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Exhibit R-2, RDT&E Budget Item Justification									Date: February 1999	
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/BUDGET ACTIVITY 4					R-1 ITEM NOMENCLATURE: Shipboard System Component Development/PE 0603513N					
COST (\$ in Millions)	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	Cost to Complete	Total Cost
Total PE Cost	56.961	100.748	108.334	114.643	135.178	110.292	101.859	93.316	Continuing	Continuing
AGS-Advanced Gun System /32467	0	15.134 (1)	28.705	29.315	38.827	35.832	35.396	28.212	Continuing	Continuing
Undersea Warfare (USW)/32468	1.700	10.667 (2)	15.527	21.170	25.694	20.830	16.941	16.924	Continuing	Continuing
Shipboard Auxiliary System Development/S0382	0	0.777	(3)	0	0	0	0	0		
Consolidated Hull, Mechanical & Electrical Improvement (HM&E)/32469	23.946	24.867 (4)	24.647	23.064	28.123	26.472	26.941	27.331	Continuing	Continuing
HM&E Improvement/S1712	0	1.028	(5)	0	0	0	0	0		
Integrated Topside Design (ITD)/32470	10.454	13.348 (5)	13.732	15.054	18.899	14.977	15.319	15.670	Continuing	Continuing
Shipboard Sys Compnt Dev/S2608	0	0.998	0	0	0	0	0	0	0	0.998
Direct Carbonate Fuel Cell/S2390	3.301	0	0	0	0	0	0	0	0	3.301
Integrated Power Systems (IPS)/32471	17.560	33.929 (6)	25.723	26.040	23.635	12.181	7.262	5.179	Continuing	Continuing
Quantity of RDT&E Articles & Cost	0	0	0	0	0	*1/TBD	*2/TBD	0		

Note (1) (U) FY 1999 funds were budgeted and executed under PE 0603795N/Project K2323 as displayed in the FY99 President's Budget exhibits. Funds from PE 0603795N/Project K2323 transitioned into PE 0603513N/Project 32467 in FY 2000 and out.

Note (2) (U) FY 1998 and FY 1999 funds were budgeted and executed under PE 0603553N/Project V1704 as displayed in the FY99 President's Budget exhibits. Funds from PE 0603553N/Project V1704 (except Distant Thunder) transitioned into PE 0603513N/Project 32468 in FY 2000 and out.

Note (3) (U) FY 1998 FY 1999 funds were budgeted and executed under PE 0603513N/Project S0382 as displayed in the FY99 President's Budget exhibits. Funds from PE 0603513N/Project S0382 transitioned into PE 0603513N/Project 32469 in FY 2000 and out.

Note (4) (U) FY 1998 and FY 1999 funds were budgeted and executed under PE 0603513N/Project S0382, PE 0603514N/Project S0384, PE 0603514N/Project S1565, and PE 0603563N/Project S2196 (only Affordability Through Commonality) as displayed in the FY99 President's Budget exhibits. Funds from PE 0603513N/Project S0382, PE 0603514N/Project S0384, PE 0603514N/Project S1565, and PE 0603563N/Project S2196 (only Affordability Through Commonality) transitioned into PE 0603513N/Project 32469 in FY 2000 and out.

Note (5) (U) FY 1998 FY 1999 funds were budgeted and executed under PE 0603513N/Project S1712 as displayed in the FY99 President's Budget exhibits. Funds from PE 0603513N/Project S1712 transitioned into PE 0603513N/Project 32470 in FY 2000 and out.

Note (6) (U) FY 1998 and FY 1999 funds were budgeted and executed under PE 0603573N/Project S1314 as displayed in the FY99 President's Budget exhibits. Funds from PE 0603573N/Project S1314 (only Integrated Power System) transitioned into PE 0603513N/Project 32471 in FY 2000 and out.

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This Program Element (PE) has been modified in FY 2000 and out to focus on DD 21 associated systems development. Specific DD 21 associated systems development efforts that have been realigned under this PE include: the Advanced Gun Systems (formerly the Vertical Gun for Advanced Ships); Undersea Warfare; Integrated Topside Design; and Integrated Power Systems. In addition, a number of HM&E development tasks have been incorporated into a consolidated HM&E Project (32469) focused on DD 21.

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APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/BUDGET ACTIVITY 4	R-1 ITEM NOMENCLATURE: Shipboard System Component Development/PE 0603513N	

(U) This PE now provides funds for the development of the DD 21 Class of U. S. Navy surface combatants and its components. The mission of the DD 21 class is to provide affordable credible independent forward presence/deterrence and operate as an integral part of Naval, Joint or Combined Maritime Forces. DD 21 will provide an advanced level of land attack in support of the ground campaign and contribute to Naval, Joint or Combined battlespace dominance in littoral operations. It will establish and maintain surface and sub-surface superiority, provide local air defense, and will incorporate signature reduction to operate in all threat environments. DD 21 will have seamless Joint Interoperability to integrate all source information for battlespace awareness and weapons direction.

* (U) For explanation of Test Articles see Projects 32467 and 32470.

B. (U) PROGRAM CHANGE SUMMARY:

	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>
(U) FY 1999 President's Budget	22.022	27.725	25.170
(U) Appropriated Value	22.694		
(U) Adjustments to FY 1998 Appropriated Value/FY 1999 President's Budget	+34.267	+73.023	+83.164
(U) FY 2000 President's Budget Submit	56.961	100.748	108.334

(U) Funding:

(U) The FY 1998 net increase of \$34.267M reflects decreases for Small Business Innovative Research (-\$0.249M), a Below Threshold Reprogramming for HM&E Improvements (-\$1.000M), a general undistributed reduction (-\$0.008M), and Comparability Adjustment (+\$35.524M).

(U) The FY 1999 net increase of \$73.023M is due to comparability adjustments (+\$74.914M) and Small Business Innovative Research (-\$1.891M).

(U) The FY 2000 net increase of \$83.164M reflects a number of realignments into this PE: Elements of Consolidated HM&E not previously addressed in this PE (+\$15.413M), IUSW (+\$15.792M), Advanced Gun System (formerly Vertical Gun Advanced Ship) (+\$39.138M) and Integrated Power Systems (+\$26.100M) as well as funds for a NWCF rate increase (+\$0.323M). Along with these realignments were reductions for Consolidated HM&E (-\$4.000M), Advanced Gun System (-\$10.000M), competitive sourcing savings associated with consolidation of service contracting efforts (-\$0.140M) and miscellaneous adjustments (+\$0.538).

(U) Schedule: N/A

(U) Technical Parameters: N/A

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Exhibit R-2a, RDT&E Project Justification								Date: February 1999		
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/Budget Activity 4		PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/PE 0603513N					PROJECT NAME AND NUMBER: AGS-Advanced Gun System/32467			
COST (\$ in Millions)	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	Cost to Complete	Total Cost
Project Cost	0	15.134 (1)	28.705	29.315	38.827	35.832	35.396	28.212	Continuing	Continuing
RDT&E Articles Qty	0	0	0	0	0	1	0	0	Continuing	Continuing
<p>Note (1) (U) FY 1999 funds were budgeted and executed under PE 0603795N/Project K2323 as displayed in the FY99 President's Budget exhibits. Funds from PE 0603795N/Project K2323 transitioned into PE 0603513N/Project 32467 in FY 2000 and out.</p> <p>A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: These funds provide for the development of the Advanced Gun System (AGS) associated with the development of DD 21. The Advanced Gun System is a major caliber gun system for the U.S. Navy next generation destroyer. The Advanced Gun System will consist of one or more major caliber guns, an automated ammunition handling system and a family of projectiles. The Advanced Gun System will as a minimum meet the DD 21 Naval Surface Fire Support (NSFS) and Surface Dominance Missions as assigned to the gun system. The Advanced Gun System will meet the DD 21 low radar cross-section requirements, either through below deck orientation and/or materials/ shaping of above decks structures. The system will provide a high rate of fire (12+ rounds per minute) along with a deep magazine and rapid re-supply to meet the U.S. Marine Corps 24 hour operational requirements. First Test Article will be fabricated in FY 2003 to support land-based gun systems testing and combat system integration risk reduction efforts.</p> <p>1. (U) FY 1998 ACCOMPLISHMENTS</p> <ul style="list-style-type: none"> • (U) N/A <p>2. (U) FY 1999 PLAN</p> <ul style="list-style-type: none"> • (U) (\$12.000) Conduct Phase I Advanced Gun System (AGS) concept formulation and begin Phase II prototype development. • (U) (\$ 0.770) Conduct Comparison of Concepts (limited AOA) to include gun alternatives and comparison to missile options. • (U) (\$ 1.982) Define AGS operational environment. • (U) (\$0.382) Portion of extramural program is reserved for Small Business Innovative Research assessment in accordance with 15 USC 638 <p>3. (U) FY 2000 PLAN</p> <ul style="list-style-type: none"> • (U) (\$4.784) Complete Concept Formulation phase (Phase II). • (U) (\$20.874) Initiate subsystem demonstration phase (Phase III). • (U) (\$2.000) Refine Operational Environment for the Advanced Gun System. • (U) (\$1.047) Develop Verification and Validation tools. 										

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Exhibit R-2a, RDT&E Project Justification		Date: February 1999
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/Budget Activity 4	PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/PE 0603513N	PROJECT NAME AND NUMBER: AGS-Advanced Gun System/32467

B. (U) OTHER PROGRAM FUNDING SUMMARY:

COST (\$ in Millions)	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	To Complete	Total Cost
SC-21 Total Ship Systems Engineering/PE 0604300N	58.548	125.964	162.056	250.719	259.629	255.326	283.413	271.857	Continuing	Continuing

C. (U) ACQUISITION STRATEGY:

(U) The Navy will conduct a comparison of concepts for the DD 21 Advanced Gun System. The Advanced Gun System will be acquired in conjunction with the DD 21 development schedule. Initial phases will be conducted under section 845/804 other transaction authority. Initial phases include: Phase I – Concept Formulation, Phase II - Initial Prototype Development, Phase III - Subsystem Testing and Validation. Later phases may be accomplished using FAR/DFAR acquisition.

