Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Navy										DATE: February 2010	
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*				R-1 ITEM NOMENCLATURE PE 0603573N: *Advanced Surface Machinery Sys*							
COST ($ in Millions)	**FY 2009 Actual**	**FY 2010 Estimate**	**FY 2011 Base Estimate**	**FY 2011 OCO Estimate**	**FY 2011 Total Estimate**	**FY 2012 Estimate**	**FY 2013 Estimate**	**FY 2014 Estimate**	**FY 2015 Estimate**	**Cost To Complete**	**Total Cost**
Total Program Element	3.192	20.553	5.459	0.000	5.459	5.408	5.493	5.614	5.726	Continuing	Continuing
2471: *Integrated Power Systems (IPS)*	0.000	5.576	5.459	0.000	5.459	5.408	5.493	5.614	5.726	Continuing	Continuing
9999: *Congressional Adds*	3.192	14.977	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	32.740

A. Mission Description and Budget Item Justification

The Electric Ship Office (ESO) is responsible for developing and executing the Next Generation Integrated Power System (NGIPS) technology development and transition plan. The ESO's initial efforts are to coordinate the ongoing electric power efforts of the PEOs and Office of Naval Research, establishing the technical basis and strategic direction for Naval power system architectures, developing decision making tools, and establishing technical standards.

This PE funds the development of specific and future electric ship technologies for DDG 1000 and Future Surface Combatant (FSC) family of ships, with focus on the Integrated Power System (IPS), which provides total ship electric power, including electric propulsion, power conversion and distribution, and combat system and mission load interfaces to the electric power system.

The IPS budget, project 2471, is in PE 0603513N for FY2009.

Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Navy	DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 ITEM NOMENCLATURE** PE 0603573N: *Advanced Surface Machinery Sys*

B. Program Change Summary ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
Previous President's Budget	9.175	5.599	0.000	0.000	0.000
Current President's Budget	3.192	20.553	5.459	0.000	5.459
Total Adjustments	-5.983	14.954	5.459	0.000	5.459
• Congressional General Reductions		-0.086			
• Congressional Directed Reductions		0.000			
• Congressional Rescissions	0.000	0.000			
• Congressional Adds		15.040			
• Congressional Directed Transfers		0.000			
• Reprogrammings	0.000	0.000			
• SBIR/STTR Transfer	0.000	0.000			
• Program Adjustments	0.000	0.000	5.459	0.000	5.459
• Congressional Recision Adjustments	0.017	0.000	0.000	0.000	0.000
• Congressional Add Adjustments	-6.000	0.000	0.000	0.000	0.000

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2009	FY 2010
Project: 9999: *Congressional Adds*		
Congressional Add: *Fan Coil of the Future*	0.000	2.709
Congressional Add: *High Density Power Conversion and Distribution Equipment*	0.000	1.195
Congressional Add: *Surf Combatant Hybrid Propulsion/Power Generation*	0.000	6.373
Congressional Add: *Microdrive for Future HVAC Systems*	0.000	1.912
Congressional Add: *Next Gen Shipboard Int Pwr Fuel Efficiency Enhancer*	0.000	1.593
Congressional Add: *Integrated Advanced Ship Control (IASC)*	1.197	1.195
Congressional Add: *Ship Affordability Through Advanced Aluminum Struc*	1.995	0.000
Congressional Add Subtotals for Project: 9999	3.192	14.977
Congressional Add Totals for all Projects	3.192	14.977

Exhibit R-2, RDT&E Budget Item Justification: PB 2011 Navy	DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 ITEM NOMENCLATURE** PE 0603573N: *Advanced Surface Machinery Sys*

Change Summary Explanation

Program Adjustments: FY09 adjustments due to moving funding for the Congressional Add for Smart Machinery Spaces system to RDTEN PE 0603513N, Shipboard System Component Development, and moving funding for two Congressional Adds for Low Signature Modual Weapon Platform and Analytics for Shipboard Monitoring Systems to RDTEN 0603563N, Ship Concept Advance Design. FY10 adjustments are a result of FY10 Congressional Adds.

FY11 from previous President's Budget is shown as zero because no FY11-15 data was presented in President's Budget 2010.

