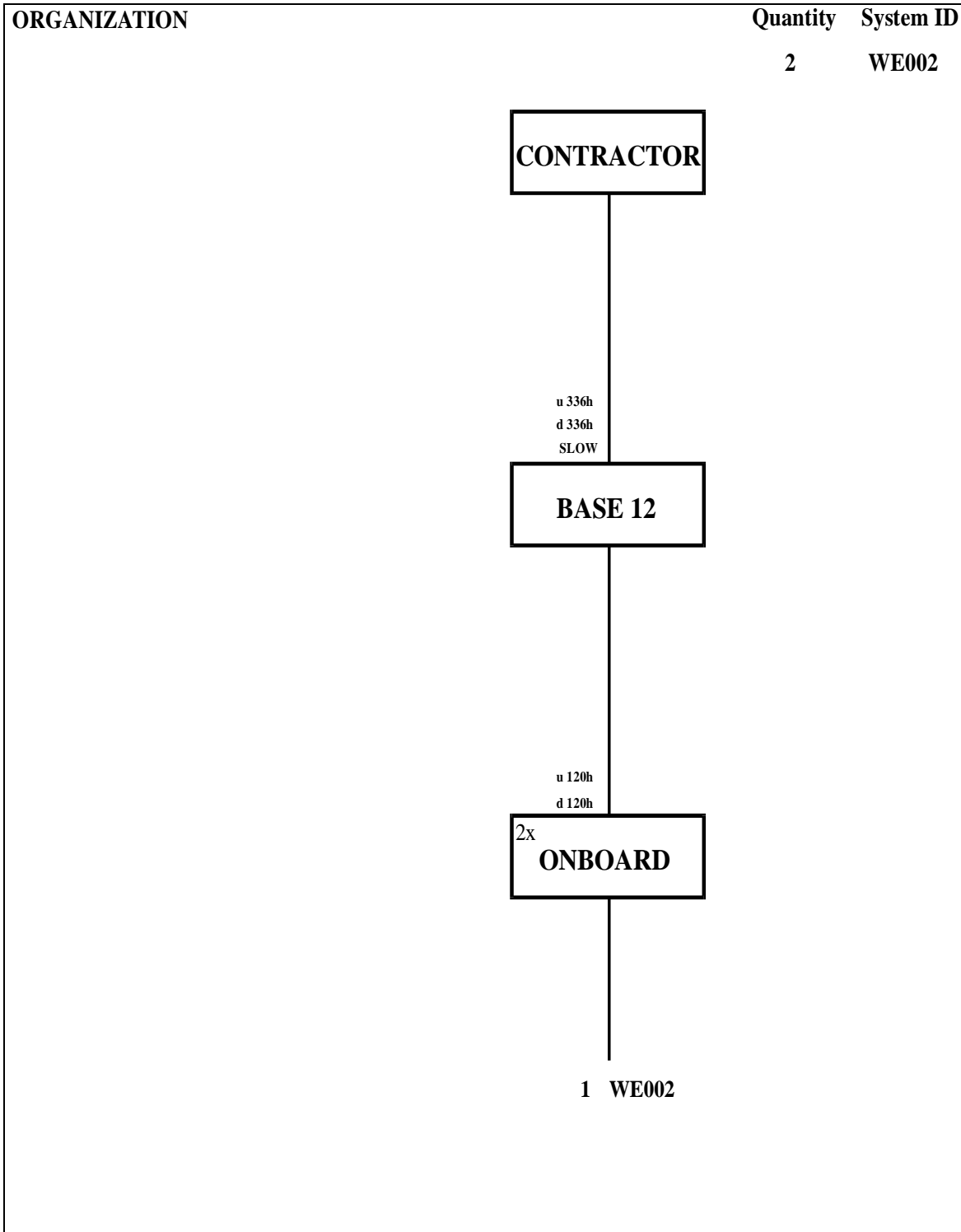


Figure 1 : Logistic Support Network

There are three cases that can be considered in this operating scenario

- The LRU's are stocked on-board, therefore, on failure the LRU is replaced and retained on-board until the end of the mission, whereupon the on-board stock will be replenished.
- The LRU's are **not** stocked on-board the vessel, therefore, on failure the Fleet Auxiliary is called and will bring the faulty LRU back to base.
- The LRU cannot be replaced during the mission since the LRU must be calibrated in situ using special test equipment, therefore, on failure the vessel aborts its mission and returns to its home base, whereupon the repair is undertaken.

3.1 Scenario 1

This scenario considers the first case where there is no limitation to the vessel carrying stock.

The generator being modelled is assumed to operate at all times whether the vessel is in port or at sea, so 100% utilisation is assumed. If sub-systems such as the engines or radar were to be modelled this utilisation may well be less than 100%.

In this case, the only repair that can be conducted on-board is on the sub-system (i.e. the generator) by sub-item replacement of faulty LRU's.

The operation of the vessel takes place in two modes - on patrol and in base. This is modelled from an OPUS point of view by adding a dummy station called INBASE. This station has zero transit time from both the Patrol Vessel and the Main Support Base. The ratio of patrol and in base activity is 2:1, therefore the demand fraction from the vessel will be 67% from INBASE and 33% from the Main Support Base. The dummy station INBASE is designated a WS and the Repair Turnaround time for Items is zero (since the vessel is at the base during these failures) with 0% recovery at this station.

The faulty LRU's remain on-board the vessel for the remainder of the mission. It has been assumed that on average these faulty LRU's remain on-board the vessel for half the mission time. Since, in this case, the mission time is 10 days, then the transportation time will be 120 hours. Since the faulty LRU's reach the Support Base at the same time as the replacement LRU's reach the vessel, in OPUS terms the transportation time will be 120 hours both to and from support station and the ordering policy will be "FAST" (which means that a demand reaches the supporting station immediately after it has arisen at the supported station, i.e. by a phone call is made warning of the faulty LRU's impending arrival.)

The input file that is used by OPUS to model this scenario together with the resultant C/E Curve and standard output file produced by the model is shown in Appendix A. The C/E Curve shown in Figure A-1 has the point used to generate the data in the standard output file shown as a solid black sphere.

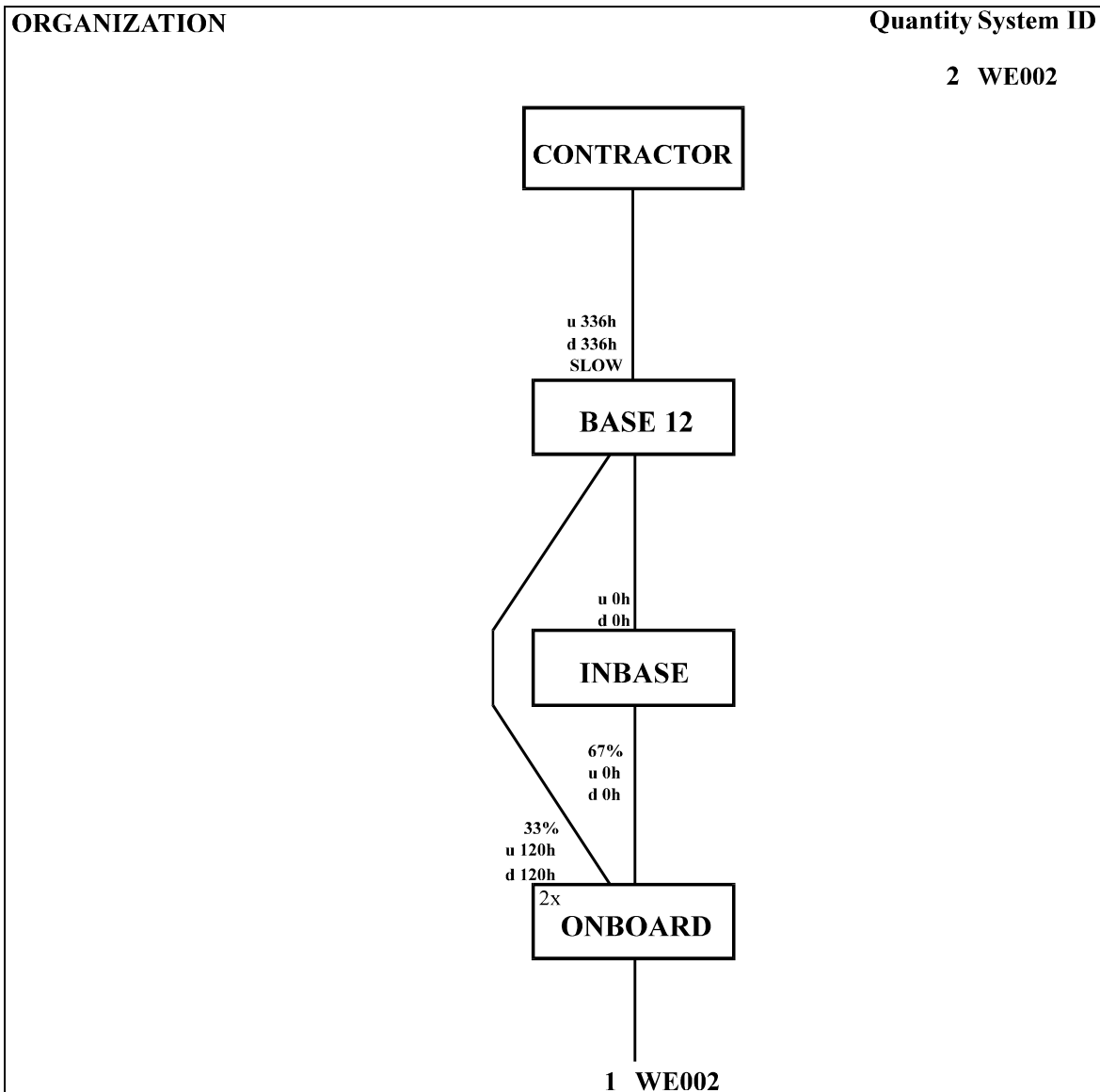


Figure 2 : Modelling Logistic Support Network for Scenario 1

3.2 Scenario 2

This scenario considers an adaptation of Scenario 1, in which, due to storage limitations on the craft there will be little or no stock or repair on-board. Due to their high failure rates, two LRU's, 002LRU14 and 002LRU18 must be carried on each of the vessels and the minimum stock for these LRU's is one. LRU's 002LRU15 and 002LRU19 to 002LRU24 can also be carried if required. All the remaining LRU's together with a supply of those which can be held on-board may also be held at the main support base.

The only repair that can be conducted on-board is on the sub-system (i.e. the generator) by sub-item replacement of faulty LRU's. If a replacement LRU is held on-board, the repair by sub-item replacement takes 1.5 hours, otherwise when a failure occurs, in order that the mission can continue, a replacement LRU is delivered by a Fleet Auxiliary vessel. This Fleet Auxiliary vessel returns the faulty LRU to the main support base. The patrol vessel is on average 24 hours away from its home port, therefore we have assumed the Fleet Auxiliary has the same transit speed and therefore the transit time is also 24 hours.

To model this scenario, the Fleet Auxiliary does not need to be physically represented as a separate station in the OPUS model, it is represented as a pipeline time by the link between stations BASE 12 and 0-ONBOARD. This pipeline time is only incurred when the patrol vessel is on patrol, therefore the 2:1 ratio of failures must also be applied to the subset station 0-ONBOARD. When the vessel is in the base, the pipeline time is zero. To cater for the delivery of spares that range from more critical to less critical, several subset stations similar to 0-ONBOARD can be added so that the different pipeline times for different modes of transport can be modelled. Once the replacement LRU is delivered by the Fleet Auxiliary vessel, the repair by sub-item replacement will take 1.5 hours.

The input file that is used by OPUS to model this scenario together with the resultant C/E Curve and standard output file produced by the model is shown in Appendix B. The C/E Curve shown in Figure B-1 has the point used to generated the data in the standard output file shown as a solid black sphere.

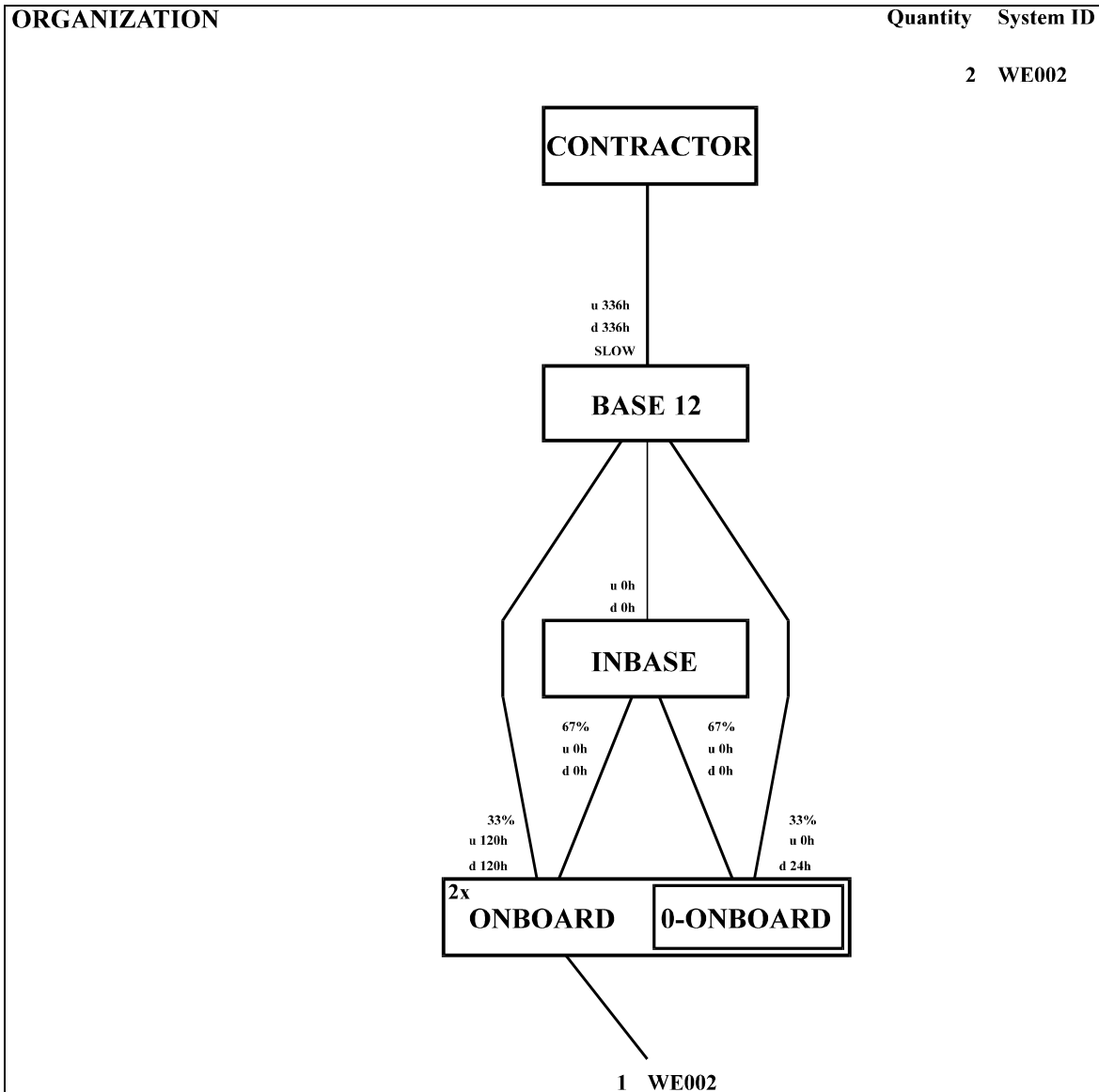


Figure 3 : Modelling Logistic Support Network for Scenario 2

3.3 Scenario 3

This scenario considers an adaptation of Scenario 2, in which, certain items can only be replaced at the Main Support Base.

The only repair that can be conducted on-board is on the sub-system (i.e. the generator) by sub-item replacement of faulty LRU's. If a replacement LRU is held on-board, the repair by sub-item replacement takes 1.5 hours, otherwise when a failure occurs, in order that the mission can continue, a replacement LRU is either delivered by a Fleet Auxiliary vessel or the Patrol Vessel must abort its mission and return to its base. It has been assumed that LRU's 002LRU4 to 002LRU7 are critical items that can only be replaced at the Main Support Base. This Fleet Auxiliary vessel returns the faulty LRU to the Main Support Base. The patrol vessel is on average 24 hours away from its Main Support Base, therefore we have assumed the Fleet Auxiliary has the same transit speed and therefore the transit time is also 24 hours.

To model the scenario of the Patrol Vessel returning to its Main Support base in OPUS we need to add a second subset station to the Patrol Vessel (ONBOARD) called CF-ONBOARD. The transportation time in this case will be twice the average time the vessel is away from its base (24 hours) i.e. 48 hours and the repair policy FAST.

