Naval Ship Life Cycle Cost (LCC) Model



The Life Cycle of a Ship

- Conception Stage: All activities necessary to develop and define a means for meeting a stated requirement. For ships and equipment, this normally includes research and development, design, contract specifications, identification of all support necessary for introduction into service, and identification of funding required and managerial structure for the acquisition.
- Acquisition Stage: All activities necessary to acquire the ship and provide support for the ship and equipment identified in the conception stage.
- In-Service Stage: All activities necessary for operation, maintenance, support and modification of the ship or equipment throughout its operational life. The inservice stage is normally the longest stage.
- **Disposal Stage:** All activities necessary to remove the ship or equipment and its supporting materials from service.

The Naval Ship Life Cycle Cost (LCC) Model is an extension to SPAR's existing cost model for estimating costs for ship design and new construction. This cost model now includes features for estimating the costs of ship operations and other life cycle activities. With the LCC estimating features linked directly to the design and construction cost model, changes in the design and production build strategy automatically flow into their impact upon LCC.



PHASE I

Initial Generation of Design & Construction Cost – Lead Ship

	% Margin	-	%	Mor	10 Hull P	atrol Boat/C	utter/Friga	te	1		NON-RECURRING COSTS			
	% Mark-Up	-	%		(Mo	del Version May 2	018)				Basic Research - (Concept Design	\$	-
%	Change Orders	-	%								Preliminary Desig	n	\$	334,626
9	Program Costs	-	%	Ship Type:			Version:	Α			Contract Design		\$	4,015,514
	6 Contingencies	15.00	%	100 m	neter 30 Kt Sur	face Combatant	Date:	1-Apr-19			Detail Design & Co	onstruction Engineeri	\$	21,081,447
											Production Planni	ng & Scheduling	\$	4,350,140
	Pricing:										Purchase Specs &	Support	\$	1,338,505
Shipbuilder Economic Mark-Up/Down: 0.		0.0%				Non-Recurring Engine	ering & Productio	n Planning			ILS, Spares & Load Items		\$	3,346,262
Technical Wage \$/Mhr:		\$ 90.75	\$ 92.56	w/ overhea	d	Standard Work Week	:		40.00	hours/week	Contract Engineering Management		\$	4,350,140
Production Wage \$/Mhr:		\$ 75.62	\$ 77.13	w/ overhea	d	Labor Rates:					Contingency Labor:		\$	5,019,392
	Overhead: 80.00 Cost/Labor Ho		Cost/Labor Hou	r	120% Senior Profession		l/Manager	\$ 92.56		per hour	Data Rights Package		\$	-
	% G&A Labor:	-	%		120%	Engineer			\$ 92.56	per hour	Miscellaneous Material & Supp		\$	401,215
	% G&A Material:	6.00	%		120%	Designer/Draftsperson/Planner			\$ 92.56	per hour	Production Jigs, Cradles, & Templates,			230,531
	Labor % Profit:	10.00	%		120%	Clerical		\$ 92.56		per hour	TOTAL NON-RECURRING COSTS:		\$	44,467,772
Ν	laterial % Profit:	10.00	%		120%	Contingency (weig	hted average)		\$ 92.56	per hour	G&A & Profit			8,277,185
												Total NRE	\$	52,744,957
Jones Act Premium	Material Factor:	No	1.00				Shipyard	Fab/Assy Mod	les					
	Current Year:	<u>2018</u>		S	hipyard Tech	Support Labor Factor:	1.0000	No Ext.Modul	es		Estimated Sch	edules		
Cur	rency Exchange	1.0000	<u> 1.000 = none</u>		Stee	el Productivity Factor:	1.3500	1.000	Est. Detail	Engineering Time:	30.00	Months		
Shipyard Mate	Shipyard Material Cost Factor: 1.0000 MILSF		MILSPEC Prem.	<u>=1.21</u>	Out	fit Productivity Factor:	1.6580	1.000	Est.	Construction Time:	30.00	Months		
Combined Material	Cost Factor:	1.0000			C	On-Block Paint Factor:	0.9500	40 % Hours O	n Block	Overlap:	10.00	Months	33.3%	
													4 5 61	
									RMS Men/Month:	377	0.44	Months	1.5%	
	SWBS	Weight	M-Hrs	Modular	Production	\$	\$	\$ G&A	RMS Men/Month: 2018	377 \$ G&A	0.44 \$ Profit	Months \$	1.5%	\$
	SWBS Group	Weight MTons	M-Hrs Per Mton	Modular M-Hrs	Production M-Hrs	\$ Labor	\$ Overhead	\$ G&A Labor Only	RMS Men/Month: 2018 \$ Material	377 \$ G&A Material Only	0.44 \$ Profit Labor + Material	Months \$ Total	1.5% Cu	\$ m.Total
Structures	SWBS Group 1	Weight MTons 927.1	M-Hrs Per Mton 198.57	Modular M-Hrs -	Production M-Hrs 184,092	\$ Labor 13,921,410	\$ Overhead 14,727,361	\$ G&A Labor Only	RMS Men/Month: 2018 \$ Material 2,265,340	377 \$ G&A Material Only 135,920	0.44 \$ Profit Labor + Material 3,105,003	Months \$ Total 34,155,035	1.5% Cu	\$ m.Total
