

APPROPRIATION/BUDGET ACTIVITY RDT&E / 4					R-1 ITEM NOMENCLATURE Program Element (PE) Name and No. Facilities Improvement 0603725N					
COST (\$ in Millions)	FY 1998	FY 1999	FY 2000	FY 2001	FY 2002	FY2003	FY 2004	FY 2005	Cost to Complete	Total Cost
Total PE Cost	6.387	1.853	1.985	1.916	1.754	1.791	1.838	1.886	CONT	CONT
Navy Facilities System/Y0995	1.669	1.853	1.985	1.916	1.754	1.791	1.838	1.886	CONT	CONT
Engineered Lumber Dev/Y2404	4.718	0	0	0	0	0	0	0	0	4.718
RDT&E Articles Qty	6	5	5	6	TBD	TBD	TBD	TBD	NA	NA

A. (U) MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: This program provides the Navy with new civil engineering capabilities that are required to overcome specific performance limitations of Naval shore facilities while reducing the cost of sustaining the Naval shore infrastructure. The program focuses available resources on satisfying facility requirements where the Navy is a major stakeholder, there are no test validated Commercial off the Shelf (COTS) solutions available, and a timely solution will not emerge without a Navy sponsored demonstration and validation. The program completes the development and validation of facility technologies originating in Navy Science and Technology programs, plus a variety of other sources which includes the National Science Foundation (NSF) and the National Institute of Standards and Technology (NIST). Validated technologies are implemented in the Navy's Military Construction (MILCON) and Real Property Maintenance (RPM) Programs. Project Y0995 is addressing four Navy facility requirements during the fiscal years FY 1998 through FY 2000: The High Performance (HP) Magazine, Waterfront Facilities Repair and Upgrade, Facility Technologies To Reduce The Real Property Maintenance (RPM) Backlog, and Modular Hybrid Pier. Additional information is provided in the Project Y0995 R-2A. Project Y2404, Engineering Lumber, is a one time Congressional increase to this program to demonstrate and validate engineered lumber products made from wood by products and recycled plastic that are being developed in the Office of Naval Research's (ONR) Materials Exploratory Development Program using funds from an FY 1997 Congressional increase to PE0602234N, Materials, Electronics and Computer Technology. Expected benefits from increased use of engineered lumber will include lower life cycle costs for Navy Waterfront structures. Engineered lumber products successfully validated by Project Y2404 will then be incorporated into Waterfront Facilities Repair and Upgrade, and Modular Hybrid Pier thrusts of Project Y0995. The execution of this program is consistent with the findings and recommendation of two National Academy of Sciences Reports: "The Role of Federal Agencies in Fostering New Technology and Innovation in Building" and "Federal Policies to Foster Innovation and Improvement in Constructed Facilities."

B. (U) PROGRAM CHANGE SUMMARY:

	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>
(U) FY 1999 President's Budget:	1.669	1.861	1.988
a. Congressional Add for Engineered Lumber Development (Y2404)	+4.852	0	0
b. SBIR Reduction to Y2404	-134	0	0
c. Revised Economic Assumptions		-4	-31
d. Civ Pers Underexecution		-4	
e. CIVPERS Pay Raise Adjustments			28
(U) FY 2000 President's Budget Submit:	6.387	1.853	1.985

APPROPRIATION/BUDGET ACTIVITY		PROGRAM ELEMENT				PROJECT NAME AND NUMBER				
RDT&E / 4		0603725N				Navy Facilities System, Y0995				
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	1.669	1.853	1.985	1.916	1.754	1.791	1.838	1.886	CONT	CONT
RDT&E Articles Qty	3	5	5	6	TBD	TBD	TBD	TBD	NA	NA

A. (U) **MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION:** This program provides the Navy with new civil engineering capabilities that are required to overcome specific performance limitations of Naval shore facilities while reducing the cost of sustaining the Naval shore infrastructure. The program focuses available resources on satisfying facility requirements where the Navy is a major stakeholder, there are no test validated Commercial off the Shelf (COTS) solutions available, and a timely solution will not emerge without a Navy sponsored demonstration and validation. The program completes the development and validation of facility technologies originating in Navy Science and Technology programs, plus a variety of other sources which includes the National Science Foundation (NSF) and the National Institute of Standards and Technology (NIST). Validated technologies are implemented in the Navy's Military Construction (MILCON) and Real Property Maintenance (RPM) Programs. This project is addressing four Navy facility requirements during the fiscal years FY 1998 through FY 2000:

