OSD RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

Date: February 2006

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE
RDT&E/ Defense Wide BA# 2	**0602234D8Z - Lincoln Laboratory**

Cost ($ in Millions)		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
Total Program Element (PE) Cost		23.445	29.438	28.975	30.425	32.281	32.862	32.103
P534	Lincoln Laboratory	23.445	26.438	25.975	27.425	29.281	29.862	29.103
P535	Technical Intelligence	0.000	3.000	3.000	3.000	3.000	3.000	3.000

A. Mission Description and Budget Item Justification: (U) The Lincoln Laboratory research line program (LL Program) (P534) is an advanced technology research and development effort conducted through a cost reimbursable contract with the Massachusetts Institute of Technology (MIT). Lincoln Laboratory is operated as an FFRDC administered by the DoD, and is unique among DoD FFRDC's: the laboratory is operated (under A-21) by MIT with no fee. The LL Program funds innovations that directly lead to the development of new system concepts, new technologies, and new components and materials. The LL Program contributed foundation technologies to two systems which received the 2002 Packard Excellence in Acquisition Award: (1) the Bio-aerosol sensing and micro-laser technologies were transferred to industry and are in production for the Joint Biological Defense Sensor (JBPDS), and (2) the Free-space optical communications technologies were used in the GeoLite optical communications satellite demonstration system. The GeoLite demonstration provides the underpinnings of the Transformation Communications Architecture. Other recent successes of the LL Program include a compact 3D imaging laser radar that uses unique photon-counting avalanche photodiode arrays and has demonstrated, in the DARPA Jigsaw program, high quality imagery of targets obscured by dense foliage or camouflage, and a biosensor that uses genetically engineered immune cells and has demonstrated the ability to identify major bio-warfare agents in under two minutes with high sensitivity and low false alarm rate. Algorithms developed under the LL Program for processing electro-optical data have directly led to a video-processing system for a sensor currently being fielded in the Iraq theatre.

(U) The LL Program currently has impact in five core technology thrusts:

(U) Persistent Surveillance, with emphasis on revolutionary sensing techniques, algorithms for detecting and recognizing battlefield targets both in the clear and hidden, and high-performance computing to enable rapid prosecution of suspected targets. The advanced sensing techniques include both active and passive sensing and span a wide frequency range—from UHF radar, to terahertz (THz) radiation, to ultra-high-resolution laser radar (ladar). The sensors are complemented by innovations in algorithms to efficiently extract information from the multiple sensors. The multi-modality sensing is fused with archived data to improve target identification (ID) and classification. .

(U) Sensor Networking and Decision Support, with an emphasis on developing and integrated a set of advanced technologies to improve the use of sensing to support military decision making. The set of technologies includes 1) dynamic mechanisms for tasking and cuing sensors to optimize the collection of high-value sensor data; 2) knowledge management to increase the value of information extracted from the sensor data; 3) information management to develop actionable information for the commander; and 4) decision aids to assist the commander in dealing with the information and quickly making the right decisions.

(U) Fiber Lasers and Directed Energy, including the development of novel lasers and advanced beam-control techniques. The laser efforts focus on developing advanced, more efficient fiber lasers and on combining multiple fiber lasers to allow scaling to high-energy-laser (HEL) power levels. It is expected that these lasers will significantly reduce the size and weight of future HEL systems. The beam-control efforts focus on controlling fiber-laser systems and on atmospheric compensation in stressing conditions (e.g., for tactical HELs in near-surface engagements).

(U) Advanced Electronics Technology, with emphasis on development of materials, devices, and subsystems utilizing microelectronic, photonic, biological, and chemical technologies to enable new system approaches to DoD sensors. Specific focus areas include work on high performance focal plane arrays such as 3-D imaging and photon-counting arrays for information, surveillance and reconnaissance (ISR) and advanced missile seekers; high-efficiency, high-brightness semiconductor lasers for active illuminators, countermeasures, and other directed energy applications; new sensors and concepts of operations for rapidly detecting and identifying low concentrations of bio-warfare agents, chemical agents, or explosives; tagging, tracking, and locating technologies; components for miniaturized RF systems for electronic intelligence and communications; and high-speed, radiation-hard, ultra-low power analog and digital circuits tailored for DoD applications.