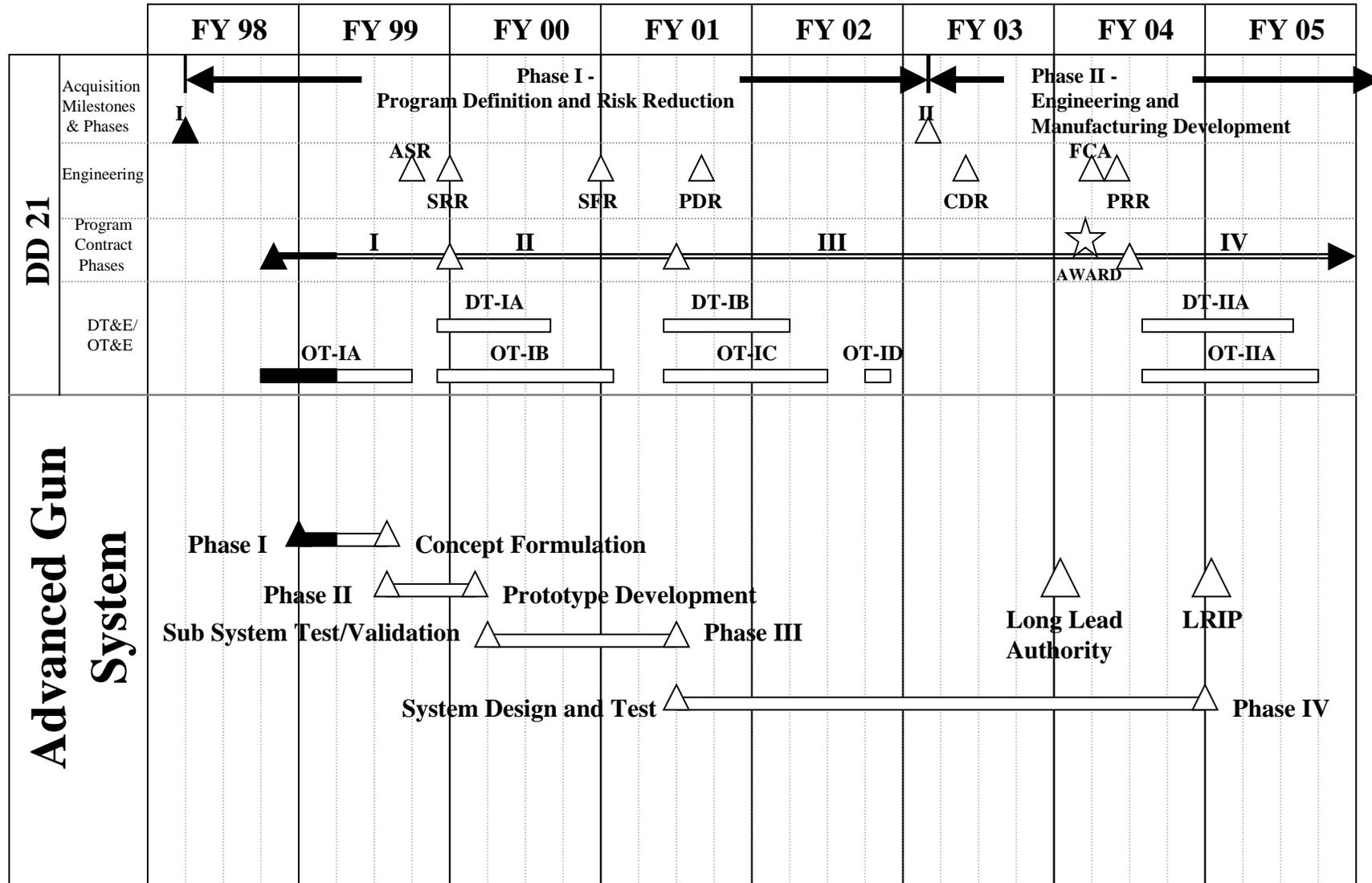
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Exhibit R-2a, RDT&E Project Justification

Date: February 1999

APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/Budget Activity 4	PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/PE 0603513N	PROJECT NAME AND NUMBER: AGS-Advanced Gun System/32467
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D. (U) SCHEDULE PROFILE:



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Exhibit R-2a, RDT&E Project Justification

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Exhibit R-3, Cost Analysis (page 1)								Date: February 1999		
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/ Budget Activity 4				PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/ PE0603513N				PROJECT NAME AND NUMBER: AGS-Advanced Gun System/32467		
Cost Categories (Tailor to WBS, or System / Item Requirements)	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY99 Cost	FY99 Award Date	FY00 Cost	FY00 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Primary Hardware Development	Section 845/804	DD 21 Industry Teams	0	12.000	2/99	4.874	10/99			
	Section 845/804	DD 21 Industry Teams	0	0		20.874	01/00	Continuing	Continuing	
Subtotal Product Development			0	12.000		25.748		Continuing	Continuing	
Remarks:										
Subtotal Support			0	0		0				
Remarks:										

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Exhibit R-3, Cost Analysis (page 2)								Date: February 1999		
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/ Budget Activity Four			PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/ PE0603513N				PROJECT NAME AND NUMBER: AGS-Advanced Gun System/32467			
Cost Categories (Tailor to WBS or System / Item Requirements)	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY99 Cost	FY99 Award Date	FY00 Cost	FY00 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Subtotal T&E			0	0		0				
Remarks: (U) No developmental or operational evaluation is scheduled during this period.										
Government Engineering Support	WR	NSWC DD Dahlgren, VA	0	0.585	1QFY99	1.613	1QFY00	Continuing	Continuing	
	WR	NSWC PHD Pt Hueneme, CA	0	0.475	1QFY99	0.661	1QFY00	Continuing	Continuing	
	WR	NSWC IH Indian Head, MD	0	0.105	1QFY99	0.336	1QFY00	Continuing	Continuing	
	WR	NSWC CD Bethesda, MD	0	0.100	1QFY99	0.226	1QFY00	Continuing	Continuing	
	WR	SSCSD San Diego, CA	0	0.170	1QFY99	0.121	1QFY00	Continuing	Continuing	
	TBD	Various	0	1.699	2QFY99	0	N/A			
Subtotal Management			0	3.134		2.957		Continuing	Continuing	
Remarks:										
Total Cost			0	15.134		28.705		Continuing	Continuing	
Remarks:										

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Exhibit R-2a, RDT&E Project Justification								Date: February 1999		
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/Budget Activity 4		PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/PE 0603513N					PROJECT NAME AND NUMBER: Undersea Warfare (USW)/32468			
COST (\$ in Millions)	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	Cost to Complete	Total Cost
Project Cost	1.700	10.667 (1)	15.527	21.170	25.694	20.830	16.941	16.924	Continuing	Continuing
RDT&E Articles Qty									Continuing	Continuing
<p>Note (1) (U) FY 1998 and FY 1999 funds were budgeted and executed under PE 0603553N/Project V1704 as displayed in the FY99 President's Budget exhibits. Funds from PE 0603553N/Project V1704 (except Distant Thunder) transitioned into PE 0603513N/Project 32468 in FY 2000 and out.</p> <p>A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The undersea warfare (USW) project provides advanced development demonstration and validation of technology for potential surface sonar and combat system application in conjunction with submarine efforts. Efforts focus on resolution of technical issues associated with providing capability against the year 2000 and beyond threat with emphasis on shallow water/littoral area USW and on Demonstration and Validation (DEM/VAL) of DD 21 Integrated Undersea Warfare (IUSW-21) concepts and technology. Key technology areas being investigated include: improvements in signal processing, advanced information processing, and multi-sensor data fusion to improve target detection and classification performance and reduce system manning requirements; and towed array, hull array and transducer technology to improve multi-static operation and in-stride mine avoidance. FY 2000 and subsequent efforts will focus on major technological and performance thrusts for DD 21 USW, which will define surface combatant USW capability for the Navy in the next century. These efforts will continue beyond DD 21 and provide improvements that apply across surface ship USW platforms. This project is funded as DEM/VAL because it develops and integrates hardware for experimental tests related to specific ship or aircraft applications.</p> <p>1. (U) FY 1998 ACCOMPLISHMENTS</p> <ul style="list-style-type: none"> • (U) (\$1.700) IUSW-21 Requirements: Developed top level requirements for IUSW-21 Advanced Development Model (ADM) based on DD-21 performance requirements. Developed top level IUSW-21 concept of operations and performed functional decomposition to identify opportunities for manning reductions. Performed technology assessment in support of functional decomposition and required manning reductions. <p>2. (U) FY 1999 PLAN</p> <ul style="list-style-type: none"> • (U) (\$2.000) Begin Concept Development for DD 21 Undersea Warfare, including risk mitigation plans and support for a Demonstration/Validation program to mitigate risk. • (U) (\$7.057) IUSW-21 BAA Risk Mitigation: Evaluate responses to a Broad Agency Announcement and competitively award contracts & tasks to contractors, government/university labs to mitigate risks associated with DD-21 USW system development. Risk mitigation will address improvements in signal processing, advanced information processing, and multi-sensor data fusion to improve target detection and classification performance and reduce system manning requirements; and hull array and transducer technology to improve broad-band operation and in-stride mine avoidance. 										

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Exhibit R-2a, RDT&E Project Justification		Date: February 1999
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/Budget Activity 4	PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/PE 0603513N	PROJECT NAME AND NUMBER: Undersea Warfare (USW)/32468

- (U) (\$1.368) IUSW-21 Systems Engineering: Complete IUSW-21 functional and operator task decomposition, identify technologies to be used to mitigate risks, establish Dem/Val environment, oversee risk mitigation effort, and conduct Dem/Val of products resulting from BAAs.
- (U) (\$0.242) Portion of extramural program is reserved for Small Business Innovative Research assessment in accordance with 15 USC 638.

3. (U) FY 2000 PLAN

- (U) (\$5.242) Begin IUSW-21 prototype development. Develop DD 21 USW concept and risk mitigation plan. Participate in IUSW peer group and evaluate USW technologies.
- (U) (\$9.068) IUSW-21 Risk mitigation. Evaluate response to a Broad Agency Announcement (BAA) and competitively award contracts and tasks to industry/University/Government labs to provide risk mitigation for DD 21 USW activities. Continue to advance technology using BAAs and Build-Test-Build process to further define advanced information processing, broadband signal processing, hull array technology including high frequency (HF) and broadband multi frequency (MF), and integrated stern risk mitigation efforts.
- (U) (\$1.217) IUSW-21 Systems Engineering. Review competing DD 21 Industry Teams USW risk mitigation plans and determine scope of future BAA technology efforts. Provide review of on going BAA efforts. Participate in IUSW-21 peer group and evaluate USW technologies for incorporation to the DD 21 Industry Teams.