- (U) **THE HIGH PERFORMANCE (HP) MAGAZINE.**

(U) Based on current magazine technologies, substantial land areas within Naval activities cannot be used for inhabited buildings in order to satisfy Explosives Safety Quantify Distance (ESQD) arcs. The converse is also true, the Navy is not able to construct new magazines where they are needed because of the presence of inhabited buildings. This effort enables a quantification of the specific hazard scenarios capable of causing ordnance detonation, an improved capability to model an ordnance explosion in a magazine, and the innovative use of energy absorbing construction materials to provide the Navy with a new magazine concept in which the ESQD arcs are based on a Maximum Credible Event (MCE) that is not the detonation of the entire magazine but rather the detonation of the contents of one, much smaller, storage cell within the magazine. For a typical magazines with Net Explosive Weight (NEW) capacities of 250,000 pounds, the allowable ordnance storage density is increased from 370 pounds/acre to 2,222 pounds/acre. In addition, the number of incompatible classes of ordnance that can be stored in the same magazine is increased from none to eight. This will lead to lower operational costs for the Receipt, Segregation, Storage, and Issue (RSSI) of ordnance and, for some activities, a reduction in the number of magazines required to accomplish their mission.

- (U) **WATERFRONT FACILITIES REPAIR AND UPGRADE.**

(U) Over 75% of the Navy's waterfront facilities are over 45 years old. They were designed for a service life of no more than 25 years and to satisfy the mission requirements existing at that time of construction. The reinforced concrete used to construct nearly all of them requires costly and repetitive repairs. In addition, they are unable to satisfy new mission requirements, such as the increase in pier deck capacity required to accomplish more extensive pier-side ship maintenance and repair tasks using truck-mounted cranes that have concentrated outrigger loads of up to 120 tons on a pier originally designed for no concentrated deck loading. This effort integrates new advanced structural diagnostic and modeling capabilities with the innovative application of high performance materials and corrosion arrestment techniques to provide new methods to extend the service life of existing waterfront facilities by an additional 15 to 30 years, and to cost-effectively upgrade them to satisfy new mission requirements. Specific benefits include increasing the durability of spalled marine concrete repairs from 3 to 15

(U) years, new longer-lasting low-maintenance fendering systems that eliminate the need for the frequent replacement of timber piles, a new Impulse Load Method of assessing the vertical load capacity of pile-supported waterfront structures, and providing new pier upgrade alternatives costing about \$5M for a typical pier instead of the now required demolish then replace approach costing about \$30M.

- (U) FACILITY TECHNOLOGIES TO REDUCE THE REAL PROPERTY MAINTENANCE (RPM) BACKLOG.

(U) The Real Property Maintenance(RPM) costs to correct critical facility deficiencies are over \$2.0B as reported in the FY 1995 Annual Inspection Summary (AIS). Current Navy RPM funding levels are insufficient to prevent the continued growth of the critical backlog of maintenance and repairs. This effort will validate and accelerate the wide-spread implementation of a broad range of advanced facility technologies needed to overcome design and construction practices that are conservative and remain costly because of the high risk the private sector associates with the utilization of new facility technologies. The effort will accelerate the validation, commercialization, and wide-spread implementation of the facility technologies urgently required to reduce the cost of deficiencies in the Navy's RPM backlog by reducing initial construction costs up to 20% and facility component service lives that are up to 25 years longer.

- (U) MODULAR HYBRID PIER.

(U) The Navy is faced with the necessity of recapitalizing a large portion of its waterfront infrastructure over the next several decades. The Modular Hybrid Pier thrust develops and validates technologies for a mission flexible waterfront infrastructure characterized by significantly reduced life cycle costs. The concepts validated by this project's Waterfront Facilities Repair and Upgrade thrust will enable the Navy to economically extend the useful service life of many existing piers and wharves. They will reduce the Navy's need to construct new piers and wharves, but will not eliminate the need completely. Emerging innovative materials technologies, particularly those that will transition from the Navy's Exploratory Development (6.2) Research Program, can provide a new capability to design replacement structures that have a comparable initial cost yet have far less maintenance and repair cost. Use of fiber-reinforced plastics (FRP) for appurtenances and FRP-reinforced high strength light-weight concrete for structural elements will produce structures that have twice the structural service life of the structures that they will replaced. Modular design will enable off-site fabrication that will shorten the duration and lower the cost of the on site construction. Modular design will also facilitate change-out of components to repair damage or to modify structure geometry or capacity to adapt to future changes in ship designs. An economic analysis has shown that a modular hybrid pier will have a Net Present Value (NPV) cost that is \$21M less over its service life than that for a conventional structure constructed of steel-reinforced concrete.

1. (U) FY 1998 ACCOMPLISHMENTS

- (U) (\$0.361M) The High Performance (HP) Magazine - Obtained Department of Defense Explosives Safety Board approval of the HP Magazine design concept. Completed 35% standard design of magazine and 100% design of operating system for the storage pit covers. Completed operational tests of Universal Straddle Lift Carrier for moving palletized and containerized ordnance within the magazine. Completed analysis to reduce cost of the magazine's overhead crane.