OSD RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

Date: February 2006

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE
RDT&E/ Defense Wide BA# 2	**0602234D8Z - Lincoln Laboratory**

(U) Bio-Chem Defense, with emphasis on detection and identification technology, systems analysis and integration. These innovations are intended to negate the effectiveness of enemy biological and chemical weapons, and include efforts in threat assessment, agent detection, and integrated protection. Specific focus areas include potential threats, including those resulting from the rapidly advancing field of genetic engineering as well as worrisome chemical agents. Emphasis is on the practical integration of chemical and biological defenses in an affordable, large-area protection context, not just as one-of-a-kind solutions.
(U) Supporting these five core technology thrusts is a new work effort titled Technical Intelligence (P535). Technical Intelligence combines efforts in two areas: 1) from the university community through the JASONs program and 2) through information on the technology maturation and development throughout the rest of the world.
1. (U) JASONs is a group of approximately 50 appropriately cleared experts who provide detailed independent technical assessment of the most difficult technological problems. JASON members are mostly fully tenured professors in physics, mathematics, engineering, and hold active SCI-level clearances. Output from JASON studies are provided to levels up to the Secretary of Defense and their studies shape programmatic and technical decisions involving literally hundreds of millions of dollars. JASONs were previously funded through university research programs, but their level of technology maturity is appropriate for incorporation into Applied Research.
2. (U) Technical Intelligence will support detailed understanding of technology advancement in important scientific area and other scientific disciplines such as nanotechnology, directed energy and propulsion. Some details are classified, but one effort, called Global Dialogue on Emerging Science and Technology will be jointly sponsored by DOD, Department of State, and CIA will give very detailed insight in such topics as Software Engineering in India, Nanotechnology in South East Asia, European Laser development, for example. This information will in turn assist in development of US capabilities.

B. Program Change Summary	FY 2005	FY 2006	FY 2007
Previous President's Budget (FY 2006)	24.846	29.914	30.493
Current BES/President's Budget (FY 2007)	23.445	29.438	28.975
Total Adjustments	-1.401	-0.476	-1.518
Congressional Program Reductions		-0.476	
Congressional Rescissions			
Congressional Increases			
Reprogrammings	-0.669		
SBIR/STTR Transfer	-0.699		
Other	-0.033		-1.518

C. Other Program Funding Summary: Not Applicable.

OSD RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

Date: February 2006

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE
RDT&E/ Defense Wide BA# 2	**0602234D8Z - Lincoln Laboratory**

D. Acquisition Strategy: Not Applicable.

E. Performance Metrics:

FY	Strategic Goals Supported	Existing Baseline	Planned Performance Improvement / Requirement Goal	Actual Performance Improvement	Planned Performance Metric / Methods of Measurement	Actual Performance Metric / Methods of Measurement
07						

Comment: Performance Metrics:
(U) Performance in the Lincoln Laboratory program (P534) is managed with a sustained and agile focus on matching emerging technology opportunities to latent national security needs. As a DoD FFRDC, Lincoln Laboratory is focused on increasing the Technology Readiness Level (TRL) of the applicable enabling technologies to support critical new DoD capabilities. An essential element of a sustained thrust is the demonstration of new systems capability in relevant (field) environments. Each thrust is structured to bring the new capability up to the TRL 5-6 range. At the same time, continuing adaptation of the emerging enabling technologies (at the TRL 2-3) assures that the critical national systems expertise is enhanced and sustained, so that additional innovations can quickly be transitioned to the services and industry as rapidly as possible.

(U) Performance in the Technical Intelligence program (P535) is managed to produce results in two areas: 1) timely advice from seasoned, tenured university representatives through the JASONs program and 2) critical insight on the technology maturation and development throughout the rest of the world.