B. (U) OTHER PROGRAM FUNDING SUMMARY:

COST (\$ in Millions)	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	To Complete	Total Cost
SC-21 Total Ship Systems Engineering/PE 0604300N	58.548	125.964	162.056	250.719	259.629	255.326	283.413	271.857	Continuing	Continuing

C. (U) ACQUISITION STRATEGY:

(U) In Contracting Phase I and II, DD 21 will use Section 845/804 agreement authority for the efforts conducted by the DD 21 Industry Teams. Broad Agency Announcements (BAAs) will be competitively awarded annually to further refine advanced information processing, broadband signal processing, hull array technology, and integrated stern mitigation and to provide further risk mitigation for DD 21 USW activities. In Contract Phase III responsibility for IUSW-21 development will be with the DD 21 Industry Teams.

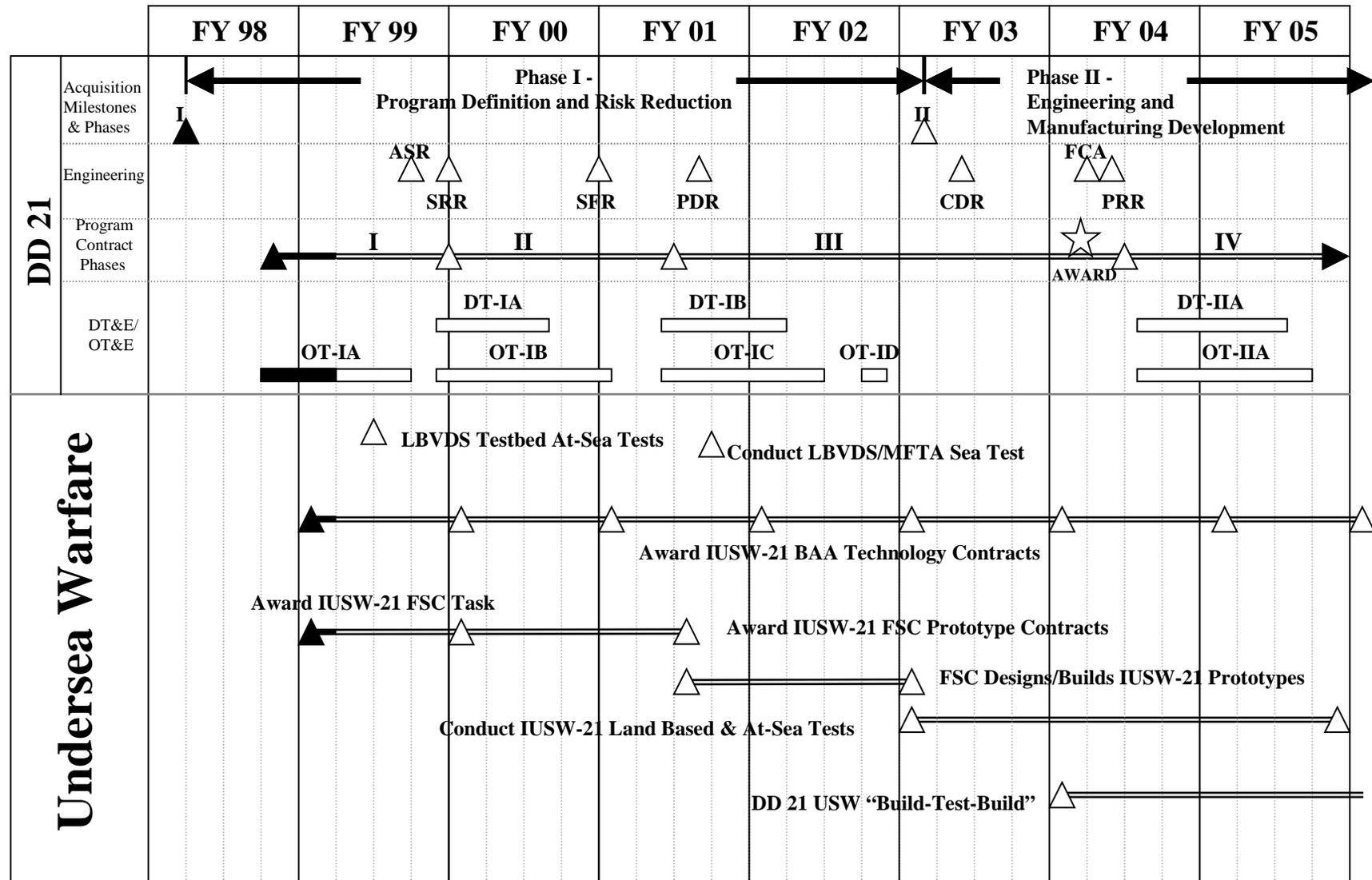
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Exhibit R-2a, RDT&E Project Justification

Date: February 1999

APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/Budget Activity 4	PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/PE 0603513N	PROJECT NAME AND NUMBER: Undersea Warfare (USW)/32468
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D. (U) SCHEDULE PROFILE:



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Exhibit R-2a, RDT&E Project Justification

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Exhibit R-3, Cost Analysis (page 1)								Date: February 1999		
APPROPRIATION/BUDGET ACTIVITY:			PROGRAM ELEMENT NAME AND NUMBER:				PROJECT NAME AND NUMBER:			
RDT&E,N/ Budget Activity 4			Shipboard System Component Development/ PE0603513N				Undersea Warfare (USW)/32468			
Cost Categories (Tailor to WBS, or System / Item Requirements)	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY99 Cost	FY99 Award Date	FY00 Cost	FY00 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Primary Hardware Development	Sect 845/804	DD 21 Industry Teams	0	2.000	11/98	5.242	10/99	Continuing	Continuing	
	BAA/CPFF	Competition	0	7.057	2QFY99	9.068	Various	Continuing	Continuing	
Subtotal Product Development			0	9.057		14.310		Continuing	Continuing	
Remarks:										
Technical Data	WR	NUWC/N Newport, RI	1.000	0.550	1QFY99	0.291	1QFY00	Continuing	Continuing	
	WR	NSWC DD Dahlgren, VA	0.200	0.075	1QFY99	0.076	1QFY00	Continuing	Continuing	
	SS/CPFF	APL/JHU Laurel, MD	0.400	0.162	1QFY99	0.150	1QFY00	Continuing	Continuing	
	SS/CPFF	APL/UW Seattle, WA	0	0.150	1QFY99	0.150	1QFY00	Continuing	Continuing	
	SS/CPFF	ARL/UT College Sta., TX	0	0.150	1QFY99	0.150	1QFY00	Continuing	Continuing	
	SS/CPFF	ARL/PSU State College,PA	0	0.150	1QFY99	0.150	1QFY00	Continuing	Continuing	
	C/CPFF	DSR Arlington, VA	0	0	N/A	0.050	1QFY00	Continuing	Continuing	
Subtotal Support			1.600	1.237		1.017		Continuing	Continuing	
Remarks:										

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Exhibit R-3, Cost Analysis (page 2)								Date: February 1999		
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/ Budget Activity 4				PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/ PE0603513N				PROJECT NAME AND NUMBER: Undersea Warfare (USW)/32468		
Cost Categories (Tailor to WBS or System / Item Requirements)	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY99 Cost	FY99 Award Date	FY00 Cost	FY00 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Subtotal T&E			0	0		0		Continuing	Continuing	
Remarks:										
Program Management Support	GSA	Techmatics Arlington, VA	0.100	0.200	1QFY99	0.200	1QFY00	Continuing	Continuing	
Miscellaneous	PD/WR	Various	0	0.173	Various	0	Various	Continuing	Continuing	
Subtotal Management			0.100	0.373		0.200		Continuing	Continuing	
Remarks:										
Total Cost			1.700	10.667		15.527		Continuing	Continuing	
Remarks:										

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Exhibit R-2a, RDT&E Project Justification									Date: February 1999	
APPROPRIATION/BUDGET ACTIVITY:		PROGRAM ELEMENT NAME AND NUMBER:					PROJECT NAME AND NUMBER:			
RDT&E,N/Budget Activity 4		Shipboard System Component Development/PE 0603513N					Consolidated Hull, Mechanical & Electrical Improvements (HM&E)/32469			
COST (\$ in Millions)	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	Cost to Complete	Total Cost
Project Cost	23.946	24.867 (1)	24.647	23.064	28.123	26.472	26.941	27.331	Continuing	Continuing
RDT&E Articles Qty	0	0	0	0	0	0	0	0	Continuing	Continuing
<p>Note (1)) (U) FY 1998 and FY 1999 funds were budgeted and executed under PE 0603513N/Project S0382, PE 0603514N/Project S0384, PE 0603514N/Project S1565, and PE 0603563N/Project S2196 (only Affordability Through Commonality) as displayed in the FY99 Presidents Budget exhibits. Funds from PE 0603513N/Project S0382, PE 0603514N/Project S0384, PE 0603514N/Project S1565, and PE 0603563N/Project S2196 (only Affordability Through Commonality) transitioned into PE 0603513N/Project 32469 in FY 2000 and out.</p> <p>A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project supports the advanced development of DD-21 HM&E ship survivability, auxiliary machinery, and affordability through commonality technologies and systems that will enable DD-21 survivability, manning, and life cycle cost goals to be met. The products developed under this project also support the existing fleet and other ship acquisition programs. Note that the efforts under this project were previously supported by four separate projects (See Note 1) and were consolidated to facilitate an integrated system development approach that ensures all design considerations are addressed. The following provides a mission description for each development area (i.e., survivability, auxiliary, and affordability):</p> <p>(U) <u>Survivability:</u> The survivability area supports development of systems and protection concepts that reduce vulnerability to conventional weapons and peacetime accidents and enable, under reduced manning conditions, a rapid recovery of mission capability. Development categories include damage control computer-based systems that provide for rapid systems restoration, fire protection devices that improve probability of survival with a reduced crew ship, and ship protection concepts that reduce magazine and commercial equipment vulnerability.</p> <p>(U) <u>Auxiliary:</u> For existing and future ships, this funding: 1) improves reliability/maintainability of fluid, electrical, and mechanical systems and 2) support reduced manning through automation of operational, maintenance, and day-to-day functions traditionally performed by the crew, and supports development of auxiliary systems to reduce ship magnetic signature and vulnerability to mines.</p> <p>(U) <u>Affordability Through Commonality:</u> The affordability through commonality program develops, demonstrates, and validates architectures, technologies, and concepts that reduce total ownership cost of existing and future ship, especially future surface combatants. Focus areas are total ship open system architectures; total ownership cost methods and modeling; use of ownership cost reduction best practices from industry and other services; cost effective equipment selection, maintenance; and logistics support, and best value enabling and innovative technologies for total ownership cost reduction.</p> <p>1. (U) FY 1998 ACCOMPLISHMENTS</p> <p>(U) <u>SURVIVABILITY:</u></p> <ul style="list-style-type: none"> (U) (\$ 8.450) Continued development of Advanced Ship Shock Isolation Systems (ASSIST) for protecting commercial electronic and machinery equipment and sensitive munitions from underwater explosion (UNDEX) induced shock. Fabricated a prototype ASSIST machinery mount; 										

