ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2 Exhibit)

February 2005

BUDGET ACTIVITY
7 - Operational system development

PE NUMBER AND TITLE
0708045A - End Item Industrial Preparedness Activities

COST (In Thousands)	FY 2□□4 Actual	FY 2□□5 Estimate	FY 2□□6 Estimate	FY 2□□7 Estimate	FY 2□□8 Estimate	FY 2□□9 Estimate	FY 2□1□ Estimate	FY 2□11 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	8□213	8812□	685□5	73273	758□4	76867	77536	78□99	□	658382
E25 MFG SCIENCE & TECH	59882	64489	68505	73273	75804	76867	77536	78099	0	637824
EA2 MANTECH INITIATIVES □CA)	20331	23631	0	0	0	0	0	0	0	20558

A. Mission Description and Budget Item Justification: This Program element (PE) funds the Army Manufacturing Technology (ManTech) program. The goal of the ManTech program is to improve readiness and reduce total ownership costs for current and future weapons systems by providing essential manufacturing technologies that will enable affordable production and sustainment of components, subsystems and systems. The ManTech program assists the Army in meeting Future Combat Systems (FCS) and Future Force timelines and goals by reducing manufacturing risks and costs associated with transition of technologies and by transferring new/improved manufacturing technologies to the industrial base. This program element comprises three projects. The Manufacturing Science and Technologies (E25) project includes efforts selected for funding that have potential for high payoff across the spectrum of Army systems as well as significant impact on national manufacturing issues. Currently, the main focus of this project is on reducing manufacturing costs and risks of FCS enabling technologies. Major investment areas include Aviation Systems, Fire Support Systems, Armor and Armaments, Sensors, Electronics/Power Systems and Precision Munitions. Work in this program is related to and fully coordinated with on-going Army S&T efforts such as the Low Cost High G MEMS IMU in PE □6□23□3A/214 and the Flexible Display Initiative in PE □6□27□5A/H94. The Army Venture Capital (EA1) initiative is an opportunity provided by Congress to engage small innovative companies that normally do not do business with the Army. The ManTech Initiatives Congressional Adds (CA) (EA2) project funds Congressional special interest items. This PE contains no duplication with any effort within the Military Departments. The cited work is consistent with Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP). The Assistant Secretary of the Army for Acquisition, Logistics and Technology through the U.S. Army Material Command and the U.S. Army Research, Development and Engineering Command manages this PE, and the Army laboratories and Research, Development and Engineering Centers execute efforts.

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B. Program Change Summary	FY 2□□5	FY 2□□6	FY 2□□7
Previous President's Budget (FY 2□□5)	67236	76945	8□149
Current Budget (FY 2□□6/2□□7 PB)	8812□	685□5	73273
Total Adjustments	2□884	-844□	-6876
Net of Program/Database Changes			
Congressional Program Reductions	-1313		
Congressional Rescissions			
Congressional Increases	2465□		
Reprogrammings			
SBIR/STTR Transfer	-2453		
Adjustments to Budget Years		-844□	-6876

Change Summary Explanation:

$1□,□17 was reprogrammed end of FY□4 in Project EA1 for Venture Capital. This funding is not reflected in this R Form because of business rules inherent to the software.

Fourteen FY□5 Congressional Adds totaling $2465□were added to this PE.

FY□5 Congressional Adds with no R-2A:
($1343) Free Form Low Cost Fabrication Using Titanium, Project EA2: The purpose of this one year Congressional add is to demonstrate a 3D printing process using titanium parts without the use of molds or casts. No additional funding is required to complete this project.

($1726) High Temperature Structural Ceramic Materials, Project EA2: The purpose of this one year Congressional add is to transition ceramic component manufacturing to enhance engine performance, increase power-to-weight ratios, decrease fuel consumption and increase the durability for aviation and ground systems. No additional funding is required to complete this project.

($1726) Laser Engineered Net Shaping (LENS) Manufacturing Qualification, Project EA2: The purpose of this one year Congressional add is to mature high-powered laser beam processes to build three-dimensional layers of metal for repair parts. No additional funding is required to complete this project.

($959) Laser Peening, Project EA2: The purpose of this one year Congressional add is to utilize lasers to extend the life of helicopter components for engines and transmissions. No additional funding is required to complete this project.

($1438) Laser System Development for Turbine Engine Applications, Project EA2: The purpose of this one year Congressional add is to polish turbo fan blades using a laser to achieve unprecedented finish results. No additional funding is required to complete this project.

($1438) LEAN Munitions Program, Project EA2: The purpose of this one year Congressional add is have full-scale LEAN integration at ARDEC using a collaborative environment. No additional funding is required to complete this project.

($959) Manufacturing Metrology for Weapon Systems Production and Sustainment, Project EA2: The purpose of this one year Congressional add is to develop manufacturing software and equipment to aid in the process of calibrating machine tools. No additional funding is required to complete this project.