- (U) (\$1.208M) Waterfront Repair and Upgrade - Designed and installed test section of fender piles for primary fendering at Pier 5000 in SUBASE San Diego. Test section contains 4749 linear feet of piling comprised of fiber-reinforced plastic shells filled with concrete manufactured by three companies: Lancaster Composites, Hardcore Fiberglass Tubular Piling, and Plastic Piling Inc. Awarded contract with Mar Inc. for design and fabrication of a composite camel system for submarine use to be tested at SUBASE New London. Awarded contract to Engineering and Research International (ERI) Inc. for development and fabrication of a falling weight deflectometer (FWD) capable of exerting 120,000 LB dynamic force for non-destructive testing of safe load capacity of pier decks.
  - (U) (\$0.100M) Real Property Maintenance (RPM) Backlog Reduction - Reviewed proposed RPM projects and emerging facility technologies to identify candidate roofing, coatings, composite material, and high performance concrete technologies that will have highest payoffs for reducing RPM cost. Coordinated FY 1999 technology selection and validation test planning with the Civil Engineering Research Foundation (CERF) and with Navy RPM managers.
2. (U) FY 1999 PLANS
- (U) (\$0.225M) The High Performance (HP) Magazine - Complete 100% standard design of magazine. Obtain certification of 100% design by Department of Defense Explosives Safety Board.
  - (U) (\$0.666M) Waterfront Repair and Upgrade - Install and test two composite submarine camels and backing fender piles (one complete submarine berth) at SUBASE New London. Collect load and energy dissipation performance data. Conduct field test of blocking, wale and camel replacement components comprised of composite wood products developed under Project Y2404, Engineered Lumber. Complete performance specifications for composite fender piling and composite camel systems. Initiate design for upgrade of a pier or wharf using composite structural systems. Validate performance of the falling weight deflectometer (FWD) on a selected Navy pier having a deck thickness greater than 18-inches.
  - (U) (\$0.962M) Real Property Maintenance (RPM) Backlog Reduction - Initiate large scale field tests to validate performance of selected facility technologies within the general areas of high performance concrete, roofing, coatings and corrosion protection, and composite materials. Continue FY 1999 testing coordination with the Civil Engineering Research Foundation (CERF), and with participating Navy activities. Begin technology selection and validation test planning for the FY 2000 tests.
  - (U) (\$0.9M) Portion of extramural program reserved for Small Business Innovation Research assessment in accordance with 15 USC 638.
3. (U) FY 2000 PLANS
- (U) (\$0.753M) Waterfront Repair and Upgrade - Complete design and award contract for corrosion stabilization, concrete repair and strengthening with composites of a selected Navy pier. Install instrumentation to monitor long term corrosion state and structural performance.
  - (U) (\$1.232M) Real Property Maintenance (RPM) Backlog Reduction - Continue technology validation tests initiated in FY 1999. Initiate additional tests planned during FY 1999. National performance standards will be used to evaluate resulting test data when they are applicable. When none exist, the resulting test data will be submitted to the National Evaluation Service - Building Innovation Center (NES-BIC) of CERF for independent technical evaluation. Begin technology selection and validation test planning for FY 2001 tests.

- B. (U) OTHER PROGRAM FUNDING SUMMARY: This project transitions waterfront facility technologies from three Navy Exploratory Development (6.2) Research Programs: PE0602121N - Ship, Submarine and Logistics Technology, PE0602234N - Materials, Electronics and Computer Technology, and PE0603712N - Environmental Quality and Logistics Advanced Technology Demonstrations. It also transitions facility technologies developed at universities under the sponsorship of the National Science Foundation (NSF), by the Building and Fire Research Laboratory (BFRL) of the National Institute of Standards and Technology (NIST), and by the Constructed Engineering Research Laboratories (CERL) and Waterways Experiment Station (WES) of the U.S. Army Corps of Engineers when they can contribute to the solution of one of the Navy requirements being addressed by this project. The project pursues opportunities to leverage private sector investment through partnerships with private sector organizations, such as the Civil Engineering Research Foundation (CERF) and the Composites Institute (CI) of The Society of the Plastics Industry (SPI). The project pursues opportunities to leverage Navy Real Property Maintenance (RPM) and Military Construction (MILCON) investment through partnerships with RPM and MILCON program and project managers.
- C. (U) ACQUISITION STRATEGY: This project is categorized as Non-ACAT (Non Acquisition). The information produced from this project for: 1) specifying the performance of the technology, 2) utilization of the technology in designs, 3) control of quality of the technology during constructions, 4) maintenance of the technology during operations, and 5) life-cycle costs of the technology is transitioned to Navy users by being included or referenced by the applicable Naval Facilities Engineering Command policy, guidance, and criteria. Navy Real Property Maintenance (RPM) and Military Construction (MILCON) program and project managers are then able to implement the technologies in their RPM and MILCON projects. Private sector capability to provide the new technology for use by the Navy is developed by including both individual contractors and industry organizations in development and testing of the technology.

