BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603271N
PROGRAM ELEMENT TITLE: RF SYSTEMS ADVANCED TECHNOLOGY

COST: (Dollars in Thousands)

Project Number & Title	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total PE	60,933	71,743	75,070	50,041	29,609	30,590	51,332	52,607
R2913	RF SYSTEMS ADVANCED TECHNOLOGY							
	44,282	43,609	75,070	50,041	29,609	30,590	51,332	52,607
R9152	COMMON AFFORDABLE RADAR PROCESSOR							
	5,783	7,627	0	0	0	0	0	0
R9329	APY-6 REALTIME PRECISION TARGETING RADAR							
	4,805	2,477	0	0	0	0	0	0
R9330	HIGHLY MOBILE TACTICAL COMMUNICATIONS (HMTC)							
	1,636	2,972	0	0	0	0	0	0
R9331	REMOTE OCEAN SURVEILLANCE SYSTEM (ROSS)							
	2,017	1,485	0	0	0	0	0	0
R9332	SCOUT (LPI) RADAR DEMONSTRATION							
	2,410	0	0	0	0	0	0	0
R9481	C BAND ACTIVE ARRAY RADAR							
	0	6,340	0	0	0	0	0	0
R9482	HORIZON EXTENSION SURVEILLANCE SYSTEM (HESS)							
	0	2,081	0	0	0	0	0	0
R9483	MINIATURE AUTOMATIC FUSION SPLICER							
	0	991	0	0	0	0	0	0
R9484	PHOTONICS PROTOTYPING FACILITY							
	0	4,161	0	0	0	0	0	0

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603271N
PROGRAM ELEMENT TITLE: RF SYSTEMS ADVANCED TECHNOLOGY

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: Work in this Program Element (PE) addresses technologies critical to enabling the transformation of discrete functions to network centric warfare which utilizes multiple, simultaneous and continuous communications/data links between platforms while simultaneously performing the functions of Electronic Warfare (EW) and radar surveillance. The Radio Frequency (RF) Systems Advanced Technology Program addresses RF technology for Surface and Aerospace Surveillance Sensors and systems, EW sensors and systems, RF Communication Systems, and Multi-Function sensor systems. The program emphasizes near to mid-term transition opportunities by developing and demonstrating technologies which enable options for Time Critical Strike, Missile Defense, Fleet Force Protection, and Knowledge Superiority and Assurance Future Naval Capabilities. Within the Naval Transformational Roadmap, this investment will achieve transformational capabilities required by: “Sea Shield” Theater Air and Missile Defense; as well as technically enable “Sea Strike” Persistent Intelligence, Surveillance, and Reconnaissance.

Due to the number of efforts in this PE, the programs described herein are representative of the work included in this PE.

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PROGRAM CHANGE SUMMARY:

	FY 2004	FY 2005	FY 2006	FY 2007
FY 2005 President's Budget Submission	62,041	44,046	53,105	53,226
Cong Rescissions/Adjustments/Undist. Reductions	0	-686	0	0
Congressional Action	0	28,400	0	0
Execution Adjustments	355	0	0	0
Federal Technology Transfer	-30	0	0	0
FNC Realignment	0	0	26,697	16,733
Non-Pay Inflation Adjustments	-58	0	0	0
Program Adjustments	0	-17	-70	-41
Program Realignment	0	0	-4,682	-20,023
Rate Adjustments	0	0	20	146
SBIR Assessment	-1,375	0	0	0
FY 2006/2007 President's Budget Submission	60,933	71,743	75,070	50,041

PROGRAM CHANGE SUMMARY EXPLANATION:
Technical: Not applicable.

Schedule: Not applicable.