($1823) Manufacturing Systems Demonstration, Project EA2: The purpose of this one year Congressional add is develop advanced manufacturing methods to support depot operations and training of manufacturing engineers. No additional funding is required to complete this project.

($326□) National Center for Defense Manufacturing & Machining, Project EA2: The purpose of this one year Congressional add is to develop, mature and deploy to industry advanced processes in manufacturing and machining related to advanced material development. No additional funding is required to complete this project.

($2394) Packaging and Interconnection Technology, Project EA2: The purpose of this one year Congressional add is to develop precision opto-electronic packaging to industry through the use of liquid crystal polymer material. No additional funding is required to complete this project.

($2443) Reactive Armor Plasma (RAP) Processing, Project EA2: The purpose of this one year Congressional add is to mature the technology from a new form of polishing at the micron/nano level to achieve unprecedented optic finishes. A deterministic controller is being developed and assembly of a second-generation machine will begin. No additional funding is required to complete this project.

($959) Six Sigma Lean Enterprise, Project EA2: The purpose of this one year Congressional add is to demonstrate lean processes in a manufacturing environment to reduce weapon system costs. No additional funding is required to complete this project.

($959) Third Generation Dual Band Infrared Imagers, Project EA2: The purpose of this one year Congressional add is to develop long term reliability for the 3rd Generation Forward Looking Infra-red using advanced manufacturing methods. No additional funding is required to complete this project.

($22□4) Virtual Parts Program, Project EA2: The purpose of this one year Congressional add is to develop data packages using laser scanning for the fabrication and manufacturing of replacement parts. No additional funding is required to complete this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2005

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
7 - Operational system development	**0708045A - End Item Industrial Preparedness Activities**	**E25**

COST (In Thousands)		FY 2□□4 Actual	FY 2□□5 Estimate	FY 2□□6 Estimate	FY 2□□7 Estimate	FY 2□□8 Estimate	FY 2□□9 Estimate	FY 2□1□ Estimate	FY 2□11 Estimate	Cost to Complete	Total Cost
E25	MFG SCIENCE & TECH	59882	64489	68505	73273	75804	76867	77536	78099	0	637824

A. Mission Description and Budget Item Justification: The major thrust of the Army Manufacturing Technology (ManTech) project is to reduce costs and risks of manufacturing FCS technologies. This project provides essential manufacturing technologies that will enable the affordable production and sustainment of future weapon systems for the Future Force and the affordable transition of new technologies as enhancements to current systems. Objectives include development of advanced manufacturing processes, equipment, systems and enhancement in quality while achieving a reduction in cost and transferring improved manufacturing technologies to the industrial base. The ManTech program assists the Army in meeting FCS and Future Force timelines, performance, sustainability and reliability goals, by reducing manufacturing risks and costs of new technologies into weapons systems. Projects selected for funding under this program have the potential for high payoff across the spectrum of Army weapon systems as well as significant impact on national manufacturing issues and the U.S. industrial base. Other factors considered in selection of efforts include cost share with both industry and the acquisition program managers and return on investment. Major programs identified are Manufacturing Technology Objectives (MTOs). The major investment areas are Aviation Systems, Fire Support Systems, Armor and Armaments, Sensors, Electronics/Power Systems and Precision Munitions. Each MTO addresses affordability and reliability in the manufacturing processes. The Low Cost Light Weight Structures (LCLWS) MTO matures processes for lightweight aviation composite structures. The Affordable Drive Train Housing (ADTH) MTO develops advanced manufacturing processes and technologies using composites, metals, and coatings (magnesium corrosion protection) to reduce weight and increase performance of helicopter and Unmanned Aviation Vehicle drive train housings. The Large Caliber Cannon Life Extension (LCCLE) MTO provides manufacturing processes to deposit high performance bore coatings on large caliber cannons to extend the service life and reduce logistic burdens. The Armor MTO provides integrated manufacturing processes for lightweight armor structures. The Durable Gun Barrel (DGB) MTO matures manufacturing processes for ultra high strength steel, composite over-wrap and explosive cladding applications for Army gun barrels. The Titanium MTO provides material and manufacturing processes for titanium used in M777 Howitzer and Future Combat System. The Military Lasers MTO matures manufacturing processes to increase efficiency of diodes for military lasers. The Dual Band Focal Plane Array Manufacturing (DBFM) MTO provides manufacturing processes to provide dector/dewar assemblies for focal plane arrays (FPAs). The Uncooled Focal Plane Array Producibility (UFPA) MTO improves the producibility of high-resolution uncooled infrared sensor technology. The ManTech portion of the Flexible Display Initiative (FDI) provides the flexible display manufacturing technologies required to enable the production of lightweight, rugged (bi-stable and high efficiency) flexible displays. The Silicon Carbide Switches (SiCS) MTO matures the fabrication processes for compact SiCS power devices for Army systems. The Power Storage Systems (PSS) consists of two MTOs: the High Energy Density (HED) Capacitor MTO that matures pulse power manufacturing processes for advanced protection systems and weapons; and the Very High Power (VHP) Batteries MTO that matures manufacturing processes for compact energy/storage systems. The Software Defined Radio (SDR) MTO matures manufacturing processes to provide the Joint Tactical Radio System embedded SDR commodities and full rate production capability. The Phase Shifters for Phased Arrays (PSPA) MTO provides manufacturing processes for On-The-Move line of sight and beyond line of sight communications and missile seeker applications. The Low Cost High-G Micro-Electro-Mechanical Systems (MEMS) Inertial Measurement Units (IMU) MTO provides the manufacturing processes for a prototype IMU that will survive launch accelerations at the required accuracy and a deeply integrated guidance and navigation unit.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R2a Exhibit)

