ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2 Exhibit)

February 2003

BUDGET ACTIVITY
3 - Advanced technology development

PE NUMBER AND TITLE
0603313A - Missile and Rocket Advanced Technology

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
	Total Program Element (PE) Cost	76979	99695	111321	94062	67650	50871	66224	75653
206	MISSILE SIMULATION	14658	16041	3061	3263	3364	3428	3510	3590
263	FUTURE MSL TECH INTEGR(FMTI)	22643	34741	50485	31667	41275	24846	14987	14982
550	COUNTER ACTIVE PROTECTION	9476	8095	0	0	0	0	0	0
567	LCPK FOR 2.75 INCH ROCKETS	3439	0	0	0	0	0	0	0
655	HYPERVELOCITY MISSILE TD	24365	36530	48563	52774	16408	19658	21232	22757
704	ADVANCED MISSILE DEMO	0	1906	6263	6358	6603	0	19626	19614
G03	NATIONAL AEROSPACE INITIATIVE ADVANCED TECHNOLOGY	0	0	2949	0	0	2939	6869	14710
NA4	MISSILE RECYCLING PROGRAM	2398	0	0	0	0	0	0	0
NA6	ARMY MAINTENANCE/MANUFACTURING ORGANIZATION (AMMO)	0	2382	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This program element demonstrates advanced missile technologies to enhance weapon system lethality, survivability, agility, deployability, and affordability capabilities for the Objective Force, including the Future Combat Systems (FCS). Efforts are conducted through system simulation, design, demonstration, and test in laboratory and operational scenarios. This program element includes demonstrations of advanced tactical missiles, real-time hardware-in-the-loop simulations, and multi-role seeker technology efforts. The technologies in this PE enhance the capabilities of locating targets in clutter, lightweight missile launchers, precision guidance, hypervelocity missile flight, and missile communications, command and control. The major efforts in this program element are the Compact Kinetic Energy Missile (CKEM), Low Cost Precision Kill (LCPK), NetFires Command, Control, and Communications (C3), NetFires next generation missiles, and the hypersonic engine demonstration. The CKEM technology program will demonstrate a prime candidate to provide overwhelming lethality for the FCS Direct Fire System, with increased stowed rounds. The funding for this program was increased to accelerate prototype testing. The goal of the CKEM effort is to design, fabricate and demonstrate a direct-fire missile that offers a significant increase in cost/kill ratio and enhanced stowed-kills, when compared to current direct-fire weapon systems. The NetFires funding provides for longer range, more robust missiles, in a network of missiles and sensors. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan (AMP). The program element contains no duplication with any effort within the Military Departments. The Aviation and Missile Research, Development, and Engineering Center, U. S. Army Aviation and Missile Command, Redstone Arsenal, AL performs the work in this PE. Transition for this effort comes from work performed in PE 0602303A (Missile Technology). This PE supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds have been provided to this program.

B. Program Change Summary	FY 2002	FY 2003	FY 2004	FY 2005
Previous President's Budget (FY 2003)	75396	87890	118564	88295
Current Budget (FY 2004/2005 PB)	76979	99695	111321	94062
Total Adjustments	1583	11805	-7243	5767
Congressional program reductions		-5500		
Congressional rescissions		-1697		
Congressional increases		22400		
Reprogrammings	3599	-572		
SBIR/STTR Transfer	-2016	-2826		
Adjustments to Budget Years			-7243	5767

Change Summary Explanation: Funding - FY 2005: Funds increased to support Networked Fires C3 and NetFires Block II efforts.