FY 2006/2007 RDT&E,N BUDGET ITEM JUSTIFICATION SHEET DATE: Feb 2005
Exhibit R-2a

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603271N PROGRAM ELEMENT TITLE: RF SYSTEMS ADVANCED TECHNOLOGY
PROJECT NUMBER: R2913 PROJECT TITLE: RF SYSTEMS ADVANCED TECHNOLOGY

COST: (Dollars in Thousands)

Project Number & Title	FY 2004 Actual	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
R2913 RF SYSTEMS ADVANCED TECHNOLOGY	44,282	43,609	75,070	50,041	29,609	30,590	51,332	52,607

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: The Radio Frequency (RF) Systems Advanced Technology project addresses technologies critical to enabling the transformation of discrete functions to network centric warfare which utilizes multiple, simultaneous and continuous communications/data links between platforms while simultaneously performing the functions of Electronic Warfare (EW) and radar surveillance. Work in this project addresses RF technology for Surface and Aerospace Surveillance sensors and systems, EW sensors and systems, RF Communication Systems, and Multi-Function sensor systems. The project emphasizes near to mid-term transition opportunities by developing and demonstrating technologies which enable options for Time Critical Strike, Missile Defense, Fleet Force Protection, and Knowledge Superiority and Assurance Future Naval Capabilities (FNCs). Within the Naval Transformational Roadmap, this investment will achieve transformational capabilities required by: “Sea Shield” Theater Air and Missile Defense; as well as technically enable “Sea Strike” Persistent Intelligence, Surveillance, and Reconnaissance.

B. ACCOMPLISHMENTS/PLANNED PROGRAM:

	FY 2004	FY 2005	FY 2006	FY 2007
ADVANCED MULTI-FUNCTION RF TECHNOLOGY	18,458	22,364	33,977	23,048

Advanced Multi-function Radio Frequency (AMRF) Technology emphasizes development, demonstration and transition of wideband, high performance multifunction Radio Frequency (RF) apertures capable of transmitting and receiving multiple, simultaneous, independent RF beams while providing reduced signature and numbers of apertures. Program goals include development and demonstration of multi functional RF technology applicable to systems development for DD(X) and other ship classes that will provide reduced recurring costs for total system functionality; reduced number of topside antennas and support systems; reduced ship radar cross section; reduced number of unique spares and lower ship manning requirements; provide ability to upgrade

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systems and capabilities with reduced cost, time, and complexity while mitigating the risk of obsolescence; and provide ability to rapidly exploit technological innovation through open systems concepts.

Major objectives within AMRF include multi function concept development, testing, and technology demonstration of communications, electronic attack, electronic surveillance, and radar functions within the AMRF-Concept (AMRF-C) Test Bed; development of a Multi Function Electronic Warfare/Electronic Surveillance (support) (MFEW/ES) Advanced Development Model (ADM) for DD(X) that demonstrates key Electronic Warfare Support (ES) capabilities for several simultaneous ES functions; development of an MFEW/ES ADM architecture that is capable of supporting additional RF functions; and conducting MFEW/ES ADM testing that satisfies DD(X) program Technology Development (TD) Phase requirements to enable a smooth transition of AMRF technology to the DD(X) System Development and Demonstration (SDD) Acquisition Phase with minimal changes in system architecture.

AMRF Systems Technology developments directly support the Department of Defense Joint Warfighter Science and Technology Plan and the Defense Technology Area Plans.
FY 2004 to FY 2005 and FY 2005 to FY 2006 increases due to FNC MFEW/ES; FY 2006 to FY 2007 decrease due to planned completion of efforts.

FY 2004 Accomplishments:

- Initiated development of a multi-function system ((MFEW)/Advanced Multi-function Radio Frequency Concept (AMRF-C) Version 2) capable of demonstrating integrated communications and Electronic Warfare (EW) for the AMRF-C effort.
- Completed multi function RF technology hardware, architecture, and component testing for the AMRF-C effort. Demonstrated the initial capability of the multi function RF technology testbed. This effort included initial designs for wideband technology with power and linearity sufficient to support communications, EW and limited radar functions.
- Continued and completed the operation of the wideband multi-function Communications and EW testbed in support of multi-function system development and multi-function technology insertion and demonstration for the AMRF-C effort.

