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 3: *Advanced Technology Development (ATD)*				R-1 ITEM NOMENCLATURE PE 0603680D8Z: *Defense Wide Manufacturing Science and Technology Program*							
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	20.992	18.916	17.888	-	17.888	22.234	22.671	23.164	23.864	Continuing	Continuing
P680: *Manufacturing Science and Technology Program*	20.992	18.916	17.888	-	17.888	22.234	22.671	23.164	23.864	Continuing	Continuing

A. Mission Description and Budget Item Justification

Defense Wide Manufacturing Science and Technology (DWM S&T) provides the Department with a comprehensive manufacturing program to achieve the strategic goals of focused technology, improved acquisition across the life cycles, and cost-effective logistics. By designing for manufacturability early in development, anticipated results will have an impact on increasing reliability and decreasing the life cycle burden of weapon systems.

DWM S&T will: 1) address manufacturing enterprise issues beyond a single Component or platform and, 2) establish and mature cross-cutting manufacturing processes required for transitioning emerging technologies which impact the time lines, affordability, and productivity of acquisition programs and shorten the deployment cycle times.

The DWM S&T program is fundamental to a coordinated development process. Concurrent development of manufacturing processes with the technology prototype enables the use of emerging technologies such as ceramic matrix composites for advanced turbine engines, affordable low observables materials for increased survivability in the kill chain of high value targets, and system-on-chip electronics for communication platforms.

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B. Program Change Summary ($ in Millions)	FY 2010	FY 2011	FY 2012 Base	FY 2012 OCO	FY 2012 Total
Previous President's Budget	14.638	18.916	18.855	-	18.855
Current President's Budget	20.992	18.916	17.888	-	17.888
Total Adjustments	6.354	-	-0.967	-	-0.967
• Congressional General Reductions		-			
• Congressional Directed Reductions		-			
• Congressional Rescissions	-	-			
• Congressional Adds		-			
• Congressional Directed Transfers		-			
• Reprogrammings	-2.100	-			
• SBIR/STTR Transfer	-0.432	-			
• Other Program Adjustments	8.886	-	-	-	-
• Defense Efficiency - Reports, Studies, Boards, and Commissions	-	-	-0.473	-	-0.473
• Defense Efficiency - Contractor Staff Support	-	-	-0.468	-	-0.468
• Economic Assumptions	-	-	-0.026	-	-0.026

Congressional Add Details ($ in Millions, and Includes General Reductions)	FY 2010	FY 2011
Project: P680: *Manufacturing Science and Technology Program*		
Congressional Add: *High Performance Manufacturing Technology Initiative*	7.500	-
Congressional Add: *California Enhanced Defense Small Manufacturing*	1.600	-
Congressional Add Subtotals for Project: P680	9.100	-
Congressional Add Totals for all Projects	9.100	-

Change Summary Explanation

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.

Defense Efficiency – Contractor Staff Support. As part of the Department of Defense reform agenda, reduces funds below the aggregate level reported in the previous budget submission for contracts that augment staff functions.

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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
P680: *Manufacturing Science and Technology Program*	20.992	18.916	17.888	-	17.888	22.234	22.671	23.164	23.864	Continuing	Continuing

A. Mission Description and Budget Item Justification

The DWM S&T program has a two-pronged approach: 1) technology initiatives and 2) specific single projects. Technology initiatives, in collaboration with the Joint Defense Manufacturing Technology Panel (JDMTP) and industry, identify and develop investment strategies to advance the manufacturing processes needed to support the specific technology. Above-the-shop-floor investments focus on new manufacturing processes that have potential to significantly improve manufacturing efficiencies. Single specific projects address investment opportunities not associated with selected technology initiatives and enable the program to respond to urgent, compelling manufacturing needs and provide seed funding to more high risk-high payoff technologies.

Data calls will be launched through two methods to identify technology initiatives and single specific issues requiring investment. One method is through the JDMTP. The JDMTP is comprised of the ManTech Directors from the Services, Defense Logistics Agency, Missile Defense Agency (MDA) and Office of Secretary of Defense (OSD). The call will be distributed through the ManTech Directors to the four JDMTP sub panels: Metals Processing and Fabrication Subpanel, Composites Processing and Fabrication Subpanel, Electronics Processing and Fabrication Subpanel and Advanced Manufacturing Enterprise Subpanel. Potential candidates will be evaluated by the JDMTP based on criteria set forth in the call and announcements and down-selected for further development prior to final selection. The other method is through a Broad Agency Announcement to industry. Priority will be given to investments that support affordability and producibility of critical enabling manufacturing technologies that cut across multiple platforms. Investments will also balance defense priorities in specialty materials, electronics, propulsion and power, and manufacturing processes including "above the shop floor" (lean and business technologies facilitating interoperable manufacturing). Final projects are selected by the OSD ManTech Director in collaboration with the JDMTP and in consultation with the Office of Director for Research and the Director, Defense Research & Engineering. Technology initiatives and projects will be executed at the Component level.

