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

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

COST: (Dollars in Thousands)

Project Number & Title	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
Total PE	63,204	100,982	45,317	2,627	26,782	26,357	25,974
2913 RF SYSTEMS ADVANCED TECHNOLOGY	35,811	73,932	45,317	2,627	26,782	26,357	25,974
9999 CONGRESSIONAL PLUS-UPS	27,393	27,050	0	0	0	0	0

A. MISSION DESCRIPTION AND BUDGET ITEM JUSTIFICATION: 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 supporting the Future Naval Capabilities (FNC) Program Enabling Capabilities (ECs) for Multi-Source ISR to the Warfighter and Advanced Electronic Sensor Systems for Missile Defense. 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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B. PROGRAM CHANGE SUMMARY:

	FY 2005	FY 2006	FY 2007
FY 2006 President's Budget Submission	71,743	75,070	50,041
Congressional Action	0	27,050	0
Congressional Undistributed Reductions/Rescissions	-55	-1,138	0
Execution Adjustments	-7,092	0	0
Federal Technology Transfer	-34	0	0
FY 2005 SBIR	-1,366	0	0
Program Adjustments	8	0	0
Program Realignment	0	0	-4,809
Rate Adjustments	0	0	85
FY 2007 President's Budget Submission	63,204	100,982	45,317

PROGRAM CHANGE SUMMARY EXPLANATION:
Technical: Not applicable.

Schedule: Not applicable.

C. OTHER PROGRAM FUNDING SUMMARY:
Not applicable.

D. ACQUISITION STRATEGY:
Not applicable.

E. PERFORMANCE METRICS:
Performance Metrics are discussed within the R-2a.

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

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603271N PROGRAM ELEMENT TITLE: RF SYSTEMS ADVANCED TECHNOLOGY
PROJECT NUMBER: 2913 PROJECT TITLE: RF SYSTEMS ADVANCED TECHNOLOGY

COST: (Dollars in Thousands)

Project Number & Title	FY 2005 Actual	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate	FY 2010 Estimate	FY 2011 Estimate
2913 RF SYSTEMS ADVANCED TECHNOLOGY	35,811	73,932	45,317	2,627	26,782	26,357	25,974

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 2005	FY 2006	FY 2007
ADVANCED MULTI-FUNCTION RF TECHNOLOGY	18,199	43,126	45,317

This effort develops, demonstrates, and transitions 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 systems and capabilities with reduced cost, time, and complexity while mitigating the risk of obsolescence; and provide ability to rapidly exploit technological innovation

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603271N PROGRAM ELEMENT TITLE: RF SYSTEMS ADVANCED TECHNOLOGY
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through open systems concepts.

Major objectives 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.

This activity also addresses the following capabilities:
Digital Array Radar S&T develops open architecture digital beamforming and digital transmit and receive capability for CG(X).

Electronic Attack (EA) Techniques maintain effective countermeasures in the face of increasingly sophisticated Naval threats.

Shipboard EO/IR Closed Loop Self-Protection develops Shipboard Integrated Electro-optic Defense System (SHIELDS) hardware which includes a Mid-wave IR (MWIR) camera operating in the 2-5 um wavelength spectral band. This effort was previously funded in PE 0603123N.

Littoral Affordability is a classified program.

FY 2005 to FY 2006 increases due to FNC MFEW/ES.

The funding profile from FY06 to FY07 reflects the reorganization of Future Naval Capabilities (FNC) Program investments into Enabling Capabilities (ECs). As a result of this reorganization, the funding for each EC has been aligned to a Budget Activity 2 and Budget Activity 3 PE as appropriate. This Activity reflects the alignment of investments for the following ECs: Multi-Source ISR to the Warfighter and Over-The-Horizon Missile Defense.

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FY2005, FY2006, and FY2007 budget growth is attributed to addition (from COMMUNICATIONS AND ELECTRONICS activity) of EA Techniques, Littoral Affordability, and Affordable Ground Based Radar; the addition of new start S-Band DAR, and the addition of EO/IR Closed Loop Self-Protection from PE 0602123N.