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Exhibit R-2a, RDT&E Project Justification		Date: February 1999
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developed design drawings. Initiated full-scale proof-of-concept demonstration tests employing ASSIST mounts and raft. Continued development of Integrated Magazine Protection System (IMPS) technologies. Conducted full scale IMPS demonstration and initiated scaled proof-of-concept IMPS demonstration tests. Integrated the Real Time Stability Status (RTSS) software module with the Damage Control System (DCS) to allow stability data to be presented from DCS consoles; and initiated fleet evaluation aboard USS RUSHMORE. Initiated development of an on-line training capability for the DCS structural assessment module and incorporated software modifications based on lessons learned. Initiated shipboard demonstration of DCS firemain reconfiguration management module. Initiated conversion of the Damage Control Assessment Management System (DCAMS) software module. Initiated weapons effects demonstrations of the ability of HM&E services to automatically isolate, reconfigure and affect the appropriate DC response (e.g. initiate fire suppression) following damage. Initiated fleet evaluations aboard the ex-USS to demonstrate the effectiveness of alternative reduced manning damage control concepts/architectures in responding to a major casualty. Completed interactive training system for the Repair Locker Leader and Damage Control Assistant. Continued development of the time-dependent, computer-based Advanced Survivability Assessment Program (ASAP) for use in evaluating ship designs. Continued development of ASAP fire and smoke model. Developed software architecture to allow models to operate in a time dependent manner. Conducted evaluation of self-contained water mist fire extinguishing systems for protecting flammable liquid storage spaces.

(U) AUXILIARY SYSTEMS:

- (U) (\$6.796) Continued development of advanced HM&E machinery and systems to reduce operational manning and eliminate at-sea maintenance. Conducted laboratory evaluations and demonstrated proof of concept for reduced manning of auxiliary machinery and systems architectures. Initiated the development of design tools to minimize the need for full-scale land based demonstrations of other auxiliary systems. Continued development of Power Electronic Building Block (PEBB) modules, Polymer Current Limiters (PCL), alternative cells for the Electrolytic Disinfectant Generator (EDG), and seals for composite pumps. Obtained Milestone III approval for EDG and composite pumps. Completed LABEVAL of auxiliary multi functional PEBB based power module (AMF PM) and concurrent engineering of design to improve performance. Continued Shipval of Ground Fault Limiters (GFL) and prepared performance specifications for Fleet applications. Conducted Labeval of 50/100 ampere single phase PCL fuse replacements. Developed eddy current field measurement capability for surface combatants and completed test aboard LPD 17 physical magnetic model under various load conditions. (\$0.915M used to forward finance FY 1998 program due to the termination of fiber optics). Continued development of the Transient Analysis Model for POSSE and continued development of the Under Water Closed Circuit Blasting System. Initiated development of the Remotely Operated Vehicle (ROV) Power System. Continued fuel cell development for ship service power applications Initiated conceptual design of baseline Molten Carbonate Fuel Cell (MCFC) including small scale screening for shock, vibration, salt and sulfur tolerance. Modified ERC contract to conduct additional preliminary design work and operate 50 KW reduced scale demonstrator with congressional plus-up in Project S2390.

(U) AFFORDABILITY THROUGH COMMONALITY:

- (U) (\$8.700) Affordability Through Commonality (ATC): Developed, demonstrated, and validated architectures, technologies, and concepts that reduce total ownership costs for the future fleet. Identified areas/methods for common, fleet-wide methods to improve life cycle affordability of future naval ships and shipboard systems. Where feasible, backfit to existing ships was pursued. Focus of these efforts was the 21st century surface combatant (SC 21), future carrier CVN(X), and other ships in the SCN plan.

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- (U) Total Ship Modular Open Systems Architecture: Initiated development of a common open systems total ship architectures for HM&E systems, C4I systems, and combat systems including interface standards for modular ship systems. Developed first cut at systems architectures that can utilize commercial processes and/or commercial-off-the-shelf (COTS) equipment and materials. Performed producibility, operational, and cost analysis of this ship architecture. Refined zonal distributed systems architectures for HVAC, firemain, and other auxiliary/support systems for a total ship open system architecture. Incorporated requirements for dedicated serviceways for zonal distributed and other support systems in ship open architecture. Developed plans and Navy-Industry team approach to define Weapons / Topside / Electronic Zones definition & interface standards for combat systems and C4I, and to develop module to ship, module to module, and intra-module interface standards for hull, mechanical & electrical systems. Supported integration of distributed computing plant schematic architecture into the physical architecture of modular ship architecture. Supported NAVSEA Professor of Ship Production research grant to incorporate world class ship production processes and practices into naval ships.
- (U) Future Surface Combatant Cost Modeling: Supported cost modeling and cost analysis for DD 21. Collected and analyzed cost data of shipbuilders for development of activity cost factors for surface combatant type ships. Updated database of cost-benefit studies done and the sources of the cost data. Analyzed the cost benefits of architectures, technologies, and concepts.
- (U) Use of Ownership Cost Reduction Best Practices from Industry & Other Services: Gathered a database of affordability best practices, lessons learned, and other information on ownership cost reduction technologies, and concepts.
- (U) Cost Effective Equipment Selection, Maintenance, and Logistics Support: Developed methods and practices for more cost-effective shipboard equipment selection. Updated equipment selection tool to utilize world wide web links to existing Navy and commercial equipment databases. Analyzed potential across programs common equipment buy and engineering support for resolution of common buy issues. Began development of equipment selection processes including use of COTS equipment. Provided equipment selection engineering support, lessons learned and practices to on going ship programs. Began benchmarking of commercial logistics support concepts.
- (U) Best Value Enabling and Innovative Technologies for Total Ownership Cost Reduction: Examined potential commercial technologies to provide more affordable solutions to shipboard functional requirements and/or reduced maintenance and modernization costs. Surveyed industry and other sources for modularity enabling technologies. Revised concept for food service (galley) modules, ventilation and chilled water HVAC modules, and ship auxiliary systems. Purchased and installed commercial food service equipment for shipboard demonstration and evaluation. Supported prototype evaluations for ships under construction (such as DDG 51 class and LPD 17 class) and modernization (CVN 68 class) for habitability common modules, and commercial furniture for offices and berthing. Demonstrated and evaluated commercial lighting systems - sulfur fusion light with light tube, and fiber optic lighting applications. Developed concepts for mission element modules that would be used across different systems/spaces that have rapidly changing equipment especially electronics. Developed radio communication modularity concepts and potential means to integrate them within the ship. Developed modular packaging concepts for Concentric Canister Launcher (CCL). Supported modular horizontal CCL concept revision, testing of electronics breadboard using commercial components, and demonstration testing. Developed and tested Shipboard Modular Architecture and Reconfiguration Technology (SMART) deck modular track/hold down systems and compartment support systems (i.e. modular electrical connections) for use in mounting standardized and modular equipment aboard ships in C4I and other types of spaces to reduce the costs of future modernization.

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2. (U) FY 1999 PLAN:

(U) SURVIVABILITY:

- (U) (\$7.461) Conduct full scale UNDEX shock proof-of-concept demonstration test of ASSIST machinery mount and raft. Conduct DD 21 ship/system integration design assessments and finalize machinery mount/ design requirements. Initiate ASSIST planning for DD 21 applicable demonstration employing mount, raft and machinery. Conduct full scale demonstration tests of the effectiveness of anti-fratricide shielding and scaled proof-of-concept IMPS demonstration tests for multiple warheads. Conduct DD 21 applicable ship/ launcher integration studies. Initiate planning for all-up full scale proof-of-concept demonstration employing multiple missiles, launcher, anti-fratricide shielding and water suppression. Complete RTSS Fleet evaluation aboard the USS Rushmore. Initiate development of a predictive stability algorithm for the RTSS software module that determines long term stability conditions based on flooding rates. Complete shipboard demonstration of DCS firemain reconfiguration management module. Complete fleet evaluations aboard the ex-USS SHADWELL to demonstrate the effectiveness of alternative reduced manning concepts. Initiate fleet evaluations aboard the ex-USS SHADWELL in support of developing shipboard procedures for firefighting in a chemical, biological, and radiological (CBR) environment. Conduct full scale weapon effects demonstrations of automated fire suppression system. Develop automated chilled water isolation and reconfiguration system options. Continue development of the ASAP fire and smoke model and initiate development of a crew casualty/damage control model. Initiate development of firefighting devices/systems that provide for remote control of a firehose nozzle enabling sustained operations in a reduced manning environment. Conduct survey of commercial robotic firefighting devices, develop operational requirements and initiate prototype system design.

(U) AUXILIARY SYSTEMS:

- (U) (\$9.394) Continue development of advanced HM&E machinery and systems architectures to reduce manning and eliminate at-sea maintenance. Complete low pressure air system full scale demonstration with Component Level Intelligent Distributed Control (CLIDC) system. Initiate laboratory demonstration of automated chilled water and other auxiliary systems with CLIDC systems. Continue development of PCL, GFL, and PEBB based AMF PM. Complete GFL algorithm development, SHIPEVAL and implementation. Complete design, fabrication and LABEVAL of 100 ampere, single phase PCL for fuse replacement. Initiate PCL design for 3 phase fuse replacement. Complete evaluation/upgrade of AMF PM brassboard and establish requirements for prototype. Continue concurrent engineering and cost analysis for AMF PM. Initiate development of a magnetic, onboard, self-monitoring, control system (CLDG) for steel hulled surface combatants including onboard sensor suites and control algorithms. Specify and initiate procurement of CLDG components. Complete development of the Underwater Closed Circuit Blasting System. Continue development of the ROV Power System. Complete development of the Transient Analysis Model for POSSE. Continue development of fuel cells for ship service power applications. Continue MCFC 2500 KW conceptual design and trade off analysis.