Structures Propulsion	SWBS Group 1 2	Weight MTons 927.1 302.9	M-Hrs Per Mton 198.57 463.38	Modular M-Hrs -	Production M-Hrs 184,092 140,365	\$ Labor 13,921,410 10,614,718	\$ Overhead 14,727,361 11,229,234	\$ G&A Labor Only -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669	377 \$ G&A Material Only 135,920 1,739,380	0.44 \$ Profit Labor + Material 3,105,003 5,257,300	Months \$ Total 34,155,035 57,830,300	1.5% Cu	\$ m.Total
Structures Propulsion Electrical	SWBS Group 1 2 3	Weight MTons 927.1 302.9 176.9	M-Hrs Per Mton 198.57 463.38 677.09	Modular M-Hrs - -	Production M-Hrs 184,092 140,365 119,762	\$ Labor 13,921,410 10,614,718 9,056,617	\$ Overhead 14,727,361 11,229,234 9,580,930	\$ G&A Labor Only - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966	377 \$ G&A Material Only 135,920 1,739,380 311,818	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633	Months \$ Total 34,155,035 57,830,300 26,560,964	1.5% Cu	\$ m.Total
Structures Propulsion Electrical Electronics & Navigation	SWBS Group 1 2 3 4	Weight MTons 927.1 302.9 176.9 97.7	M-Hrs Per Mton 198.57 463.38 677.09 135.72	Modular M-Hrs - - - -	Production M-Hrs 184,092 140,365 119,762 13,264	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128	\$ G&A Labor Only - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 3,66	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676	S Total 34,155,035 57,830,300 26,560,964 6,541,437	1.5% Cu	\$ m.Total
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems	SWBS Group 1 2 3 4 5	Weight MTons 927.1 302.9 176.9 97.7 307.7	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93	Modular M-Hrs - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950	\$ G&A Labor Only - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699	Months \$ Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685	1.5% Cu	\$ m.Total
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings	SWBS Group 1 2 3 4 5 6	Weight MTons 927.1 302.9 176.9 97.7 307.7 220.3	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42	Modular M-Hrs - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470	\$ G&A Labor Only - - - - - - - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315	1.5% Cu	\$ m.Total
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament	SWBS Group 1 2 3 4 5 6 7	Weight MTons 927.1 302.9 176.9 97.7 307.7 220.3 49.7	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64	Modular M-Hrs - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021	\$ G&A Labor Only - - - - - - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315 1,331,082	Cu	\$ m.Total
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament Technical Support	SWBS Group 1 2 3 4 5 6 7 8	Weight MTons 927.1 302.9 176.9 97.7 307.7 220.3 49.7 10.0%	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64 67.37	Modular M-Hrs - - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300 140,323	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439 12,733,777	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021 11,225,809	\$ G&A Labor Only - - - - - - - - - - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618 250,000 216,618 250,000 216,010 200,000<	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997 15,000	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007 2,422,459	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315 1,331,082 26,647,045	Cu	\$ m.Total
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament Technical Support Shipyard Services	SWBS Group 1 2 3 4 5 6 7 7 8 9	Weight MTons 927.1 302.9 176.9 97.7 307.7 220.3 49.7 10.0% 25.0%	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64 67.37 168.44	Modular M-Hrs - - - - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300 140,323 350,807	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439 12,733,777 26,528,701	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021 11,225,809 28,064,524	\$ G&A Labor Only - - - - - - - - - - - - - - - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618 250,000 7,227,277	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997 15,000 433,637	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007 2,422,459 6,225,414	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315 1,331,082 26,647,045 68,479,552	Cu	\$ m.Total