B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Title: Ceramic Matrix Composite (CMC) Manufacturing Initiative	0.380	-	-
Description: Turbine engines are the main propulsion system for virtually all Department of Defense aircraft and helicopters and also power an array of ships and tanks. Improvements in manufacturing process technology must be achieved with each new generation of engines for these challenging new designs to be manufactured with acceptable quality, cost, and delivery rate to meet the warfighters' needs. This initiative seeks to advance and establish the manufacturing technologies for CMCs needed to support the development, production and sustainment of advanced gas turbine engines. Successful efforts will enable the use of CMCs for defense systems, resulting in significant life cycle cost avoidance through improved fuel efficiencies and greatly reduced maintenance costs over metallic flaps and seals and vanes for turbine engines.			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Program Outputs: Demonstrate the advancement of CMC manufacturing technologies that result in: 1) improved non-destructive evaluation (NDE) techniques 2) reduced production time, 3) consistent performance of the CMC materials, and 4) reduced unit cost such that CMC materials can be incorporated in Advanced Turbine Engines resulting in 1) reduced weight, 2) increased engine performance, 3) decreased maintenance, 4) increased production flow through, and 5) increased safety. Advanced manufacturing material processes will reduce re-work, increase production capacity, and enable production rate requirements for engine components. Life cycle cost avoidance for this initiative is projected in the billions, with technology maturity within three to five years. ***FY 2010 Accomplishments:*** 1) In-line tow coating performed 2X and 4X length full scale validation runs using simulated inline process. 4X length inline process reduces labor costs by 60%. Specification was written for in-line machine based on validated experimental results. Real time process metrology task demonstrated capability to measure coating thickness using Fourier Transform Infrared Spectroscopy method. Real time method for tow coating thickness was previously non-existent. Treatment of deposition tube surfaces leveraged to other coating runs yielding 2X increase in run length. Post-processed mechanical test data from final task 2.5 runs, and began integrating into final report. (2) Demonstrated coating 35 meters of carbon cloth, longest run ever demonstrated; 40% increase compared to baseline; demonstrated boron nitride coating with 5th lance; reduced fabric inspection time by 33%. OEM requirements and documentation were coordinated. Supplied samples to support development of prototype thickness measurement systems. (3) Non-destructive evaluation (NDE) – General Electric completed fabrication of 4 generic airfoils, cut plans established for specimens, preliminary trials and discovery experiments complete for all NDE technologies on flat specimens. NDE data acquisition complete on flat specimens. (4) For 3D Airfoil inspections, a study was conducted to evaluate cycle time elements of the inspections, part movement, and analysis to identify areas for future cycle time reduction. GE has reviewed and approved the Rolls-Royce draft on shiny measurement systems and a draft of an optical standard for the Aviation industry and provided feedback for incorporation. The 3DAI system has been shipped to GE-Global research for additional software to enable it to be incorporated directly into the Rutland production facility. ***FY 2011 Plans:*** 1) Compile and submit In-line tow coating final report. Work General Electric procurement activity for in-line machine. 2) Silicon Carbide Fabrics - Demonstrate larger batch size, goal of 80 meters; perform reactor condition trials using 5th lance.			
Title: Low Observable Material Manufacturing Initiative ***Description:*** Manufacturing Scale-up for Low Observable (LO) Materials and Platforms	0.874	-	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Program Outputs: Three key areas: 1) precision component fabrication; 2) multi-spectral LO integration; and 3) minimization of sustainment cost and cycle time drivers. Investment in the three key areas is projected to have a significant multi-million dollar payback throughout the Future Years' Defense Plan and beyond. Technology is expected to mature beginning in FY 2010. ***FY 2010 Accomplishments:*** Completed final scale-up of the key project to meet initial DoD-level needs. Completed additional testing. Overall goal of 50 times increase in throughput and ten times reduction in cost.			
Title: System-On-Chip (SOC) ***Description:*** Enables smaller, less costly Global Positioning Systems (GPS) by developing the manufacturing technologies to enable reduced weight, size and power consumption to provide leap-ahead communication and sensor capability by maturing technologies that move heavy, high volume/power demand systems to small, power efficient System-On-Chip (SOC) packaging technology. Small form factor GPS components will be available to designers for incorporation into a wide variety of weapons systems. Program Outputs: Moves the basic packaging technology from a manufacturing proof-of-concept to qualification for application in the Ground-Based GPS Receiver Application Module (GB-GRAM) as the initial adopter. DWM S&T investments will refine the fabrication process, develop design rules for complex integration of non-optimized electronic devices into very high density packages, and accelerate the development and integration of the receiver module that can be used for downstream system application. The combination of bare die, high density silicon interposers, 3-dimensional die stacking, advanced RF quality laminates, and the use of micro-passive surface mount devices will be used to achieve a 62% volume reduction over the present GB-GRAM circuit card assembly. ***FY 2010 Accomplishments:*** Radio Frequency (RF) module development was completed. Fabricated more than 250 GPS modules, with recent process yields of 96%. Demonstrated better than Class 2 reliability. Parts completing internal reliability testing showed an estimated mean time between failures of greater than 100 years. Four GB GRAM modules were built with JV2 Jaguar ASICs for engineering evaluations. Achieved a 20.5% surface area reduction over the present Type II GB-GRAM layout, which meets the APTIDS project goal for surface area reduction. ***FY 2011 Plans:*** Complete the RF module development and testing. Deliver functional RF modules (with test data). Complete the GPS module development and testing. Deliver functional GPS modules (with test data). Complete the GB-GRAM detail design and	1.421	-	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
development. Achieve availability of Jaguar application specific integrated circuit from fabrication. Make a Go/No Go decision on the manufacturing implementation in the Ground-Based GPS Receiver Application Module .			
Title: Prosthetics and Orthotics Manufacturing Initiative ***Description:*** This project was previously titled "Custom Composite Orthotics and Prosthetics" in the FY 2009 President's Budget. New manufacturing technologies are required for the development of custom composite orthotics and prosthetics for injured men and women of the armed services. Orthotics and prosthetics present a two-fold challenge in that they contain a high degree of customization in design and a labor intensive means of manufacturing. Recent advances in solid modeling, reconfigurable tooling, room temperature resin chemistry, automated fabrication of custom fiber architectures, and novel resin infusion methods have created the potential to develop a highly integrated, low cost, custom orthotic and prosthetic technology to address the unique requirements and needs of the armed services. Rapid prototyping technologies and new composite manufacturing solutions have shown the potential to provide a 24-hour turnaround time for component fabrication. The current state-of-the-art for orthotics is to thermoform plastic materials such as polypropylene to create a custom fit orthotic. New manufacturing techniques integrated with advanced polymer composite technologies have allowed for initial prototyping work using woven glass reinforced adiprene. These new materials are compliant, but sufficiently rigid for use with prosthetics. The integration of composite materials could provide up to a 20 percent weight savings and an approximate 40 percent reduction in skin contact over current thermoform plastic solutions. Outcome: New rapid prototyping and affordable manufacturing processes resulting in 20 percent weight savings and 40 percent reduction in skin contact. Improved reliability of new composite prosthetics. ***FY 2010 Accomplishments:*** Formally cleared the use of conformal foams and resins at the Navy Medical Center – San Diego. Scheduled a trial event for early FY11. Completed the Magnetic resonance imaging segmentation of patient data . SensorTech has planned the commercial launch of its sensor socket product for early FY11. Mentis Sciences Inc. began recording and documenting all techniques to support automated manufacturing. Two commercial manufacturers (Ossur and Friddles Orthopedic) are interested in acquiring the rapid prototyping manufacturing cells that would provide prosthetics to the military at reduced costs. Ossur is a very large name in the business and would result in significantly increased visibility and use of the technology. Friddles Orthopedic is a manufacturer that sells directly to medical practitioners. ***FY 2011 Plans:*** Efforts will continue to accumulate metrics to quantify project benefits. The team will continue working with Ossur and Friddles Orthopedic to commercialize the technology.	0.826	-	-
Title: Direct Digital Manufacturing Inspection and Distortion Control	0.874	0.936	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: Increase the affordability of electron beam additive manufacturing (EBAM) titanium 6-4 components for air, sea, and land based systems. Develop thermal control and deposition strategies to control aluminum loss and minimize distortion during deposition. Optimize non-destructive inspection techniques. . ***FY 2010 Accomplishments:*** Independently varied thermal control and deposition parameters to correlate to aluminum loss. Compared multiple distortion control methods and down selected to the best approach or combination to further develop. Explored non-destructive inspection methods for their suitability to the as-deposited wavy surface prior to machining. Conducted testing for aluminum loss control, and determined that loss is repeatable and controllable. Compared multiple distortion control methods and downselected to the best approach to further develop. Created all needed specimens for non-destructive testing and delivered them to the test facilities. ***FY 2011 Plans:*** Optimize distortion control. Demonstrate a 90% probability of detection of defects at a 95% confidence level on EBAM deposits that are several inches thick. Transition will be on the F-35 flaperon spar. The goal is to begin production implementation of EBAM flaperon spars in low rate initial production (LRIP) block 7. The long-lead for LRIP 7 starts in mid-2013.			
Title: Emerging Manufacturing ***Description:*** Emerging Manufacturing is a series of new efforts addressing advanced manufacturing technologies and enterprise business practices for defense applications. Initiatives and projects under development will continue to identify and transition advanced manufacturing processes/technologies that will achieve significant productivity and efficiency gains in the defense manufacturing base. The key focus areas are: manufacturing technologies to accelerate delivery of technical capabilities to impact current warfighting operations; to prepare for an uncertain future; and to reduce the cost, acquisition time and risk of our major defense acquisition programs. The Out of Autoclave Bismaleimide program developed out of autoclave aerospace composites with service temperature uses of up to 350F. The Carbon Nanotube Cable project will demonstrate high volume quality controlled carbon nanotube fiber and sheet for signal and power transmission. The technology involves replacing copper in signal and power cables with carbon nanotubes, which would greatly reduce its weight, subsequently causing a significant increase in fuel efficiency and overall performance. The Extreme Breakover Diode (XBOD) project will mature manufacturing processes for a high-speed, high-voltage, solid-state switches for directed energy weapon applications.	1.488	4.011	0.641