The input file that is used by OPUS to model this scenario together with the resultant C/E Curve and standard output file produced by the model is shown in Appendix C. The C/E Curve shown in Figure C-1 has the point used to generate the data in the standard output file shown as a solid black sphere.

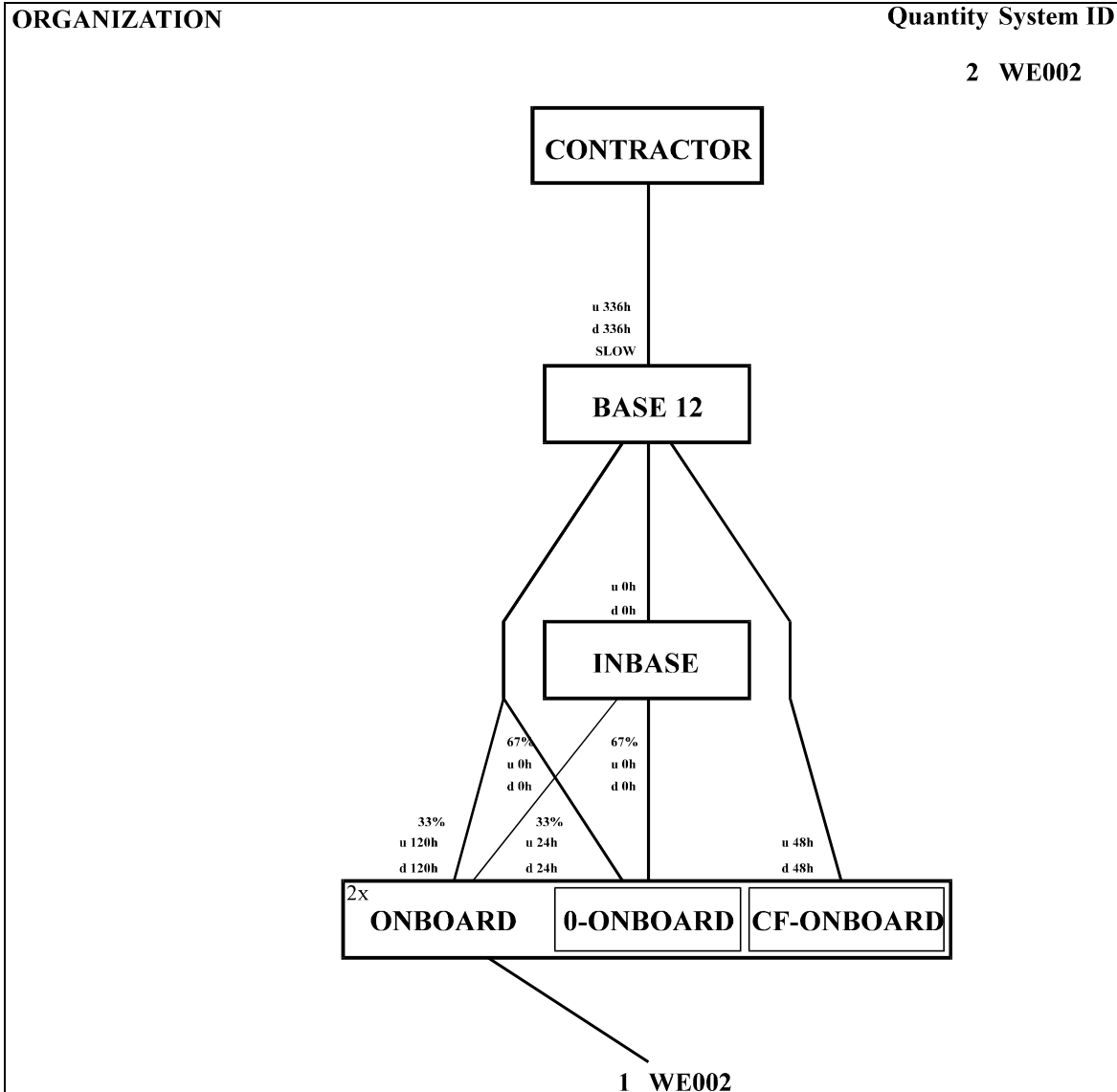


Figure 4 : Modelling Logistic Support Network for Scenario 3

4. **Maritime Users**

The following table shows the current worldwide users who specifically use OPUS for Maritime applications. These companies use OPUS for defence, commercial and offshore applications.

Company	Location
Australian Submarine Corps	Adelaide, Australia
Karlskronavarvet	Karlskrona, Sweden
MINDEF Singapore	Singapore
Naval Material Department (FMV:MUH)	Stockholm, Sweden
Royal Australian Navy	Canberra, Australia
STATOIL DDB	Bergen, Norway
STATOIL DTJ/Heidrun	Stjørdal, Norway
STATOIL TEK/OPTEK	Stavanger, Norway
VSEL	Barrow-in-Furness

5. Conclusions

Using the techniques detailed in this document, OPUS can be easily used to accurately assess the optimum spares ranging and scaling of spares in Maritime/naval applications.

Although the example shown is fairly simplistic, the techniques described in this document can be developed for more complex realistic support scenarios.

The example used is merely a mechanism to show the techniques that should be used and should not therefore be used to draw specific comparisons from the result files included in the appendices. However, if this were a study being performed on behalf of an ILS Manager who posed the question *what would be the effect on system availability of holding spares on-board the vessel or at the main support base and transporting them using an auxiliary vessel*, then it can be seen that there is no advantage in holding most spares on-board the vessel. This would release space so that spares more critical sub-systems could be stored in the limited storage available on-board the vessel which have more impact on availability. These critical spares are determined by further OPUS analyses of the other sub-systems that make up the patrol vessel.

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APPENDIX A
INPUT AND RESULTS FILE FOR SCENARIO 1

INPUT FILE

*PROBLEM TEXT

```

+-----+
!                                     PTEXT                                     !
!           Problem header and a short description                           !
+-----+
!WE002 - Fast Patrol Vessel                                               !
!                                                                           !
!All items can be stored on board the vessels                             !
!                                                                           !
+-----+

```

*PROBLEM DEFINITION

```

+-----+
! STYPE : Scenario type (STEADY-STATE) !                                     !
+-----+
! PTYPE : Problem type (INITIAL)      !                                     !
+-----+
! PRMOE : Primary MoE (NOR)           !A                                     !
+-----+

```

*GLOBAL PARAMETERS

```

+-----+
! IRATE : Interest rate in %          (0.0) ! 0.00!
+-----+
! LIFEL : System lifelength in years   ! 5.0!
+-----+
! ENPER : Endurance time period        ! !
+-----+
! MANHC : Manhour cost                  (0.0) ! !
+-----+
! CURRN : Currency name                 !pounds !
+-----+
! BDVMR : Batched demands VMR          (1.0) ! !
+-----+

```

*SYSTEM

```

+-----+
! SID  !! DENOM          ! PRICE ! FRT ! CTID  !
! System !! Denomination ! Unit !Failure ! Repair !
! identifier!!          ! price ! rate !category !
!      !!          !      ! 10-6 !      !
!      !!          !      !      ! (=SID) !
+-----+
!WE002 !!SYSTEM          !      !      !      !
+-----+

```

*STATION

STID	DENOM	QTY	LEVEL	TYPE	GPID
Station	Denomination	Total	Level	Type	Group of
identifier		quantity			station
		(1)		(DEPOT)	
CONTRACTOR	CONTRACTOR REPAIR			WS	
BASE 12	HOME BASE			DEPOT	
ONBOARD	ONBOARD REPAIR	2		DEPOT	
INBASE		1		WS	

*STATION STRUCTURE

STID	STIDS	TFRSS	TTOSS	CFRSS	CTOSS	DFRAC	OPOL
Station	Support	Time from	Time to	Cost from	Cost to	Demand	Ordering
identifier	station	support	support	support	support	fraction	policy
				(0.0)	(0.0)	(1.0)	(FAST)
BASE 12	CONTRACTOR	336.0	336.0				SLOW
ONBOARD	BASE 12	120.0	120.0			0.330	
INBASE		0.0	0.0				
ONBOARD	INBASE	0.0	0.0			0.670	

*SYSTEM DEPLOYMENT

SID	STID	QTYPS	UTILF
System	Station	Quantity	Utilization
identifier	identifier	per	factor
		(1)	(1.0)
WE002	ONBOARD	1	0.300

*ITEM

IID	DENOM	PRICE	FRT	CTID	NSIMI	EXIST	AFFRT
Item	Denomination	Unit	Failure	Stock &	Number	Existing	Appli-
identifier		price	rate	repair	similar	stock	cation
			10-6	category			factor
			(=IID)	(1)	(0)	(1.0)	
002LRU1	LRU	4360.000	37.57				
002LRU2	LRU	8437.000	52.50				
002LRU3	LRU	280.000	5.02				
002LRU4	LRU	11306.000	96.61				
002LRU5	LRU	6430.000	85.21				
002LRU6	LRU	4996.000	42.74				
002LRU7	LRU	4643.000	31.97				
002LRU8	LRU	5109.000	22.62				
002LRU9	LRU	24904.000	190.19				
002LRU10	LRU	13758.000	74.98				

*ITEM

IID	DENOM	PRICE	FRT	CTID	NSIMI	EXIST	AFFRT
Item	Denomination	Unit	Failure	Stock &	Number	Existing	Appli-

!identifier!!	! price	! rate	! repair	!similar!	! stock	! cation!
! !!	! !	! 10-6	!category	! !	! !	! factor!
! !!	! !	! !	! (=IID)	! (1)	! (0)	! (1.0) !
!002LRU11 !!LRU	!10157.000!	! 103.18!	!	!	!	!
!002LRU12 !!LRU	!22362.000!	! 144.20!	!	!	!	!
!002LRU13 !!LRU	! 646.000!	! 5.00!	!	!	!	!
!002LRU14 !!LRU	! 4074.000!	!1011.34!	!	!	!	!
!002LRU15 !!LRU	! 4200.000!	! 23.12!	!	!	!	!
!002LRU16 !!LRU	! 3564.000!	! 13.30!	!	!	!	!
!002LRU17 !!LRU	! 2659.000!	! 20.00!	!	!	!	!
!002LRU18 !!LRU	! 3.000!	!2020.00!	!	!	!	!
!002LRU19 !!LRU	! 360.000!	! 2.25!	!	!	!	!
!002LRU20 !!LRU	! 356.000!	! 2.25!	!	!	!	!
!002LRU21 !!LRU	! 158.000!	! 0.20!	!	!	!	!
!002LRU22 !!LRU	! 640.000!	! 4.80!	!	!	!	!
!002LRU23 !!LRU	! 675.000!	! 4.80!	!	!	!	!
!002LRU24 !!LRU	! 675.000!	! 4.80!	!	!	!	!

*ITEM STRUCTURE

! IIDS	! IDM	!! QTYPM	! ENVF	! RRF
! Subitem	!Motheritem!!	! Quantity	!Environment!	!Removal!
!identifier!	!or system !!	! per	! factor	! rate !
!	!identifier!!	!motheritem!	!	!factor !
!	!	!! (1)	! (1.0)	! (1.0) !
!002LRU1 !WE002	!!	2!	1.000!	1.000!
!002LRU2 !	!!	2!	1.000!	1.000!
!002LRU3 !	!!	2!	1.000!	1.000!
!002LRU4 !	!!	2!	1.000!	1.000!
!002LRU5 !	!!	2!	1.000!	1.000!
!002LRU6 !	!!	2!	1.000!	1.000!
!002LRU7 !	!!	2!	1.000!	1.000!
!002LRU8 !	!!	2!	1.000!	1.000!
!002LRU9 !	!!	2!	1.000!	1.000!
!002LRU10 !	!!	2!	1.000!	1.000!
!002LRU11 !	!!	2!	1.000!	1.000!
!002LRU12 !	!!	6!	1.000!	1.000!
!002LRU13 !	!!	2!	1.000!	1.000!
!002LRU14 !	!!	4!	1.000!	1.000!
!002LRU15 !	!!	2!	1.000!	1.000!
!002LRU16 !	!!	2!	1.000!	1.000!
!002LRU17 !	!!	2!	1.000!	1.000!
!002LRU18 !	!!	4!	1.000!	1.000!
!002LRU19 !	!!	2!	1.000!	1.000!
!002LRU20 !	!!	6!	1.000!	1.000!
!002LRU21 !	!!	2!	1.000!	1.000!
!002LRU22 !	!!	2!	1.000!	1.000!
!002LRU23 !	!!	2!	1.000!	1.000!
!002LRU24 !	!!	2!	1.000!	1.000!

*REPAIR POLICY

! CTID	! STID	!! DIRPM	! DIRPT	! SURPM	! SURPT	! DIRPF	! SURPF
! Category	! Station	!! Direct	! Direct	! Subitem	! Subitem	! Direct	! Subitem
! Identifier	! Identifier	!! repair	! repair	! replacem	! replacem	! repair	! replacem
!	!	!! manhours	! TAT	! manhours	! TAT	! fraction	! fraction
!	!	!! (0.0)	!	! (0.0)	!	! (1.0)	! (=DIRPF)
!WE002	!ONBOARD	!!	!	!	1.0!	1.5!	!
!002LRU1	!INBASE	!!	!	0.0!	!	!	0.000!
!002LRU2	!	!!	!	0.0!	!	!	0.000!
!002LRU3	!	!!	!	0.0!	!	!	0.000!
!002LRU4	!	!!	!	0.0!	!	!	0.000!
!002LRU5	!	!!	!	0.0!	!	!	0.000!
!002LRU6	!	!!	!	0.0!	!	!	0.000!
!002LRU7	!	!!	!	0.0!	!	!	0.000!
!002LRU8	!	!!	!	0.0!	!	!	0.000!
!002LRU9	!	!!	!	0.0!	!	!	0.000!
!002LRU10	!	!!	!	0.0!	!	!	0.000!
!002LRU11	!	!!	!	0.0!	!	!	0.000!
!002LRU12	!	!!	!	0.0!	!	!	0.000!
!002LRU13	!	!!	!	0.0!	!	!	0.000!
!002LRU14	!	!!	!	0.0!	!	!	0.000!
!002LRU15	!	!!	!	0.0!	!	!	0.000!
!002LRU16	!	!!	!	0.0!	!	!	0.000!
!002LRU17	!	!!	!	0.0!	!	!	0.000!
!002LRU18	!	!!	!	0.0!	!	!	0.000!
!002LRU19	!	!!	!	0.0!	!	!	0.000!
!002LRU20	!	!!	!	0.0!	!	!	0.000!
!002LRU21	!	!!	!	0.0!	!	!	0.000!
!002LRU22	!	!!	!	0.0!	!	!	0.000!
!002LRU23	!	!!	!	0.0!	!	!	0.000!
!002LRU24	!	!!	!	0.0!	!	!	0.000!
!002LRU1	!BASE 12	!!	!	!	!	!	0.000!
!002LRU2	!	!!	!	!	!	!	0.000!
!002LRU3	!	!!	!	!	!	!	0.000!
!002LRU4	!	!!	!	!	!	!	0.000!
!002LRU5	!	!!	!	!	!	!	0.000!
!002LRU6	!	!!	!	!	!	!	0.000!
!002LRU7	!	!!	!	!	!	!	0.000!
!002LRU8	!	!!	!	!	!	!	0.000!
!002LRU9	!	!!	!	!	!	!	0.000!
!002LRU10	!	!!	!	!	!	!	0.000!
!002LRU11	!	!!	!	!	!	!	0.000!
!002LRU12	!	!!	!	!	!	!	0.000!
!002LRU13	!	!!	!	!	!	!	0.000!
!002LRU14	!	!!	!	1680.0!	!	!	0.800!
!002LRU15	!	!!	!	1680.0!	!	!	0.800!
!002LRU16	!	!!	!	!	!	!	0.000!
!002LRU17	!	!!	!	!	!	!	0.000!
!002LRU18	!	!!	!	1680.0!	!	!	0.800!
!002LRU19	!	!!	!	1680.0!	!	!	0.800!
!002LRU20	!	!!	!	1680.0!	!	!	0.800!
!002LRU21	!	!!	!	1680.0!	!	!	0.800!
!002LRU22	!	!!	!	1680.0!	!	!	0.800!
!002LRU23	!	!!	!	1680.0!	!	!	0.800!
!002LRU24	!	!!	!	1680.0!	!	!	0.800!
!002LRU1	!CONTRACTOR	!!	!	8760.0!	!	!	!
!002LRU2	!	!!	!	8760.0!	!	!	!
!002LRU3	!	!!	!	8760.0!	!	!	!
!002LRU4	!	!!	!	8760.0!	!	!	!
!002LRU5	!	!!	!	8760.0!	!	!	!
!002LRU6	!	!!	!	8760.0!	!	!	!
!002LRU7	!	!!	!	8760.0!	!	!	!

