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APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-wide BA3 Advanced Technology Development				R-1 ITEM NOMENCLATURE Command, Control and Communications Systems PE 0603760E, R-1 # 46				
COST (In Millions)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Total Program Element (PE) Cost	189.062	219.765	216.408	220.918	257.552	267.296	256.872	257.884
Command & Control Information Systems CCC-01	24.737	54.629	56.422	59.610	70.030	70.400	70.900	70.900
Information Integration Systems CCC-02	114.453	99.146	108.384	110.907	124.295	128.795	127.985	127.985
Classified CCC-CLS	49.872	65.990	51.602	50.401	63.227	68.101	57.987	58.999

Mission Description:

(U) This program element is budgeted in the Advanced Technology Development Budget Activity because its purpose is to demonstrate and evaluate advanced information systems research and development concepts.

(U) The goals of the Command and Control Information Systems project are to develop and test innovative, secure architectures and tools to enhance information processing, dissemination and presentation capabilities for the commander. This will give the commander insight into the disposition of enemy and friendly forces, a joint situational awareness picture that will improve planning, decision-making and execution support capability and provide secure multimedia information interfaces and assured software to "on the move" users. Integration of collection management, planning and battlefield awareness programs is an essential element for achieving battlefield dominance through assured information systems.

(U) The goals of the Information Integration Systems project are to take diverse data inputs from a variety of sources, efficiently disseminate the information, and perform distributed and dynamic all-source correlation and fusion to produce an integrated, geo-spatially referenced, battlefield database and knowledge-base. The principal element of this project is assured communications using standard and non-traditional means.

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(U) Program Change Summary: *(In Millions)*

	FY 2004	FY 2005	FY2006	FY2007
Previous President's Budget	193.562	225.784	222.153	245.421
Current Budget	189.062	219.765	216.408	220.918
Total Adjustments	-4.500	-6.019	-5.745	-24.503
Congressional program reductions	0.000	-6.019		
Congressional increases	0.000	0.000		
Reprogrammings	-4.500	0.000		
SBIR/STTR transfer	0.000	0.000		

(U) Change Summary Explanation:

FY 2004	Decrease from reprogramming for Grand Challenge to Project AE-02.
FY 2005	Decrease reflects congressional program reduction for Space Based Networking and undistributed reductions.
FY 2006	Decrease reflects minor project repricing.
FY 2007	Decrease reflects phase down of Advanced Ground Tactical Battlefield Manager and Urban Commander programs in Project CCC-01; phase down of Next Generation (XG), Symbiotic Control and Optical & RF Combined Link Experiment (ORCLE) for planned transitions in the 2006/2007 timeframe; and reductions to classified programs in CCC-CLS.

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COST (In Millions)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Command & Control Information Systems CCC-01	24.737	54.629	56.422	59.610	70.030	70.400	70.900	70.900

(U) Mission Description:

(U) Military operations since the end of the Cold War illustrate that current theater-level command, control, communications, and intelligence/information systems lack the ability to fully support operations in complex, time-critical environments. Warfighters must be prepared for operations ranging from conflict and peacekeeping in urban centers to heavy battle actions in remote areas. Current capabilities do not provide the commander with real-time, secure, situational awareness or the ability to orchestrate high-tempo planning, rehearsal, and execution. The programs in this project are developing and testing innovative, secure architectures and tools to enhance information processing, dissemination, and presentation capabilities. The programs provide the commander insight into the disposition of enemy and friendly forces, a joint situational awareness picture that will improve planning, decision-making, and execution support capability, as well as secure multimedia information interfaces and software assurance to the warfighter "on the move." Integration of collection management, planning, and battlefield awareness are essential elements for achieving battlefield dominance through assured information systems.

(U) Warfighter dependence on information systems is growing. DoD systems must deliver and protect information and assure the availability of associated services – particularly in a stressed environment. Included in this project are Joint Air/Ground Operations: Unified Adaptive Replanning (JAGUAR), Advanced Ground Tactical Battle Manager, Predictive Battlespace Awareness, Comprehensive Force Protection, Urban Commander, Heterogeneous Urban Reconnaissance Team (HURT), Tactical Group Decision Analysis Support System, Organically Assured and Survivable Information Systems (OASIS), and Active Templates (AcT).

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(U) Program Accomplishments/Planned Programs:

	FY 2004	FY 2005	FY 2006	FY 2007
Joint Air/Ground Operations: Unified, Adaptive Replanning (JAGUAR)	7.586	10.936	10.178	10.356

(U) The Joint Air/Ground Operations: Unified, Adaptive Replanning (JAGUAR) program will improve battle management for complex air campaigns that employ new air platforms featuring precision sensors and weapons and communications relays. JAGUAR technology employs: 1) targeting information, both for sensor targets and strikes, expressed as point and area targets (i.e., search, combat air patrol); 2) rules of engagement and procedural constraints, such as airspace restrictions; and 3) availability of platforms, weapons, sensors, and communications equipment. From this information JAGUAR will produce ingress routes, flight schedules and patrol zones, while assuring airspace and electronic deconfliction. The technology will provide pilots and commanders the option to choose conventional tactics or conceive unconventional operations. In the latter case, the system will capture the innovation and retain the strategic maneuver for future mission plans. JAGUAR monitors actual plan execution against expected results and alerts commanders to significant differences. The technology will capture statistical descriptions of insignificant differences to help assess the robustness of future plans. The JAGUAR technology is planned for transition to the Air Force at the conclusion of Phase III anticipated to be completed by FY 2008.

(U) Program Plans:

- Equip a training facility with software tools and human observers to capture plans as constructed, executed, and modified.
- Conduct exercises and capture a large set (several hundred) of mission plans as example cases.
- Decompose each plan into plan fragments.
- Assemble groups of related plan fragments into plan templates.
- Develop a large-scale integration algorithm to assemble plan fragments into a synchronized operational plan.
- Build optimization tools to tailor routes, schedule events, and deconflict airspace and radio frequencies.
- Compile standard mission plan products from the optimized operational plan.
- Demonstrate tools to correlate actual field events to planned events.
- Evaluate these techniques in periodic training events.

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	FY 2004	FY 2005	FY 2006	FY 2007
Advanced Ground Tactical Battle Manager	3.041	9.000	9.220	6.133

(U) The Advanced Ground Tactical Battle Manager program is developing automated decision support tools for Army and Marine tactical commanders at the battalion level and below. The program also provides support for combined operations employing dismounted soldiers, manned platforms, and autonomous vehicles. The tool will elicit skeletal courses of action through a graphical interface with unit commanders and extend plans by applying adversarial reasoning techniques to identify vulnerabilities and opportunities in the predicted enemy course of action. Finally, modifications or counteractions will be developed to reduce vulnerabilities. A variant of the program would issue plans to subordinate unit commanders and human controllers and possibly integrate necessary elements to automated platforms or automated battle managers.

