Exhibit R-2, RDT&E Budget Item Justification: PB 2012 Office of Secretary Of Defense										DATE: February 2011	
APPROPRIATION/BUDGET ACTIVITY 0400: *Research, Development, Test & Evaluation, Defense-Wide* BA 2: *Applied Research*				R-1 ITEM NOMENCLATURE PE 0602234D8Z: *Lincoln Laboratory*							
COST ($ in Millions)	**FY 2010**	**FY 2011**	**FY 2012 Base**	**FY 2012 OCO**	**FY 2012 Total**	**FY 2013**	**FY 2014**	**FY 2015**	**FY 2016**	**Cost To Complete**	**Total Cost**
Total Program Element	31.913	32.830	37.916	-	37.916	38.359	38.545	44.114	45.408	Continuing	Continuing
P534: *Lincoln Laboratory*	28.061	29.596	31.441	-	31.441	34.073	34.241	39.703	40.868	Continuing	Continuing
P535: *Technical Intelligence*	3.852	3.234	3.475	-	3.475	3.786	3.804	4.411	4.540	Continuing	Continuing
P536: *Testbed for Comparative Analysis*	-	-	3.000	-	3.000	0.500	0.500	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

(U) The Lincoln Laboratory research line program (LL Program) 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 innovations that directly lead to the development of new system concepts, new technologies, and new components and materials.

The LL Program currently includes six core technologies and four technical initiatives:
(U) Advanced Electronics Technologies, 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) Advanced Optical Communications, focusing on high-efficiency free-space optical communications links.
(U) Intelligence, Surveillance, and Reconnaissance, including the development of novel active and passive RF and electro-optic sensors useful for intelligence, surveillance, and reconnaissance applications, as well as advanced data exploitation techniques.
(U) Net-centric Operations, with an emphasis on developing and demonstrating the key technologies that will enable composable and dynamic multi-mission net-centric operations on the Global Information Grid.
(U) Decision Support, with the goal of developing and demonstrating fundamental technologies and architectures supporting real time decisions across large, dynamic, heterogeneous data sets.
(U) Homeland Protection, with the objective of developing and demonstrating architectures and the key technologies that support homeland protection.
(U) Technical Initiatives, including biological sciences to aid the warfighter, promote public health, and develop tools for biological research; cybersecurity technologies to develop new techniques for the protection of systems against cyber attack and exploitation; autonomous systems technologies with the objective of developing mobile, autonomous, robotic platforms that demonstrate key capabilities needed for a wide range of defense applications; and quantum information sciences to develop basic technologies that support the storage, transport, and computation of quantum information.

(U) Supporting these and other priority technology and capability areas are work efforts entitled Technical Intelligence and Testbed for Comparative Analysis:

(U) Technical Intelligence is working to develop a comprehensive understanding of technology emergence and advancement in a range of relevant scientific areas such as nanotechnology, directed energy, and propulsion. Some details are classified, but one focus area is working to establish a broad horizon scanning and technology

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forecasting capability through a collaborative effort by DOD and the Intelligence Community. This effort will develop insight into our relative position in science and technology around the world over time, as well as determine potential impacts on DOD capability development and future threat environments.

(U) The Testbed for Comparative Analysis will enable the evaluation of quantitative and horizon scanning and technology forecasting techniques for discovering disruptive technologies that may impact the DOD. This effort will provide the DOD with objective ways to evaluate the accuracy of existing and future horizon scanning and technology forecasting efforts.

B. Program Change Summary ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	34.034	32.830	33.447	-	33.447
Current President's Budget	31.913	32.830	37.916	-	37.916
Total Adjustments	-2.121	-	4.469	-	4.469
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-0.195	-			
• SBIR/STTR Transfer	-1.000	-			
• Other Program Adjustments	-0.926	-	5.500	-	5.500
• Defense Efficiency - Reports, Boards, Studies, and Commissions	-	-	-0.978	-	-0.978
• Economic Assumptions	-	-	-0.053	-	-0.053

Change Summary Explanation

Baseline Review. As part of the Department of Defense reform agenda, implemented a zero-based review of the organization to align resources to the most critical priorities and eliminate lower priority functions. This included the addition of $3.000M for a Comparative AnalysisTestbed and $2.500M to the core program.

Defense Efficiency – Report, Studies, Boards and Commissions. As part of the Department of Defense reform agenda, reflects a reduction in the number and cost of reports, studies, DoD Boards and DoD Commissions below the aggregate level reported in the previous budget submission.

