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

June 2001

BUDGET ACTIVITY
3 - ADV TECHNOLOGY DEV

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

COST (In Thousands)		FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
Total Program Element (PE) Cost		43991	51629	59518	0	0	0	0	0	0	0
206	MISSILE SIMULATION	2412	10346	2792	0	0	0	0	0	0	0
263	FUTURE MSL TECH INTEGR(FMTI)	19324	20680	30051	0	0	0	0	0	0	0
380	MULTI PLATFORM LAUNCHR	2122	0	0	0	0	0	0	0	0	0
493	RAPID FORCE PROJ DEMO	13018	0	0	0	0	0	0	0	0	0
550	COUNTER ACTIVE PROTECTION	1936	6902	5483	0	0	0	0	0	0	0
567	LCPK FOR 2.75 INCH ROCKETS	5179	3793	0	0	0	0	0	0	0	0
655	HYPERVELOCITY MISSILE TD	0	0	21192	0	0	0	0	0	0	0
704	ADVANCED MISSILE DEMO	0	0	0	0	0	0	0	0	0	0
713	STARSTREAK/STINGER LIVE FIRE TEST	0	9908	0	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification:

PLEASE NOTE: This administration has not addressed FY2003-2007 requirements. All FY 2003-2007 budget estimates included in this book are notional only and subject to change.

This program element demonstrates advanced missile technologies to enhance weapon system lethality, survivability, agility, deployability, and affordability capabilities for the Future Combat Systems (FCS) and the Objective Force. 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, and hypervelocity missile flight. The major efforts in this project are the Compact Kinetic Energy Missile (CKEM), Common Missile (CM), Low Cost Precision Kill (LCPK), NetFires and loitering attack munition-aviation (LAM-A). The CKEM technology program will demonstrate a prime candidate to provide overwhelming lethality for the FCS Direct Fire System, with increased stowed rounds. The CKEM program schedule has been aligned with the FCS schedule. The funding for this program was increased to accelerate prototype testing for insertion into the FCS demonstrator. The goal is to design, fabricate and demonstrate a direct-fire missile that offers FCS a significant increase in cost/kill ratio and enhanced stowed-kills, when compared to current direct-fire weapon systems. The NetFires funding provides for acceleration and risk reduction for the NetFires Precision Attack Missile (PAM) effort, by initiating funding for a second PAM contractor. The remaining funding for the NetFires program is in PE 0603005A as part of the overall FCS program. The LAM-A funding provides acceleration and risk reduction for development and demonstration of a long range precision strike munition for the Objective Force. This demonsration will use the loiter attack munition (LAM) being developed under the Netfires program and leverages technologies and sub systems being developed by Defense Advanced Research Projects Agency (DARPA). The cited work is consistent with the Army Science and Technology Master Plan (ASTMP), the Army Modernization Plan (AMP) and Project Reliance.

The program element contains no duplication with any effort within the Military Departments. Work is performed by the Aviation and Missile Research, Development, and Engineering Center, U. S. Army Aviation and Missile Command, Redstone Arsenal, AL. Transition for this effort comes from work performed in PE 0602303A (Missile Technology).

B. Program Change Summary	FY 2000	FY 2001	FY 2002	FY 2003
Previous President's Budget (FY2001 PB)	51188	25107	24942	0
Appropriated Value	51639	52107	0	
Adjustments to Appropriated Value	0	0	0	
a. Congressional General Reductions	0	0	0	
b. SBIR / STTR	-1264	0	0	
c. Omnibus or Other Above Threshold Reductions	-195	0	0	
d. Below Threshold Reprogramming	-5933	0	0	
e. Rescissions	-256	-478	0	
Adjustments to Budget Years Since FY2001 PB	0	0	34576	
Current Budget Submit (FY 2002/2003 PB)	43991	51629	59518	0

Change Summary Explanation: Funding - FY 2001: Congressional adds were received for project D263, AMCOM Technical Base (+7500), project D550, Counter Active Protection Systems (+1500), project D206, Missile Simulation Technology (+8000), and project 713, Starstreak/Stinger Live Fire Test (+1000

0).
- (+10000) Starstreak/Stinger Live Fire Test - One year congressional add to complete blast overpressure reduction validation and performance envelope expansion analysis. Complete Air-to-Air Stinger Kit (ATASK) system design and validate component performance. Continue supporting Army Test and Evaluation Command (ATEC) operational test planning. Perform system hardware and software integration and testing in the Boeing Aircraft Integration Lab (AIL) hot bench. Initiate integration of hardware and software into AH-64D testbed aircraft.