(U) Program Plans:
- Develop an exercise environment with the Army Battle Command Battle Labs.
- Define interfaces to existing and future Army intelligence and command and control systems.
- Develop prototype tools to augment capability.
- Conduct experiments to ascertain the value of the tools.

	FY 2004	FY 2005	FY 2006	FY 2007
Predictive Battlespace Awareness	2.000	6.034	4.046	3.258

(U) The Predictive Battlespace Awareness program is developing technology to predict the range of an opponent's future actions. The program will enable commanders to pre-position sensors, weapons, and information to counter the opponent's actions. The program will develop model- and knowledge-based techniques to predict areas of operation and tactical objectives. The technology will support the modeling of courses of action ranging over time horizons from hours to days. Program techniques permit "on-the-fly" tailoring of models and contextual knowledge and leverage knowledge of sensor effectiveness, mobility factors, tactical templates, and target characteristics. Techniques to be developed include variable-fidelity prediction, such as the ability to determine both target locations over minutes and force zones of influence over hours. The tools anticipate enemy operations in time to thwart them with effects-based targeting, enabling use of sensors and other resources in proactive

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modes. The program empowers commanders to avoid canned responses and supports rapid incorporation of insights about new enemy strategies, capabilities, and tactics from peacetime to the heat of battle. The program will significantly enhance today's mostly manual, slow planning, and analysis processes.

(U) Program Plans:
- Survey recent military operations to identify cases where opponent's actions could have been anticipated.
- Define a set of realistic challenge problems, including scenarios and a simulation facility to illustrate the context and value of predictive battlespace awareness.
- Develop approaches to prediction that combine physics-based modeling (e.g., for mobility and observability) with knowledge-based techniques (e.g., plan generation or recognition).
- Evaluate alternative approaches against the challenge problems.
- Define a system architecture that combines the best approaches into a consistent, mutually supporting toolkit.
- Integrate selected technologies into the toolkit.

	FY 2004	FY 2005	FY 2006	FY 2007
Comprehensive Force Protection	2.500	4.224	4.943	7.763

(U) The Comprehensive Force Protection program is developing a rapidly deployable system to provide assured protection of permanent or temporary U.S. base camps in hostile territory. The system includes wide-area sensors and platforms to maintain continuous surveillance of the camp area. The sensors detect potential intruders and weapon launches. The program also includes a suite of airborne sensor platforms that can be tasked rapidly to investigate potential threats or "lock on" to personnel or weapons involved in an attack. Data collected from sensors is automatically analyzed, correlated, and provided to commanders to confirm threats and authorize precision weapons to engage. The system maintains continuous perimeter surveillance, allows rapid investigation, and, when authorized, attack threats.

(U) Program Plans:
- Review past and forecasted threat analyses to characterize intrusions, events, activities and signatures.
- Select a test area in which data on intrusions can be collected.

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- Place a variety of sensors, both extant and developmental, into the test site along with a communications network back to a data analysis and command station.
- Collect data on realistic intrusions in a variety of weather conditions.
- Characterize the performance of candidate signal processing, target recognition and localization, and environment monitoring algorithms on the test data.
- Select a set of algorithms for a baseline system build.
- Construct and calibrate a system performance model for the selected algorithms.
- Exercise the baseline system in the testbed and compare results against the performance model.
- Selectively improve algorithmic components that contribute most to performance gaps.
- Demonstrate the final system in continuous operation at a CONUS base.

	FY 2004	FY 2005	FY 2006	FY 2007
Urban Commander	2.415	15.200	14.025	11.727

(U) The Urban Commander thrust will develop automated tools to help ground commanders construct detailed, realistic operational plans, particularly in nontraditional and urban environments. Partial plans will be represented in hierarchical task networks and visualized through synchronization matrices, icon overlays, or tactical sketch animations. Commanders and staff will modify, refine, and extend a plan through voice, sketching, and semi-structured input. The system links fragments constructed at different sites, transfers information among related parts, and discovers and recommends solutions for inconsistencies. The system continuously compiles a set of plan cases and employs analogical matching to propose extensions to current plans suggested by past experience. Plan elements are communicated through an integrated set of protocols from the unit commander down to dismount commanders equipped with advanced heads-up displays and helmet-worn sensors. Finally, the program will continuously assess progress against the operational plan and alert users to significant deviations.

- The Urban Commander program is developing planning and control tools tailored to dismounted operations in complex urban environments. Urban warfare combines limited sightlines and mobility with insufficient knowledge of the disposition of enemy combatants, civilians, and the structures occupied. Urban Commander will form a command and control substrate that enables ground forces, including vehicles and dismounts, to rapidly coordinate actions as the situation and commanders knowledge of the situation

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change. The program includes: 1) spatial analysis to determine lines of sight and fields of fire; 2) planning aids to assist in sensor placement and route planning; 3) visualization tools to allow commanders and soldiers to rapidly apprehend and address a situation; and 4) analysis tools to suggest locations and types of potential threats.

- The Multi-spectral Adaptive Networked Tactical Imaging System (MANTIS) program is developing, integrating, and demonstrating a soldier-worn visualization system. The system consists of five elements: 1) helmet-mounted, multi-spectral sensor suite; 2) helmet-mounted, high resolution digital display; 3) helmet-mounted, inertial measurement unit (IMU); 4) high-speed processor; and 5) power supply. MANTIS provides the warfighter with digitally-fused imagery in real time from the multi-spectral sensor suite, exploiting the signatures of imagery in three spectral bands: 1) the Visible/Near Infrared (VNIR, .4 - .9 microns); 2) the Short Wave Infrared (SWIR, 1 - 2 microns); and 3) the Long Wave Infrared (LWIR, 8 - 12 microns). MANTIS will regain the nighttime advantage for the individual warfighter in terms of mobility, situational awareness, and targeting. The system will also allow the warfighters to record and "play back" the video while on the battlefield. The record/playback feature includes: electronic zoom, scroll, pan and panoramic image stitching. In total, these technologies will furnish a larger field-of-view to enhance context. MANTIS will provide a vision-aided inertial navigation system (INS) and will interface with the future soldier's global positioning system (GPS). When combined with precise pose estimation from the helmet-mounted IMU, MANTIS will allow battlefield information to be overlaid on the display to provide augmented reality and increased situational awareness. MANTIS will interface with the future soldier's advanced communications systems, allowing the warfighter to send/receive video images and position information with fellow soldiers and commanders in real time. MANTIS will also allow the soldier to receive images and information from remote sensors. The coupling of the imaging system with INS/GPS will provide the individual warfighter a "point-click-kill" capability for real-time target hand-off capability to networked smart weapons fired from remote locations, thereby significantly increasing the lethality of the individual warfighter. The MANTIS technology is planned for transition to the Army at the conclusion of Phase III anticipated to be completed by FY 2006.