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(U) AFFORDABILITY THROUGH COMMONALITY:

- (U) (\$7.676) Affordability Through Commonality: Continue to develop, demonstrate, and validate architectures, technologies, and concepts that reduce total ownership costs for the future fleet. Identify areas/methods for common, fleet-wide means to improve life cycle affordability of future naval ships and shipboard systems. Where feasible, backfit to existing ships will be pursued. Focus these efforts on applications for on-going ship programs (DDG 51, DD21, CVN77, CVN(X)) and other ships in the SCN plan.
- (U) Total Ship Modular Open Systems Architecture: Continue multi-year Navy-Industry effort to develop a total ship open systems architecture. This architecture will feature defined modules and zones for weapons, sensors & electronics as well as hull, mechanical & electrical (HM&E) equipment with zonal distributed systems for ship-wide support systems such as fire fighting, heating, ventilation, air conditioning, and equipment cooling. Develop total ship modular open systems architecture requirements for surface combatants. Draft performance specifications and other requirements for this modular open systems architecture, including common interfaces. Perform operational, survivability, and cost analysis of this ship architecture. Begin to define module to ship, module to module, and intra-module interface standards for hull, mechanical, and electrical systems, adaptable to zonal and other advanced distributive systems concepts, and with applicability across the fleet. Evaluate and use industry interface standards where available. Conduct studies/analyses of promising alternative distributed systems concepts, including assessment of survivability and ship operations. Support integration of distributed computing plant schematic architecture into the physical architecture of modular ship architecture. Evaluate impact of commonality architecture and zonal distributed systems on ship production costs and build strategy, including; scheduling, fabrication, erection, outfitting, and testing. Support NAVSEA Professor of Ship Production research grant to incorporate world class ship production processes and practices into naval ships.
- (U) Future Surface Combatant Cost Modeling: Collect and analyze shipbuilders cost data for development of activity cost factors for surface combatant type ships. Analyze cost benefits of architectures, technologies, and concepts. Update database of cost-benefit studies done and the sources of the cost data.
- (U) Use of Ownership Cost Reduction Best Practices from Industry & Other Services: Benchmark affordability/ life cycle cost reduction best practices from industry & other services. Adapt affordability best practices for naval fleet / ship use.
- (U) Cost Effective Equipment Selection, Maintenance, and Logistics Support: Develop engineering tools, criteria, and methods for cost effective selection. Update equipment selection tool links to commercial equipment databases. Transfer lessons learned and adapt the across acquisition program common equipment buy to ongoing ship acquisition programs. Develop equipment selection processes including use of COTS equipment. Equipment selection support to on-going ship design / acquisition programs. Gather and transfer equipment selection lessons learned and practices to on-going ship programs Complete benchmarking of commercial logistics support concepts. Analyze the cost-benefit and performance of commercial logistics support concepts.
- (U) Best Value Enabling and Innovative Technologies for Total Ownership Cost Reduction: Examine, adapt, demonstrate and evaluate potential commercial technologies to provide more affordable solutions to shipboard functional requirements and or reduced maintenance and modernization costs. Develop galley of the future module concept design using commercial food preparation technologies. Complete engineering effort for prototype evaluation of habitability common modules, and commercial furniture on ships under construction (such as DDG 51 class and LPD 17 class), and modernization (CVN 68 class). Modular packaging systems engineering and concept development for

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Concentric Canister Launcher (CCL) in support of at-sea demonstration. Complete development and testing on Shipboard Modular Architecture and Reconfiguration Technology (SMART) deck modular track/hold down systems. Continue to develop SMART compartment support systems and concepts, including modular reconfigurable electrical connections and concepts for rapidly reconfigurable ventilation. Assessment of incorporation of SMART deck system and concepts in prototype Combat Information Centers (CIC) for the future to demonstrate greatly reduced installation and upgrade / modernization costs. Support C4I modularity especially the use of standard commercial 'racks' and interfaces for radio communication equipment. Complete development of radio communication modularity using commercial equipment and open system standards. Work to backfit these on ships under construction and in modernization.

(U) (\$0.336) Portion of extramural program is reserved for Small Business Innovative Research assessment in accordance with 15 USC 638.

3. (U) FY 2000 PLAN:

(U) SURVIVABILITY:

- (U) (\$6.553) Continue development of the Real-Time Stability System (RTSS) predictive stability software. Complete fleet evaluation aboard the ex-USS Shadwell in support of developing firefighting procedures in a chemical, biological, and radiological environment. Initiate full scale weapons effects testing of alternative total ship computing plant architectures to demonstrate initialization of software applications on undamaged computers to support continued, uninterruptible operation of mission critical functions. Continue development of the time-dependent, computer-based ASAP for use in evaluating ship designs. Complete development of the ASAP fire and smoke model and continue development of the crew casualty/ damage control model. Continue development of firefighting devices/ systems that provide for remote control of a nozzle enabling sustained operations in a reduced manning environment. Complete system design and initiate prototype construction. Continue development of ASSIST. Initiate construction of DD 21 applicable ASSIST machinery concepts. Initiate design of ASSIST mounts for protecting sensitive munitions stowed in vertical launchers and bulk magazines. Continue development of IMPS technologies. Initiate construction of full scale IMPS models.

(U) AUXILIARY SYSTEMS:

- (U) (\$11.593) Along with DD 21 industry teams, develop alternative machinery system architectures to reduce manning and eliminate at-sea maintenance of shipboard auxiliary systems; validate design tools and produce simulations of alternative architectures/machinery systems for DD-21. Award contract for prototype AMF PM for IPS auxiliary machinery applications. Continue development of 3 Phase PCL fuse replacement. Complete CLDG sensor development and procurement; conduct full-scale CLDG ranging tests. Complete development of conceptual/preliminary designs of 2.5 megawatt (MW) Ship Service Fuel Cell Power Module and initiate detailed design of 0.5 MW reduced scale demonstrator. Complete subscale stack and reformer risk reduction demonstrations. Initiate development of the Improved Shaft Coating System. Initiate development of the Smart Tow Monitoring System. Complete development of the ROV Power System.

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(U) AFFORDABILITY THROUGH COMMONALITY:

- (U) (\$3.101) Total Ship Modular Open Systems Architecture: Continue Navy-Industry effort to develop, demonstrate, validate and implement fleet-wide open systems architectures (OSA) and non-proprietary standard interfaces. This architecture will feature weapon, sensor & electronic - modules and zones as well as hull, mechanical & electrical (HM&E) equipment with zonal distributed systems for ship-wide support systems such as fire fighting, heating, ventilation, air conditioning, and equipment cooling. The OSA will employ commercial processes and commercial off the shelf material and equipment to the greatest extent practicable.
 - Continue development of detailed, fleet-wide standard interfaces for an OSA chilled water module. Initiate fabrication of an OSA chilled water module and associated standard interface for demonstrating and evaluating effectiveness of OSA technology for meeting the requirements of Naval shipboard operational environment.
 - Continue development of detailed development of an OSA HVAC system for a shipboard C4I space arranged with SMART deck reconfigurable foundation system. Initiate fabrication of prototype SMART Space including HVAC system, to demonstrate and validate effectiveness of SMART OSA technologies for meeting requirements of the Naval Shipboard operational environment.
 - Continue development and / or adaptation of technology concepts for non-proprietary OSA standard interface enablers. These 'enablers' will allow the use of COTS components from multiple vendors to meet Navy unique environmental requirements without modification.
- (U) (\$0.500) Total Ownership Cost Methods & Modeling: Develop Product Oriented Design and Construction (PODAC) cost model estimating ratios for shipbuilding intermediate products, parametric scaleable systems, and shipboard equipment for surface combatant ships. Analyze cost benefits of architectures, technologies, and concepts.
- (U) (\$0.400) Cost Effective Equipment Selection, Maintenance, and Logistics Support: Continue development, demonstration, validation and implementation of SAVEPRO and SEALINK engineering tools for Fleet-wide cost effective equipment selection and expand these tools to include commercial market. Provide equipment selection support to on-going ship design / acquisition programs, including lessons learned.
- (U) (\$2.500) Best Value Enabling and Innovative Technologies for Total Ownership Cost Reduction: Investigate and evaluate commercial technologies for potential to provide more affordable solutions to Naval shipboard functional requirements and/or reduced maintenance and modernization costs. These efforts include continued systems engineering and ship integration efforts in support of; Concentric Canister Launcher (CCL) at-sea demonstration, Commercial material handling and management technologies development and Galley of the Future concepts. Efforts will also include completion of habitability common modules and commercial furniture for offices and berthing, commercial sulfur lighting with advanced distribution systems, and the advanced embarkation / debarkation system. Foster the transition of these technologies and concepts to on-going ship design and acquisition programs.

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B. (U) OTHER PROGRAM FUNDING SUMMARY:

COST (\$ in Millions)	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	To Complete	Total Cost
SC-21 Total Ship Systems Engineering/PE 0604300N	58.548	125.964	162.056	250.719	259.629	255.326	283.413	271.857	Continuing	Continuing

C. (U) ACQUISITION STRATEGY:

(U) These development efforts were realigned into this project in an effort to consolidate related DD 21 RDT&E efforts and will be transitioned into the DD 21 acquisition strategy in FY 2000 and out.

