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ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)	DATE February 1999
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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602303A Missile Technology
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COST (<i>In Thousands</i>)	FY1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost	22199	30130	32892	31469	29440	26045	27501	28859	Continuing	Continuing
A205 Solid State Dye Lasers	2810	0	0	0	0	0	0	0	0	6720
A214 Missile Technology	19389	30130	32892	31469	29440	26045	27501	28859	Continuing	Continuing

A. Mission Description and Budget Item Justification: This applied research program element is designed to provide the Army with missile, rocket, and unmanned vehicle technology for enhancement of existing assets. Its overall objective is to provide a continental U.S. (CONUS)-based Army with weapon systems enabling immediate world-wide deployment of forces with the capability to initially contain and ultimately achieve decisive victory against hostile forces equipped with modern weapons. The program element is driven by U. S. Army Training and Doctrine Command (TRADOC) Battle Labs and mission area analyses of deficiencies in the areas of close combat, fire support, air defense, intelligence/electronic warfare, and the priorities set forth in the Army Science and Technology Master Plan. The program element is focused on technologies which enhance weapon system deployability, flexibility, lethality, survivability, and affordability. Work within the program is conducted through system simulation, virtual prototyping, concept synthesis, hardware development, and focused technology demonstrations. The work in this program element is consistent with the resource constrained Army Science and Technology Master Plan, the Army Modernization Plan and the Defense Technology Area Plan. Work in this program element is related to and fully coordinated with efforts in PE 0602702E (Tactical Technology), PE 0602602F (Conventional Munitions), PE 0603601F (Conventional Weapons Technology), PE 0601104A (University and Industry Research Centers), PE 0603313A (Missile and Rocket Advanced Technology), PE 0603654A (LOSAT Advanced Concept Technology Demonstration), PE 0602782A (Command, Control and Communications (C3) Technology), PE 0605601A (Army Test Ranges and Facilities) in accordance with the ongoing Reliance joint planning process and contains no unwarranted duplication of effort among the Military Departments. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL.

B. Program Change Summary	<u>FY 1998</u>	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>
Previous President's Budget (<u>FY 1999</u> PB)	24238	25180	28460	26560
Appropriated Value	25335	30380		
Adjustments to Appropriated Value				
a. Congressional General Reductions	-1097	-250		
b. SBIR / STTR	-73			
c. Omnibus or Other Above Threshold Reductions	-24			
d. Below Threshold Reprogramming	-1942			
e. Rescissions				
Adjustments to Budget Years Since <u>FY 1999</u> PB			+4432	+4909
Current Budget Submit (<u>FY 2000</u> PB)	22199	30130	32892	31469

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BUDGET ACTIVITY
2 - Applied Research

PE NUMBER AND TITLE
0602303A Missile Technology

Change Summary Explanation: FY 1999: Congressional increase of 5200.
FY 2000: Increase of 3374 for high performance, non-detonable, low signature insensitive propellant.
FY 2000: Increase of 1058 for demonstration of CKEM increased missile lethality and ballistic flight test.
FY 2001: Increase of 4909 for CKEM controlled flight tests and preparation of guided flight tests in FY02.