(U) Program Plans:

– Urban Commander.
  -- Identify a set of urban combat scenarios ranging from peacekeeping to aggressive assault.
  -- Document sets of mission tasks from which tactical plans may be constructed.
  -- Define a common plan representation, based on service training material, for combined arms operations.
  -- Construct an initial collection of operational plans, for many scenarios and force structures.
  -- Develop tools to visualize, edit, modify, and assemble new plans from mixed-mode human interaction at one location.

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-- Develop mechanisms to define and enforce policies limiting the aspects of a plan deemed relevant to each location.
-- Construct protocols to propagate changes generated at one location to affected locations, in accordance with defined policy.
-- Build flexible algorithms to match changes received from remote locations to the aspects of a plan retained locally.
-- Demonstrate detection of plan inconsistencies and recommend corrections.
-- Conduct a series of laboratory evaluations with Army and Marine commanders to assess the quality and utility of program products.

– Multi-spectral Adaptive Networked Tactical Imaging System (MANTIS).
-- Delivered Short Wave Infrared (SWIR) sensor assemblies for evaluation.
-- Completed independent laboratory characterization/field tests on SWIR sensors.
-- Completed system design analyses.
-- Evaluate/demonstrate multi-sensor imagery and processing capability via MANTIS testbed.
-- Complete prototype design.
-- Deliver two MANTIS prototypes for evaluation.
-- Complete independent laboratory/field tests of MANTIS prototypes.
-- Transition to U.S. Army Future Soldier/Land Warrior via Future Force Warrior to Special Operations Forces and other transition partners.

	FY 2004	FY 2005	FY 2006	FY 2007
Heterogenous Urban Reconnaissance Team (HURT) (formerly (C3RS))	0.000	9.235	11.157	15.782

(U) The Heterogeneous Urban Reconnaissance Team (HURT) initiative (formerly the Command and Control for CollaboRobotic Systems effort) will develop integrated tactical planning and battle management systems for heterogeneous collections of unmanned platforms operating in urban environments. HURT employs a model-based, control architecture, dynamic teaming and platform-independent command and control. The system registers new platforms with the battle manager (kinematics, maneuverability, endurance, payloads, and communications links) within the overall control model. HURT will provide a commander's interface, which allows collaborative tasking of the platforms in the form of operational missions, such as search, track, identify, or engage, rather than routes and events. Additionally, it could supply computationally intensive decision aids, such as advanced 4D airspace and groundspace deconfliction tools, route planners, and task/platform assignments algorithms. The

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technology will present mission status and future courses of action to commanders for collaborative adjudication. HURT will enable augmentation of low-footprint, rapidly deployable, easily sustainable human command structures with teams of machines operating together. HURT will define suitable roles for human command staffs charged with controlling squads of automated forces. The HURT technology is planned for transition to the United States Marine Corps, U.S. Special Operations Command, and Air Force Special Operations Command at the conclusion of Phase III anticipated to be completed by FY 2007.

(U) Program Plans:
- Select a baseline planning/control algorithm.
- Develop hybrid state models.
- Define multi-user reconnaissance missions.
- Assess the ability of the planning/control algorithms to effectively use each platform.
- Conduct field tests at an urban warfare training facility.

	FY 2004	FY 2005	FY 2006	FY 2007
Tactical Group Decision Analysis Support System	0.000	0.000	2.853	4.591

(U) The Tactical Group Decision Analysis Support Systems program will develop distributed group decisions analysis tools. These tools will increase the tempo of the tactical commander's observe-orient-decide-act (OODA) loop, the quality of decisions, and contribution of data point input across the organization with an emphasis on maximizing input on decisions breadth, decision content, problem attributes considered, and events/actions considered. The developed tools will be applied in crisis management situations for tactical commanders and could be transitioned to existing emergency response command and control systems as well as emerging tactical command and controls systems.

(U) Program Plans:
- Develop novel data structures and algorithms to exploit as many individual contributions as possible to a group decision problem in order to provide a comprehensive and well-founded automated decision.
- Create distributed infrastructure and user interface mechanisms to support real-time group decision analysis without the need for expert facilitators/participants to be in the same place at the same time.

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- Provide a capability for continuous tracking of real-world events as well as stakeholder revisions related to the decision, to alert the tactical commander when the decision that was made is no longer optimal.

	FY 2004	FY 2005	FY 2006	FY 2007
OASIS	5.227	0.000	0.000	0.000

(U) The Organically Assured and Survivable Information Systems (OASIS) program developed technologies for DoD information systems to sustain the operation of mission-critical functions in the face of cyber attacks or accidental faults. These technologies included an intrusion tolerant database architecture using commercial off-the-shelf (COTS) components; a distributed architecture for deploying intrusion-tolerant mechanisms featuring explicitly stated but flexible tolerance policy; a framework for tolerating intrusions in large-scale, heterogeneous, networked computing enterprises; and system integrity and availability framework that combines passive intrusion tolerance and active intrusion recovery mechanisms. The program used the systems approach to the intrusion problem by integrating prevention, detection, response and tolerance technologies into a military system. The goal was to significantly improve the survivability of the system in the face of a large-scale cyber attack. The OASIS technology will transition to the Air Force after completion of red team validations. Specifically, key aspects of the survivable design are planned to be incorporated to the Joint Battlespace Infosphere (JBI) system development.

(U) Program Plans:

- Integrated OASIS and other DARPA and commercial technologies to develop and demonstrate a survivable variant of the Joint Battlespace Infosphere (JBI).
- Validated survivability claims of OASIS researchers technologies using recognized methodologies on operational systems.
- Demonstrated the effectiveness of survivable architectures in the face of a determined cyber attack on critical military information system.
- Evaluated and applied novel approaches to composing assurance cases for large-scale systems.