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2006

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 2	**0602234D8Z - Lincoln Laboratory**	**P534**

Cost ($ in Millions)		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
P534	Lincoln Laboratory	23.445	26.438	25.975	27.425	29.281	29.862	29.103

A. Mission Description and Project Justification: (U) The Lincoln Laboratory program (LL Program) (P534) is an advanced technology research and development effort conducted through a cost reimbursable contract with the Massachusetts Institute of Technology (MIT). The LL Program funds advanced research activities that directly lead to the development of new system concepts, new technologies, and new components and materials, with impact in five core technology thrusts:

(U) Persistent Surveillance, with emphasis on revolutionary sensing techniques, algorithms for detecting and recognizing battlefield targets both in the clear and hidden, and high-performance computing to enable rapid prosecution of suspected targets.

(U) Sensor Networks and Decision Support, with an emphasis on developing and integrated a set of advanced technologies to improve the use of sensing to support military decision making.

(U) Fiber Lasers and Directed Energy, including the development of novel lasers and advanced beam-control techniques. The laser efforts focus on developing advanced, more efficient fiber lasers and on combining multiple fiber lasers to allow scaling to high-energy-laser (HEL) power levels

(U) Advanced Electronics Technology, with emphasis on development of materials, devices, and subsystems utilizing microelectronic, photonic, biological, and chemical technologies to enable new system approaches to DoD sensors.

(U) Bio-Chem Defense, including technology, analysis and systems aimed at defeating enemy use of biological and chemical weapons, and includes efforts in agent detection, diagnosis and treatment, and informatics systems.

B. Accomplishments/Planned Program:

Accomplishment/Planned Program Title	FY 2005	FY 2006	FY 2007
Persistent Surveillance	5.787	6.526	6.412

FY 2005 Accomplishments:
(U) Radar Technology: Completed concept demonstration of advanced conformal phased-array architecture begun in FY 2003. This technology is now being incorporated into several major radar projects.

(U) Passive Optical Sensing: Collected data piggybacking on a major Navy field exercise. Used these data to further develop and refine video-processing algorithms to process large amounts of video data and to track objects. This effort has directly enabled the rapid fielding of an operational video persistent-surveillance system.

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2006

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 2	**0602234D8Z - Lincoln Laboratory**	**P534**

(U) Advanced Laser Radar (Ladar): Performed systems analysis and developed concept for ultra-high-resolution ladar. Began development of an optical arbitrary waveform generator and an ultra-wide-bandwidth RF chirp generator. Characterized material attenuation for active terahertz (THz) systems. Developed new simulation tools and analyzed optical to THz conversion.

(U) Advanced Processing: Designed, fabricated, and tested the major RF components needed to implement an integrated receiver on a chip. Conducted an investigation of an ultra-wideband, low-power analog-to-digital converter.

(U) Multi-Sensor Measurements: Conducted initial measurements of moving vehicles from aircraft platform.

FY 2006 Plans:
(U) Radar Technology: Use the Lincoln Laboratory airborne radar testbed to conduct innovative foliage-penetration experiments.

(U) Passive Optical Surveillance: Design a novel read-out array for large-scale infrared focal planes. This read-out will provide direct digital output at each pixel. Begin fabrication of the read-out array.

(U) Advanced Ladar: Demonstrate first phase of ultra-high-resolution ladar in the laboratory at modest range. Demonstrate Thz detection using detection concept developed in FY 2005. Initiate effort in quantum ladar.

(U) Advanced Processing: Develop and test a single-die, integrated radar receiver on a chip. Begin development of a digital beamformer. Initiate an effort to develop advanced software tools to take advantage of modern trends in computer hardware, such as tiled processors and novel storage devices.

(U) Multi-Sensor Measurements: Conduct measurements from an airborne platform using a combination of 3D ladar and passive video.

FY 2007 Plans:
(U) Passive Optical Surveillance: Complete fabrication of the read-out array and demonstrate the read-out in the laboratory.

