



Operating and Support Cost Analysis Model



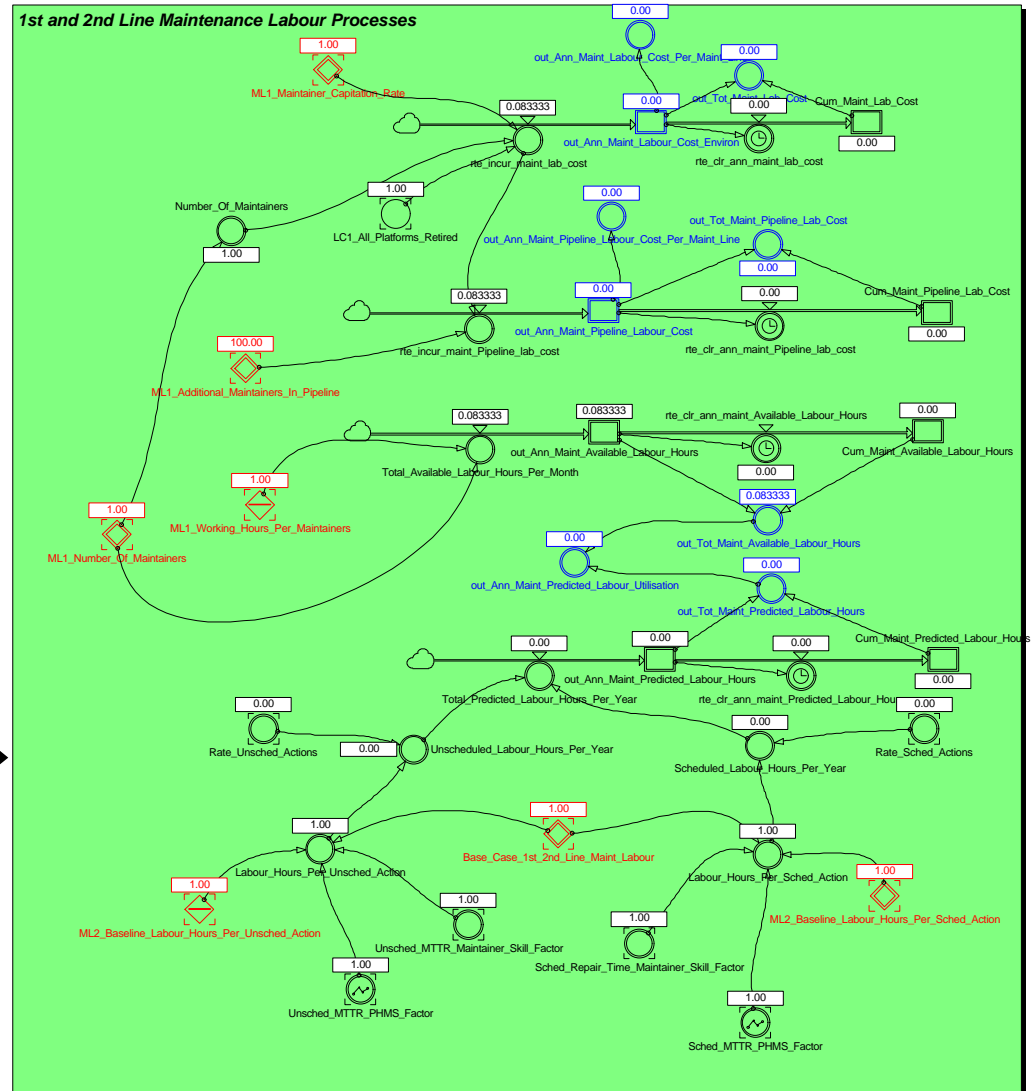
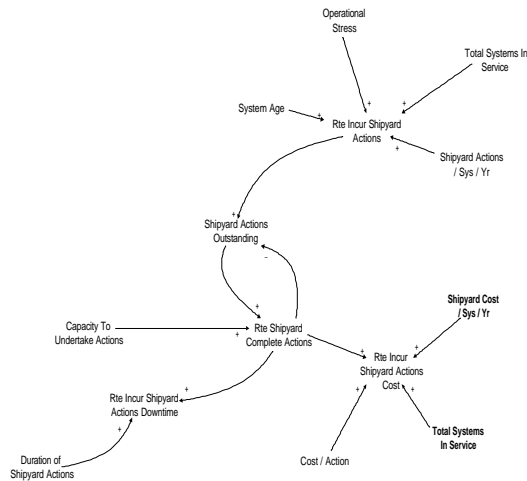
*Simulating Operating & Support Costs
Using System Dynamics*

TOC/CAIV Workshop
4 November 99



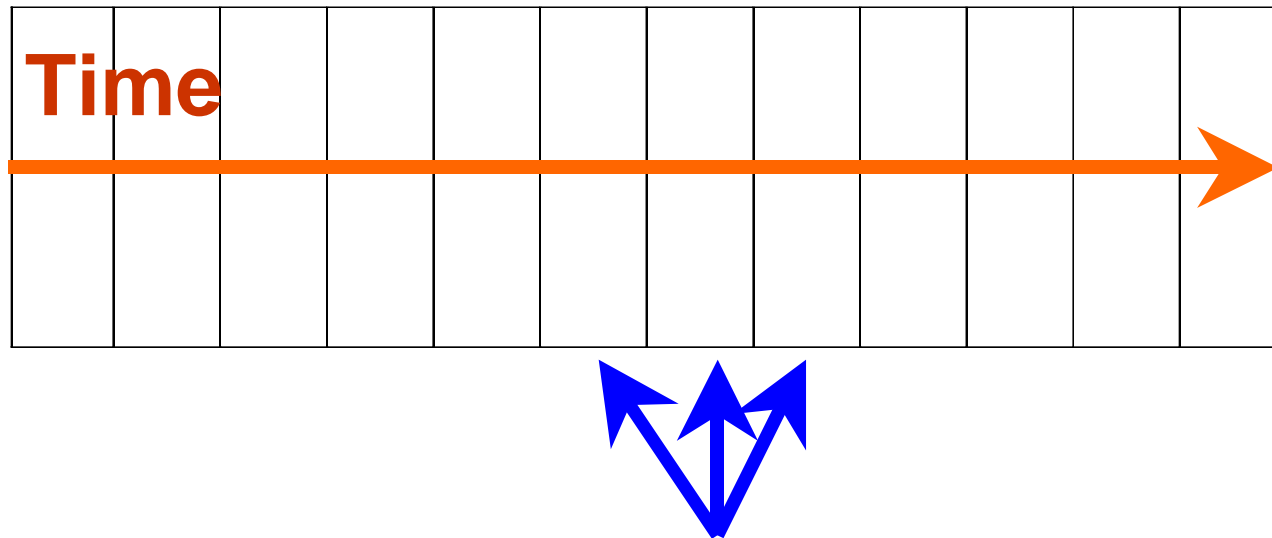
System Dynamics Stock Flow Diagram

- ◆ Each Influence Diagram is converted into a Stock Flow Diagram, which is used to quantify/code the cause & effect relationships





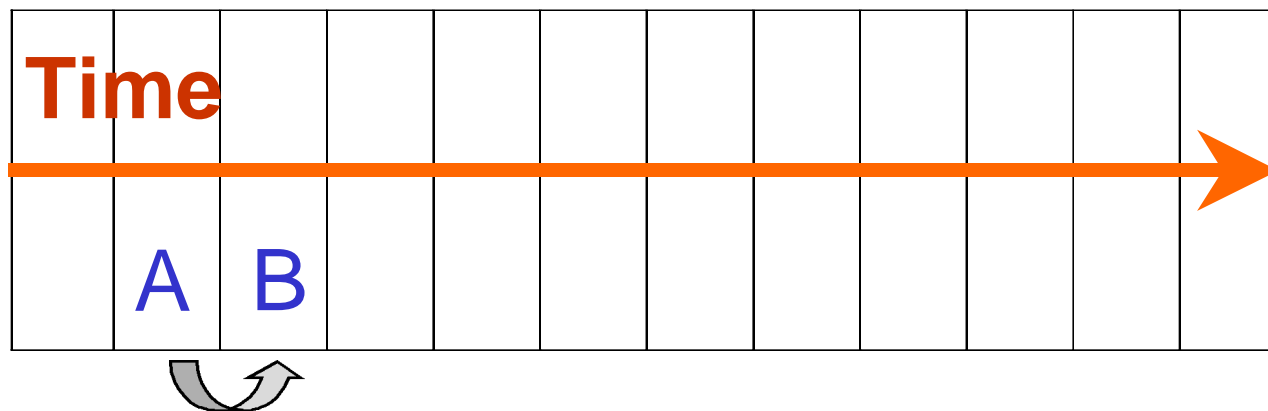
How the Simulation Works



The platform lifetime is divided into a series of equal time intervals (approx 1 month)