FY 2002: Funding increased to accelerate the CKEM technology effort in project D655, CKEM (+16576); added funding to accelerate loiter attack munitions for aviation effort in project D263, LAM-A (+5000) and added funding for a second PAM contractor in project D263, Netfires (+13000).

FY 2003: Funding increased to accelerate the CKEM technology effort in project D655, CKEM (+18285).

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

June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - ADV TECHNOLOGY DEV	**0603313A - Missile and Rocket Advanced Technology**	**206**

COST (In Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
206 MISSILE SIMULATION	2412	10346	2792	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This project supports three separate, but related, tasks. The first task is design, expansion, and improvement of hardware-in-the-loop (HWIL) simulation capabilities. The HWIL simulation is applicable to the evaluation of tactical missiles guided by signals in radio frequency (RF), millimeter wave (MMW), electro-optical (EO), and infrared (IR) electromagnetic spectral regions and multi-mode guidance technologies such as those envisioned for the Common Missile and other systems for the FCS and Objective Force. The second task is Distributed Interactive Simulation (DIS) via a node to the Defense Advanced Research Projects Agency (DARPA) Defense Simulation Internet. The third task is battlefield distributed simulation, which provides an all-analytical simulation of FCS and Objective Force weapon systems engaging multiple targets in a simulated battlefield environment, including the effects of natural and battle-caused obscurants and disturbances. Evaluation by means of HWIL provides cost-effective support to missile maturation throughout weapon system life cycles and permits a reduction in the number of flight tests actually performed. Work is performed by the Aviation and Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, AL. Major contractors are Boeing Defense and Space Group, Seattle, WA; and CSC-Nichols Research Corporation, Huntsville, AL. This program supports the Objective Force transition path of the Transformation Campaign Plan (TCP).

FY 2000 Accomplishments

- 1616
  - Initiated technology investigations for tri-mode HWIL simulation to support Common Missile (CM) design.
  - Implemented improvements to MMW signal generation to support high-speed digital processing of intermediate frequency signals in the digital domain for radio frequency guided missiles and submunitions.
  - Investigated means of implementing a HWIL simulation capability for active IR and laser detection and ranging (LADAR) guidance systems.
- 796
  - Extended battlefield test bed and Distributed Simulation Center capabilities to support Simulation Based Acquisition principles and investigated future battle-fighting techniques via live, constructive, and virtual simulations.
  - Upgraded software tools and virtual prototype applications to HLA compliance. Improved real-time computer-generated forces to support R&D requirements.

Total 2412

FY 2001 Planned Program

•	1740	- Design and implement CM HWIL simulation, including, semiactive laser mode and MMW signal radiation. Initiate trichroic beam combiner technology.
		- Develop technology components applicable to implementation of a HWIL simulation capability for active IR, such as LADAR, guidance systems.
•	591	- Upgrade distributed simulation capabilities including the Advanced Prototype and Experimentation (APEX) lab, Battlefield Highly Immersive Virtual Environment (BHIVE), classified and unclassified Ethernet and fiber optic wide area and local network equipment to sufficient bandwidth, image processing power, and recent technological advances.
•	7710	- One year congressional add for Missile Simulation Technology to develop design and build new manned simulators and virtual prototypes of future aviation and missile systems based upon battlefield highly immersive virtual environment technology (BHIVE), and system design data from collaborative environments; incorporate and demonstrate the Emissive Sources Imaging (ESI) Model with the PC based common missile class of models; develop design and build real-time emulation of emissive smoke using parallel processing techniques applied to sensor analysis.
•	305	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	10346	

FY 2002 Planned Program

•	2094	- Support implementation of a HWIL simulation facility for CM by leveraging program management office (PMO) funds.
		- Mature trichroic beam combiner technology for CM HWIL simulation.
		- Further 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.
•	698	- Design and implement distributed simulation capabilities including the APEX BHIVE, classified and unclassified ethernet and fiber optic wide area and local network equipment to analyze FCS, CKEM, 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 (RDEC's).
		- Investigate parallel processing techniques to provide image processing power to enhance obscuration modeling required by both real and virtual prototype simulators.
Total	2792	

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

June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - ADV TECHNOLOGY DEV	**0603313A - Missile and Rocket Advanced Technology**	**263**