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament Technical Support Shipyard Services rgin, Bonds & Insurance	SWBS Group 1 2 3 4 5 6 7 8 9 9 10	Weight MTons 927.1 302.9 176.9 97.7 307.7 220.3 49.7 10.0% 25.0%	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64 67.37 168.44	Modular M-Hrs - - - - - - - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300 140,323 350,807	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439 12,733,777 26,528,701	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021 11,225,809 28,064,524 -	\$ G&A Labor Only 	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618 250,000 7,227,277 105,272,521	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997 15,000 433,637 6,316,351	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007 2,422,459 6,225,414 11,158,887	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315 1,331,082 26,647,045 68,479,552 122,747,760	Cu	\$ m.Total
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament Technical Support Shipyard Services rgin, Bonds & Insurance Lead Ship Totals:	SWBS Group 1 2 3 4 5 6 7 8 9 10	Weight MTons 927.1 302.9 176.9 97.7 307.7 220.3 49.7 10.0% 25.0% - 2,083	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64 67.37 168.44 - 909.55	Modular M-Hrs - - - - - - - - - - - - - - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300 140,323 350,807 - 1,894,355	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439 12,733,777 26,528,701 - \$ 145,377,282	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021 11,225,809 28,064,524 - 151,548,428	\$ G&A Labor Only - - - - - - - - - - - - - - - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618 250,000 7,227,277 105,272,521 \$ 216,071,950	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997 15,000 433,637 6,316,351 \$ 12,964,317	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007 2,422,459 6,225,414 11,158,887 52,596,198	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315 1,331,082 26,647,045 68,479,552 122,747,760 \$ 578,558,175	S	\$ m.Total 578,558,175
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament Technical Support Shipyard Services rgin, Bonds & Insurance Lead Ship Totals: Non-Recurring Costs:	SWBS Group 1 2 3 4 5 6 7 8 9 9 10 10 % Total L	Weight MTons 927.1 302.9 176.9 97.7 307.7 220.3 49.7 10.0% 25.0% - 2,083 Ship G	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64 67.37 168.44 - 909.55 1-7 Man-Hours:	Modular M-Hrs - - - - - - - - - - - - - - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300 140,323 350,807 - 1,894,355 473,589	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439 12,733,777 26,528,701 - \$ 145,377,282 \$ 43,836,026	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021 11,225,809 28,064,524 - 151,548,428 37,887,127	\$ G&A Labor Only - - - - - - - - - - - - - - - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618 250,000 7,227,277 105,272,521 \$ 216,071,950 \$ 631,746	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997 15,000 433,637 6,316,351 \$ 12,964,317 \$ 37,905	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007 2,422,459 6,225,414 11,158,887 52,596,198 8,239,280	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315 1,331,082 26,647,045 68,479,552 122,747,760 \$ 578,558,175 \$ 90,632,084	Cu Cu S S	\$ m.Total 578,558,175 669,190,259
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament Technical Support Shipyard Services rgin, Bonds & Insurance Lead Ship Totals: Non-Recurring Costs:	SWBS Group 1 2 3 4 5 6 7 8 9 9 10 7 8 9 10 7 8 7 7 8 9 10	Weight MTons 927.1 302.9 176.9 97.7 307.7 220.3 49.7 10.0% 25.0% - 2,083 ead Ship G Tec	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64 67.37 168.44 - - 909.55 1-7 Man-Hours: hnical Support:	Modular M-Hrs - - - - - - - - - - - - - - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300 140,323 350,807 - 1,894,355 473,589 Production \$	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439 12,733,777 26,528,701 - \$ 145,377,282 \$ 43,836,026 Costs	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021 11,225,809 28,064,524 - 151,548,428 37,887,127 See Note 1	\$ G&A Labor Only 	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618 250,000 7,227,277 105,272,521 \$ 216,071,950 \$ 631,746 \$ 631,746 \$ 531,746 \$ 531,746 \$ 531,746 \$ 541,746	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997 15,000 433,637 6,316,351 \$ 12,964,317 \$ 37,905 Prime Contractor M	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007 2,422,459 6,225,414 11,158,887 52,596,198 8,239,280 anagement Team:	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315 1,331,082 26,647,045 68,479,552 122,747,760 \$ 578,558,175 \$ 90,632,084	5 5	\$ m.Total 578,558,175 669,190,259