February 2005

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
7 - Operational system development	**0708045A - End Item Industrial Preparedness Activities**	**E25**

The MEMS Safe and Arm (S&A) MTO matures MEMS wafer-based manufacturing processes; and provides, miniature, high-G "inertial mechanical logic" to control position of explosive charge for S&A applications. This project contains no duplication with any effort within the Military Departments. The cited work is consistent with the Strategic Planning Guidance, the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan, and the Defense Technology Area Plan (DTAP).

Accomplishments/Planned Program	FY 2004	FY 2005	FY 2006	FY 2007
Aviation Systems – The LCLWS MTO: In FY04, performed a trade study to show the impact of a common tail cone design for Blackhawk variants. Conducted baseline configuration design of a UH-60 Blackhawk tail cone for incorporation of Common Missile Warning Systems and Joint Tactical Radio System. Completed a detailed design analysis of existing Chinook pylon and pylon latch. In FY05, design and manufacture tooling for fabricating composite tail cones/pylons. Fabricate and evaluate composite tail cone articles and forward pylon. In FY06, will evaluate second tail cone, integrate tail cone onto test aircraft and conduct ground testing. In FY07, will complete testing and evaluation of tail cone, and complete flight qualification. The ADTH MTO: In FY04, assessed various coatings, gathered specific magnesium corrosion data and evaluated paint removal methods for magnesium drive train housings. In FY05, analyze and evaluate repair procedures and coating schemes for magnesium housings. Complete material properties characterization and tool design and for gearbox housings. In FY06, will finalize tooling design, and initiate manufacturing of the outer gearbox housing. In FY07, will complete gearbox-housing manufacturing; perform system integration, conduct testing and evaluation of gearbox housing, and complete flight qualification.	5389	1935	1370	2038
Fire Support Systems – The LCCLE MTO: In FY04, completed construction of a full scale pre-production cylindrical magnetron sputtering prototype for depositing tantalum on large caliber cannon barrels to increase wear resistance for the 120mm FCS Mounted Combat System MCS) and M1 tank cannons. Supported the 120mm Line Of Sight and Beyond Line Of Sight Advanced Technology Demonstration by providing tantalum sputtered coated liners for live fire testing. In FY05, will deliver full scale 120mm XM36 FCS MCS gun barrel for live fire testing, complete post-firing of 120mm XM36 FCS MCS barrels and transition barrels into production.	1198	1935	0	0

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
Armor and Armaments - The Armor MTO: In FY04, initiated durability trials for semi-continuous processed ceramic tiles. Produced composite pre-forms for ballistic evaluation and baseline composite processing technology. In FY05, will conduct ceramic processing trials and design composite armor pre-form manufacturing cells. Achieve reduced cycle time, cost, and mature processes to bond tiles to metal and dissimilar materials joining. In FY06, will demonstrate a prototype production line and scale up the low cost titanium plate process. Begin pre-form manufacturing cell construction and select multi-material armor integration processes. In FY07, will automate and streamline subassembly processes and produce solid-state titanium plates. Demonstrate integration of dissimilar material structures, optimize assembly to maximize carry through strength and develop a tile encapsulation process. The DGB MTO: In FY04, Matured advanced lightweight large caliber manufacturing processes on medium caliber gun barrel coating processes. Initiated fabrication of an automated winding-in-tension composite over-wrap prototype machine and start explosively bonded medium caliber coating on short section barrels. In FY05, will scale-up high strength steels, complete fabrication of composite prototypes and clad barrels. In FY06, will construct full-scale demonstration barrels utilizing advanced steel. The Titanium MTO: In FY04, Applied extruded shapes for FCS titanium hull frame components and implemented high productivity titanium welding. In FY05, will implement automated laser hybrid welding to reduce costs. In FY06, will validate the manufacturing, cost and weight goals.	10180	14832	19866	24664