(U) Advanced Ladar: Significantly improve the resolution of the ultra-high-resolution ladar to enable phase 2 measurements in the laboratory. Begin developing multi-element THz detectors. Demonstrate THz ladar system in laboratory. Begin ladar experiments using quantum-measurement techniques.

(U) Advanced Processing: Refine radar receiver on a chip and complete digital beamformer. Continue advanced software effort by implementing hierarchical storage on tiled processor and demonstrating prototype application kernels.

(U) Multi-Sensor Measurements: Add additional ladar modalities to optical aircraft system. Conduct coordinated measurements involving radar systems on one aircraft and passive optical and ladar measurements on another aircraft.

Accomplishment/Planned Program Title	FY 2005	FY 2006	FY 2007
Sensor Networks & Decision Support	2.730	3.078	3.025

FY 2005 Accomplishments:
(U) Refocused networking efforts to concentrate on the networking, information management, and knowledge management necessary to support rapid decision-making. Set up a decision laboratory

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2006

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 2	**0602234D8Z - Lincoln Laboratory**	**P534**

incorporating a virtual, simulated sensor net based on actual airborne radar and electro-optical measurements. Began a decision experiment involving the cuing of a UAV-based electro-optical system from an airborne radar system.

FY 2006 Plans:
(U) Efforts are being conducted in 3 related areas: 1) dynamic command and control (C2) for networked intelligence, surveillance, and reconnaissance (ISR), 2) structured knowledge spaces, and 3) distributed service architecture. In dynamic C2 for networked ISR, will complete the cuing experiments begun in FY 2005 and will develop scheduling algorithms to allocate sensor collections based on predefined priorities. In structured knowledge spaces, will develop software to create a linked map of relationships between raw ISR data, extracted information, and derived knowledge. In distributed service architecture, will begin to develop a discovery architecture that provides reliable access to ISR data anywhere, even over low-bandwidth, intermittent communications networks.

FY 2007 Plans:
(U) Using simulated ISR data from a computer-generated tactical scene, will conduct an integrated lab decision-support demonstration of the technologies developed in FY 2006. Based on the results of this integrated demonstration, will continue and expand developments in dynamic C2 for networked ISR, structured knowledge spaces, and distributed service architecture.

Accomplishment/Planned Program Title	FY 2005	FY 2006	FY 2007
Fiber Lasers & Directed Energy	2.746	3.096	3.042

FY 2005 Accomplishments:
(U) Fiber Laser Technology: Demonstrated a diode-laser system with world-record brightness designed to pump high-power fiber lasers. Demonstrated near diffraction-limited output in novel large-diameter microstructure fiber. Initiated development of short-pulse fiber laser to enable 3D ladar systems on compact platforms (e.g., small UAVs). Fabricated 4×8 element Vertical Cavity Surface Emitting Laser (VCSEL) array.

(U) Beam-Control Technology: Performed initial lab experiments exploring beam control for arrays of fiber lasers. Developed concept for novel wavefront sensor to measure distortions of lasers propagating through the atmosphere. Continued theoretical analysis of laser propagation as related to free-space optical communication.

FY 2006 Plans:
(U) Fiber Laser Technology: Demonstrate single-mode lasing in large-diameter microstructure fiber. Demonstrate combining of short-pulse fiber lasers for 3D ladar. Extend short-pulse fiber lasers for 3D ladar to eye safe wavelengths appropriate for tactical systems. Develop 1,000-element electrically addressable VCSEL array.

(U) Beam-Control Technology: Investigate techniques for turbulence compensation using arrays of phased fibers. Develop and test prototype of novel wavefront sensor. Focus propagation analysis on propagation for 3D ladar.

FY 2007 Plans:
(U) Fiber Laser Technology: Scale arrays of short-pulse fibers to higher powers for longer-range ladar systems. Develop arrays of VCSELs at 1.5μm wavelengths compatible with fiber communications systems.