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament Technical Support Shipyard Services rgin, Bonds & Insurance Lead Ship Totals: Non-Recurring Costs:	SWBS Group 1 2 3 4 5 6 7 8 9 9 10 7 8 9 10 7 7 8 9 10	Weight MTons 927.1 302.9 176.9 97.7 307.7 220.3 49.7 10.0% 25.0% - 2,083 ead Ship G Tec Shi	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64 67.37 168.44 - - 909.55 1-7 Man-Hours: hnical Support: pyard Services:	Modular M-Hrs - - - - - - - - - - - - - - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300 140,323 350,807 - 1,894,355 473,589 Production \$ Production \$	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439 12,733,777 26,528,701 - \$ 145,377,282 \$ 43,836,026 Costs Costs	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021 11,225,809 28,064,524 - 151,548,428 37,887,127 See Note 1	\$ G&A Labor Only - - - - - - - - - - - - - - - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618 250,000 7,227,277 105,272,521 \$ 216,071,950 \$ 631,746 \$ 631,746 \$ 531,746 \$ 531,746 \$ 541,746	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997 15,000 433,637 6,316,351 \$ 12,964,317 \$ 37,905 Prime Contractor M n Management Fee:	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007 2,422,459 6,225,414 11,158,887 52,596,198 8,239,280 anagement Team: 0.0%	Months	5 5	\$ m.Total 578,558,175 669,190,259
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament Technical Support Shipyard Services rgin, Bonds & Insurance Lead Ship Totals: Non-Recurring Costs:	SWBS Group 1 2 3 4 5 6 7 8 9 10 10 % Total L	Weight MTons 927.1 302.9 97.7 307.7 220.3 49.7 10.0% 25.0% - 2,083 ead Ship G Tec Shi E, F	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64 67.37 168.44 - 909.55 1-7 Man-Hours: hnical Support: pyard Services: ees & Insurance:	Modular M-Hrs - - - - - - - - - - - - - - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300 140,323 350,807 - 1,894,355 473,589 Production \$ Production \$	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439 12,733,777 26,528,701 - \$ 145,377,282 \$ 43,836,026 Costs Costs	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021 11,225,809 28,064,524 - 151,548,428 37,887,127 See Note 1	\$ G&A Labor Only - - - - - - - - - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618 250,000 7,227,277 105,272,521 \$ 216,071,950 \$ 631,746 \$ 631,746 \$ 531,746 \$ 531,746 \$ 541,746	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997 15,000 433,637 6,316,351 \$ 12,964,317 \$ 37,905 Prime Contractor M m Management Fee: e with Prime Contractor	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007 2,422,459 6,225,414 11,158,887 52,596,198 8,239,280 anagement Team: 0,0% actor Management	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315 1,331,082 26,647,045 68,479,552 122,747,760 \$ 590,632,084 \$ - \$ 669,190,259	5 5	\$ m.Total
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament Technical Support Shipyard Services rgin, Bonds & Insurance Lead Ship Totals: Non-Recurring Costs:	SWBS Group 1 2 3 4 5 6 7 8 9 10 7 8 9 10 7 8 7 7 8 9 10	Weight MTons 927.1 302.9 176.9 97.7 307.7 220.3 49.7 10.0% 25.0% - 2,083 ead Ship G Tec Shi F Non-I	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64 67.37 168.44 - 909.55 1-7 Man-Hours: hnical Support: pyard Services: ees & Insurance: Recurring Costs:	Modular M-Hrs - - - - - - - - - - - - - - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300 140,323 350,807 - 1,894,355 473,589 Production \$ Production \$ Production \$	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439 12,733,777 26,528,701 - \$ 145,377,282 \$ 43,836,026 Costs Costs Costs Costs	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021 11,225,809 28,064,524 - 151,548,428 37,887,127 See Note 1	\$ G&A Labor Only - - - - - - - - - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618 250,000 7,227,277 105,272,521 \$ 216,071,950 \$ 631,746 \$ 631,746 \$ 517,746 \$ 517,746 \$ 517,746	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997 15,000 433,637 6,316,351 \$ 12,964,317 \$ 37,905 Prime Contractor M management Fee: e with Prime Contra	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007 2,422,459 6,225,414 11,158,887 52,596,198 8,239,280 anagement Team: 0,0% actor Management: ated CER Cost Risk	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315 1,331,082 26,647,045 68,479,552 122,747,760 \$ 5 669,190,259 \$ 32,900,487	5 5 8 8	\$ m.Total