FY03 Congressional Adds:
Missile Simulation Technology, Project 206 ($7700); Loitering Attack Munition for Aviation, Project 263 ($3000); CKEM Distributed Protyping Simulation, Project 655 ($1200); Army Maintenance and Manufacturing Organization, Project NA6 ($2500); M-72 LAW, Project 704 ($2000); Volumetrically Controlled Manufacturing, Project 206 ($6000)

Projects with no R-2A:
- ($8095) Counter Active Protection, Project 550: The objective of this project is to continue fabrication of four third generation RFCM flight prototypes; and complete design of conformal head assemblies, complete fabrication of reduced size of radar receivers. Conduct multiple field tests of close-in Active Protection System (APS).
- ($2382) Army Maintenance and Manufacturing Organization (AMMO), Project NA6: The objective of this one year Congressional add is to focus on remanufacturing efforts through advanced materials processing technologies. No additional funding is required to complete this effort.
- ($1906) M-72 LAW, Project 704: The objective of this one year Congressional add is to mature and demonstrate an increased capability light anti-tank weapon for Special Operations Forces in urban environments. No additional funding is required to complete this effort.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**206**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
206	MISSILE SIMULATION	14658	16041	3061	3263	3364	3428	3510	3590

A. Mission Description and Budget Item Justification: This project supports three separate, but related, tasks. The first task is the design, expansion, and improvement of hardware-in-the-loop (HWIL) simulation capabilities. The HWIL simulation is used to evaluate tactical missiles that are guided by radio frequency (RF), millimeter wave (MMW), electro-optical (EO), and infrared (IR) spectral signals. Future missile systems will use multi-mode combinations of these guidance technologies such as those envisioned for the Common Missile, NetFires, and other systems within the Objective Force systems. Evaluation by means of HWIL provides a cost-effective support to missile maturation throughout weapon system life cycles and permits a reduction in the number of flight tests actually performed. The second task is Distributed Interactive Simulation (DIS) via a node to the Defense Research and Engineering Network (DREN). This effort will facilitate tying together the modeling and simulation capabilities of various Army agencies allowing cooperative simulation efforts such as the RDEC Federation, which is envisioned for FCS and Objective Force evaluation. The third task is battlefield distributed simulation, which provides an all-analytical simulation of Objective Force weapon systems engaging multiple targets in a simulated battlefield environment, including the effects of natural and battle-caused obscurants and disturbances. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan. The program contains no duplication of effort within the Military Departments. The Aviation and Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, AL performs the work in this project. This program supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds have been provided to this project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- Missile Simulation - In FY02, matured a high-fidelity performance assessment capability for tri-mode (MMW/RF/IR/semi-active laser) seekers and guidance hardware/software using HWIL simulation; established implementation plan for development of a life cycle support capability for tri-mode guided weapons using HWIL simulation. In FY03, mature tri-mode beam combiner technology for multi-mode guided missiles and sub-munitions; develop IR scene projector capabilities to 1024x1024 elements with frame update rates exceeding 250 Hz, and with "snap" update electronics; implement an IR in-band target scene projector based on micro-electromechanical systems (MEMS) devices for HWIL simulation. In FY04, develop Laser Detection and Ranging (LADAR) radar scene projector for HWIL simulation; mature end-to-end HWIL simulation techniques with remotely located ground equipment (launchers, C4I, fire control sensors and units) connected to real-time HWIL missile components and simulations. In FY05, design and implement distributed simulation capabilities including classified and unclassified Ethernet and fiber optic wide area and local network equipment to analyze FCS, CKEM, NetFires, the Objective Force and weaponization of manned and unmanned air and ground vehicles in conjunction with Battle Labs and other Research, Development, and Engineering Centers; investigate parallel processing techniques to provide image processing power to enhance obscuration modeling required by both real and virtual prototype simulators.	2790	2981	3061	3263
- Missile Simulation Technology – This Congressional interest item matures high fidelity, man-in-the-loop, simulation support to missile and missile platform development programs. No additional funding is required to complete this project.	6673	7340	0	0
- Volumetrically Controlled Manufacturing – This Congressional interest item matures simulation / modeling capability to optimize component design and manufacturing, using volumetrically controlled manufacturing methods. No additional funding is required to complete this project.	2410	5720	0	0
- High Bandwidth Technology – This Congressional interest item matures high bandwidth communications for the Missile Defense Agency (MDA) Pacific Rim test range effort---from Kwajalein Missile Range, Pacific Missile Range Facility, the Alaska Missile Range, and associated supercomputing centers. No additional funding is required to complete this project.	2785	0	0	0
Totals	14658	16041	3061	3263