(U) Beam-Control Technology: Field test beam control using low-power fiber array. Develop and test novel wavefront sensor in pulsed mode appropriate to HEL systems such as the Airborne Laser (ABL).

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2006

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 2	**0602234D8Z - Lincoln Laboratory**	**P534**

(U) Laser Radar: Continue to develop multi-function laser-radar systems for applications in advanced ballistic and tactical seekers, surface surveillance, and combat identification to demonstrate operational form, fit, and function. This includes efforts at electronics miniaturization using Application Specific Integrated Circuits (ASIC) components to generate systems that show a direct development path to fit on a seeker, hand carried sensor, or small UAV. Initiate development of ultra-high-resolution ladar for applications such as long-range face recognition.

(U) High Energy Laser Technology: Continue MCAO and nonlinear-phase-conjugation efforts with particular emphasis on thermal-blooming compensation. Continue the exploration of real-time decision aids to help optimize the performance of HELs in varying atmospheric conditions. Continue modeling and simulation work with the ultimate goal of developing a complete "photon birth-to-death" model. Test microstructure fiber laser. Demonstrate combined spectral and coherent beam combining for high-power fiber lasers.

(U) Hyper-Spectral Imaging: Install the HSI system developed in FY 2004 on an aircraft and take simultaneous measurements with the HSI system and with a 3D ladar system. Develop algorithms to combine the two different kinds of data.

Accomplishment/Planned Program Title	FY 2005	FY 2006	FY 2007
Advanced Electronics Technology	7.430	8.378	8.231

FY 2005 Accomplishments:
(U) Developed processes and device designs to improve fill-factor and pixel isolation of visible photon-counting focal planes, to enable larger array sizes, smaller pixels, and new concepts for per-pixel electronics in support of ISR applications. Improved silicon-on-insulator-based process technologies for 3-D integration to build smart focal planes and high-clock-rate low-power digital processing functions, and demonstrated working focal plane using three vertically interconnected silicon layers. Developed technologies for advanced focal planes which allow 2-D tiling of large arrays. Developed lithographic technology and epitaxial growth process for fabricating lithographically defined quantum-dot materials, for application to semiconductor lasers and detectors. Developed process for deep-submicrometer Josephson-junction fabrication in support of research in quantum computation, and demonstrated multi-photon qubit spectroscopy. Explored anti-tamper concepts for protection of microelectronic subsystems. Developed component integration technologies including integrated passives and frequency control elements, silicon active RF components, and MEMs switches, enabling low-cost, miniaturized receiver-on-a-chip and receiver-in-a-package solutions tailored to DoD applications. Demonstrated state-of-art thermo-optic modulators for use in silicon photonic integrated systems. Completed design and demonstration of a pre-prototype video micro-sensor being developed for long endurance unattended ground sensors. Demonstrated new concepts for tagging, tracking, and identifying terrorist-related assets. Performed field data collections on explosives sensing, in support of counter-terrorism and counter-IED objectives. Continued development of diode-laser sources for efficient UV generation for bio-aerosol sensors.

FY 2006 Plans:
(U) Continue work to develop tagging and tracking technologies for counter-terrorism applications. Continue field experiments to characterize signatures of facilities handling explosives and fabricating IEDs or other explosive devices. Continue development of improved photon-counting arrays and related readout circuits, with emphasis on enabling passive imaging ISR applications. Develop four-side-abuttable tiling techniques needed to support very large focal plane arrays for ISR applications. Develop improved process modules for CCD imager and rad-hard CMOS imager processes which support unique focal planes being developed for various DoD ISR systems. Continue development of lithographically defined quantum-dot artificial materials for optoelectronic applications. Develop technologies for highly integrated RF front ends, with emphasis on film bulk acoustic resonators and SOI CMOS RF transistors. Investigate potential of cryogenic operation of silicon-on-insulator CMOS for both analog processing and high performance computing applications. Continue development of superconducting technology for application to quantum computation. Develop Si-based modulators and detectors for use in integrated silicon microphotonic systems, for photonic signal processing applications. Develop high-power photodetectors for use in low-noise RF sources, arbitrary waveform generation, and photonically fed transmitters. Demonstrate large-mode-volume, high-power semiconductor lasers for use in active sensing, countermeasures, or UV sources for bio-agent sensors. Continue efforts to transition technology to a wide range of DoD system demonstrations, and to industry for volume manufacturing.