D. (U) SCHEDULE PROFILE:

FY98 FY99 FY00 FY01

HIGH PERFORMANCE (HP) MAGAZINE

DDESB approval of concept and 35% design using concept      =====X  
 100% design using concept and DDESB approval of design      X=====X

WATERFRONT FACILITIES REPAIR AND UPGRADE

Impulse load assessment methodology using Falling Weight Deflectometer (FWD)      =====X  
 Advanced fendering and camel systems using composite materials      =====X  
 Pier and wharf capability upgrades using composite materials      X=====X  
 Corrosion stabilization, and concrete repair and strengthening      X=====X

REAL PROPERTY MAINTENANCE (RPM) BACKLOG REDUCTION

Develop execution plan, initiate partnership with CERF, and plan initial tests      X=====X  
 FY 1999 initiated technology validation      X=====X  
 FY 2000 initiated technology validation      X=====X  
 FY 2001 initiated technology validation      X=====>

MODULAR HYBRID PIER

Design based on transitioned technologies and planning of testing of new components      =====X  
 Validation testing of components      =====>

Exhibit R-3 Cost Analysis (page 1)			PROGRAM ELEMENT NAME AND NUMBER: Facs Improvement, PE060372.5N					Date: February 1999				
APPROPRIATION/BUDGET ACTIVITY RDT&E/ 4			PROJECT NAME AND NUMBER Navy Facilities System, Y0995									
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
High Performance (HP) Magazine	WX	NFESC Pt Hueneme, CA	3.478	85	1 <sup>st</sup> qtr							
	WR	NSWC Indian Head, CA	45	15	1 <sup>st</sup> qtr							
	WR/RC	LANTDIV Norfolk, VA	334	100	1 <sup>st</sup> qtr							
	FP	SVERDRUP St Louis, MO	236	25	2 <sup>nd</sup> qtr							
Waterfront Facilities Repair and Upgrade	WX	NFESC Pt Hueneme, CA	770	466	Varies	297	1 <sup>st</sup> qtr	122				
	WR	NUWC New London, CT	487	200	Varies							
	FP	Contractors TBD Locations TBD				452	varies	150				
Real Property Maintenance (RPM) Backlog Reduction	WX	NFESC Pt Hueneme, CA	200	401	1 <sup>st</sup> qtr	446	1 <sup>st</sup> qtr	440			cont.	na
	FP	CERF Washington D.C.	45	50	1 <sup>st</sup> qtr	50	1 <sup>st</sup> qtr	50			cont.	na
	FP	Contractors TBD Locations TBD		511	Varies	740	varies	854			cont.	na
Modular Hybrid Pier	WX	NFESC Pt Hueneme, CA						300			cont.	na
Subtotal Product Development			5.595	1.853		1.985		1.916				
Remarks:												
Total Prior Years Cost: Summation starts with FY94. Subtotal does not include performing activities from prior years that are no longer performing activities.												

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**Exhibit R-3, Project Cost Analysis**  
(Exhibit R-3, page 7 of 8)

Exhibit R-3 Cost Analysis (page 2)								Date: February 1999				
APPROPRIATION/BUDGET ACTIVITY RDT&E/ 4				PROGRAM ELEMENT NAME AND NUMBER: Facs Improvement, PE06037 25N				PROJECT NAME AND NUMBER Navy Facilities System, Y0995				
Development Support Equipment												
Software Development												
Training Development												
Integrated Logistics Support												
Configuration Management												
Technical Data												
GFE												
Subtotal Support			0	0		0						
Remarks: Included in Product Development costs.												
Cost Categories (Tailor to WBS or System/Item Requirements)	Contract Method & Type	Performing Activity & Location	Total PYs Cost	FY99 Cost	FY 99 Award Date	FY00 Cost	FY00 Award Date	Cost to Complete			Total Cost	Target Value of Contract
Developmental Test & Evaluation												
Operational Test & Evaluation												
Tooling												
GFE												
Subtotal T&E			0	0		0		0				
Remarks: Included in Product Development costs.												
Contractor Engineering Support												
Government Engineering Support												
Program Management Support												
Program Management Personnel												
Travel												
Labor (Research Personnel)												
Overhead												
Subtotal Management			0	0		0		0				
Remarks: Included in Product Development costs.												
Total Cost			5.595	1.853		1.985		1.916				
Remarks												