UNCLASSIFIED

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)								DATE February 1999		
BUDGET ACTIVITY 2 - Applied Research				PE NUMBER AND TITLE 0602303A Missile Technology					PROJECT A205	
<i>COST (In Thousands)</i>	FY1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
A205 Solid State Dye Lasers	2810	0	0	0	0	0	0	0	0	6720
<p>Mission Description and Justification: Funds for this program were provided by Congress in FY 97 and FY 98. The effort is complete in FY98 and will require no additional funds. This program leverages technology developed under PE 0602307A/ Project A139 (Laser Technology). Project A205 provides for the development of dye laser technologies appropriate to future directed energy weapons, battlefield remote sensing, and the transfer of these technologies to medical applications. This project focuses on developing technologies related to the use of directed energy as a weapon against hardened targets, based on the fact that optical and radio frequency components are inherently vulnerable to laser radiation in their operating bands. This program is closely coordinated with the other services through the Joint Directors of Laboratories (JDL) Reliance Panel on Conventional Weapons. Work is performed by the Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command (AMCOM) Redstone Arsenal, AL. Major contractors include Textron Defense Systems (Wilmington, MA) and Physical Sciences Inc (Andover MA).</p> <p>FY 1998 Accomplishments:</p> <ul style="list-style-type: none"> • 1096 - Completed the development and characterization of advanced solid host dye laser materials. • 984 - Completed adaptation of zigzag resonator for use with solid dye laser gain media. • 730 - Completed development and characterization of novel dye laser pump sources. <p>Total 2810</p> <p>FY 1999 Planned Program: Program not funded in FY 1999.</p> <p>FY 2000 Planned Program: Program not funded in FY 2000.</p> <p>FY 2001 Planned Program: Program not funded in FY 2001.</p>										
Project A205			Page 3 of 7 Pages				Exhibit R-2A (PE 0602303A)			

UNCLASSIFIED

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)								DATE February 1999		
BUDGET ACTIVITY 2 - Applied Research				PE NUMBER AND TITLE 0602303A Missile Technology				PROJECT A214		
COST (In Thousands)	FY1998 Actual	FY 1999 Estimate	FY 2000 Estimate	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY2004 Estimate	FY2005 Estimate	Cost to Complete	Total Cost
A214 Missile Technology	19389	30130	32892	31469	29440	26045	27501	28859	Continuing	Continuing
<p>Mission Description and Justification: This project is focused on missile and rocket technologies that support high fire power/logistic support weight ratio concepts. Efforts address concepts that enhance the survivability of launch systems, provide greater effectiveness under adverse battlefield conditions, increase kill probabilities against diverse targets, and provide powerful new simulation and virtual prototyping analysis tools. This project encompasses seven major areas: missile guidance systems; air defense target acquisition systems; multi-spectral missile seekers; high fidelity system level simulations; missile aerodynamics and structure; smart, stealthy, smokeless missile propulsion; and focused technology integration/demonstrations. As efforts in these technology areas mature, work is transitioned to PE 0603313A (Missile and Rocket Advanced Technology) to support demonstrations of capabilities for Future Missile Technology Integration (FMTI), Low Cost Precision Kill for 2.75 inch rockets, and an advanced light weight hypervelocity missile. Technologies being developed focus on improvements to existing missile systems.</p> <p>FY 1998 Accomplishments:</p> <ul style="list-style-type: none"> • 10276 - Missile guidance systems – Completed seeker design for High Quantities Anti-Materiel Submunition (HI-QUAMS) which provides a smaller seeker that will lead to a 5-10x improvement in stowed kills for Multiple Launch Rocket System/ Army Tactical Missile System (MLRS/ATACMS) when attacking lightly armored, high-value targets. Completed sensor requirements for detection, characterization, and/or identification of masked and concealed targets for Army missile cueing. Completed infrared (IR) polarimetry demonstrations. Developed fly-over-shoot-down imaging tracking algorithms. <ul style="list-style-type: none"> - High fidelity system level simulations - Completed a design for high-speed field programmable gate array circuits to achieve 10 Msamples/sec wideband digital quadrature modulator processing; developed and implemented codes and procedures to perform distributed XPATCH radio frequency signature code calculations; developed IR model validation; developed software for the control of programmable 'model board' IR and visual scene injection processors and interfaces, allowing the use of general purpose digital computers. - Missile aerodynamics and structure – Completed canard/grid fin roll control interaction wind tunnel test, completed elliptical body wind tunnel test, developed Chemically Reacting After Body (CRAFT) time-accurate, finite-volume, Navier-Stokes computational fluid dynamics model. Completed preliminary design and evaluated seeker dome for air and missile defense; demonstrated feasibility of composite airframes and structures. • 9113 - Smart, stealthy, smokeless missile propulsion –Evaluated pintle materials and a high exponent propellant, and demonstrated multiple thrust levels; developed and evaluated minimum signatures solid propulsion propellants; developed advanced oxidizer fuel gels for long range, survivable, multi-mission capabilities which reduce assets required. <ul style="list-style-type: none"> - Focused technology integration/demonstrations - Developed a motor and propulsion concept of the compact kinetic energy missile (CKEM) technology; demonstrated necessary accuracy in hardware-in-the-loop (HWIL) simulation for a low cost accurate control package for the 2.75" rocket that will provide reduced cost per kill, minimized collateral damage and greatly increased number of stowed kills over the present fielded system. Completed and evaluated preliminary packaging/dispensing concept design for MLRS Smart Tactical Rocket (MSTAR). <p>Total 19389</p>										
Project A214	Page 4 of 7 Pages					Exhibit R-2A (PE 0602303A)				