FY 2007 Plans:

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2006

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 2	**0602234D8Z - Lincoln Laboratory**	**P534**

(U) Develop technologies for focal planes which enable new approaches to DoD electro-optical sensors, with emphasis on improved photon-counting arrays and related readout circuits, three-dimensionally integrated detectors and mixed-signal readout circuits, and unique designs and processes for ultra-low power operation, high data collection rates, or operation in stressing environments. Continue work on the development of gigapixel tiled focal planes. Develop new techniques for detecting and pre-empting terrorist activity. Develop technologies for highly integrated RF front ends, including silicon-based transceivers for use in low cost and reconfigurable RF systems. Continue development of advanced electro-optical and cell-based bio-defense sensors. Continue development of solid state and semiconductor laser illuminators for active sensing, countermeasures, and high power laser applications. Develop new approaches to electronic devices to allow continued scaling and performance improvements for defense and commercial electronics. Continue activities to provide increased hardness, countermeasure resistance, and anti-tamper capability for U. S. military systems. Continue efforts to transition technology to a wide range of DoD system demonstrations, and to industry for volume manufacturing.

Accomplishment/Planned Program Title	FY 2005	FY 2006	FY 2007
Bio-Chem Defense	4.752	5.360	5.265

FY 2005 Accomplishments:
(U) Biological Agent Sensing: Multifaceted effort included biological identification with CANARY (Cellular Analysis and Notification of Antigen Risks and Yields), a sensing concept proven to be the only true detect-to-warn bio-identifier. CANARY saw progress in overcoming barriers to acceptance in logistical support for maintenance of cells. CANARY was implemented in both manual bench top and automated field instruments, and a significant field database was developed. Two efforts related to orthogonal sample collection and analysis of biological pathogens were demonstrated - a cartridge-based extraction technique to separate proteins from DNA and an analysis technique using peptides and protein nucleic acid (PNA) molecules for rapid concurrent identification. Methodologies for bio-attack defense preparation and post-attack characterization were developed and tested via both in situ measurements as well as modeling. Standoff biosensing was analyzed for its efficacy as part of a comprehensive defensive system and bio-aerosol signatures for point and standoff sensing were experimentally acquired. Facilities were completed to provide advanced sensor testing capability.
(U) Chemical Agent Sensing: Addressed the need for test and evaluation for comparative testing of existing and emerging chemical sensing technologies. Agents of interest included toxic industrial compounds and biotoxins in addition to traditional chemical warfare agents and simulants. A new concept for chemical agent early warning was designed based on a perimeter-defense strategy. Measurements of long-wave infrared backgrounds helped to establish standoff sensor limits.
(U) Facility Defense: Initiated first phase of the Hanscom-Lincoln Testbed (HaLT), developed to provide a site where state-of-the-art sensors, response strategies, filtration, neutralization, and command and control concepts can be tested in a realistic setting. In FY 2005 the HaLT characterized and modeled credible threats for relevant scenarios, built or procured baseline point sensors and confirmatory identification equipment and completed the command center and data collection system. Planned technology insertions were developed or investigated, including an ion-mobility spectrometer for water testing, a ventilation-system neutralization strategy, and a portal device for personnel screening.