COST (In Thousands)		FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
263	FUTURE MSL TECH INTEGR(FMTI)	19324	20680	30051	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This project demonstrates advanced tactical missile technologies including seekers, propulsion, airframes, and guidance and control for FCS and the Objective Force. The major efforts in this project are the Common Missile (CM), an effort to initiate a second PAM contractor for the NetFires programs, and accelaration of loiter attack munition-aviation (LAM-A) technologies. CM technology is the demonstration and integration of multi-mode seeker concepts, controllable thrust rocket motors (gels or pintle-controlled solids), automatic target recognition (ATR), and wide-band secure datalinks. Seeker technology will address imaging infrared, and millimeter wave seeker technologies combined with the existing semi-active laser, in order to provide precision strike and fire-and-forget guidance modes without major modifications to the host platform. 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 the Air-to-Ground (ATG) and Ground-to-Ground (GTG) roles. ATR will be demonstrated permitting true fire-and-forget at targets beyond visual range. Finally, secure wide-band datalink hardware, allowing target position updates during missile flight, will be demonstrated. These efforts are a risk mitigation effort in support of a FY 2004 System Development and Demonstration (new 5000.2) start for CM and are supported by the Program Executive Officer Tactical Missiles. The CM technologies developed will enable the Netfires program to mature a common module family of missiles. The family of missiles will include direct fire, indirect fire, loiter attack - ground, loiter attack - aviation, air defense, and deep operations capabilities. The LAM-A effort will develop and demonstrate a long-range (60 km) precision strike munition for the Objective Force. The demonstration will use the LAM munition developed by the Netfires program and will leverage technologies and subsystem components being developed by DARPA. The full-scale system demonstrations for the air defense and deep operations will be completed in project D704. Work is performed by the Aviation and Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command (AMCOM), Redstone Arsenal, AL. Major contractors are TRW Space Electronics Group, Redondo Beach, CA; Raytheon Systems Company, Tucson, AZ; The Boeing Company, Huntsville, AL; Northrop-Grumman Corporation, Baltimore, MD; Lockheed Martin Fire Control Division, Orlando, FL; BAE North America, Austin TX; Thiokol, Elkton, MD; Atlantic Research Corporation, Gainesville, VA; TRW Redondo Beach, CA; Boeing, Rocketdyne, Canoga Park, CA; and Alliant Tech Systems, Inc. Rocket Center, WV. This program supports the Objective Force transition path of the TCP.

FY 2000 Accomplishments

•	6076	- Downselected to best value CM tri-mode seeker concepts based on FY 1999 seeker tradeoff studies.
		- Identified alternative CM seeker that offers higher payoff and greater risk than selected primary seeker.
•	5540	- Investigated best controllable thrust propulsion both gel and pintle-solid designs for CM.
		- Investigated Automatic Target Recognition (ATR) hardware and software that best meets CM requirements.
•	7708	- Successfully performed flight test of FMTI full-up missile (Congressional Plus-up).
Total	19324	

FY 2001 Planned Program

•	8376	- Complete hardware design and begin fabrication of captive flight test seekers.
		- Conduct bench and tower test of prototype seekers.
		- Begin preparations for seeker flight test program.
		- Design and fabricate scene generator and multi-mode seeker testbed.
•	7602	- Conduct controllable propulsion trade study for CM.
		- Conduct analysis of alternative propulsion systems.
		- Conduct analysis of fuel/oxidizer chemistry to enhance performance.
		- Complete controllable thrust motor maturation.
		- Conduct static test firings of controllable thrust motor.
		- Explore ATR hardware/software for use on CM.
		- Conduct guidance datalink feasibility.
•	4109	- Investigate aircraft integration issues for the Loiter Attack Munition - Aviation (LAM-A).
		- Support the DARPA Network Fires program, to include test, analysis, and simulation to reduce overall technical risk.
		- Investigate low cost missile alternatives for soft targets.
•	593	- Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.
Total	20680	

FY 2002 Planned Program

•	7200	- Continue final seeker hardware fabrication and assembly.
		- Conduct seeker tower testing.
		- Prepare seekers and range for Captive Flight Testing.
•	4200	- Continue final fabrication of propulsion system hardware and static testing of flight- type hardware.
•	651	- Explore datalink and ATR implication in CM designs.
•	13000	- Initiate second PAM contractor to increase competition and encourage cost reduction for the joint DARPA/Army Netfires program. The remaining funding for this effort is provided in PE 0603003A.
		- Provide alternate PAM concepts.
		- Accelerate flight testing of prototype NetFires missiles.
•	5000	- Accelerate demonstration and flight testing of a full-scale LAM-A prototype.
		- Initiate engineering design of soft launch boost motor and aircraft rail interface.
		- Purchase long lead-time items to build prototype missiles.
		- Develop test plans to include ballistic, controlled, and guided flight testing.