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament Technical Support Shipyard Services rgin, Bonds & Insurance Lead Ship Totals: Non-Recurring Costs:	SWBS Group 1 2 3 4 5 6 7 8 9 10 10 % Total L	Weight MTons 927.1 302.9 97.7 307.7 220.3 49.7 10.0% 25.0% - 2,083 ead Ship G Tec Shi F Non-l	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64 67.37 168.44 - 909.55 1-7 Man-Hours: hnical Support: pyard Services: ees & Insurance: Recurring Costs:	Modular M-Hrs - - - - - - - - - - - - - - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300 140,323 350,807 - 1,894,355 473,589 Production \$ Production \$ Production \$ Production \$ Production \$	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439 12,733,777 26,528,701 - \$ 145,377,282 \$ 43,836,026 Costs Costs Costs Costs \$ 360,683,819	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021 11,225,809 28,064,524 - 151,548,428 37,887,127 See Note 1 62.3%	\$ G&A Labor Only - - - - - - - - - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618 250,000 7,227,277 105,272,521 \$ 216,071,950 \$ 631,746 5timated Cost for F Over-All Program Total Price 5,7% 4,1%	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997 15,000 433,637 6,316,351 \$ 12,964,317 \$ 37,905 Prime Contractor M n Management Fee: a with Prime Contra Estima Est. Eng'rg Ov	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007 2,422,459 6,225,414 11,158,887 52,596,198 8,239,280 anagement Team: 0.0% actor Management ated CER Cost Risk erlap Rework Risk:	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315 1,331,082 26,647,045 68,479,552 122,747,760 \$ 5 669,190,259 \$ 32,900,487 \$ 23,624,076	S S W/o Proi	\$ m.Total
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament Technical Support Shipyard Services rgin, Bonds & Insurance Lead Ship Totals: Non-Recurring Costs:	SWBS Group 1 2 3 4 5 6 7 8 9 10 10 % Total L 909.55	Weight MTons 927.1 302.9 97.7 307.7 220.3 49.7 10.0% 25.0% - 2,083 ead Ship G Tec Shi F Non-l	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64 67.37 168.44 909.55 1-7 Man-Hours: hnical Support: pyard Services: ees & Insurance: Recurring Costs:	Modular M-Hrs - - - - - - - - - - - - - - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300 140,323 350,807 - 1,894,355 473,589 Production \$ Production \$ Production \$ Production \$	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439 12,733,777 26,528,701 - \$ 145,377,282 \$ 43,836,026 Costs Costs Costs Costs \$ 360,683,819	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021 11,225,809 28,064,524 - 151,548,428 37,887,127 See Note 1 62.3%	\$ G&A Labor Only - - - - - - - - - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618 250,000 7,227,277 105,272,521 \$ 216,071,950 \$ 631,746 5 Total Price 5,7% 4.1% 57.8%	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997 15,000 433,637 6,316,351 \$ 12,964,317 \$ 37,905 Prime Contractor M n Management Fee: with Prime Contractor M n Management Fee: S Statistic Shipyard	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007 2,422,459 6,225,414 11,158,887 52,596,198 8,239,280 anagement Team: 0,0% actor Management: ated CER Cost Risk erlap Rework Risks: Performance Risk:	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315 1,331,082 26,647,045 68,479,552 122,747,760 \$	S S w/o Proi w/o Proi w/o Proi	\$ m.Total
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament Technical Support Shipyard Services rgin, Bonds & Insurance Lead Ship Totals: Non-Recurring Costs: Production Hrs/LSW:	SWBS Group 1 2 3 4 5 6 7 8 9 10 10 % Total L 909.55 909.55 1	Weight MTons 927.1 302.9 97.7 307.7 220.3 49.7 10.0% 25.0% - 2,083 ead Ship G Tec Shi F Non-l	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64 67.37 168.44 - 909.55 1-7 Man-Hours: hnical Support: pyard Services: ees & Insurance: Recurring Costs:	Modular M-Hrs - - - - - - - - - - - - - - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300 140,323 350,807 - 1,894,355 473,589 Production \$ Production \$ Production \$ Production \$	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439 12,733,777 26,528,701 - \$ 145,377,282 \$ 43,836,026 Costs Costs Costs Costs \$ 360,683,819	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021 11,225,809 28,064,524 - 151,548,428 37,887,127 See Note 1 62.3%	\$ G&A Labor Only - - - - - - - - - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618 250,000 7,227,277 105,272,521 \$ 216,071,950 \$ 631,746 5timated Cost for F Over-All Program Total Price 5,7% 4,1% 57.8% 5	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997 15,000 433,637 6,316,351 \$ 12,964,317 \$ 37,905 Prime Contractor M n Management Fee: with Prime Contra Estim. Est. Eng'rg Ov Est. Shipyard Est. Eng'rg Ov	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007 2,422,459 6,225,414 11,158,887 52,596,198 8,239,280 anagement Team: 0,0% actor Management: ated CER Cost Risk erlap Rework Risks: Performance Risk: Performance Risk:	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315 1,331,082 26,647,045 68,479,552 122,747,760 \$ \$ 669,190,259 \$ \$ \$ 26,640,044 \$ 5 122,747,760 \$ \$ \$ \$ 90,632,084 \$	S w/o Proi w/o Proi w/o Proi w/o Proi	\$ m.Total 578,558,175 669,190,259 fit fit fit fit fit