FY 2006 Plans:
(U) Advanced Biological and Chemical Agent Threat Assessment: This new task for FY 2006 recognizes the importance of the evolving threat, and is based on a study of the potential threats represented by the broad class of chemical and toxin Novel Threat Agents, combined with the prospects for modern microbiology including genetic engineering. This activity enables prioritization and categorization of advanced threats for resource allocation, including addressing countermeasures to current systems.
(U) Biological Agent Sensing: CANARY sensing approach is focusing on techniques for preservation and storage of B-cells for up to 6 months, which appears achievable with techniques under investigation. Automated CANARY is being tested in field conditions, establishing Receiver Operating Characteristics (ROCs) - an approach imported from the radar community. PNA probes are being developed to enable fast, multiplexed, environmental and clinical diagnostics by rapid detection of specific DNA targets without time-consuming processing and amplification.
(U) Chemical Agent Sensing: Exercising the chemical sensor testbed for quantitative assessment of chemical sensor approaches, establishing ROC performance metrics. In addition, this effort develops a novel, low-cost early-warning chemical agent sensor that could be used in line monitoring or perimeter defense, based on an inexpensive spectrometer designed to examine the variation in transmitted infrared spectrum from a cooperative thermal source. A custom infrared spectrometer for the rapid standoff detection of chemical agent plumes over large ranges (kilometers) is being completed with on-base testing.
(U) Integrated Solutions (formerly Facility Defense): Completing first phase of the HaLT, developed to provide a site where advanced sensors, response strategies, filtration, neutralization, and command and control concepts can be tested in a realistic setting. Biological and chemical sensors are being deployed in a portion of laboratory building space, and passive and active protection measures are being created

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)	Date: February 2006

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 2	**0602234D8Z - Lincoln Laboratory**	**P534**

to reduce agent exposure. The approach monitors and tracks meteorological conditions as well as particulate and chemical vapors, networking the sensors through the HaLT command post for both operational evaluation and algorithm development. Development of strategies for decision support system, to aid in real-time course-of-action guidance, continues both for the HaLT as well as for generic DoD system approaches.

FY 2007 Plans:
(U) Advanced Biological and Chemical Agent Threat Assessment: Efforts based on earlier studies will lead to specific approaches for sensing requirements to address current vulnerabilities or mitigation strategies. Novel detection schemes will be incorporated into existing systems, and will be extended to methods for tagging or tracking stock components or potential protection concepts. Projects will, 1) continue analytical efforts aimed at advanced threat, including tools in disease progression, fluid dynamics, distribution modeling (of food and water), 2) understand better how agent fate and transport affects realistic bio threats and vulnerabilities, and 3) consider modes of attack other than aerosol (including potable water).
(U) Biological Agent Sensing: Address technology development and evaluation to meet the sensing needs of the military and homeland defense communities. CANARY detect-to-warn sensor will be improved, emphasizing efforts to improve cell logistics and false positive rate, and based on field tests under varied background conditions. New methodologies for sensor testing will be established, moving beyond current industry approaches that are largely threshold event driven. ROC curves will be continued to be promulgated as method of fair comparison among sensors.
(U) Chemical Agent Sensing: Will apply testbed and resources to test and evaluation for comparative testing of emerging chemical sensing technologies. Program will model and develop stimulants for current and emerging chemical agent challenges, interferents and backgrounds. The novel, low-cost early-warning perimeter chemical agent sensor developed in FY 2006 will be deployed in the HaLT and at a remote site. The custom infrared spectrometer for rapid standoff detection of chemical agent plumes will be tested similarly.
(U) Integrated Solutions: Integrated systems will evolve in scope and functionality, as the HaLT expands to encompass a larger portion of Hanscom AFB, adding perimeter-monitoring and/or early-warning chemical and biological sensing capability. The mote sensor network expands to include new conductive-polymer chemical sensing constructs and focus on a demonstration of network utility in release detection and tracking. With the HaLT the project will develop predictive strategies that can be employed at National Special Events, explore alternative architectures involving sensing and HVAC control as well as other proactive and response strategies such as portal screening.

C. Other Program Funding Summary: Not Applicable.

D. Acquisition Strategy: Not Applicable.

E. Major Performers

Category	Name	Location	Type of Work and Description	Award Date
Labs				
	Headquarters Electronic Systems Center	Hanscom AFB, MA	Funds are provided to LL to support the following five core technology thrust areas:1) Persistent Surveillance2) Sensor Networking and Decision Support3) Fiber Lasers and Directed Energy4) Advanced Electronics Technology5) Bio-Chem Defense	16 NOV 2004

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)

Date: February 2006

APPROPRIATION/ BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
RDT&E/ Defense Wide BA# 2	**0602234D8Z - Lincoln Laboratory**	**P535**

Cost ($ in Millions)		FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011
P535	Technical Intelligence	0.000	3.000	3.000	3.000	3.000	3.000	3.000

A. Mission Description and Project Justification: (U) Supporting these five core technology thrusts is a new work effort titled Technical Intelligence (P535). Technical Intelligence combines efforts in two areas: 1) from the university community through the JASONs program and 2) through information on the technology maturation and development throughout the rest of the world.

1. (U) JASONs is a group of approximately 50 appropriately cleared experts who provide detailed independent technical assessment of the most difficult technological problems. JASON members are mostly fully tenured professors in physics, mathematics, engineering, and hold active SCI-level clearances. Output from JASON studies are provided to levels up to the Secretary of Defense and their studies shape programmatic and technical decisions involving literally hundreds of millions of dollars. JASONs were previously funded through university research programs, but their level of technology maturity is appropriate for incorporation into Applied Research.

2. (U) The technical intelligence program will support collaborative work with the U.S. federal intelligence community on emerging and disruptive technologies, primarily through further development of the Science and Technology Net Assessment studies, which assess a select set of technologies from both a domestic and foreign development perspective. The program will also support collaborative work with international partner nations on emerging and disruptive technology assessments. The technical intelligence program will also support development of tools that enable collaborative analysis of emerging and disruptive technologies.

B. Accomplishments/Planned Program:

Accomplishment/Planned Program Title	FY 2005	FY 2006	FY 2007
Technical Intelligence	0.000	3.000	0.000

FY 2006 Plans:
(U) Focus the JASON studies and Technical Intelligence in areas critical to national security. JASON studies will be focused depending on the area most important in the security environment at the time. For the Technical Intelligence portion, support detailed understanding of technology advancement in important areas of nanotechnology, directed energy, and so forth. Some details are classified, but one effort, called Global Dialogue on Emerging Science and Technology will be jointly sponsored by DOD, Department of State, and CIA. This program will sponsor 4-5 conferences in countries and technologies of interest. These conferences will be completely open, but will give very detailed insight in such topics as Software Engineering in India, Nanotechnology in South East Asia, European Laser development, for example. By funding and carefully targeting these opportunities, the DDR&E will be able to better shape the S&T program.

Accomplishment/Planned Program Title	FY 2005	FY 2006	FY 2007
Technical Intelligence	0.000	0.000	3.000

FY 2007 Plans:
(U) Continue to focus the JASON studies and Technical Intelligence in areas critical to national security. JASON studies will be focused depending on the area most important in the security environment at

OSD RDT&E PROJECT JUSTIFICATION (R2a Exhibit)		Date: February 2006
APPROPRIATION/ BUDGET ACTIVITY RDT&E/ Defense Wide BA# 2	PE NUMBER AND TITLE **0602234D8Z - Lincoln Laboratory**	PROJECT **P535**

the time. For the Technical Intelligence portion, support detailed understanding of technology advancement in important areas of nanotechnology, directed energy, and so forth. Some details are classified, but one effort, called Global Dialogue on Emerging Science and Technology will be jointly sponsored by DOD, Department of State, and CIA. This program will sponsor 4-5 conferences in countries and technologies of interest. These conferences will be completely open, but will give very detailed insight in such topics as Software Engineering in India, Nanotechnology in South East Asia, European Laser development, for example. By funding and carefully targeting these opportunities, the DDR&E will be able to better shape the S&T program.

C. Other Program Funding Summary: Not Applicable.

D. Acquisition Strategy: Not Applicable.

E. Major Performers Not Applicable.