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**263**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
263	FUTURE MSL TECH INTEGR(FMTI)	22643	34741	50485	31667	41275	24846	14987	14982

A. Mission Description and Budget Item Justification: This project demonstrates advanced tactical missile technologies including seekers, propulsion, airframes, communications, command and control (C3), and guidance and control for FCS and the Objective Force. The major efforts in this project are the NetFires C3 and NetFires Block II programs. These technologies include the demonstration and integration of multi-mode seeker concepts, controllable thrust rocket motors (gels or pintle-controlled solids), aided target recognition (ATR), wide-band secure data links, missile antennas, and C3 networking. Seeker technology will address imaging infrared, LADAR, and millimeter wave seeker technologies, combined with semi-active laser technology, to provide precision strike and fire-and-forget guidance modes. Affordable, controllable thrust rocket motors, such as gelled bi-propellants or pintle-controlled solids, will be demonstrated to provide longer ranges and shorter flight times while increasing system robustness in air-to-ground, ground-to-ground, and ground-to-air roles. ATR will be demonstrated permitting true fire-and-forget at targets beyond visual range. Secure wide-band data link hardware, allowing target position updates during missile flight, and transmission of imagery to the ground will be demonstrated. NetFires C3 will mature and demonstrate a tactically appropriate C3 system providing a proof-of-principle for the larger Networked Fires architecture for the start of NetFires Block I SDD. The demonstration will consist of a tactical communications segment, a tactical networking segment, and a tactical C2 segment. The products of the program are a missile-compatible network radio (JTRS surrogate), network protocols for missiles, interfaces between missile and ground elements, a mission manager application, imagery interpreter, a distributed C2 capability, and an interface to the Objective Force C4ISR. These efforts provide risk mitigation in support of a planned System Development and Demonstration start for NetFires in FY04 and are supported by the Program Executive Officer Tactical Missiles. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan. The program contains no duplication of effort within the Military Departments. The Aviation and Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, AL performs the work in this project. This program supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds have been provided to this project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- NetFires C3 Threshold - In FY02, performed NetFires full system simulation in a battlefield scenario to determine technical requirements, which included identification of missile radio technical requirements, missile networking technical requirements, and C2 technical requirements. In FY03, design and test NetFires prototype 2-way missile radios with limited bandwidth, omni directional antennas, networking protocols that allow up to 25 missiles in flight, and missile manager applications that will transition into NetFires Block I SDD.	7237	14984	15400	0
- NetFires C3 Block II - In FY03, mature and test increased bandwidth missile radio, scale missile communications network to enable up to 200 missiles in flight, and initiate modifications to missile manager to facilitate reduced man-in-the-loop requirements. In FY04, mature and test NetFires command and control cell and demonstrate NetFires C3 architecture in a relevant environment. In FY05, mature and demonstrate missile network performance to handle multiple missiles in flight, transmitting more data to a ground-based automated mission manager application hosted on an Future Combat Systems (FCS) C2 computer.	0	11000	12297	14000
- NetFires Block II Missile - In FY03, mature missile on-board automatic target recognition algorithms to better handle obscured vehicles and targets with countermeasures; perform full-system simulation of the key NetFires subsystem to boost NetFires performance and/or affordability. New members of the NetFires missile family (e.g. air defense, non-lethal) will also be investigated and developed. In FY04 mature and test longer range/longer duration missile propulsion systems; develop breadboard components and software for improved missile seeker for better resolution. In FY05 demonstrate in-flight missile management, ATR, and conduct multi-functional warhead testing.	1600	3421	22788	17667
- Common Missile - In FY02, fabricated and assembled final seeker hardware for CM, and completed final fabrication of propulsion system hardware and static testing of flight-type hardware. In FY03, conduct seeker tower testing; prepare seekers and range for Captive Flight Testing; perform Captive Flight Testing of Tri-mode seekers for CM; and conduct final flight-type static testing of controllable propulsion system(s).	11106	2460	0	0
LAM-A - In FY02, accelerated demonstration and flight-testing of a full-scale LAM-A prototype; developed engineering design of soft launch boost motor and aircraft rail interface; and developed test plans to include ballistic, controlled, and guided flight testing. Project completed in FY02.	2700	0	0	0
LAM-A – This Congressional interest item funds stabilized test vehicle flight tests from a helicopter rail; continue turbofan engine development testing and perform simulations to refine and optimize command and control techniques. No additional funding is required to complete this project.	0	2876	0	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Totals	22643	34741	50485	31667

