RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)					DATE February 1999				
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-Wide/Applied Research - BA2					R-1 ITEM NOMENCLATURE WMD Related Technologies; 0602715BR				
COST (In Millions)	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	Cost to Complete
Total 0602715BR Cost	203.8	211.4	203.5	206.5	209.1	212.0	217.3	222.8	Continuing
Project AB Test & Simulation Technology	54.5	57.7	52.8	49.6	48.8	49.4	50.5	51.7	Continuing
Project AC Weapon Systems Lethality	41.1	39.4	35.8	36.3	36.8	38.9	40.3	41.1	Continuing
Project AE Weapon Safety & Operational Support	28.3	30.2	31.7	33.9	34.8	36.0	36.7	37.7	Continuing
Project AF Weapon System Operability	43.3	44.5	47.8	51.2	51.8	52.8	53.9	55.3	Continuing
Project AG Scientific Computations & Information Systems	19.1	22.0	21.5	21.6	22.2	21.8	22.5	23.2	Continuing
Project AI Hard Target Tunnel Defeat and NTS Sustainment	9.9	10.2	12.1	12.3	12.6	13.1	13.4	13.8	Continuing
Project AL Classified Program	2.6	2.4	1.8	1.6	2.1	0.0	0.0	0.0	Terminated
Project AN Thermionics	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	Completed
Project AQ Deep Digger	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	Completed
Project AY Bioenvironmental Hazards Research	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Completed

A. Mission Description and Budget Item Justification

This program develops the technology base needed to support national security issues relevant to nuclear and other advanced weapons and force application technologies. Program initiatives include the development, upgrade, and maintenance of advanced nuclear weapons effects simulators to address weapon systems operability issues; conventional weapon

targeting and strike planning tools for regional contingencies; battle damage prediction/assessment of conventional strikes against fixed hardened facilities; and

Mission Description and Budget Item Justification (cont'd)

predictive models for dispersion and transport of hazardous particles generated by attacks sustainment of a core nuclear competence in the national industrial base. Efforts encompass:

- -Support for national security policy implementation.
- -Support to CINCs in nuclear force structure, logistics, operations and stockpile programs.
- -Quantitative assessments of nuclear weapons systems with development and maintenance of nuclear weapons system safety databases.
- -Development, upgrade, and operation of simulators (radiation, blast, thermal, radio frequency propagation and optical/infrared background effects) to characterize operability of military systems during and after exposure to nuclear disturbed environments.
- -Physical and functional characterization of hardened underground structure designs and associated vulnerabilities.
- -Determination of nuclear and conventional weapons effectiveness against fixed targets. Emphasis is on targeting technical support, hard target kill criteria, and damage assessment methodologies.
- -Utilization of weapons effects information to support development of adaptive targeting methodologies.
- -Support of high-performance computing capability to maintain and upgrade the Agency's predictive codes in radiation hydrodynamics, structural dynamics, and electromagnetic propagation supporting nuclear and conventional weapon system lethality, operability, and safety assessments.

Mission Description and Budget Item Justification (cont'd) - The 6.2 programs under this Program Element (0602715BR) are divided into ten projects. It should be noted that information concerning Project AL is classified per DoD Directive 0-5205.7, Para B.2.f.

The November 1997 Defense Reform Initiative (DRI) directed the establishment of a Defense Threat Reduction Agency (DTRA) effective 1 October 1998. As a result of the DRI, resources for FY 1999 and out which were previously addressed in Defense Special Weapons Agency Program Element (PE) 0602715H have been transferred to this PE.

Project AB - Test & Simulation Technology - Development of effective, survivable, and economical weapon systems requires robust testing technologies and simulation capabilities to support acquisition managers, nuclear effects researchers, and decision-makers. This project develops, provides and maintains unique DoD test and simulation facilities and enabling technologies that are used by the Defense Agencies, the Services and other federal agencies to evaluate the impact of hostile environments from conventional, nuclear and other special weapons on military or civilian systems and targets. These facilities provide blast, thermal, electromagnetic pulse, ionizing radiation and radio frequency propagation environments and testbeds to support DoD and national test requirements. This project leverages fifty years of testing expertise to investigate weapons effects and target response to a spectrum of hostile environments that could be created by proliferant nations or terrorist organizations with access to advanced conventional weapons or weapons of mass destruction (nuclear, biological and chemical).

The project includes the upgrade of existing simulator technologies to extend the utility and life of simulators, the decommissioning of under-utilized simulators, and the development of new simulators to support emerging customers from DoD/DOE, NSA, and U.S. Allies. Additionally, it provides the innovative, enabling technologies that make simulator enhancements and new facilities technically feasible and cost effective. Specific programs in this project include: 1) Based on user test requirements, maintain two existing test centers--one at Maxwell Physics International in San Leandro, California, and one at Arnold Engineering Development Center (AEDC) in Tullahoma, Tennessee, including the development, construction and checkout of the new Decade x-ray facility; development of technologies to provide enhanced radiation sources on the Decade simulator. 2) Development of communications and radar propagation effects simulators, and infrared and optical scene generators; partnership with Sandia National Laboratories (DOE) to develop technologies in energy storage, power flow, plasma switches, debris shields, and radiation sources that are applicable to stockpile stewardship and DoD strategic systems sustainment.
3) Characterization, optimization and operation of the Large Blast/Thermal Simulator

Project AB - Test & Simulation Technology (cont'd)

(LB/TS) at White Sands Missile Range (WSMR), including the demonstration of a non-ideal airblast simulation capability. 4) Operation and maintenance of the ARES electromagnetic pulse (EMP) facility at Kirtland AFB. 5) Target defeat assessments for precision-guided and special weapons against Weapons of Mass Destruction (WMD) related targets.

The project provides test beds for full- and sub-scale tests that focus on weapon-target interaction with fixed, hardened facilities to include hardened aboveground bunkers, cut-and-cover facilities and deep underground tunnels. This effort supports the Services' requirements for hard target defeat testing and emphasizes teaming with the Services to assess weapon-target interaction of existing and developmental weapon systems. Specific activities include test bed design and construction, instrumentation and data collection, test coordination and execution, and post-test analysis and documentation.