*REPAIR POLICY

! CTID	! STID	!! DIRPM	! DIRPT	! SURPM	! SURPT	! DIRPF	! SURPF
! Category	! Station	!! Direct	! Direct	! Subitem	! Subitem	! Direct	! Subitem

!identifier!	!identifier!	!! repair	! repair	!replacem!	replacem!	repair	replacem!
!	!	!!manhours!	TAT	!manhours!	TAT	!fraction!	fraction!
!	!	!! (0.0)	!	! (0.0)	!	! (1.0)	!(=DIRPF)!
!002LRU8	!	!!	!	8760.0!	!	!	!
!002LRU9	!	!!	!	8760.0!	!	!	!
!002LRU10	!	!!	!	8760.0!	!	!	!
!002LRU11	!	!!	!	8760.0!	!	!	!
!002LRU12	!	!!	!	8760.0!	!	!	!
!002LRU13	!	!!	!	8760.0!	!	!	!
!002LRU14	!	!!	!	8760.0!	!	!	!
!002LRU15	!	!!	!	8760.0!	!	!	!
!002LRU16	!	!!	!	8760.0!	!	!	!
!002LRU17	!	!!	!	8760.0!	!	!	!
!002LRU18	!	!!	!	8760.0!	!	!	!
!002LRU19	!	!!	!	8760.0!	!	!	!
!002LRU20	!	!!	!	8760.0!	!	!	!
!002LRU21	!	!!	!	8760.0!	!	!	!
!002LRU22	!	!!	!	8760.0!	!	!	!
!002LRU23	!	!!	!	8760.0!	!	!	!
!002LRU24	!	!!	!	8760.0!	!	!	!

*STOCK POLICY

! CTID	! STID	!! CUNIT	! CVAL	! MINST	! MAXST
! Category	! Station	!! Storage	! Storage	! Minimal	! Maximal
!identifier!	!identifier!	!! cost	! cost	! stock	! stock
!	!	!! per unit!	!per value!	!	!
!	!	!! (0.0)	! (0.0)	! (0)	!
!002LRU1	!BASE 12	!!	!	!	!
!002LRU2	!	!!	!	!	!
!002LRU3	!	!!	!	!	!
!002LRU4	!	!!	!	!	!
!002LRU5	!	!!	!	!	!
!002LRU6	!	!!	!	!	!
!002LRU7	!	!!	!	!	!
!002LRU8	!	!!	!	!	!
!002LRU9	!	!!	!	!	!
!002LRU10	!	!!	!	!	!
!002LRU11	!	!!	!	!	!
!002LRU12	!	!!	!	!	!
!002LRU13	!	!!	!	!	!
!002LRU14	!	!!	!	!	!
!002LRU15	!	!!	!	!	!
!002LRU16	!	!!	!	!	!
!002LRU17	!	!!	!	!	!
!002LRU18	!	!!	!	!	!
!002LRU19	!	!!	!	!	!
!002LRU20	!	!!	!	!	!
!002LRU21	!	!!	!	!	!
!002LRU22	!	!!	!	!	!
!002LRU23	!	!!	!	!	!
!002LRU24	!	!!	!	!	!
!002LRU1	!ONBOARD	!!	!	!	!
!002LRU2	!	!!	!	!	!
!002LRU3	!	!!	!	!	!
!002LRU4	!	!!	!	!	!
!002LRU5	!	!!	!	!	!

*STOCK POLICY

! CTID	! STID	!! CUNIT	! CVAL	! MINST	! MAXST
! Category	! Station	!! Storage	! Storage	! Minimal	! Maximal
!identifier!	!identifier!	!! cost	! cost	! stock	! stock
!	!	!! per unit!	!per value!	!	!
!	!	!! (0.0)	! (0.0)	! (0)	!

```

!002LRU6  !      !!      !      !      !      !
!002LRU7  !      !!      !      !      !      !
!002LRU8  !      !!      !      !      !      !
!002LRU9  !      !!      !      !      !      !
!002LRU10 !      !!      !      !      !      !
!002LRU11 !      !!      !      !      !      !
!002LRU12 !      !!      !      !      !      !
!002LRU13 !      !!      !      !      !      !
!002LRU14 !      !!      !      !      !      !
!002LRU15 !      !!      !      !      !      !
!002LRU16 !      !!      !      !      !      !
!002LRU17 !      !!      !      !      !      !
!002LRU18 !      !!      !      !      !      !
!002LRU19 !      !!      !      !      !      !
!002LRU20 !      !!      !      !      !      !
!002LRU21 !      !!      !      !      !      !
!002LRU22 !      !!      !      !      !      !
!002LRU23 !      !!      !      !      !      !
!002LRU24 !      !!      !      !      !      !
+-----+-----+-----+-----+-----+

```

*LIMITS BRIEF RESULTS

```

+-----+-----+-----+-----+
! NPNTB : Number of points      (30) !      !
+-----+-----+-----+-----+
! MINCB : Minimal LSC           !      !
+-----+-----+-----+-----+
! MAXCB : Maximal LSC           !      !
+-----+-----+-----+-----+
! MINMB : Minimal MoE           !      !
+-----+-----+-----+-----+
! MAXMB : Maximal MoE           !      !
+-----+-----+-----+-----+
! OLEVl : Optimize level  (NORMAL) !      !
+-----+-----+-----+-----+

```

RESULTS

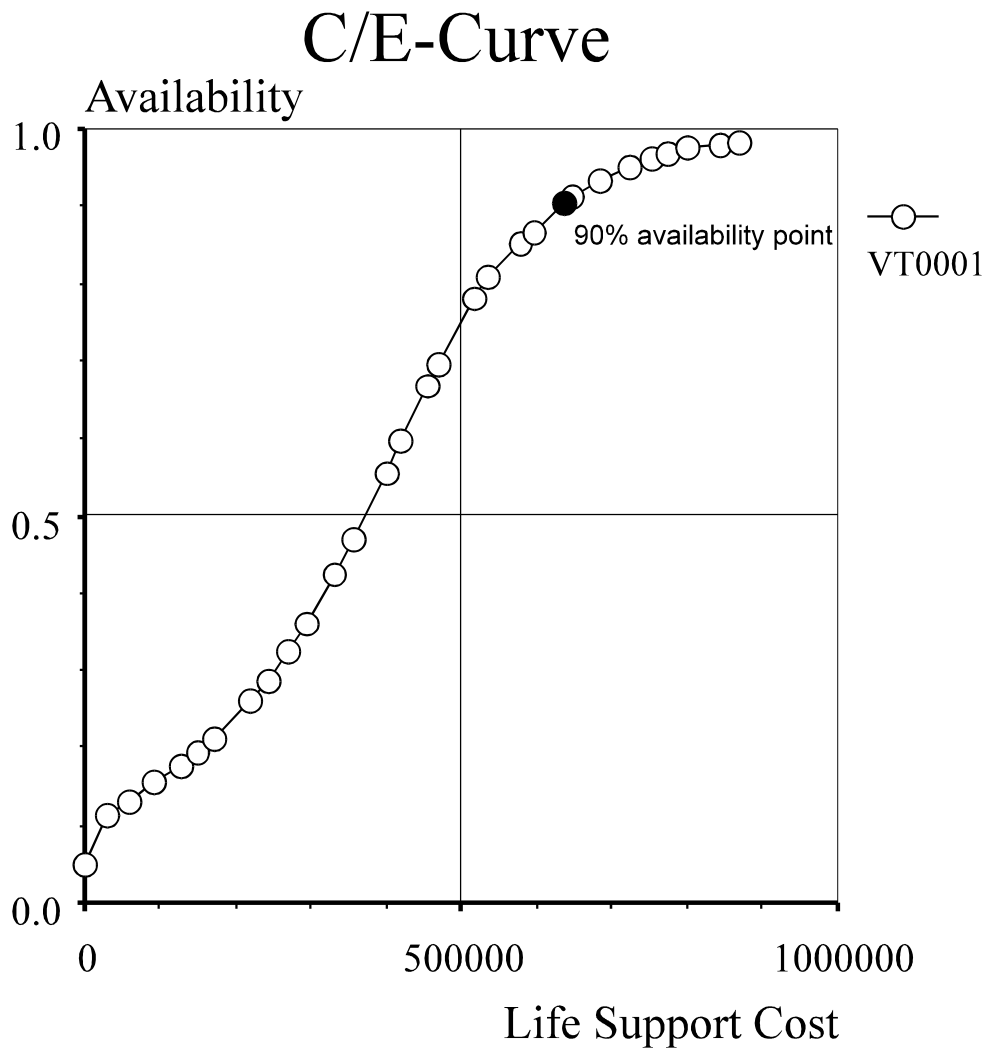


Figure A1 : Cost Effectiveness Curve for Scenario 1

Sample OPUS Results File

OPUS10 (version 1.2e)

WE002 - Fast Patrol Vessel

WSAL

10:44:28

Oct 02 1995

Results for infile: C:\OPUS10\VT0001.OPI
 at (Date & Time): Sep 29 1995, 13:57:36

PTEXT

WE002 - Fast Patrol Vessel

All items can be stored on board the vessels

*Cost and MoE Summary

POINT	LSC	CI	WT	ROS	MDT	A
1	0.00	0.00	4337.28	1.0000	4338.78	0.0498
2	29186.00	29186.00	1784.07	0.3811	1785.57	0.1131
3	58361.00	58361.00	1492.90	0.4507	1494.40	0.1322
4	91790.00	91790.00	1247.13	0.4507	1248.63	0.1542
5	126669.00	126669.00	1062.75	0.4484	1064.25	0.1762
6	149031.00	149031.00	953.88	0.4484	955.38	0.1924
7	172783.00	172783.00	843.90	0.4484	845.40	0.2121
8	220049.00	220049.00	644.40	0.4484	645.90	0.2606
9	242411.00	242411.00	562.11	0.4484	563.61	0.2877
10	269938.00	269938.00	472.08	0.4484	473.58	0.3246
11	294842.00	294842.00	399.71	0.4484	401.21	0.3620
12	330711.00	330711.00	306.03	0.1975	307.53	0.4253
13	357273.00	357273.00	254.12	0.1975	255.62	0.4710
14	400295.00	400295.00	180.60	0.1975	182.10	0.5555
15	419805.00	419805.00	152.44	0.1975	153.94	0.5965
16	456398.00	456398.00	111.75	0.1915	113.25	0.6677
17	470366.00	470366.00	97.93	0.1915	99.43	0.6960
18	517632.00	517632.00	62.00	0.1433	63.50	0.7819
19	536937.00	536937.00	52.27	0.1433	53.77	0.8089
20	579642.00	579642.00	38.52	0.1150	40.02	0.8505
21	596210.00	596210.00	33.42	0.1385	34.92	0.8670
22	638620.00	638620.00	22.71	0.1247	24.21	0.9039
23	648259.00	648259.00	20.50	0.1247	22.00	0.9119
24	684135.00	684135.00	14.97	0.1031	16.47	0.9325
25	723868.00	723868.00	10.55	0.0617	12.05	0.9497
26	755250.00	755250.00	7.59	0.0278	9.09	0.9616
27	774831.00	774831.00	6.27	0.0178	7.77	0.9670
28	802493.00	802493.00	4.61	0.0080	6.11	0.9739
29	846264.00	846264.00	3.03	0.0069	4.53	0.9805
30	868549.00	868549.00	2.26	0.0038	3.76	0.9837

! 90% Point Selected for Output

Cost results are expressed in pounds

OPUS10 (version 1.2e)

WE002 - Fast Patrol Vessel

WSAL

10:44:28

Oct 02 1995

*Input Summary

STYPE : Scenario type	STEADY-STATE
PTYPE : Problem type	INITIAL
NSYST : Number of different systems	1
NITEM : Number of different items	24
NSTAT : Number of different stations	4
NSYSP : Number of system positions	1
TNBRD : Total number of deployed systems	2
NITMP : Number of item positions	96
NSTKP : Number of stock positions	48
PSIZE : Problem size	48
EXVAL : Value of existing stock	0.00
INCEX : Include EXVAL in Investment	N
IRATE : Interest rate in %	0.00
LIFEL : System lifelength in years	5.0
PVFAC : Present Value Factor	5.0

*Reliability Data /System

SID	MIDRT	MTTF	MTFC	AINHE	TNBRD	MUTIL
WE002	4393.73	68.28	227.60	0.9935	2	0.30

*Repair Volumes /System

SID	RPAPY	RPMPY	MRPT	SEPRC
WE002	76.98	76.98	1.50	368530.0

OPUS10 (version 1.2e)

WSAL

WE002 - Fast Patrol Vessel

10:44:28

Oct 02 1995

*Demand Rate and Resupply Time /Item&Station

IID	STID	DRT	RST0	OASHT	DLAYT	NRSCO
002LRU1	CONTRACTOR	45.08	8760.00	0.00	0.00	0.3949
002LRU1	BASE 12	45.08	711.60	672.00	39.60	0.0321
002LRU1	ONBOARD	22.54	39.60	39.60	0.00	0.0009
002LRU1	INBASE	30.21	0.00	0.00	0.00	0.0000
002LRU2	CONTRACTOR	63.00	8760.00	0.00	0.00	0.5519
002LRU2	BASE 12	63.00	711.60	672.00	39.60	0.0448
002LRU2	ONBOARD	31.50	39.60	39.60	0.00	0.0012
002LRU2	INBASE	42.21	0.00	0.00	0.00	0.0000
002LRU3	CONTRACTOR	6.02	8760.00	0.00	0.00	0.0528
002LRU3	BASE 12	6.02	711.60	672.00	39.60	0.0043
002LRU3	ONBOARD	3.01	39.60	39.60	0.00	0.0001
002LRU3	INBASE	4.04	0.00	0.00	0.00	0.0000
002LRU4	CONTRACTOR	115.93	8760.00	0.00	0.00	1.0156
002LRU4	BASE 12	115.93	711.60	672.00	39.60	0.0825
002LRU4	ONBOARD	57.97	39.60	39.60	0.00	0.0023
002LRU4	INBASE	77.67	0.00	0.00	0.00	0.0000
002LRU5	CONTRACTOR	102.25	8760.00	0.00	0.00	0.8957
002LRU5	BASE 12	102.25	711.60	672.00	39.60	0.0728
002LRU5	ONBOARD	51.13	39.60	39.60	0.00	0.0020
002LRU5	INBASE	68.51	0.00	0.00	0.00	0.0000
002LRU6	CONTRACTOR	51.29	8760.00	0.00	0.00	0.4493
002LRU6	BASE 12	51.29	711.60	672.00	39.60	0.0365
002LRU6	ONBOARD	25.64	39.60	39.60	0.00	0.0010
002LRU6	INBASE	34.36	0.00	0.00	0.00	0.0000
002LRU7	CONTRACTOR	38.36	8760.00	0.00	0.00	0.3361
002LRU7	BASE 12	38.36	711.60	672.00	39.60	0.0273
002LRU7	ONBOARD	19.18	39.60	39.60	0.00	0.0008
002LRU7	INBASE	25.70	0.00	0.00	0.00	0.0000
002LRU8	CONTRACTOR	27.14	8760.00	0.00	0.00	0.2378
002LRU8	BASE 12	27.14	711.60	672.00	39.60	0.0193
002LRU8	ONBOARD	13.57	39.60	39.60	0.00	0.0005
002LRU8	INBASE	18.19	0.00	0.00	0.00	0.0000
002LRU9	CONTRACTOR	228.23	8760.00	0.00	0.00	1.9993
002LRU9	BASE 12	228.23	711.60	672.00	39.60	0.1624
002LRU9	ONBOARD	114.11	39.60	39.60	0.00	0.0045
002LRU9	INBASE	152.91	0.00	0.00	0.00	0.0000
002LRU10	CONTRACTOR	89.98	8760.00	0.00	0.00	0.7882
002LRU10	BASE 12	89.98	711.60	672.00	39.60	0.0640
002LRU10	ONBOARD	44.99	39.60	39.60	0.00	0.0018
002LRU10	INBASE	60.28	0.00	0.00	0.00	0.0000
002LRU11	CONTRACTOR	123.82	8760.00	0.00	0.00	1.0846
002LRU11	BASE 12	123.82	711.60	672.00	39.60	0.0881
002LRU11	ONBOARD	61.91	39.60	39.60	0.00	0.0025
002LRU11	INBASE	82.96	0.00	0.00	0.00	0.0000
002LRU12	CONTRACTOR	519.12	8760.00	0.00	0.00	4.5475
002LRU12	BASE 12	519.12	711.60	672.00	39.60	0.3694
002LRU12	ONBOARD	259.56	39.60	39.60	0.00	0.0103
002LRU12	INBASE	347.81	0.00	0.00	0.00	0.0000
002LRU13	CONTRACTOR	6.00	8760.00	0.00	0.00	0.0526
002LRU13	BASE 12	6.00	711.60	672.00	39.60	0.0043
002LRU13	ONBOARD	3.00	39.60	39.60	0.00	0.0001
002LRU13	INBASE	4.02	0.00	0.00	0.00	0.0000
002LRU14	CONTRACTOR	485.44	8760.00	0.00	0.00	4.2525
002LRU14	BASE 12	2427.22	1518.00	672.00	39.60	3.6845
002LRU14	ONBOARD	1213.61	39.60	39.60	0.00	0.0481
002LRU14	INBASE	1626.23	0.00	0.00	0.00	0.0000
002LRU15	CONTRACTOR	5.55	8760.00	0.00	0.00	0.0486
002LRU15	BASE 12	27.74	1518.00	672.00	39.60	0.0421
002LRU15	ONBOARD	13.87	39.60	39.60	0.00	0.0005
002LRU15	INBASE	18.59	0.00	0.00	0.00	0.0000
002LRU16	CONTRACTOR	15.96	8760.00	0.00	0.00	0.1398
002LRU16	BASE 12	15.96	711.60	672.00	39.60	0.0114
002LRU16	ONBOARD	7.98	39.60	39.60	0.00	0.0003
002LRU16	INBASE	10.69	0.00	0.00	0.00	0.0000
002LRU17	CONTRACTOR	24.00	8760.00	0.00	0.00	0.2102
002LRU17	BASE 12	24.00	711.60	672.00	39.60	0.0171