UNCLASSIFIED

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 1999
BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602303A Missile Technology	PROJECT A214
<p>FY 1999 Planned Program:</p> <ul style="list-style-type: none"> • 13187 - Missile guidance systems - Complete signature tests for difficult targets and masked helicopters, assess tracker, automatic target recognition, and non-cooperative target recognition on wide spectrum realistic data sets and targets which will develop acquisition technologies for defeating classes of targets which are currently difficult or impossible to defeat. <ul style="list-style-type: none"> - High fidelity system level simulations - Implement field programmable gate array processor-based digital quadrature modulators and verify 10 Msamples/sec processing performance; design Ka-band radio frequency (RF) front end processor (downconverter, intermediate frequency processor and analog-digital conversion) for the RF target verification monitor. Extend gray level co-occurrence matrices (GLCM) IR signature validation techniques to larger matrix sizes and increased number of gray scales. Investigate methods for parallel processing of segmented target image scenes on the programmable model board and address the resulting input/output issues. - Missile aerodynamics and structure – Evaluate MicroElectroMechanical Systems (MEMS) devices for lift enhancement; upgrade grid fin analytical model, investigate and model turbulent exhaust plume chemistry and solid carbon oxidation; complete final design, prototype fabrication, and ground testing of seeker dome for air and missile defense. • 11157 - Smart, stealthy, smokeless missile propulsion – Demonstrate high performance, minimum signature solid propulsion, complete actuator and control integration and complete axial pintle component design; develop gel flightweight component for long range, survivable, multi-mission capabilities which reduce assets required; demonstrate proof of concept of accurate age assessment through non-destructive evaluation to field aged samples for service life extension. <ul style="list-style-type: none"> - Focused technology integration/demonstrations – Demonstrate/validate flightweight compact hypervelocity missile technology propulsion concepts for CKEM which will provide an overmatch capability against all tanks and armored targets; wind tunnel test and transition Low Cost Precision Kill (LCPK) to PE0603313A, which will provide reduced cost per kill, minimized collateral damage and greatly increased number of stowed kills over the present fielded system stable airframe. • 1450 - Acoustic methods will be evaluated for applicability to enhanced mixing concepts for propulsion for Army missile systems. • 1933 - Evaluate Scramjet hardware and develop a combustor concept for M > 10 operation. • 1934 - Upgrade APS radar testbed, for CAPS testing, to represent new threat capabilities; design munitions test bed; and design and fabricate salvage sensor breadboards. • 469 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs <p>Total 30130</p> <p>FY 2000 Planned Program:</p> <ul style="list-style-type: none"> • 14567 Missile guidance systems – Integrate and test HI-QUAMS seeker brassboard which provides a smaller seeker that will lead to a 5-10x improvement in stowed kills for MLRS/ATACMS when attacking lightly armored, highly-valued targets; develop jamming/spoofing models needed to develop anti-jamming/spoofing technology small enough and affordable for Army tactical missiles; complete baseline design for a HMMWV-based SHORAD sensor system for air defense firecontrol/missile guidance radar. 		
Project A214	Page 5 of 7 Pages	Exhibit R-2A (PE 0602303A)