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	FY 2004	FY 2005	FY 2006	FY 2007
Active Templates (AcT)	1.968	0.000	0.000	0.000

(U) The Active Templates (AcT) program produced robust, lightweight software technologies to improve Special Operations Forces mission planning and execution. Active Templates are distributed applications whose variables were linked to live data feeds and external problem-solving algorithms. AcT helped automate planning and execution by capturing, suggesting, and updating critical information, such as current state, goals, constraints, alternative actions, standard defaults, decisions in context and rationale. Active Templates were designed to be easily tailored, networked, noise-tolerant, user-supported, scalable, and widely adopted. AcT enabled special operations planners to create plans six times faster, improved plan quality by considering up to eight times more options, reduced staff-hours required to track and coordinate missions by 60 percent, and enhanced capture of lessons learned. This technology promises significantly improved national capability to respond in a crisis. Early prototypes of AcT technologies have been adopted and used by Special Operations Command (SOCOM), including use during Operation Enduring Freedom. There, they reduced plan development time by a factor of four and reduced personnel required for battle tracking by a factor of six. DARPA is working closely with the Joint Special Operations Command to develop temporal and spatial planning applications and simple forms-based coordination tools that may be defined dynamically by ordinary users in less than a day. Special Operations Command has approved a program for transitioning these technologies to the theater forces.

(U) Program Plans:
- Incorporated advanced problem solvers like generative planning, temporal/uncertain reasoning, and triggering for complex events.
- Demonstrated temporal, spatial, and forms-based mission planning and execution control tools.
- Measured their effectiveness in special operations exercises.
- Transitioned to U.S. Special Operations Command (SOCOM) and to all theater special operations commands.

(U) Other Program Funding Summary Cost:

- Not Applicable.

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COST (In Millions)	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Information Integration Systems CCC-02	114.453	99.146	108.384	110.907	124.295	128.795	127.985	127.985

(U) Mission Description:

(U) The goals of the Information Integration Systems project are to take diverse data inputs from a variety of sources, efficiently disseminate the information, and perform distributed and dynamic all-source correlation and fusion to produce an integrated, geo-spatially referenced, battlefield database and knowledge-base. Through the use of wideband dissemination and integrated sensor management, the project will also facilitate multi-site, real-time, collaborative situation assessment and course-of-action evaluations to enable true network centric warfare concepts. This project hosts many of DARPA's most innovative communications and networking systems. Programs funded are: Secure Adaptive Waveforms (SAW) program, the Connectionless Networking (CN) program, the Next Generation (XG) program, the Advanced Speech Encoding (ASE) program, the Symbiotic Communications (SYCO) program, the Optical & RF Combined Link Experiment (ORCLE), the Policy Based Network Management program, the Disruption Tolerant Networking program, the Network Centric Operations / Battle Command program, the Advanced Antenna Concepts program, the Navy Photonics program, the Advanced HF Communications program, the Communications to the Tactical Edge program, the Self-Forming Geographic Networks program, the Ideal RF Link program, the Robust, Responsive, Reconfigurable and Invisible (R3I) Network program and the Airborne Communications Node (ACN)/Adaptive Joint C4ISR Node Advanced Concept Technology Demonstrator (AJCN ACTD).

(U) Program Accomplishments/Planned Programs:

	FY 2004	FY 2005	FY 2006	FY 2007
Secure Adaptive Waveforms (SAW)	7.146	7.800	4.013	6.753

(U) The Secure Adaptive Waveforms (SAW) program, and the related Polarized Rotation Modulation (PRZM) Communications program, will address lessons learned from the Airborne Communication Node (ACN) program concerning the need for secure communications waveforms. The SAW program will investigate approaches for an adaptive waveform agile communications system that can change structure (frequency,

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modulation, data rate, hop rate, code, etc.) on a periodic or aperiodic basis to minimize the probability of detection, interception, and exploitation in order to support covert operations. New means of conducting secure communications are needed because the commercial availability of high performance RF components makes the basic tools necessary for conducting signals intelligence (SIGINT) exploitation available to our adversaries. It is realistic to assume that adversaries will soon have the capability and means to develop software exploitation techniques that make even the most advanced U. S. communications systems vulnerable. To defeat this threat, the technical goal is to identify approaches to eliminate repeatability in transmissions by adapting the waveform randomly and forcing random network routing.

(U) The goal of the Polarized Rotation Modulation (PRZM) Communications program is to develop new extremely high data rate, point-to-point, and wireless communications using the PZRM communications concept which can be implemented at any wavelength – RF to visible – to exploit the presently unused polarization and rotation dimensions of radiation. The PRZM communications program will investigate the use of polarization modulation and the ability for conventional radios to carry all information over the transmitted signal amplitude, phase and frequency. Polarization modulation introduces an additional dimension. A radio with four polarization possibilities would transmit four times the information with all other aspects of the waveform held constant. Use of the antenna as part of the information processing architecture of a radio has not been previously performed. This technology will greatly increase the capability of existing channels without increase in spectrum or modem complexity. The program will be demonstrated as an enhancement to an otherwise state of the art networking system. The Polarization Modulation technology is planned for transition to Service applications in FY 2008.

(U) Program Plans:

- Secure Adaptive Waveforms
  - Initiate system design effort.

- Polarized Rotation Modulation Communications
  - Perform simulations to determine bit error rates and the optimum modulation schemes commensurate with the center frequencies and bandwidth permissible.
  - Conduct simulations to verify performance predictions and identify component elements.
  - Construct a demonstration prototype and undertake laboratory test to validate PRZM concept.
  - Demonstrate at long range under operational conditions.

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	FY 2004	FY 2005	FY 2006	FY 2007
Connectionless Networking (CN)	9.539	7.800	5.707	3.085

(U) In order to bring data efficiently from high value, but energy limited sensors (such as unattended ground sensors (UGS), into system architectures like that of the Airborne Communications Node (ACN) a new fundamental emphasis must be placed on how these kinds of sensor networks communicate. The Connectionless Networking (CN) program will develop technology to allow networks (such as UGS) to send and receive messages without initial link acquisition or previous sharing of routing information. This will, in turn, improve energy per bit of delivered information by as much as 100 to 1,000 times compared to conventional and near-term deployable communications systems such as contemplated by both commercial and military users. Conventional radio link and network designs expend most of the energy on link establishment and maintenance, as well as packet and network overhead. This energy requirement not only limits the lifetime of energy-limited systems, it unnecessarily fills the radio spectrum, limiting available bandwidth, creates unnecessary risks of detection, and increases thermal loads. These impacts are especially severe for communications with proliferated sensors, or remotely operated or updated weapons. Eliminating the requirement to maintain a continuous network linkage would enable these platforms to provide continuous connectivity without consumption of power, or compromising emanations. The CN program will exploit current signal processing components, intelligent (processing and memory intensive) routing, and availability of situational information to demonstrate a total energy savings of at least 100 times typical connection oriented network applications. The Connectionless Networking technology is planned for transition to the Army, Navy, and Air Force for Unattended Ground Sensors and low duty cycle in FY 2007.