OPUS10 (version 1.2e)

WSAL

WE002 - Fast Patrol Vessel

10:44:28

Oct 02 1995

*Demand Rate and Resupply Time /Item&Station

IID	STID	DRT	RST0	OASHT	DLAYT	NRSCO
002LRU17	ONBOARD	12.00	39.60	39.60	0.00	0.0005
002LRU17	INBASE	16.08	0.00	0.00	0.00	0.0000
002LRU18	CONTRACTOR	969.60	8760.00	0.00	0.00	8.4937
002LRU18	BASE 12	4848.00	1518.00	672.00	39.60	7.3593
002LRU18	ONBOARD	2424.00	39.60	39.60	0.00	0.0960
002LRU18	INBASE	3248.16	0.00	0.00	0.00	0.0000
002LRU19	CONTRACTOR	0.54	8760.00	0.00	0.00	0.0047
002LRU19	BASE 12	2.70	1518.00	672.00	39.60	0.0041
002LRU19	ONBOARD	1.35	39.60	39.60	0.00	0.0001
002LRU19	INBASE	1.81	0.00	0.00	0.00	0.0000
002LRU20	CONTRACTOR	1.62	8760.00	0.00	0.00	0.0142
002LRU20	BASE 12	8.10	1518.00	672.00	39.60	0.0123
002LRU20	ONBOARD	4.05	39.60	39.60	0.00	0.0002
002LRU20	INBASE	5.43	0.00	0.00	0.00	0.0000
002LRU21	CONTRACTOR	0.05	8760.00	0.00	0.00	0.0004
002LRU21	BASE 12	0.24	1518.00	672.00	39.60	0.0004
002LRU21	ONBOARD	0.12	39.60	39.60	0.00	0.0000
002LRU21	INBASE	0.16	0.00	0.00	0.00	0.0000
002LRU22	CONTRACTOR	1.15	8760.00	0.00	0.00	0.0101
002LRU22	BASE 12	5.76	1518.00	672.00	39.60	0.0087
002LRU22	ONBOARD	2.88	39.60	39.60	0.00	0.0001
002LRU22	INBASE	3.86	0.00	0.00	0.00	0.0000
002LRU23	CONTRACTOR	1.15	8760.00	0.00	0.00	0.0101
002LRU23	BASE 12	5.76	1518.00	672.00	39.60	0.0087
002LRU23	ONBOARD	2.88	39.60	39.60	0.00	0.0001
002LRU23	INBASE	3.86	0.00	0.00	0.00	0.0000
002LRU24	CONTRACTOR	1.15	8760.00	0.00	0.00	0.0101
002LRU24	BASE 12	5.76	1518.00	672.00	39.60	0.0087
002LRU24	ONBOARD	2.88	39.60	39.60	0.00	0.0001
002LRU24	INBASE	3.86	0.00	0.00	0.00	0.0000

OPUS10 (version 1.2e)

WE002 - Fast Patrol Vessel

WSAL

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Oct 02 1995

*Point Summary (POINT: 22)

Life Support Cost, LSC.....	638620.00
Total Investment, CI.....	638620.00
PV Total Annual Cost, CN.....	0.00
Mean Waiting Time, WT.....	22.71
Expected Number of Backorders, NBO.....	0.20
Risk of Shortage, ROS.....	0.1247
Availability, A.....	0.9039
Mean Down Time, MDT.....	24.21

Cost results are expressed in pounds

OPUS10 (version 1.2e)

WE002 - Fast Patrol Vessel

WSAL

10:44:28

Oct 02 1995

*LSC Summary (POINT: 22)

Life Support Cost (LSC)	638620.00		
Total Investment (CI)		638620.00	
Investment Repairables (CIR)			638620.00
Investment Discardables (CID)			0.00
Investment Resources (CIX)			0.00
PV Total Annual Cost (CN)		0.00	
PV Consumption Spares (CND)			0.00
PV Reorder Cost (CNO)			0.00
PV Storage Cost (CNS)			0.00
PV Transport Cost (CNT)			0.00
PV Repair Manhours (CNC)			0.00
PV Resource Cost (CNX)			0.00

Cost results are expressed in pounds

OPUS10 (version 1.2e)

WSAL

WE002 - Fast Patrol Vessel

10:44:28

Oct 02 1995

*Cost and MoE /Item (POINT: 22)

IID	LSC	CI	WT	NBO	ROS	STSIZ
002LRU1	13080.00	13080.00	63.47	0.00	1.0000	3
002LRU2	25311.00	25311.00	98.64	0.01	1.0000	3
002LRU3	560.00	560.00	44.59	0.00	1.0000	2
002LRU4	45224.00	45224.00	95.88	0.01	1.0000	4
002LRU5	25720.00	25720.00	76.57	0.01	1.0000	4
002LRU6	9992.00	9992.00	333.52	0.02	1.0000	2
002LRU7	9286.00	9286.00	213.98	0.01	1.0000	2
002LRU8	10218.00	10218.00	131.51	0.00	1.0000	2
002LRU9	124520.00	124520.00	180.88	0.04	1.0000	5
002LRU10	41274.00	41274.00	188.26	0.02	1.0000	3
002LRU11	50785.00	50785.00	24.29	0.00	0.0210	5
002LRU12	201258.00	201258.00	96.51	0.05	0.1033	9
002LRU13	646.00	646.00	303.71	0.00	1.0000	1
002LRU14	61110.00	61110.00	7.51	0.02	0.0700	15
002LRU15	4200.00	4200.00	183.55	0.01	1.0000	1
002LRU16	7128.00	7128.00	73.07	0.00	1.0000	2
002LRU17	5318.00	5318.00	112.50	0.00	1.0000	2
002LRU18	126.00	126.00	0.00	0.00	0.0001	42
002LRU19	360.00	360.00	53.99	0.00	1.0000	1
002LRU20	356.00	356.00	82.53	0.00	1.0000	1
002LRU21	158.00	158.00	40.88	0.00	1.0000	1
002LRU22	640.00	640.00	70.20	0.00	1.0000	1
002LRU23	675.00	675.00	70.20	0.00	1.0000	1
002LRU24	675.00	675.00	70.20	0.00	1.0000	1

Cost results are expressed in pounds

OPUS10 (version 1.2e)

WE002 - Fast Patrol Vessel

WSAL

10:44:28

Oct 02 1995

*Stock levels /Item&Station (POINT: 22)

```

+-----+
| STSIZ /Station: Recommended nominal stock level |
+-----+
| IID | STSIZ | QTY: Total number of each station |
| Item | Total |
+-----+
| identifier | per | STID: Station identifier |
| item | item |
+-----+
| // | 1 | 2 |
| // | // | // |
+-----+
| // | BASE 12 | ONBOARD |
+-----+
| 002LRU1 | 3 | 3 | |
| 002LRU2 | 3 | 3 | |
| 002LRU3 | 2 | 2 | |
| 002LRU4 | 4 | 4 | |
| 002LRU5 | 4 | 4 | |
| 002LRU6 | 2 | 2 | |
| 002LRU7 | 2 | 2 | |
| 002LRU8 | 2 | 2 | |
| 002LRU9 | 5 | 5 | |
| 002LRU10 | 3 | 3 | |
| 002LRU11 | 5 | 3 | 1 |
| 002LRU12 | 9 | 7 | 1 |
| 002LRU13 | 1 | 1 | |
| 002LRU14 | 15 | 13 | 1 |
| 002LRU15 | 1 | 1 | |
| 002LRU16 | 2 | 2 | |
| 002LRU17 | 2 | 2 | |
| 002LRU18 | 42 | 36 | 3 |
| 002LRU19 | 1 | 1 | |
| 002LRU20 | 1 | 1 | |
| 002LRU21 | 1 | 1 | |
| 002LRU22 | 1 | 1 | |
| 002LRU23 | 1 | 1 | |
| 002LRU24 | 1 | 1 | |
+-----+
    
```

PS/ADS/WSAL/1388
6th October 1995

APPENDIX B
INPUT AND RESULTS FILE FOR SCENARIO 2

INPUT FILE

*PROBLEM TEXT

```

+-----+
!                                     PTEXT                                     !
!           Problem header and a short description                           !
+-----+
!WE002 - Fast Patrol Vessel                                               !
!                                                                           !
!                                                                           !
!Limited items can be stored on board the vessels                         !
!                                                                           !
!All other items are held at the main support base and are transported !
!                                                                           !
!by a Fleet Auxiliary vessel                                             !
!                                                                           !
+-----+

```

*PROBLEM DEFINITION

```

+-----+
! STYPE : Scenario type (STEADY-STATE) !                                     !
+-----+
! PTYPE : Problem type (INITIAL)      !                                     !
+-----+
! PRMOE : Primary MoE (NOR)           !A                                     !
+-----+

```

*GLOBAL PARAMETERS

```

+-----+
! IRATE : Interest rate in %          (0.0) !      0.00!
+-----+
! LIFEL : System lifelength in years   !          5.0!
+-----+
! ENPER : Endurance time period        !          !
+-----+
! MANHC : Manhour cost                  (0.0) !          !
+-----+
! CURRN : Currency name                 !pounds   !
+-----+
! BDVMR : Batched demands VMR          (1.0) !          !
+-----+

```

*SYSTEM

```

+-----+
! SID  !!      DENOM          ! PRICE ! FRT  ! CTID  !
! System !! Denomination      ! Unit  !Failure ! Repair !
!identifier!!                ! price ! rate  !category !
!      !!                    !      ! 10-6 !      !
!      !!                    !      !      ! (=SID) !
+-----+
!WE002  !!SYSTEM              !      !      !      !
+-----+

```

*STATION

STID	DENOM	QTY	LEVEL	TYPE	GPID
Station	Denomination	Total	Level	Type	Group of
identifier		quantity			station
		(1)		(DEPOT)	
CONTRACTOR	CONTRACTOR REPAIR			WS	
BASE 12	HOME BASE			DEPOT	
ONBOARD	ONBOARD REPAIR	2		DEPOT	
INBASE	DUMMY FO IN BASE OPERATION	1		WS	

*STATION STRUCTURE

STID	STIDS	TFRSS	TTOSS	CFRSS	CTOSS	DFRAC	OPOL
Station	Support	Time from	Time to	Cost from	Cost to	Demand	Ordering
identifier	station	support	support	support	support	fraction	policy
				(0.0)	(0.0)	(1.0)	(FAST)
BASE 12	CONTRACTOR	336.0	336.0				SLOW
ONBOARD	BASE 12	120.0	120.0			0.330	
INBASE		0.0	0.0				
ONBOARD	INBASE	0.0	0.0			0.670	
0-ONBOARD	BASE 12	24.0	24.0			0.330	
	INBASE	0.0	0.0			0.670	

*SYSTEM DEPLOYMENT

SID	STID	QTYPS	UTILF
System	Station	Quantity	Utilization
identifier	identifier	per	factor
		(1)	(1.0)
WE002	ONBOARD	1	0.300

*ITEM

IID	DENOM	PRICE	FRT	CTID	NSIMI	EXIST	AFFRT
Item Identifier	Denomination	Unit price	Failure rate	Stock & repair category	Number similar	Existing stock	Application factor
!!	!!	!	! 10-6	! (=IID)	!	!	!
!	!	!	!	!	(1)	(0)	(1.0)
!002LRU1	!!LRU	! 4360.000!	! 37.57!	!	!	!	!
!002LRU2	!!LRU	! 8437.000!	! 52.50!	!	!	!	!
!002LRU3	!!LRU	! 280.000!	! 5.02!	!	!	!	!
!002LRU4	!!LRU	!11306.000!	! 96.61!	!	!	!	!
!002LRU5	!!LRU	! 6430.000!	! 85.21!	!	!	!	!
!002LRU6	!!LRU	! 4996.000!	! 42.74!	!	!	!	!
!002LRU7	!!LRU	! 4643.000!	! 31.97!	!	!	!	!
!002LRU8	!!LRU	! 5109.000!	! 22.62!	!	!	!	!
!002LRU9	!!LRU	!24904.000!	! 190.19!	!	!	!	!
!002LRU10	!!LRU	!13758.000!	! 74.98!	!	!	!	!
!002LRU11	!!LRU	!10157.000!	! 103.18!	!	!	!	!
!002LRU12	!!LRU	!22362.000!	! 144.20!	!	!	!	!
!002LRU13	!!LRU	! 646.000!	! 5.00!	!	!	!	!
!002LRU14	!!LRU	! 4074.000!	!1011.34!	!	!	!	!
!002LRU15	!!LRU	! 4200.000!	! 23.12!	!	!	!	!
!002LRU16	!!LRU	! 3564.000!	! 13.30!	!	!	!	!
!002LRU17	!!LRU	! 2659.000!	! 20.00!	!	!	!	!
!002LRU18	!!LRU	! 3.000!	!2020.00!	!	!	!	!
!002LRU19	!!LRU	! 360.000!	! 2.25!	!	!	!	!
!002LRU20	!!LRU	! 356.000!	! 2.25!	!	!	!	!
!002LRU21	!!LRU	! 158.000!	! 0.20!	!	!	!	!
!002LRU22	!!LRU	! 640.000!	! 4.80!	!	!	!	!
!002LRU23	!!LRU	! 675.000!	! 4.80!	!	!	!	!
!002LRU24	!!LRU	! 675.000!	! 4.80!	!	!	!	!

*ITEM STRUCTURE

! IIDS	! IDM	!! QTYPM	! ENVF	! RRF
! Subitem	! Motheritem	!! Quantity	! Environment	! Removal
! Identifier	! or system	!! per	! factor	! rate
!	! Identifier	!! motheritem	!	! factor
!	!	!! (1)	! (1.0)	! (1.0)
!002LRU1	!WE002	!!	2!	1.000!
!002LRU2	!	!!	2!	1.000!
!002LRU3	!	!!	2!	1.000!
!002LRU4	!	!!	2!	1.000!
!002LRU5	!	!!	2!	1.000!
!002LRU6	!	!!	2!	1.000!
!002LRU7	!	!!	2!	1.000!
!002LRU8	!	!!	2!	1.000!
!002LRU9	!	!!	2!	1.000!
!002LRU10	!	!!	2!	1.000!
!002LRU11	!	!!	2!	1.000!
!002LRU12	!	!!	6!	1.000!
!002LRU13	!	!!	2!	1.000!
!002LRU14	!	!!	4!	1.000!
!002LRU15	!	!!	2!	1.000!
!002LRU16	!	!!	2!	1.000!
!002LRU17	!	!!	2!	1.000!
!002LRU18	!	!!	4!	1.000!
!002LRU19	!	!!	2!	1.000!
!002LRU20	!	!!	6!	1.000!
!002LRU21	!	!!	2!	1.000!
!002LRU22	!	!!	2!	1.000!
!002LRU23	!	!!	2!	1.000!
!002LRU24	!	!!	2!	1.000!