This project relies on hardening and simulation technologies [Testable Hardware and Aboveground Testing/Underground Testing (AGT/UGT) Correlation] funded under Project AF and supports the evaluation of weapons lethality accomplished in Projects AC and AI. Funded programs support JCS Joint Warfighting Capabilities: Control Space, Counterproliferation, Discriminate Attack, Global Reach and Situational Awareness, and also provide support to STRATCOM, EUCOM, USFK (PACOM), and ACOM.

FY 1998 Accomplishments

Test & Simulation ($19,613K)

- Continued to provide high explosive (HE) simulation infrastructure and test support, and to maintain Permanent High Explosives Test Site (PHETS) facility at White Sands Missile Range (WSMR) and Chestnut Site at Kirtland AFB.
- Continued Radar Nuclear Effects Corruption Simulators (RNECS) development for National Missile Defense (NMD); completed Advanced Channel Simulator (ACS) development and began initial operational test planning; evaluated advanced SATCOM Simulation Test Support to assess NMD architecture communications link operability; continued communication/radar atmospheric effects simulator participation in operability

Project AB - Test & Simulation Technology (cont'd)

assessment/warfighting exercises; and evaluated NMD Ground-Based Radar (GBR) operability.

Evaluated off-the-shelf technology for improvements in thermal and pressure diagnostics capabilities of LB/TS. Tested three Navy ship deckings and one United Kingdom communications shelter, and continued testing of Israeli subscale structure.

Supported test requirements by providing utilities and maintaining the construction capability infrastructure needed for the Counterproliferation (CP), Hard Target Defeat (HTD) and Hard and Deeply Buried Target (HDBT) programs.

Completed Phase 1 Advanced Concept Technology Demonstration (ACTD) for the CP program with infrastructure support and rehab capabilities at PHETS.

Completed over 80 individual high explosive tests supporting HTD Program, Counterterrorism Program, Service Support of F-117 attack methodologies, and penetration abilities of weapons.

Developed specialized airblast testing methodologies in LB/TS for large window safety testing in support of Counterterrorism.

Developed critical data supporting Non-ideal Airblast (NIAB) simulations in the LB/TS.

Completed ARES commercial pulse injection testing, DoD testing of electronic safe locks, GPS survivability and general upkeep of the facility.

Weapon/Target Interaction ($7,144K)

Awarded contract to develop and validate end-to-end targeting capability for conventional and nuclear weapons against tunnels.

Continued to construct and rehab test target facilities, provided utilities, maintained construction infrastructure, and executed tests needed for the CP, HTD, and HDBT programs.

Initiated construction of a full scale tunnel facility.

Project AB - Test & Simulation Technology (cont'd)

- Continued to develop signature requirements and munitions effectiveness assessment for hard target defeat.
- Continued construction of industrial targets for the assessment of WMD component damage, target response, and collateral effects for conventional weapons and enhanced payloads.

Radiation Simulators ($27,753K)

- Initiated an integrated modeling program for opening switches, power flow, and soft x-ray sources.
- Developed active debris mitigation valves for debris-free exposures greater than $100cm^2$.
- Demonstrated long-implosion soft x-ray sources on SATURN at Sandia National Labs in support of Decade source development.
- Developed improved fidelity source for NWE testing on the Decade simulator, plasma imaging and current diagnostics, and high-current, long-time implosion soft x-ray sources.
- Continued advanced, high-fluence, soft x-ray and high-dose and dose-rate hot x-ray development for the Decade Quad.
- Initiated Decade improvement program for power flow technologies to support high-fluence, soft x-ray sources.
- Assembled back-end power source for a Decade Quad at AEDC, and finalized front-end MITL-diode design.
- Completed very large ($410cm^2$) passive debris shields for cold x-ray testing.
- Began closure of the High Power Microwave Simulator.
- Continued development of a portable, compact, high-fidelity x-ray simulator.
- Partially replaced aging and obsolete instrumentation and diagnostics at test and R&D centers.
- Procured and integrated new diagnostics and instrumentation to enhance user test support.

Project AB - Test & Simulation Technology (cont'd)

Completed demonstration of high-fidelity, hot x-ray source for strategic system component testing.
Demonstrated high-fidelity, cold x-ray source and improved passive debris shield technology for solar array testing.
Demonstrated prototype remote access data system to save customer testing funds.
Demonstrated efficient laser-produced cold x-ray sources.

FY 1999 Plans

Test & Simulation ($20,325K)

Continue to respond to emerging user testing needs through R&D upgrades.
Continue to provide high-explosive simulation infrastructure and test support, and maintain PHETS facility at WSMR and Chestnut Site at Kirtland AFB.
Complete RNECS development for National Missile Defense (NMD) and begin initial operational tests.
Develop mitigation techniques for NMD GBR in a nuclear-disturbed environment and provide advanced SATCOM/User Early Warning Radar (UEWR) Simulation Test Support to assess NMD architecture operability.
Continue communication/radar atmospheric effects simulator participation in operability assessment/warfighting exercises.
Evaluate NMD UEWRs for operability and continue advanced Simulation Test Support to MILSTAR, IFICS, and Global Positioning System (GPS).
Develop advanced optical scene generator techniques and capabilities to support testing of NMD infrared (IR) sensors.
Complete evaluation of Anti Radiation Missile Systems using the improved 512 x 512 Nuclear Optical Dynamic Display System (NODDS) scene generator.
Complete modifications to LB/TS for blast and thermal diagnostics. Test one Navy ship decking and six Israeli tactical systems.

Project AB - Test & Simulation Technology (cont'd)

- Continue to provide HE simulation infrastructure and test support, and maintain PHETS facility at WSMR and Chestnut Site at Kirtland AFB.
- Complete large scale high explosive test in hard rock.
- Continue to rehab test target facilities at WSMR.
- Continue to support LB/TS maturing NIAB technology, window testing capabilities, and testing of vehicles against ideal nuclear airblast and thermal effects.
- Begin HE infrastructure support of Phase 2 ACTD, Counterterrorism and Hard Target Defeat Testing.
- Begin phenomenology testing of penetration of weapons into rocks and into damaged concrete. Complete penetration testing into granite. Initiate testing into limestone.
- Initiate Joint Attack Stand-Off Missile (JASM) infrastructure test support of three out of five fundamental target types. JASM program also supports the CP and HTD program.
- Begin ARES support of small operation testing and the TRW, Inc., Army tent tests.

Weapon/Target Interaction ($7,111K)

- Develop and validate tunnel targeting capability for system component level.
- Continue to construct and rehab test target facilities, provide utilities, maintain the construction capability infrastructure, and execute tests for CP, HTD, and HDBT programs.
- Complete tunnel testbed facility outfitting.
- Continue to develop signature requirements and munitions effectiveness assessment for hard target defeat.
- Collect operational signatures for tunnel testbed facility.
- Begin rehab of industrial targets for the assessment of WMD component damage, target response, and collateral effects for conventional weapons and enhanced payloads.

Project AB - Test & Simulation Technology (cont'd)

Radiation Simulators ($30,260K)

- Develop source capabilities for NWE testing with Nova laser.
- Continue development of large survivable passive debris shields for cold x-ray testing on Double-EAGLE simulator.
- Continue development of active debris mitigation valves for debris-free exposures greater than 300cm^2.
- Demonstrate long-implosion soft x-ray sources in support of Decade source development.
- Develop current, density-imaging, PRS diagnostics with demonstration of a Plasma Opening Switch (POS) diagnostic.
- Continue Decade improvement program for power flow technologies to support improved fidelity and intensity x-ray sources.
- Complete assembly of Decade Quad at AEDC.
- Optimize Decade Quad hot x-ray source and operation for user testing.
- Continue to support ongoing NWE test programs by maintaining DTRA's suite of ionizing radiation simulators.
- Complete closure of HPM facility at Maxwell Physics International.
- Demonstrate and deploy quick-turnaround, cold x-ray diagnostic system.
- Demonstrate high-spectral fidelity hot x-ray source on PITHON simulator.
- Continue development of a portable, compact, high-fidelity simulator.
- Begin augmented pulsed power concept development for advanced simulators for strategic component testing.
- Begin fast discharge energy storage technology development.
- Begin process of transferring MBS Calorimetry technology and design to AEDC.

FY 2000 Plans

Test & Simulation ($18,374K)

- Conduct testing of UEWRs in support of NMD program upgrades. Develop radar mitigation techniques for NMD GBR and UEWR.

Project AB - Test & Simulation Technology (cont'd)

Support IR scene testing of NMD TMD seekers. Support IR and communications testing of Space-Based Infrared Satellite (SBIRS).
Continue communication/radar atmospheric effects participation in operational/ warfighting exercises.
Continue support of testing of MILSTAR, IFICS, and GPS.
Continue to provide HE simulation infrastructure and test support, and maintain PHETS facility at WSMR and Chestnut Site at Kirtland AFB.
Continue to rehab test target facilities at WSMR.
Complete LB/TS NIAB development and tests, improve window testing capabilities, and continue testing of vehicles against nuclear airblast and thermal effects.
Continue HE infrastructure support of Phase 2 ACTD, Counterterrorism and Hard Target Defeat Testing.
Continue phenomenology testing of penetration of weapons into rocks and into damaged concrete. Continue penetration into limestone and complete testing into damaged concrete.
Continue infrastructure support of JASSM test support of three fundamental target types.
Begin ARES testing of Army All Source Analysis System (distributed battlefieldintel system).

Weapon/Target Interaction ($7,068K)

Conduct operational tunnel defeat demonstrations using existing and developmental weapons.
Demonstrate reconstitution times and costs after each demonstration.
Collect signatures of the tunnel facility for characterization before, during, and after each weapon application.
Exercise target planning tools through each of the participating CINCs.
Initiate construction of tunnel facility #2 of a different functional type in a different geology.

Project AB - Test & Simulation Technology (cont'd)

Conduct weapon lethality experiments to evaluate new weapons for functional defeat of tunnel facilities.

Radiation Simulators ($27,358K)

Demonstrate high-fluence, soft x-ray source on Decade Quad.
Demonstrate >500cm^2 debris shields for the Decade Quad.
Make large-area, hot x-ray source available for user testing on Decade Quad.
Initiate hardware development to support high-dose and high-dose-rate bremsstrahlung sources on Decade Quad.
Continue to support NWE test and R&D customers on DTRA's suite of ionizing radiation simulators.
Demonstrate and characterize high-fidelity wire array plasma radiation source on Double-EAGLE.
Demonstrate and characterize high-fluence ion beam capability on Pithon.
Upgrade control systems on radiation simulators at Maxwell Physics International for improved reliability.
Enhance Remote On-Line Simuator Access data encryption and access control capabilities.
Complete conversion of high-density plasma models to high-performance computers.
Demonstrate 20krads(Si) hot x-ray operation on Decade Quad.
First operation of Decade Quad cold x-ray capability.
Complete compact x-ray pulser.
Demonstrate distributed laser-produced x-ray source technology.

FY 2001 Plans

Test & Simulation ($19,170K)

Develop and test radar mitigation techniques for NMD GBRs. Support NMD UEWR mitigation upgrades.

Project AB - Test & Simulation Technology (cont'd)

Complete development of advanced IR scene generation simulator.
Continue development of the WCS.
Continue communication/radar atmospheric effects participation in operational/warfighting exercises.
Continue support of testing of IFICS and SBIRS.
Continue to provide HE simulation infrastructure and test support, and maintain PHETS facility at WSMR and Chestnut Site at Kirtland AFB.
Continue to rehab test target facilities at WSMR.
Continue HE infrastructure support of Phase 2 ACTD, Counterterrorism and Hard Target Defeat Testing.
Complete penetration testing into limestone and damaged concrete.
Complete JASSM test support of three fundamental target types.
Continue to support LBTS operations and infrastructure supporting vehicle and window testing.
Initiate ARES testing in SBIRS and THAAD (missile model/engineering representation) testing.

Weapon/Target Interaction ($6,890K)

Complete construction and outfitting of tunnel facility #2.
Conduct strike planning for operational attacks against the tunnel facility.
Collect signatures for target characterization during operational, strike, and post-strike phases of each attack.
Demonstrate improved tunnel target planning tools for both physical and functional defeat of tunnel facilities.
Conduct weapon-target interaction tests against tunnels.
Conduct reconstruction of the tunnel facility after each strike.

Radiation Simulators ($23,496K)

Soft x-ray source capability to Decade Quad.

Project AB - Test & Simulation Technology (cont'd)

- Initiate demonstration of high-fidelity, low-end-point energy bremsstrahlung source on Decade Quad.
- Continue to operate and improve DTRA's suite of ionizing radiation simulators in support of NWE testing and R&D customers.
- Transfer test technologies from Maxwell Physics International to Decade Radiation Test Facility, and characterize/correlate new test environments.
- Complete engineering enhancements to active, large-area debris shieldsysstems to provide user-friendly and reliable, debris-free, cold x-ray test environments on both Double-EAGLE and Decade.
- Demonstrate critical technologies for an advanced radiation simulator.
- Complete enhanced opening switch performance verification.
- Demonstrate >500cm^2 debris shields on Decade Quad soft x-ray source.
- Begin high energy demonstration of laser x-ray sources for NWE testing.

Project AC - Weapons Systems Lethality - This project addresses the lethality of the full spectrum of weapons, including advanced conventional and nuclear weapons, against the target base of today and tomorrow -- ranging from ultra-hard underground facilities to above ground, unhardened surface facilities and other special facilities that may be associated with the production, storage or deployment of weapons of mass destruction. Helping to maintain the continued effectiveness of the nuclear deterrent, this project also seeks to provide decision makers and warfighters expanded conventional weapon options against well-protected, high-priority targets. The program relies extensively on advanced numerical methods, as well as laboratory scale experiments, intermediate and full-scale field tests and operational test data to quantify functional and physical damage criteria and collateral effects. Project results will be provided to operational planners through PC-Based analytic prediction and visualization tools, multimedia hypertext databases, and technical manuals. Central to this support is an automated expert system to assist in pre-strike target planning and post-strike battle damage assessment. Technology developed in this project will also enable civil agencies to assess engineering designs to mitigate direct and collateral damage from terrorist attacks such as occurred at the Oklahoma City Federal Building, Khobar towers attack in Saudi Arabia, and the U.S. Embassies in West Africa. Additionally, the technology developed directly supports force protection issues, operations other than war and DoD support to civil authority.

On a broader scale, improvements in weapon effects and target response codes will be used to upgrade and expand physics-based modeling and simulation. These improved codes include: coupled finite difference-finite element codes, structure-medium interaction codes, groundshock propagation codes suitable for jointed and/or layered media and high resolution dynamic codes capable of predicting the transport of hazardous aerosol clouds over complex terrain. The understanding of weapon-target interaction resulting from this project will support the generation of weapon system requirements for the changing worldwide target base and provide a quantitative basis for planning contingency operations against high value targets. It will also improve the understanding of target/weapon

Project AC - Weapons Systems Lethality (cont'd)

interactions and their consequences for battle damage prediction and assessment. The project also allows the assessment of collateral effects from counterforce attacks, military strikes, terrorist action, incident or accident from nuclear facilities.

Project AC also includes the development of advanced weapons hardware technology. It supports the development of high power electromagnetic source technology for warfighting applications and hardening technologies for emerging radiofrequency (RF) threats. This project also includes electrothermal chemical (ETC) gun advanced technology and projectile lifting body programs per memorandum of agreement (MOA) with the Navy; ETC gun technologies for direct-fire (tank) applications, per MOA with the Army; and initiates development of ETC gun technologies for future indirect fire (artillery) Army applications.

FY 1998 Accomplishments

Weapons Effects Phenomenology ($3,716K)

- Developed concepts for demonstrating nuclear weapons effects on underground storage facilities, and other very hard and very deep targets.
- Developed a weapons output report on nuclear weapons effects from potential proliferants' weapons.
- Completed energy coupling analysis and effective yield models for cratering and ground motion.
- Accomplished ground motion predictions and experiment for Degelen-98 100 ton underground high explosive event.
- Developed prototype Integrated Munitions Effects Assessment (Nuclear) (IMEA-N) model to allow collateral consequence assessment of targeting weapons of mass destruction (WMD) materials. Model designated interim NATO standard.
- Completed nuclear targeting analysis for Air Force Milestone 0 study.

Project AC - Weapons Systems Lethality (cont'd)

- Delivered fire vulnerability assessment tool to USSTRATCOM.
- Reviewed Russian EMP Test Data and developed a framework for an EMP vulnerability Number (EMPVN) Model and a SREMPTAPS "Smart System" for WMD Target Planning database.
- Completed the development of STRATCAT Version 2 as a top level, quick C3I Assessment Tool and installed on STRATCOM's Top Secret LAN system.

Technical Information ($1,528K)

- Began development of integrated CD ROM nuclear weapons effects computational aid.
- Beta tested and distributed battlefield nuclear targeting CD ROM.
- Disseminated electronic version of Effects Manual-1 (EM-1) Technical Handbook.

Application of Nuclear Weapons Expertise ($16,346K)

- Defined the vulnerabilities of nuclear reactors to conventional weapon effects. Developed a prototype of a Munitions Effects Assessment (MEA) module for nuclear reactors.
- Demonstrated radiofrequency (RF) hardening technology of commercial off-the-shelf (COTS) equipment during an OSD sponsored Advanced Technology Demonstration.
- Completed field test of long-pulse sub-megawatt-class RF power source.
- Tested High Power Microwave (HPM) hardening countermeasures on tactical systems.
- Developed an innovative device to detect RF sources, the "Witness Chip", which can be used to warn of existing electronic attack.

Weapon/Target Interaction ($15,706K)

- Executed initial phase of a test program to define the vulnerability of C3I components and subsystems found in former Soviet Block high-value fixed targets.
- Developed fragility models for components found in high value fixed targets.
- Delivered electronic version of Design and Analysis of Hardened Structures (DAHS) and the electronic version of Protective Structures Analysis and Design System (PSADS).

Project AC - Weapons Systems Lethality (cont'd)

- Executed tests and performed analyses to develop vulnerability models for nuclear power plants attacked by advanced weapons.
- Performed precision scale tests to fill the data gaps in DAHS methodologies.
- Completed a precision test program to define penetration limits for advanced penetrator concepts for three rock types and impact velocity up to 1.5 Km/Sec.
- Completed an Independent Verification and Validation (IV&V) of the second generation weapon effect models in MEA 3.0.
- Provided technical support and hardware/software to integrate weapons effects and target response codes into distributive environment.
- Completed World-Wide Research Reactor Isotopic Inventories.
- Integrated Research Reactors into the Hazard Prediction and Assessment Capability (HPAC).
- Demonstrated a Comprehensive Weaponeering Environment that links diverse weaponeering tools on a computer network.
- Applied advanced weapon effect codes to current terrorist events to support civil authorities.
- Developed/delivered a prototype Force Protection Tool. Used the tool to support special State Department embassy surveys.
- Developed an initial tunnel defeat module for MEA to support Korean (USFK/PACOM) targets.
- Developed IMEA tunnel portal module for hard target defeat office.
- Provided structural engineering/weaponeering support of Persian Gulf operations.
- Provided weaponeering support for UFL (ROK).
- Conducted vulnerability assessments of U.S. Government facilities in the National Capital area.
- Conducted vulnerability assessments of U.S. embassies abroad for the State Department.

Project AC - Weapons Systems Lethality (cont'd)

- Provided conventional weapons effects tests and analysis support for FBI anti-terrorism programs.
- Began vulnerability reassessment of Russian silos for STRATCOM.
- Developed initial anti-terrorism planning software for force protection assessments.
- Provided technical support for the bilateral MOU between the USAF and the German Ministry of Defense (MoD).
- Provided engineering support to DIA and J2T (Target) Office (J2T) for BDA analysis during contingencies.
- Applied analytical tools to vulnerability assessments of deployed forces' sites and high priority CONUS sites.
- Conducted joint tests and foreign bunker exploitation visits with German MoD to gather data on potential foe's storage and control of Weapons of Mass Destruction.
- Demonstrated a robust capability to analyze complex fluid/structure interaction found in weapons effects environments using newly developed coupled code capability.
- Successfully completed 5-inch, Navy ETC gun-launched, horizontal range (700 feet) testing of two each full-up steel and composite projectile flight bodies that validated rear fin deployment, rear obturator performance, and rocket motor ignition. Both projectile designs survived 18MJ muzzel energy gun launch and performed as designed.
- Successfully designed, developed and evaluated two different ETC ignitor assemblies to meet ETC tank requirements.
- Successfully developed and produced an advanced, colayered, gun propellant that will meet energetic requirements for the 120mm ETC tank gun cartridge performance criteria.
- Successfully tested gun propellant candidates in subscale gun firings (60mm) to validate performance characteristics prior to manufacturing full-scale gun propellants.

Project AC - Weapons Systems Lethality (cont'd)

- Successfully initiated full-scale gun testing (120mm M256 tank gun) of the first delivery of advanced propellants using the ETC ignitor system. Preliminary firings (unoptimized) demonstrated a 23% increase in performance over the fielded 120mm M256 tank gun.
- Completed development of the explosive charge preparation and handling facility and initiated its operation at the Green Farm Electric Gun R&D Facility.
- Completed 20 ETC ignitor and charge development phenomenology experiments, ten 120mm ETC gun tests, and seven 90mm electromagnetic (EM) gun firings to evaluate EM, UK-designed, anti-tank projectiles at the Green Farm Facility.

US/Allied Survivability and Operability in Nuclear/Special Weapon Environments ($370K)

- Add graphics to analysis tools for STRATCOM to assess B-2 aircraft dust survivability for planned SIOP routes.

Test and Simulation ($1,182K)

- Performed validation testing for particle formulation models for nuclear fallout prediction in urban areas.
- Executed nuclear energy-coupling simulation utilizing NRL PHAROS laser system.

Technical Information ($1,528K)

- Began development of integrated CD ROM nuclear weapons effects computational aid.
- Beta tested and distributed battlefield nuclear targeting CD ROM.
- Disseminated electronic version of Effects Manual-1 (EM-1) Technical Handbook.

FY 1999 Plans

Weapons Effects Phenomenology ($7,742K)

- Distribute interim Threat Volume 2 of Nuclear Weapons Manual & Output Handbook.
- Begin work on advanced nuclear threat volume.
- Start development of computational capabilities to obtain 3-D radioactive output for strategic weapons.

Project AC - Weapons Systems Lethality (cont'd)

- Continue work on very deep hard target kill methodologies that will address assessments of weapons systems.
- Complete the geological analysis of two additional foreign sites.
- Finish material properties definition of a third foreign target site.
- Provide nuclear MEA capability to NATO/SHAPE in the MEA 4.0 release.
- Execute scaled nuclear target simulation test.
- Complete nuclear terrorist incident analysis and consequence assessment.
- Proof-of-concept demonstration of EMPVN Model for Lon lines connected Power and Telecommunications system of the Military.
- Develop simulation & modeling of EMP targeting of WMD using coherent pulsed power and nuclear EMP Simulator Sources based on air, land, and sea mobile platforms- a new initiative.
- Upgrade STRATCAT tool set for STRATCOM and for Regional Commands specific C3I assessment mission requirements.
- Upgrade the source region EMP target assessment and planning system (SREMPTAPS) to include new and war planners required weapon designs parameters.
- Develop 3-D Simulation of new Nuclear Weapon Effects (NWE) and Asymmetric Threat via SHYPS code suing the DoD high power computing (HPC) capability and in collaboration with LLNL.

Technical Information ($1,247K)

- Complete and demonstrate integrated NWE computational aids.
- Update 2 chapters of Effects Manual-1 (EM-1).

Application of Nuclear Weapons Expertise ($16,341K)

- Construct brassboard compact power sources.
- Conduct high-level testing of compact power distribution source prototype.
- Define the vulnerability of nuclear reactors and nuclear reprocessing facilities to advanced conventional weapons effects.
- Complete development of substrate conduction, an innovative protection technology effective against all EM threat frequencies.

Project AC - Weapons Systems Lethality (cont'd)

- Apply High Power Microwave (HPM)/EM hardening technology to a warfighter system.
- In partnership with the U.S. Telecommunications industry, apply HPM/EM hardening technology to critical, disaster recovery, communications hub.
- Complete key technologies for an advanced long pulse HPM solid-state source.
- Continue development of Witness Chip RF detector, increasing its sensitivity, improving computer interfaces, increasing its dynamic range, and adding frequency selectivity, for final product.
- To support a DIA request, review the lethality models for Soviet missile silos in light of current technical information. Support revision of VN/TK.
- Provide HPM source to allow OSD and Joint Services to conduct HPM experiments.

Weapon/Target Interaction ($12,456K)

- Develop detailed analysis of blast effects on First and Third Generation Aircraft Shelters to include the effects on stored assets and protection viability.
- Develop vulnerability/collateral effects tools for uranium mining/milling facilities module and transport model including effects of rainout/washout.
- Provide technical support, hardware/software to integrate weapons effects, target response codes in distributive interactive environment.
- Develop 3-dimensional, real-time visualization of targets with variable damage levels from physics-based weapon effects.
- Develop and implement joint service component vulnerability model into the MEA.
- Conduct functional defeat tests on systems.
- Produce an initial CD-ROM revision of the DAHS manual and begin work on an update to DAHS based on state-of-the-art technology.
- Execute field scale and full scale testing to reduce the uncertainty of penetration tests into rock, weathered rock, and hardened targets using advanced weapon concepts.
- Initiate the Integrated Comprehensive Weaponeering Capability (ICWC) that provides the warfighter a standardized weaponeering framework for a full spectrum of weapons and targets.

Project AC - Weapons Systems Lethality (cont'd)

- Develop an optimized dual delivery capability and implement it into MEA 4.0.
- Deliver a fully operational Force Protection tool and support Force Protection site surveys.
- Begin work on an Expert Design Advisor to guide the designer through the design of a complex protective structure.
- Transfer weapon effects data and models and develop a prototype forensic tool for civil applications that includes improvised and terrorist bombs.
- Develop models for optimized dual delivery of weapons for incorporation into IMEA.
- Develop IMEA module to support SOCOM requirements.
- Extend IMEA to meet the requirements of the Counterproliferation 2 Advanced Concepts Technology Demonstration (CP2 ACTD) and the hard target defeat demonstration.
- Extend IMEA nuclear weapons module to include ground shock kill of ultra-hard targets.
- Develop and update weapons effects and fragility models for incorporation into IMEA.
- Complete development of anti-terrorism planning software for force protection assessments.
- Provide technical support for the bilateral MOU between the U.S. and the German Ministry of Defense.
- Provide engineering support to DIA and J2T for BDA analysis during contingencies.
- Provide conventional weapons effects tests and analysis support for FBI anti-terrorism programs.
- Conduct vulnerability assessments of U.S. Government facilities in the National Capital area.
- Conduct vulnerability assessments of U.S. embassies abroad for the State department as requested.
- Assist in development of comprehensive IMEA training program.
- Complete validation verification and accreditation of IMEA through Joint Technical Coordination Group for Munitions Effectiveness (JTCG/ME).

Project AC - Weapons Systems Lethality (cont'd)

- Continue joint tests with German MoD to quantify WMD control and storage equipment lethality.
- Provide high-fidelity vulnerability assessments for deployed sites and high priority CONUS sites.
- Demonstrate new capability to more accurately predict target response using meshless numerical analysis.
- Complete ballistic range validation testing of 5-inch Navy gun-fired steel and composite projectile flight bodies at Wallops Island NASA Facility. Tests will evaluate projectile performance at ranges exceeding 25nmi.
- Complete repeatability testing of the 120mm ETC tank gun cartridge with advanced colayered propellants to achieve 14MJ muzzle energy performance in the M256 tank gun. Complete assessment and evaluation of the selected ETC tank cartridge to understand the impacts of operational temperature (-25°F to 125°F) extremes on gun performance. Investigate mitigation techniques, potentially available using ETC plasma ignitors, to overcome temperature-induced performance degradations.
- Complete 120mm ETC cartridge program.
- Initiate ETC 155mm Artillery charge development program to adapt ETC ignitor designs to the 155mm Modular Artillery Charge (MAC) propulsion system to evaluate theorized significant operational performance enhancements. This phase will evaluate the ability to use ETC ignition for both a single as well as multiple MAC cartridge components.
- Initiate relocation of the Green Farm Electric Gun R&D Facility so as to vacate Marine Corps Air Station Miramar (due to BRAC realignment) by 30 Sep 99. Maintain EM gun firing operations until Dec 98 in support of the US/UK program and ETC phenomenology and gun testing operations until Jun 99. Determine destination and begin preparation for the new site location.
- Complete isotopic inventories for reprocessing facilities.

Project AC - Weapons Systems Lethality (cont'd)

Integrate reprocessing facility into HPAC to assess hazards from these facilities due to attack, accident or incident.

Deliver radiological weapon operational module to HPAC.

US/Allied Survivability and Operability in Nuclear/Special Weapon Environments ($270K)

Update analysis tool for STRATCOM to assess aircraft dust survivability for planned SIOP routes.

Test and Simulation ($1,354K)

Validate height-of-burst airblast environments for models used in the STRATCOM PDCALC tool using advanced Adaptive Mesh Refinement (AMR) computational code.

Execute laboratory scale fireball-in-tunnel nuclear simulation with PHAROS laser system.

FY 2000 Plans

Nuclear Weapons Effects Phenomenology ($8,143K)

Distribute completed Volume 2 of Nuclear Weapon Manual & Output Handbook. Complete advanced technical threat volume.

Deliver SHAPE/NATO integrated nuclear Munitions Effects Assessment (MEA)/Hazard Prediction Assessment Capability, version 3.0.

Deliver STRATCOM microphysics based fall out model.

Complete analysis of the geology of three additional sites.

Upgrade EMPVN Model for specific WMD Targets.

Upgrade and transfer SREMPTAPS Smart System for WMD Target Planning

Develop end-to-end Targeting Models of WMD for the simulated nuclear EMP stress on Targets via the new initiative.

Complete the development of STRATCAT Tool and transfer the tool to CINC commands.

Develop Shock Acceleration Model for nuclear burst pumped Radiation Belts.

Technical Information ($1,263K)

Update 2 chapters of Effects Manual-1 (EM-1).

Convert 5 new chapters in EM-1 Manual to be electronically interactive.

Project AC - Weapons Systems Lethality (cont'd)

Applications of Nuclear Weapons Expertise ($16,375K)

- Develop and integrate MEA for application of nuclear weapons to defeat WMD targets, agents and material.
- Develop both physical/functional defeat models for enhanced warhead concepts such as high temperature incendiary.
- Integrate RF detection device ("Witness Chip") into existing Commercial Off-the-Shelf (COTS) and MILSPEC equipment.
- Develop advanced solid state techniques for microwave production.
- Develop advanced cathode and power supply technologies for microwave production.

Weapon Target Interaction ($8,634K)

- Produce a final CD-ROM revision of the DAHS manual and complete work on an update to PSADS based on state-of-the-art technology.
- Execute validation tests for complex blast and blast/fragment damage models within MEA to support DTO WE 57.
- Exploiting computing advances, develop an Advanced Lethality Tool (ALT) which brings advanced numerical techniques for end-to-end solutions of WMD related attack/planning scenarios.
- Deliver ICWC 1.0 to the warfighter that integrates the first set of weaponeering tools. Demonstrate the use in an operational exercise. Initiate ICWC 2.0 to add additional tools.
- Develop/deliver a MEA tunnel module to support the Tunnel Defeat Demonstration.
- Complete final phase of the testing and analysis to define the vulnerability of C3I components and sub-systems found in former Soviet Block high value fixed targets.
- Upgrade IMEA module to support SOCOM requirements.
- Extend IMEA to meet the requirements of the CP2 ACTD and the hard target defeat demonstration.
- Update IMEA nuclear weapons module.
- Develop and update weapons effects and fragility models for incorporation into IMEA.

Project AC - Weapons Systems Lethality (cont'd)

- Develop models for the Conventional Air Launched Cruise Missle (CALCM) warheads for incorporation into IMEA.
- Update anti-terrorism planning software for force protection assessments.
- Provide technical support for the bilateral MOU between the U.S. and the German Ministry of Defense.
- Provide engineering support to DIA and the J2T for BDA analysis during contingencies.
- Provide conventional weapons effects tests and analysis support for FBI anti-terrorism programs.
- Conduct vulnerability assessments of U.S. Government facilities in the National Capital area.
- Conduct vulnerability assessments of U.S. embassies abroad for the State department as requested.
- Assist in update of IMEA training program.
- Maintain validation verification and accreditation of IMEA through JTCG/ME.
- Develop version 2.0 of PSADS.
- Develop version 2.0 of DAHS CWE.
- Apply meshless methods to target response problems.
- Provide high-fidelity vulnerability assessments for deployed sites and high priority CONUS sites.
- Deliver combined lethality and hazard prediction module for nuclear power reactors in HPAC.
- Deliver a nuclear weapon accident hazard module for HPAC.

Test and Simulation ($1,365K)

- Demonstrate HE charge design for tunnel airblast simulation.
- Execute proof-of-principle nuclear airblast in tunnel simulation at the Army Waterways Experiment Station.
- Begin second in a series of three tunnel complexes to be used in the Hard Target Defeat Program.

Project AC - Weapons Systems Lethality (cont'd)

FY 2001 Plans

Weapons Effects Phenomenology ($8,302K)

- Complete Full Consequences Assessment of Nuclear Terrorism Urban Scenario.
- Update Geological and Material Properties Characterization Capabilities based on First Model Target Data.
- Update assessment of 2 and 3 Dimensional weapons output estimates for critical weapons capabilities.

Technical Information ($1,286K)

- Update 2 chapters of Effects Manual-1 (EM-1).
- Convert 5 new chapters in EM-1 manual to be electronically interactive.

Application of Nuclear Weapons Expertise ($16,799K)

- Develop an enhanced warhead module for MEA that incorporates both physical/functional damage to targets, components, and WMD material.
- Transfer proven COTS hardware kit, which provides easy-to-install devices and simple techniques to harden COTS computers against RF threats.
- Integrate advanced cross field amplifier tube design and improved subsystems into HPM technology demonstrator.

Weapon Target Interaction ($8,758K)

- Build an MEA module for the vulnerability of former Soviet Block C3I components.
- Complete validation database for synergistic weapon effects. Develop appropriate lethality models and implement into MEA.
- Demonstrate ICWC 2.0 during a mini-exercise that supports the CP2 ACTD which has integrated additional tools and enhanced functionality.
- Execute system level validation test that includes realistic WMD components to validate MEA modules.
- Validate the Advanced Lethality Tool (ALT) using precision small scale tests for end-to-end solutions of WMD related attack/planning scenarios.
- Update models for optimized dual delivery of weapons for incorporation into IMEA.

Project AC - Weapons Systems Lethality (cont'd)

- Upgrade IMEA module to support SOCOM requirements.
- Extend IMEA to meet the requirements of the CP2 ACTD and the hard target defeat demonstration.
- Update IMEA nuclear weapons module to include tunnel defeat.
- Develop and update weapons effects and fragility models for incorporation into IMEA.
- Develop models for High Temperature Incendiary weapons for incorporation into IMEA.
- Update anti-terrorism planning software for force protection assessments.
- Provide technical support for the bilateral MOU between the USAF and the German Ministry of Defense.
- Provide engineering support to DIA and J2T for BDA analysis during contingencies.
- Provide conventional weapons effects tests and analysis support for FBI anti-terrorism programs.
- Conduct vulnerability assessments of U.S. Government facilities in the National Capital area.
- Conduct vulnerability assessments of U.S. embassies abroad for the State department as requested.
- Assist in update of IMEA training program.
- Maintain validation verification and accreditation of IMEA through JTCG/ME.
- Deliver a combined lethality and hazard prediction model for nuclear fuel production reactors.
- Deliver a radiological accident and hazard module for HPAC.
- Publish version 2.0 of PSADS. Publish version 2.0 DAHS CWE.

Test and Simulation ($1,186K)

- Complete initial assessment of predictions and data for full-scale nuclear simulation tests at NTS.
- Complete second tunnel complex in support of the Hard Target Defeat Program.

Project AE - Weapon Safety and Operational Support - This project is critical to the maintenance of a safe, secure and reliable nuclear deterrent, given that the enduring stockpile will retain weapons far beyond their designed life. Stockpile support efforts in this project include nuclear weapons stockpile technology for weapon systemsustainment, probabilistic risk-based system safety assessments, and nuclear physical security policy/requirements validation. Reliability efforts include participation and assistance to Dual Revalidation, Annual Certification, and the Stockpile Stewardship Program. This project performs research and development in support of nuclear contingency planning, force structure deployment and employment options, innovative nuclear command and control concepts, nuclear mission planning, vulnerability assessments, safety assessments, advanced survivability concepts, and theater missile defense against Weapons of Mass Destruction (WMD) delivery systems and warheads. Vulnerability assessments of DoD and Allied fixed and mobile Command, Control and Communications (C3) assets subjected to WMD effects are also part of this project. This project includes the Modeling and Simulation Center, which provides integration of weapons effects, downwind hazard prediction models and force effectiveness models to users in acquisition, training, exercises, operations other than war, and warfighting. Oversight, technical support and curriculum review for the Defense Nuclear Weapons School (DNWS) and other DoD nuclear training activities are also provided. This project is in direct support of Presidential Decision Directives andtaskings and requirements from OSD, the Joint Staff and CINCs. Relevant directives include National Security Strategy of Engagement and Enlargement, National Security Science and Technology Strategy, National Military Strategy, Joint Strategic Capabilities Plan, Presidential Decision Directives, Defense Planning Guidance, and prioritization memorandums from CINCs. These efforts have been closely coordinated with Joint Staff, OSD offices, CINCs and Services, Department of Energy, Federal Emergency Management Agency and the Federal Bureauof Investigation. The thrust of this project supports the JCS Joint Vision 2010 Warfighting Capabilities of Dominant Maneuver, Precision Engagement, and Full-Dimensional Protection.

Project AE - Weapon Safety and Operational Support (cont'd)

FY 1998 Accomplishments

Nuclear Operations ($16,313K)

- Completed the analysis of monomethylhydrazine (hypergolic) propellant for Minuteman III.
- Continued the safety assessment of the B-52H aircraft.
- Continued the safety assessment of the Minuteman III missile system.
- Continued safety assessment for dual capable fighter aircraft to define operational risk management inputs and ensure USAFE nuclear capable weapon systems availability.
- Provided safety assessment support to the Nuclear Weapons Council (NWC), ATSD(NCB), STRATCOM, Services, and Project Officer's Group.
- Continued experimental testing to develop a technology base for mechanical impacts of fuel fire, energetic materials and electrical/lightning.
- Completed the study on the development of an interface between the Air Vehicle Planning System (APS) and service planning systems such as Tactical Aircraft Mission Planning System (TAMPS), NATO Nuclear Planning System (NNPS), and US/NATO intelligence systems.
- Continued an adaptive planning system software program to develop a deployable strategic planning capability for STRATCOM and initiated a modernized software interface between data collection sources and the Nuclear Planning and Execution System (NPES).
- Completed the development of a replacement message/data handling spooler for the NPES. Cooperative effort with STRATCOM, JCS J38, and DISA.
- Completed development of prototype computer-based training capability for nuclear staff planners, emphasizing adaptive nuclear planning.

Project AE - Weapon Safety and Operational Support (cont'd)

- Continued development of the nuclear planning system target data feed which provides intelligence planning data in support of NATO.
- Completed the development of a methodology for STRATCOM, which includes the impact of fallout effects in achieving effective denial or delay of enemy access to key installations as a result of a nuclear strike.
- Continued to provide analytical support to assess STRATCOM's capability to effectively meet national objectives involving the SIOP while reducing its complexity.
- Utilized an analytical framework that facilitates alternative WMD deterrence approaches to the needs of multi-regional scenarios.
- Continued to provide quick turn analysis on WMD consequence issues for OSD, Services, and Joint Staff and provided weapons effects analysis to Project Officer's Groups and weapons modifications program as required.
- Began development of an integrated reporting system for automated reporting of Nuclear, Biological and Chemical (NBC) activity and hazard predictions.
- Provided support to the CINC planning staffs on NBC capability and impacts on warfighting capability.
- Developed mission and consequence analysis for HQ Air Combat Commands (ACC's) Agent Defeat Weapon phase studies and Analysis of Alternatives (AOAs).
- Trained and provided analysis support teams for each CINC in support of their counterproliferation development missions.

Education/Training to Maintain Core Competencies ($1,038K)

- Provided nuclear operational training support to CINCs, Services, and OSD.
- Continued development of general interest DoD nuclear training program.
- Continued development, improvement, and integration of course materials for the Defense Nuclear Weapons School (DNWS).
- Supported DoD and CINC exercises and wargames with WMD/target response analysis.

Nuclear Weapons Stockpile Programs ($379K)

- In support of stockpile stewardship and reliability, continued Agency participation in, and support to, the Dual Revalidation program with research, technical analysis, and assessment reports.

Project AE - Weapon Safety and Operational Support (cont'd)

- Provided technical support, progress reports and recommendations to ATSD(NCB), Joint Staff, Services, STRATCOM and other Combatant Commanders as required related to weapons safety, reliability and performance.
- Provided support to the Annual Certification program and to the service weapons life-extension programs.
- Developed a collection of historical development documents on CD-ROM related to sustainment of DoD nuclear weapon delivery platforms.

Modeling and Simulation ($2,479K)

- Increased Agency Modeling and Simulation (M&S) Center capability with a broadband (DS-3) global networking circuit and an operational INTEL-S node.
- Continued integration of WMD modules into campaign level analytical and assessment models.
- Provided technical and operational consequence analysis support for exercises and wargames.
- Continued Analysis and Assessments Phase II contract to provide real-time support to Services through enhanced infrastructure, deployment teams, integrated models, and technical support.
- Updated and refined support database per CINCs, Services and Joint Staff guidance and continued development of consequence analysis of WMD counterproliferation programs.
- Continued development of Extended Air Defense Simulation (EADSIM) based scenarios for additional studies to support STRATCOM requests.
- Integrated Agency weapons effects codes into Common Operational Modeling, Planning and Simulation Strategy (COMPASS) program.
- