CLASSIFICATION:

EXHIBIT R-2, RDT&E Budget Item Justification							DATE: **January 2005**	
APPROPRIATION/BUDGET ACTIVITY **RESEARCH DEVELOPMENT TEST & EVALUATION, NAVY / BA-7**				R-1 ITEM NOMENCLATURE **PE 0101221N Strategic Sub & Wpns Sys Spt**				
COST ($ in Millions)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Total PE Cost*(total may or may not add due to rounding)	**59.2**	**89.9**	**90.0**	**89.4**	**93.1**	**93.3**	**94.9**	**97.1**
0004 TRIDENT Submarine System Improvement	4.0	7.4	3.0	2.9	3.0	3.0	3.1	3.2
2228 Technology Applications Program	55.2	82.5	87.0	86.5	90.1	90.3	91.8	93.9

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

The TRIDENT II (D5) Submarine Launched Ballistic Missile (SLBM) provides the U.S. a weapon system with greater accuracy and payload capability as compared to the TRIDENT I (C4) system. TRIDENT II enhances U.S. strategic deterrence providing a survivable sea-based system capable of engaging the full spectrum of potential targets with fewer submarines. This Program Element supports investigations into new technologies which would help mitigate the program impact due to component obsolescence and a rapidly decreasing manufacturing support base. These efforts include Reentry System Applications and Guidance System Applications, Radiation Hardened Electronics Applications, and Strategic Propulsion Applications. The TRIDENT Submarine System Improvement Program develops and integrates command and control Improvements needed to maintain TRIDENT Submarine operational capability through the life cycle of this vital strategic asset. The program conducts efforts needed to maintain strategic connectivity, ensure platform invulnerability, and reduce lifecycle costs through Obsolete Equipment Replacement (OER) and commonality.

R-1 SHOPPING LIST - Item No. 164

CLASSIFICATION:

EXHIBIT R-2a, RDT&E Project Justification							DATE: **February 2005**	
APPROPRIATION/BUDGET ACTIVITY **RDT&E, N / BA7**	PROGRAM ELEMENT NUMBER AND NAME **PE 0101221N Strategic Sub & Wpns Sys Spt**				PROJECT NUMBER AND NAME **0004 Trident Submarine Sys Imp**			
COST ($ in Millions)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Project Cost	**3.958**	**7.401**	**3.010**	**2.875**	**2.978**	**3.047**	**3.091**	**3.155**
RDT&E Articles Qty								

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:

The TRIDENT operational systems development program results in improvements to the baseline TRIDENT Combat System. Current TRIDENT Combat Systems were first developed in the early 1970s and are becoming increasingly difficult to maintain and offer comparitively less performance than more recently designed systems. Previous efforts to upgrade portions of the TRIDENT Combat System include improvements via sonar and combat control hardware and software (e.g., QE2 programs), feasibility of increased countermeasure capability and a concept evaluation of an Submarine Fleet Mission Program Library (SFMPL) interface. Due to the sensitivity of TRIDENT programs it is assessed that international technology will not have a major impact or be a recipient of the benefits derived from this effort. Development strategies will significantly enhance the sustainability and operability of the sonar, communications and Combat Control Systems on TRIDENTs by evaluating both Obsolete Equipment Replacement (OER) possibilities and potential improvements.

CLASSIFICATION:

EXHIBIT R-2a, RDT&E Project Justification		DATE: **February 2005**
APPROPRIATION/BUDGET ACTIVITY	PROGRAM ELEMENT NUMBER AND NAME	PROJECT NUMBER AND NAME
RDT&E, N / BA-7	**PE 0101221N Strategic Sub & Wpns Sys Spt**	**'0004 Trident Submarine Sys Imp**

B. Accomplishments/Planned Program

	FY 04	FY 05	FY 06	FY 07
Valve Regulated Lead Acid (VRLA) Batteries	2.500		0.000	0.000
RDT&E Articles Quantity				

Valve Regulated Lead Acid (VRLA) Batteries are sealed state-of-the-art technology that significantly reduces the maintenance involved with traditional flooded lead acid submarine batteries. VRLA eliminates the need for air agitation systems, battery make-up water additions, flash arrestors and charcoal filters. VRLA enables convenience charging, requires no special ventilation lineups, requires fewer environmental concerns and offers increased life up to 8 years. Most importantly, VRLA batteries also have many workload (quality of life) and cost reduction benefits. FY04 funds will be used to perform the initial VRLA cell design, battery well assessment studies, install and operate prototype battery cells, and develop ship alteration packages for all classes.

	FY 04	FY 05	FY 06	FY 07
Ship Control Station Obsolete Equipment Upgrade	0.094	2.020	2.434	0.000
RDT&E Articles Quantity				

In order to support the expected 42-year operational cycle for a TRIDENT submarine a Ship Control Station (SCS) and Obsolete Equipment Replacement programs needs to be instituted. The OER program will attempt to utilize the design changes that are being developed for the VIRGINIA Class SCS Hull, Mechanical and Electrical (HM&E) interfaces. The replacement SCS will utilize commercial off the shelf components and will replace existing hardware wired displays and indications with flat panel displays and indications.

	FY 04	FY 05	FY 06	FY 07
Architecture Model Maintenance & COTS	0.371	0.677	0.576	0.687
RDT&E Articles Quantity				

Conduct COTS/emergent technology and CCS performance requirements evaluations supporting Trident modernization program/plans. Research and evaluate effectiveness of proposed new technology over the ships' life cycle. Analyze impacts on platform performance with proposed new technology changes using architecture models and tests. Study and identify options in selecting and installing new technology improvements. Evaluate Navigation data interface requirements to meet ECDIS-N compliance on Trident hulls. Complete CCC CONOPS study to accommodate Revision 7.3 (MK2 ECP4) installation. Provide arrangement layouts GFI to Electric Boat (EB) Ship Design Agent (SDA).

CLASSIFICATION:

EXHIBIT R-2a, RDT&E Project Justification		DATE: **February 2005**
APPROPRIATION/BUDGET ACTIVITY	PROGRAM ELEMENT NUMBER AND NAME	PROJECT NUMBER AND NAME
RDT&E, N / BA-7	**PE 0101221N Strategic Sub & Wpns Sys Spt**	**'0004 Trident Submarine Sys Imp**

B. Accomplishments/Planned Program (Cont.)

	FY 04	FY 05	FY 06	FY 07
TRIDENT Unique Obsolete Equipment Replacement (OER)	0.000	0.000	0.000	2.188
RDT&E Articles Quantity				

The TRIDENT Command and Control System (CCS) will continue to evolve during its extended service life. The driving factors that have, and will continue to influence the direction in which it will evolve include submarine fleet commonality, Commercial Off the Shelf (COTS) insertion, technology refresh/Planned Program Performance Improvements (P3I), network-centric architecture vice legacy point-to-point interfaces, and Obsolete Equipment Replacement (OER) needs. Given the extended life-span of the platform, the OER driver becomes inescapable, and the way associated CCS renovations will be managed must reflect the balance of the aforementioned drivers. To facilitate the replacement and enhancement of the TRIDENT CCS legacy subsystems, the CCS Renovations task will evaluate potential areas of renovation, and to identify a phased evolutionary approach that facilitates TRIDENT out-year planning and include the following activities:

Continue analysis of the physical requirements and characteristics of OER items, including the satisfaction of redundancy, high availability, survivability and out-year maintainability requirements.

Analyze and recommend applicable COTS hardware and software items, and the identification of any developmental items required for the completion of the final product as well as technical refresh of existing products.

Identify design options for centralized system anomaly, fault and failure data gathering and analysis.
Identify design options to better meet high availability and data throughput requirements levied by the processing of mission critical data as well as total system statusing and alarming in a net-centric environment, including the provision for a remote HMI capability in critical spaces to facilitate complete status monitoring and fault isolation capabilities.

Analyze networked architectures embraced by non-TRIDENT platforms for applicability.
Analyze design and component capture potential from other platforms and maximize commonality with proposed architectures.

Continue to conduct system engineering working group meetings to facilitate a plan to migrate away from the UYK-43 computer. This includes analysis of existing legacy subsystem requirements and the determination of applicability to future SSBN/SSGN design as well as identification of legacy functionality that may be accommodated by the DPS Workstation designs.

CLASSIFICATION:

EXHIBIT R-2a, RDT&E Project Justification		DATE: **February 2005**
APPROPRIATION/BUDGET ACTIVITY	PROGRAM ELEMENT NUMBER AND NAME	PROJECT NUMBER AND NAME
RDT&E, N / BA-7	**PE 0101221N Strategic Sub & Wpns Sys Spt**	**'0004 Trident Submarine Sys Imp**

B. Accomplishments/Planned Program

	FY 04	FY 05	FY 06	FY 07
Thin Plate Lead Acid Battery	1.000	4.704	0.000	0.000
RDT&E Articles Quantity				

Thin Plate Pure Lead Batteries - Submarine main storage batteries are the primary back-up source of power for nuclear submarines. Thin Plate Pure Lead technology (TPPL) is designed to improve the efficiency of the chemical reaction that occurs on the plates of batteries. Hence, incorporating TPPL technology into submarine batteries could significantly increase the achievable energy, power density and life of future submarine batteries. This effort would attempt to scale up the current TPPL product to a size suitable for use in submarine main storage batteries. It is possible that by coupling TPPL plates with VRLA battery technology, the Navy could further increase the energy, power density and life of VRLA submarine main storage batteries. The increase in battery life could result in a commensurate reduction in life cycle cost.

	FY 04	FY 05	FY 06	FY 07
RDT&E Articles Quantity				

	FY 04	FY 05	FY 06	FY 07
RDT&E Articles Quantity				

CLASSIFICATION:

EXHIBIT R-2a, RDT&E Project Justification		DATE: **February 2005**
APPROPRIATION/BUDGET ACTIVITY	PROGRAM ELEMENT NUMBER AND NAME	PROJECT NUMBER AND NAME
RDT&E, N / BA-7	**PE 0101221N Strategic Sub & Wpns Sys Spt**	**'0004 Trident Submarine Sys Imp**

C. PROGRAM CHANGE SUMMARY:

Funding:	FY 2004	FY 2005	FY 2006	FY 2007
FY05 President's Budget:	3.966	2.569	3.468	3.349
FY06/07 President's Budget	3.958	7.401	3.01	2.875
Total Adjustments	-0.008	4.832	-0.458	-0.474
Summary of Adjustments				
Congressional undistributed reductions	-0.001	-0.068		
Programmatic adjusments			-0.458	-0.474
Cancelled Accounts	-0.007			
Congressional increase Thin Plate		4.900		
Inflation Savings				
Subtotal	-0.008	4.832	-0.458	-0.474

Schedule:

FY04 (4th Qtr) - Cell Qualification Testing
FY05 (2nd QTR) - Certification / IOC

Technical:

Not Applicable

CLASSIFICATION:

EXHIBIT R-2a, RDT&E Project Justification		DATE: **February 2005**
APPROPRIATION/BUDGET ACTIVITY	PROGRAM ELEMENT NUMBER AND NAME	PROJECT NUMBER AND NAME
RDT&E, N / BA-7	**PE 0101221N Strategic Sub & Wpns Sys Spt**	**'0004 Trident Submarine Sys Imp**

D. OTHER PROGRAM FUNDING SUMMARY:

Line Item No. & Name	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	To Complete	Total Cost
267600 / 267606 BA2 OPN (Electronics)	7219	5233	3285	3890	4019	4109	4248	4364	0	36367
095000 BA1 (HM&E)	20416	15712	11024	16808	10445	14281	16492	16977	0	122155
094500 / 094505 BA1 (Batteries)	13889	25927	26575	34075	41059	34488	32267	30207	0	238487

E. ACQUISITION STRATEGY:

VRLA Battery - The Type Commanders (TYCOMs) establish battery replacement schedules based on battery performance and maintenance availability. Beginning in FY05, NAVSEA intends to shift procurement from flooded batteries to VRLA. In FY06, the only replacement batteries available will be VRLA; thus the SHIPALT must be accomplished to support installations beginning in FY06.

Ship Control Station - The proposed architecture will consist of the following hardware components. Ship Control Panel (SCP), Ballast Control Panel (BCP), Remote Interface Controller (RIC), Remote Interface Box (RIB). The SCP will be modified be removing the existing panels and replacing them with the flat panel display that provide the operator controls and indications needed to control all plane surfaces. The existing emergency hydraulic control will be maintained.

F. MAJOR PERFORMERS:

VRLA Batteries - NSWC Crane, In: Development engineering and test support.
GNB, Fort Smith, Arkansas: Battery cell design/development.
General Dynamics Electric Boat, Groton, Connecticut: Ship alteration package design/development.
Northrop Grumman Newport News, Newport News, VA: Ship alteration package design/development.
Ship Control Station - Electric Boat, NSWC Carderock
Thin Plate Pure Lead Battery - NSWC Crane

CLASSIFICATION:

Exhibit R-3 Cost Analysis (page 1) | DATE: **February 2005**

APPROPRIATION/BUDGET ACTIVITY: **RDT&E, N / BA-7** | PROGRAM ELEMENT: **PE 0101221N Strategic Sub & Wpns Sys Spt** | PROJECT NUMBER AND NAME: **'0004 Trident Submarine Sys Imp**

Cost Categories	Contract Method & Type	Performing Activity & Location	Total PY s Cost	FY 04 Cost	FY 04 Award Date	FY 05 Cost	FY 05 Award Date	FY 06 Cost	FY 06 Award Date	Cost to Complete	Total Cost	Target Value of Contract
											0.000	
											0.000	
Design/Development Engineering	SS/CPFF	Electric Boat, Groton, CT	0.800	0.094	01/04	1.900	N/A	2.434	01/06	0.000	5.228	3.415
Design/Development Engineering	SS/CPFF	NG NNEWS, VA	1.270	0.000	01/04	0.000	N/A	0.000	N/A	0.000	1.270	1.270
Design/Development Engineering	SS/PD	SUPSHIP Groton, CT	0.500	1.054	03/04	0.000	N/A	0.000	N/A	0.000	1.554	1.554
Developmental Test & Evaluation	SS/WR	NSWC CRANE, IN	1.430	2.446	03/04	4.704	N/A	0.000	N/A	0.000	8.580	3.876
Design/Development Engineering	SS/WR	NSWC Carderock, MD	0.000	0.000	01/04	0.120	01/05	0.000	N/A	0.000	0.120	2.020
Design/Development Engineering	SS/WR	NUWC Newport, RI	0.480	0.364	01/04	0.677	01/05	0.576	01/06	0.000	2.097	1.976
Developmental Test & Evaluation	SS/WR	NUWC Newport, RI	0.723	0.000	01/00	0.000				0.000	0.723	0.723
											0.000	
Subtotal Product Development			5.203	3.958		7.401		3.010		0.000	19.572	

Remarks: NSWC Crane - Funds will be used to perform the initial VRLA cell design, battery well assessment studies and develop the prototype battery.

											0.000	
											0.000	
											0.000	
											0.000	
											0.000	
											0.000	
											0.000	
											0.000	
Subtotal Support			0.000	0.000		0.000		0.000		0.000	0.000	

Remarks:

R-1 SHOPPING LIST - Item No. 164

CLASSIFICATION:

Exhibit R-3 Cost Analysis (page 2)										DATE: **February 2005**		
APPROPRIATION/BUDGET ACTIVITY **RDT&E, N / BA-7**			PROGRAM ELEMENT **PE 0101221N Strategic Sub & Wpns Sys Spt**			PROJECT NUMBER AND NAME **'0004 Trident Submarine Sys Imp**						
Cost Categories	Contract Method & Type	Performing Activity & Location	Total PY s Cost	FY 04 Cost	FY 04 Award Date	FY 05 Cost	FY 05 Award Date	FY 06 Cost	FY 06 Award Date	Cost to Complete	Total Cost	Target Value of Contract
											0.000	
											0.000	
											0.000	
											0.000	
											0.000	
											0.000	
											0.000	
Subtotal T&E			0.000	0.000		0.000		0.000		0.000	0.000	
											0.000	
											0.000	
											0.000	
											0.000	
											0.000	
											0.000	
Subtotal Management			0.000	0.000		0.000		0.000		0.000	0.000	
Total Cost			5.203	3.958		7.401		3.010		0.000	19.572	

Remarks:

R-1 SHOPPING LIST - Item No. 164

CLASSIFICATION:

EXHIBIT R4, Schedule Profile

DATE: **February 2005**

APPROPRIATION/BUDGET ACTIVITY
RDT&E, N / BA-7

PROGRAM ELEMENT NUMBER AND NAME
PE 0101221N Strategic Sub & Wpns Sys Spt

PROJECT NUMBER AND NAME
'0004 Trident Submarine Sys VRLA/Thin Plate

Fiscal Year	2004				2005				2006				2007				2008				2009				2010				2011			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestones								IOC																								
			Complete																													
VRLA Battery Development																																
ShipAlt Development (Three ShipAts)		Start					Complete																									
VRLA Battery Procurments (OPN/SCN Funded)							Start							VRLA Procurement trhough the FYDP to support ShipAlt Installation in all submarines																			
VRLA ShipAlt Installation (OPN/SCN Funded)								Start							Installation goes trhough the FYDP to support ShipAlt Installation in all submarines																	
VRLA Battery Technology Enhancement **(Thin Plate Technology)**																																

R-1 SHOPPING LIST - Item No. 164

* Not required for Budget Activities 1, 2, 3, and 6

CLASSIFICATION:

EXHIBIT R4, Schedule Profile																													DATE: **February 2005**			
APPROPRIATION/BUDGET ACTIVITY **RDT&E, N / BA-7**									PROGRAM ELEMENT NUMBER AND NAME PE 0101221N Strategic Sub & Wpns Sys Sp **Architecture Model Maintenance & COTS**												PROJECT NUMBER AND NAME '0004 Trident Submarine Sys Imp UYK 43/TSDC											
Fiscal Year	2004				2005				2006				2007				2008				2009				2010				2011			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
CCS Legacy System Renovation																																
UYK-43 OER					Requirement Definition																											
TSDC OER					Requirement Definition																											
IC/TACNAV									Requirement Definition																							
SIM/STIM									Requirement Definition																							
SONAR/CC (Tech Refresh)					Problem Definition				Requirement Definition																							
Information Assurance					Requirement Definition																											

R-1 SHOPPING LIST - Item No. 164

* Not required for Budget Activities 1, 2, 3, and 6

CLASSIFICATION:

EXHIBIT R4, Schedule Profile

DATE: **February 2005**

APPROPRIATION/BUDGET ACTIVITY: **RDT&E, N / BA-7**

PROGRAM ELEMENT NUMBER AND NAME: PE 0101221N Strategic Sub & Wpns Sys Spt

PROJECT NUMBER AND NAME: '0004 Trident Submarine Sys Imp SCR OER

Fiscal Year	2004				2005				2006				2007				2008				2009				2010				2011			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Acquisition Milestones																																
SCS OER Development			Start													Complete																
System Development Plan																																
Define HM&E Interfaces																																
Define Hardware and Arrangements																																
Preliminary System Specifications																																
Preliminary Design Review (PDR)																																
Detailed Design																																
Critical Design Review (CDR)																																
ShipAlt Development (Eighteen ShipAts)									Start															Complete								
SCS Hardware Procurements (OPN Funded)													Start	Ship Contro Station hardware Procurement trhough the FYDP to support ShipAlt Installation in all submarines																	
SCS Hardware Installation (OPN Funded)																	Start	Installation goes trhough the FYDP to support ShipAlt Installation in all submarines													

R-1 SHOPPING LIST - Item No. 164

CLASSIFICATION:

Exhibit R-4a, Schedule Detail						DATE: **February 2005**		
APPROPRIATION/BUDGET ACTIVITY **RDT&E, N / BA-7**	PROGRAM ELEMENT PE 0101221N Strategic Sub & Wpns Sys Spt				PROJECT NUMBER AND NAME '0004 Trident Submarine Sys Imp			
Schedule Profile	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
VRLA Battery Development	3Q							
Start VRLA ShipAt Development (Non RDT&E)	2Q							
Complete VRLA Ship Development (Non RDT&E)		4Q						
Start VRLA Battery Procurement (OPN/SCN)		2Q						
VRLA Battery Procurements (OPN/SCN)			1Q- 4Q	1Q- 4Q	1Q- 4Q	1Q- 4Q	1Q- 4Q	1Q- 4Q
Start VRLA Battery Installation (OPN/SCN)		4Q						
VRLA Battery ShipALT Installations			1Q- 4Q	1Q- 4Q	1Q- 4Q	1Q- 4Q	1Q- 4Q	1Q- 4Q
VRLA Battery Technology Enhancements **(Thin Plate)**	2Q							
Prototype Development UYK-43 Replacement Design/Development			1Q-4Q	1Q-4Q				
SCAP								
MS								
SONAR								
TSDC Replacement Design/Development					1Q-4Q	1Q-4Q		
SHIP CONTROL STATION OBSOL EQUIP REP								
Prototype T&E HW/SW Evaluation							1Q-4Q	1Q-4Q
Develop System Develoment Plan	4Q							
Define Electrical and Mechanical System Interfaces		1Q						
Develop Concept Architecture and Arrangement		1Q						
Develop Preliminary System Segment Design Document (SSDD)		1Q,2Q,3Q						
Develop Preliminary System Descriptions		4Q						
Develop Program Cost Estimate and Schedule		4Q						
Develop System Segment Detailed Design		4Q	1Q,2Q					
Identify Component Specifications		4Q	1Q					
Develop Hardware Design			2Q,3Q					
Develop Shipboard Design Changes			4Q					
Develop Software Requirements Specification		2Q,3Q,4Q						
Develop Software Detail Design			1Q,2Q,3Q,4Q					

R-1 SHOPPING LIST - Item No. 164

CLASSIFICATION:

EXHIBIT R-2a, RDT&E Project Justification	DATE: **January 2005**
APPROPRIATION/BUDGET ACTIVITY **RESEARCH DEVELOPMENT TEST & EVALUATION, NAVY / BA-7**	PROJECT NUMBER AND NAME **Technology Applications 2228**

COST ($ in Millions)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Project Cost 2228 Technology Applications	**55.2**	**82.5**	**87.0**	**86.5**	**90.1**	**90.3**	**91.8**	**93.9**
RDT&E Articles Qty								

A. (U) MISSION DESCRIPTION AND BUDGET PROJECT JUSTIFICATION:

This project supports implementation of a coordinated Navy/Air Force Reentry System Applications Program (RSAP), a coordinated Navy/Air Force Strategic Guidance Applications Program (GAP), a coordinated Navy/Air Force Strategic Propulsion Applications Program (SPAP), and a coordinated Department of Defense Radiation Hardened Applications Program (RHAP). Reentry vehicle and guidance technology had been rapidly eroding beyond the point of being capable to respond to increasing aging phenomena and future requirements. The SPAP program, which commenced in FY 2004, demonstrates and validates technologies unique to strategic missile applications. The RHAP program, which commenced in FY 2004, addresses production, qualification and manufacturing issues associated with strategic and space radiation hardened electronics. The December 2001 DOD Nuclear Posture Review determined that infrastructure is a critical part of the new triad and these efforts form part of the infrastructure that supports the nuclear force structure.

• The RSAP program, through sustainment of the reentry vehicle technology base, will maintain confidence in the dependability and reliability of strategic SLBM and ICBM weapon systems over the long term when no new systems will be in development. Critical and unique attributes necessary for the design, development and in-service support of current and modernized SLBM reentry systems have been defined and will be maintained to insure a functioning readiness application technical capability in reentry is preserved. Working closely with the Air Force, Navy and Air Force requirements have been integrated into a comprehensive program. The program maintains close coordination with the DOD Science and Technology (S&T) community in order to: leverage S&T programs, ensure system driven technology base requirements are considered in contract awards, eliminate duplication of effort and provide an opportunity to demonstrate appropriate emerging technologies through a reentry flight test evaluation process.

• The GAP program provides a minimum strategic guidance core technology development capability consistent with the Strategic Advisory Group (SAG) recommendations to COMSTRATCOM. The SAG recommended that SSP establish a program which preserves this critical design and development core. It is a basic bridge program which develops critical guidance technology applicable to any of the existing Air Force/Navy strategic missiles. The objective is to transition from current capability to a long term readiness status required to support deployed systems. Air Force and Navy guidance technology requirements are integrated and needs prioritized. Efforts are focused on alternatives to technologies identified as system "weak links." Current system accuracy and functionality depends upon key technologies which provide radiation hardened velocity, attitude and stellar sensing capabilities. As the underlying technologies that currently provide these capabilities age and are no longer technically supportable, modern alternatives must be made available in order to allow for orderly replacement. There is no commercial market for these technologies and their viability depends on the strategic community.

• The SPAP program is a coordinated Navy/Air Force effort and addresses infrastructure needs by exercising critical developmental skills to allow for future large-scale rocket motor test firings. A sound base of demonstrated technologies suitable for Strategic Missile applications will be maintained and will provide the nation a talent base and source of technologies suitable for a follow-on development program. Boost propulsion (missile stages), post boost propulsion (missile payload delivery vehicle) and Ordnance (separation events and flight termination events) are all integral parts of missile propulsion application efforts.

• The RHAP program sustains critical skills in radiation hardened electronics by advancing radiation hardened simulation technologies to reflect the processes in future systems. These efforts become of greater importance because of the shrinking industrial base for radiation hardened electronics, the unavailability of underground testing resources, and the loss of radiation hardened expertise. These efforts are coordinated by the Radiation Hardened Oversight Council (RHOC) chaired by the Director, Defense Research & Engineering (DDR&E). The RHAP program focuses on a coordinated Productization & Qualification Program which provides a transition between Science and Technology (S&T) and production by efficient utilization of limited resources, sharing of information to eliminate redundancy, increased use of common part/technologies, coordination into the RHOC technology road map and implementation of the USD (AT&L) investment strategy. The RHAP compliments the GAP electronic part activities by specifically focusing on those tasks required to ensure producability of radiation hardened parts.

EXHIBIT R-2a, RDT&E Project Justification	DATE: January 2005
APPROPRIATION/BUDGET ACTIVITY **RESEARCH DEVELOPMENT TEST & EVALUATION, NAVY / BA-7**	PROJECT NUMBER AND NAME **Technology Applications 2228**

B. (U) Accomplishments/Planned Program

	FY 04	FY 05	FY 06	FY 07
Reentry Systems Application Program (RSAP)	19.7	25.9	26.6	27.0
RDT&E Articles Quantity				

(U) FY 2004 PLAN

- (U) ($19.7) Continued Reentry System Applications Program. Full obligation is complete.
  FY 2004 efforts include:
  - (U) Continued to maintain the current capability and implement planned service life extension of Navy reentry systems.
  - (U) Assessed data relating to aging trends to establish the impact on system performance and address any effects on the extended service of the deployed systems. Plan and execute test programs for the evaluation of aging effects and the development of predictive methodologies to mitigate the risks associated with aging mechanisms and the planned extended service of the deployed Navy reentry systems.
  - (U) Continued with the development, test, and assessment of replacement heatshield, nosetip, and aft closure materials for use on reentry systems, including those available from Science and Technology (S&T). Make recommendations for improved material thermal protection concepts and test techniques.
  - (U) Continued development of low-cost design approach and components for Arming and Fuzing applications.
  - (U) Assess, integrate, and test reentry system instrumentation, including software and hardware development for avionics computer, GPS, and inertial sensor technology.
  - (U) Maintained the RSAP technical program plan, and conduct system assessments as required.
  - (U) Continued development and improvement of analytical models and techniques for predicting reentry body and components response to stressing environments.
  - (U) Improved methods of assessing the vulnerability and hardness of reentry systems in the absence of underground testing (UGT).

(U) FY 2005 PLAN

- (U) ($25.9) Continue Reentry System Applications Program. Full obligation is projected by the 3rd quarter of the first year.
  FY 2005 efforts include:
  - (U) Maintain the current capability and support the planned service life extension of Navy reentry systems.
  - (U) Continue development and ground testing of reentry vehicle candidate heatshield and nosetip materials including those available from Science & Technology (S&T).
  - (U) Characterize and develop alternate low-cost heatshield and replacement nosetip material.
  - (U) Conduct a ground and flight test program to assess performance of reentry components exposed to operational environments beyond their design life; complete evaluation of ground test results; flight test repackaged components for risk mitigation.
  - (U) Initiate fabrication of RB inertial sensor flight test instrumentation for FY 2006 flight test.
  - (U) Maintain RSAP technical program plan, conduct system assessments and continue Vulnerability & Hardening certification process development in absence of Nuclear Under Ground Testing (UGT) facilities.
  - (U) Continue Reentry Body material development and advanced flight test instrumentation activities.
  - (U) Begin development of radiation hardened processor for advanced GPS receiver.
  - (U) Initiate feasibility study of the use of Terminal Fix Sensors (TFS) for target area trajectory correction
  - (U) Ground test advanced reentry material systems
  - (U) Initiate development of low cost replacement In Flight Disconnect (IFD) connector for the MK4A Reentry system
  - (U) Initiate development of optimized Reentry Body separation system
  - (U) Develop advanced avionics computer for new engineering instrumentation package.
  - (V)

CLASSIFICATION:

EXHIBIT R-2a, RDT&E Project Justification	DATE: **January 2005**
APPROPRIATION/BUDGET ACTIVITY **RESEARCH DEVELOPMENT TEST & EVALUATION, NAVY / BA-7**	PROJECT NUMBER AND NAME **Technology Applications 2228**

B. (U) Accomplishments/Planned Program (Continued)

(U) FY 2006 PLAN

- (U) ($26.6) Continue Reentry System Applications Program. Full obligation is projected by the 3rd quarter of the first year.
  FY 2006 efforts include:
  - (U) Maintain the current capability and support the planned service life extension of Navy reentry systems.
  - (U) Continue development and ground testing of reentry vehicle candidate heatshield and nosetip materials including those available from Science & Technology (S&T).
  - (U) Flight test alternate low-cost heatshield and replacement nosetip material.
  - (U) Flight test operationally aged heatshields to support aging trends and replacement materials assessments
  - (U) Complete development and flight test advanced reentry instrumentation such as inertial sensor and avionics computer, encapsulated on the updated engineering instrumentation package
  - (U) Maintain RSAP technical program plan, conduct system assessments and continue Vulnerability & Hardening certification process development in absence of Nuclear Under Ground Testing (UGT) facilities.
  - (U) Continue Reentry Body material development and advanced flight test instrumentation activities
  - (U) Continue development of advanced GPS receiver
  - (U) Ground test advanced reentry material systems and advanced instrumentation components
  - (U) Develop test instrumentation to demonstrate D5LE missile reentry body interface compatibility
  - (U) Continue development of low cost replacement In Flight Disconnect (IFD) connector for the MK4A Reentry system
  - (U) Continue development of optimized Reentry Body separation system

(U) FY 2007 PLAN

- (U) ($27.0) Continue Reentry System Applications Program. Full obligation is projected by the 3rd quarter of the first year.
  FY 2007 efforts include:
  - (U) Maintain the current capability and support the planned service life extension of Navy reentry systems.
  - (U) Continue development of reentry vehicle replacement heatshield and nosetip materials and tooling
  - (U) Conduct aging assessment update for reentry vehicle materials and their replacements
  - (U) Develop low cost replacement materials using new/improved materials and processes for flight test experimentation.
  - (U) Develop appropriate flight test plan and initiate activities to test improved in-flight instrumentation data transfer
  - (U) Flight test and evaluate the Mk4A advanced engineering instrumentation package
  - (U) Maintain RSAP technical program plan, conduct system assessments and continue Vulnerability & Hardening certification process development in absence of Nuclear Under Ground Testing (UGT) facilities.
  - (U) Continue Reentry Body material development and advanced flight test instrumentation activities
  - (U) Continue development of test instrumentation to demonstrate D5LE missile reentry body interface compatibility
  - (U) Final development of advanced GPS receiver and integrate for flight test demonstration
  - (U) Continue ground testing of advanced instrumentation components

EXHIBIT R-2a, RDT&E Project Justification	DATE: **January 2005**
APPROPRIATION/BUDGET ACTIVITY **RESEARCH DEVELOPMENT TEST & EVALUATION, NAVY / BA-7**	PROJECT NUMBER AND NAME **Technology Applications 2228**

	FY 04	FY 05	FY 06	FY 07
Guidance Application Program (GAP)	17.5	20.5	21.0	21.4
RDT&E Articles Quantity				

(U) FY 2004 PLAN

- (U) ($17.5) Continued Strategic Guidance Applications Programs (GAP). Full obligation is complete.
  FY 2004 efforts include:
  - (U) Continued to develop alternate models for incorporation in Integrated Engineering Environment (IEE) and Hardware in the Loop (HWIL). Incorporate alternate sensor technologies into virtual system and HWIL. Utilize IEE/HWIL capability to perform system architecture/design tradeoffs in support of technology down select in FY 2006 for D5 Life Extension.
  - (U) Continued to evaluate high risk/high payoff sensor technologies (accelerometer, gyro, and stellar) and proximity electronics for application in the D5 Life Extension Guidance system and/or replacement of system weak links. Continue prototype radiation hard sensor build and test.
  - (U) Invested in non-volatile non-destructive memory development to meet MK6 Life Extension memory goals
  - (U) (Sensors) Designed, built, and evaluated Silicon Oscillator Accelerometer (SOA) support electronics and improved build processes. Prove SOA capability to meet Rad-hard strategic goals
  - (U) (GYRO) Built 8 gyros focused on improved dynamic and radiation margin in support of Life Extension.
  - (U) (GYRO) Developed Interferometic Fiber Optic Gyro (IFOG) hardenable electronic circuits.

(U) FY 2005 PLAN

- (U) ($20.5) Continue Strategic Guidance Applications Programs (GAP). Full obligation is projected by the 3rd quarter of the 1st year.
  FY 2005 efforts include:
  - (U) Utilize alternate models for incorporation in IEE and HWIL. Exercise alternate sensor technologies in the virtual system and the HWIL experiments. Finalize IEE/HWIL capability to an increased fidelity for system architecture/design tradeoffs in support of technology downselect by FY 2006 for D5 Life Extension.
  - (U) Continue to evaluate alternate sensor technologies, (accelerometer, gyro, and stellar) and proximity electronics for application in the D5 Life Extension Guidance system and/or replacement of system weak links. Evaluate prototype radiation-hard sensor build and test results for appropriate applications.
  - (U) (Sensors) Design, build, and evaluate SOA support electronics and improved build processes. Prove SOA capability to meet Rad-hard strategic goals
  - (U) (GYRO) Build 6 gyros focused on improved dynamic and radiation margin in support of Life Extension.
  - (U) (GYRO) Develop IFOG hardenable electronic circuits.
  - (U) (Stellar) Invest in alternate star sensor technologies for advanced system concepts, e.g. Electron Bombarded (intensified) Charged Coupled Device (CCD) and Active Pixel sensors.

(U) FY 2006 PLAN

- (U) ($21.0) Continue Strategic Guidance Applications Programs (GAP). Full obligation is projected by the 3rd quarter of the 1st year.
  FY 2006 efforts include:
  - (U) Completion of the prototype virtual system simulation model and demonstrate models in a closed-loop system. Modeling and simulation support for sub-system design and HWIL infrastructure development.
  - (U) Continue to evaluate alternate sensor technologies, (accelerometer, gyro, and stellar) and proximity electronics for application in the D5 Life Extension Guidance system and/or replacement of system weak links. Evaluate prototype radiation-hard sensor build and test results for appropriate applications.
  - (U) (SOA) Continue design, build and evaluate SOA support electronics and improved build processes. Prove SOA capability to meet Rad-hard strategic goals.
  - (U) (AltPIGA) Develop producible long-life, low cost hemispherical gas bearing wheel.
  - (U) (Hemospherical Resonator Gyro (HRG)) Examine and demonstrate technologies for reducing long term bias trending. Improve performance during and following shock and vibration events.
  - (U) (IFOG) Improve IFOG proximity electronics hardness to strategic radiation levels.

CLASSIFICATION:

EXHIBIT R-2a, RDT&E Project Justification	DATE: **January 2005**
APPROPRIATION/BUDGET ACTIVITY **RESEARCH DEVELOPMENT TEST & EVALUATION, NAVY / BA-7**	PROJECT NUMBER AND NAME **Technology Applications 2228**

B. (U) Accomplishment/Planned Program (Continued)

(U) FY 2007 PLAN

•(U) ($21.4) Continue Strategic Guidance Applications Programs (GAP). Full obligation is projected by the 3rd quarter of the first year. FY 2007 efforts include:

(U) Support the IMU system integration effort, model simulation development in support of the enhanced ground testing (EGT) task, support remaining non-real-time subsystem/system simulation effort and support software Verification & Validation (V&V) testing.

(U) Continue to evaluate alternate sensor technologies, (accelerometer, gyro, and stellar) and proximity electronics for application in the D5 Life Extension Guidance system and/or replacement of system weak links. Evaluate prototype radiation-hardened sensor build and test results for appropriate applications.

(U) (SOA) Continue design, build and evaluate SOA support electronics and improved build processes. Test the all-silicon SOA in a strategic radiation environment.

(U) (AltPIGA) Develop producible long-life, low cost hemispherical gas bearing wheel and commercial processes/vendors for mass-produced flexure/pick off assemblies for AltPIGA.

(U) (IFOG) Build and radiation test complete sense head. Perfect technologies and processes for producing low cost Rad-hard fiber. Conduct investigations to improve circumvention and recovery performance.

(U) (HRG) Improve benign scale factor performance. Examine and demonstrate technologies for reducing long term bias trending. Improve performance during and following shock and vibration events.

EXHIBIT R-2a, RDT&E Project Justification	DATE: January 2005
APPROPRIATION/BUDGET ACTIVITY **RESEARCH DEVELOPMENT TEST & EVALUATION, NAVY / BA-7**	PROJECT NUMBER AND NAME **Technology Applications 2228**

B. (U) Accomplishments/Planned Program

	FY 04	FY 05	FY 06	FY 07
Strategic Propulsion Applications Program (SPAP)	7.9	21.3	18.2	17.8
RDT&E Articles Quantity				

(U) FY 2004 PLAN
- (U) ($7.9) Initiated SPAP program. Full obligation is complete.
  FY 2004 efforts included:
  - (U) Conducted in depth biennial Industrial Base Assessment.
  - (U) Identified, evaluated and down selected suitable technologies for boost motor test.
  - (U) Identified and evaluated suitable technologies for post boost propulsion technologies test.
  - (U) Identified and evaluated suitable technologies for ordnance technologies test.
  - (U) Identified boost motor test fabrication hardware.

(U) FY 2005 PLAN
- (U) ($21.3) Continue SPAP program. Full obligation is projected by the 3rd quarter of the first year.
  FY 2005 efforts include:
  - (U) Continue down select process of boost motor components by testing and prepare for a boost rocket motor test demonstration.
  - (U) Initiate component tests for identified post boost control technologies.
  - (U) Initiate component tests for identified missile ordnance technologies.
  - (U) Complete fabrication of boost motor test hardware
  - (U) Initiate down-select process for suitable post boost technologies test

(U) FY 2006 PLAN
- (U) ($18.2) Continue SPAP program. Full obligation is projected by the 3rd quarter of the first year.
  FY 2006 efforts include:
  - (U) Conduct biennial Industrial Base assessment.
  - (U) Complete boost rocket motor test demonstration
  - (U) Complete boost rocket motor post test assessment and evaluation.
  - (U) Continue component tests for identified post boost control technologies.
  - (U) Continue component tests for identified missile ordnance technologies.
  - (U) Continue down select process for suitable missile ordnance technologies test.

(U) FY 2007 PLAN
- (U) ($17.8) Continue SPAP program. Full obligation is projected by the 3rd quarter of the first year.
  FY 2007 efforts include:
  - (U) Continue components tests for suitable boost motor technologies.
  - (U) Continue component tests for identified post boost control technologies.
  - (U) Continue to evaluate and down-select suitable post boost control technologies test.
  - (U) Continue component tests for identified missile ordnance technologies.
  - (U) Initiate preparations for post boost and ordnance demonstration test

EXHIBIT R-2a, RDT&E Project Justification	DATE: **January 2005**
APPROPRIATION/BUDGET ACTIVITY **RESEARCH DEVELOPMENT TEST & EVALUATION, NAVY / BA-7**	PROJECT NUMBER AND NAME **Technology Applications 2228**

B. (U) Accomplishments/Planned Program

	FY 04	FY 05	FY 06	FY 07
Radiation Hardened Applications Program (RHAP)	10.1	14.9	21.3	20.3
RDT&E Articles Quantity				

(U) FY 2004 PLAN

- (U) ($10.1) Initiated RHAP program. Full obligation is complete.
  FY 2004 efforts include:
  - (U) Commenced productization of .35 micron digital Silicon-0n-Insulator (SOI) technology
  - (U) Commenced productization of .7 micron mixed signal SOI technology.
  - (U) Commenced technology/product development of alternate non-volatile memories, including Chalcogenide (CRAM), Magnetic (MRAM), and Silicon-On-Nitride (SONOS) technologies.
  - (U) Identified, evaluated and down-select in process for a physics based model for nuclear radiation effects (Electromagnetic Pulse (EMP) and X-ray) on missile and missile components..
  - (U) Identified, evaluated, and down-select in process for a physics based modeling method for nuclear radiation effects (System Generated EMP (SGEMP)) on missile cables and connectors.
  - (U) Identified and evaluating potential built in self test system circuit models and develop a strategy for modeling nuclear radiation effects.
  - (U) Commenced evaluation of post radiation SPICE models for dose rate, total ionizing dose events

U) FY 2005 PLAN

- (U) ($14.9) Continue RHAP program. Full obligation is projected by the 3rd quarter of the first year.
  FY 2005 efforts include:
  - (U) Continue productization and qualification of .35 micron digital SOI technology.
  - (U) Continue productization and qualification of .7 micron mixed signal SOI technology.
  - (U) Continue physics based modeling method for nuclear radiation effects (X-ray, gamma, and neutron) on missile and guidance missile components.
  - (U) Initiate physics based modeling for nuclear radiation effects on complex digital circuits with built in testability.
  - (U) Initiate productization and qualification of high voltage analog SOI technology.
  - (U) Continue evaluation and validation of post radiation SPICE models for dose rate, total ionizing dose, and single event effects
  - (U) Continue technology/product development of alternate non-volatile memories, including Chalcogenide (CRAM), Magnetic (MRAM), and Silicon-on-Nitride (SONOS) technologies.

EXHIBIT R-2a, RDT&E Project Justification	DATE: January 2005
APPROPRIATION/BUDGET ACTIVITY **RESEARCH DEVELOPMENT TEST & EVALUATION, NAVY / BA-7**	PROJECT NUMBER AND NAME **Technology Applications 2228**

B. (U) Accomplishments/Planned Program (Continued)

(U) FY 2006 PLAN

•(U) ($21.3) Continue RHAP program, Full obligation is projected by the 3rd quarter of the first year.
FY 2006 efforts include:
- (U) Initiate productization and qualification of .15 micron digital CMOS-epi and SOI technology.
- (U) Continue productization and qualification of .35 micron mixed-signal SOI technology.
- (U) Complete productization and qualification of .35 micron digital SOI technology
- (U) Complete productization and qualification of .7 micron mixed-signal SOI technology
- (U) Initiate productization and qualification of alternate non-volatile memories, including Chalcogenide (CRAM), Magnetic (MRAM) and Silicon-on-Nitride (SONOS) technologies.
- (U) Continue productization and qualification of high-voltage analog SOI technology.
- (U) Complete physics based modeling methods for nuclear radiation effects (X-ray, gamma, neutron) on missile and guidance/missile components.
- (U) Continue physics based modeling for nuclear radiation effects on complex digital circuits with built in testability.
- (U) Continue evaluation and validation of post radiation SPICE models for dose rate, total ionizing dose, neutron and single event effects.
- (U) Initiate physics based modeling of survivability and rail-span collapse of complex digital circuits in dose-rate (X-ray and gamma) environment.