FY 2005 Accomplishments:

- Continued the MFEW/ES Program Technology Development Phase.
- Continued 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.
- Continued MFEW/ES Core Software Development.
- Continued Shipboard EO/IR Closed Loop Self-Protection effort. Effort was moved into this activity from PE 0603123N.
- Completed ADM testing of the AGBR project in time to support Marine Corps Milestone B decision on the GATOR MRRS program in mid-FY 2005.
- Initiated development of a High Band array antenna capable of simultaneously supporting multiple Electronic Support Measures (ESM) surveillance functions for the MFEW/ES ADM, providing 4 high gain high sensitivity Electronics Support Measures beams.
- Initiated development of a Mid Band array antenna capable of simultaneously supporting multiple ESM functions for the MFEW/ES ADM.
- Initiated development of back-end analog receiver equipment supporting MFEW/ES ADM.
- Initiated 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.
- Initiated development of S-band Digital Array Radar, enabling simultaneous SBT and AAW missions.
- Initiated and completed a segment of the Missile Defense FNC Littoral Affordability effort (classified program).
- Initiated the Advanced Technology Development phase of the EA Techniques to Counter Advanced Threats effort by commencing laboratory demonstration of synthetic sea clutter EA waveforms with a timing resolution of 20 nanoseconds.
- Initiated development of a Real Time PS&T Radar, providing 360 degree maritime surveillance.

FY 2006 Plans:

- Continue all efforts of FY 2005 less those noted as completed above.

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PROGRAM ELEMENT: 0603271N PROGRAM ELEMENT TITLE: RF SYSTEMS ADVANCED TECHNOLOGY
PROJECT NUMBER: 2913 PROJECT TITLE: RF SYSTEMS ADVANCED TECHNOLOGY

• Complete the integration and testing of the Real Time PS&T Radar, providing 360 degree maritime surveillance.

FY 2007 Plans:

• Continue all efforts of FY 2006 less those noted as complete above.
• Complete the MFEW/ES Program Technology Development Phase. Demonstrate 4 beams/band operations on ADM, with following functionality:
• 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. Demonstrate capability to support 4 beams/band transmit functions.
• Complete development of S-band Digital Array Radar components development.
• Complete the EA Techniques to Counter Advanced Threats effort by conducting field testing of the Coherent EA Advanced Techniques Generator (ATG) and Digital Radio Frequency Memory (DRFM) Hardware containing a field programmable gate array (FPGA) development board that is capable of operating at 200 MHz.
• Complete the Shipboard EO/IR Closed Loop Self-Protection effort by final at-sea demonstration of the Shipboard Integrated Electro-optic Defense System (SHIELDS) hardware which includes a Mid-wave IR (MWIR) camera operating in the 2-5 um wavelength spectral band.

	FY 2005	FY 2006	FY 2007
ELECTRONICS AND COMMUNICATIONS TECHNOLOGIES	17,612	30,806	0

The funding profile from FY06 to FY07 reflects the reorganization of Future Naval Capabilities (FNC) Program investments into Enabling Capabilities (ECs). As a result of this reorganization, the funding for each EC has

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603271N PROGRAM ELEMENT TITLE: RF SYSTEMS ADVANCED TECHNOLOGY
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been aligned to a Budget Activity 2 and Budget Activity 3 PE as appropriate. This Activity reflects the alignment of investments for the following FORCEnet ECs: Discriminate and Provide Terminal Guidance for Weapons Targeted at Moving Targets, GIG-Compliant Networking, Advanced Communication for FORCEnet, and Marine and UxV Tactical ISR.

Beginning in FY07, the following projects previously reported within the ELECTRONICS and COMMUNICATIONS TECHNOLOGIES activity are aligned with the SEA SHIELD FNC EC, and have accordingly moved to the ADVANCED MULTI-FUNCTION RF TECHNOLOGY activity under this PE: S-Band Digital Array Radar (DAR), EA Techniques to Counter the Advanced Threat, Littoral Affordability, and Affordable Ground Based Radar.

FY 2005 to FY 2006 increase due to transfer of the High Altitude Relay from 0602235N; and FY 2006 to FY 2007 decrease due to planned completion of FNC efforts.

FY 2005 Accomplishments:

- Completed Real Time Composite Networking and transition to Advanced Digital Networking System (PMW-173).
- Completed development of X/Ku band phased array antenna, providing > 100 Mbps within 3 degree beamwidth.
- Initiated development of Ultra High Frequency (UHF)/L Band Phased Array Antennas for Carrier Vessel Nuclear (CVN), to provide 16-20 JTRS compliant communications beams within CVN RCS requirements.
- Initiated development of a Real Time Precision Surveillance Targeting (PS&T) Radar.
- Initiated Airborne Communications Package and complete airborne testing.
- Initiated advanced development of Next Generation Communication at Speed and Depth (NGCSD), 2400 bps throughput.
- Initiated demonstration and performance optimization of the Integrated, Very High, Ultra High Frequency, L Band (IVUL) prototype antenna, meeting DD(X) RCS with -20 to -30 dB intermod products.

