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

February 2002

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

COST (In Thousands)		FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
	Total Program Element (PE) Cost	48444	75396	87890	118564	88295	86086	69346
206	MISSILE SIMULATION	10341	15176	3139	3631	3337	3446	3514
263	FUTURE MSL TECH INTEGR(FMTI)	16972	29788	33506	52473	22773	12798	6363
493	RAPID FORCE PROJ DEMO	1115	0	0	0	0	0	0
550	COUNTER ACTIVE PROTECTION	6714	5436	8523	0	0	0	0
567	LCPK FOR 2.75 INCH ROCKETS	3689	1489	0	0	0	0	0
655	HYPERVELOCITY MISSILE TD	0	21007	42722	54589	54107	10307	266
704	ADVANCED MISSILE DEMO	0	0	0	7871	8078	59535	59203
713	STARSTREAK/STINGER LIVE FIRE TEST	9613	0	0	0	0	0	0
NA4	MISSILE RECYCLING PROGRAM	0	2500	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, 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 the Loitering Attack Munition for 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 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 acceleration and risk reduction for the NetFires Precision Attack Missile (PAM) effort. The LAM-A funding provides acceleration and risk reduction for development and demonstration of a long range precision strike munition for the Objective Force. The LAM-A demonstration will use the Loitering Attack Munition (LAM) being developed under the Netfires program and leverages technologies and sub-systems being developed by the 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).

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Missile and Rocket Advanced Technology

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Budget Item Justification

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

B. Program Change Summary	FY 2001	FY 2002	FY 2003
President's Budget (FY2002 PB)	51629	59518	50774
Appropriated Value	52107	76018	0
Adjustments to Appropriated Value	0	0	0
a. Congressional General Reductions	0	-622	0
b. SBIR / STTR	-1485	0	0
c. Omnibus or Other Above Threshold Reductions	0	0	0
d. Below Threshold Reprogramming	-1700	0	0
e. Rescissions	-478	0	0
Adjustments to Budget Years Since FY2002 PB	0	0	37116
Current Budget Submit (FY 2003 PB)	48444	75396	87890

Change Summary Explanation:

Significant Changes:
FY 2003 - Adjustments were made for Netfires Command, Control and Commmunications (C3) for risk reduction, Project D263 ($26000) and No Slew Active Protection System (APS) to provide the technology for an FCS Block I APS based on the technology developed in the Counter Actve Protection Systems (CAPS) project, Project D550 ($6000).

Congressional Adds:
FY 2002 - Congressional adds were made for Missile Recycling Program, Project NA4 ($2500); Standoff NATO International Precision Enhanced Rocket, Project 567 ($1500); Aerospace Applications of VCM Composites Technology, Project 206 ($2500); Wide Bandwidth Technology, Project 206 ($3000) and Missile Simulation Technology, Project 206 ($7000).

Projects with no R-2A:
- ($2500) Missile Recycling Program, Project NA4: The objective of this one year Congressional add is to conduct research and experiments to investigate techniques to recycle solid rocket motors of obsolete missiles.

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Missile and Rocket Advanced Technology

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

Due to environmental regulations, the use of open burn/detonation techniques is no longer acceptable for disposal of the motors. No additional funding is required to complete this project.

- ($1500) Standoff NATO International Precision Enhanced Rocket, Project 567: The objective of this one year Congressional add is to perform counter-countermeasure studies, review electronic packaging issues, and perform warhead performance test for the Low Cost Precision Kill effort. No additional funding is required to complete this project.

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

February 2002

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

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
206 MISSILE SIMULATION	10341	15176	3139	3631	3337	3446	3514

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 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 within the Objective Force. The second task is Distributed Interactive Simulation (DIS) via a node to the Defense Advanced Research Evaluation 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. 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 2001 Accomplishments:

- 1765   - Designed and implemented Common Missile (CM) HWIL simulation, including, semiactive laser mode and MMW signal radiation. Initiated trichroic beam combiner technology.

  - Developed technology components applicable to implementation of a HWIL simulation capability for active IR, such as LADAR, guidance systems.

- 589   - Upgraded 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.

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MISSILE SIMULATION

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| BUDGET ACTIVITY
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0603313A - Missile and Rocket Advanced Technology | PROJECT
206 |

FY 2001 Accomplishments: (Continued)

- 7987   - One year congressional add for Missile Simulation Technology developed, designed, and built 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; incorporated and demonstrated the Emissive Sources Imaging (ESI) Model with the PC based common missile class of models; developed, designed, and built real-time emulation of emissive smoke using parallel processing techniques applied to sensor analysis.