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COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
P534: *Lincoln Laboratory*	28.061	29.596	31.441	-	31.441	34.073	34.241	39.703	40.868	Continuing	Continuing

A. Mission Description and Budget Item Justification

(U) The Lincoln Laboratory research line program (LL Program) 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 innovations that directly lead to the development of new system concepts, new technologies, and new components and materials.

(U) The LL Program currently includes six core technologies and four technical initiatives:
(U) Advanced Electronics Technologies, 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) Advanced Optical Communications, focusing on high-efficiency free-space optical communications links.
(U) Intelligence, Surveillance, and Reconnaissance, including the development of novel active and passive RF and electro-optic sensors useful for intelligence, surveillance, and reconnaissance applications, as well as advanced data exploitation techniques.
(U) Net-centric Operations, with an emphasis on developing and demonstrating the key technologies that will enable composable and dynamic multi-mission net-centric operations on the Global Information Grid.
(U) Decision Support, with the goal of developing and demonstrating fundamental technologies and architectures supporting real time decisions across large, dynamic, heterogeneous data sets.
(U) Homeland Protection, with the objective of developing and demonstrating architectures and the key technologies that support homeland protection.
(U) Technical Initiatives, including biological sciences to aid the warfighter, promote public health, and develop tools for biological research; cybersecurity technologies to develop new techniques for the protection of systems against cyber attack and exploitation; autonomous systems technologies with the objective of developing mobile, autonomous, robotic platforms that demonstrate key capabilities needed for a wide range of defense applications; and quantum information sciences to develop basic technologies that support the storage, transport, and computation of quantum information.

(U) Supporting these and other priority technology and capability areas, is a work effort entitled Technical Intelligence. Technical Intelligence supports comprehensive understanding of technology emergence and advancement in a range of relevant scientific areas such as nanotechnology, directed energy and propulsion. Some details are classified, but one effort focused on establishing a broad horizon scanning and technology forecasting effort is a collaborative effort by DOD and the Intelligence community. This effort will develop insight over time into our relative position in science and technology around the world and potential impacts on capability development and future threat environments.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Advanced Electronics Technology	6.900	6.981	7.068
FY 2010 Accomplishments:			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
(U) Developed technologies for imaging focal planes that enable new approaches to electro-optical sensors. Developed unique integrated circuit designs and processes for ultra-low power electronics, high data collection rates, or operation in stressing environments. Developed photonic integrated circuits components to enable advanced compact sensing systems. Developed novel high-power, frequency-agile sources for sensing. Received RD100 Award for Geiger-mode Avalanche Photodiode Focal Plane Array development. ***FY 2011 Plans:*** (U) Continue technology development for imaging focal planes through the use of an advanced set of design and fabrication tools. Develop advanced 3-D integrated electronics and imagers. Continue development of coherent photonics integrated circuit components. Continue development of frequency-agile sources for sensing. ***FY 2012 Plans:*** (U) Develop new imager and electronics architectures for multi-modal imaging. Develop photonics integrated-circuit-based coherent optical systems.			
Title: Advanced Optical Communications ***FY 2010 Accomplishments:*** (U) Developed technologies to increase the data rate of ultra sensitive communications links. Developed advanced channel equalization techniques to allow wide-band optical data transmission through scattering media. Received RD100 Award for development of Sub-wavelength-Separated Superconducting Nanowire Single-Photon Detector Arrays. ***FY 2011 Plans:*** (U) Evaluate novel optical communication schemes to further increase the operational utility of optical communications. Develop lower power, more sensitive receivers for optical communications. ***FY 2012 Plans:*** (U) Develop novel optical communication schemes and components for covert secure optical communications.	2.010	2.284	2.303
Title: Intelligence, Surveillance, and Reconnaissance (ISR) ***FY 2010 Accomplishments:*** (U) Continued to improve sensitivity and data throughput rate of infrared digital focal plane array surveillance camera. Continued to investigate MIMO radar architectures. Developed technologies for highly integrated RF front ends, including silicon-based transceivers for use in low cost and reconfigurable RF systems. Developed novel computer architectures designed specifically	5.080	6.844	5.757