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
The Direct Write Electronics project will enable electronic circuits to be printed directly from computer aided design files, much like printing text on a piece of paper from a word processor file. Direct Write circuits will revolutionize electronics manufacturing & fabrication techniques and enhance warfighter platform effectiveness through an increase in sensor/instrumentation placement. Cost savings for each sensor/circuit placement are realized by eliminating all associated installation tooling, reducing one man-day of assembly time (per sensor application), and eliminating inspection criteria for cutting, drilling, and assembly of sensor subcomponents. The Copper Nanoparticle Solder-Free Electronics Scale-up project will demonstrate a method for producing printed circuit boards that does not require solder. The project scope is to produce test quantities of copper nanoparticles, use them to assemble a representative circuit board, and evaluate their performance. ***FY 2010 Accomplishments:*** The Out of Autoclave Bismaleimide program fabricated several trial panels using dam and damless bagging schemes, and both methods produced good results. Six test panels began non-destructive inspection at WPAFB. Received material for infusion test panels and the bagging and manufacturing plan for them was completed. The Carbon Nanotube Cable project began (1) increasing the throughput of carbon nanotube wire and sheet systems and (2) producing and test demonstration cables sufficient to prove this technology. Conducted several iterations of CNT cable tests. Preliminary results look promising with significant improvements over earlier test samples. Began production qualification runs for the HTF system design. Began HTF system integration planning. The XBOD project awarded a contract in September 2010, and began generation of XBOD switching specifications and test plans. The Direct Write Electronics project awarded a contract in September 2010, initiated efforts to create a capacitor and resistor fabrication library, and extended tool-path conversion software to support standard electronic design packages. The Copper Nanoparticle project awarded a contract in September 2010 and initiated efforts to scale-up the nanocopper powder production. ***FY 2011 Plans:*** The Carbon Nanotube Cable project will optimize the manufacturing process resulting in an affordable, high quality carbon nanotube cable. The XBOD project will continue to generate XBOD switching specifications and test plans, and conduct an XBOD trade study. The project will also develop an XBOD trigger circuit and begin design/fabrication/verification of test beds. The Direct Write Electronics project will continue to develop the library, automate the tool-path generation, and it will perform component			