FY 2005 Plans:

- Continue the MFEW/ES Program Technology Development Phase.
- Continue operation of the wideband multi-function Communications and EW testbed in support of multi-

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function system development and multi-function technology insertion and demonstration for the AMRF-C effort.
• Continue MFEW/ES Core Software Development.
• Initiate development of a High Band array antenna capable of simultaneously supporting multiple Electronic Support Measures (ESM)surveillance functions for the MFEW/ES ADM.
• Initiate development of a Mid Band array antenna capable of simultaneously supporting multiple ESM functions for the MFEW/ES ADM.
• Initiate development of back-end analog receiver equipment supporting MFEW/ES ADM.
• Initiate systems integration, risk reduction, and Navy critical subsystem development effort leading to demonstration of MFEW/ES ADM in a relevant environment and support MFEW/ES hardware/component testing within the AMRF-C testbed.

FY 2006 Plans:

• Continue all efforts of FY 2005.

FY 2007 Plans:

• Continue all efforts of FY 2006.
• Complete the MFEW/ES Program Technology Development Phase.
• Complete MFEW/ES Core Software Development.
• Complete development of a High Band array antenna capable of simultaneously supporting multiple ESM surveillance functions for the MFEW/ES ADM.
• Complete development of a Mid Band array antenna capable of simultaneously supporting multiple ESM functions for the MFEW/ES ADM.
• Complete development of back-end analog receiver equipment supporting MFEW/ES ADM.
• Complete systems integration, risk reduction, and Navy critical subsystem development effort leading to demonstration of MFEW/ES ADM in a relevant environment and support MFEW/ES hardware/component testing within the AMRF-C testbed.
• Initiate Shipboard EW Improvement and Electronic Attack (EA) Transmitter projects to develop Electronic Warfare/Electronic Attack capability for rapid technology insertion into DD(X) and other ship classes utilizing MFEW/ES ADM components and architecture and AMRF-C testbed technology.

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	FY 2004	FY 2005	FY 2006	FY 2007
ELECTRONICS AND COMMUNICATIONS TECHNOLOGIES	25,824	21,245	41,093	26,993

This activity includes Future Naval Capabilities (FNC) investments formerly included in the Activity for Radio Communications Radio Frequency (RF) Advanced Technology and Surface and Aerospace Surveillance Advanced RF Systems. This additional breakout provides improved detail of the underlying investment.

The Radio Communications RF Technology addresses critical naval communications technology deficiencies and needs that are not addressed by the commercial technology sector. The activity's goal is enabling network-centric operations by addressing high-bandwidth, reliable interoperable communications at all levels of command and technology to enable rapid and reliable utilization of government and commercial telecommunication assets worldwide. The Radio Communications RF Technology includes support to the FNC Capabilities for: Advanced Communication for FORCEnet Knowledge Superiority and Assurance (KSA) Enabling Capability (EC) (KSA EC-4B); Global Information Grid (GIG) Compliant Networking (KSA EC-4C); Discrimination and Provision of Terminal Guidance for Weapons Targeted at Moving Targets (KSA(EC)-4B); Marine and UxV Tactical Intelligence Surveillance, and Reconnaissance (ISR) (KSA EC-7G); and Multi-Source ISR to the Warfighter (KSA EC-7B).

The Surface and Aerospace Surveillance Advanced RF Systems address development of sensor technologies and systems for transition into new and existing naval platforms. The technology activity focuses on providing the Navy with high performance affordable surveillance systems that are responsive to identified naval needs for real time situational awareness, long range target detection, discrimination, identification, tracking and targeting of air and surface threats in all operating conditions. Surface and Aerospace Surveillance Advanced RF Systems includes support to the FNC for: Long Range RF Detection and Tracking Missile Defense (MD)(MD EC-1B); and Advanced Electronics Sensor Systems for MD (MD EC-1A). Also included are projects developed and demonstrated under the Fleet and Force Protection (F/FP) FNC. These include the Electronic Attack (EA) Techniques to Counter Advanced Threat and the Enhanced NULKA Payload projects. These Electronic Warfare projects support the Sea Shield Concept of the Naval Power 21 Strategic Plan. FY 2004 to FY 2005 decrease due to planned completion of efforts; FY 2005 to FY 2006 increase due to transfer of the High Altitude Relay from 0602235N and the new FNC initiative S-band Digital Array Radar; and FY 2006 to FY 2007 decrease due to planned completion of FNC efforts.