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
for rapidly processing graph data relevant to military operations. Key developments of Digital-Pixel Focal Plane Arrays and Miniaturized Radio Frequency Four-Channel Receivers were recognized with RD100 Awards. ***FY 2011 Plans:*** (U) Continue development of lower size, weight and power reconfigurable RF systems. Continue development of computer architectures for graph analysis. Demonstrate multi-mission, UAV-based sensing, processing and data exploitation for Counter IED applications. Begin demonstration of large-scale Multi-Int data fusion for persistent surveillance. ***FY 2012 Plans:*** (U) Develop compact, low-power, multi-modal active imaging systems. Develop low SWaP integrated RF/electro-optics systems. Complete demonstration on Multi-INT persistent surveillance. Develop distributed ISR systems.			
Title: Net-centric Operations (NCO) ***FY 2010 Accomplishments:*** (U) Continued with the development of advanced, automated services and architectural features for net-centric operations. Demonstrated a second large scale field experiment incorporating additional NCO services. ***FY 2011 Plans:*** (U) Continue to add advanced architectural features and services useful for NCO. ***FY 2012 Plans:*** (U) Expand work to include secure net-centric operations, knowledge creation services, and automated verification of systems.	1.300	1.605	1.382
Title: Counter Terrorism Technologies ***FY 2010 Accomplishments:*** (U) Demonstrated advanced ISR and signals intelligence (SIGINT) capabilities, particularly for small UAVs, including the design and development of Ku-band synthetic aperture radar (SAR), performance testing of high-resolution camera payloads, and development of SIGINT sensor payloads. Designed and prototyped novel ultra-wideband digital beamforming array antenna appropriate for persistent counter-terrorism missions. ***FY 2011 Plans:*** (U) All Counter Terrorism Technology activities incorporated into ISR effort (described earlier). No exclusive FY11 effort. ***FY 2012 Plans:*** (U) All Counter Terrorism Technology activities incorporated into ISR effort (described earlier). No exclusive FY12 effort.	2.110	-	-
Title: Decision Support	2.910	1.723	1.560

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: (U) Demonstrated an integrated multi-source information and knowledge management architecture to provide decision support for military applications. Explored conceptual architectures for the human-machine interface. ***FY 2011 Plans:*** (U) Continue to develop and test knowledge building tools to facilitate decision support for the military. Begin work on Decision Support architectures for Cybersecurity. ***FY 2012 Plans:*** (U) Develop and apply collaborative gameplay technology for multiple mission domains to extend decision support capabilities and develop and demonstrate decision support capabilities for cyber operations.			
Title: Homeland Protection ***FY 2010 Accomplishments:*** (U) Completed a communications and sensor network that supports national response to homeland disasters. Developed and tested advanced video analytics technologies to provide critical infrastructure surveillance. ***FY 2011 Plans:*** (U) Expand the critical infrastructure protection effort to include multi-camera tracking and forensics. Evaluate standoff biometric technologies. Explore small-UAV-based distributed sensing for border protection. ***FY 2012 Plans:*** (U) Incorporate standoff biometric technologies into critical infrastructure protection. Expand border protection activities to demonstration phase.	1.860	1.546	1.727
Title: Technical Initiatives ***FY 2010 Accomplishments:*** (U) Work in biological sciences focused on developing field diagnostics, gene synthesis platforms, and biomarkers for depression. Efforts in cyber security technologies concentrated on building a next-generation cyber warfare test range, developing the concept of an open architecture anti-tamper system, and creating an automated cyber mission risk assessment tool. The autonomous systems (formerly robotics) technologies objectives included demonstrating cooperative interior mapping using two autonomous robots and initiating development of a mobile ground robot capable of acting as a convoy lead. The quantum information science goals included demonstrating long range quantum information transmission and initial development of improved quantum information storage mechanisms. ***FY 2011 Plans:***	5.891	8.613	11.644