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
testing that is representative of the planned actual component usage. The Copper Nanoparticle project will produce the copper nanoparticles, assemble a circuit board with them, and evaluate the circuit board's performance. ***FY 2012 Plans:*** The Carbon Nanotube Cable project will develop a vendor transition production demonstration plan and a customer transition plan, and platform application tasking will be performed by Northrop Grumman and Sikorsky. The XBOD project will optimize back-end processing for the 2nd generation package and test the 2nd generation XBOD.			
Title: Chip Scale Atomic Clock ***Description:*** Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) systems require precise timekeeping even if the Global Positioning System (GPS) is unavailable. The size, weight, power, and cost components of conventional atomic clocks are too high for tactical applications. Chip Scale Atomic Clock (CSAC) provides improved long-term frequency stability that gets integrated into long-term time accuracy. The focus of this project is to leverage DARPA investments in the CSAC technology to reduce operational costs and transition beyond custom fabrication of the current CSAC. Mass manufacturing capabilities will be enabled with the development of batch processes, manufacturing tools, and automated assembly and test. Development of a network of multiple vendors to foster competition and ensure a viable supply base is a complementary goal. Successful performance will enable an environment of continued operation of critical Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance systems, regardless of the presence or absence of GPS. The ability to rapidly reacquire GPS military code in a hostile Electro Magnetic Interference (EMI) environment is an additional targeted benefit. ***FY 2010 Accomplishments:*** Contracts awarded in September 2010. Increased manufacturing readiness by improving current manual assembly in a lab environment to mass manufacturing capability. Focused on developing batch processes, manufacturing tools, and automated assembly and test of the physics package. ***FY 2011 Plans:*** Demonstrate a production-ready manufacturing process for resonance cell and physics package fabrication on chip scale atomic clocks. Initiate engagement with integrated product team core members, providing periodic program status reviews. ***FY 2012 Plans:*** Advance the manufacturing process toward an end-of-project objective of a TRL7 and MRL8. Conduct laboratory testing in relevant environments at the end of each phase, sending samples for system integration and system-level testing.	1.584	3.571	8.064
Title: Fiber Placement of Out of Autoclave Composites	0.810	-	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Description: An alternative to the traditional use of autoclaves in the production of large carbon fiber composites is Out of Autoclave (OOA) processing, which uses far less expensive ovens. Fabrication of large carbon fiber composite parts is limited by the small number of existing large autoclaves that are currently tied up with Boeing 787 and F-35 production. In addition, the high capital cost of buying large autoclaves is prohibitive. The ability to use less expensive ovens, coupled with the use of resins at lower cure temperatures, will allow more suppliers to enter the market and fabricate a greater number of larger carbon fiber composite parts at lower costs. Outcomes: The initial phase of this project focuses on the development of the fiber placement process. The goal is to demonstrate the lay down rates required to meet projected requirements and the fabrication of quality laminates with autoclave-equivalent mechanical performance. Candidate aircraft for this technology are: Air Force/Army Joint Future Theatre Lift (C-130 successor) – 180' wingspan and 140' fuselage; National Aeronautics and Space Administration (NASA) Ares V - 33' diameter; Navy P-8 Raked Wing Tip. ***FY 2010 Accomplishments:*** Established material and process parameters to be evaluated, defined the equipment to be used, defined the parts to be manufactured, determined materials to be ordered. Lockheed Martin completed fiber placement for solid laminate and honeycomb panels, and quality assessments were started. Boeing completed fiber placement for 12 quasi panels, and began non-destructive inspection. ***FY 2011 Plans:*** Methods of fabricating out of autoclave composite components via fiber placement will be defined for each commercially available domestic fiber placement machine. Demonstrate methods on representative aerospace parts. Techniques will be published and distributed throughout the composites supplier base.			
Title: Rapid Manufacturing of Aerospace Structures ***Description:*** Allow faster and more affordable access to low-volume, state-of-the-art production capabilities for acquisition of defense unique technologies for low density, high demand systems. Rapid prototyping includes many different fabrication technologies. Stereo Lithography (SL), selective laser sintering (SLS), laminated object manufacturing (LOM), and fused deposition modeling (FDM) are a few examples. These Rapid Prototyping processes have already had the effect of both improving products and reducing their development time. Rapid Manufacturing is an attempt to transition these prototyping techniques to the manufacturing floor. This form of manufacturing can be incredibly cost-effective and the process is far more flexible than conventional manufacturing. Rapid Prototyping processes have been shown to	0.146	1.672	1.692