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FY 2004 Accomplishments:

• Completed integration and performance evaluation of the S-Band receive phased array and transition into the AEGIS MD System.
• Completed design of full duplex phased array Ku-band antenna for Firescout Unmanned Airborne Vehicles (UAV) communication payload.
• Completed redesign for Q-band transmit phased array antenna.
• Completed K/Ka/Q-band fabrication of wideband mimic.
• Completed X-Ku band card assembly design transition to DDX Extremely High Frequency (EHF) Satellite Communication (SATCOM).
• Continued Integrated, Very High, Ultra High Frequency, L band (IVUL) multi-couplers for cosite mitigation.
• Completed fabrication and integration of the radar signal processor, receiver exciter and finalized the design for the 2-D array and rotary coupler for UAV installations
• Continued fabrication and platform integration; began testing of the Affordable Ground Based Radar (AGBR) project, an advanced development model (ADM) technology candidate for the Marine Corps Ground/Air Task-Oriented Radar (GATOR) (formerly Multi-Role Radar System (MRRS)) for use in defending mobile forces against air and missile attacks.

FY 2005 Plans:

• Initiate development of Ultra High Frequency (UHF)/L Band Phased Array Antennas for Carrier Vessel Nuclear (CVN).
• Initiate development of S-band Digital Array Radar.
• Initiate advanced development of Next Generation Communication at Speed and Depth (NGCSD).
• Initiate and complete a segment of the Missile Defense FNC Littoral Affordability effort (classified program).
• Initiate development of EA Techniques to Counter Advanced Threats.
• Initiate development of a Real Time Precision Surveillance Targeting (PS&T) Radar.
• Initiate demonstration and performance optimization of the integrated IVUL prototype antenna.
• Initiate Airborne Communications Package and complete airborne testing.
• Complete Real Time Composite Networking and transition to Advanced Digital Networking System (PMW-173).
• Complete development of X/Ku band phased array antenna.

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• Complete ADM testing of the AGBR project in time to support Marine Corps Milestone B decision on the GATOR MRRS program in mid-FY 2005.

FY 2006 Plans:

• Continue all efforts of FY 2005 less those noted as completed above.
• Complete development of NGCSD advanced development demonstration unit.
• Complete demonstration and performance optimization of the integrated IVUL prototype antenna.
• Complete Airborne Communications Package and transition to Firescout UAV (PMA-263).
• Complete the integration of the PS&T radar system and conduct initial flight testing aboard the BAC-111 flight test Aircraft.
• Continue development of EA Techniques to Counter Advanced Threat by conducting field testing of Coherent EA Advanced Techniques Generator (ATG) and Digital Radio Frequency Memory (DRFM) Hardware.
• Initiate development of High Altitude Airborne Relay and Router Package.

FY 2007 Plans:

• Complete development of UHF/L Band Phased Array Antennas for CVN.
• Complete development of High Altitude Airborne Relay and Router Package.
• Complete development of S-band Digital Array Radar.
• Continue development of EA Techniques to Counter Advanced Threat by conducting field testing of the Coherent EA ATG and DRFM Hardware.
• Initiate Enhanced NULKA Payload project with the assembly and testing of a prototype transmit array using Gallium Arsenide (GaAs).