*REPAIR POLICY

! CTID	! STID	!! DIRPM	! DIRPT	! SURPM	! SURPT	! DIRPF	! SURPF
! Category	! Station	!! Direct	! Direct	! Subitem	! Subitem	! Direct	! Subitem
! Identifier	! Identifier	!! repair	! repair	! replacem	! replacem	! repair	! replacem
!	!	!! manhours	! TAT	! manhours	! TAT	! fraction	! fraction
!	!	!! (0.0)	!	! (0.0)	!	! (1.0)	! (=DIRPF)
!WE002	!ONBOARD	!!	!	!	1.0!	1.5!	!
!002LRU1	!INBASE	!!	!	0.0!	!	0.000!	!
!002LRU2	!	!!	!	0.0!	!	0.000!	!
!002LRU3	!	!!	!	0.0!	!	0.000!	!
!002LRU4	!	!!	!	0.0!	!	0.000!	!
!002LRU5	!	!!	!	0.0!	!	0.000!	!
!002LRU6	!	!!	!	0.0!	!	0.000!	!
!002LRU7	!	!!	!	0.0!	!	0.000!	!
!002LRU8	!	!!	!	0.0!	!	0.000!	!
!002LRU9	!	!!	!	0.0!	!	0.000!	!
!002LRU10	!	!!	!	0.0!	!	0.000!	!
!002LRU11	!	!!	!	0.0!	!	0.000!	!
!002LRU12	!	!!	!	0.0!	!	0.000!	!
!002LRU13	!	!!	!	0.0!	!	0.000!	!
!002LRU14	!	!!	!	0.0!	!	0.000!	!
!002LRU15	!	!!	!	0.0!	!	0.000!	!
!002LRU16	!	!!	!	0.0!	!	0.000!	!
!002LRU17	!	!!	!	0.0!	!	0.000!	!
!002LRU18	!	!!	!	0.0!	!	0.000!	!
!002LRU19	!	!!	!	0.0!	!	0.000!	!
!002LRU20	!	!!	!	0.0!	!	0.000!	!
!002LRU21	!	!!	!	0.0!	!	0.000!	!

*REPAIR POLICY

! CTID	! STID	!! DIRPM	! DIRPT	! SURPM	! SURPT	! DIRPF	! SURPF
! Category	! Station	!! Direct	! Direct	! Subitem	! Subitem	! Direct	! Subitem

!identifie	!identifie	!! repair	! repair	!replacem	!replacem	! repair	!replacem
!	!	!!manhours	TAT	!manhours	TAT	!fraction	!fraction
!	!	!! (0.0)	!	! (0.0)	!	! (1.0)	!(=DIRPF)
!002LRU22	!	!!	!	0.0!	!	!	0.000!
!002LRU23	!	!!	!	0.0!	!	!	0.000!
!002LRU24	!	!!	!	0.0!	!	!	0.000!
!002LRU1	!BASE 12	!!	!	!	!	!	0.000!
!002LRU2	!	!!	!	!	!	!	0.000!
!002LRU3	!	!!	!	!	!	!	0.000!
!002LRU4	!	!!	!	!	!	!	0.000!
!002LRU5	!	!!	!	!	!	!	0.000!
!002LRU6	!	!!	!	!	!	!	0.000!
!002LRU7	!	!!	!	!	!	!	0.000!
!002LRU8	!	!!	!	!	!	!	0.000!
!002LRU9	!	!!	!	!	!	!	0.000!
!002LRU10	!	!!	!	!	!	!	0.000!
!002LRU11	!	!!	!	!	!	!	0.000!
!002LRU12	!	!!	!	!	!	!	0.000!
!002LRU13	!	!!	!	!	!	!	0.000!
!002LRU14	!	!!	!	1680.0!	!	!	0.800!
!002LRU15	!	!!	!	1680.0!	!	!	0.800!
!002LRU16	!	!!	!	!	!	!	0.000!
!002LRU17	!	!!	!	!	!	!	0.000!
!002LRU18	!	!!	!	1680.0!	!	!	0.800!
!002LRU19	!	!!	!	1680.0!	!	!	0.800!
!002LRU20	!	!!	!	1680.0!	!	!	0.800!
!002LRU21	!	!!	!	1680.0!	!	!	0.800!
!002LRU22	!	!!	!	1680.0!	!	!	0.800!
!002LRU23	!	!!	!	1680.0!	!	!	0.800!
!002LRU24	!	!!	!	1680.0!	!	!	0.800!
!002LRU1	!CONTRACTOR	!!	!	8760.0!	!	!	!
!002LRU2	!	!!	!	8760.0!	!	!	!
!002LRU3	!	!!	!	8760.0!	!	!	!
!002LRU4	!	!!	!	8760.0!	!	!	!
!002LRU5	!	!!	!	8760.0!	!	!	!
!002LRU6	!	!!	!	8760.0!	!	!	!
!002LRU7	!	!!	!	8760.0!	!	!	!
!002LRU8	!	!!	!	8760.0!	!	!	!
!002LRU9	!	!!	!	8760.0!	!	!	!
!002LRU10	!	!!	!	8760.0!	!	!	!
!002LRU11	!	!!	!	8760.0!	!	!	!
!002LRU12	!	!!	!	8760.0!	!	!	!
!002LRU13	!	!!	!	8760.0!	!	!	!
!002LRU14	!	!!	!	8760.0!	!	!	!
!002LRU15	!	!!	!	8760.0!	!	!	!
!002LRU16	!	!!	!	8760.0!	!	!	!
!002LRU17	!	!!	!	8760.0!	!	!	!
!002LRU18	!	!!	!	8760.0!	!	!	!
!002LRU19	!	!!	!	8760.0!	!	!	!
!002LRU20	!	!!	!	8760.0!	!	!	!
!002LRU21	!	!!	!	8760.0!	!	!	!
!002LRU22	!	!!	!	8760.0!	!	!	!
!002LRU23	!	!!	!	8760.0!	!	!	!
!002LRU24	!	!!	!	8760.0!	!	!	!

*STOCK POLICY

CTID	STID	CUNIT	CVAL	MINST	MAXST
Category	Station	Storage	Storage	Minimal	Maximal
!identifier!	!identifier!	!! cost	! cost	! stock	! stock
!	!	!! per unit	!per value!	!	!
!	!	!! (0.0)	! (0.0)	!(0)	!
!002LRU1	!BASE 12	!!	!	!	!
!002LRU2	!	!!	!	!	!
!002LRU3	!	!!	!	!	!
!002LRU4	!	!!	!	!	!
!002LRU5	!	!!	!	!	!
!002LRU6	!	!!	!	!	!
!002LRU7	!	!!	!	!	!
!002LRU8	!	!!	!	!	!
!002LRU9	!	!!	!	!	!
!002LRU10	!	!!	!	!	!
!002LRU11	!	!!	!	!	!
!002LRU12	!	!!	!	!	!
!002LRU13	!	!!	!	!	!
!002LRU14	!	!!	!	!	!
!002LRU15	!	!!	!	!	!
!002LRU16	!	!!	!	!	!
!002LRU17	!	!!	!	!	!
!002LRU18	!	!!	!	!	!
!002LRU19	!	!!	!	!	!
!002LRU20	!	!!	!	!	!
!002LRU21	!	!!	!	!	!
!002LRU22	!	!!	!	!	!
!002LRU23	!	!!	!	!	!
!002LRU24	!	!!	!	!	!
!002LRU1	!0-ONBOARD	!!	!	!	0!
!002LRU2	!	!!	!	!	0!
!002LRU3	!	!!	!	!	0!
!002LRU4	!	!!	!	!	0!
!002LRU5	!	!!	!	!	0!
!002LRU6	!	!!	!	!	0!
!002LRU7	!	!!	!	!	0!
!002LRU8	!	!!	!	!	0!
!002LRU9	!	!!	!	!	0!
!002LRU10	!	!!	!	!	0!
!002LRU11	!	!!	!	!	0!
!002LRU12	!	!!	!	!	0!
!002LRU13	!	!!	!	!	0!
!002LRU14	!ONBOARD	!!	!	1!	!
!002LRU15	!	!!	!	!	!
!002LRU16	!0-ONBOARD	!!	!	!	0!
!002LRU17	!	!!	!	!	0!
!002LRU18	!ONBOARD	!!	!	1!	!
!002LRU19	!	!!	!	!	!
!002LRU20	!	!!	!	!	!
!002LRU21	!	!!	!	!	!
!002LRU22	!	!!	!	!	!
!002LRU23	!	!!	!	!	!
!002LRU24	!	!!	!	!	!

*LIMITS BRIEF RESULTS

```

+-----+
! NPNTB : Number of points   (30) !
+-----+
! MINCB : Minimal LSC       !
+-----+
! MAXCB : Maximal LSC       !
+-----+
! MINMB : Minimal MoE       !
+-----+
! MAXMB : Maximal MoE       !
+-----+
! OLEVl : Optimize level   (NORMAL) !
+-----+

```

*SUBSET STATION

```

+-----+
! STID  !!      DENOM      ! GPID ! STIDM !
! Subset !! Denomination !Group of!Main station!
! station !!              !station ! identifier !
!identifier!!              !      !
+-----+
!0-ONBOARD !!              !      !ONBOARD !
+-----+

```

RESULTS

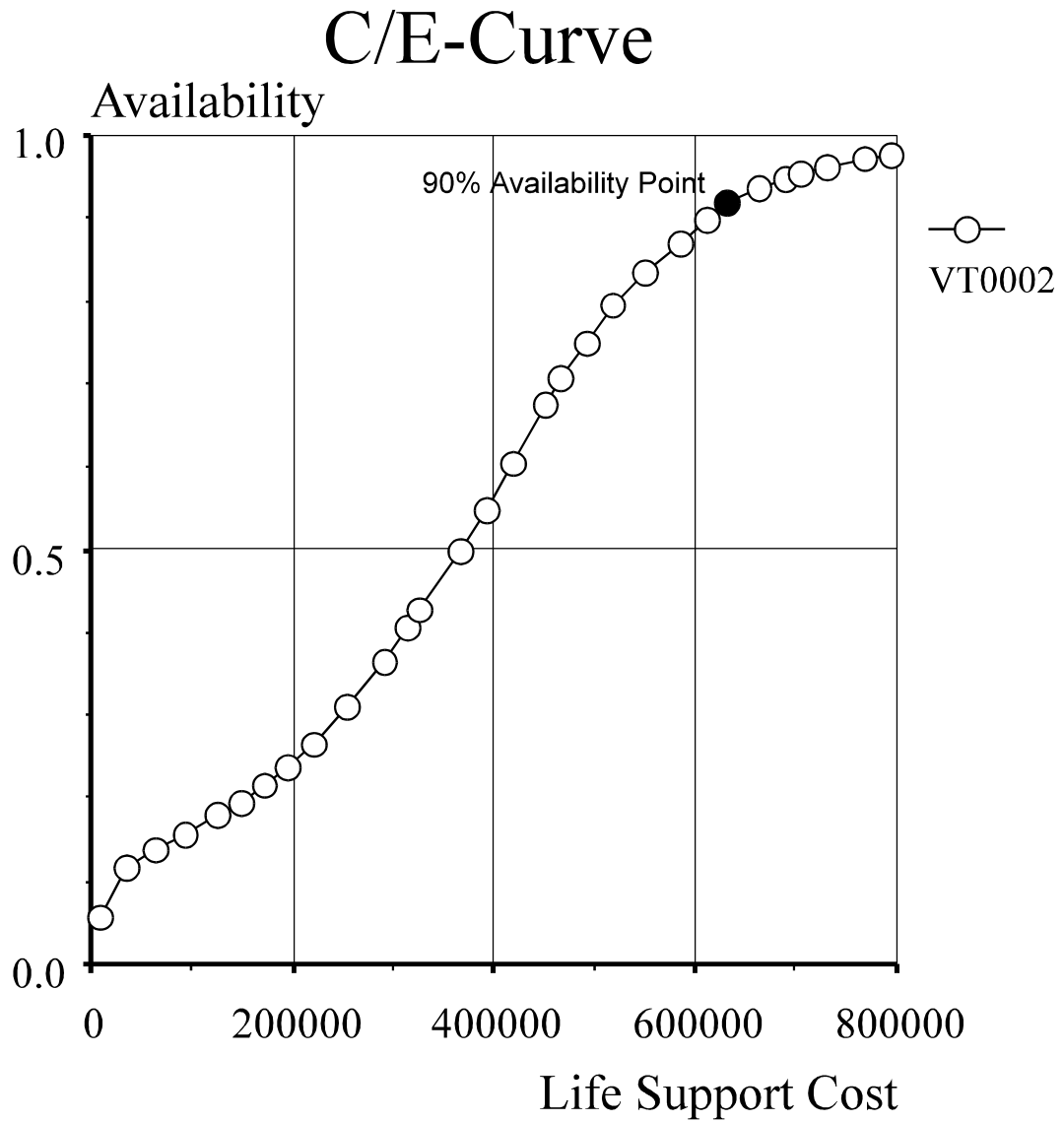


Figure B1 : Cost Effectiveness Curve for Scenario 2

Sample OPUS Results File

OPUS10 (version 1.2e)

WE002 - Fast Patrol Vessel

WSAL

13:29:30

Oct 02 1995

Results for infile: C:\OPUS10\VT0002.OPI
 at (Date & Time): Sep 29 1995, 13:54:23

PTEXT

WE002 - Fast Patrol Vessel

Limited items can be stored on board the vessels

All other items are held at the main support base and are transported

by a Fleet Auxiliary vessel

*Cost and MoE Summary

POINT	LSC	CI	WT	ROS	MDT	A
1	8154.00	8154.00	3875.76	0.9948	3877.26	0.0554
2	35324.00	35324.00	1703.24	0.3795	1704.74	0.1178
3	62709.00	62709.00	1433.38	0.2773	1434.88	0.1369
4	91790.00	91790.00	1227.67	0.2796	1229.17	0.1562
5	126669.00	126669.00	1043.07	0.2472	1044.57	0.1789
6	149031.00	149031.00	934.27	0.2472	935.77	0.1956
7	172783.00	172783.00	824.61	0.2472	826.11	0.2160
8	195145.00	195145.00	725.98	0.2472	727.48	0.2383
9	220049.00	220049.00	625.38	0.2472	626.88	0.2664
10	252568.00	252568.00	506.25	0.2472	507.75	0.3095
11	290768.00	290768.00	393.70	0.2472	395.20	0.3654
12	313130.00	313130.00	332.03	0.2472	333.53	0.4056
13	326637.00	326637.00	302.16	0.2078	303.66	0.4284
14	367117.00	367117.00	228.86	0.2078	230.36	0.4970
15	392021.00	392021.00	187.31	0.2078	188.81	0.5466
16	418889.00	418889.00	147.08	0.1975	148.58	0.6050
17	452324.00	452324.00	107.35	0.1975	108.85	0.6765
18	466289.00	466289.00	93.63	0.1975	95.13	0.7052
19	491193.00	491193.00	74.08	0.1975	75.58	0.7507
20	518664.00	518664.00	56.91	0.1975	58.41	0.7958
21	550727.00	550727.00	43.74	0.1763	45.24	0.8342
22	586174.00	586174.00	32.53	0.1763	34.03	0.8699
23	611078.00	611078.00	24.83	0.1763	26.33	0.8963
24	633174.00	633174.00	18.96	0.1763	20.46	0.9175
25	665175.00	665175.00	13.54	0.1763	15.04	0.9380
26	690797.00	690797.00	10.86	0.1753	12.36	0.9485
27	704555.00	704555.00	9.60	0.1753	11.10	0.9535
28	729845.00	729845.00	7.64	0.1703	9.14	0.9614
29	769943.00	769943.00	5.31	0.1703	6.81	0.9709
30	793749.00	793749.00	4.30	0.1683	5.80	0.9752

! 90% Point Selected for Output

Cost results are expressed in pounds

OPUS10 (version 1.2e)

WE002 - Fast Patrol Vessel

WSAL

13:29:30

Oct 02 1995

*Input Summary

STYPE : Scenario type	STEADY-STATE
PTYPE : Problem type	INITIAL
NSYST : Number of different systems	1
NITEM : Number of different items	24
NSTAT : Number of different stations	4
NSYSP : Number of system positions	1
TNBRD : Total number of deployed systems	2
NITMP : Number of item positions	96
NSTKP : Number of stock positions	33
PSIZE : Problem size	33
EXVAL : Value of existing stock	0.00
INCEX : Include EXVAL in Investment	N
IRATE : Interest rate in %	0.00
LIFEL : System lifelength in years	5.0
PVFAC : Present Value Factor	5.0

*Reliability Data /System

SID	MIDRT	MTTF	MTFPC	AINHE	TNBRD	MUTIL
WE002	4393.73	68.28	227.60	0.9935	2	0.30

*Repair Volumes /System

SID	RPAPY	RPMPY	MRPT	SEPRC
WE002	76.98	76.98	1.50	368530.0

OPUS10 (version 1.2e)