How the Simulation Works

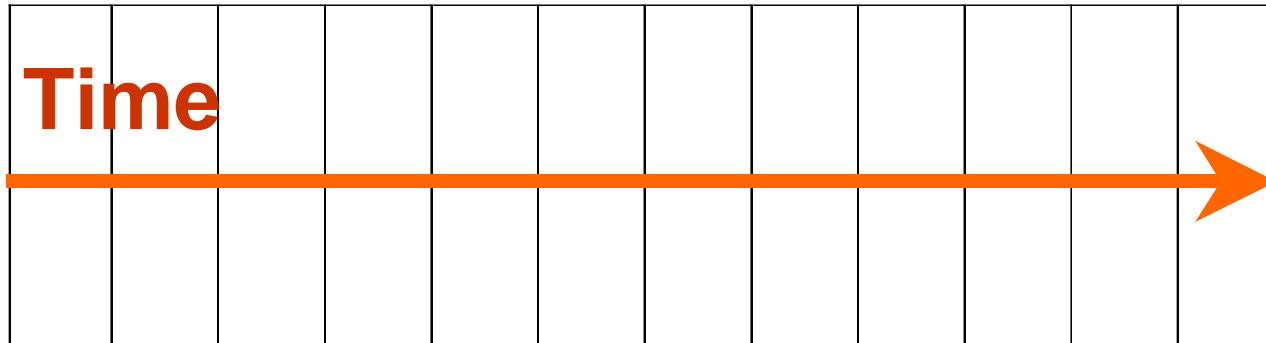


Status of platform at time B is determined by that at A plus/minus other factors and constraints





For Example



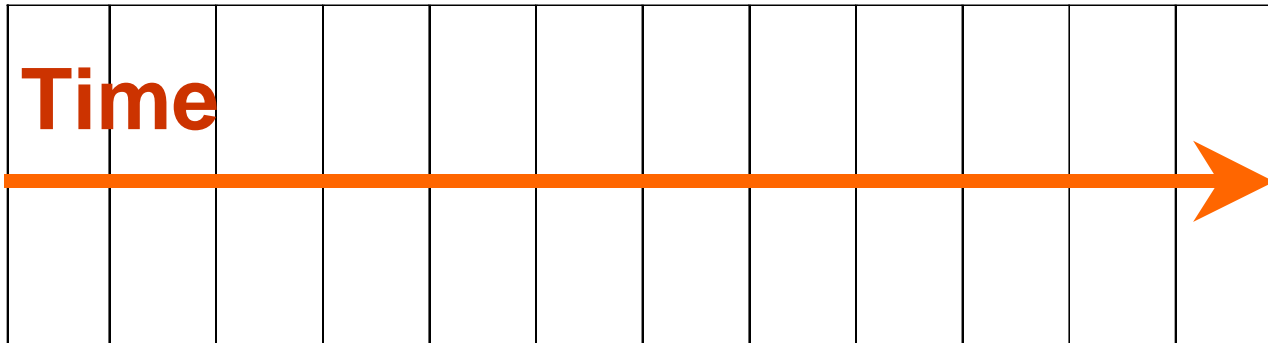
Time in operation



Planned maintenance period



For Example



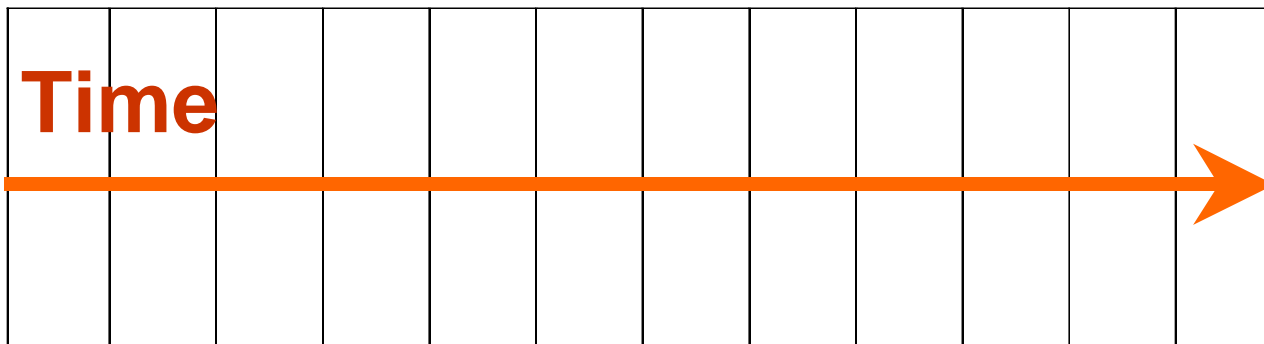
Time in operation



Equipment under
extra stress



For Example



Time in operation



Equipment under
extra stress

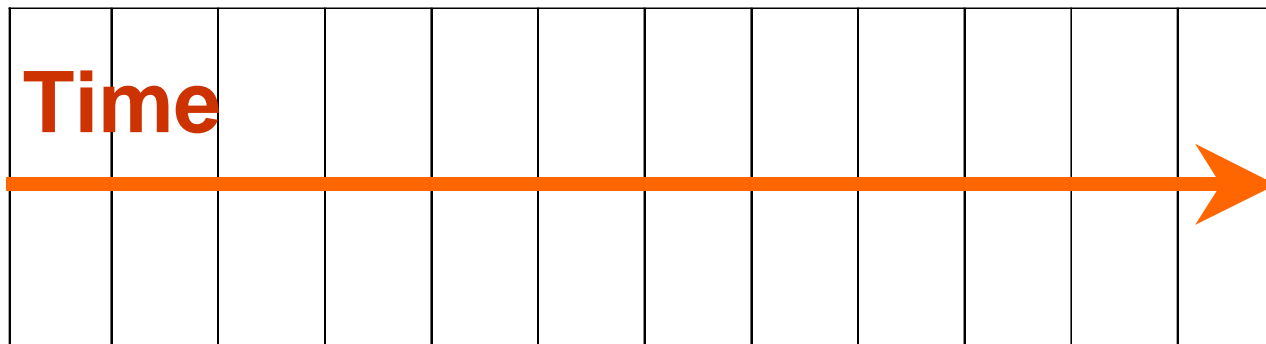


Planned maintenance period





For Example



Time in operation



Equipment under
extra stress



Planned maintenance period



Actual maintenance period
calculated by model



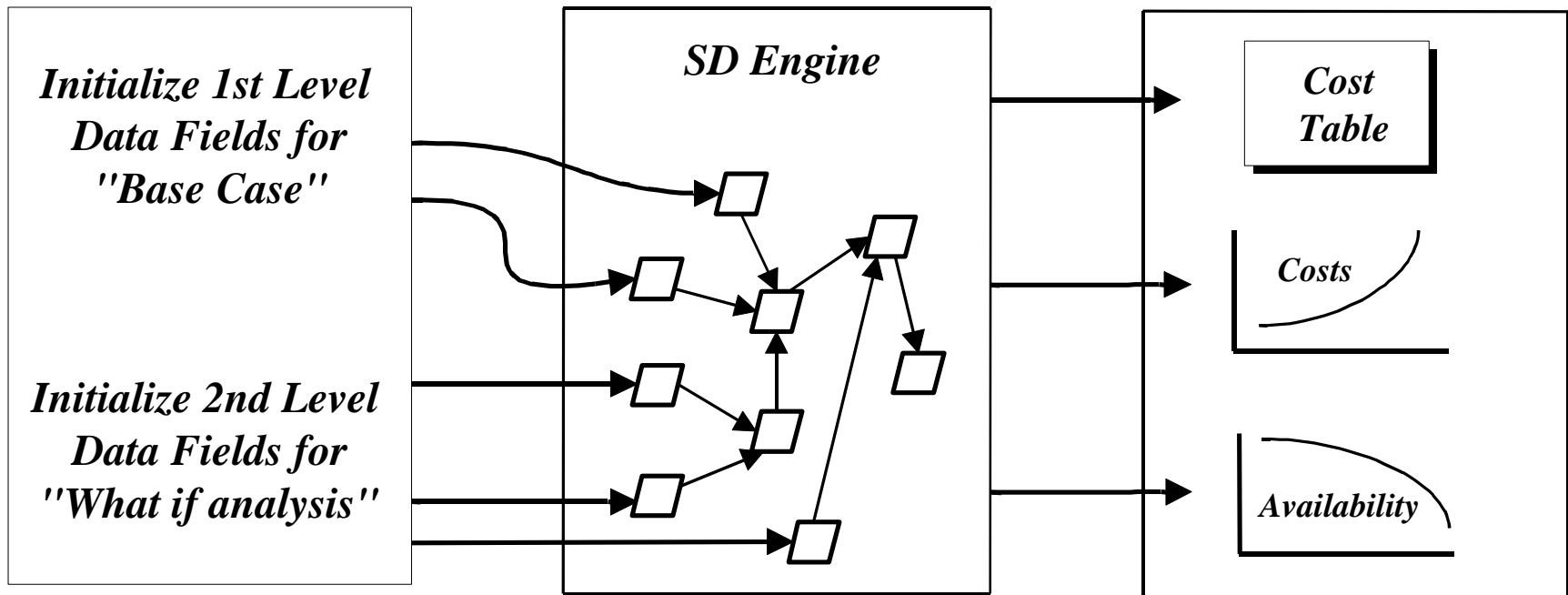


Model Architecture Inputs

DELPHI - User Interface

Powersim Software Tool

Model Output



↑
Following slides
address this portion



Input Data

- ◆ Model designed for two levels of simulation
 - 1st level input data required to run base case simulation
 - » OSCAM Shipboard System - up to 97 fields
 - » OSCAM Ship - up to 173 fields
 - 2nd level input data required to run ‘what if’ simulation
 - » OSCAM Shipboard System - up to 74 fields
 - » OSCAM Ship - up to 74 fields
- ◆ 2nd level simulation leverages the system dynamics capabilities of the model