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
be economically feasible for use in the manufacture of non structural parts in quantities. This Rapid Manufacturing effort will focus on the use of these Rapid Prototyping processes in the fabrication and/or assembly of Aerospace Structures. ***FY 2010 Accomplishments:*** Contract awarded September 2010. Initiated programs to demonstrate the use of rapid manufacturing in the fabrication and/or assembly of aerospace structures. Examples of parts that could be fabricated include but are not limited to control surfaces, edges, and ducting. ***FY 2011 Plans:*** Fabricate subscale parts to assess the unique capabilities of rapid prototyping technologies. Initial testing will be performed on these subscale articles to ensure they meet to the structural design requirements ***FY 2012 Plans:*** Develop demonstration articles and associated costing data to validate the ability of rapid manufacturing techniques to fabricate timely affordable structural components.			
Title: High Performance Manufacturing Technology Initiative ***Description:*** This initiative funds a collection of projects to identify, advance, and accelerate manufacturing processes and technologies and business practices that will achieve productivity and efficiency gains in the defense manufacturing base. Activities include maturing manufacturing process development, strategic planning and roadmapping, development of prototypes and test beds, workshops, incentives, and outreach, model based enterprise, supply chain management, and technical data package development. FY 2010 funded through congressional add (as adjusted for DoD Appropriation General Provisions). FY 2011 and beyond funded out of President's budget. ***FY 2010 Accomplishments:*** Augments congressional add identified below. Developed and tested a software framework and algorithms to provide more effective supply chain risk management. Updated the Requirements-Based Cost Modeling System to support more accurate evaluation of new requirements during a cost assessment. The Improved Design Effectiveness Through Next Generation Visualization (IDEV) project enhanced the software's collaboration features and improved device input support. Graphics from NX modeling software were successfully distributed to 3D display while simultaneously viewing the remote desktop. Software updates were successfully deployed to Raytheon and Rockwell Collins. Mechdyne completed the development of its software product, and prepared to demonstrate and release the product in late 2010.	1.019	0.502	-