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D. (U) SCHEDULE PROFILE:		
<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>
<p align="center">SURVIVABILITY</p> <p>4Q ASSIST Machinery Mount / Design</p> <p>3Q IMPS Single Warhead Test</p> <p>4Q ASAP Time Dependent Software</p> <p>4Q DCS Structural Software Module</p> <p>4Q Self-Contained Water Mist Evaluations</p>	<p>4Q DD 21 Machinery Integration Study</p> <p>4Q DD 21 IMPS Ship Integration Study</p> <p>1Q ASSIST UNDEX Machinery Mount Shock Tests</p> <p>3Q IMPS Demonstration</p> <p>4Q DCAMS Windows NT Software</p> <p>4Q DCS Structural Training Software</p> <p>3Q Remote Control Firefighting Operational Requirements</p> <p>4Q Reduced Manning Option Evaluations</p> <p>4Q Firemain Reconfiguration Shipboard Demonstration</p> <p>3Q Automated Fire Suppression Demonstrations</p>	<p>4Q CBR Firefighting Proced</p> <p>4Q Remote Control Firefighting Design</p>

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<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>
<p align="center">AUXILIARY SYSTEMS</p> <p>Auxiliary Systems 3Q EDG MS III 4Q Comp Pump MS III 4Q LABEVAL PCL (10) 4Q LABEVAL AMF PM EDM</p> <p>Salvage 2Q Initiate ROV Power System Dev.</p> <p>Fuel Cell 4Q MCFC 2.5 MW Concept Design Interim Report</p> <p>Magnetic Silencing 4Q LPD 17 Model Complete 4Q Eddy Current Measurement Capability for Surface Ship</p> <p>Advanced Auxiliaries 4Q LP Air & Chilled Water LABEVAL Proof of Concept 4Q Complete DDG-51 Chilled Water & LP Air Simulation Model</p>	<p>4Q Complete GFL SHIPEVAL 4Q GFL Specification 4Q Prototype AMF PM Requirements 4Q LABEVAL PCL</p> <p>4Q Complete UW Closed Cir. Blast Sys. 4Q Complete Transient Analysis Model</p> <p>4Q PEM FC Concept Design 4Q MCFC Concept Design</p> <p>1Q Advanced Deg ATD transitions to Surface Combatants 4Q CLIDG System for Surface Combatants Defined</p> <p>2Q Complete LP Air LABEVAL 4Q Demo Functional Control System Design 4Q Validate Chilled Water Fluid Simulation</p>	<p>4Q AMF PM Labeval Compl</p> <p>1Q Initiate Improved Shaft Coating System 2Q Initiate Smart Tow Monitoring System 4Q Complete ROV Power System</p> <p>1Q Reduced Scale Risk Reduction Demos 1Q PEM FC Preliminary Design 1Q MCFC Preliminary Design 4Q .5 MW Reduced Scale Demo Design</p> <p>3Q CLDG Ranging of CLDG 4Q CLDG Sensor Dev Complete</p> <p>4Q New Sys Arch Concepts to Support Reduced Manning 4Q Val Chilled Water Sim & Design Tools</p>

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<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>
AFFORDABILITY THROUGH COMMONALITY		
Integrated Joiner Bulkhead System Complete 4Q	Modular Food Service Level II Design 4Q	Commercial Furniture For Offices/Berthing Complete 4Q
Radio Communication Modular Equipment Stds. 4Q	C4I Modularity Distributed Systems Prototype 4Q	Draft Performance Specification For Open Systems Architectures HVAC & CW Demonstrator 1Q
HM&E Open Systems Interface Standards Development Plan 4Q	Open Systems Interface Definitions for HVAC and CW 4Q	Initiate Fabrication Opens System Architecture Chill Water Demonstrator 3Q
Combat Systems Zone & Interface Standards Development Plan 4Q	Zonal HVAC Distributed System Open Systems Concept Design 4Q	PODAC Cost Model Cost Estimating Relationships for surface combatants 4Q
	Surface Combatant Open Ship Systems Arch. GBS Phase II 4Q	Advanced Embarkation/Debarkation System Complete 4Q

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Exhibit R-3, Cost Analysis (page 1)								Date: February 1999		
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/ Budget Activity 4			PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/ PE0603513N				PROJECT NAME AND NUMBER: Consolidated Hull, Mechanical & Electrical Improvement (HM&E)/32469			
Cost Categories (Tailor to WBS, or System / Item Requirements)	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY99 Cost	FY99 Award Date	FY00 Cost	FY00 Award Date	Cost To Complete	Total Cost	Target Value of Contract
SURVIVABILITY										
Product Development	Section 845/804	DD 21 Industry Teams	0	2.020	11/98	5.043	10/99	Continuing	Continuing	N/A
	WR	NSWC CD Bethesda, MD	3.332	3.291	Various	0.500	Various	Continuing	Continuing	N/A
	Various	Other Govt Activities	3.018	1.500	Various	0.578	Various	Continuing	Continuing	N/A
	Various	Other Contractors	2.100	0.752	Various	0.432	Various	Continuing	Continuing	N/A
Subtotal Survivability			8.450	7.563		6.553		Continuing	Continuing	
Remarks:										
AFORDABILITY THROUGH COMMONALITY										
Engineering Development, Demonstration & Evaluation	Section 845/804	DD 21 Industry Teams	0	2.500	11/98	5.008	10/99	Continuing	Continuing	N/A
	WR	NSWC CD Bethesda, MD	2.795	1.945	Various	0.700	10/99	Continuing	Continuing	N/A
	RC	NSWC CD Bethesda, MD	1.145	0.760	Various	0	N/A	Continuing	Continuing	N/A
	Various	Other Govt Activities	1.129	1.020	Various	0.200	10/99	Continuing	Continuing	N/A
	C/CPFF	AME Arlington, VA	1.690	0.775	2QFY99	0	N/A	Continuing	Continuing	N/A
	Various	Other Contractors	1.941	0.789	Various	0.593	Various	Continuing	Continuing	N/A
Subtotal ATC			8.700	7.789		6.501		Continuing	Continuing	
Remarks:										

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Exhibit R-3, Cost Analysis (page 2)								Date: February 1999		
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Cost Categories (Tailor to WBS or System / Item Requirements)	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY99 Cost	FY99 Award Date	FY00 Cost	FY00 Award Date	Cost To Complete	Total Cost	Target Value of Contract
AUXILIARY SYSTEMS										
Product Development	Sect 845/804	DD 21 Industry Teams	0	4.950	11/98	8.232	10/99	Continuing	Continuing	N/A
	WR	NSWC CD Bethesda, MD	5.481	3.595	11/98	2.361	Various	Continuing	Continuing	N/A
	Various	Other Govt Activities	0.751	0	N/A	0	N/A	Continuing	Continuing	N/A
	Various	Other Contractors	0.564	0.970	Various	1.000	Various	Continuing	Continuing	N/A
Subtotal Auxiliary Systems			6.796	9.515		11.593		Continuing	Continuing	
Remarks:										
Total Cost			23.946	24.867		24.647		Continuing	Continuing	
Remarks:										

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APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/Budget Activity 4		PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/PE 0603513N					PROJECT NAME AND NUMBER: Integrated Topside Design (ITD)/32470			
COST (\$ in Millions)	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	Cost to Complete	Total Cost
Project Cost	10.454	13.348 (1)	13.732	15.054	18.899	14.977	15.319	15.670	Continuing	Continuing
RDT&E Articles Qty	0	0	0	0	0	0	2	0	Continuing	Continuing
<p>Note (1) (U) FY 1998 and FY 1999 funds were budgeted and executed under PE 0603513N/Project S1712 as displayed in the FY99 President's Budget exhibits. Funds from PE 0603513N/Project S1712 transitioned into PE 0603513N/Project 32470 in FY 2000 and out.</p> <p>A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project develops and integrates the necessary technologies to achieve a total integrated topside design focused on DD 21 and future surface combatant ships. Technology areas including topside signature control, sensor and antenna integration, weapon system integration, HM&E integration, related decision-making tools, and composite materials will be addressed. Other stand alone technology programs will be synergistically integrated with this topside design integration effort to assure total ship systems integration for future ship design efforts. Surface combatants will need an added (stealth) layer of defense to support hardkill and softkill systems in defeating future threats. Composite materials will also be considered for their corrosion control, reduced maintenance, and reduced manning attributes. This project also develops improved equipments that are small but critical components of non-propulsion HM&E systems. This program is directed toward improved affordability, performance, reduced life cycle cost, reliability and maintainability, signature reduction, standardization, and weight and manning reductions for the existing and future fleet. RDT&E test articles will be used to demonstrate the producibility, cost and performance of low observable ITD concepts.</p> <p>1. (U) FY 1998 ACCOMPLISHMENTS</p> <ul style="list-style-type: none"> • (U) (\$8.354) Identified common platform for integrated topside design toolset implementation. Initiated development of integrated topside design toolset. Initiated systems engineering study to identify and prioritize design concepts for integrated topside HM&E prototype components. Developed draft composite design procedures. Initiated validation of statistical allowables for composite materials, validation of composite joint design procedures, and updated the PC based composite materials database. Improved Radar Target Signature (RTS) Code and assessed IRENE and SHIPIR infrared (IR) signature codes. Initiated scale modeling signature assessments. Determined environmental effects relative to improvements needed for Cruise Missile engagement simulations. • (U) (\$1.196) Supported risk reduction engineering studies for the transition of Advanced Enclosed Mast/Sensor (AEM/S) System to LPD-17 topside. Conducted at-sea performance assessments of AEM/S on USS Arthur Radford. • (U) (\$0.904) Continued development of affordable mechanical and electrical machinery including feasibility study of commercial ship service genset and pump seal technology. Awarded trade off analysis contract to Solar Industries for genset trade off analysis. Received Phase I report from Allison. Completed qualification of 12-inch glass reinforced plastic (GRP) 2-way ball valve and issued manufacturing drawing and ILS package for family of ball valves up to 12 inches. Initiated qualification of 3-way ball valve prototypes. <p>2. (U) FY 1999 PLAN</p> <ul style="list-style-type: none"> • (U) (\$8.604) Continue development and validation of composite material design procedures and revision of the PC based composite materials database. Evaluate composite materials for their corrosion control and reduced maintenance attributes. Continue scale modeling signature assessments. Continue development of radar cross section (RCS), Infrared (IR), and electronic warfare (EW) prediction codes. Begin development of improved baseline EM ENGINEERING toolset. Support transition of AEM/S system to LPD-17 topside. 										

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Exhibit R-2a, RDT&E Project Justification		Date: February 1999
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/Budget Activity 4	PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/PE 0603513N	PROJECT NAME AND NUMBER: Integrated Topside Design (ITD)/32470

- (U) (\$4.515) Develop a modeling and simulation plan and a risk reduction plan for integrated topside design (ITD) activities. Initiate risk reduction test in support of DD 21 Industry Team ITD risk reduction plan.
- (U) (\$0.229) Portion of extramural program is reserved for Small Business Innovative Research assessment in accordance with 15 USC 638.