Input Data Entry Options

1st Level Data

- ◆ Platform-level (for OSCAM Ship) and system-level (for OSCAM Sys) cost data
 - Actuals (7-10 year average) via VAMOSOC/3M-based OSCAM data sets
 - Parametrically estimated 'data' via **Parametric Cost Tool (PCT)**
 - Actuals or estimates via user data sets
- ◆ System-level (for OSCAM Ship) & subsystem-level (for OSCAM Sys) cost data
 - Actuals or estimates for various EIC/ESWBS levels of indenture via **Data Management Tool (DMT)**



1st Level Input Data Fields OSCAM (Sys)

System Characteristics	O/I-Level Maintenance	Depot/Rework
System Production Cost	Unscheduled/Scheduled/Alteration Actions	Contractor Depot Cost per System per Year
System Installation Cost	Actions per System per Year	Other Depot Cost per System per Year
System Weight	Manhours per Action	
	Repair Parts per Action	Modernization
Manning	Cost per Repair Part	CPM per System per Year
Operators per System	Repairables per Action	Installation Cost per System per Year
Maintainers per System	Average Exchange Cost	
Annual Operator Labor Rate	Average Issue Cost	Software
Annual Maintainer Labor Rate	% of Exchanges	Software Maintenance Cost per Year
Fuel	I-Level Maintenance Labor	Engineering Technical Services
Fuel Cost per System per Year	Hourly Labor Rate	ETS Cost per Year
	Direct Rate	
Ordnance	Overhead Factor	Training
Ordnance Cost per System per Year		Student-Days per System per Year
	Shipyard Repair	Cost per Student-Day
Disposal	Shipyard Cost per System per Year	Instructor Cost
De-Installation Factor		Facilities Cost
Disposal Cost per lb		



Agenda

- ◆ Overview
- ◆ History/Schedule
- ◆ Methodology/Inputs/Outputs
- ◆ Model Screen Shots
- ◆ Users & Training
- ◆ Summary



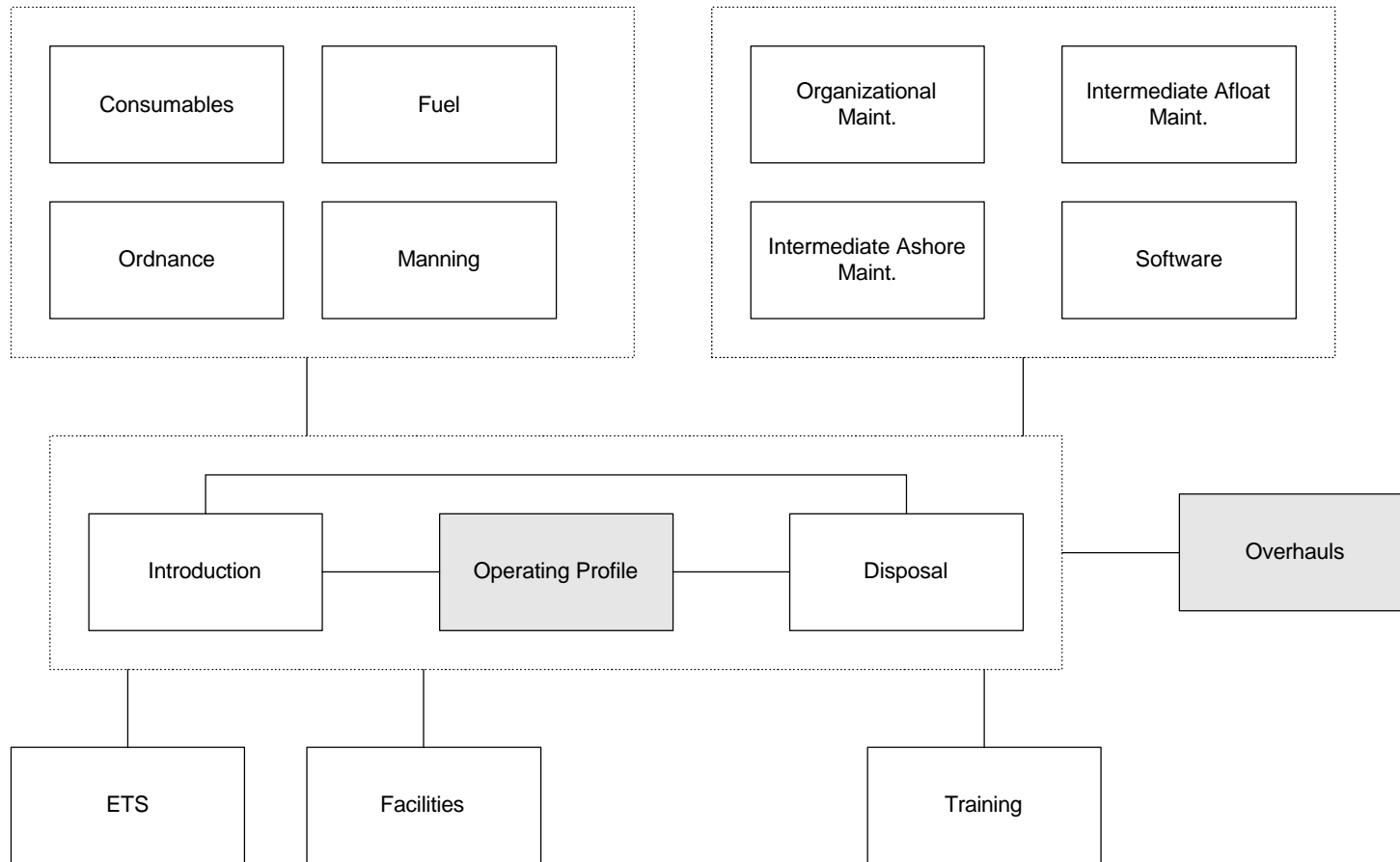
What is OSCAM?

- ◆ Standardized, yet flexible approach to analyzing O&S costs for new and in-service systems
 - Coverage of all direct and some indirect O&S \$
- ◆ Business process model that facilitates understanding of O&S processes, O&S costs and their interdependencies
 - Dynamic time-based simulation via system dynamics technique
- ◆ Appropriate for use throughout the life cycle by logisticians, cost analysts, engineers, etc.



What is OSCAM?

OSCAM(Ship) Sectors



Sectors are linked & interdependent



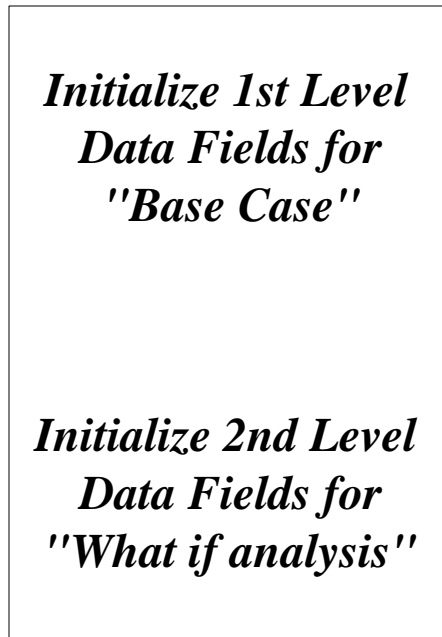
Development History

- ◆ NCCA/UK MOD collaborative development effort initiated in Spring 96
 - OSCAM Shipboard System (Sys)
 - OSCAM Ship
 - OSCAM Air (prototype in Dec 99)
- ◆ UK MOD leveraged OSCAM Sys & Ship experience to develop
 - OSCAM Land
 - OSCAM Air Defence Ground Environment (ADGE)
 - OSCAM Future Amphibious Support Helicopter (FASH)
- ◆ NCCA/NAVAIR leveraging OSCAM FASH experience to develop OSCAM Air
- ◆ NCCA/DRPM AAV to leverage OSCAM Land to develop OSCAM AAV

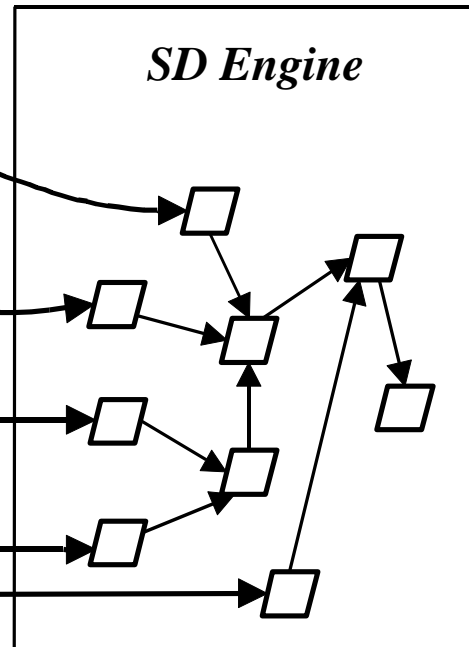


Model Architecture Methodology

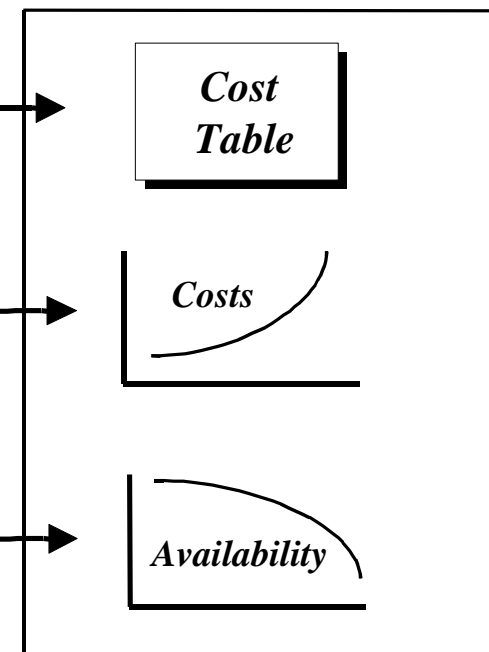
DELPHI - User Interface



Powersim Software Tool



Model Output



Following slides
address this portion



System Dynamics

What Is It & Why Use It?