(U) Program Plans:

- Investigated specific technology requirements for each of the traditional wireless networks.
- Determined layer specific solutions.
- Investigated layer integrating approaches.
- Modeled acquisition and media access; network and transport design; and aggregate energy cost savings.
- Predicted achievable performance improvement.
- Translate the technology design and simulations into actual hardware and software.
- Design and fabricate prototype CN network node devices, and perform laboratory and field CN demonstrations.
- Develop and evaluate candidate approaches for implementation complexity, on-board processor and memory capability/power, overhead, scalability and performance.

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	FY 2004	FY 2005	FY 2006	FY 2007
Next Generation (XG)	20.856	15.571	10.916	6.265

(U) The Next Generation (XG) program goals are to develop both the enabling technologies and system concepts to provide dramatic improvements in assured military communications in support of a full range of worldwide deployments through the dynamic redistribution of allocated spectrum along with novel waveforms. U.S. Forces face unique spectrum access issues in each country in which they operate, due to competing civilian or government users of national spectrum. These constraints must be reflected in all force planning and may preclude operation of critical systems. Coalition and allied operations are even more complex to manage, and may severely limit the U.S. ability to fully exploit its superiority and investment in information technology. The XG program approach is to develop the theoretical underpinnings for dynamic control of the spectrum, the technologies and subsystems that enable reallocation of the spectrum, and the system prototypes to demonstrate applicability to legacy and future DoD radio frequency emitters. The approach plans to investigate methods to leverage the technology base in microelectronics with new waveform and medium access and control protocol technologies to construct an integrated system. The proposed program goals are to develop, integrate, and evaluate the technology to enable equipment to automatically select spectrum and operating modes to both minimize disruption of existing users, and to ensure operation of U.S. systems. The result of the XG program will be to develop and demonstrate a set of standard dynamic spectrum adaptation technologies for legacy and future emitter systems for joint service utility. The XG Comms technology is planned for transition to the Army in the Joint Tactical Radio Systems clusters and is anticipated to be complete in FY 2007.

(U) Program Plans:

- Conducted CONUS and OCONUS spectrum usage analysis.
- Analyzed military bands during force exercises.
- Analyzed civilian band usage in a variety of locales (urban and rural settings).
- Optimized correlation between distributed nodes.
- Investigate concepts for employment and utility of a dynamic waveform to the warfighter.
- Conduct lab demo of sense and adaptation technology performance.
- Perform analysis and simulation of multiple control protocols.
- Use military band spectrum analysis to assess subsystem technology development.
- Develop testbed for hardware in-the-loop testing of concepts.

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- Characterize next generation and RF component technology for inclusion into eventual demonstrator.

	FY 2004	FY 2005	FY 2006	FY 2007
Advanced Speech Encoding (ASE)	11.032	6.228	6.699	5.832

(U) The Advanced Speech Encoding (ASE) program will achieve an order of magnitude reduction of voice communication bit rates in noisy military environments over current state-of-the-art voice encoders (vocoders). Such a reduction will significantly decrease the probability of detection of transmitted signals and will also decrease the required transmit energy, thereby increasing battery lifetime. The program will pursue two novel approaches toward achieving its goal. One approach builds upon multiple noise-immune sensors that have been combined with traditional coding algorithms to achieve significant improvements in intelligibility and quality in harsh noise environments at 2400 bps. This approach will be extended to nontraditional ultra-low-bit-rate coding algorithms in order to achieve 300 bps coding capability in harsh military environments. An alternative approach explores the possibility of communication without acoustic information by extracting laryngeal and sublingual muscle signals that are produced when a person generates subvocal speech. This approach will yield a revolutionary capability in situations where stealth is of the utmost importance, or in situations where acoustic signals cannot be used, such as under water. The Advanced Speech Encoding technology is planned for transition to the Army and is anticipated to be completed by FY 2008.

(U) Program Plans:

- Demonstrated significant improvement in intelligibility and quality in harsh noise environments at 2400 bps.
- Demonstrate a voice communication system (sensors plus coder) operating at 1000 bits per second (bps) that is at least as good as that of today's DoD standard in harsh military noise environments.
- Demonstrate 300 bps vocoder with intelligibility, quality and aural speaker recognizability in harsh military noise environments that is at least as good as that of today's DoD standard.
- Demonstrate the capability for ultra-low-rate coding in a field demonstration of a prototype communications system.
- Characterize the nature of subvocalic signals (physiological source, speaker dependence, robustness) and the information content of the signals.

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	FY 2004	FY 2005	FY 2006	FY 2007
Symbiotic Communications	22.440	12.726	8.738	2.259

(U) The Symbiotic Communications (SYCO) program will develop an airborne passive radar system to enable precision targeting and battlefield situational awareness. SYCO will generate, (1) High Resolution Terrain Information (HRTI), in real time, with accuracy at a minimum of Level 4 (as defined by the National Geospatial-Intelligence Agency (NGA)) to enable precision targeting and situational awareness; (2) passive persistent Ground Moving Target Indication (GMTI) of very slow moving targets; and (3) high resolution Synthetic Aperture Radar (SAR) imagery. This system will operate passively and be effective in clear and adverse weather. SYCO has demonstrated a proof-of-concept through ground-based and airborne flight tests. Further efforts will develop a prototype system capable of demonstrating a higher level of performance and will be packaged to be capable of deployment in a C-130 aircraft. The SYCO technology is planned for transition to the Air Force in FY 2007.

(U) Program Plans:
- Demonstrate automated algorithms to enable real-time processing.
- Develop real-time airborne demonstrator system.
- Demonstrate HRTI Level 4 with real-time processing of flight data.
- Demonstrate real-time GMTI of very slow movers.
- Participate in limited user testing.

	FY 2004	FY 2005	FY 2006	FY 2007
Optical & RF Combined Link Experiment (ORCLE)	38.541	24.519	21.041	3.791

(U) The Optical & RF Combined Link Experiment (ORCLE) seeks to develop combined radio frequency (RF) & free space optical (FSO) communications as well as networking technologies that exploit the benefits of complementary path diversity. This effort will demonstrate improved battlespace communications using a hybrid RF and FSO link in air-to-air-to-ground environments. The central challenge is to enable optical communications bandwidth without giving up RF reliability and "all-weather" performance. ORCLE will develop RF and FSO propagation channel analysis, coding techniques and modeling to include weather, atmospherics and aero-optics to provide the joint force

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commander assured high-data rate communications. The technical objective is to prototype and flight demonstrate hybrid FSO/RF air-to-air-to-ground links that combine the best attributes of both technologies and simulate hybrid network performance. The ORCLE technology is planned for transition to the Air Force by late FY 2006/early FY 2007.