WSAL

WE002 - Fast Patrol Vessel

13:29:30

Oct 02 1995

*Demand Rate and Resupply Time /Item&Station

IID	STID	DRT	RST0	OASHT	DLAYT	NRSCO
002LRU1	CONTRACTOR	45.08	8760.00	0.00	0.00	0.3949
002LRU1	BASE 12	45.08	679.92	672.00	7.92	0.0307
002LRU1	ONBOARD	22.54	7.92	7.92	0.00	0.0002
002LRU1	INBASE	30.21	0.00	0.00	0.00	0.0000
002LRU2	CONTRACTOR	63.00	8760.00	0.00	0.00	0.5519
002LRU2	BASE 12	63.00	679.92	672.00	7.92	0.0428
002LRU2	ONBOARD	31.50	7.92	7.92	0.00	0.0002
002LRU2	INBASE	42.21	0.00	0.00	0.00	0.0000
002LRU3	CONTRACTOR	6.02	8760.00	0.00	0.00	0.0528
002LRU3	BASE 12	6.02	679.92	672.00	7.92	0.0041
002LRU3	ONBOARD	3.01	7.92	7.92	0.00	0.0000
002LRU3	INBASE	4.04	0.00	0.00	0.00	0.0000
002LRU4	CONTRACTOR	115.93	8760.00	0.00	0.00	1.0156
002LRU4	BASE 12	115.93	679.92	672.00	7.92	0.0788
002LRU4	ONBOARD	57.97	7.92	7.92	0.00	0.0005
002LRU4	INBASE	77.67	0.00	0.00	0.00	0.0000
002LRU5	CONTRACTOR	102.25	8760.00	0.00	0.00	0.8957
002LRU5	BASE 12	102.25	679.92	672.00	7.92	0.0695
002LRU5	ONBOARD	51.13	7.92	7.92	0.00	0.0004
002LRU5	INBASE	68.51	0.00	0.00	0.00	0.0000
002LRU6	CONTRACTOR	51.29	8760.00	0.00	0.00	0.4493
002LRU6	BASE 12	51.29	679.92	672.00	7.92	0.0349
002LRU6	ONBOARD	25.64	7.92	7.92	0.00	0.0002
002LRU6	INBASE	34.36	0.00	0.00	0.00	0.0000
002LRU7	CONTRACTOR	38.36	8760.00	0.00	0.00	0.3361
002LRU7	BASE 12	38.36	679.92	672.00	7.92	0.0261
002LRU7	ONBOARD	19.18	7.92	7.92	0.00	0.0002
002LRU7	INBASE	25.70	0.00	0.00	0.00	0.0000
002LRU8	CONTRACTOR	27.14	8760.00	0.00	0.00	0.2378
002LRU8	BASE 12	27.14	679.92	672.00	7.92	0.0185
002LRU8	ONBOARD	13.57	7.92	7.92	0.00	0.0001
002LRU8	INBASE	18.19	0.00	0.00	0.00	0.0000
002LRU9	CONTRACTOR	228.23	8760.00	0.00	0.00	1.9993
002LRU9	BASE 12	228.23	679.92	672.00	7.92	0.1552
002LRU9	ONBOARD	114.11	7.92	7.92	0.00	0.0009
002LRU9	INBASE	152.91	0.00	0.00	0.00	0.0000
002LRU10	CONTRACTOR	89.98	8760.00	0.00	0.00	0.7882
002LRU10	BASE 12	89.98	679.92	672.00	7.92	0.0612
002LRU10	ONBOARD	44.99	7.92	7.92	0.00	0.0004
002LRU10	INBASE	60.28	0.00	0.00	0.00	0.0000
002LRU11	CONTRACTOR	123.82	8760.00	0.00	0.00	1.0846
002LRU11	BASE 12	123.82	679.92	672.00	7.92	0.0842
002LRU11	ONBOARD	61.91	7.92	7.92	0.00	0.0005
002LRU11	INBASE	82.96	0.00	0.00	0.00	0.0000
002LRU12	CONTRACTOR	519.12	8760.00	0.00	0.00	4.5475
002LRU12	BASE 12	519.12	679.92	672.00	7.92	0.3530
002LRU12	ONBOARD	259.56	7.92	7.92	0.00	0.0021
002LRU12	INBASE	347.81	0.00	0.00	0.00	0.0000
002LRU13	CONTRACTOR	6.00	8760.00	0.00	0.00	0.0526
002LRU13	BASE 12	6.00	679.92	672.00	7.92	0.0041
002LRU13	ONBOARD	3.00	7.92	7.92	0.00	0.0000
002LRU13	INBASE	4.02	0.00	0.00	0.00	0.0000
002LRU14	CONTRACTOR	485.44	8760.00	0.00	0.00	4.2525
002LRU14	BASE 12	2427.22	1518.00	672.00	39.60	3.6845
002LRU14	ONBOARD	1213.61	39.60	39.60	0.00	0.0481
002LRU14	INBASE	1626.23	0.00	0.00	0.00	0.0000
002LRU15	CONTRACTOR	5.55	8760.00	0.00	0.00	0.0486
002LRU15	BASE 12	27.74	1518.00	672.00	39.60	0.0421
002LRU15	ONBOARD	13.87	39.60	39.60	0.00	0.0005
002LRU15	INBASE	18.59	0.00	0.00	0.00	0.0000
002LRU16	CONTRACTOR	15.96	8760.00	0.00	0.00	0.1398
002LRU16	BASE 12	15.96	679.92	672.00	7.92	0.0109
002LRU16	ONBOARD	7.98	7.92	7.92	0.00	0.0001
002LRU16	INBASE	10.69	0.00	0.00	0.00	0.0000
002LRU17	CONTRACTOR	24.00	8760.00	0.00	0.00	0.2102
002LRU17	BASE 12	24.00	679.92	672.00	7.92	0.0163

*Demand Rate and Resupply Time /Item&Station

IID	STID	DRT	RST0	OASHT	DLAYT	NRSCO
002LRU17	ONBOARD	12.00	7.92	7.92	0.00	0.0001
002LRU17	INBASE	16.08	0.00	0.00	0.00	0.0000
002LRU18	CONTRACTOR	969.60	8760.00	0.00	0.00	8.4937
002LRU18	BASE 12	4848.00	1518.00	672.00	39.60	7.3593
002LRU18	ONBOARD	2424.00	39.60	39.60	0.00	0.0960
002LRU18	INBASE	3248.16	0.00	0.00	0.00	0.0000
002LRU19	CONTRACTOR	0.54	8760.00	0.00	0.00	0.0047
002LRU19	BASE 12	2.70	1518.00	672.00	39.60	0.0041
002LRU19	ONBOARD	1.35	39.60	39.60	0.00	0.0001
002LRU19	INBASE	1.81	0.00	0.00	0.00	0.0000
002LRU20	CONTRACTOR	1.62	8760.00	0.00	0.00	0.0142
002LRU20	BASE 12	8.10	1518.00	672.00	39.60	0.0123
002LRU20	ONBOARD	4.05	39.60	39.60	0.00	0.0002
002LRU20	INBASE	5.43	0.00	0.00	0.00	0.0000
002LRU21	CONTRACTOR	0.05	8760.00	0.00	0.00	0.0004
002LRU21	BASE 12	0.24	1518.00	672.00	39.60	0.0004
002LRU21	ONBOARD	0.12	39.60	39.60	0.00	0.0000
002LRU21	INBASE	0.16	0.00	0.00	0.00	0.0000
002LRU22	CONTRACTOR	1.15	8760.00	0.00	0.00	0.0101
002LRU22	BASE 12	5.76	1518.00	672.00	39.60	0.0087
002LRU22	ONBOARD	2.88	39.60	39.60	0.00	0.0001
002LRU22	INBASE	3.86	0.00	0.00	0.00	0.0000
002LRU23	CONTRACTOR	1.15	8760.00	0.00	0.00	0.0101
002LRU23	BASE 12	5.76	1518.00	672.00	39.60	0.0087
002LRU23	ONBOARD	2.88	39.60	39.60	0.00	0.0001
002LRU23	INBASE	3.86	0.00	0.00	0.00	0.0000
002LRU24	CONTRACTOR	1.15	8760.00	0.00	0.00	0.0101
002LRU24	BASE 12	5.76	1518.00	672.00	39.60	0.0087
002LRU24	ONBOARD	2.88	39.60	39.60	0.00	0.0001
002LRU24	INBASE	3.86	0.00	0.00	0.00	0.0000

*Point Summary (POINT: 24)

Life Support Cost, LSC.....	633174.00
Total Investment, CI.....	633174.00
PV Total Annual Cost, CN.....	0.00
Mean Waiting Time, WT.....	18.96
Expected Number of Backorders, NBO.....	0.17
Risk of Shortage, ROS.....	0.1763
Availability, A.....	0.9175
Mean Down Time, MDT.....	20.46

Cost results are expressed in pounds

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WSAL

WE002 - Fast Patrol Vessel

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*LSC Summary (POINT: 24)

Life Support Cost (LSC)	633174.00		
Total Investment (CI)		633174.00	
Investment Repairables (CIR)			633174.00
Investment Discardables (CID)			0.00
Investment Resources (CIX)			0.00
PV Total Annual Cost (CN)		0.00	
PV Consumption Spares (CND)			0.00
PV Reorder Cost (CNO)			0.00
PV Storage Cost (CNS)			0.00
PV Transport Cost (CNT)			0.00
PV Repair Manhours (CNC)			0.00
PV Resource Cost (CNX)			0.00

*Cost and MoE /Item (POINT: 24)

IID	LSC	CI	WT	NBO	ROS	STSIZ
002LRU1	13080.00	13080.00	31.49	0.00	1.0000	3
002LRU2	25311.00	25311.00	66.24	0.00	1.0000	3
002LRU3	560.00	560.00	12.87	0.00	1.0000	2
002LRU4	45224.00	45224.00	63.40	0.01	1.0000	4
002LRU5	25720.00	25720.00	44.35	0.00	1.0000	4
002LRU6	9992.00	9992.00	299.12	0.02	1.0000	2
002LRU7	9286.00	9286.00	180.66	0.01	1.0000	2
002LRU8	10218.00	10218.00	98.95	0.00	1.0000	2
002LRU9	124520.00	124520.00	147.04	0.03	1.0000	5
002LRU10	41274.00	41274.00	154.84	0.01	1.0000	3
002LRU11	40628.00	40628.00	76.80	0.01	1.0000	4
002LRU12	201258.00	201258.00	99.53	0.05	1.0000	9
002LRU13	1292.00	1292.00	12.83	0.00	1.0000	2
002LRU14	65184.00	65184.00	2.31	0.01	0.0149	16
002LRU15	4200.00	4200.00	183.55	0.01	1.0000	1
002LRU16	7128.00	7128.00	41.06	0.00	1.0000	2
002LRU17	5318.00	5318.00	80.12	0.00	1.0000	2
002LRU18	117.00	117.00	0.00	0.00	0.0001	39
002LRU19	360.00	360.00	53.99	0.00	1.0000	1
002LRU20	356.00	356.00	82.53	0.00	1.0000	1
002LRU21	158.00	158.00	40.88	0.00	1.0000	1
002LRU22	640.00	640.00	70.20	0.00	1.0000	1
002LRU23	675.00	675.00	70.20	0.00	1.0000	1
002LRU24	675.00	675.00	70.20	0.00	1.0000	1

Cost results are expressed in pounds

OPUS10 (version 1.2e)

WSAL

WE002 - Fast Patrol Vessel

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*Stock levels /Item&Station (POINT: 24)

STSTIZ /Station: Recommended nominal stock level			
IID	STSTIZ	QTY: Total number of each station	
Item	Total		
identifier	per	STID: Station identifier	
item	item		
//////////		1	2
//////////			
//////////	BASE 12		ONBOARD
002LRU1	3	3	0
002LRU2	3	3	0
002LRU3	2	2	0
002LRU4	4	4	0
002LRU5	4	4	0
002LRU6	2	2	0
002LRU7	2	2	0
002LRU8	2	2	0
002LRU9	5	5	0
002LRU10	3	3	0
002LRU11	4	4	0
002LRU12	9	9	0
002LRU13	2	2	0
002LRU14	16	12	2
002LRU15	1	1	
002LRU16	2	2	0
002LRU17	2	2	0
002LRU18	39	33	3
002LRU19	1	1	
002LRU20	1	1	
002LRU21	1	1	
002LRU22	1	1	
002LRU23	1	1	
002LRU24	1	1	

APPENDIX C
INPUT AND RESULTS FILE FOR SCENARIO 3

INPUT FILE

*PROBLEM TEXT

```

+-----+
!                                     PTEXT                                     !
!           Problem header and a short description                           !
+-----+
!WE002 - Fast Patrol Vessel                                               !
!                                                                           !
!                                                                           !
!Limited items can be stored on board the vessels                         !
!                                                                           !
!All other items are held at the main support base and are transported    !
!                                                                           !
!by a Fleet Auxiliary vessel                                             !
!                                                                           !
!Failure of Critical Items means that the vessel must return to its Main Support Base!
+-----+

```

*PROBLEM DEFINITION

```

+-----+
! STYPE : Scenario type (STEADY-STATE) !                                     !
+-----+
! PTYPE : Problem type (INITIAL)      !                                     !
+-----+
! PRMOE : Primary MoE (NOR)           !A                                  !
+-----+

```

*GLOBAL PARAMETERS

```

+-----+
! IRATE : Interest rate in %          (0.0) ! 0.00!
+-----+
! LIFEL : System lifelength in years   ! 5.0!
+-----+
! ENPER : Endurance time period        ! !
+-----+
! MANHC : Manhour cost                  (0.0) ! !
+-----+
! CURRN : Currency name                 !pounds !
+-----+
! BDVMR : Batched demands VMR          (1.0) ! !
+-----+

```

*SYSTEM

```

+-----+
! SID  !! DENOM          ! PRICE ! FRT ! CTID !
! System !! Denomination ! Unit !Failure ! Repair !
!identifier!!          ! price ! rate !category !
!      !!          !          ! 10-6 !      !
!      !!          !          !      ! (=SID) !
+-----+
!WE002  !!SYSTEM        !      !      !      !
+-----+

```

*STATION

STID	DENOM	QTY	LEVEL	TYPE	GPID
Station	Denomination	Total	Level	Type	Group of
identifier		quantity			station
		(1)		(DEPOT)	
CONTRACTOR	CONTRACTOR REPAIR			WS	
BASE 12	HOME BASE			DEPOT	
ONBOARD	ONBOARD REPAIR	2		DEPOT	
INBASE	DUMMY FO IN BASE OPERATION	1		WS	

*STATION STRUCTURE

STID	STIDS	TFRSS	TTOSS	CFRSS	CTOSS	DFRAC	OPOL
Station	Support	Time from	Time to	Cost from	Cost to	Demand	Ordering
identifier	station	support	support	support	support	fraction	policy
				(0.0)	(0.0)	(1.0)	(FAST)
BASE 12	CONTRACTOR	336.0	336.0				SLOW
ONBOARD	BASE 12	120.0	120.0			0.330	
INBASE		0.0	0.0				
ONBOARD	INBASE	0.0	0.0			0.670	
0-ONBOARD	BASE 12	24.0	24.0			0.330	
	INBASE	0.0	0.0			0.670	
CF-ONBOARD	BASE 12	48.0	48.0				

*SYSTEM DEPLOYMENT

SID	STID	QTYPS	UTILF
System	Station	Quantity	Utilization
identifier	identifier	per	factor
		(1)	(1.0)
WE002	ONBOARD	1	0.300

*ITEM

! IID	!! DENOM	! PRICE	! FRT	! CTID	! NSIMI	! EXIST	! AFFRT
! Item	!! Denomination	! Unit	! Failure	! Stock &	! Number	! Existing	! Appli-
! identifier!!	!!	! price	! rate	! repair	! similar	! stock	! cation!
!	!!	!	! 10-6	! category	!	!	! factor!
!	!!	!	!	! (=IID)	! (1)	! (0)	! (1.0)!
!002LRU1	!!LRU	! 4360.000!	! 37.57!		!	!	!
!002LRU2	!!LRU	! 8437.000!	! 52.50!		!	!	!
!002LRU3	!!LRU	! 280.000!	! 5.02!		!	!	!
!002LRU4	!!LRU	!11306.000!	! 96.61!		!	!	!
!002LRU5	!!LRU	! 6430.000!	! 85.21!		!	!	!
!002LRU6	!!LRU	! 4996.000!	! 42.74!		!	!	!
!002LRU7	!!LRU	! 4643.000!	! 31.97!		!	!	!
!002LRU8	!!LRU	! 5109.000!	! 22.62!		!	!	!
!002LRU9	!!LRU	!24904.000!	! 190.19!		!	!	!
!002LRU10	!!LRU	!13758.000!	! 74.98!		!	!	!
!002LRU11	!!LRU	!10157.000!	! 103.18!		!	!	!
!002LRU12	!!LRU	!22362.000!	! 144.20!		!	!	!
!002LRU13	!!LRU	! 646.000!	! 5.00!		!	!	!
!002LRU14	!!LRU	! 4074.000!	!1011.34!		!	!	!
!002LRU15	!!LRU	! 4200.000!	! 23.12!		!	!	!
!002LRU16	!!LRU	! 3564.000!	! 13.30!		!	!	!
!002LRU17	!!LRU	! 2659.000!	! 20.00!		!	!	!
!002LRU18	!!LRU	! 3.000!	!2020.00!		!	!	!
!002LRU19	!!LRU	! 360.000!	! 2.25!		!	!	!
!002LRU20	!!LRU	! 356.000!	! 2.25!		!	!	!
!002LRU21	!!LRU	! 158.000!	! 0.20!		!	!	!
!002LRU22	!!LRU	! 640.000!	! 4.80!		!	!	!
!002LRU23	!!LRU	! 675.000!	! 4.80!		!	!	!
!002LRU24	!!LRU	! 675.000!	! 4.80!		!	!	!