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**655**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
655	HYPERVELOCITY MISSILE TD	24365	36530	48563	52774	16408	19658	21232	22757

A. Mission Description and Budget Item Justification: Compact Kinetic Energy Missile (CKEM) ATD will enable the Objective Force, including FCS, by providing overwhelming lethality with a small, light, fast hypervelocity compact kinetic energy missile. CKEM will demonstrate enhanced system lethality with a 52-inch long, 65-lb missile. Miniature guidance inertial measurement unit (IMU) technology will be demonstrated to survive high-g missile launch, and provide precision guidance to kill targets at ranges of 0.4-5 km. The program will mature and demonstrate advanced component and subsystem and system level technologies in a missile system configuration to achieve next-generation system level performance improvements. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan. The program contains no duplication of effort within the Military Departments. The Aviation and Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, AL performs the work in this project. This program supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds have been provided to this project.

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**655**

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- CKEM - In FY02 demonstrated critical technologies applicable to FCS weapon system applications in battlefield operational environments and validated through simulation. Built missile emulator with 6 degrees of freedom. In FY03 continue demonstration of critical hypervelocity technologies in operational environments and award competitive ATD contracts to system prime contractors to complete design trade studies for ATD missile system, and finalize design, fabricate and test components/subsystems: advanced propulsion, enhanced lethality, miniaturized high-g guidance and control, and fully operational Inertial Measurement Unit (IMU). Develop fire control requirements and interface definitions for weapon system integration. In FY04 incorporate demonstrated component technologies into an integrated system and continue to perform critical technology demonstrations and subsystem integration testing and evaluation including hardware-in-the-loop to validate performance models. Conduct full-scale lethality sled tests against advanced threat armors to evaluate penetrator design performance. Integrate advanced propulsion designs into competing missile configurations; complete guidance and control test vehicle flight to characterize performance; perform constructive and virtual simulation and modeling applicable to FCS weapon system applications in battlefield operational environments and validate through utilization of battlefield simulation & modeling. In FY05, conduct integrated weapon system firing demonstration with FCS and Objective Force representative size combat vehicles.	24365	35386	48563	52774
- CKEM Distributed Prototype Simulation – This Congressional interest item funds the design of high-bandwidth tool sets for use with simulation models to provide low-cost evaluation techniques for CKEM. No additional funding is required to complete this project.	0	1144	0	0
Totals	24365	36530	48563	52774

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**704**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
704	ADVANCED MISSILE DEMO	0	1906	6263	6358	6603	0	19626	19614