(U) Program Plans:

- Develop a networking schema for quality of service using RF for latency sensitive assured delivery and FSO for bulk high bandwidth transfers that are less latency sensitive using a dynamic & synergistic dual physical layer.
- Develop compact beam steering using a small form factor and wide field of view.
- Perform range and flight demonstrations of air-to-air-to-ground hybrid FSO/RF links with high availability and gigabit data flows.
- Investigate the optical channel obscuration mitigation using ultra short pulse lasers and partially coherent beams.
- Execute common/combined FSO/RF apertures that enable transition to operational platforms as replacements rather than addition to current systems while maintaining or improving current capabilities.

	FY 2004	FY 2005	FY 2006	FY 2007
Policy Based Network Management (PBNM)	0.000	2.000	4.599	6.457

(U) Drawing upon lessons learned from the ACN/AJCN program and previous DARPA programs in mobile ad-hoc networking, the Policy Based Network Management (PBNM) program seeks to enable reliable and understandable control of non-homogeneous ad-hoc networks and other communications systems that must interact to support the commander's mission objectives. This effort seeks to create a system control methodology that will allow intuitive control over complex communications systems while still preserving the flexibility of the emerging ad-hoc networks. In addition to creating a method for an operator to understand the state of the network, PBNM will allow the network to implement the commander's intent for the operation by dynamically changing function and allocation throughout the duration of a mission. PBNM will control traffic at the application level by making the system aware of what is currently possible, what is currently allowed, and how communications are expected to change over the duration of a mission. The Policy Based Network Management technology is planned for transition to the Army in FY 2008.

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(U) Program Plans:
- Develop robust, secure self-forming tactical networks able to be dynamically changed based on the commander's strategic and operational mission objectives.

	FY 2004	FY 2005	FY 2006	FY 2007
Disruption Tolerant Networking (DTN)	0.000	7.100	6.633	10.511

(U) Drawing upon technical challenges identified in specific programs such as ACN/AJCN and other non-ground based Mobile Ad-Hoc Network (MANET) programs, the Disruption Tolerant Networking (DTN) will develop network protocols that provide high reliability information delivery using communications media that are not available at all times, such as low earth satellites, UAV over-flights, orbital mechanics, etc. The program will develop a single model for bundling information and ensuring its delivery, even through a series of episodic communications links, from generator to user. DARPA will develop the specifications, engage the military, commercial and the Internet communities to maximize the applicability and commercial viability of these protocols, and develop the basic software in an open source mode. DARPA will then implement these protocols in a typical military system to verify both the performance of the protocol, and to validate the utility. These protocols are also applicable to NASA applications, such as deep space communications. The Disruptive Tolerant Networking technology is planned for transition to the Army in FY 2009.

(U) Program Plans:
- Demonstrate that information organized into bundles can be delivered by the network.
- Commence research to show "fuzzy scheduling" can make network routing decisions in the presence of uncertainty about available or optimal paths.
- Investigate policy cognitive operation by moving intelligence into networks to make the best choices on delivery.
- Enable networks to deliver traffic without the end-to-end address and routing information using deferred, hierarchical address binding techniques.

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	FY 2004	FY 2005	FY 2006	FY 2007
Network Centric Operations/Battle Command	0.000	7.500	9.054	12.296

(U) The DoD is transforming to a more network centric focus for military operations, e.g., FORCENet, Joint Battlespace Infosphere, and Future Combat Systems/Unit of Action (UA). Until recently, the primary technological emphasis has been oriented towards improving Command, Control, Communications and Computing, Intelligence, Surveillance and Reconnaissance (C4ISR) systems to enable better sensor-decider-shooter linkages. To be more effective in joint operations, network centricity development must receive equal priority to facilitate battlefield understanding to the commanders at all echelons, in a form best suited for their information assimilation (receptive) and decision processes (intuitive). In other words, network centricity must improve the art of battle command, rather than just the science of C4ISR, to be a force multiplier. This new initiative will develop and demonstrate the enabling technologies for Network Centric Operations, with emphasis on creating understanding for battle command. It will seamlessly connect the Network Centric Enterprise and Network Centric Warfare layers through understanding, thereby enabling shared awareness, collaboration and self-synchronization among the various joint components and echelons. This program integrates technologies enabling secure, assured, multi-subscriber, multi-purpose (e.g., maneuver, logistics, intelligence) networks with commander-centric command and control/intelligence technologies, including forecasting/prediction of Courses of Action (COA) and sustainment tools, into one unified joint battle command system. It will allow the Strategic/Operational Commanders to simultaneously orchestrate and coordinate the deployment, combat operations and resourcing of multiple UAs supported by multi-service, interagency, multinational and nongovernmental activities. It will also support long range indirect fire support and effects, persistent theater Intelligence Surveillance Reconnaissance (ISR), and continuous sustainment. For example, results of this program could help the Army produce within 30 minutes, with a quality equivalent to what could be produced by a staff of senior planners with no time limit, (1) Running start insertion plan for multiple UAs; (2) transition plan for 3 UAs to maintain tempo in multiple battles; and (3) Operational maneuver of a UA by strategic air lift. Future capabilities include, but are not limited to: Network Centric Operations, including Enterprise and Warfare layers; synergistic battle command among all joint components and echelons; networked manned and unmanned systems; cognitive systems; and robust, secure self-forming tactical networks seamlessly connected to the Global Information Grid (GIG). Initial technologies developed in the program will transition to the Army Unit of Employment and the U.S. Joint Forces Command as a basal capability in FY 2006, with more comprehensive capabilities transitioning in FY 2008 and FY 2009.

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(U) Program Plans:

- Develop and demonstrate a single common architecture and common technology building blocks for seamlessly integrating the Strategic, Operational and Tactical levels of warfare.
- Research and demonstrate new protocols for mobile ad hoc network (MANET)-type self-forming, ad hoc, tactical networks incorporating low probabilities of detection and intercepts (LPD/LPI), spectrum efficient waveforms; advanced information assurance; and unmanned air vehicle (UAV) gateways.
- Develop interface systems for seamlessly integrating data from MANET-type self-forming, ad hoc, tactical networks into high data rate internet-type networks like the GIG.
- Develop a military unique version of Code Division Multiple Access (CDMA) spread spectrum communications that may leverage commercial advancements in CDMA for the physical and media access control (MAC) layers.
- Develop methods for creating running estimates of operations and sustainment.
- Develop and demonstrate technologies for integrating prediction/forecasting techniques into COA generation and real-time war gaming for understanding.
- Develop commander-machine interfaces, including receptive graphics generators, to facilitate intuitive decision making.
- Investigate e-commerce logistics techniques for application to battle space sustainment.