FY 2006 Plans:

- Continue all efforts of FY 2005 less those noted as completed above.
- Complete the integration of the PS&T radar system and conduct initial flight testing aboard the P-3C flight test Aircraft.
- Complete development of NGCSD, 2400 bps throughput; effort transfers to PMW 770 Submarine Integrated Antenna System (SIAS).
- Complete demonstration and performance optimization of the Integrated, Very High, Ultra High Frequency, L

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603271N PROGRAM ELEMENT TITLE: RF SYSTEMS ADVANCED TECHNOLOGY
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Band (IVUL) prototype antenna, meeting DD(X) RCS with -20 to -30 dB intermod products.
• Complete the integration and testing of the Real Time Precision Surveillance Targeting Radar, providing 360 degree maritime surveillance.
• Continued development of Ultra High Frequency (UHF)/L Band Phased Array Antennas for Carrier Vessel Nuclear (CVN), to provide 16-20 JTRS compliant communications beams within CVN RCS requirements. FY07 work will continue in PE 0603235N.
• Initiate and complete Airborne Communications Package and transition to FIRESCOUT UAV (PMA-263), providing 3-beam TCDL out to greater than 80 nautical miles. (FY05 work was funded under PE 0602235N.)
• Initiate development of High Altitude Airborne Relay and Router Package to deliver multi-beam relay/router and high altitude (>65,000ft) capability across UHF, VHF, L and Ku bands with > 200 nm footprint. Work was funded in PE 0602235N in FY05; FY07 work will continue under PE 0603235N.

FY 2007 Plans:

• No further efforts in this activity.

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)
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 (USMC Advanced Technology Demonstration (ATD))

NON-NAVY RELATED RDT&E: Not applicable.

D. ACQUISITION STRATEGY:
Not applicable.

BUDGET ACTIVITY: 03
PROGRAM ELEMENT: 0603271N PROGRAM ELEMENT TITLE: RF SYSTEMS ADVANCED TECHNOLOGY
PROJECT NUMBER: 9999 PROJECT TITLE: Congressional Plus-Ups

CONGRESSIONAL PLUS-UPS:

	FY 2005	FY 2006
APY-6 REAL TIME PRECISION TARGETING RADAR	2,413	2,000

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

FY 2006 - This effort supports APY-6 real time precision targeting radar research.

	FY 2005	FY 2006
C-BAND ACTIVE ARRAY RADAR (CBAAR)	6,173	12,750

FY 2005 - This effort developed affordable Transmit and Receive modules and radar at C-Band for small ships, where high performance S and X band arrays are not required.

FY 2006 - This effort supports CBAAR research.

	FY 2005	FY 2006
COMMON AFFORDABLE RADAR PROCESSOR	7,426	6,800

FY 2005 - This effort replicated and scaled the baseline Data Distribution Module (DDM) and demonstrated row and column integration and scalability for the S-band radar digital beam forming application.

FY 2006 - This effort supports common affordable radar processor research.

	FY 2005	FY 2006
HIGHLY MOBILE TACTICAL COMMUNICATIONS	2,893	2,600

FY 2005 - This effort developed the technology to provide a scalable networking demonstration for integrating

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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 was 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.

FY 2006 - This effort supports HMTC research.

	FY 2005	FY 2006
HORIZON EXTENSION SURVEILLANCE SYSTEM	2,026	1,400

FY 2005 - This effort developed a UAV based radar for extending the detection horizon against sea skimming missiles.

FY 2006 - This effort supports HESS research.

	FY 2005	FY 2006
JOINT ELECTRONIC ATTACK UNMANNED VEHICLES	0	1,500

This effort supports Joint Electronic Attack Unmanned vehicles research.

	FY 2005	FY 2006
MINIATURE AUTOMATIC FUSION SPLICER	964	0

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

	FY 2005	FY 2006
PHOTONICS PROTOTYPING FACILITY	4,052	0

This effort developed a prototyping process technology needed to fabricate prototype photonic integrated circuitry for military and commercial requirements.

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	FY 2005	FY 2006
REMOTE OCEAN SURVEILLANCE SYSTEM (ROSS)	1,446	0

This effort developed and demonstrated an operational high resolution, multispectral camera for the detection and classification of underwater objects.