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
(U) Biosciences: Evaluate performance of field diagnostic platforms and further develop concept of integrated gene synthesis and sequencing platform. Develop advanced signal processing techniques for biomarker depression and anticipatory monitoring. Cybersecurity: Demonstrate advanced cyber warfare test range and cyber mission risk assessment tools. Demonstrate utility of an open architecture anti-tamper hardware. Demonstrate low-artifact network sensing. Autonomous systems: Demonstrate robot convoy leader functions and begin development of cognitive robot architecture and algorithms. Quantum Information Sciences: Develop several qubit technologies with improved coherence time for quantum information storage and computation. ***FY 2012 Plans:*** (U) Biosciences: Exploit advances in digital microfluidics to create multi-analyte sensing platform. Continue to investigate and develop tools for optical bio-imaging. Cybersecurity: Develop automated mission-relevant cyber risk assessment tools, novel hardware sensors for low-level low-artifact cyber data collection and refrence implementations for cyber testing standards. Continue work on flexible anti-tamper architecture to enable rapid insertion of anti-tamper components into rapid prototypes and other acquisition programs. Autonomous systems: Demonstrate optimized algorithms for distributed robotics networks and model-based autonomy algorithms for higher-level autonomy, and develop the technology underpinnings of a cognitive robotics architecture featuring biomimetic algorithms for true robot autonomy. Quantum Information Sciences: Continue to work on optimization of qubits, with an objective of demonstrating few-qubit basic computational capability.			
Accomplishments/Planned Programs Subtotals	28.061	29.596	31.441

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
P535: *Technical Intelligence*	3.852	3.234	3.475	-	3.475	3.786	3.804	4.411	4.540	Continuing	Continuing

A. Mission Description and Budget Item Justification

Technical Intelligence supports DDR&E priorities through two primary mechanisms: 1) leveraging the university community through the JASONs (this is not an acronym); and 2) accessing information on the emergence, maturation and development of technology globally.

(U) JASONs is a group of approximately 65 appropriately cleared experts who provide detailed independent technical assessments of challenging technological problems. JASON members are primarily fully tenured professors in physics, mathematics, biosciences, and engineering, disciplines who hold active SCI-level clearances. The outputs of the JASONs annually are studies provided across the leadership and program manager levels which inform and often shape programmatic and technical decisions involving millions of dollars. JASONs were previously funded through university research programs, but their level of technical expertise in systems and development is appropriate for incorporation into Applied Research.

(U) The technical intelligence program will support collaborative work with the U.S. intelligence community on emerging and disruptive technologies, primarily through continued development of Technical Assessment, including Science & Technology (S&T) Net Assessments and Baseline Assessments. These assessments look at sets of technologies from both a domestic and foreign development perspective. The program will also support focused technology and regional trend studies and collaborative work with international partner nations on assessments of emerging and disruptive technologies and their relevance to national defense. The technical intelligence program also supports development of horizon scanning and technology forecasting approaches that enable broader assessment of emerging and disruptive technologies.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Technical Intelligence	3.852	3.234	3.475
FY 2010 Accomplishments: (U) Continued to focus the JASON studies and Technical Intelligence in areas critical to national security. JASON studies were focused on areas underpinning significant technological challenges in the security environment. For the Technical Intelligence portion some details are classified. The program conducted S&T technical assessments on global technology advancement in collaboration with the National S&T Intelligence Committee in quantum science and others as identified by the S&T net assessment program in FY 2009. This program continued tri-lateral collaboration with the United Kingdom and Australia to target assessments on emerging and disruptive technology and made progress towards including Canada and New Zealand. The program continued work with the National Academy of Sciences (under the National Research Council) through the Board on Global Science and Technology to engage globally on targeted areas of science and technology to understand global shifts and their relevance to national security; the Board is sponsoring several conferences in countries and technologies of interest, with an initial focus on the large data challenge. A future technology war-game was conducted at the National Defense University,			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012

focused on the potential disruptive impact of rare earth materials. In coordination with the National Intelligence Committee and the Defense Intelligence Community effort to Strengthen Science and Technology Analysis, this program initiated the implementation of a structured enterprise approach to determine, prioritize, track, distribute and evaluate S&T intelligence requirement and generated a report on the health of Defense S&T Intelligence to support the defense S&T program. Country specific reports by the Library of Congress Federal Research Division commissioned in FY 2009 were finalized. Technical Intelligence provided a top tier of S&T Intelligence priorities to the U.S. Intelligence Community and provided a classified mechanism for linking intelligence products to DoD scientists and engineers.

FY 2011 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 the time. For the Technical Intelligence portion some details are classified. The program will initiate S&T baseline assessments for the S&T Intelligence priorities and full technical net assessments on global technology advancement in collaboration with the National S&T Intelligence Committee in the areas such as electronic warfare, and others as identified by the S&T net assessment program in FY 2010. This program will continue 'five eyes' collaboration with the United Kingdom, Australia, Canada, and New Zealand to continue assessments on emerging and disruptive technologies and will leverage the best collection of methodologies for scanning/discovery, prioritization and assessment of the military relevance for those emerging technologies. The program will continue the effort of a National Academy of Sciences (under the National Research Council) through the Board of Global Science and Technology to engage globally on targeted areas of science and technology to understand global shifts and their relevance to national security. The Board is sponsoring several conferences in countries in reference to technologies of interest, with the initial focus on the large data challenge. A future technology war-game will be conducted at the National Defense University, focused on the potential disruptive impact of commercially available technologies relevant to an emerging threat. In coordination with the National Intelligence Committee and the Defense Intelligence Community effort to Strengthen Science and Technology Analysis, this program will continue a strong partnership with the intelligence community to provide clear feedback on products, improve articulation of S&T requirements, and define higher impact products for future development. Technical Intelligence will continue to update and refine the S&T Intelligence priorities and mechanisms for increasing information flow from the intelligence community.

FY 2012 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 the time. For the Technical Intelligence portion some details are classified. The program will initiate S&T baseline assessments for the S&T Intelligence priorities and full technical net assessments on global technology advancement in collaboration with the National S&T Intelligence Committee in the areas such as electronic warfare, and others as identified by the S&T net assessment program in FY 2010. This program will continue 'five eyes' collaboration with the United Kingdom, Australia, Canada, and New Zealand to continue assessments on

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
emerging and disruptive technologies and will leverage the best collection of methodologies for scanning/discovery, prioritization and assessment of the military relevance for those emerging technologies. The program will continue the effort of a National Academy of Sciences (under the National Research Council) through the Board of Global Science and Technology to engage globally on targeted areas of science and technology to understand global shifts and their relevance to national security. The Board is sponsoring several conferences in countries in reference to technologies of interest, with the initial focus on the large data challenge. A future technology war-game will be conducted at the National Defense University, focused on the potential disruptive impact of commercially available technologies relevant to an emerging threat. In coordination with the National Intelligence Committee and the Defense Intelligence Community effort to Strengthen Science and Technology Analysis, this program will continue a strong partnership with the intelligence community to provide clear feedback on products, improve articulation of S&T requirements, and define higher impact products for future development. Technical Intelligence will continue to update and refine the S&T Intelligence priorities and mechanisms for increasing information flow from the intelligence community.			
Accomplishments/Planned Programs Subtotals	3.852	3.234	3.475

C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

N/A

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COST ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total	FY 2013	FY 2014	FY 2015	FY 2016	Cost To Complete	Total Cost
P536: *Testbed for Comparative Analysis*	-	-	3.000	-	3.000	0.500	0.500	-	-	Continuing	Continuing

A. Mission Description and Budget Item Justification

(U) The Testbed for Comparative Analysis will include a data, test, and evaluation environment to enable analysis of both quantitative and qualitative techniques for technology forecasting and horizon scanning. This includes the ability to derive an understanding of accuracy, relevance, and robustness of analysis techniques and algorithms (e.g. cluster analysis) to identify emerging technology trends and potentially disruptive weak signals. The testbed will be developed in collaboration with other interested government agencies with modularity and expansion capabilities in mind.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Testbed for Comparative Analysis	-	-	3.000
Description: (U) The Testbed for Comparative Analysis will include a data, test, and evaluation environment to enable analysis of both quantitative and qualitative techniques for technology forecasting and horizon scanning. This includes the ability to derive an understanding of accuracy, relevance, and robustness of analysis techniques and algorithms (e.g. cluster analysis) to identify emerging technology trends and potentially disruptive weak signals. The testbed will be developed in collaboration with other interested government agencies with modularity and expansion capabilities in mind. ***FY 2010 Accomplishments:*** N/A - New Project in FY12 ***FY 2011 Plans:*** N/A - New Project in FY12 ***FY 2012 Plans:*** (U) Design and implement an initial data, test, and evaluation environment to enable analysis of both quantitative and qualitative techniques for technology forecasting and horizon scanning. This includes the ability to derive an understanding of accuracy, relevance, and robustness of analysis techniques and algorithms (e.g. cluster analysis) to identify emerging technology trends and potentially disruptive weak signals. The testbed will be developed in collaboration with other interested government agencies with modularity and expansion capabilities in mind.			
Accomplishments/Planned Programs Subtotals	-	-	3.000

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C. Other Program Funding Summary ($ in Millions)

N/A

D. Acquisition Strategy

N/A

E. Performance Metrics

TBD