*ITEM STRUCTURE

! IIDS	! IDM	!! QTYPM	! ENVF	! RRF
! Subitem	! Motheritem	!! Quantity	! Environment	! Removal
! identifier	! or system	!! per	! factor	! rate
!	! identifier	!! motheritem	!	! factor
!	!	!! (1)	! (1.0)	! (1.0)
!002LRU1	!WE002	!!	2!	1.000!
!002LRU2	!	!!	2!	1.000!
!002LRU3	!	!!	2!	1.000!
!002LRU4	!	!!	2!	1.000!
!002LRU5	!	!!	2!	1.000!
!002LRU6	!	!!	2!	1.000!
!002LRU7	!	!!	2!	1.000!
!002LRU8	!	!!	2!	1.000!
!002LRU9	!	!!	2!	1.000!
!002LRU10	!	!!	2!	1.000!
!002LRU11	!	!!	2!	1.000!
!002LRU12	!	!!	6!	1.000!
!002LRU13	!	!!	2!	1.000!
!002LRU14	!	!!	4!	1.000!
!002LRU15	!	!!	2!	1.000!
!002LRU16	!	!!	2!	1.000!
!002LRU17	!	!!	2!	1.000!
!002LRU18	!	!!	4!	1.000!
!002LRU19	!	!!	2!	1.000!
!002LRU20	!	!!	6!	1.000!
!002LRU21	!	!!	2!	1.000!
!002LRU22	!	!!	2!	1.000!
!002LRU23	!	!!	2!	1.000!
!002LRU24	!	!!	2!	1.000!

*REPAIR POLICY

! CTID	! STID	!! DIRPM	! DIRPT	! SURPM	! SURPT	! DIRPF	! SURPF
! Category	! Station	!! Direct	! Direct	! Subitem	! Subitem	! Direct	! Subitem
! identifier	! identifier	!! repair	! repair	! replacem	! replacem	! repair	! replacem
!	!	!! manhours	! TAT	! manhours	! TAT	! fraction	! fraction
!	!	!! (0.0)	!	! (0.0)	!	! (1.0)	! (=DIRPF)
!WE002	!ONBOARD	!!	!	!	1.0!	1.5!	!
!002LRU1	!INBASE	!!	!	0.0!	!	0.000!	!
!002LRU2	!	!!	!	0.0!	!	0.000!	!
!002LRU3	!	!!	!	0.0!	!	0.000!	!
!002LRU4	!	!!	!	0.0!	!	0.000!	!
!002LRU5	!	!!	!	0.0!	!	0.000!	!
!002LRU6	!	!!	!	0.0!	!	0.000!	!
!002LRU7	!	!!	!	0.0!	!	0.000!	!
!002LRU8	!	!!	!	0.0!	!	0.000!	!
!002LRU9	!	!!	!	0.0!	!	0.000!	!
!002LRU10	!	!!	!	0.0!	!	0.000!	!
!002LRU11	!	!!	!	0.0!	!	0.000!	!
!002LRU12	!	!!	!	0.0!	!	0.000!	!
!002LRU13	!	!!	!	0.0!	!	0.000!	!
!002LRU14	!	!!	!	0.0!	!	0.000!	!
!002LRU15	!	!!	!	0.0!	!	0.000!	!
!002LRU16	!	!!	!	0.0!	!	0.000!	!
!002LRU17	!	!!	!	0.0!	!	0.000!	!
!002LRU18	!	!!	!	0.0!	!	0.000!	!
!002LRU19	!	!!	!	0.0!	!	0.000!	!
!002LRU20	!	!!	!	0.0!	!	0.000!	!
!002LRU21	!	!!	!	0.0!	!	0.000!	!

*REPAIR POLICY

! CTID	! STID	!! DIRPM	! DIRPT	! SURPM	! SURPT	! DIRPF	! SURPF
! Category	! Station	!! Direct	! Direct	! Subitem	! Subitem	! Direct	! Subitem

!identifier!	!identifier!	!! repair !	! repair !	!replacem!	!replacem!	! repair !	!replacem!
!	!	!!manhours!	TAT	!manhours!	TAT	!fraction!	!fraction!
!	!	!! (0.0) !	!	! (0.0) !	!	! (1.0) !	!(=DIRPF)!
!002LRU22	!	!!	!	0.0!	!	0.000!	!
!002LRU23	!	!!	!	0.0!	!	0.000!	!
!002LRU24	!	!!	!	0.0!	!	0.000!	!
!002LRU1	!BASE 12	!!	!	!	!	0.000!	!
!002LRU2	!	!!	!	!	!	0.000!	!
!002LRU3	!	!!	!	!	!	0.000!	!
!002LRU4	!	!!	!	!	!	0.000!	!
!002LRU5	!	!!	!	!	!	0.000!	!
!002LRU6	!	!!	!	!	!	0.000!	!
!002LRU7	!	!!	!	!	!	0.000!	!
!002LRU8	!	!!	!	!	!	0.000!	!
!002LRU9	!	!!	!	!	!	0.000!	!
!002LRU10	!	!!	!	!	!	0.000!	!
!002LRU11	!	!!	!	!	!	0.000!	!
!002LRU12	!	!!	!	!	!	0.000!	!
!002LRU13	!	!!	!	!	!	0.000!	!
!002LRU14	!	!!	!	1680.0!	!	0.800!	!
!002LRU15	!	!!	!	1680.0!	!	0.800!	!
!002LRU16	!	!!	!	!	!	0.000!	!
!002LRU17	!	!!	!	!	!	0.000!	!
!002LRU18	!	!!	!	1680.0!	!	0.800!	!
!002LRU19	!	!!	!	1680.0!	!	0.800!	!
!002LRU20	!	!!	!	1680.0!	!	0.800!	!
!002LRU21	!	!!	!	1680.0!	!	0.800!	!
!002LRU22	!	!!	!	1680.0!	!	0.800!	!
!002LRU23	!	!!	!	1680.0!	!	0.800!	!
!002LRU24	!	!!	!	1680.0!	!	0.800!	!
!002LRU1	!CONTRACTOR!	!!	!	8760.0!	!	!	!
!002LRU2	!	!!	!	8760.0!	!	!	!
!002LRU3	!	!!	!	8760.0!	!	!	!
!002LRU4	!	!!	!	8760.0!	!	!	!
!002LRU5	!	!!	!	8760.0!	!	!	!
!002LRU6	!	!!	!	8760.0!	!	!	!
!002LRU7	!	!!	!	8760.0!	!	!	!
!002LRU8	!	!!	!	8760.0!	!	!	!
!002LRU9	!	!!	!	8760.0!	!	!	!
!002LRU10	!	!!	!	8760.0!	!	!	!
!002LRU11	!	!!	!	8760.0!	!	!	!
!002LRU12	!	!!	!	8760.0!	!	!	!
!002LRU13	!	!!	!	8760.0!	!	!	!
!002LRU14	!	!!	!	8760.0!	!	!	!
!002LRU15	!	!!	!	8760.0!	!	!	!
!002LRU16	!	!!	!	8760.0!	!	!	!
!002LRU17	!	!!	!	8760.0!	!	!	!
!002LRU18	!	!!	!	8760.0!	!	!	!
!002LRU19	!	!!	!	8760.0!	!	!	!
!002LRU20	!	!!	!	8760.0!	!	!	!
!002LRU21	!	!!	!	8760.0!	!	!	!
!002LRU22	!	!!	!	8760.0!	!	!	!
!002LRU23	!	!!	!	8760.0!	!	!	!
!002LRU24	!	!!	!	8760.0!	!	!	!

*STOCK POLICY

CTID	STID	CUNIT	CVAL	MINST	MAXST
Category	Station	Storage	Storage	Minimal	Maximal
!identifier!	!identifier!	!! cost	! cost	! stock	! stock
!	!	!! per unit	!per value!	!	!
!	!	!! (0.0)	! (0.0)	! (0)	!
!002LRU1	!BASE 12	!!	!	!	!
!002LRU2	!	!!	!	!	!
!002LRU3	!	!!	!	!	!
!002LRU4	!	!!	!	!	!
!002LRU5	!	!!	!	!	!
!002LRU6	!	!!	!	!	!
!002LRU7	!	!!	!	!	!
!002LRU8	!	!!	!	!	!
!002LRU9	!	!!	!	!	!
!002LRU10	!	!!	!	!	!
!002LRU11	!	!!	!	!	!
!002LRU12	!	!!	!	!	!
!002LRU13	!	!!	!	!	!
!002LRU14	!	!!	!	!	!
!002LRU15	!	!!	!	!	!
!002LRU16	!	!!	!	!	!
!002LRU17	!	!!	!	!	!
!002LRU18	!	!!	!	!	!
!002LRU19	!	!!	!	!	!
!002LRU20	!	!!	!	!	!
!002LRU21	!	!!	!	!	!
!002LRU22	!	!!	!	!	!
!002LRU23	!	!!	!	!	!
!002LRU24	!	!!	!	!	!
!002LRU1	!0-ONBOARD	!!	!	!	0!
!002LRU2	!	!!	!	!	0!
!002LRU3	!	!!	!	!	0!
!002LRU4	!CF-ONBOARD	!!	!	!	0!
!002LRU5	!	!!	!	!	0!
!002LRU6	!	!!	!	!	0!
!002LRU7	!0-ONBOARD	!!	!	!	0!
!002LRU8	!	!!	!	!	0!
!002LRU9	!	!!	!	!	0!
!002LRU10	!	!!	!	!	0!
!002LRU11	!	!!	!	!	0!
!002LRU12	!	!!	!	!	0!
!002LRU13	!	!!	!	!	0!
!002LRU14	!ONBOARD	!!	!	1!	!
!002LRU15	!	!!	!	!	!
!002LRU16	!0-ONBOARD	!!	!	!	0!
!002LRU17	!	!!	!	!	0!
!002LRU18	!ONBOARD	!!	!	1!	!
!002LRU19	!	!!	!	!	!
!002LRU20	!	!!	!	!	!
!002LRU21	!	!!	!	!	!
!002LRU22	!	!!	!	!	!
!002LRU23	!	!!	!	!	!
!002LRU24	!	!!	!	!	!

*LIMITS BRIEF RESULTS

```

+-----+
! NPNTB : Number of points   (30) !
+-----+
! MINCB : Minimal LSC       !
+-----+
! MAXCB : Maximal LSC       !
+-----+
! MINMB : Minimal MoE       !
+-----+
! MAXMB : Maximal MoE       !
+-----+
! OLEVl : Optimize level   (NORMAL) !
+-----+

```

*SUBSET STATION

```

+-----+
! STID  !!      DENOM      ! GPID ! STIDM !
! Subset !! Denomination !Group of!Main station!
! station !!            !station ! identifier !
!identifier!!            !      !
+-----+
!0-ONBOARD !!            !      !ONBOARD !
!CF-ONBOARD!!            !      !ONBOARD !
!      !!            !      !
+-----+

```

RESULTS

C/E-Curve

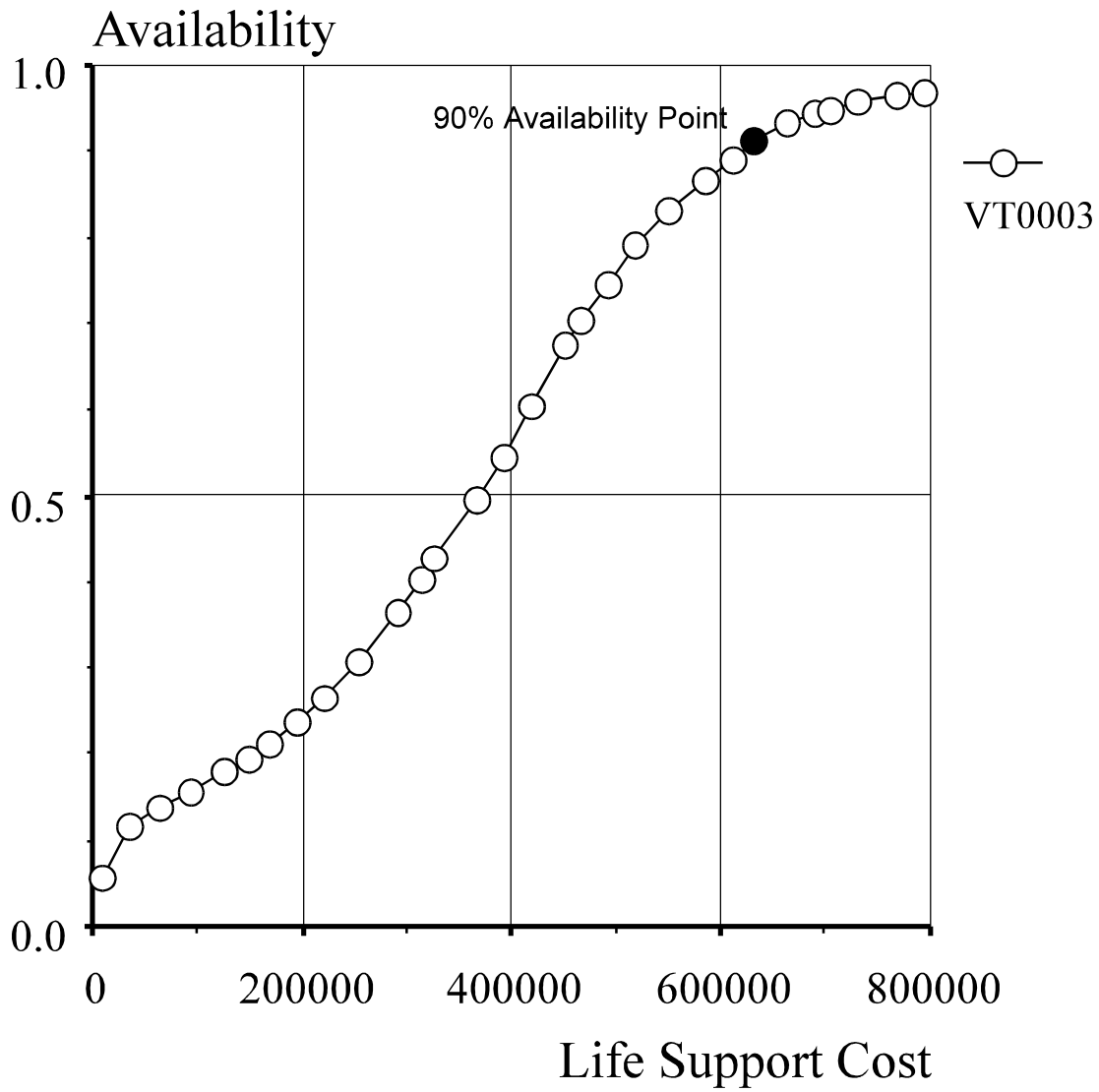


Figure C1 : Cost Effectiveness Curve for Scenario 3

Sample OPUS Results File

OPUS10 (version 1.2e)

WE002 - Fast Patrol Vessel

WSAL

13:30:36

Oct 02 1995

Results for infile: C:\OPUS10\VT0003.OPI
 at (Date & Time): Sep 29 1995, 14:06:15

PTEXT

WE002 - Fast Patrol Vessel

Limited items can be stored on board the vessels

All other items are held at the main support base and are transported

by a Fleet Auxiliary vessel

Failure of Critical Items means that the vessel must return to its Main Support Base

OPUS10 (version 1.2e)