Total 10341

FY 2002 Planned Program

- 1994   - 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.

- 682   - 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, 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 (RDEC's).

  - Investigate parallel processing techniques to provide image processing power to enhance obscuration modeling required by both real and virtual prototype simulators.

- 7000   - One-year Congressional Add to provide high fidelity, man-in-the-loop, simulation support to missile and missile platform development programs.

- 2500   - One-year Congressional Add to develop simulation / modeling capability to optimize component design and manufacturing, using volumetrically controlled manufacturing methods.

- 3000   - One-year Congressional Add to develop wide-bandwidth, low-latency connectivity of HWIL simulation and test facilities at Redstone Arsenal. Complete the "high" frame-rate communications, and establish connectivity between the Millimeter-wave Simulation System facility and the Flight Mission Simulator facility.

Total 15176

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

FY 2003 Planned Program

- 2350   - Continue implementation of a HWIL simulation facility for CM.

      - Establish implementation plan for a product assurance/lot acceptance HWIL simulation facility for CM.

      - Implement an IR in-band target scene projector based on micro-electromechanical systems (MEMS) devices for HWIL simulation.

- 789   - Upgrade distributed simulation capabilities including the APEX BHIVE, classified and unclassified ether net and fiber optic wide area and local network equipment to incorporate recent technological advances and to insure compatibility to the Battle Labs and other Research, Development and Engineering Centers (RDEC's).

      - Utilize distributed simulation capabilities to analyze FCS, CKEM, the Objective Force and weaponization of manned and unmanned air and ground vehicles in conjunction with Battle Labs and other RDEC's.

Total   3139

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

February 2002

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

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
263 FUTURE MSL TECH INTEGR(FMTI)	16972	29788	33506	52473	22773	12798	6363

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), a second PAM contractor for the NetFires programs, and the acceleration of the Loitering Attack Munition-Aviation (LAM-A). CM technology is the demonstration and integration of multi-mode seeker concepts, controllable thrust rocket motors (gels or pintle-controlled solids), aided target recognition (ATR), and wide-band secure datalinks. Seeker technology will address imaging infrared and millimeter wave seeker technologies, combined with an 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 CM efforts provides risk mitigation in support of a planned System Development and Demonstration (new AR 5000.2) start for CM and are supported by the Program Executive Officer Tactical Missiles. The CM technologies will be leveraged by 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, Advanced Missile Demonstration. 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 and 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; Boeing, Rocketdyne, Canoga Park, CA; and Alliant Tech Systems, Inc. Rocket Center, WV. This program supports the Objective Force transition path of the TCP.

0603313A (263)
FUTURE MSL TECH INTEGR(FMTI)

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Exhibit R-2A
Budget Item Justification

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

FY 2001 Accomplishments:

- 8376   - Conducted bench and tower test of prototype seekers.
  - Completed preparations for seeker flight test program.
  - Designed and fabricated scene generator and multi-mode seeker testbed.
- 4602   - Conducted controllable propulsion trade study for CM.
  - Conducted analysis of alternative propulsion systems.
  - Conducted analysis of fuel/oxidizer chemistry to enhance performance.
  - Completed controllable thrust motor maturation.
  - Conducted static test firings of controllable thrust motor.
  - Explored ATR hardware/software for use on CM.
  - Conducted guidance datalink feasibility.
- 3994   - Investigated aircraft integration issues for the Loiter Attack Munition - Aviation (LAM-A).
  - Supported the DARPA Network Fires program, to include test, analysis, and simulation to reduce overall technical risk.
  - Investigated low cost missile alternatives for soft targets.

Total 16972

FY 2002 Planned Program

- 7200   - Fabricate and assemble final seeker hardware for CM.
  - Conduct seeker tower testing.
  - Prepare seekers and range for Captive Flight Testing.
- 4200   - Complete final fabrication of propulsion system hardware and static testing of flight- type hardware.
- 651   - Explore datalink and ATR concepts for incorporation in CM designs.
- 12737   - Establish a second PAM contractor to increase competition and encourage cost reduction for the joint DARPA/Army Netfires program.
  - Provide alternate PAM concepts.
  - Accelerate flight testing of prototype NetFires missiles.