Total 30051

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

June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - ADV TECHNOLOGY DEV	**0603313A - Missile and Rocket Advanced Technology**	**550**

COST (In Thousands)		FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
550	COUNTER ACTIVE PROTECTION	1936	6902	5483	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: This project will mature and demonstrate technologies, which can be applied to anti-tank guided weapons (ATGW), including chemical warhead FCS and Objective Force weapons. This technology will improve the effectiveness of ATGW against threat armor equipped with active protection systems (APS). Current technology development is concentrated in the following areas; electronic warfare (EW) radio frequency (RF) countermeasure (RFCM) technology that jams or deceives the radar sensors of threat APS, and warhead integration to fire the missile warhead before being destroyed by the APS. Work is performed by the Aviation and Missile Research, Development, and Engineering Center, U.S. Army Aviation and Missile Command, Redstone Arsenal, Alabama; Phase IV Systems, Inc, Huntsville, AL. This program supports the Objective Force transition path of the TCP.

FY 2000 Accomplishments

• 1936 - Completed first iteration monolithic microwave integrated circuit (MMIC) component maturation for third generation RF countermeasure.

- Began design and fabrication of brassboard activity detector, first iteration antennas, and brassboard base band module.

Total 1936

FY 2001 Planned Program

• 5402 - Complete brassboards of activity detector, first iteration antennas, and brassboard base band module.
- Complete brassboard RF transceiver module using first iteration MMICs.
- Complete functional demonstration of third generation RFCM using brassboard modules and components.
- Complete second iteration MMIC component development.
- Begin design and fabrication of third generation RF test bed.
- Begin integration to missile test bed airframes.

FY 2001 Planned Program (Continued)

- 1312 - One year congressional add for Counter Active Protection Systems to design and fabricate additional MMIC components for the RF transceiver module and upgrade RF test bed.
- 188 - Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs.

Total 6902

FY 2002 Planned Program

- 5483 - Complete third iteration MMIC component maturation.
  - Complete third generation RF test bed.
  - Complete final RF transceiver module prototype.
  - Complete full performance and functional demonstration of third generation RFCM prototype in dynamic test against APS second and third generation RF test beds.
  - Begin fabrication of twelve third generation RFCM flight prototypes.

Total 5483

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

June 2001

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - ADV TECHNOLOGY DEV	**0603313A - Missile and Rocket Advanced Technology**	**655**

COST (In Thousands)	FY 2000 Actual	FY 2001 Estimate	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate	Cost to Complete	Total Cost
655 HYPERVELOCITY MISSILE TD	0	0	21192	0	0	0	0	0	0	0

A. Mission Description and Budget Item Justification: Compact Kinetic Energy Missile (CKEM) will enable the Objective Force and the Future Combat Systems by providing overwhelming lethality with a small, light, fast hypervelocity compact kinetic energy missile. CKEM will develop and demonstrate advanced hypervelocity missile technology necessary for the next generation kinetic energy weapon applicable to Future Combat Systems (FCS). CKEM will demonstrate enhanced system lethality with 4 foot long, 50-lb. objective hypervelocity kinetic energy (KE) missile. Miniature guidance inertial measurement unit (IMU) technology will demonstrate high-g missile launch, independent of launcher attitude and provide precision kill at target impact ranges of 0.4-5 km. The program will develop, mature, and demonstrate advanced component and subsystem and system level technologies in a missile system configuration to achieve next-generation system level performance. Major contractors are Lockheed Martin, Dallas, TX; MILTEC/Boeing, Huntsville, Al; and Raytheon Company, Tucson, AZ. This program supports the Objective Force transition path of the TCP.

FY 2000 Accomplishments

Project not funded in FY 2000.

FY 2001 Planned Program

Project not funded in FY 2001.

FY 2002 Planned Program

- 4699 - Incorporate the results of the technology and component maturation efforts (in PE 0602303A, Missile Technology) and ensure compatibility with FCS and other Objective Force platform development efforts.

  - Incorporate the technology matured under PE 0602303A, Missile Technology, into a flight worthy component and demonstrate that the component meets the defined form, performance, interface and flight environmental requirements.

- 16493 - Mature and validate critical component performance through subsystems and system integration and tests, leading to missile flight tests. Conduct critical issue and risk assessment phase of the system contract efforts with two prime contractors.

  - Validate high fidelity system simulation through hardware-in-the-loop of propulsion unit, guidance system, and hypervelocity aero-ballistic models.

  - Demonstrate enhanced lethality in system configuration to include novel penetrators for missile applications and quantification of lethality effects other than perforation.

  - Incorporate hypervelocity technology into integrated tactical system concepts whose design has been demonstrated to meet the system performance, interface and flight environment requirements.

Total 21192