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
The Risk Assessment for Next Generation Supply Chain Readiness (RANGER) project identified relationships between risk drivers and performance measures and created a network map of these relationships. Testing and validation in test beds was conducted using Joint Direct Attack Munition (JDAM) as a test case. The software was demonstrated at three industry conferences. Six defense organizations and four companies expressed an interest in the RANGER program and they would like to be involved in providing the program team with user requirements and early software tool evaluators. The Cost Modeling for Enterprise Transformation (COMET) project demonstrated the ability to extract information from CAD files of multiple types and input the data directly into a cost model. Used STEP design model software to input information into a cost model. Completed development of the ability to extract actual manufacturing data and input it into the cost model, using Boeing databases. COMET surpassed the capabilities of Boeing's previous cost modeling initiative. Awarded new contracts in September 2010 for the following new projects: Prime Supplier Software, Improving Manufacturing Supply Chain Design and Resiliency, Customer/Supplier Interoperability During Collaborative Design. ***FY 2011 Plans:*** Validate the supply chain risk management software against real world cases. Develop a "stand-alone" version of the Requirements-Based Cost Modeling System for small businesses, refine the operation of the system to satisfy security requirements in processing sensitive information (specifically for DoD utilization), and develop a commercialization model and channels to deployment.			
Title: Field Assisted Sintering Technology ***Description:*** This effort addresses limitations of conventional sintering manufacturing processes. Conventional sintering takes from hours to days in a sintering oven, and the beneficial characteristics of nano-structured materials are lost when the material is sintered. Field Assisted Sintering Technology (FAST) is a new technology that has potential to dramatically reduce cycle time and manufacturing cost for all materials, and to maintain the beneficial characteristics of nano-structured materials. The FAST process passes a pulsed direct current through the part while it is pressed in a die, and the combination of rapid heating and compressive loading results in fine grained, fully dense materials in short processing times that are not possible with conventional sintering processes. Many parts that are made with a powder press and sinter process are candidates for FAST, but this project will focus on ceramic body and vehicle armor, tungsten kinetic energy penetrators, IR windows, heat sinks for electromagnetic propulsion cooling, and hypersonic and high temperature for enhanced performance jet propulsion. Program Outputs: The project will mature the technology, resulting in reduced cost and cycle times for conventional materials, and higher performance for nano-structured materials.	0.364	0.870	0.677