A. Mission Description and Budget Item Justification: This project demonstrates advanced state-of-the-art missile system concepts to enhance weapon system lethality, survivability, agility, versatility, deployability and affordability for FCS and the Objective Force. Current planned advanced demonstrations are Fire Control-Node Engagement Technology (FC-NET) and Advanced Multi-Role Miniature Precision Guided Missile (AMMPGM). The FC-NET program objective is to develop a common fire control system for the Future Combat Systems (FCS) family of vehicles. This program will leverage work performed in the Multi Role Armament and Ammunition System (MRAAS) program to develop Missile Target Pairing Algorithms (MTPA) that shall be incorporated into the Combat Decision Aid Software (CDAS) product. The resulting Validated Fire Control Software Package, Enhanced Combat Decision Aid Software (ECDAS), will enable a commander or platform to effectively manage an interchangeable and distributed suite of weapons. The system will recommend Weapon-Target Pairings for multiple weapons (missiles & guns) and is expandable to include future weapon types. The objective of AMMPGM is to mature and demonstrate advanced miniature, multi-role precision-guided missile technology that provides robust defeat of a variety of non-armored threats from multiple platforms including manned and unmanned air and ground platforms with a significantly reduced logistics footprint. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan. The program contains no duplication of effort within the Military Departments. The Aviation and Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, AL performs the work in this project. This program supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds have been provided to this project.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- FC-NET - In FY04, design and mature technical fire control components through modeling and simulation and demonstrate technical fire control to include missile target paring algorithm. Begin integration of FC-NET system into the Enhanced Combat Decision Aid Software (ECDAS), baseline ECDAS and conduct system testing in a virtual simulation environment. In FY05, mature and demonstrate tactical fire control components using modeling and simulation and complete Tactical Fire Control Demonstration to include ECDAS.	0	0	4965	3443
- AMMPGM - In FY04, complete wind tunnel testing, fabrication and static testing of flight weight motor. In FY05, complete ballistic flight testing of flight weight motor. Transition technology and designs to APKWS Block II SDD.	0	0	1298	2915
M-72 LAW – This Congressional interest item will mature and demonstrate increased capability light anti-tank weapon (LAW) for Special Operations Forces in urban environments. No additional funding is required to complete this project.	0	1906	0	0

Accomplishments/Planned Program (continued)	FY 2002	FY 2003	FY 2004	FY 2005
Totals	0	1906	6263	6358

ARMY RDT&E BUDGET ITEM JUSTIFICATION (R-2A Exhibit)

February 2003

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**G03**

COST (In Thousands)		FY 2002 Actual	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	FY 2008 Estimate	FY 2009 Estimate
G03	NATIONAL AEROSPACE INITIATIVE ADVANCED TECHNOLOGY	0	0	2949	0	0	2939	6869	14710

A. Mission Description and Budget Item Justification: This project funds advanced technology development to mature and demonstrate the critical technologies required to develop expendable hypersonic cruise missiles and ballistic missiles. Primary technology focus areas are those deemed critical by the National Aerospace Initiative (NAI) to the advancement of national goals in hypersonic weapon development and access to space. These focus areas include scramjet engine development, hypersonic airframe aerodynamics and structures, thermal protection systems, active and passive cooling mechanisms, turbulent mixing enhancement at low Reynolds numbers, computational fluid dynamics, high yield fuel grain development and alternate methods of hypersonic missile guidance, navigation and control. Efforts will be conducted through detailed system and subcomponent simulation, design, development and test in laboratory and operational settings. Funding for this effort is provided in coordination with other DOD and government elements participating in NAI. As a result, numerous leveraging and technology insertion opportunities are available. The cited work is consistent with the Army Science and Technology Master Plan (ASTMP) and the Army Modernization Plan (AMP). The program element contains no duplication with any effort within the Military Departments. Work is performed at the Aviation & Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, AL. This project supports the Objective Force transition path of the Transformation Campaign Plan. No Defense Emergency Response Funds have been provided to this program.

Accomplishments/Planned Program	FY 2002	FY 2003	FY 2004	FY 2005
- NAI System Studies: In FY04, detailed program management and system engineering plans will be developed, management oversight processes and integrated product teams will be established to govern program execution; system level and component level analysis of alternatives will be completed to quantify the advantages and disadvantages of various airframe and engine concepts and subcomponent options.	0	0	2949	0
Totals	0	0	2949	0