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament Technical Support Shipyard Services rgin, Bonds & Insurance Lead Ship Totals: Non-Recurring Costs: Production Hrs/LSW: MT/MT	SWBS Group 1 2 3 4 5 6 6 7 8 9 10 8 9 10 % Total L 909.55 1	Weight MTons 927.1 302.9 97.7 307.7 220.3 49.7 10.0% 25.0% - 2,083 ead Ship G Tec Shi F Non-I	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64 67.37 168.44 - 909.55 1-7 Man-Hours: hnical Support: pyard Services: ees & Insurance: Recurring Costs:	Modular M-Hrs - - - - - - - - - - - - - - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300 140,323 350,807 - 1,894,355 473,589 Production \$ Production \$ Production \$ Production \$	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439 12,733,777 26,528,701 - \$ 145,377,282 \$ 43,836,026 Costs Costs Costs Costs \$ 360,683,819	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021 11,225,809 28,064,524 - 151,548,428 37,887,127 See Note 1 62.3%	\$ G&A Labor Only - - - - - - - - - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618 250,000 7,227,277 105,272,521 \$ 216,071,950 \$ 631,746 Estimated Cost for F Over-All Program Total Price 5,7% 4,1% 57.8% 1,5%	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997 15,000 433,637 6,316,351 \$ 12,964,317 \$ 37,905 Prime Contractor M n Management Fee: e with Prime Contra Est. Eng'rg Ov Est. Shipyard Est. Eng'rg Est. Prod'n S	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007 2,422,459 6,225,414 11,158,887 52,596,198 8,239,280 anagement Team: 0,0% actor Management team: 1,00% actor Management te	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315 1,331,082 26,647,045 68,479,552 122,747,760 \$ 5 669,190,259 \$ \$ 23,624,076 \$ 170,248,972 \$ 8,451,430	S S W/o Prol W/o Prol W/o Prol W/o Prol W/o Prol	\$ m.Total 578,558,175 669,190,259 fit fit fit fit fit fit fit
Structures Propulsion Electrical Electronics & Navigation Auxiliary Systems Outfit & Furnishings Armament Technical Support Shipyard Services rgin, Bonds & Insurance Lead Ship Totals: Non-Recurring Costs: Production Hrs/LSW: MT/MT	SWBS Group 1 2 3 4 5 6 6 7 7 8 9 10 7 8 9 10 7 8 9 10 7 8 9 10 7 8 9 10 7 8 9 10 7 8 9 10 7 8 9 10 7 8 9 10 8 9 10 10 10 10 10 10 10 10 10 10 10 10 10	Weight MTons 927.1 302.9 176.9 97.7 307.7 220.3 49.7 10.0% 25.0% - 2,083 ead Ship G Tec Shi F Non-l	M-Hrs Per Mton 198.57 463.38 677.09 135.72 2,295.93 1,057.42 126.64 67.37 168.44 909.55 1-7 Man-Hours: hnical Support: pyard Services: Recurring Costs:	Modular M-Hrs - - - - - - - - - - - - -	Production M-Hrs 184,092 140,365 119,762 13,264 706,512 232,931 6,300 140,323 350,807 - 1,894,355 473,589 Production \$ Production \$ Production \$ Production \$	\$ Labor 13,921,410 10,614,718 9,056,617 1,003,058 53,427,858 17,614,704 476,439 12,733,777 26,528,701 - \$ 145,377,282 \$ 43,836,026 Costs Costs Costs Costs \$ 360,683,819	\$ Overhead 14,727,361 11,229,234 9,580,930 1,061,128 56,520,950 18,634,470 504,021 11,225,809 28,064,524 - 151,548,428 37,887,127 See Note 1 62.3%	\$ G&A Labor Only - - - - - - - - - - - - -	RMS Men/Month: 2018 \$ Material 2,265,340 28,989,669 5,196,966 3,662,806 53,620,922 9,369,831 216,618 250,000 7,227,277 105,272,521 \$ 216,071,950 \$ 631,746 Estimated Cost for F Over-All Program Total Price 5.7% 4.1% 57.8% 67.8% 67.8%	377 \$ G&A Material Only 135,920 1,739,380 311,818 219,768 3,217,255 562,190 12,997 15,000 433,637 \$ 37,905 Prime Contractor M m Management Fee: with Prime Contractor M M M M M M M M M M M M M M M M M M M	0.44 \$ Profit Labor + Material 3,105,003 5,257,300 2,414,633 594,676 16,678,699 4,618,120 121,007 2,422,459 6,225,414 11,158,887 52,596,198 8,239,280 anagement Team: 0.0% actor Management: ated CER Cost Risk erlap Rework Risk: Performance Risk: Performance Risk: Chedule Cost Risk: Cice with 100% Risk:	S Total 34,155,035 57,830,300 26,560,964 6,541,437 183,465,685 50,799,315 1,331,082 26,647,045 68,479,552 122,747,760 \$ 5 669,190,259 \$ 32,900,487 \$ 23,624,076 \$ 170,248,972 \$ 8,451,430 \$ 1,123,084,941 \$ \$	S S W/o Prot W/o Prot W/o Prot W/o Prot W/o Prot W/o Prot	\$ m.Total