	FY 2004	FY 2005	FY 2006	FY 2007
Advanced Antenna Concepts	0.000	4.152	5.711	7.068

(U) The Adaptive Amplification to Enable Electrically Small Antennas effort (formerly known as the Micro-Aperture Circuit effort) will develop and implement advanced circuit theory (non-Foster matching) that will enable electrically short antennas to be used with similar effectiveness to larger ones, and to dynamically match antennas throughout a wide range of frequencies. Current antenna technology limits the ability to miniaturize the physical size of the antenna, resulting in a requirement for large platforms or physical deployments for frequencies (High Frequency) very suitable for special operations. Similarly, limited antenna bandwidth limits the ability to fully exploit software-based radios, such as Joint Tactical Radio System (JTRS), since the antennas they utilize are limited in bandwidth. Application of advanced technology (wide-band gap materials) offers the ability to fabricate devices that can effectively couple to very non-resonant antennas. In this program DARPA will develop the basic technology, and then apply it to develop radios with wide bands of operation and very small physical size. Approaches will include building amplifiers that operate under highly reactive loads and the leveraging of new junctions and amplifier modes for increased

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performance. A potential application will be a self-contained cell phone size device that can use High Frequency (HF) to communicate around the world without any infrastructure. The Adaptive Amplification to Enable Electrically Small Antennas technology is planned for transition to the Army (primary), Navy and Air Force (secondary) in FY 2009.

(U) The Ultra-Fast Radar effort will entail the design, construction, and demonstration of an X-band noise correlating radar with a retro-directive antenna. This effort will research and develop a new type of radar sensor based on the correlations of the Gaussian noise received by an antenna array from a small object located in the far field of the antennas and the retro-directive re-radiation of the correlated noise by interconnecting the receive elements to transmit elements in a conjugate ("van-Atta") fashion. The idea is the combining and tailoring of noise-correlating interferometry and retro-directive antenna arrays into retro-directive noise-correlating (RNC) radar. The combination of these innovations allows the radar to operate in omni-directional search mode by broadcasting white noise over a specified search angle determined by the beam pattern of the individual elements. Once a target of adequate cross section enters the beam within the range of the sensor, correlations appear in the noise between neighboring antennas. The received noise power is then amplified by the transceiver electronic chain and re-transmitted directly towards the target in a process call the RNC feedback loop. The result of this project will be a new type of search-mode radar having promising performance in terms of short acquisition time and low probability-of-intercept. The Ultra Fast Radar technology is planned for transition to the Army in FY 2007.

(U) Program Plans:

- Adaptive Amplification to Enable Electrically Small Antennas
  - Develop negative inductors and capacitors in both grounded and floating configurations.
  - Show that non-foster coupling allows order-of-magnitude decrease in cavity volume and antenna length.
  - Demonstrate improved communications on small and low-observable platforms.
  - Demonstrate better power efficiency with non-foster matching.
  - Design, build, and demonstrate a non-foster matching circuit amplifier to deliver 5W or more to an electrically-small antenna.

- Ultra-Fast Radar
  - Develop an X-band noise correlating radar with a retro-directive antenna to show an approximately 5-times reduction in acquisition time compared to traditional electronically-steered search-mode radar, and an even greater reduction in comparison to mechanically scanned radar.

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- Design and demonstrate ultra-fast radar using retro-directive antenna arrays that will show a significant reduction in probability-of-intercept compared to traditional search radars based on coherent transmitters.
- Determine if the concept offers significantly reduced cost and greater simplicity to radar development and antenna designs than current systems.

	FY 2004	FY 2005	FY 2006	FY 2007
Navy Photonics Program	0.000	3.750	4.000	2.750

(U) The Navy Photonics Program will develop and field technology in partnership with the Naval Air Systems Command (NAVAIR) Program Executive Office (Tactical Aircraft Programs) (PEO (T)) in a rapid research, development, and demonstration project. This effort will pursue opto-electronic integration of state-of-the art radio frequency (RF) and digital photonics, RF and digital integrated circuits and micro-electro-mechanics (MEMS) technologies for embedded aerospace applications. The photonics technology from this effort will result in the development of a common optical backbone in place of many point-to-point links. The DARPA portion of the Navy Photonics Program will address high-risk development areas including reduction of fiber optic device size. As a result, this size reduction will enable placement of components in currently inaccessible locations (i.e., beyond the wing-fold). This program should result in a tighter integration of optical components with a decrease in unit size, increased reliability and decreased production costs. Based on the results of the risk reduction and accomplishments of this program, the goal is the operational transition into the Navy EA-6B Prowler and other tactical aircraft (i.e. EA-18, EA-35, E-2C, and MMA). DARPA established an MOA with the Navy Tactical Aircraft Program Office for this program. The Navy Photonics technology is planned for transition to the Navy by FY 2008.

(U) Program Plans:

- Develop a fiber optic backbone network capable of interconnecting to the transmitter side of an electronic aircraft podded jamming system.
- Design optical components that will meet the volume, weight, and environmental specifications for an airborne platform.
- Integrate and reduce the size of the technology to allow the external optical interfaces to be positioned inside the electronic warfare equipment space.
- Perform flight demonstrations showing the use of the fiber optical backbone interconnected to the electronic attack aircraft jamming systems.

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	FY 2004	FY 2005	FY 2006	FY 2007
Advanced HF Communications	0.000	0.000	1.842	5.472

(U) The goal of the Advanced HF Communications program is to provide always-available, high-rate communications at long ranges for Special Operations Force (SOF) teams. Currently SOF teams rely on satellite communications (Satcom) for long range connectivity. However, Satcom requires line of site access, and channel availability. The Advanced HF Communications will develop antenna and radio technology to provide high-rate communications at long ranges using ground wave and near vertical incidence skywave (NVIS) propagation. A fundamental challenge is reducing the size, weight and power requirements for SOF applicability. Novel miniature HF antenna technologies and channel adaptive radio technologies will be developed and demonstrated in man portable form factors.

(U) Program Plans:

- Investigate novel antenna designs for miniature form factor and high efficiency.
- Perform propagation experiments to determine atmospheric effects on communications using both ground wave and NVIS electromagnetic propagation modalities.
- Develop improved statistical models of atmospheric effects on communications to implement effective equalization techniques using state of the art digital signal processing components and algorithms.
- Develop dual mode transceiver prototype in a package that validates the size, weight and power requirements of the SOF user.
- Perform field demonstration on prototype transceiver in various environments to validate the concept.