- ◆ Structured method of addressing questions regarding the *dynamic tendencies of complex systems*, i.e., the behavioral patterns they generate over time
- ◆ The operating & support of DON weapon systems constitutes a *complex system characterized by dynamic behavior/processes*
- ◆ Traditional cost models are static in nature, thus do not support analysis of change & cannot address the types of questions posed today, e.g.,

How can the Navy reduce O&S costs while maintaining readiness?

System Dynamics facilitates understanding of costs



System Dynamics

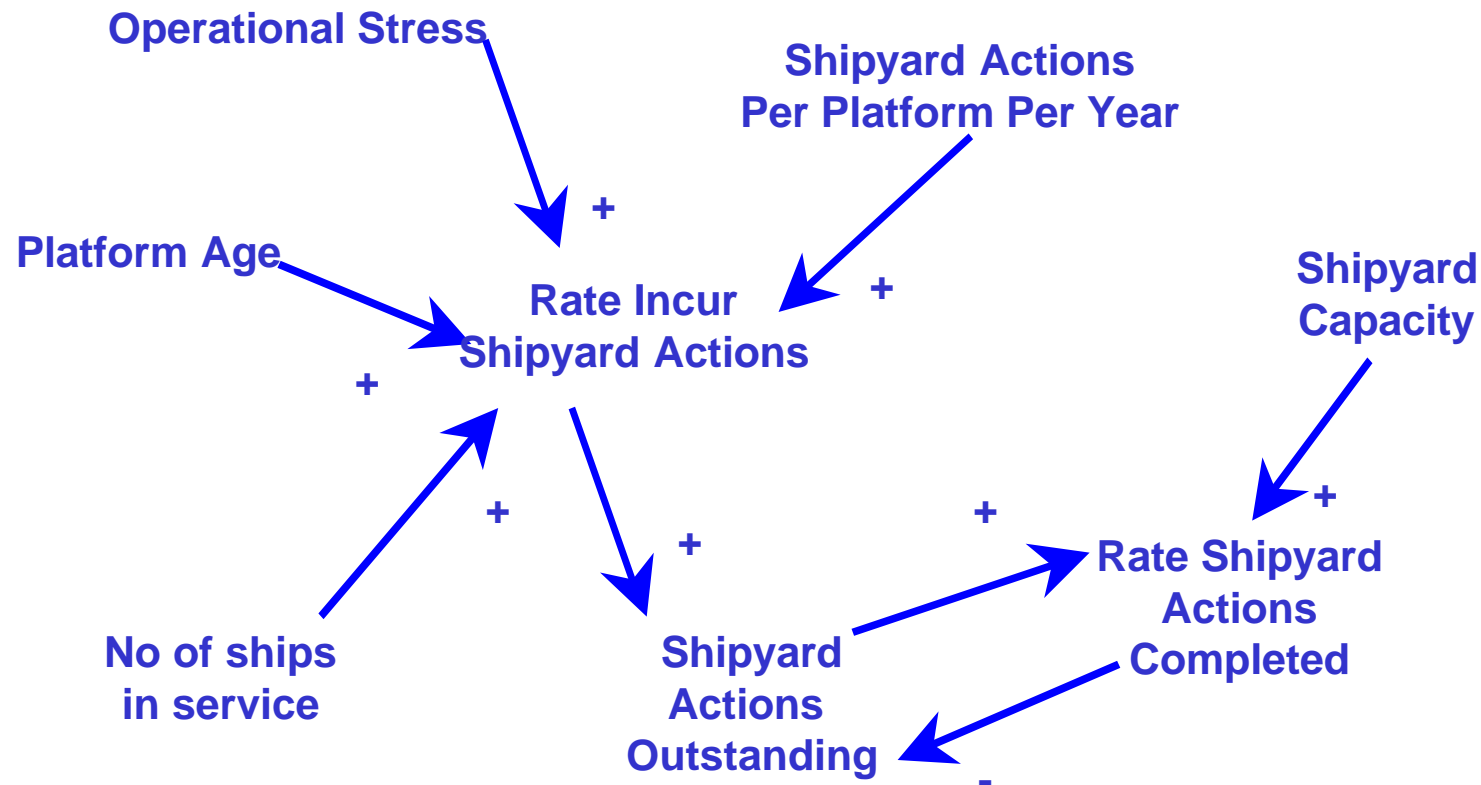
What Is It & Why Use It?

- ◆ Established business process modelling technique
- ◆ Dynamic, time based simulation
- ◆ Designed to provide a holistic view
- ◆ Lends itself to rapid prototyping
- ◆ Complements existing modelling techniques



System Dynamics

Influence Diagram (Shipyards Process)



Each model sector has an Influence Diagram, which identifies cause & effect relationships



Historical Data Sets* OSCAM(Sys)

<p>FCS(15)</p> <p>Surface Ship</p> <p>Harpoon WS MK 74 FCS MK 86 GFCS MK 92 FCS MK 16 ASROC MK 15 CIWS MK 23 MK 57 MK 31 RAM SYQ 20</p> <p>Submarine</p> <p>MK 1 MK 2 MK 116 MK 117 MK 118</p>	<p>Radars(35)</p> <table border="1"> <thead> <tr> <th>Surface Search</th> <th>Air Search</th> <th>Submarine</th> </tr> </thead> <tbody> <tr><td>SPS 5</td><td>SPS 6</td><td>BPS 4</td></tr> <tr><td>SPS 10</td><td>SPS 12</td><td>BPS 5</td></tr> <tr><td>SPS 21</td><td>SPS 29</td><td>BPS 9</td></tr> <tr><td>SPS 36</td><td>SPS 30</td><td>BPS 11</td></tr> <tr><td>SPS 46</td><td>SPS 37</td><td>BPS 14</td></tr> <tr><td>SPS 53</td><td>SPS 39</td><td>BPS 15</td></tr> <tr><td>SPS 55</td><td>SPS 40</td><td>BPS 16</td></tr> <tr><td>SPS 59</td><td>SPS 42</td><td></td></tr> <tr><td>SPS 60</td><td>SPS 43</td><td></td></tr> <tr><td>SPS 64</td><td>SPS 48C</td><td></td></tr> <tr><td>SPS 66</td><td>SPS 48E</td><td></td></tr> <tr><td>SPS 67</td><td>SPS 49</td><td></td></tr> <tr><td></td><td>SPS 52</td><td></td></tr> <tr><td></td><td>SPS 58</td><td></td></tr> <tr><td></td><td>SPS 62</td><td></td></tr> <tr><td></td><td>SPS 65</td><td></td></tr> </tbody> </table>			Surface Search	Air Search	Submarine	SPS 5	SPS 6	BPS 4	SPS 10	SPS 12	BPS 5	SPS 21	SPS 29	BPS 9	SPS 36	SPS 30	BPS 11	SPS 46	SPS 37	BPS 14	SPS 53	SPS 39	BPS 15	SPS 55	SPS 40	BPS 16	SPS 59	SPS 42		SPS 60	SPS 43		SPS 64	SPS 48C		SPS 66	SPS 48E		SPS 67	SPS 49			SPS 52			SPS 58			SPS 62			SPS 65		<p>Sonars(16)</p> <p>Surface Ship</p> <p>SQS 53A SQS 53C SQS 56 SQQ 32 SQQ 89</p> <p>Submarine</p> <p>BQQ 5 BQQ 6 BQS 15 BSY 1 BSY 2</p> <p>Towed Arrays</p> <p>SLQ 48 SQR 19 SURTASS TB 23</p> <p>Acoustical Signal Processors</p> <p>UYS 1 UYS 2</p>
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First Level Input Data Fields OSCAM(Ship)

<u>Primary Data Set</u>		
Ship Characteristics	General Stores/Supplies	Other Depot Maintenance
Weight (Full Load Displacement FLD)	General Stores/Supplies Cost	Other Gov Depot Cost per Ship per Year
Steaming Characteristics	Publications Cost	Contractor Depot Cost per Ship per Year
SHU In Fleet Time		
NU External Power In Fleet Time	Ordnance	Unscheduled Repair
Support Services	Expendables Cost	Type A, B Repairs
Variable At Sea Support Services Cost	Handling Cost	Repairs per Ship per Year
Fixed At Sea Support Services Cost		Repair Cost per Repair
Variable Alongside Support Services Cost	O-Level, I-Level Ashore/Afloat Maintenance	Average Duration of Repair
Fixed Alongside Support Services Cost	Unscheduled/Scheduled/Alteration Actions	
Variable Routine Trials Cost	Actions per Ship per Year	Software
Fixed Routine Trials Cost	Manhours per Action	Software Maintenance Cost
Manning	Repair Parts per Action	
Enlisted Crew per Ship	Cost per Repair Part	Engineering Technical Services
Officer Crew per Ship	Repairables per Action	ETS Cost
Enlisted Pay Rate	Average Exchange Cost	
Officer Pay Rate	Average Issue Cost	Training
Temporary Additional Duty Cost	% of Exchanges	Enlisted, Officer Training
		Student-Days per Year
Fuel	I-Level Contractor Support Cost per Ship per Year	Direct Cost per Student-Day
Bbls Fuel per SHU		Indirect Cost per Student-Day
Bbls Fuel per NU Own Power	I-Level Ashore, Afloat Maintenance Labor	
Bbls Fuel per NU External Power	Direct Rate	Disposal
Cost per Bbl Fuel	Overhead Factor	Disposal Cost per Long Ton
Other POL Cost		