The Cost Model has features for estimating new construction costs for multiple vessel acquisition programs

12 Ship New Construction Cost Estimates



New Construction Costs & Schedules



The Cost Model assumes ship operations begins when construction is completed.



PHASE II

Generation of Operations, Repair & Maintenance Scenarios

Estimated A	nnual Life	Cycle C	Cost			
Number of Shine Built	12	Maximum of 8 t	or this analysis			
Total Price per Shin:	\$ 442,470,724	Waximum of of	Averane Life	45	Vears	
Added Cost Risk	\$ 46 484 422	Averag	e Ops Hours/Annum	2 000	rears	
Average Acg. Cost	\$ 496 480 822	Average Or	s Hours/Annual Day	5.48		
Average Acquisition \$/Annum	\$ 11 032 907	2018 US S	Pef "Aca Summary	Report" worksheet		
Av Acquisition \$/One Hour	\$ 5.516	2010 00 0	There is the community	Report workbreet		
Av. Acquisition arops from	÷ 5,510		Designed			
Manning			Accommodations	Av\$/Man/Annum	otal Manning \$/Annu	m
Commissioned Officers	4*	Dereene	ACCOMMODIA	C 165 740	c 1 000 075	1
Non Commissioned Officers	14	Dereene	12	© 100,740	a 1,500,075 c 2,002,104	-
Non-Commissioned Officers	70	Dereene	10	a 100,044	5 3,003,104 C 7,020,077	-
Enlisted	100	Persons	10 E "Chin Characteristi	a 95,265	\$ 1,239,911 ¢ 12,222,025	
	100	Persons	Ship Unaracteristi	cs	\$ 12,232,033	
Estimated Training	\$ 998,533	8.16%	annual manning cos	percentages of manpow	er \$ from USN NCAD 2	005 = (4/49)
Fuel:	Ref "Propulsion" worksheet	4		Enter on	ly the	
2018 US \$/Metric Tonne	\$ 850.00	see below for e	stimated fuel price	s Litter Off	iy the	
Design Total Propulsion kW	24,000			data c	alla	
Maximum Speed Knots	30.00			data c		
Design Total Ship Services kW	15,534			colored	gray.	
Estimated MT Fuel/Annum	8,870					
Estimated Fuel \$/Annum	\$ 7,539,185					
	.,					
	Knots	kW	% Ops Hrs	Ops Hrs	Est. Fuel MT/Hr	MT/Annum
Estimated kW Warfside	-	15,534	30%	600	4.96	2.977
Estimated kW at Cruise:	15.00	8,789	60%	1,200	2.81	3,368
Full Power	30.00	39,534	10%	200	12.63	2.525
						8.870
				Estimated SFC: g-kw/hr	319	
	Includes E	st. Fuel Savings:	Ref "Propulsion Co	omponents" Worksheet	t 0.00%	
LCC Cost Summary	¢10	CODE Usua	¢10	Average Lost Ops Hours	S: Cost of Lost Ops Hou	urs
Average Cost/Annum	\$/Annum	\$/OPS nour	3/Annum	per Annum	per Annum	
Average Capital Cost	\$ 11,032,907 ¢ 43,333,035	3 5,510 C C 11C	23.13%			
Manning TAD & DCS	\$ 12,232,033 ¢ 340,633	\$ 0,110 c 105	25.05%	accountered of mannous	er © from LICNI NCAD 2	1005 - (1(40))
Ivianning TAD & PCS	\$ 249,033	3 125	2.04%	percentages of manpow	er \$ from USN NCAD 2	1005 = (1/49)
	\$ 221,690	\$ 111 C 2.770	0.10%	percentages of manpow	er \$ from USN NCAD 2	005 = (4/49)
Fuel Otacca & Occarlian	5 7,039,160	\$ 3,110	15.61%		C C C C C C C C C C C C C C C C C C C	
Stores & Supplies	5 1,240,107	\$ 624 © 074	2.62%	percentages of manpow	er \$ from USN NCAD 2	(005 = (5%/49%)
Repair Parts & Repairables	5 1,747,434	\$ 8/4	3.00%	percentages of supplies	S TROM USIN INCAD 200	J5 (1%/5%)
Iviaintenance & Repairs	\$ 4,800,404	\$ 2,428	10.18%	80	\$ 442,660	
Iviain Iviachinery Overnauls	3 1,100,341	\$ 550	2.31%			
C4 Re-Fresh	\$ 321,012	\$ 164	0.69%		C 240.070	
Wodernization & Opgrades	\$ 6,209,627	3 <u>3,105</u>	13.02%	58	5 319,272	
Casualty Repairs	\$ 666,667	\$ 333	1.40%	-	ۍ -	
Engineering & Technical Services	\$ 244,444	\$ 122	0.51%			
Decommissioning/Disposal	\$ 21,202	\$ 11	0.04%			
I otal \$ per Annum	\$ 47,696,013	\$ 23,848		138	\$ /61,932	
w/o Capital Cost	\$ 36,663,106					
w/o Modernization	S 30 453 479					