3. (U) FY 2000 PLAN

- (U) (\$2.929) Continue development of improved baseline EM ENGINEERING toolset. Continue validation of composite material design procedures and revision of the PC-based composite materials database. Evaluate composite materials for their corrosion control and reduced maintenance attributes. Continue development of radar cross section (RCS), infrared (IR), and electronic warfare (EW) prediction codes. Develop Infrared Signature Database Update. Validate and publish LO Model scaling techniques.
- (U) (\$9.803) Initiate execution of ITD risk reduction plan by DD 21 Industry Teams.
- (U) (\$1.000) Continue development of heat pipe based bleed air heat exchanger and affordable HM&E machinery for existing and future fleet.

B. (U) OTHER PROGRAM FUNDING SUMMARY:

COST (\$ in Millions)	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	To Complete	Total Cost
SC-21 Total Ship Systems Engineering/PE 0604300N	58.548	125.964	162.056	250.719	259.629	255.326	283.413	271.857	Continuing	Continuing

C. (U) ACQUISITION STRATEGY:

(U) These development efforts were realigned into this project in an effort to consolidate related DD 21 RDT&E efforts and will be transitioned into the DD 21 acquisition strategy in FY 2000 and out.

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Exhibit R-2a, RDT&E Project Justification		Date: February 1999
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/Budget Activity 4	PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/PE 0603513N	PROJECT NAME AND NUMBER: Integrated Topside Design (ITD)/32470

D. (U) SCHEDULE PROFILE:

PROGRAM MILESTONES		
FY 1998	FY 1999	FY 2000
2Q 2-Way Ball Valve Design 4Q Comp Joint Design Procedures 4Q LPD 17 AEM/S Design 4Q At-Sea AEM/S Evaluation 4Q Comp Fire Performance Requirements 4Q Improved RTS Code 4Q Signatures Trade Off Analysis	2Q C_Missile Update 4Q RCS Medium Scale Model Test Results 4Q Final LPD 17 Mast EM/Signature/Structural Design 4Q EM Engineering Baseline Upgrade 4Q Complete Structural Design Guide 4Q ITD M&S and Risk Reduction Plans 2Q Solar Conceptual Design Data 4Q Gen Set Complete 4Q 3 Way Ball Valve Drawing and ILS Package 4Q Allison Conceptual Design Data	2Q C_Missile Update 4Q Comp Structural Design Guide Update 4Q EM Engineering Baseline Upgrade 4Q IRDatabase Updates

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Exhibit R-3, Cost Analysis (page 1)								Date: February 1999			
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/ Budget Activity 4				PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/ PE0603513N				PROJECT NAME AND NUMBER: Integrated Topside Design/32470			
Cost Categories (Tailor to WBS, or System / Item Requirements)	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY99 Cost	FY99 Award Date	FY00 Cost	FY00 Award Date	Cost To Complete	Total Cost	Target Value of Contract	
Primary Hardware Development	Sect 845/804	DD 21 Industry Teams	0	4.515	11/98	9.803	10/99	Continuing	Continuing		
Subtotal Product Development			0	4.515		9.803		Continuing	Continuing		
Remarks											
Engineering Support	WR	NSWC CD Bethesda, MD	5.532	4.317	1QFY99	2.258	1QFY00	Continuing	Continuing		
	WR	NRL Suitland, MD	1.005	1.104	1QFY99	0.622	1QFY00	Continuing	Continuing		
	WR	Various Navy Labs	0.120	0.450	1QFY99	0.225	1QFY00	Continuing	Continuing		
	RC	NAVLOGCTR PA	0	0.870	1QFY99	0.450	1QFY00	Continuing	Continuing		
	Various	Various	2.054	1.307	1QFY99	0.199	1QFY00	Continuing	Continuing		
Software Development	C/CPFF	TBD	1.508	0.640	2QFY99	0.175	1QFY00	Continuing	Continuing		
	MP	JSC Annapolis, MD	0.210	0.145	1QFY99	0	N/A	Continuing	Continuing		
Subtotal Support			10.429	8.833		3.929		Continuing	Continuing		
Remarks:											

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Exhibit R-3, Cost Analysis (page 2)								Date: February 1999		
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/ Budget Activity 4			PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/ PE0604513N					PROJECT NAME AND NUMBER: Integrated Topside Design/32470		
Cost Categories (Tailor to WBS or System / Item Requirements)	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY99 Cost	FY99 Award Date	FY00 Cost	FY00 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Subtotal T&E			0	0		0		Continuing	Continuing	
Remarks:										
Miscellaneous	Various	Various	0.025	0		0		Continuing	Continuing	
Subtotal Management			0.025	0		0		Continuing	Continuing	
Remarks:										
Total Cost			10.454	13.348		13.732		Continuing	Continuing	
Remarks:										

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Exhibit R-2a, RDT&E Project Justification								Date: February 1999		
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/Budget Activity 4		PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/PE 0603513N					PROJECT NAME AND NUMBER: Integrated Power Systems (IPS)/32471			
COST (\$ in Millions)	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	Cost to Complete	Total Cost
Project Cost	17.560	33.929 (1)	25.723	26.040	23.635	12.181	7.262	5.179	Continuing	Continuing
RDT&E Articles Qty	0	0	0	0	0	0	0	0	Continuing	Continuing
<p>Note (1) (U) FY 1998 and FY 1999 funds were budgeted and executed under PE 0603573N/Project S1314 as displayed in the FY99 President's Budget exhibits. Funds from PE 0603573N/Project S1314 (only Integrated Power Systems) transitioned into PE 0603513N/Project 32471 in FY 2000 and out.</p> <p>A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This project supports the Integrated Power Systems (IPS) program. IPS provides total ship electric power, including electric propulsion, power conversion and distribution, and mission load interfaces to the electric power system. IPS supports multiple ship class applications for future surface ships, with DD21 being the primary ship application target. The goals of the IPS are to reduce acquisition and operating costs of naval ships and increase military effectiveness. These goals are to be accomplished by leveraging investments in technologies that will be usable by both military and commercial sectors.</p> <p>(U) IPS has the potential to revolutionize the design, construction and operation of U.S. naval ships by using electricity as the primary energy transfer medium aboard ship. The flexibility of electric power transmission allows power generating modules with various power ratings to be connected to propulsion loads and ship service in any arrangement that supports the ship's mission at lowest overall cost. Systems engineering in IPS is focused on increasing the commonality of components used across ship types and in developing modules which will be integral with standardization, zonal system architectures, and generic shipbuilding strategies. The purpose of increased commonality is to reduce the total cost of ship ownership by using common modules composed of standard components and/or standard interfaces.</p> <p>(U) IPS addresses ship platform program goals through: reduced ship acquisition cost through integration of propulsion and ship's service prime movers; lower ship operational costs resulting from more flexible operating characteristics and more efficient components; reduced ship construction costs by allowing more extensive modular construction of power generation, distribution, and loads if desired; improved ship survivability and reduced vulnerability through increased arrangement flexibility and improved electrical system survivability; reduced manning through improved power management systems and reduced on-board maintenance requirements; improved ship signature characteristics, if required; improved design adaptability to meet future requirements of multiple ship types or missions; integrating power management and protection by fully utilizing the power electronics in the system to perform fault protection as well as power conversion and load management functions; simplified technology insertion which allows new technologies to be installed within IPS much more inexpensively than presently possible; and, reduced machinery system acquisition costs through utilization of commercially shared technologies and components. The efforts in this project are divided into three major areas as follows:</p> <ul style="list-style-type: none"> (U) System development: IPS development consists of the efforts necessary to develop and demonstrate warfighting and cost reduction requirements, as well as related risk reduction for ship platform applications. (U) At Sea Testing: At Sea Testing of IPS subsystems and components will be conducted on the Trimaran Demonstrator developed and built under a US/UK cooperative Memorandum of Understanding (MOU) signed 3 September 1997. Initial testing on the Trimaran will focus on Naval Architectural and sea-keeping aspects of the Trimaran hull form. The Trimaran is being constructed initially with a commercial electric drive system as well as provisions for fitting IPS components. An opportunity for the US to backfit IPS components and conduct at sea testing is built into the MOU. 										

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Exhibit R-2a, RDT&E Project Justification		Date: February 1999
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/Budget Activity 4	PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/PE 0603513N	PROJECT NAME AND NUMBER: Integrated Power Systems (IPS)/32471

The US financial contribution to the MOU is also funded from this project. A contract for construction of the demonstrator was awarded in July, 1998. The efforts in this project support the at sea testing on the Trimaran Demonstrator.

- (U) Mission Load Interfaces: Studies have shown that significant opportunities exist to reduce the cost and improve the performance of combat and auxiliary systems by providing the type and quantity of power required directly to the user system. Traditional methods provide standard power and require individual users to perform multiple conversions and conditioning steps prior to use. The efforts in this project provide for initial studies, development, and testing.

1. (U) FY 1998 ACCOMPLISHMENTS:

- (U) (\$ 2.900) Continued Full Scale Advanced Development (FSAD) Land Based Engineering Site (LBES) site preparations including: completed INCO of generator/lube oil subsystems, power distribution and SSDS equipment; completed integration of engine/generator.
- (U) (\$11.760) Continued development of IPS including: Completed generator subsystem, and power distribution subsystems fabrication and factory acceptance testing (FAT); completed propulsion motor/converter subsystem fabrication; completed modifications to functional equivalent modules including ship service inverter modules, ship service converter modules and DC power supply; completed IPS power management code and test; completed FSAD Simulation/Stimulation (SIM/STIM) system integration and test; took delivery of generator and power distribution subsystems; conducted FSAD pre-LBES testing.
- (U) (\$ 2.900) Perform life cycle costing, producibility studies, manning studies, module development, systems integration, and architecture design and other IPS efforts.