Exhibit R-2A, RDT&E Project Justification: PB 2011 Navy			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	R-1 ITEM NOMENCLATURE PE 0603573N: *Advanced Surface Machinery Sys*	PROJECT 2471: *Integrated Power Systems (IPS)*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
2471: *Integrated Power Systems (IPS)*	0.000	5.576	5.459	0.000	5.459	5.408	5.493	5.614	5.726	Continuing	Continuing
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0		

A. Mission Description and Budget Item Justification

This project supports the Integrated Power Systems (IPS) program. IPS provides total ship electric power, including electric propulsion, and power conversion and distribution. The DDG 1000 will be an electric drive ship with integrated power architecture. IPS reduces acquisition and operating costs of naval ships and increases military effectiveness. IPS leverages investments in technologies that will be useable by both military and commercial sectors.

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 to 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.

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; 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; 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 less expensively than presently possible; and, reduced machinery system acquisition costs through utilization of commercially shared technologies and components.

The IPS budget, project 2471, is in PE 0603513 for FY2009.

B. Accomplishments/Planned Program ($ in Millions)

Exhibit R-2A, RDT&E Project Justification: PB 2011 Navy		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	R-1 ITEM NOMENCLATURE PE 0603573N: *Advanced Surface Machinery Sys*	PROJECT 2471: *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
IPS System Development	0.000	2.500	2.175	0.000	2.175
FY 2010 Plans: System Development: Continue to conduct detailed design and prototype fabrication of power conversion equipment for advanced architecture. Continue to improve baseline power system performance by performing analysis, modeling and simulation, life cycle cost analysis, producibility studies, module development, ship integration, architecture design, ship electric architectures and high power weapons systems requirements, and related efforts. Continue to evaluate emerging technologies for ship applications to determine future feasibility and development requirements. Emerging technologies include fuel cells, high-energy weapons, high power radars, and advanced power electronics.					
FY 2011 Base Plans: System Development: Continue to conduct detailed design and prototype fabrication of power conversion equipment for advanced architecture. Continue to improve baseline power system performance by performing analysis, modeling and simulation, life cycle cost analysis, producibility studies, module development, ship integration, architecture design, ship electric architectures and high power weapons systems requirements, and related efforts. Continue to evaluate emerging technologies for ship applications to determine future feasibility and development requirements. Emerging technologies include fuel cells, high-energy weapons, high power radars, and advanced power electronics.					
IPS System Test	0.000	2.926	3.134	0.000	3.134
FY 2010 Plans: System Test: Continue to conduct land based testing of power conversion equipment at NSWCCD, Philadelphia PA to mitigate potential risks associated with a fielded IPS system and reduce ship's signature, improve survivability and efficiency by fabricating components, inserting into the IPS test site or an appropriate test platform. Continue to conduct demonstrations to maintain and develop					

Exhibit R-2A, RDT&E Project Justification: PB 2011 Navy		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	R-1 ITEM NOMENCLATURE PE 0603573N: *Advanced Surface Machinery Sys*	PROJECT 2471: *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
the critical engineering capability and capacity to insert future high power weapon systems (radars, lasers and electromagnetic launch weapons) into DDG-1000 and future ship classes including FSC. Continue to conduct demonstrations to show improved performance and potential to reduce combat system costs. *FY 2011 Base Plans:* System Test: Continue to conduct land based testing of power conversion equipment at NSWCCD, Philadelphia PA to mitigate potential risks associated with a fielded IPS system and reduce ship's signature, improve survivability and efficiency by fabricating components, inserting into the IPS test site or an appropriate test platform. Continue to conduct demonstrations to maintain and develop the critical engineering capability and capacity to insert future high power weapon systems (radars, lasers and electromagnetic launch weapons) into DDG-1000 and future ship classes including FSC. Continue to conduct demonstrations to show improved performance and potential to reduce combat system costs.					
Platform Specific *FY 2010 Plans:* Platform Specific: Continue to develop IPS configurations in support of all future surface ship programs. Continue to develop / modify IPS ship configuration documentation including concepts of operations, System Level description / Requirements, and module performance specifications as necessary to support power system requirements for the DDG-51, FSC and other future ships. Continue to improve ship power system smart product model to support cost / performance tradeoffs of alternative IPS ship configurations and evaluation of emerging electric power system and component technologies. *FY 2011 Base Plans:* Platform Specific: Continue to develop IPS configurations in support of all future surface ship programs. Continue to develop / modify IPS ship configuration documentation including concepts	0.000	0.150	0.150	0.000	0.150

Exhibit R-2A, RDT&E Project Justification: PB 2011 Navy		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	R-1 ITEM NOMENCLATURE PE 0603573N: *Advanced Surface Machinery Sys*	PROJECT 2471: *Integrated Power Systems (IPS)*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010	FY 2011 Base	FY 2011 OCO	FY 2011 Total
of operations, System Level description / Requirements, and module performance specifications as necessary to support power system requirements for the DDG-51, FSC and other future ships. Continue to improve ship power system smart product model to support cost / performance tradeoffs of alternative IPS ship configurations and evaluation of emerging electric power system and component technologies.					
Accomplishments/Planned Programs Subtotals	0.000	5.576	5.459	0.000	5.459

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

IPS is a candidate system for DDG 1000, Future Surface Combatant (FSC), and all other future surface ships.