WE002 - Fast Patrol Vessel

WSAL

13:30:36

Oct 02 1995

*Cost and MoE Summary

POINT	LSC	CI	WT	ROS	MDT	A
1	8154.00	8154.00	3878.22	0.9948	3879.72	0.0554
2	35324.00	35324.00	1705.52	0.3795	1707.02	0.1176
3	62709.00	62709.00	1435.66	0.2773	1437.16	0.1367
4	91790.00	91790.00	1229.63	0.2796	1231.13	0.1560
5	126669.00	126669.00	1045.03	0.2472	1046.53	0.1786
6	149031.00	149031.00	936.23	0.2472	937.73	0.1953
7	169219.00	169219.00	842.31	0.2472	843.81	0.2124
8	195145.00	195145.00	727.77	0.2472	729.27	0.2379
9	220049.00	220049.00	627.17	0.2472	628.67	0.2658
10	252568.00	252568.00	508.04	0.2472	509.54	0.3088
11	290768.00	290768.00	395.29	0.2472	396.79	0.3645
12	313130.00	313130.00	333.63	0.2472	335.13	0.4045
13	326637.00	326637.00	303.69	0.2078	305.19	0.4272
14	367117.00	367117.00	230.38	0.2078	231.88	0.4953
15	392021.00	392021.00	188.84	0.2078	190.34	0.5446
16	418889.00	418889.00	148.61	0.1975	150.11	0.6026
17	452324.00	452324.00	108.79	0.1975	110.29	0.6736
18	466289.00	466289.00	94.97	0.1975	96.47	0.7023
19	491193.00	491193.00	75.42	0.1975	76.92	0.7474
20	518664.00	518664.00	58.25	0.1975	59.75	0.7921
21	550727.00	550727.00	45.08	0.1763	46.58	0.8301
22	586174.00	586174.00	33.87	0.1763	35.37	0.8655
23	611078.00	611078.00	26.17	0.1763	27.67	0.8916
24	633174.00	633174.00	20.23	0.1763	21.73	0.9129
25	665175.00	665175.00	14.79	0.1763	16.29	0.9332
26	690797.00	690797.00	12.12	0.1753	13.62	0.9435
27	704555.00	704555.00	10.85	0.1753	12.35	0.9485
28	729845.00	729845.00	8.90	0.1703	10.40	0.9563
29	769943.00	769943.00	6.55	0.1703	8.05	0.9658
30	793749.00	793749.00	5.53	0.1683	7.03	0.9700

! 90% Point Selected for Output

Cost results are expressed in pounds

OPUS10 (version 1.2e)

WE002 - Fast Patrol Vessel

WSAL

13:30:36

Oct 02 1995

*Input Summary

STYPE : Scenario type	STEADY-STATE
PTYPE : Problem type	INITIAL
NSYST : Number of different systems	1
NITEM : Number of different items	24
NSTAT : Number of different stations	4
NSYSP : Number of system positions	1
TNBRD : Total number of deployed systems	2
NITMP : Number of item positions	96
NSTKP : Number of stock positions	33
PSIZE : Problem size	33
EXVAL : Value of existing stock	0.00
INCEX : Include EXVAL in Investment	N
IRATE : Interest rate in %	0.00
LIFEL : System lifelength in years	5.0
PVFAC : Present Value Factor	5.0

*Reliability Data /System

SID	MIDRT	MTTF	MTFC	AINHE	TNBRD	MUTIL
WE002	4393.73	68.28	227.60	0.9935	2	0.30

*Repair Volumes /System

SID	RPAPY	RPMPY	MRPT	SEPRC
WE002	76.98	76.98	1.50	368530.0

Cost results are expressed in pounds

OPUS10 (version 1.2e)

WSAL

WE002 - Fast Patrol Vessel

13:30:36

Oct 02 1995

*Demand Rate and Resupply Time /Item&Station

IID	STID	DRT	RST0	OASHT	DLAYT	NRSCO
-----	------	-----	------	-------	-------	-------

002LRU1	CONTRACTOR	45.08	8760.00	0.00	0.00	0.3949
002LRU1	BASE 12	45.08	679.92	672.00	7.92	0.0307
002LRU1	ONBOARD	22.54	7.92	7.92	0.00	0.0002
002LRU1	INBASE	30.21	0.00	0.00	0.00	0.0000
002LRU2	CONTRACTOR	63.00	8760.00	0.00	0.00	0.5519
002LRU2	BASE 12	63.00	679.92	672.00	7.92	0.0428
002LRU2	ONBOARD	31.50	7.92	7.92	0.00	0.0002
002LRU2	INBASE	42.21	0.00	0.00	0.00	0.0000
002LRU3	CONTRACTOR	6.02	8760.00	0.00	0.00	0.0528
002LRU3	BASE 12	6.02	679.92	672.00	7.92	0.0041
002LRU3	ONBOARD	3.01	7.92	7.92	0.00	0.0000
002LRU3	INBASE	4.04	0.00	0.00	0.00	0.0000
002LRU4	CONTRACTOR	115.93	8760.00	0.00	0.00	1.0156
002LRU4	BASE 12	115.93	720.00	672.00	48.00	0.0835
002LRU4	ONBOARD	57.97	48.00	48.00	0.00	0.0028
002LRU4	INBASE	0.00	0.00	0.00	0.00	0.0000
002LRU5	CONTRACTOR	102.25	8760.00	0.00	0.00	0.8957
002LRU5	BASE 12	102.25	720.00	672.00	48.00	0.0736
002LRU5	ONBOARD	51.13	48.00	48.00	0.00	0.0025
002LRU5	INBASE	0.00	0.00	0.00	0.00	0.0000
002LRU6	CONTRACTOR	51.29	8760.00	0.00	0.00	0.4493
002LRU6	BASE 12	51.29	720.00	672.00	48.00	0.0369
002LRU6	ONBOARD	25.64	48.00	48.00	0.00	0.0012
002LRU6	INBASE	0.00	0.00	0.00	0.00	0.0000
002LRU7	CONTRACTOR	38.36	8760.00	0.00	0.00	0.3361
002LRU7	BASE 12	38.36	679.92	672.00	7.92	0.0261
002LRU7	ONBOARD	19.18	7.92	7.92	0.00	0.0002
002LRU7	INBASE	25.70	0.00	0.00	0.00	0.0000
002LRU8	CONTRACTOR	27.14	8760.00	0.00	0.00	0.2378
002LRU8	BASE 12	27.14	679.92	672.00	7.92	0.0185
002LRU8	ONBOARD	13.57	7.92	7.92	0.00	0.0001
002LRU8	INBASE	18.19	0.00	0.00	0.00	0.0000
002LRU9	CONTRACTOR	228.23	8760.00	0.00	0.00	1.9993
002LRU9	BASE 12	228.23	679.92	672.00	7.92	0.1552
002LRU9	ONBOARD	114.11	7.92	7.92	0.00	0.0009
002LRU9	INBASE	152.91	0.00	0.00	0.00	0.0000
002LRU10	CONTRACTOR	89.98	8760.00	0.00	0.00	0.7882
002LRU10	BASE 12	89.98	679.92	672.00	7.92	0.0612
002LRU10	ONBOARD	44.99	7.92	7.92	0.00	0.0004
002LRU10	INBASE	60.28	0.00	0.00	0.00	0.0000
002LRU11	CONTRACTOR	123.82	8760.00	0.00	0.00	1.0846
002LRU11	BASE 12	123.82	679.92	672.00	7.92	0.0842
002LRU11	ONBOARD	61.91	7.92	7.92	0.00	0.0005
002LRU11	INBASE	82.96	0.00	0.00	0.00	0.0000
002LRU12	CONTRACTOR	519.12	8760.00	0.00	0.00	4.5475
002LRU12	BASE 12	519.12	679.92	672.00	7.92	0.3530
002LRU12	ONBOARD	259.56	7.92	7.92	0.00	0.0021
002LRU12	INBASE	347.81	0.00	0.00	0.00	0.0000
002LRU13	CONTRACTOR	6.00	8760.00	0.00	0.00	0.0526
002LRU13	BASE 12	6.00	679.92	672.00	7.92	0.0041
002LRU13	ONBOARD	3.00	7.92	7.92	0.00	0.0000
002LRU13	INBASE	4.02	0.00	0.00	0.00	0.0000
002LRU14	CONTRACTOR	485.44	8760.00	0.00	0.00	4.2525
002LRU14	BASE 12	2427.22	1518.00	672.00	39.60	3.6845
002LRU14	ONBOARD	1213.61	39.60	39.60	0.00	0.0481
002LRU14	INBASE	1626.23	0.00	0.00	0.00	0.0000
002LRU15	CONTRACTOR	5.55	8760.00	0.00	0.00	0.0486
002LRU15	BASE 12	27.74	1518.00	672.00	39.60	0.0421
002LRU15	ONBOARD	13.87	39.60	39.60	0.00	0.0005
002LRU15	INBASE	18.59	0.00	0.00	0.00	0.0000
002LRU16	CONTRACTOR	15.96	8760.00	0.00	0.00	0.1398
002LRU16	BASE 12	15.96	679.92	672.00	7.92	0.0109
002LRU16	ONBOARD	7.98	7.92	7.92	0.00	0.0001
002LRU16	INBASE	10.69	0.00	0.00	0.00	0.0000
002LRU17	CONTRACTOR	24.00	8760.00	0.00	0.00	0.2102
002LRU17	BASE 12	24.00	679.92	672.00	7.92	0.0163
002LRU17	ONBOARD	12.00	7.92	7.92	0.00	0.0001

OPUS10 (version 1.2e)

WSAL

WE002 - Fast Patrol Vessel

13:30:36

Oct 02 1995

*Demand Rate and Resupply Time /Item&Station

IID	STID	DRT	RST0	OASHT	DLAYT	NRSCO
002LRU17	ONBOARD	12.00	7.92	7.92	0.00	0.0001
002LRU17	INBASE	16.08	0.00	0.00	0.00	0.0000
002LRU18	CONTRACTOR	969.60	8760.00	0.00	0.00	8.4937
002LRU18	BASE 12	4848.00	1518.00	672.00	39.60	7.3593

002LRU18	ONBOARD	2424.00	39.60	39.60	0.00	0.0960
002LRU18	INBASE	3248.16	0.00	0.00	0.00	0.0000
002LRU19	CONTRACTOR	0.54	8760.00	0.00	0.00	0.0047
002LRU19	BASE 12	2.70	1518.00	672.00	39.60	0.0041
002LRU19	ONBOARD	1.35	39.60	39.60	0.00	0.0001
002LRU19	INBASE	1.81	0.00	0.00	0.00	0.0000
002LRU20	CONTRACTOR	1.62	8760.00	0.00	0.00	0.0142
002LRU20	BASE 12	8.10	1518.00	672.00	39.60	0.0123
002LRU20	ONBOARD	4.05	39.60	39.60	0.00	0.0002
002LRU20	INBASE	5.43	0.00	0.00	0.00	0.0000
002LRU21	CONTRACTOR	0.05	8760.00	0.00	0.00	0.0004
002LRU21	BASE 12	0.24	1518.00	672.00	39.60	0.0004
002LRU21	ONBOARD	0.12	39.60	39.60	0.00	0.0000
002LRU21	INBASE	0.16	0.00	0.00	0.00	0.0000
002LRU22	CONTRACTOR	1.15	8760.00	0.00	0.00	0.0101
002LRU22	BASE 12	5.76	1518.00	672.00	39.60	0.0087
002LRU22	ONBOARD	2.88	39.60	39.60	0.00	0.0001
002LRU22	INBASE	3.86	0.00	0.00	0.00	0.0000
002LRU23	CONTRACTOR	1.15	8760.00	0.00	0.00	0.0101
002LRU23	BASE 12	5.76	1518.00	672.00	39.60	0.0087
002LRU23	ONBOARD	2.88	39.60	39.60	0.00	0.0001
002LRU23	INBASE	3.86	0.00	0.00	0.00	0.0000
002LRU24	CONTRACTOR	1.15	8760.00	0.00	0.00	0.0101
002LRU24	BASE 12	5.76	1518.00	672.00	39.60	0.0087
002LRU24	ONBOARD	2.88	39.60	39.60	0.00	0.0001
002LRU24	INBASE	3.86	0.00	0.00	0.00	0.0000

*Point Summary (POINT: 24)

Life Support Cost, LSC.....	633174.00
Total Investment, CI.....	633174.00
PV Total Annual Cost, CN.....	0.00
Mean Waiting Time, WT.....	20.23
Expected Number of Backorders, NBO.....	0.18
Risk of Shortage, ROS.....	0.1763
Availability, A.....	0.9129
Mean Down Time, MDT.....	21.73

*LSC Summary (POINT: 24)

Life Support Cost (LSC)	633174.00	
Total Investment (CI)	633174.00	
Investment Repairables (CIR)		633174.00
Investment Discardables (CID)		0.00
Investment Resources (CIX)		0.00
PV Total Annual Cost (CN)	0.00	
PV Consumption Spares (CND)		0.00
PV Reorder Cost (CNO)		0.00
PV Storage Cost (CNS)		0.00
PV Transport Cost (CNT)		0.00
PV Repair Manhours (CNC)		0.00
PV Resource Cost (CNX)		0.00

Cost results are expressed in pounds

OPUS10 (version 1.2e)

WSAL

WE002 - Fast Patrol Vessel

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*Cost and MoE /Item (POINT: 24)

IID	LSC	CI	WT	NBO	ROS	STSIZ
002LRU1	13080.00	13080.00	31.49	0.00	1.0000	3
002LRU2	25311.00	25311.00	66.24	0.00	1.0000	3
002LRU3	560.00	560.00	12.87	0.00	1.0000	2
002LRU4	45224.00	45224.00	104.50	0.01	1.0000	4
002LRU5	25720.00	25720.00	85.11	0.01	1.0000	4
002LRU6	9992.00	9992.00	342.64	0.02	1.0000	2
002LRU7	9286.00	9286.00	180.66	0.01	1.0000	2
002LRU8	10218.00	10218.00	98.95	0.00	1.0000	2

002LRU9	124520.00	124520.00	147.04	0.03	1.0000	5
002LRU10	41274.00	41274.00	154.84	0.01	1.0000	3
002LRU11	40628.00	40628.00	76.80	0.01	1.0000	4
002LRU12	201258.00	201258.00	99.53	0.05	1.0000	9
002LRU13	1292.00	1292.00	12.83	0.00	1.0000	2
002LRU14	65184.00	65184.00	2.31	0.01	0.0149	16
002LRU15	4200.00	4200.00	183.55	0.01	1.0000	1
002LRU16	7128.00	7128.00	41.06	0.00	1.0000	2
002LRU17	5318.00	5318.00	80.12	0.00	1.0000	2
002LRU18	117.00	117.00	0.00	0.00	0.0001	39
002LRU19	360.00	360.00	53.99	0.00	1.0000	1
002LRU20	356.00	356.00	82.53	0.00	1.0000	1
002LRU21	158.00	158.00	40.88	0.00	1.0000	1
002LRU22	640.00	640.00	70.20	0.00	1.0000	1
002LRU23	675.00	675.00	70.20	0.00	1.0000	1
002LRU24	675.00	675.00	70.20	0.00	1.0000	1

*Stock levels /Item&Station (POINT: 24)

```

+-----+
| STSIZ /Station: Recommended nominal stock level |
+-----+
| IID | STSIZ | QTY: Total number of each station |
| Item | Total |
+-----+
| identifier | per | STID: Station identifier |
| item | item |
+-----+
| // | 1 | 2 |
| // | // | // |
| // | // | // |
| // | // | // |
+-----+
| 002LRU1 | 3 | 3 | 0 |
| 002LRU2 | 3 | 3 | 0 |
| 002LRU3 | 2 | 2 | 0 |
| 002LRU4 | 4 | 4 | 0 |
| 002LRU5 | 4 | 4 | 0 |
| 002LRU6 | 2 | 2 | 0 |
| 002LRU7 | 2 | 2 | 0 |
| 002LRU8 | 2 | 2 | 0 |
| 002LRU9 | 5 | 5 | 0 |
| 002LRU10 | 3 | 3 | 0 |
| 002LRU11 | 4 | 4 | 0 |
| 002LRU12 | 9 | 9 | 0 |
| 002LRU13 | 2 | 2 | 0 |
| 002LRU14 | 16 | 12 | 2 |
| 002LRU15 | 1 | 1 | 0 |
| 002LRU16 | 2 | 2 | 0 |
| 002LRU17 | 2 | 2 | 0 |
| 002LRU18 | 39 | 33 | 3 |
| 002LRU19 | 1 | 1 | 0 |
| 002LRU20 | 1 | 1 | 0 |
| 002LRU21 | 1 | 1 | 0 |
| 002LRU22 | 1 | 1 | 0 |
| 002LRU23 | 1 | 1 | 0 |
| 002LRU24 | 1 | 1 | 0 |
+-----+

```