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
Sensors - Military Lasers MTO: In FY04, completed fabrication of the 4 watt, 930 nanometer (nm) laser diodes and scaled up wafer fabrication for 807 nm laser diodes from 2" to 4". Tested baseline 807 nm laser diode arrays (LDA). In FY05, will improve uniformity of epitaxial growth on 4" wafers. Automate bar stacking and handling for coating processes and deliver final LDAs. DBFM MTO: In FY04, improved yield and reduced cost of large format, small pixel, dual band FPAs. Achieved 65% yield on larger substrate using molecular beam epitaxy (MBE)) Reduced number of layers stitched from 50% to 20% for read-out integrated circuit (ROIC), and showed a 60% hybridization yield. In FY05, will increase MBE growth on substrate sizes of 50 cm2 to 55% yield, improve small pixel processing yield to 35%. In FY06, will increase MBE yield to 60%, small pixel to 60%, with an acceptance of 25%. Reduce cost to $60k per dual band FPA. UFPA Producibility MTO: In FY04, matured bolometer fabrication, did wafer level testing and improved packaging design, processed ROICs, assembled automation, and implemented numerous integrated circuit processes. In FY05, will increase FPA yield to greater than 30% with a package yield of 90% for a unit cost less than $5K. The ManTech portion of FDI: In FY04, began installing a 6" display processing line at the Army's Flexible Display Center. In FY05, will qualify the 6" display line and integrate flexible display technologies to produce 2.5" diagonal test displays. Begin installation of Generation II (GEN II) equipment. In FY06, will mature technology to enable 4" displays on flexible substrates, and continue GEN II qualification of manufacturing processes for 15" diagonal backplane display drivers. In FY07, will qualify the GEN II line for reflective and emissive displays; and integrate and fabricate flexible displays up to 7.5" diagonals from the 15" diagonal line.	22156	23216	18496	9870

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
Electronics/Power Systems - The SiCS MTO: In FY04, improved base material growth and automated wafer fabrication processes for larger, higher power diodes/switches and substrate material for advanced vehicle mobility, lethality and survivability systems. In FY05, will baseline 2nd and 3rd generation (gen) power diodes and switches and demo 1st gen SiCS diode production. In FY06, will mature mfrg processes for diodes and switches. In FY07, will baseline 4th and 5th gen switches and diodes. The PSS MTOs: In FY04, matured processes/ materials to enhance safety, reliability, energy density and production rate for reduced cost FCS batteries and high energy density capacitors coating, metalization, winding and end connection. In FY05, will mature mfrg processes for improved electrodes; evaluate cell construction automation and initiate process, packaging and design improvements. In FY06, will increase battery safety with improved electrode and electrolyte materials. In FY07, will design and implement improved cell processing, conduct design trials, assemble and test battery modules. The SDR MTO: In FY04, defined hardware dependencies, matured electronically tunable wideband filters, and miniaturized packaging techniques. In FY05, will complete engineering design analysis, define a common SDR core transceiver and mature power mgmt architecture. In FY06, complete mfrg process analysis and define qualification test methodology. In FY07, will prototype and mature mfrg sub-process for common SDR core transceiver. The PSPA MTO: In FY04 did an assessment of US Army requirements for ferroelectrics and MEMS phase shifters. In FY05, will initiate automated mfrg process improvements. In FY06, will improve automated processes to increase operational switch life, process yields, throughput and reliability. In FY07, will reduce packaging and assembly costs, eliminate stiction, and transition improved phase shifter design to WIN-T Block II.	10779	14832	21922	29592

Accomplishments/Planned Program (continued)	FY 2004	FY 2005	FY 2006	FY 2007
Precision Munitions - The Low Cost High G MEMS IMU MTO: In FY04, matured manufacturing processes to produce sensor components meeting technical performance at increased yield. In FY05, will mature packaging and manufacturing processes to improve performance parameters, meet volume, cost and yield goals. In FY06, will produce smaller pre-production IMUs and begin testing. In FY07, will validate manufacturing processes for transition to production. The MEMS S&A MTO: In FY04 produced and evaluated prototype wafers, tested new explosive formulations and produced sample MEMS S&As for testing in the XM307 weapon. In FY05, will down-select fabrication and loading processes and test integrated MEMS S&As on the XM25 weapon. In FY06, will implement micro-fabrication processes, combined with explosive direct loading and test under XM29 and XM307 load conditions. In FY07, will evaluate fabrication, loading and automated assembly technologies safety and reliability, start qualification of the MEMS-based munitions and transition common MEMS S&A integrated with fuze electronics to Low Rate Initial Production.	10180	7739	6851	7109
Totals	59882	64489	68505	73273

B. Other Program Funding Summary: Not applicable for this item.

C. Acquisition Strategy: Not applicable for this item.