Historical Data Sets*

OSCAM(Ship)

<u>Carriers(8)</u>	<u>Combatants(20)</u>	<u>Submarines(21)</u>	<u>Support(29)</u>	<u>Mine Warfare(3)</u>
AVT-16CL	BB-61CL	AGSS-555CL	AD-14CL	MCM-1CL
AVT-59CL	CG-16CL	SS-576CL	AD-37CL	MHC-51CL
CV-41CL	CG-26CL	SS-580CL	AD-41CL	MSO-422CL
CV-59CL	CG-47CL	SSBN-598CL	AE-21CL	
CV-63CL	CGN-09CL	SSBN-616CL	AE-23CL	<u>Patrol(2)</u>
CV-67CL	CGN-25CL	SSBN-627CL	AE-26CL	PC-1CL
CVN-65CL	CGN-35CL	SSBN-640CL	AFS-1CL	PHM-1CL
CVN-68CL	CGN-36CL	SSBN-726CL	AGDS-2CL	
	CGN-38CL	SSN-575CL	AO-177CL	
<u>Amphibs(14)</u>	DD-963CL	SSN-578CL	AO-51CL	
AGF-03CL	DDG-2CL	SSN-585CL	AOE-1CL	
AGF-11CL	DDG-37CL	SSN-594CL	AOE-6CL	
LCC-19CL	DDG-51CL	SSN-597CL	AOR-1CL	
LHA-1CL	DDG-993CL	SSN-608CL	AR-05CL	
LHD-1CL	FF-1037CL	SSN-637CL	ARL-1CL	
LKA-113CL	FF-1040CL	SSN-640CL	ARS-38CL	
LPD-1CL	FF-1052CL	SSN-671CL	ARS-50CL	
LPD-4CL	FF-1098CL	SSN-685CL	ARS-6CL	
LPH-2CL	FFG-1CL	SSN-688CL1	AS-11CL	
LSD-28CL	FFG-7CL	SSN-688CL2	AS-19CL	
LSD-36CL		SSN-688CL3	AS-31CL	
LSD-41CL			AS-33CL	
LSD-49CL			AS-36CL	
LST-1179CL			AS-39CL	
			ASR-07CL	
			ASR-21CL	
			ATF-148CL	
			ATS-1CL	
			AVM-1CL	



Data Generation Tools

◆ Parametric Cost Tool (PCT)

- Used to *estimate* 1st level data when an analogy or average of analogies from the VAMOSC/3M-based OSCAM data sets are not appropriate
- Contains NCCA developed, regression-based relationships that generate estimates for most of the 1st level data fields
- Relationships are linear, logarithmic and power functions
 - » Dependent variables: cost, manhrs, manning, maint actions, etc.
 - » Independent variables: horsepower, weight, power, range, etc.

◆ Data Management Tool (DMT)

- Used to *create* 1st level data when level of detail from the VAMOSC/3M-based OSCAM data sets are not appropriate for the type of analysis desired (e.g., propulsion system trade-offs)
- Enables user to input actuals or estimates at various levels of EIC or ESWBS indenture



2nd Level Input Data Fields OSCAM(Ship)

Operations

Facilities

Var At Sea Supt Svcs (\$K/Ship/OT)
 Var Alongside Svcs (\$K/Ship/OT)
 Var Routine Trials Cost (\$K/Ship/OT)

Steaming Characteristics

Optempo Impact On % SHU (factor)
 % Reduction In SHU At End Of Life

Fuel

Age Impact On SHU Fuel Consmp (fctr)
 Age Impact On NU Fuel Consmp (fctr)
 Hull Clean Impact On FuelCon (fctr)
 Optempo Impact on Fuel Consmp (fctr)

Ordnance

Avg Rate Of Firing (rnds/mth IFT)
 Avg Rte Of Hndling (actions/mth IFT)
 Cost Of Handling (\$K/action)
 Cost Of Firing (\$K/round)

O / I Maintenance

Organizational Maintenance Sector

Maintainers Within Crew (%)
 Maint Effort Avail (pers/mth/mth)

O & I (Ashore and Afloat) Maintenance Sectors

Unscheduled Actions

Age Impact On Unschd Actions (fact)
 Logistic Delay Time (Hrs)
 Time To Undertake Repair (Hrs)
 Staff Avail Impact On MTTR (factor)
 Optempo Impact On Actions (factor)

Scheduled Actions

Age Impact On Sched Actions (fact)
 Logistic Delay Time (Hrs)
 Time To Undertake Repair (Hrs)
 Staff Avail Impact On MTTR (factor)

Alterations

Age Impact On Alt Actions (fact)
 Logistic Delay Time (Hrs)
 Time To Undertake Repair (Hrs)
 Staff Avail Impact On MTTR (factor)

Scheduled Overhaul

Capacity For Ovrhls (simul. ovrhls)
 % Outstanding Upkeep Discarded
 % Emergent Upkeep
 % Retained Upkeep To O-level
 Equiv. Upkp Person Mths/Unschd Act
 Upkeep Considered Essential (fract)
 Hull Clean Threshld Duration (mths)
 Engineering Technical Services
 Fuel
 O and I Level Maintenance
 Ordnance
 Scheduled Overhaul
 Steaming
 Software
 Training
 Unscheduled Overhaul

Overhaul Schedule

Overhaul Profile

Effective Aging Fctr (eff days/day)

Extended Readiness

Effective Aging Fctr (eff days/day)

Unscheduled Shipyard Repair

Type A Repairs

Type A Unscheduled Repairs/Ship/OT
 Impact of Schd Alt Actions
 Impact of Unschd Actions

Type B Repairs

Type B Unscheduled Repairs/Ship/OT
 Impact of Schd Alt Actions
 Impact of Unschd Actions

Type C Repairs

% of the backlog to work off
 O Level Unschd. Backlog Trigger Level
 Strike Rate
 Overhaul Cost (\$K/Month)

Training

General

Skill Impact On Actions (factor)
 Skill Impact On Downtime (factor)
 Modify Post Overhaul Trng (factor)
 Time To Correct Shortfalls (mths)
 Modify Base Training Reqs (factor)

Enlisted Training

Post Overhaul Training Req. (days)
 Shortfall Immediacy Period (mths)
 Training Capacity (tot. days/mth)

Officer Training

Post Overhaul Training Req. (days)
 Shortfall Immediacy Period (mths)
 Training Capacity (tot. days/mth)

ETS

% Ships In Service vs Cost Factor
 Midlife Update Addl Cost (\$K/yr)
 Midlife Update Start Time (mths)
 Midlife Update End Time (mths)
 Midlife Updte Addl Cst Bld Up (mths)
 Midlife Updte Addl Cst Wnd Dwn (mths)

Software

% Ships In Service vs Cost Factor



Example 2nd Level Analyses OSCAM(Ship)