2. (U) FY 1999 PLAN:

- (U) (\$26.627) Systems Development: Continue development of IPS. In conjunction with DD21 industry teams: develop IPS architecture concept options based on industry specific approaches to DD21 design; evaluate alternative ship's service distribution concepts to determine potential cost effective solutions for further development; and, begin combat systems interface studies to determine areas where combat system performance can be improved or where cost can be reduced by providing tailored power interfaces. Complete factory acceptance testing (FAT) of the propulsion motor/converter. Take delivery of Ship Service Distribution System (SSDS) equipment and propulsion motor/converter. Complete Installation and Checkout (INCO) of propulsion motor/converter. Complete integration of all advanced development equipment. Conduct advanced development testing at the Land Based Engineering Site at NSWC Philadelphia to: verify and characterize individual component performance; verify that system design requirements are met and validate design tools; verify that requirements for power quality are met throughout the advanced development system; characterize system interfaces for use in future performance/interface specifications; and validate the distributed control system architecture, system design, and performance; demonstrate various operational modes, incorporate multi workstation control and automated reconfiguration. Provide testing feedback to DD 21 design teams. Conduct an Early Operational Assessment (EOA) by COMOPTEVFOR.
- (U) (\$ 4.400) At Sea Testing: Note: At sea testing of IPS subsystems and components will be conducted on the Trimaran Demonstrator developed and built under a US/UK cooperative MOU. Begin system analysis, preliminary design; and, procurement of IPS hardware for Trimaran at sea demonstration.
- (U) (\$ 2.200) Mission Load Interfaces: Commence assessment of C4I electronic load interfaces. Commence development of variable speed drive motor controller for auxiliary applications. Commence development of direct current power supply to combat systems/survivability demonstration to show improved performance and potential to reduce combat system costs.

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Exhibit R-2a, RDT&E Project Justification		Date: February 1999
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/Budget Activity 4	PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/PE 0603513N	PROJECT NAME AND NUMBER: Integrated Power Systems (IPS)/32471

- (U) (\$0.702) Portion of extramural program is reserved for Small Business Innovative Research assessment in accordance with 15USC 638.

3. (U) FY 2000 PLAN:

- (U) (\$23.553) Systems Development: Continue IPS design, development, and integration including performance analysis and testing, modeling and simulation, life cycle cost analysis, producibility studies, manning studies, module development, ship integration, architecture design and related efforts. Continue support for DD 21 development and design efforts as well as support for other ship platforms. Continue advanced development testing at NSWC, Philadelphia PA, including controls and power management upgrades. Demonstrate the survivability and zonal isolation/fight through features of the advanced development system including replacing the reduced scale functional equivalent modules used for initial testing with full scale modules; demonstrate automated system reconfiguration and start up. Start acoustics testing of the IPS FSAD motor, LBES SSDS enhancements. Continue propulsion motor analysis using the reduced scale Laboratory Drive Motor.
- (U) (\$ 0.850) At Sea Testing: Note: At sea testing of IPS subsystems and components will be conducted on the Trimaran Demonstrator developed and built under a US/UK cooperative MOU. Begin detailed development and design of the Trimaran IPS configuration for at-sea testing. Begin development of IPS control system modifications for use during at sea testing.
- (U) (\$ 1.320) Mission Load Interfaces: Continue development of direct current power supply to combat systems/survivability demonstration to show improved performance and potential to reduce combat system costs. Continue development of variable speed drive motor controller for auxiliary applications.

B. (U) OTHER PROGRAM FUNDING SUMMARY:

COST (\$ in Millions)	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004	FY 2005	To Complete	Total Cost
SC-21 Total Ship Systems Engineering/PE 0604300N	58.548	125.964	162.056	250.719	259.629	255.326	283.413	271.857	Continuing	Continuing

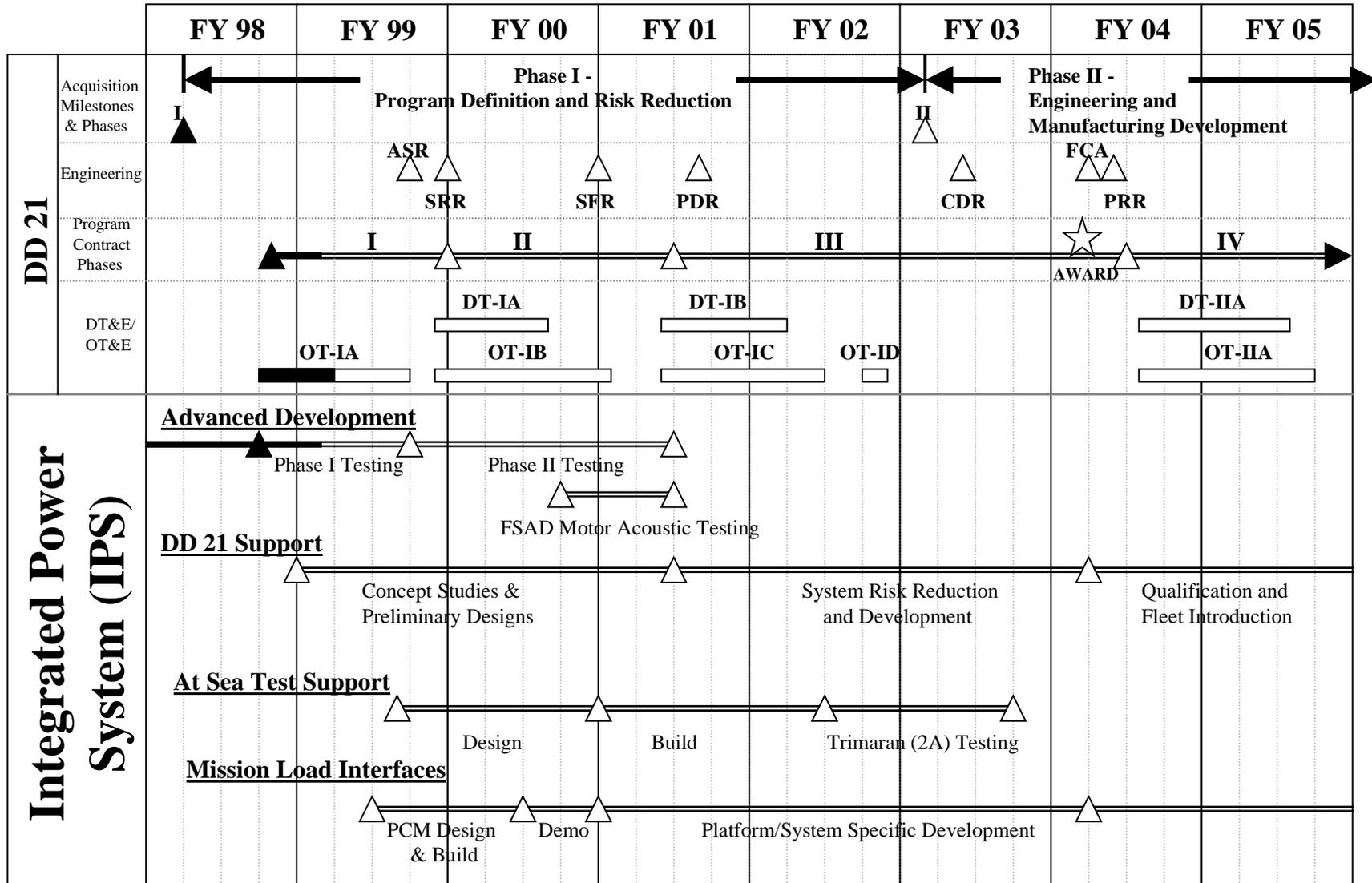
C. (U) ACQUISITION STRATEGY:

(U) IPS is a candidate system for DD-21 and all other future surface ships.

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Exhibit R-2a, RDT&E Project Justification		Date: February 1999
APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/Budget Activity 4	PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/PE 0603513N	PROJECT NAME AND NUMBER: Integrated Power Systems (IPS)/32471

D. (U) SCHEDULE PROFILE:



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Exhibit R-3, Cost Analysis (page 1)								Date: February 1999		
APPROPRIATION/BUDGET ACTIVITY:			PROGRAM ELEMENT NAME AND NUMBER:					PROJECT NAME AND NUMBER:		
RDT&E,N/ Budget Activity 4			Shipboard System Component Development/ PE0603513N					Integrated Power System (IPS)/32471		
Cost Categories (Tailor to WBS, or System/Item Requirements)	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY99 Cost	FY99 Award Date	FY00 Cost	FY00 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Primary Hardware Development	C/CPAF	Lockheed Martin Corp., Syracuse, NY	9.417	8.853	1QFY99	6.500	1QFY00	Continuing	Continuing	
	Section 845/804	DD21 Industry Teams	0	0.800	1QFY99	4.258	10/99	Continuing	Continuing	
	C/CPAF	DC Power Conversion Module	0	0	N/A	1.050	1QFY00	Continuing	Continuing	
	S/FFP	Trimaran – DERA,UK	0	0.200	2QFY99	0.250	1QFY00	Continuing	Continuing	
	C/CPAF	Power Systems Group Anaheim, CA	0.071	1.200	2QFY99	0.500	1QFY00	Continuing	Continuing	
	MISC	Contractors	1.089	2.882	1QFY99	1.040	1QFY00	Continuing	Continuing	
	MISC	Other Government Activities	0.002	0.200	1QFY99	0.100	1QFY00	Continuing	Continuing	
	WR	NSWC/A, MD	3.030	3.370	1QFY99	1.961	1QFY00	Continuing	Continuing	
	S/FFP	Power Systems Group Anaheim, CA	0	8.500	2QFY99	6.500	1QFY00	Continuing	Continuing	
TBD	Electric Drive Component Studies	0	2.500	2QFY99	0	N/A	Continuing	Continuing		
Award Fees	C/CPAF	Lockheed Martin Corp., Syracuse, NY	0.801	1.024	2QFY99	TBD		Continuing	Continuing	
Subtotal Product Development			14.410	29.529		22.223		Continuing	Continuing	
Remarks:										
Subtotal Support			0	0		0				
Remarks:										
Exhibit R-3, Cost Analysis (page 2)								Date: February 1999		

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APPROPRIATION/BUDGET ACTIVITY: RDT&E,N/ Budget Activity 4			PROGRAM ELEMENT NAME AND NUMBER: Shipboard System Component Development/ PE0603513N				PROJECT NAME AND NUMBER: Integrated Power System (IPS)/32471			
Cost Categories (Tailor to WBS, or System/Item Requirements)	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY99 Cost	FY99 Award Date	FY00 Cost	FY00 Award Date	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NSWC CD Philadelphia, PA	3.050	4.300	12/98	3.50	1QFY00	Continuing	Continuing	
Subtotal T&E			3.050	4.300		3.50		Continuing	Continuing	
Remarks:										
Miscellaneous	Various	Various	0.100	0.100	1QFY99	0	N/A	Continuing	Continuing	
Subtotal Management			0.100	0.100		0		Continuing	Continuing	
Remarks:										
Total Cost			17.560	33.929		25.723		Continuing	Continuing	
Remarks:										