E. Performance Metrics

The Integrated Power System (IPS) project within the Electric Ships Office (ESO) will: mitigate 20% of Next Generation IPS (NGIPS) Technology Development Roadmap activities/risks; Address 20% of the relevant specs and standards written addressing components and subsystems on the NGIPS roadmap; Execute 100% of the signed Technology Transition Agreements with ONR; Complete 100% of the advanced developments currently planned for the Energy Storage Module and Propulsion Generation Module.

Exhibit R-3, RDT&E Project Cost Analysis: PB 2011 Navy		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	R-1 ITEM NOMENCLATURE PE 0603573N: *Advanced Surface Machinery Sys*	PROJECT 2471: *Integrated Power Systems (IPS)*

Product Development ($ in Millions)

				FY 2010		FY 2011 Base		FY 2011 OCO		FY 2011 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Total Prior Years Cost	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Primary HW Development	C/CPFF	Alion Science Corp Fairfax VA	4.925	1.000	Oct 2009	1.254	Oct 2010	0.000		1.254	0.000	7.179	Continuing
Primary HW Development	C/CPFF	Curtiss-Wright EMD Pittsburgh, PA	10.000	0.750	Oct 2009	0.000		0.000		0.000	0.000	10.750	Continuing
Primary HW Development	C/CPFF	Adv Pwr Elec TBD	0.000	0.250	Mar 2010	1.000	Oct 2010	0.000		1.000	0.000	1.250	Continuing
Primary HW Development	WR	NSWCCD-SSES Phila, PA	26.741	1.000	Oct 2009	1.000	Oct 2010	0.000		1.000	0.000	28.741	Continuing
		Subtotal	41.666	3.000		3.254		0.000		3.254	0.000	47.920	

Remarks

Test and Evaluation ($ in Millions)

				FY 2010		FY 2011 Base		FY 2011 OCO		FY 2011 Total			
Cost Category Item	Contract Method & Type	Performing Activity & Location	Total Prior Years Cost	Cost	Award Date	Cost	Award Date	Cost	Award Date	Cost	Cost To Complete	Total Cost	Target Value of Contract
Developmental Test & Evaluation	WR	NSWCCD-SSES Phila, PA	20.005	2.576	Oct 2009	2.205	Oct 2010	0.000		2.205	0.000	24.786	Continuing
		Subtotal	20.005	2.576		2.205		0.000		2.205	0.000	24.786	

Remarks

Exhibit R-3, RDT&E Project Cost Analysis: PB 2011 Navy			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	R-1 ITEM NOMENCLATURE PE 0603573N: *Advanced Surface Machinery Sys*	PROJECT 2471: *Integrated Power Systems (IPS)*	

	Total Prior Years Cost	FY 2010		FY 2011 Base		FY 2011 OCO		FY 2011 Total	Cost To Complete	Total Cost	Target Value of Contract
Project Cost Totals	61.671	5.576		5.459		0.000		5.459	0.000	72.706	

Remarks

Exhibit R-4, RDT&E Schedule Profile: PB 2011 Navy		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 ITEM NOMENCLATURE** PE 0603573N: *Advanced Surface Machinery Sys*	**PROJECT** 2471: *Integrated Power Systems (IPS)*