UNCLASSIFIED

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)		DATE February 1999
BUDGET ACTIVITY 2 - Applied Research		PE NUMBER AND TITLE 0602303A Missile Technology
		PROJECT A214
<p>FY 2000 Planned Program: (continued)</p> <ul style="list-style-type: none"> - High fidelity system level simulations - Extend the field programmable gate array digital quadrature modulator for increased processor throughput and higher clock rates; investigate Doppler phase shift effects on RF signatures during signal integration times and develop phase coherent signal processing techniques for frequency modulated and frequency stepped RF guidance signals; extend the Ka-band radio frequency (RF) front-end processor design of the RF target verification monitor to handle extremely short RF pulses; implement parallel processing programmable model board software for real-time, dynamic representation of missile seeker input optics and target image sensed scene irregularities. - Missile aerodynamics and structure - Design the Container Launched Attack Weapon System (CLAWS) launch orientation module hardware and software that will provide an order of magnitude increase in firepower for selected situations; perform imaging demonstration for a seeker dome with conformal optics for air and missile defense that will provide the technology to extend the range for Stinger Block II. • 18325 - Smart, stealthy, smokeless missile propulsion – Complete development of improved fuel gel for long range, survivable, multi-mission capabilities which reduce assets required; develop hydrogen chloride (HCl)-free propellants, and a small scale motor testing of ADN propellants for minimum signature propulsion. - Focused technology integration/demonstrations – Demonstrate 25% increase in missile lethality and conduct a ballistic flight test to demonstrate packing of a reduced size/mass CKEM which will provide an overmatch capability against all tanks and armored targets; develop control and datalink for Remote Readiness Asset Prognostics/Diagnostics System (RRAPDS) which provides near real-time logistics situational awareness thereby significantly reducing operating and support costs. <p>Total 32892</p> <p>FY 2001 Planned Program</p> <ul style="list-style-type: none"> • 12426 Missile guidance systems –Package the HI-QUAMS seeker that will lead to a 5-10x improvement in stowed kills for MLRS/ATACMS when attacking lightly armored, highly-valued targets; integrate inertial instruments in a laboratory brassboard MEMS based Inertial Measurement Unit (IMU) which will lead to a low cost IMU with common features for use in multiple weapon systems; <ul style="list-style-type: none"> - High fidelity system level simulations – Investigate IR target signature modeling approaches applicable to active IR target acquisition and track sensors; develop methods and software for representing 3-dimensional target geometry models applicable to active IR sensors where signal polarization may be a processing discriminant; investigate methods of projecting HWIL in-band IR target images and scenes with adequate scene detail and dynamic range to include the effects of active and passive IR countermeasures. - Missile aerodynamics and structure –Build and test the CLAWS launch orientation module hardware and software that will provide an order of magnitude increase in firepower for selected situations; complete a time-accurate vehicle/nozzle/plume computational fluid dynamics model which will aid in the design of missile structures. • 19043 - Smart, stealthy, smokeless missile propulsion –Complete component development of flight type hardware integrate into a brassboard and test a flexible sustainer for long range, survivable, multi-mission capabilities which reduce assets required; complete vacuum aging study for service life prediction for cost avoidance of replacing propulsion systems and increased system safety and performance reliability. 		
Project A214	Page 6 of 7 Pages	Exhibit R-2A (PE 0602303A)

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BUDGET ACTIVITY 2 - Applied Research	PE NUMBER AND TITLE 0602303A Missile Technology	February 1999
PROJECT A214		
FY 2001 Planned Program: (Continued)		
- Focused technology integration/demonstrations –Complete first generation system integration of RRAPDS which provides near real-time logistics situational awareness thereby significantly reducing operating and support costs; demonstrate airframe integrity, verify guidance communications and characterize launch environment, perform controlled flight tests and prepare for guided flight tests (early FY02) of CKEM; complete design of a miniature aerial vehicle to provide real-time targeting for short/medium range indirect fire munitions.		
Total	31469	
Project A214	Page 7 of 7 Pages	Exhibit R-2A (PE 0602303A)

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