(U) FY 2007 PLAN

•(U) ($20.3) Continue RHAP Program. Full obligation is projected by the 3rd quarter of the first year.
FY 2007 efforts include:
- (U) Continue productization and qualification of .15 micron digital CMOS-epi and SOI technology.
- (U) Complete productization and qualification of .35 micron mixed-signal SOI technology.
- (U) Continue productization and qualification of alternate non-volatile memories, including Chalcogenide (CRAM), Magnetic (MRAM) and Silicon-on-Nitride (SONOS) technologies.
- (U) Initiate productization and qualification of .15 micron mixed-signal SOI technology.
- (U) Complete productization and qualification of high-voltage analog SOI technology.
- (U) Complete physics based modeling methods for nuclear radiation effects on complex digital circuits with built in testability.
- (U) Complete evaluation and validation of post radiation SPICE models for dose rate, total ionizing dose, neutron and single event effects.
- (U) Continue physics based modeling of survivability and rail-span collapse of complex digital circuits in dose-rate (X-ray and gamma) environment.

EXHIBIT R-2a, RDT&E Project Justification	DATE: January 2005
APPROPRIATION/BUDGET ACTIVITY **RESEARCH DEVELOPMENT TEST & EVALUATION, NAVY / BA-7**	PROJECT NUMBER AND NAME **Technology Applications 2228**

C. (U) Other Program Funding Summary: (Dollars in Thousands)

FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	Total Complete	Total Cost
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

D. (U) Acquisition Strategy:

Contracts will continue to be awarded to those sources who were engaged in the TRIDENT II (D5) development program and are currently engaged in the production and/or operational support of the deployed D5 Strategic Weapons Systems on the basis of Other Than Full and Open Competition pursuant to the authority of 10 U.S.C. 2304 (c) (1) and (3) implemented by FAR 6.302.-1, 3 4.

E. (U) Major Performers:

- LMSS / CA - Reentry Body Systems integration (RSAP)
- NSWC / VA - Heatshield Nosetip materials development (RSAP)
- ITT / CO - Vulnerability and hardness technologies (RSAP)
- CSDL / MA - Reentry Systems flight test instrumentation (RSAP)
- DOE / NM - Advanced fuzing technology (RSAP)
- CSDL / MA - Guidance Application program support (GAP)
- CSDL/MA- Guidance radiation hardened electronics integration(RHAP)
- HI/FL- RADHARD application specific Integrated Circuit library (RHAP)
- NGMS/CA- RADHARD oxi-nitride non-volatile memory productization (RHAP)
- CSDL/MA- Analog, digital, mixed-signal and discreet radiation model development (RHAP)
- BAE/MD- 4M-bit RADHARD Chalcogenide non-volatile memory product development (RHAP)

NAWC/CA - Rocket motor testing & integration(SPAP)

- LMSSC/CA - Missile systems integration (SPAP)
- NSWC/VA - Coordinating and executing ordnance tests (SPAP)

CLASSIFICATION:

Exhibit R-3 Cost Analysis		DATE: **January 2005**
APPROPRIATION/BUDGET ACTIVITY	PROGRAM ELEMENT	PROJECT NUMBER AND NAME
RDT&E, N / BA-7	**PE 0101221N Strategic Sub & Wpns Sys Spt**	**Technology Applications 2228**

Cost Categories	Contract Method & Type	Performing Activity & Location	Total PY s Cost	FY 04 Cost	FY 04 Award Date	FY 05 Cost	FY 05 Award Date	FY 06 Cost	FY 06 Award Date	FY 07 Cost	FY 07 Award Date	Cost to Complete	Total Cost	Target Value of Contract
Support & Management														
Technology Applications	SS - CPFF	LMMS / CA	57.7	11.1	10-03	12.8	10-04	12.5	10-05	13.7	10-06	Cont.	Cont.	TBD
Technology Applications	WR	NSWC / CA	40.5	5.6	10-03	5.8	10-04	5.7	10-05	6.2	10-06	Cont.	Cont.	TBD
Technology Applications	MIPR	DOE / NM	17.1	0.6	10-03	1.0	10-04	1.0	10-05	1.0	10-06	Cont.	Cont.	TBD
Technology Applications	SS - CPFF	CSDL / MA	5.6	1.0	10-03	4.0	10-04	5.4	10-05	4.2	10-06	Cont.	Cont.	TBD
Technology Applications	SS - CPFF	ITT / CO	1.0	1.3	10-03	1.8	10-04	1.8	10-05	1.9	10-06	Cont.	Cont.	TBD
Technology Applications	SS - CPFF	CSDL / MA	120.0	17.5	10-03	20.5	10-04	21.0	10-05	21.4	10-06	Cont.	Cont.	TBD
Technology Applications	SS - CPFF	LMSSC/CA	N/A	6.8	10-03	17.7	10-04	17.0	10-05	16.6	10-06	Cont.	Cont.	TBD
Technology Applications	WR	NAWC/CA	N/A	0.8	10-03	2.1	10-04	0.4	10-05	0.4	10-06	Cont.	Cont.	TBD
Technology Applications	WR	NSWC / CA	N/A	0.2	10-03	1.0	10-04	0.8	10-05	0.8	10-06	Cont.	Cont.	TBD
Technology Applications	SS - CPFF	CSDL / MA	N/A	2.2	10-03	5.2	10-04	5.8	10-05	5.6	10-06	Cont.	Cont.	TBD
Technology Applications	SS - CPFF	HI/FL	N/A	5.6	10-03	6.2	10-04	8.5	10-05	6.7	10-06	Cont.	Cont.	TBD
Technology Applications	SS - CPFF	NGMS/CA	N/A	1.0	10-03	1.5	10-04	1.5	10-05	2.0	10-06	Cont.	Cont.	TBD
Technology Applications	SS - CPFF	BAE /MD	N/A	1.3	10-03	0.5	10-04	3.5	10-05	4.0	10-06	Cont.	Cont.	TBD
Technology Applications	SS - CPFF	INTERSIL	N/A			1.5	10-04	2.0	10-05	2.0	10-06	Cont.	Cont.	TBD
Technology Applications	VARIOUS	VARIOUS	N/A	0.2	10-03	0.9	10-04	0.1	10-05		10-06	Cont.	Cont.	TBD
Subtotal Product Development			241.9	55.2		82.5		87.0		86.5	10-06	Cont.	Cont.	TBD

Remarks:

Total Cost			241.9	55.2		82.5		87.0		86.5		Cont.	Cont.	

Remarks: