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<b>RDT&amp;E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)</b>							DATE February 2002			
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense Wide/BA 3							R-1 ITEM NOMENCLATURE Joint Wargaming Simulation Management Office <b>PE 0603832D8Z</b>			

COST <i>(In Millions)</i>		FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	Cost to Complete	Total Cost
Total Program Element (PE) Cost		62.390	46.104	49.929	46.623	47.951	47.617	48.313	Continuing	Continuing
JSM/P476		62.390	46.104	49.929	46.623	47.951	47.617	48.313	Continuing	Continuing

**(U) A. Mission Description and Budget Item Justification**

**(U) BRIEF DESCRIPTION OF ELEMENT**

The Defense Modeling and Simulation Office has corporate-level responsibility for the cooperation and synergism of modeling and simulation (M&S) activities within the Department of Defense. M&S has demonstrated the capability to revolutionize the way in which the Department makes decisions and conducts its operations. Working as a system of systems, M&S can support a full range of applications (e.g. joint training, doctrine development, formulation and assessment of operational plans, mission rehearsal, force structuring and the acquisition of new systems). To ensure effective and efficient use of M&S, the Department has developed a strategy fostering interoperability and re-use, embodied in the Department of Defense Modeling and Simulation Master Plan, which serves as the basis for execution of this program. The major element of the strategy is development of a common technical framework (CTF) for M&S consisting of three components: the High Level Architecture; Functional Descriptions of the Mission Space (FDMS); and Data Standardization. Supporting these is a broad range of shared common services which include environmental representations; human and organizational behavioral representation; verification, validation and accreditation of simulations; a modeling and simulation resource repository; a modeling and simulation information analysis center; and outreach and education initiatives to ensure standardized and timely implementation of the plan. All aspects of these efforts are focused on the Warfighters of today and tomorrow through a rigorous and ongoing process of capturing and addressing Warfighting customer needs and requirements. As a result of this effort, the Department will be able to lead, integrate and leverage M&S technologies for the Warfighter and thus improve readiness, enhance mission rehearsal, optimize investment decisions, and achieve cost-effective acquisitions.

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**(U) FY 2001 Accomplishments:**

(U) The High Level Architecture (HLA) for simulation program implemented software enhancements to Runtime Infrastructure (RTI) 1.3 Next Generation (NG), current version, based on testing with the Joint Simulation System (JSIMS) program and Millennium Challenge 2002 (MC02). Development and testing of a new Institute of Electrical and Electronics Engineers (IEEE) 1516 Runtime Infrastructure (RTI) commenced. Critical HLA Tools, including the Object Model Development Tool, Federation Execution Planner's Workbook Tool, Federation Verification Tool, Federation Management Tool and Data Collection Tool are in the process of being upgraded to the new IEEE specification. Experimentation with and performance of the RTI is being performed and measured in consonance with the technical requirements of major joint efforts.

(U) Created the Military Domain Representation Framework (MDRF, version 1.0) by integrating the OSD developed Functional Descriptions of the Mission Space, the ASD/C3I C4ISR Architecture Framework, and the DOT&E Vulnerability/Lethality Taxonomy. MDRF was formally adopted by the US Army OneSAF and Combat XXI programs and is under consideration by PM Objective Force (Army) and PM C2ISR Enterprise (Air Force). The FDMS Library was integrated into the M&S Resource Repository and deployed at the US Army's Simulation Training and Instrumentation Command (STRICOM). The Unit Order of Battle (UOB) Toolset has been adopted by the Joint Training Information Management System (JTIMS) for use by all Joint exercises under the Joint Training System, by the Training and Operational Data Synchronization (TODS) program (Army Battle Control System 6.2), and by the JSIMS Common Component Workstation. Continued to provide Functional Data Administration for M&S in accordance with DoDD 8320.1.

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(U) Completed environmental interchange mechanism definition and full technical documentation, to include advancing six standards based on Synthetic Environment Data Representation and Interchange Specification (SEDRIS) technologies under the International Standards Organization and the International Electro-technical Commission to Advanced Working Drafts (versions 4/5). Expanded software tools for SEDRIS transmittal generation, verification, and consumption through two public releases of SEDRIS core and application software. Completed initial atmosphere, ocean and space environmental data model. Expanded existing atmospheric and terrain scenario generation and archiving capabilities. Initiated development of a conceptual architecture and the key technical components of an INE Authoritative Representation Process to facilitate the scenario composition and generation of physically consistent environmental representations. Expanded operational capability for the Master Environmental Library with both Internet and SIPRNET made available to the DoD user community. Developed prototype data sets to support user system test events, experiments and exercises (JWARS, JSIMS/WARSIM, Global Wargame 2001). Completed end-to-end experiments/demonstrations to assess and validate the progress of technical development including demonstration of generation and use of robust environmental representation in key runtime federations.

(U) Conducted research into performance moderator functions and their application to operations other than war modeling and simulation. Completed initial maritime scenario development for decision modeling challenge problem in partnership with US Naval Space and Warfare Systems Command (SPAWAR). Completed Icarus HLA federation of cognitive models and air traffic control scenario in partnership with the Air Force Research Laboratory (AFRL) and Office of Naval Research (ONR). Fielded Intelligent Mission Controller Node (automated air tasking order generator for exercises and wargames) in partnership with AFRL and the Naval Air Warfare Center, Training Systems Division (NAWC-TSD).

(U) Completed development of Build 2 of the web-based M&S Verification, Validation & Accreditation Recommended Practices Guide (RPG) that focuses on VV&A of legacy simulations. The RPG addresses the VV&A issue at multiple levels of detail and provides the user with dynamic and interactive capabilities. Initiated Verification, Validation and Accreditation (VV&A) applications for fidelity, specifications for reuse, and conceptual framework model coverage. Performed technical analysis of human behavior models with respect to VV&A practices and methods.

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(U) Completed an initial design of a Joint Theater Level Simulation-Joint Conflict and Tactical Simulation (JTLS-JCATS) interface that will allow mixed-resolution simulation play during joint training exercises. In cooperation with TRANSCOM, completed an initial interface between the MIDAS and ELIST logistics models that provides an automated interface between these models, allowing faster logistics processing and Time Phased Force Deployment Data (TPFDD) development. Performed integration and testing of the HLA Runtime Infrastructure within the Joint Training Confederation (JTC) and, in conjunction with the USFK/ROK, evaluated the potential inclusion of the ROK Chang Jo 21 model within the JTC. Assessed the utility of linking the JSIMS and Joint Warfare System (JWARS) models for applications involving joint training and analysis.

(U) Initiated ground breaking M&S Science and Technology initiative projects in partnership with the services focusing on modeling and simulating Operations Other Than War (OOTW). Completed first round of M&S Science and Technology initiative projects in partnership with the Services. The result of these projects will advance the state-of-the-art in M&S technology and will be transitioned to Service labs, Advanced Concept Technology Demonstrations (ACTDs) and used in key exercises and experiments.

(U) Fielded an application that allows for the rapid initialization of the Naval Simulation System (NSS) using data available in the Global Command and Control System (GCCS) for the purposes of executing course of action (COA) analysis. Completed testing of a GCCS-Pegasus interface that identified issues involving the interaction of faster than real-time analysis simulations with real-time command and control systems. Documented an initial set of requirements for M&S applications to be integrated into the DII COE. Investigated inclusion of the HLA RTI within the DII COE. Enhanced the Army's Eagle-ABCS interface that utilized the RTI to connect to the Joint Common Database (JCDB).

(U) Analyzed alternatives for a Weapons of Mass Destruction (WMD) Attack-Effects-Response Assessment capability at USJFCOM. Completed development of Operational Requirements, Concept of Operations, and Technical Design documents.

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(U) Developed a Synthetic Range technical architecture and software framework for implementation at the Pacific Missile Range Facility to expand the capabilities of test and evaluation as well as reduce associated costs inherent in large-scale or platform driven events. Built a useable, limited prototype using the Synthetic Range software framework. Developed metrics to quantify the value added benefit of Synthetic Range.

(\$62.390 million)

**(U) FY 2002 Plans:**

(U) Continue as Development Agent for the High Level Architecture (HLA) Runtime Infrastructure (RTI) for JSIMS multi-service simulation training program. Continue RTI performance assessment and testing within the JSIMS program, increase RTI optimization performance to meet warfighter needs as part of multi-service advanced distributed simulation exercises including Millennium Challenge, Olympic Challenge, and Ulchi-Focus Lens. Continue refinement of HLA RTI prototype software to address security gateways among different levels of classified simulations. Continue experimentation with specifications to ensure distributed simulation architecture is buildable in a standardized fashion and demonstrate it meets user requirements. Complete HLA RTI performance benchmarks and supporting software for RTI 1.3 Next Generation (NG). Continue work to transition HLA RTI for sustainment by the commercial sector in support of distributed simulation.

(U) Continue experimentation that addresses the flexibility and military utility of the new DDM 1516 specification for complex applications and the scalability of the architecture, advanced time management algorithms of distributed simulations with different time scaling factors and the use of the HLA in communication environments other than networks (e.g. shared memory, multi-process, parallel-process, handling video/voice).

(U) Continue experimentation devoted to new implementation approaches available by applying emerging commercial advanced information technologies to the implementation of HLA. Applications would include: designs and implementations of advanced time management techniques, use of HLA in next generation internet, implementation within mobile computing environments (e.g., Network Centric Warfare environments), in high performance computing platforms, and the use of intelligent agent technologies to support implementation within evolving warfighter requirements.

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(U) Develop tool sets to be upgraded to Institute for Electrical and Electronics Engineers (IEEE) 1516 standard. This will include the tool sets available for system developers. The tool sets include the Object Model Development Tool (OMDT), Federation Verification Tool (FVT), Federation Management Tool (FMT), Data Collection Tool (DCT), and Object Model Resource Center (ORMC) and will support the transition of the HLA simulation architecture and tool sets to the commercial marketplace. Initiate development of a certification process for software applicable to DoD interoperability requirements for simulation to ensure promulgation of a reliable standard for live, virtual, and constructive simulation.

(U) Initiate feasibility to interweave the specifications, rules, and object models from the Advanced Distributed Learning (ADL) initiative's Sharable Content Object Reference Model (SCORM) with those from the modeling and simulation community's High Level Architecture. This new technology complements the current ADL framework by extending the simulation object models of military platforms (interactions, attributes, and parameters) to a broader audience of military learners and equipment users.

(U) Develop initial experimentataion to test interoperability between existing and planned digital knowledge repositories of both learning objects and simulation objects, allowing an expansion of the training capabilities in HLA and a strengthening of the simulation and gaming capabilities of ADL. Utilitze wideband fiber optic distributed classroom testbed already in existence to test the limits of interoperability of interactive simulation and modeling initiatives.

(U) Begin banyan integration research. Develop and deploy the Military Domain Representation Framework (MDRF) version 2.0 to add initial system-of-systems representation. Adapt the knowledge acquisition tools to support selected Joint Modeling and Simulation System (JMASS) representation requirements. Develop and deploy FDMS Model Library version 7.0 to provide initial capability for distributed data repositories and round trip data exchange with MDRF version 1.0 knowledge exchange representation. Employ paired comparison test procedures with NPS to collect quantitative, business case metrics using selected C4ISR-AF and Transformation of the Army knowledge products. Begin Scenario Generation For Common Operating Environment (SGCOE) for four to six Defense Planning Guidance (DPG) Illustrative Planning Scenarios (IPS). Continue to develop JWARS, JSIMS, DPG IPS's, UTL and METL, and C4ISR-AF military operations knowledge bases for Internet and SIPRnet. Extend hosting of Transformation of the Army and JMASS military operations knowledge bases. Begin to host selected USAF and USMC military

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operations knowledge bases.

(U) Begin Materiel Configuration Toolset (MCT) development. Begin Electronic Order of Battle (EOB) Toolset and Task Organization Toolset (TOTL) development by deploying version 1.0 of each toolset. Continue integration the Data, Integrated Natural Environment (INE), Human Behavior Representation (HBR), and MSRR programs, the OSD/PA&E Joint Deployment System, the JFCOM Joint Integrated Data Provisioning System with DoD Service, Component, and Agency data provisioning activities to define Joint Model + Data Provisioning System (JM+DPS) version 2.0. Initiate Joint Munitions Effectiveness Manual (JMEM) transition to Joint Munitions Effectiveness (JMET) Toolset Collaborate ICW the Joint Technical Coordinating Group, Munitions Effectiveness. Develop Data Verification Interactive Editor (DAVIE) and deploying version 2.0. Employ paired-comparison test procedures with Service PME schools and the Aircraft Evaluation Test Facility (ACETEF) to collect quantitative, business case metrics using the OSD/PA&E JDS and the JFCOM JIDPS. Transition ADS Library to MSRR. Begin to host selected Electronic Order of Battle (EOB) and Task Organization Toolset (TOTL) data sets. Distribute JM+DPS selected data sets.

(U) Complete Synthetic Environment Data Representation and Interchange Specification (SEDRIS) standardization and guidance product development through ISO/IEC process. Expand user-defined interchange experiments. Initiate transition of SEDRIS standards and software tools to industry consortium. Implement initial Integrated Natural Environment Authoritative Representation Program (INEARP) infrastructure resulting from the baseline conceptual architecture design incorporating key enabling technologies. Continue to expand library services capabilities including review of compliance with evolving international meta-data standards. Continue a series of periodic end-to-end experiments/demonstrations to assess and validate the progress of synthetic environment technical development. Prototype, document and provide to user sample warfighting simulation components that illustrate appropriate use of environmental representations in runtime distributed simulations.

(U) Develop Human Behavior Representation (HBR) requirements process and integrated road map for HBR research and development. Conduct experiments and advanced demonstrations on HBR challenge areas using emerging technologies, such as Bayesian networks and neural networks, to meet evolving requirements for major simulation systems. Develop additional testbeds and scenarios for HBR Challenge Problem and incorporate performance moderators. Conduct research into agent-based simulations as applied to HBR. Initiate development of Common Human Behavior Representation Interchange System (CHRIS).

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(U) Complete Verification, Validation and Accreditation (VV&A) applications for fidelity, specifications for reuse, and conceptual framework model coverage. Perform VV&A experiments regarding human and organizational behavior models to assess VV&A practices and methods.

(U) Complete Science and Technology initiative projects in partnership with the services focusing on OOTW. Transition the products of the initiatives to Service labs, ACTDs and for use in key exercises and experiments. Identify and initiate additional science and technology initiative projects in partnership with the services focusing on a high priority problem area. Identify and initiate science and technology projects with universities, ACTDs, industry, and FFRDCs as appropriate.

(U) Extend the current NSS-GCCS COA initialization capability to the Integrated Theater Engagement Model (ITEM) for use in USFK exercises in 2002. Include M&S segments in the Defense Information Infrastructure (DII) Common Operating Environment (COE) that have broad applicability across all of DoD.

(U) In conjunction with USFK, integrate the ROK Chang Jo 21 model with the Joint Training Confederation (JTC). Support to USJFCOM and focus on the continuing development of JTLS-JCATS.  
(\$46.104 million)

**(U) FY 2003 Plans:**

(U) Continue as Development Agent for Runtime Infrastructure (RTI) for JSIMS multi-service simulation training program. Continue RTI performance assessment and testing within the JSIMS program, increase HLA RTI optimization performance to meet warfighter needs as part of multi-service advanced distributed simulation exercises including Olympic Challenge, and Ulchi-Focus Lens. Further develop RTI prototype software to address security gateways among different levels of classified simulations. Integrate experimentation results and develop tools to ensure distributed simulation architecture is buildable in a standardized fashion and demonstrate it meets user requirements. Complete transition of the HLA RTI for sustainment by the commercial sector in support of distributed simulation.

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(U) Continue experimentation to exploit the flexibility and military utility of the new Data Distribution Management (DDM) 1516 specification for complex applications and the scalability of the architecture, development of new data types to ensure all data forms are able to managed by the HLA RTI, advanced time management algorithms of distributed simulations with different time scaling factors and the use of the HLA in communication environments other than networks (e.g. shared memory, multi-process, parallel-process, handling video/voice).

(U) Conduct further experimentation devoted to new implementation approaches available by applying emerging commercial advanced information technologies to the implementation of HLA. Applications would include: designs and implementations of advanced time management techniques, use of HLA in next generation internet, implementation within mobile computing environments (e.g., Network Centric Warfare environments), in high performance computing platforms, and the use of intelligent agent technologies to support implementation within evolving warfighter requirements.

(U) Expand development of tool sets to be upgraded to IEEE 1516 standard with a view toward commercialization. This will include the tool sets available for system developers. The tool sets include Object Model Development Tool (OMDT), Federation Verification Tool (FVT), Federation Management Tool (FMT), Data Collection Tool (DCT), and Object Model Resource Center (ORMC) and will support the transition of the HLA simulation architecture and tool sets to the commercial marketplace. Complete certification process development for software applicable to DoD interoperability requirements for simulation to ensure promulgation of a reliable standard for live, virtual, and constructive simulation.

(U) Conduct experiments and demonstrations of the capability to interweave the specifications, rules, and object models from the Advanced Distributed Learning (ADL) initiative's Sharable Content Object Reference Model (SCORM) with those from the modeling and simulation community's High Level Architecture (HLA). This new technology complements the current ADL framework by extending the simulation object models of military platforms (interactions, attributes, and parameters) to a broader audience of military learners and equipment users.

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(U) Complete banyan research integration. Develop and deploy MDRF version 3 to complete system of system representation. Adapt the knowledge acquisition tools to support selected JMASS, USN, and DIA representation requirements. Develop and deploy FDMS Model Library version 8.0 to provide additional distributed knowledge management capability and round trip data exchange with MDRF version 2 knowledge exchange representation. Employ paired comparison test procedures with NPS to collect quantitative, business case metrics using selected JMASS knowledge products. Begin distributed knowledge management of JWARS, JSIMS, DPG IPS's, UTL and METL, C4ISR-AF, Transformation of the Army, and selected JMASS, USAF, and USMC military operations knowledge databases on Internet and SIPRnet. Extend hosting of Transformation of the Army and JMASS military operations knowledge bases. Begin collaborative knowledge management of selected USN and DIA military operations knowledge bases.

(U) Continue Electronic Order of Battle (EOB) Toolset and Task Organization Toolset (TOTL) development by deploying version 2.0 of each toolset. Continue MCT development by deploying version 1.0. Continue integration the DMSO Data, INE, HBR, and MSRR programs, the OSD/PA&E JDS, the JFCOM JIDPS with DoD Service, Component, and Agency data provisioning activities to define JM+DPS version 3. Begin development of the System Characteristics and Performance Toolset (SCP Toolset). Employ paired-comparison test procedures with Service PME schools and the Aircraft Evaluation Test Facility (ACETEF) to collect quantitative, business case metrics using the JMET. Continue distributed JM+DPS management of ADS, UOB, EOB, TOTL, DPG-IPS, INE, and JMET data sets on Internet and SIPRnet. Begin distributed JM+DPS management of MCT data sets.

(U) Complete formal establishment of a management consortium for SEDRIS technologies. Initiate investigation in the use and expansion of the SEDRIS data representation model in supporting dynamic changes in the physical environment. Investigate very-high-resolution database designs that incorporate computer-added design files, and microclimate environmental information for use in dynamic fly-throughs in an integrated urban environment. Continue to reduce integrated database generation timelines to meet evolving operational mission planning and mission rehearsal timeline requirements. Continue Integrated Natural Environment Authoritative Representation Program (INEARP) implementation development by demonstrating production and use of operational resources. Demonstrate use of measures of database consistency to assess interoperability potential and tailor database design, generation and/or modification activities in establishing simulation federations and conducting exercise scenarios. Fully link the Master Environmental Library (MEL) system with the National Spatial Data Infrastructure and appropriate international systems to ensure a robust capability to support U.S. DoD needs thus establishing a "one stop shop" capability for all environmental information

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needs. Continue a series of periodic end-to-end experiments/demonstrations to assess and validate the progress of technical development. Continue to incorporate environmental representation into the chosen warfighting simulations in order to exercise them. Modify warfighting simulations as needed to react appropriately to environmental factors. Increase level of participation of robust environmental representations in user test, experiments and exercises.

(U) Continue additional scenarios for the HBR Challenge Problem. Initiate toolkit. Conduct further research into agent-based simulations. Continue development of CHRIS.

(U) Complete Verification, Validation, and Accreditation (VV&A) applications for fidelity, specifications for reuse, and conceptual framework model coverage. Perform VV&A experiments regarding human and organizational behavior models to assess VV&A practices and methods.

(U) Develop a plan for future interoperability with Master Environmental Library, to be executed in the following year. Begin incorporation of tools capable of delivering model ready data, directly to simulations or simulation centers, via established databases. Upgrade controlled vocabulary.

(U) Complete Science and Technology initiative projects in partnership with the services focusing on high interest problem area. Transition the results of the initiatives to service labs, ACTDs and for use in experiments and exercises. Identify and initiate additional science and technology initiative projects in partnership with the services focusing on a high priority problem area. Identify and initiate science and technology projects with universities, ACTDs, industry, and FFRDCs as appropriate.

(U) Extend COA capabilities by focusing on new C4I systems and data sources that can be used to initialize analysis simulations used for COA analysis and planning. Also, the program will begin to look at ways to integrate tools such as the Unit Order of Battle (UOB) tool with the current COA initialization capabilities. Finally, new M&S segments will be added to the DII COE, as appropriate.

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(U) The CINC/Service program will support fielding of the JTLS-JCATS interface during appropriate JFCOM exercises during FY03. The program will also support fielding of the CJ21-JTC interface during UFL03. Finally, the program will continue to support CINC/Service M&S needs and initiatives, as appropriate.

(U) Working closely with DoD and federal intelligence, homeland security, law-enforcement, transportation, and emergency response organizations; create a taxonomy, functional description of the mission space (FDMS), and validated models for the range of terrorist and other unconventional actions that use unlawful or inhumane Rules of Engagement (ROEs) (e.g., targeting civilians, economic centers, information systems, and religious/symbolic icons). Similarly, develop a taxonomy, FDMS, and validated models for mitigating the consequences of such actions, including the utilization of recent advances in modeling and simulation (M&S) of weapons of mass destruction and their effects. Develop military tactical and non-military M&S which can incorporate unconventional and novel ROEs to respond to these threats, as well as approaches for planning, rehearsal, and training for emergency responses to successful threat actions. Within a synthetic environment, demonstrate the analytical and tactical development utility of such M&S in both military tactical and civilian non-tactical scenarios.  
(\$49.929 million)

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<b>(U) B. Program Change Summary</b>	<b><u>FY2001</u></b>	<b><u>FY2002</u></b>	<b><u>FY2003</u></b>	<b><u>Total Cost</u></b>
Previous President's Budget Submit	56.971	59.286	45.067	Continuing
Delta	5.419	-14.221	0.000	
FY 2002 Amended PB Submission	62.390	45.065	45.067	
Appropriated Value	62.971	46.565	0.000	Continuing
Adjustments to Appropriated Value				
a. Congressionally Directed Undistributed Reduction	0.000	-0.461	0.000	
b. Rescission/Below-threshold Reprogramming, Inflation Adjustment	-0.581	0.000	0.000	
c. Other	0.000	0.000	-4.862	
Current FY 2003 Budget Submission	62.390	46.104	49.929	Continuing

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**Change Summary Explanation:**

(U) **Funding:** FY 2001 reductions reflect Section 8086 adjustments. FY 2003 increase was the result of adjusted priorities and programmatic decisions.

(U) **Schedule:** N/A

(U) **Technical:** N/A.

(U) C. **Other Program Funding Summary Cost:** N/A

(U) D. **Acquisition Strategy:** N/A

(U) E. **Schedule Profile:** N/A

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