0603313A (263)
FUTURE MSL TECH INTEGR(FMTI)

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

February 2002

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

FY 2002 Planned Program (Continued)

- 5000   - Accelerate demonstration and flight testing of a full-scale LAM-A prototype.

       - Develop 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 29788

FY 2003 Planned Program

- 26000   - Initiate development of a miniaturized Small Unit Operations Situational Awareness System (SUO/SAS) radio for missile and ground vehicle applications.

       - Initiate software development of networking and fires/effects routed to higher command level and integrate software into existing FCS-C2 software.

       - Validate NetFires-SUO/SAS radio operations via Hardware in the Loop testing.- Validate NetFires-C3 operation in scenario based Hardware in the Loop/Software in the Loop testing.

- 1852   - Perform Captive Flight Testing of Trimode seekers for CM.

- 654   - Conduct final flight-type static testing of controllable propulsion system(s).

- 5000   - Accelerate flight testing of prototype Netfires missiles

Total 33506

0603313A (263)
FUTURE MSL TECH INTEGR(FMTI)

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Budget Item Justification

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

February 2002

BUDGET ACTIVITY	PE NUMBER AND TITLE	PROJECT
3 - Advanced technology development	**0603313A - Missile and Rocket Advanced Technology**	**550**

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
550 COUNTER ACTIVE PROTECTION	6714	5436	8523	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 2001 Accomplishments:

- 5402   - Completed brassboards of activity detector, first iteration antennas, and brassboard base band module.

    - Completed brassboard RF transceiver module using first iteration monolithic microwave integrated circuits (MMIC).

    - Completed hardware for functional demonstration of third generation RFCM using brassboard modules and components

    - Completed second iteration MMIC component development.

    - Began design and fabrication of third generation RF test bed.

    - Began integration to missile test bed airframes.

- 1312   - One year congressional add for Counter Active Protection Systems designed and fabricated alternate low cost RF transceiver module.

Total   6714

0603313A (550)
COUNTER ACTIVE PROTECTION

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Exhibit R-2A
Budget Item Justification

BUDGET ACTIVITY **3 - Advanced technology development**	PE NUMBER AND TITLE **0603313A - Missile and Rocket Advanced Technology**	PROJECT **550**

FY 2002 Planned Program

- 5436   - Complete third generation 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   5436

FY 2003 Planned Program

- 6033   - Initiate design of conformal head assemblies, reduce size of radar receivers, and complete radar software. Perform radar integration and live interceptor/launcher testing.

- 2490   - Complete fabrication of twelve third generation RFCM flight prototypes.

         - Complete integration to missile test bed airframes.

         - Transition to missile system project management offices and prime contractors for flight test demonstrations with a Technology Readiness Level (TRL) of Six.

Total   8523

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

February 2002

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

COST (In Thousands)	FY 2001 Actual	FY 2002 Estimate	FY 2003 Estimate	FY 2004 Estimate	FY 2005 Estimate	FY 2006 Estimate	FY 2007 Estimate
655 HYPERVELOCITY MISSILE TD	0	21007	42722	54589	54107	10307	266

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 develop and demonstrate advanced hypervelocity missile technology necessary for the next generation kinetic energy weapon. CKEM will demonstrate enhanced system lethality with a 52 inch long, 65-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 2001 Accomplishments:

         Project not funded in FY 2001.

FY 2002 Planned Program

- 4699   - Incorporate the results of the CKEM 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.

- 16308   - 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.

0603313A (655)
HYPERVELOCITY MISSILE TD

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FY 2002 Planned Program (Continued)

    - 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.

    - Finalize ATD Management Plan and coordinate transition to system development and demonstration (SDD).

Total 21007

FY 2003 Planned Program

- 11000 - Provide two tactical hypervelocity missile systems ready for demonstration/validation in FY 2003-2006 and primed for SDD phase in FY 2006. Maintain competitive acquisition up to SDD with two system prime contractors.

- 8700 - Incorporate the technology (previously incorporated into a flight worthy component) into integrated tactical system whose design has been demonstrated to meet the defined form, performance, interface and flight environmental requirements.

- 16000 - Demonstrate technology maturation of Technology Readiness Level (TRL) 6 of component and integrated missile system concepts.

- 7022 - Validate critical component performance through subsystem and system integration testing

Total 42722

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HYPERVELOCITY MISSILE TD
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Budget Item Justification