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
FY 2010 Accomplishments: Awarded the contract September 2010. Selected candidate powder materials, optimized process parameters for those materials, and characterized material properties. ***FY 2011 Plans:*** Manufacture prototype hardware, demonstrate prototype effectiveness, document process efficiency and cost savings. ***FY 2012 Plans:*** Implement process for full scale components, document material and process specifications, support transition to industry for selected components.			
Title: Advanced Body Armor ***Description:*** While current body armor is effective, it is too heavy for some threats, environments, and operations. Even a 10% reduction in system weight would significantly increase warfighter acceptance, mobility, agility, and endurance. This effort will leverage prior DoD investments to mature three complimentary manufacturing technologies that will reduce body armor weight by 10% - 20% while improving ballistic performance and flexibility. Cost will be reduced 5% - 30% and cycle time will be reduced by 10X-100X. Program Outputs: The project will mature three manufacturing technologies for lighter weight armor from a capability to produce the technologies in a laboratory to a capability to produce them in an environment representative of a production facility. The three technologies are: 1) Incremental Pressure Application System (IPAS), which allows production of highly flexible “hard” and “soft” composite armor in same host material with no loss of ballistic and structural continuity in fibers. 2) Hotblox processing, which will reduce cost and cycle time for production of a composite material that will reduce armor weight by 10% while maintaining ballistic performance. 3) Verco processing, which will allow production of extremely hard boron carbide ceramic armor that conforms to soldier body shapes. ***FY 2010 Accomplishments:*** Awarded the contract September 2010. Began developing prototype tooling and production processes for all three technologies. ***FY 2011 Plans:*** Optimize process parameters and develop next-generation tooling. Produce prototype armor for ballistic and related testing. Begin integrating the materials and manufacturing processes into systems for the initially targeted applications. ***FY 2012 Plans:***	0.728	2.007	1.692

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Conduct ballistic and related testing, integrate the most successful technologies, and scale up to LRIP capacity.			
Title: Large Affordable Substrates ***Description:*** High performance infrared (IR) focal plane arrays (FPAs) are grown on Cadmium Zinc Telluride (CZT) substrates that are currently only available in relatively small wafer sizes (6cm x 6cm) from a single foreign source. This effort will leverage prior and concurrent Department of Defense (DoD) investments to enable a domestic source to manufacture 12cm x 12cm CZT substrates. The results will be reduced cost and assured availability of CZT substrates that will enable affordable, high performance ground and air IR sensor systems with rapid wide area search, long range ID, and dual band multispectral aided target detection capability against difficult targets while on-the-move. Program Outputs: Large, affordable CZT substrates from the domestic source will initially transition on FPAs for the 3rd Gen FLIR Engine Engineering Manufacturing Development program, to be followed by multiple transitions to other DoD weapon systems including the Army's Common Sensor Payload, Air Force's High Stare, Missile Defense Agency's SM-3 Programs, and also rapid Prototype Systems (LRAS3) to be deployed in theatre. ***FY 2010 Accomplishments:*** Awarded contract September 2010. Initiated baseline lots ***FY 2011 Plans:*** Conduct tradeoffs, select initial process improvement targets for boule growth and substrate surface finish, and complete baseline lots through array fabrication (substrate wafer size of 9x9 cm with surface roughness of 2.0 nm). Manufacturing will be matured to a capability to produce a prototype system in a production environment. ***FY 2012 Plans:*** Complete program lot 2, complete boule growth process improvements and initial surface finish, complete baseline lots through FPA testing, complete program lot 1 (wafer size increase to 12x12 cm and surface roughness of 1.5 nm), and complete program lot 3 (MRL7/8; pilot line capability demonstrated; ready to begin low rate initial production).	0.292	1.672	1.692
Title: JSF Sensor Hardening ***Description:*** Current F-35 Electro-Optical Targeting System (EOTS) and Electro-Optical Distributed Aperture System (EODAS) focal plane arrays (FPAs) are vulnerable to jamming and damage from enemy lasers. In addition, these FPAs are suffering manufacturing yield and cost issues. This effort will leverage prior and concurrent DoD investments to make manufacturing improvements that incorporate laser protection technology into the FPA's Read-Out Integrated Circuits (ROICs) while concurrently reducing ROIC defects and cost, and increasing size and yield. Program Outputs: This project will increase the maturity of laser-hardened ROICs to TRL 6 and will demonstrate the capability to produce a prototype in a production environment. The goal is to	0.292	1.505	1.354