Manning Level Impacts on Maintenance/Availability

OPTEMPO Impact on Fuel Consumption

OPTEMPO Impact on Steaming Hours Underway

OPTEMPO Impact on Maintenance Requirements

Age Impact on Steaming Hours Underway

Age Impact on Fuel Consumption

Age Impact on Maintenance Requirements

Hull Cleaning Impact on Fuel Consumption

Rate of Firing Impacts

Rate of Handling Operations Impacts

Logistics Delay Impacts on Availability

Maintenance Requirement Impacts on Unscheduled Repairs/Availability

Midlife Overhaul Impacts on Engineering Technical Services

Training Requirements Impact on Maintenance/Availability

Scheduled Overhaul Cycle Impacts on Shipyard Capacity

Scheduled Overhaul Impacts on Ship Age

Scheduled Overhaul Requirement Impacts on O/I-Level Maintenance

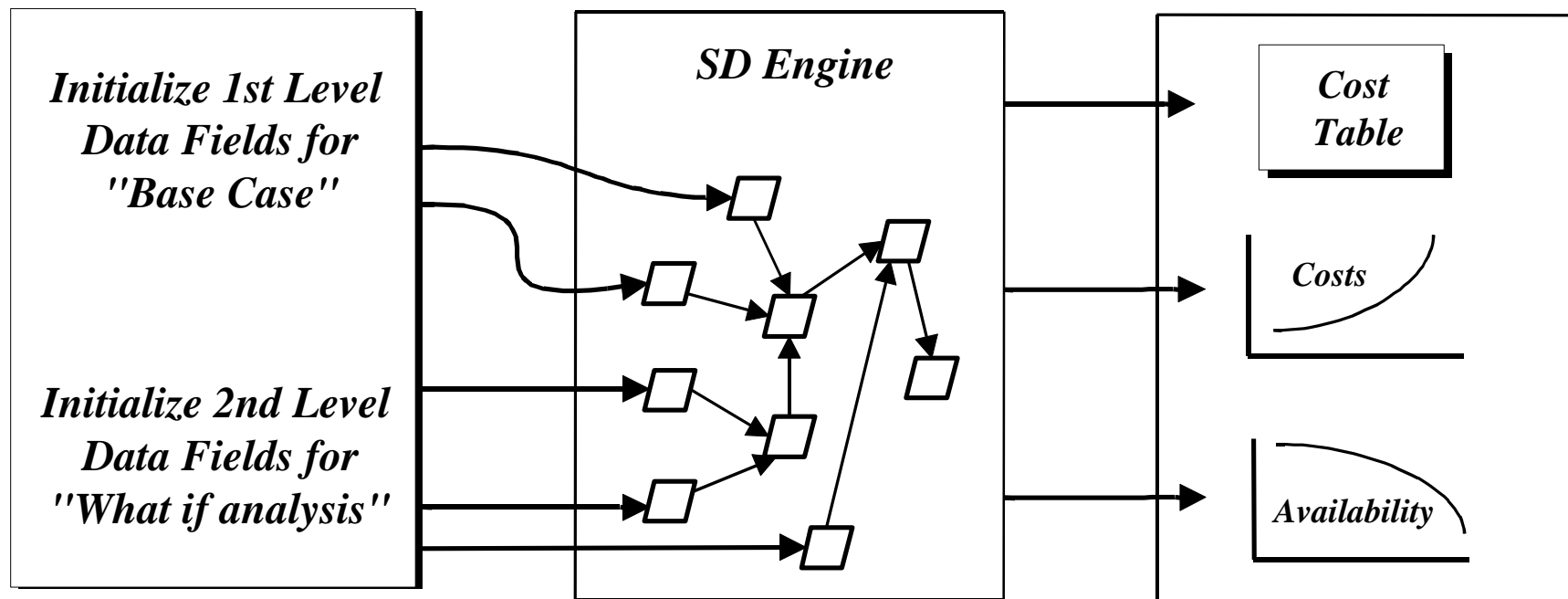


Model Architecture Outputs

DELPHI - User Interface

Powersim Software Tool

Model Output



↑
Following slides
address this portion



Outputs

- ◆ Cost
 - cumulative and current
 - summary and detailed
 - constant \$ (1970 - 2024)
- ◆ Availability
 - based on system uptime metrics, e.g. materially available vessel days (ship models) or system downtime
 - simple availability measures aiming to highlight cost tradeoffs



OSCAM SCREEN SHOTS

OSCAM Ship File Selection Form - [Operations Input...]

File Window Help

Allows a written report of the changes made to be saved in the Ship Characteristics Dataset.

Data Set **CVN-65CL** Cost Base Year **2000**

Details Close Form

Ship Characteristics Data Source

1. Std Displacement at ISD (ktonnes)

Ship Characteristics Dataset name which may be edited here at any time.

Steaming Characteristics

2. % In Fleet Time spent Underway (%) CVN-65CL

24. Disposal Cost (Rev) (£K/t)

3. % In Fleet Time on Shore Power (%)

Close the form here or go directly to another form using the window menu.

Support Services

4. Var Afloat Supp Cost (£K/Ship/y) CVN-65CL

7. Fix Ashore Supp Cost (£K/Class/y) CVN-65CL

5. Fix Afloat Supp Cost (£K/Class/y) CVN-65CL

8. Var Routine Trial Cost (£K/Ship/y) CVN-65CL

6. Var Ashore Supp Cost (£K/Ship/y) CVN-65CL

9. Fix Routine Trial Cost (£K/Class/y) CVN-65CL

Source of this data value, either this ship (CVN-65CL), another ship (e.g. CVN-68CL) or a user (USER) defined value. This source information is saved with the Dataset.

Manning

10. Initial Complement - Ratings/Ship CVN-65CL

11. Initial Complement - Officers/Ship CVN-65CL

12. Avg Cost Rating (£K/m/person) CVN-65CL

13. Avg Cost Officer (£K/m/Person) CVN-65CL

Short US or UK description of parameter.

14. Temp Add Duty Cost (£K/Person/y) CVN-65CL

Long US or UK description of parameter.

General Stores/Supplies

15. Gen Stores/Supplies (£K/Person/y) CVN-65CL

16. Publications Cost (£K/Ship/y) CVN-65CL

Ordnance Requirements

17. Expendable Ord Costs (£K/Ship/y) CVN-65CL

18. Handling Costs (£K/Ship/y) CVN-65CL

General Stores Costs (but not including common ranges of mechanical, electrical and electronic items). Also includes victualling.

1st Line Maintenance Data Input Form

Data Set **CVN-65CL** Cost Base Year **2000**

Details Close Form

Data value selection window.

Data values for ships in the Reference Ship characteristics Datafile (if one was selected).

Corrective Actions

25. Corrective Actions/Ship/Year	10496.308	CVN-65CL
26. Corrective Actions/Ship/Year		CVN-65CL
27. Corrective Actions/Ship/Year		CVN-65CL
28. Corrective Actions/Ship/Year		CVN-65CL
29. Corrective Actions/Ship/Year		CVN-65CL

All data may be edited manually or, by double clicking in the data area, data may be selected from the data selection window.

Data Selection Form

Select Ship Type With The Appropriate Value For:

34. Labour Hours/Preventative Action

Primary Ships | Secondary Ships

AVT-16CL	4.589
AVT-59CL	4.589
CV-41CL	0
CV-59CL	7.27
CV-63CL	23.362
CV-67CL	10.159
CVN-65CL	25.59
CVN-68CL	46.499

Accept Cancel

Preventative Actions

33. Preventative Actions/Ship/Year	6.31	CVN-65CL
34. Labour Hours/Preventative Action	25.59	CVN-65CL
35. Repair Parts/Preventative Action	3.834	CVN-65CL
36. Avg Cost (£K/Exchange)		CVN-65CL
37. Repair Parts/Preventative Action		CVN-65CL
38. Avg Exchange Cost (£K/Exchange)	0	CVN-65CL
39. Avg Issue Cost (£K/Issue)	0	CVN-65CL
40. % of Repairables Exchanged (%)	85	CVN-65CL

Data values for ships in the selected Ship characteristics Datafile.

Base Case avg number of labour manhours required to perform a preventative action at 1st line.

5 Types of overhaul. These may be dragged onto the overhaul schedule.

Allows a written report of the changes made to be saved in the Program Profile/Scheduled Overhauls Dataset.

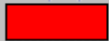
Data Set CVN-65CL

Overhaul Profile CVN-65CL

Start Date Year 2000

OverHaul Templates

Type 1



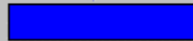
Type 2



Type 3



Type 4



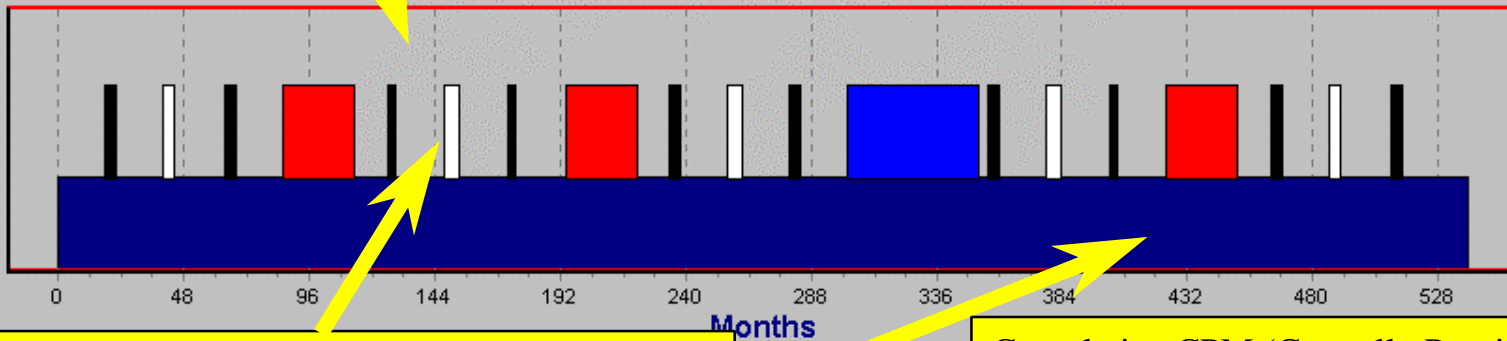
Type 5



Modify Types

Details

Platform Life Time And Overhauls Profile



Upto 30 overhauls which may be dragged to a new month, deleted or added to. Ship lifetime may also be altered.

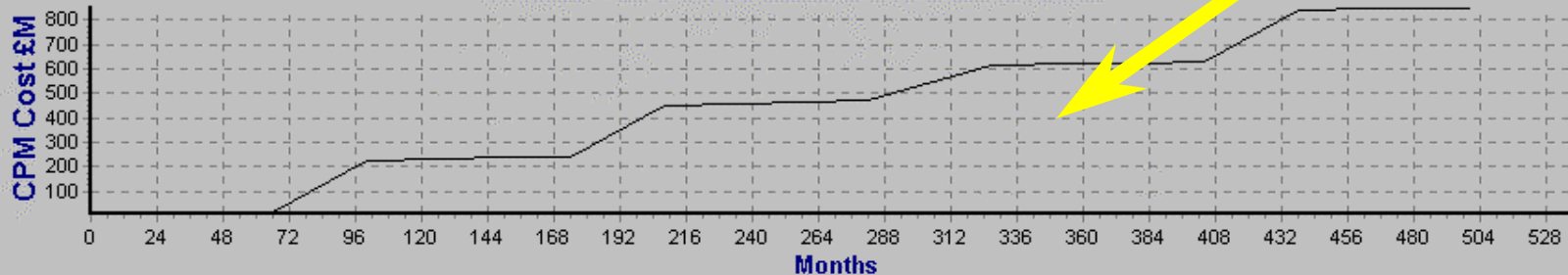
Cumulative CPM (Centrally Provided Material) Cost based on the overhaul profile, the standard CPM cost per overhaul type and the CPM factor for each overhaul

Extended Readiness Start Date (m)

999

Duration of Extended Readiness (m)

Cumulative Centrally Provided Material Costs

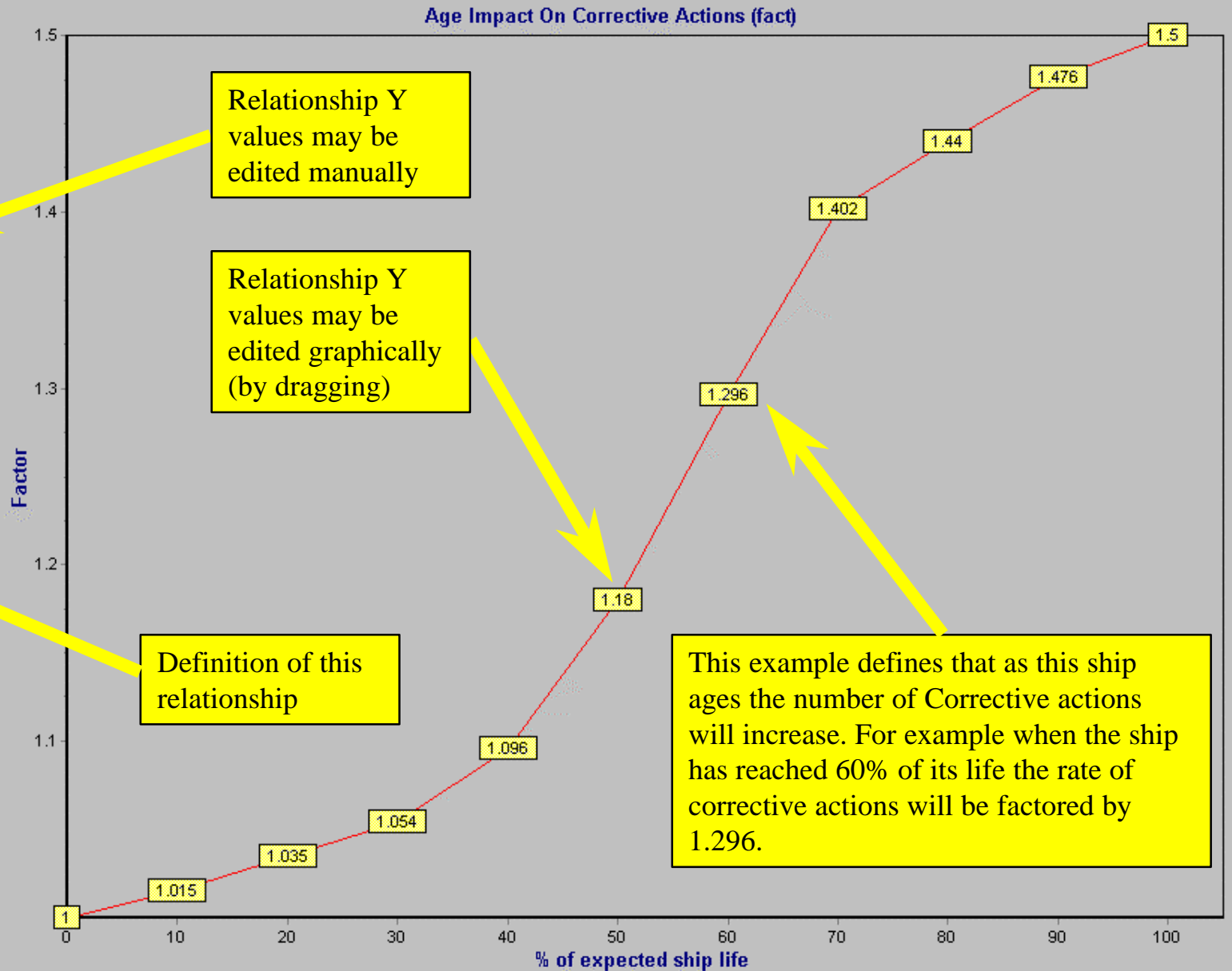


2nd Level Graph Input

X values	Y values
0.000	1.000
10.000	1.015
20.000	1.035
30.000	1.054
40.000	1.096
50.000	1.180
60.000	1.296
70.000	1.402
80.000	1.440
90.000	1.476
100.000	1.5

This is the effect of the ship age on the rate of corrective maintenance actions across each line. This is defined graphically.

Accept Cancel



Zoom and Reset using Left mouse button, Pan using Right mouse button, hold down the SHIFT key and move the cursor with the mouse to reshape the graph

Ending	2009	2010	2011	2012	2013	2014	2015	2016	2017
Nuclear Refuel Replacement Core Costs (\$M)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ordnance Costs (\$M)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Disposal Costs (\$M)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Maintenance Costs (\$M)	38.246	35.942	12.294	12.294	15.428	13.989	15.428	12.294	13.90
O-Level Costs (\$M)	9.000	9.000	9.000	9.000	9.000	9.000	9.000	9.000	9.000
O-Level Repair Parts Costs (\$M)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
O-Level Repairables Costs (\$M)	9.000	9.000	9.000	9.000	9.000	9.000	9.000	9.000	9.000
O-Level Issues Costs (\$M)	9.000	9.000	9.000	9.000	9.000	9.000	9.000	9.000	9.000
O-Level Exchanges Costs (\$M)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
I-Level Costs (\$M)	0.995	0.995	0.995	0.995	0.995	0.995	0.995	0.995	0.995
I-Level Ashore Costs (\$M)	0.995	0.995	0.995	0.995	0.995	0.995	0.995	0.995	0.995

Double click to display this data stream in the graph

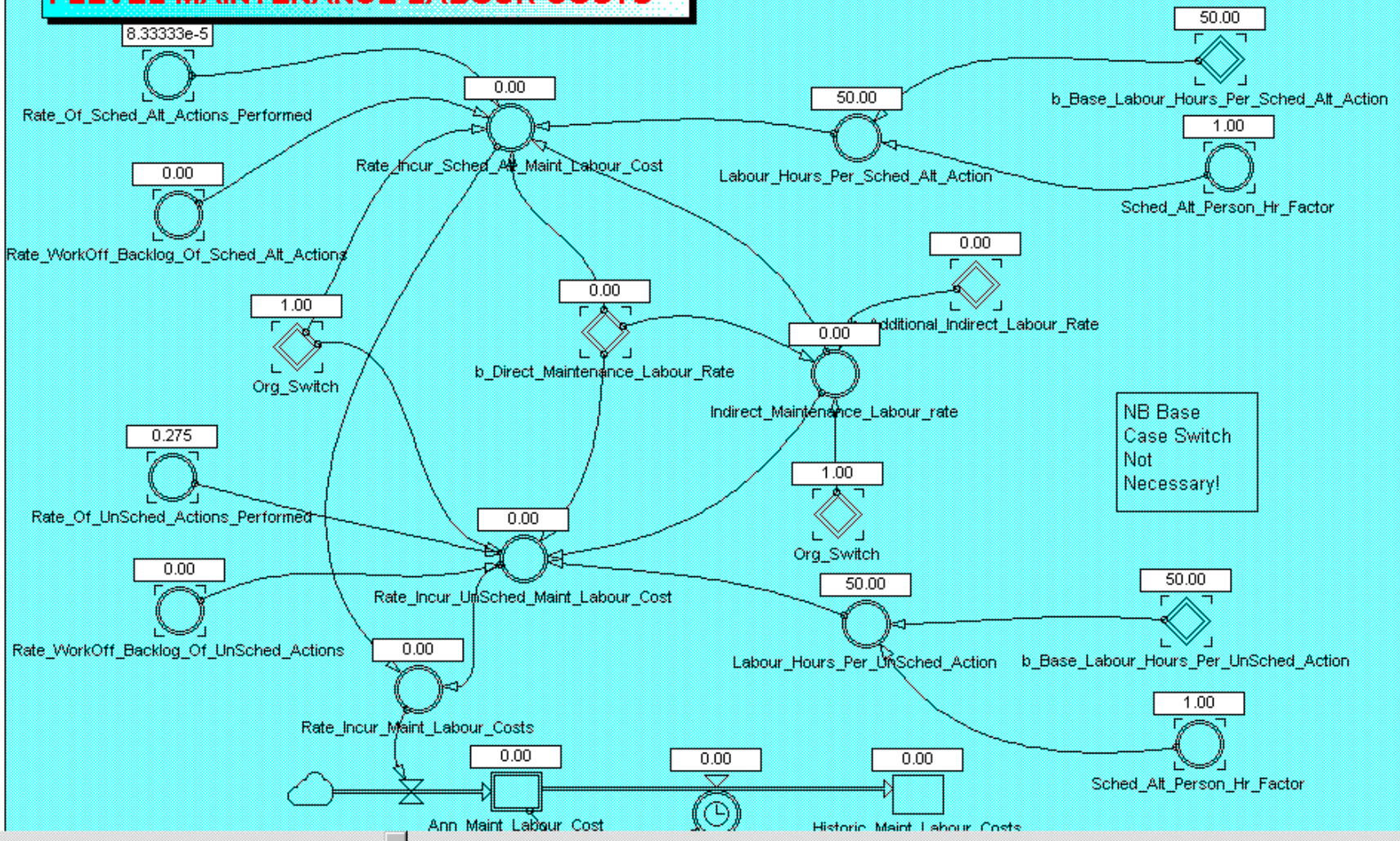
Multiple result sets shown with tabs (up to 10)