The LCC Cost Model generates a full compliment of pertinent overview charts that easily show the effects of design/construction/operations alternatives upon LCC. *Chart does not include planned Modernization*.





MID-LIFE MODERNIZATION

The LCC Cost Model offers features for planning large-scale re-investments for mid-life refurbishing, upgrades and modernization.

Such activities typically require costs to rip-out and dispose of existing equipment and systems prior to fabricating and installing the replacement upgrades.

		Material	N	ew Fab &		
Labo	r Strip-Out	Disposal		Install	Total Mod	
\$	1,260,546	\$ 10,566	\$	6,831,007	\$ 8,102,118	Structural
\$	6,302,730	\$ 676,039	\$	57,830,300	\$ 64,809,069	Propulsion
\$	146,482	\$ 40,398	\$	2,752,329	\$ 2,939,209	Electrical - Electrical Machinery
\$	790,756	\$ 8,371	\$	4,372,334	\$ 5,171,460	Electrical - Cabling, Lighting, & Appliances
\$	197,689	\$ 11,828	\$	1,579,825	\$ 1,789,342	Electrical - Switch Boards, Transformers & Alarms
\$	3,151,365	\$ 42,708	\$	3,270,718	\$ 6,464,792	Electronics Hardware
\$	5,610,449	\$ 288,290	\$	42,466,752	\$ 48,365,490	Auxiliary System - Piping
\$	8,415,673	\$ 432,435	\$	63,700,127	\$ 72,548,236	Auxiliary System - HVAC
\$	1,647,479	\$ 64,948	\$	11,484,795	\$ 13,197,223	Auxiliary System - Aux. Machinery & Systems
\$	2,167,658	\$ 104,229	\$	16,049,748	\$ 18,321,635	Outfit & Furnishing
\$	32,355	\$ 758	\$	199,662	\$ 232,775	Armament
\$	-	\$ -	\$	17,119,888	\$ 17,119,888	Shipyard Services
\$	-	\$ -	\$	22,658,021	\$ 22,658,021	Technical Services
					\$ 5,671,975	Dry Docking for 380 Days
					\$ (7,958,029)	Credit for Ops Fuel Costs not expended



Cumulative Costs that Include Mid-Life Modernization



LCC for Multi-Vessel Class Programs

Since the Design & Construction Cost Model has features for estimating costs for multiple ship acquisition programs, additional features estimate LCC across the multiple ship class.

Estimated Annual LCC Costs Across Class



SPAR ASSOCIATES, INC.

Cumulative LCC Costs Across Class



The LCC Cost Model can be used to identify differences in LCC with alternative ship systems, materials, construction build strategies as well as operations and maintenance scenarios.

Selecting better design choices can produce ships that are less expensive to operate and maintain and can increase the in-service time, and even lengthen its useful life expectancy in meeting the ship's mission requirements.

Summarizing LLC per Ship Operating Hours



PHASE III

Evaluate impact on LCC for changes in design/construction scenarios, operations requirements, repair & maintenance plans Life cycle costing can be applied to establish improvements at different levels of technology evolution:

- **1. Ship Design Decisions**
- 2. Ship Alterations/Modifications/Conversions
- 3. Equipment Selections
- 4. Plant Configurations
- 5. Commonality Evaluations
- 6. Replacement Upgrades versus Maintaining Older Obsolete Equipment/Systems
- 7. Substituting Different Materials & Methods in Design, Engineering, & Manufacture
- 8. Alternate Maintenance and Upgrade Plans & Schedules

The life cycle modeling provides many ways to vary not only the impact of changes in elements of design and construction, but also the many variations of operation requirements, maintenance and upgrade plans.

While the cost model offers cost data extracted from SPAR's wide ranging libraries, other sources of cost data can be added.

For additional details of the LCC cost model, its <u>user manual</u> can be downloaded from SPAR's web site.

Over 45 Years Serving the Shipbuilding & Repair Industry