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
transition laser-hardened FPAs in time for the F-35Block 5 Upgrade. Although focused on applications for JSF, these technologies are applicable to any Medium Wavelength Infrared detector, including those on tactical and reconnaissance sensor systems. ***FY 2010 Accomplishments:*** Awarded contracts September 2010. Initiated Manufacturing Readiness Assessment (MRA). ***FY 2011 Plans:*** Complete the initial MRA, increase wafer size, and reduce defects. ***FY 2012 Plans:*** Continue wafer size enhancements and defect reduction work. Initiate an FPA production scale-up effort.			
Title: Advanced RF Packaging ***Description:*** This effort will develop a low-cost, open-architecture radar solution for the Littoral Combat Ship (LCS) program. This program will reduce the cost of the current radar system by ~20% and fit into the existing TRS-3D top side and below decks available footprint. The open architecture configuration will allow upgrades for new technologies over the lifetime of the program as well as offer lower cost via open competition for the radar's building blocks. The results of this open architecture, reduced cost radar effort will be directly integrated back to the Army's EQ-36 Counter-fire Target Acquisition Radar for associated impact and cost savings. Finally, the plastic packaging effort as a part of this program will have a direct impact on the Volume Search Radar (VSR) on CVN-79 – creating an additional $1M/hull cost savings for the Navy. Manufacturing technology improvements will have a direct impact on the rate and quantity of this capability delivered to current operations. Program Outputs: This effort will provide the Navy with the first truly open architecture radar solution that will be able to accommodate different MMIC technologies, Line Replaceable Unit (LRU) technologies, processor, and power supplies from multiple vendors. It will provide the Army with significant cost savings due to the implementation of these advanced Monolithic Microwave Integrated Circuits and printed wire board manufacturing technologies. Estimated lifetime cost avoidance for the LCS and EQ-36 programs is estimated at $151M. ***FY 2010 Accomplishments:*** Awarded contract September 2010. Initiated an advanced packaging effort to address the low-cost packaging, both plastic and ceramic, of the High Power Amplifiers (HPAs) for the both the VSR module and the high power stage for the LCS Line Replaceable Unit (LRU). Both types of package technologies were developed to work on Printed Wiring Boards (PWBs). ***FY 2011 Plans:***	0.794	2.170	2.076

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B. Accomplishments/Planned Programs ($ in Millions)	FY 2010	FY 2011	FY 2012
Continue the advanced packaging effort. Yield performance of higher levels of integration for the LRU will also be evaluated. The second phase (run concurrently) will focus on the radar system development, concentrating on the radar's open architecture and low cost manufacturing and assembly processes. A development of low-cost antenna assembly and the repackaging of ruggedized commercial off the shelf electronics in standard Navy cabinets will be addressed. ***FY 2012 Plans:*** At the conclusion of the second phase, a land-based integration and test of the low-cost radar using the manufacturing technology developed from the first phase and the open architecture development from the second phase will be accomplished.			
Accomplishments/Planned Programs Subtotals	11.892	18.916	17.888

	FY 2010	FY 2011
Congressional Add: High Performance Manufacturing Technology Initiative	7.500	-
FY 2010 Accomplishments: Developed and demonstrated modeling and simulation tools that address the project goals. Promoted the increased use of such tools. Awarded new contracts in September 2010 for the following new projects: Prime Supplier Software, Improving Manufacturing Supply Chain Design and Resiliency, Customer/Supplier Interoperability During Collaborative Design.		
Congressional Add: California Enhanced Defense Small Manufacturing	1.600	-
FY 2010 Accomplishments: Reprogrammed to the Defense Logistics Agency		
Congressional Adds Subtotals	9.100	-

C. Other Program Funding Summary ($ in Millions)

Line Item	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
• (BA3) 0603680F: *Air Force ManTech*	39.913									Continuing	Continuing
• (BA7) 0708045A: *Army ManTech*	68.466									Continuing	Continuing
• (BA7) 0708011N: *Navy ManTech*	56.691									Continuing	Continuing
• (BA7) 0708011S: *DLA ManTech*	20.514									Continuing	Continuing

D. Acquisition Strategy

Not applicable for this item. Outyear data for "Other Program Funding" is contained within the Service budgets.

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E. Performance Metrics

The majority of project performance metrics are specific to each effort and include measures identified in the project plans. The metrics include items such as target dates from project work break down schedules, production measures, production goals, production numbers and demonstration goals and dates. In addition, generic performance metrics applicable to the Manufacturing Science and Technology (MS&T) program includes attainment of previous administration goal, "Speed technology transition focused on warfighting needs". The metrics for this objective and the objective of MS&T is to transition 30% of completing demonstrations program per year. Due to the relatively new time frame of the MS&T program, transition rates for completed efforts for this new project are not available yet.