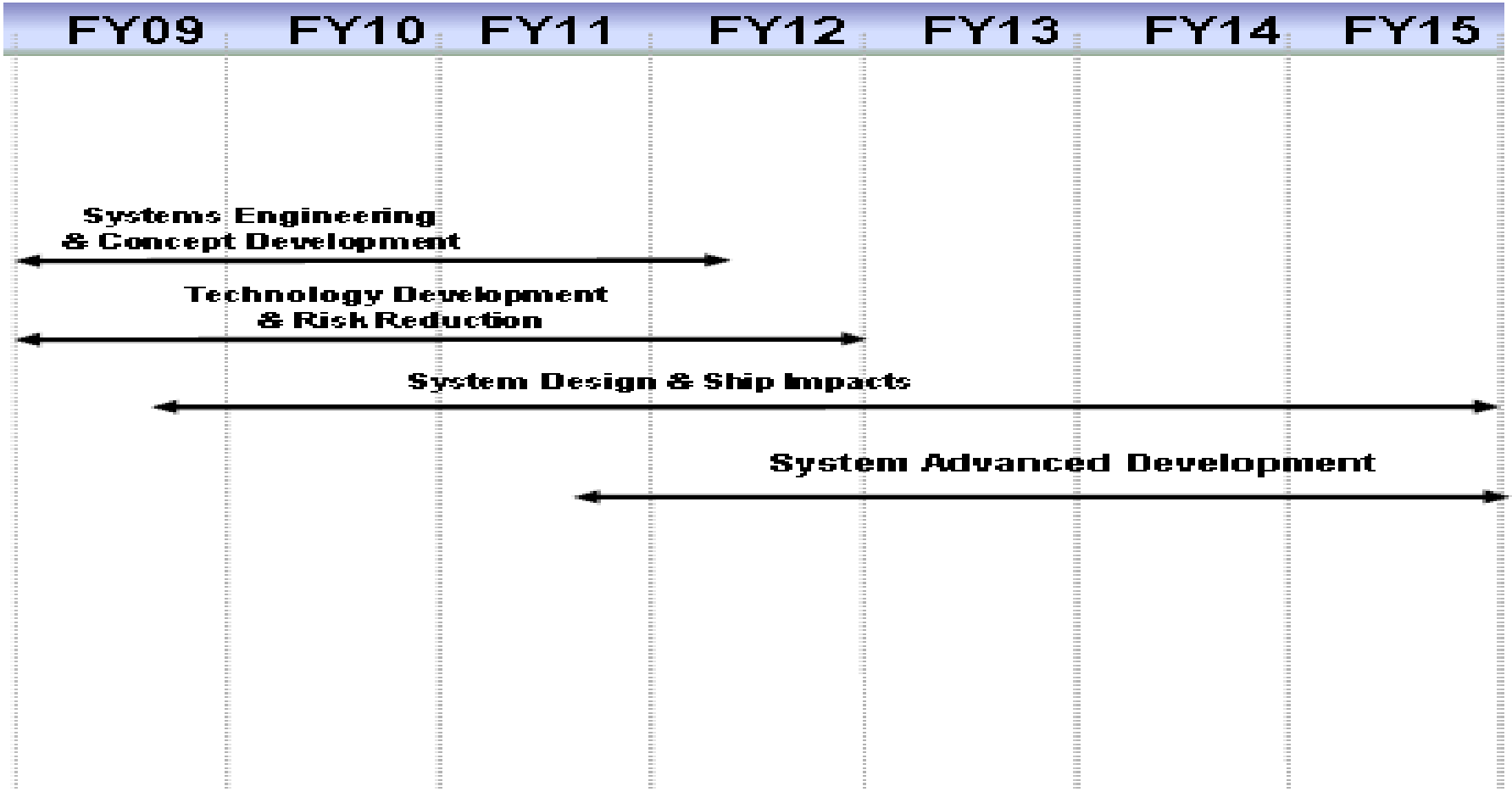

Exhibit R-4A, RDT&E Schedule Details: PB 2011 Navy		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 ITEM NOMENCLATURE** PE 0603573N: *Advanced Surface Machinery Sys*	**PROJECT** 2471: *Integrated Power Systems (IPS)*

Schedule Details

	Start		End	
Event	**Quarter**	**Year**	**Quarter**	**Year**
System Engineering & Concept Development	1	2009	2	2012
Technology Development & Risk Reduction	1	2009	4	2012
System Design & Ship Impact	3	2009	4	2015
System Advanced Development	3	2011	4	2015

Exhibit R-2A, RDT&E Project Justification: PB 2011 Navy			DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	R-1 ITEM NOMENCLATURE PE 0603573N: *Advanced Surface Machinery Sys*	PROJECT 9999: *Congressional Adds*	

COST ($ in Millions)	FY 2009 Actual	FY 2010 Estimate	FY 2011 Base Estimate	FY 2011 OCO Estimate	FY 2011 Total Estimate	FY 2012 Estimate	FY 2013 Estimate	FY 2014 Estimate	FY 2015 Estimate	Cost To Complete	Total Cost
9999: *Congressional Adds*	3.192	14.977	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	32.740
Quantity of RDT&E Articles	0	0	0	0	0	0	0	0	0		