C. OTHER PROGRAM FUNDING SUMMARY:
NAVY RELATED RDT&E:
PE 0204152N (E-2 Squadrons)
PE 0601153N (Defense Research Sciences)
PE 0602271N (RF Systems Applied Research)
PE 0602123N (Force Protection Applied Research)

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PE 0603123N (Force Protection Advanced Technology)
PE 0602235N (Common Picture Applied Research)
PE 0603235N (Common Picture Advanced Technology)
PE 0602131M (Marine Corps Landing Force Technology)
PE 0603640M (Marine Corps Advanced Technology Demonstration (ATD))

NON-NAVY RELATED RDT&E: Not applicable.

D. ACQUISITION STRATEGY:
Not applicable.

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PROJECT NUMBER: Various PROJECT TITLE: Congressional Plus-Ups

CONGRESSIONAL PLUS-UPS:

R9152	FY 2004	FY 2005
COMMON AFFORDABLE RADAR PROCESSOR	5,783	7,627

The FY 2004 effort developed a single Data Distribution Module (DDM) and demonstrated four input data streams and four output beams via open architecture Ethernet based interfaces.

The FY 2005 effort will be used to replicate and scale the baseline DDM and demonstrate row and column integration and scalability for the S-band radar digital beam forming application.

R9329	FY 2004	FY 2005
APY-6 REALTIME PRECISION TARGETING RADAR	4,805	2,477

The FY 2004 effort updated the current AN/APY-6 with a wideband surface mode, increased the number of test flight hours and additional software for surface target identification.

The FY 2005 effort will develop additional maritime modes and software for the APY-6 baseline. The Navy has a particular interest in "image while scan" and periscope detection modes. The plans include a high altitude data collection of sea clutter, to develop detection algorithms, and integrate "image while scan" processing.

R9330	FY 2004	FY 2005
HIGHLY MOBILE TACTICAL COMMUNICATIONS	1,636	2,972

The FY 2004 effort integrated Iridium satellite communications with current Expeditionary Maneuvering Warfare (EMW) Line-of-sight terrestrial tactical communication systems. Demonstrated Iridium tactical communication overlay technology.

The FY 2005 effort will design and develop the technology to provide a scalable networking demonstration for integrating military tactical radios (SINCGARS, EPLRS) with small form factor, ruggedized Iridium satellite handsets in order to provide over-the-horizon communications for Marine Corps warfighters. The focus will be

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on the scalability of this networking technology in a realistic test environment with a large number of nodes in order to more accurately assess performance and future product suitability.

R9331	FY 2004	FY 2005
REMOTE OCEAN SURVEILLANCE SYSTEM (ROSS)	2,017	1,485

The FY 2004 effort was used to conduct experiments, develop algorithms and assess the performance of three separate imagers.

The FY 2005 effort will be used to develop a real time processor for the system.

R9332	FY 2004	FY 2005
SCOUT (LPI) RADAR DEMONSTRATION	2,410	0

This effort completed modifications to the timing and waveform subsystem for zoom modes modification in the Scout radar system.

R9481	FY 2004	FY 2005
C BAND ACTIVE ARRAY RADAR	0	6,340

This effort will develop affordable Transmit and Receive modules and radar at C-Band for small ships, where high performance S and X band arrays are not required.

R9482	FY 2004	FY 2005
HORIZON EXTENSION SURVEILLANCE SYSTEM (HESS)	0	2,081

This effort will develop a UAV based radar for extending the detection horizon against sea skimming missiles.

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R9483	FY 2004	FY 2005
MINIATURE AUTOMATIC FUSION SPLICER	0	991

This effort will develop an automated splicer for military fiber optic cables onboard ships, aircraft, and land bases. The technology will develop electronic video image processing to perform automatic alignment and high voltage spark fiber optic welding to precisely align and fuse the optical fibers automatically.

R9484	FY 2004	FY 2005
PHOTONICS PROTOTYPING FACILITY	0	4,161

The effort will develop a prototyping process technology needed to fabricate prototype photonic integrated circuity for military and commercial requirements.