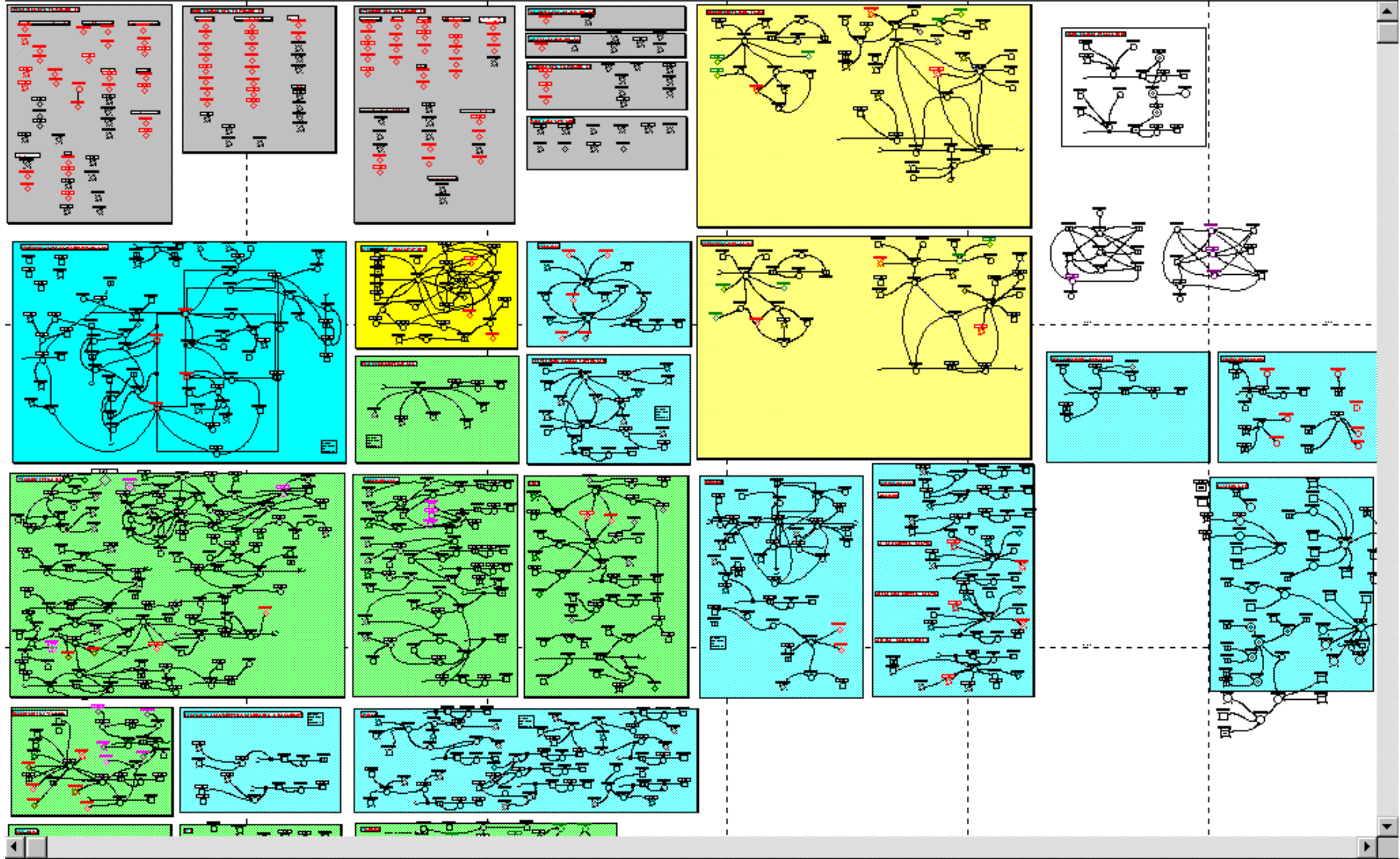


Display Graph Annually or Cumulatively

This is the results table for each run. Double click a row (not the left most column) to show that data in the graph.

I-LEVEL MAINTENANCE LABOUR COSTS







Parametric Cost Tool (PCT)

Characteristics Form

View Sector

Operational Intermediate Afloat Other Sectors
 Organisational Intermediate Ashore

Ship Characteristics

Ship Type	CARRIER	Ship Life (Years)	45	SWBS Group 200 (LT)	15000
Propulsion	NUCLEAR	Length (ft)	1092	SWBS Group 400 (LT)	15000
Volume of Hull (Cubic Feet)	2710000	Shaft Horse Power (SHP)	10720	SWBS Group 500 (LT)	15000
Beam (ft)	134	Light Ship Displacement(LT)	75000	SWBS Group 700 (LT)	15000
		SCN Cost \$K	1200000		

Ship Overhaul

Exit Details Recalculate Auditing: None



Data Management Tool (DMT)

O and I Level Maintenance Transfer DMT Data Total Number Of Elements: 7 Number of Elements Selected: 0

Study Ship Structure | **Reference Ship Structure**

- New Ship (From EIC Codes)
 - "ADMINISTRATION HABITABILITY, OUTFIT/FURNISHINGS"
 - COMBAT SYSTEMS**
 - AVIATION SHIP INSTALLATION
 - "ORDNANCE EQUIPMENT, SPECIALIZED"
 - "ORDNANCE, EXPENDABLE"
 - HULL STRUCTURE
 - "PROPULSION SYSTEM, MAIN DIESEL, MECHANICAL"

Element Information

Data Input | **Graphical Display**

3 Line Maintenance Parameters

- Actions/System/Year
- Person-Hours/Action
- Repair Parts/Action
- Cost/Repair Part
- Repairables/Action
- Exchange Cost/Repairable
- Issue Cost/Repairable
- %Repairables Exchanged
- I - Level Support Cost

Sub-Systems of The "New Ship (From EIC Codes)"

Sub-System	Sum of Actions/System/Year (Approximate)
"ADMINISTRATION HABITABILITY, OUTFIT/FURNISHINGS"	1,000,000
AVIATION SHIP INSTALLATION	1,000,000
"ORDNANCE EQUIPMENT, SPECIALIZED"	1,000,000
"ORDNANCE, EXPENDABLE"	6,000,000
"PROPULSION SYSTEM, MAIN DIESEL, MECHANICAL"	1,000,000



OSCAM 'Users'/Training

- ◆ Programs using model
 - CVN(X) (NAVSEA & Newport News)
 - CVN 77 (NAVSEA & Newport News)
 - T-ADC(X) (NAVSEA requiring use by Phase 2 bidders)
 - DD21 (Lockheed Martin)
 - LPD-17 (Avondale, BIW & Raytheon)

- ◆ Five day class
 - 91 Navy & industry reps trained since Aug 98
 - Separate courses provided to T-ADC(X), T-ADC(X) bidders, CVN(X), Ingalls and Avondale



DOD/Others Trained

◆ Navy/MSC/OSD

- Military Sealift Command
- NAVSEA HQ (017, PMS325/350/378)
- NCCA
- NSWC-Carderock
- NSWC-Dahlgren
- NUWC-Keyport
- NUWC-Newport
- OSD CAIG
- NAVSUP Office of Special Projects
- SPAWAR
- Supship - Newport News*

◆ Universities

- Virginia Tech

◆ FFRDC Organizations

- Draper Laboratory*
- RAND*



Contractors Trained

- ◆ Shipbuilders
 - Avondale
 - Bath Iron Works*
 - Electric Boat
 - Halter Marine
 - Ingalls
 - NASSCO
 - Newport News
- ◆ Shipboard System Suppliers
 - Lockheed Martin
 - Northrup Grumman
 - Raytheon
- ◆ Support Contractors
 - Acquisition Logistics Eng.
 - AERA, Inc.
 - George G. Sharp, Inc.
 - Gibbs & Cox
 - JJMA
 - KPMG Peat Marwick L.L.P.
 - Litton TASC
 - Newport News (AMSEC LLC)
 - PRICE Systems, L.L.C.
 - Quantic Engineering
 - Tecolote Research Inc.

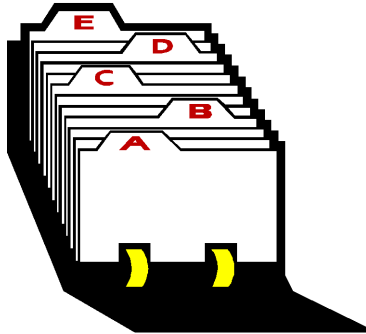


Summary

- ◆ OSCAM provides
 - A time-based simulation of equipment operation
 - The ability to assess and understand O&S costs and drivers
 - The ability to explore strategies for reducing O&S costs
 - A method of prioritizing O&S data collection



For more information.....



O

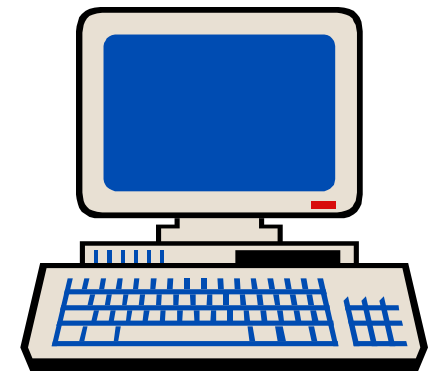
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***OSCAM Web Sites: www.ncca.navy.mil/products.htm
www.oscamtools.com***