	FY 2004	FY 2005	FY 2006	FY 2007
Communications to the Tactical Edge	0.000	0.000	4.375	9.062

(U) The future DoD communications architecture will provide a multi-tiered capability consisting of a worldwide, broadband Global Information Grid (GIG), transportable nets like the Army Warfighter Information Network-Tactical (WIN-T) and totally wireless mobile ad hoc tactical networks formed using the next generation Joint Tactical Radio System (JTRS) terminals. This network of networks is “user-ignorant”; it only transports packets or sets up voice circuits, and does so on a “best-effort” basis. It puts the burden on the mobile users at the edge to find

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connections and join a "user-ignorant" network. This project will provide technology to make networks "user-aware" and oriented toward delivering tailored services to each user by balancing communications supply and demand. Rather than provide "best effort" with no guarantees, the network will provide "best service" with guarantees. The key challenge is providing services to disadvantaged users for whom demand exceeds supply.

(U) Program Plans:

- Develop technology to implement a user-transparent service layer that monitors the communications supply and demand at each user (or end system) and is aware of the military missions being executed by each user.
- Develop middleware technology to modulate demands to meet supply by means such as context-preserving "compression" and filtering.
- Develop protocols to find and form relationships across diverse networks and proactively adapt transport flow and quality to the available links by management of network topology vice ad hoc networking.
- Perform trial demonstrations using simulation and emulation over existing backbone networks.

	FY 2004	FY 2005	FY 2006	FY 2007
Self-Forming Networks	0.000	0.000	4.606	7.929

(U) The Self-Forming Networks program seeks to develop networks that use addresses that are distributed topographically (e.g., geographically or by organizational unit). Current network routing methodologies use IP address numbers that are distributed in no defined pattern or methodology. As a result, current routing systems spend large amounts of time and computing power updating and maintaining tables that 'point' to where different IP addresses are located geographically. The Self-forming Networks will reduce the load on routers as well as greatly simplify router configuration. These networks will be a paradigm shift in that numbered IP addresses will no longer exist, and changes to the Domain Naming Server (DNS) system will allow for services to mobile users to be incorporated.

(U) Program Plans:

- Develop machine naming schema for data packets that are geographically based and that allow for fine grained control of precedence and improved quality of service capabilities.

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- Develop tactical router replacements that work with existing computers/routers and require no new configuration and enable self-forming networks that will result in at least an order-of-magnitude reduction in training, configuration, and installation time.
- Develop changes to DNS functions to accommodate the forwarding services to mobile users.

	FY 2004	FY 2005	FY 2006	FY 2007
Ideal RF Link	0.000	0.000	5.370	9.499

(U) The Ideal RF Link program seeks to exploit recent advances in analog transmit and receive technology with progress in ultra-high speed logic to simultaneously reduce the transceiver phase noise and reduce analog device non-linearities with digital correction techniques. In particular, the current performance of Silicon Germanium and Indium Phosphide bipolar device technology is now fast enough, with cut-off frequencies of > 350 GHz, that error correction technique such as predistortion and feed forward correction can be considered for application to RF components. The effort will develop new circuit topologies and algorithms along with cross technology integrations schemes. The combination will increase the maximum signal data rate (increase the bits/sec/Hz) for DoD RF links.

(U) Program Plans:
- Study fundamental limits to RF communications links and perform system study.
- Define critical technical challenges to increasing link margin by improving component linearity.
- Establish program metrics for optimum RF link demonstration.
- Initiate component development and heterogeneous integration demonstrations.

	FY 2004	FY 2005	FY 2006	FY 2007
Robust, Responsive, Reconfigurable and Invisible (R3I) Network	0.000	0.000	5.080	11.878

(U) The Robust, Responsive, Reconfigurable and Invisible (R3I) Network program will develop a networked radio system that supports voice and data. The goal of this program is a network that is dynamically controllable using techniques such as reconfiguration, optimum resource allocations based on mission priorities, and dynamic policies, as opposed to relatively passive reactions to changes by the commercial

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infrastructure. This program will develop the essential network structure to enable robust, mobile, tactical wireless networks, which are the foundation for the Global Information Grid and network centric warfare concepts. The fundamental technical challenges are scalability, covertness, robustness and platform size, weight and power requirements.

(U) Program Plans:
- Develop the waveform and access protocols necessary to meet capacity and availability requirements.
- Explore new areas of information theory to investigate more robust routing algorithms and protocols.
- Expand existing dynamic planning software to ensure connectivity between users based on mission needs and resource availability with respect to tactically relevant time constraints.
- Validate system performance through a combination of simulation and hardware prototype field demonstrations.

	FY 2004	FY 2005	FY 2006	FY 2007
Airborne Comms Node (ACN)/AJCN ACTD	4.899	0.000	0.000	0.000

(U) The Airborne Communications Node (ACN) program enabled an affordable, autonomous communications infrastructure that simultaneously provides assured communications, situational awareness and signals intelligence (SIGINT). ACN payloads can be integrated on platforms ranging from High Altitude Endurance (HAE) unmanned airborne platforms (e.g., Global Hawk) to vessels or ground vehicles. The ACN system operational utility will be assessed by U.S. Joint Forces Command as part of a Joint Advanced Concept Technology Demonstrations (ACTD), named the Adaptive Joint C4ISR Node (AJCN) that began in FY 2003 and will complete in FY 2005 with an extended user evaluation in FY2006 – FY2007. The ACTD, jointly funded by Memorandum of Agreement between DARPA, Army, Air Force, U.S. Joint Forces Command, and the Office of the Secretary of Defense, will integrate ACN payloads onboard Air Force and Army aircraft. Additionally, in response to Operation Iraqi Freedom, DARPA is developing a simplified version of the Airborne Comms Node that will be deployed from an aerostat to provide communication coverage for remotely located U. S. troops. Transition of the program has been accomplished by the ACTD and the Marine Airborne Relay Terminal programs.

(U) Program Plans:
- Conducted a flight demonstration lab payload and began integration of the flight payload that will be used for the Interim Joint Military Utility Assessment (IJMUA).

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- Integrated a Joint Tactical Radio Systems (JTRS) Software Component Architecture (SCA) 2.2 Core Framework and showed the ability to run software waveforms using that SCA implementation.
- Integrated AJCN payload and antennas on C-23 aircraft and conducted an Interim Joint Military Utility Assessment (IJMUA) of multi-mission functionality.
- Conducted flight test on C-23 to evaluate in-flight co-site mitigation performance.
- Integrated JTRS (Single Channel Ground Air Radio System) SINCGARS waveform within AJCN architecture to demonstrate feasibility of porting JTRS waveforms.
- Initiated development of Concept of Operations, Tactics, Techniques and Procedures (TTP), and training package.
- Investigated technologies to provide secure waveforms.
- Investigated technologies to incorporate other systems (such as UGS) into the ACN architecture.
- Investigated technologies for advanced networking concepts, especially between dissimilar platforms.
- Integrated AJCN payloads on 2 Hunters and 2 NKC-135s.

(U) Other Program Funding Summary Cost:

- Not Applicable.