A. Mission Description and Budget Item Justification

Congressional Adds

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010
Congressional Add: Fan Coil of the Future *FY 2010 Plans:* This project will create the Fan Coil Assemblies that will give the Navy 25-50% more cooling capacity, while also reducing weight by 25-50%, and lowering noise.	0.000	2.709
Congressional Add: High Density Power Conversion and Distribution Equipment *FY 2010 Plans:* High density power conversion and distribution equipment: Develop high density power conversion and distribution equipment to support the increased demand for electrical energy from new equipment and weapons systems. Conduct efforts associated with the increasing voltage and current requirements which require advances in switchboard design, current interruptions devices, and distribution systems. Conduct proof of concept and prototype development for new systems with the capacity to handle the increased electrical loading of naval surface ships.	0.000	1.195
Congressional Add: Surf Combatant Hybrid Propulsion/Power Generation	0.000	6.373

Exhibit R-2A, RDT&E Project Justification: PB 2011 Navy		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	R-1 ITEM NOMENCLATURE PE 0603573N: *Advanced Surface Machinery Sys*	PROJECT 9999: *Congressional Adds*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010
FY 2010 Plans: Surface Combatant Hybrid Propulsion/Power Generation: design, build and test a prototype Hybrid Electric Drive (HED) for surface combatants.		
Congressional Add: Microdrive for Future HVAC Systems *FY 2010 Plans:* This project will develop small, light, and cooler drive systems that can react smoothly to temperature variations. The new system will also be quieter, allowing these systems to be put in sections of the ship that are low noise spaces.	0.000	1.912
Congressional Add: Next Gen Shipboard Int Pwr Fuel Efficiency Enhancer *FY 2010 Plans:* Next Generation Shipboard Integrated Power Fuel Efficiency Enhancer: Continue development of advanced propulsion technologies to enhance fuel economy, lower acquisition costs, and reduce weight on United States Navy ships. Continue the development of Integrated Power System and Hybrid Electric Drive technologies for surface ship and submarine propulsion	0.000	1.593
Congressional Add: Integrated Advanced Ship Control (IASC) *FY 2009 Accomplishments:* Accomplished the initial technical enhancement which includes the standardization of hardware and software interfaces, evolving to a fully-open architecture configuration that will apply to all US Navy ships. The primary focus will be to standardize interconnecting interfaces. Software development that supports commonality across the US Navy fleet will be integrated into the system, in accordance with the common Navy data library of components, for graphical user interface (GUI) requirements. To	1.197	1.195

Exhibit R-2A, RDT&E Project Justification: PB 2011 Navy		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	R-1 ITEM NOMENCLATURE PE 0603573N: *Advanced Surface Machinery Sys*	PROJECT 9999: *Congressional Adds*

B. Accomplishments/Planned Program ($ in Millions)

	FY 2009	FY 2010
support system development, initial prototype and operational testing was accomplished in a land-based environment. *FY 2010 Plans:* Continue the technical enhancement which includes the standardization of hardware and software interfaces, evolving to a fully-open architecture configuration that will apply to all US Navy ships. The primary focus will be to standardize interconnecting interfaces. Software development that supports commonality across the US Navy fleet will be integrated into the system, in accordance with the common Navy data library of components, for graphical user interface (GUI) requirements. To support system development, initial prototype and operational testing was accomplished in a land-based environment.		
Congressional Add: Ship Affordability Through Advanced Aluminum Struc *FY 2009 Accomplishments:* Accomplished design optimization and developed tools to be used to identify specific needs and material solutions in defined thrust areas where validation is necessary to overcome technical barriers to the use of aluminum. These needs may include optimization of existing aluminum alloys and/or development of new aluminum alloys for enhanced corrosion resistance, development of manufacturing technologies to reduce cost and part count, and development of advanced joining technologies such as friction stir welding.	1.995	0.000
Congressional Adds Subtotals	3.192	14.977

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

Exhibit R-2A, RDT&E Project Justification: PB 2011 Navy		DATE: February 2010
APPROPRIATION/BUDGET ACTIVITY 1319: *Research, Development, Test & Evaluation, Navy* BA 4: *Advanced Component Development & Prototypes (ACD&P)*	**R-1 ITEM NOMENCLATURE** PE 0603573N: *Advanced Surface Machinery Sys*	**PROJECT** 9999: *Congressional Adds*

E. Performance Metrics

Congressional Adds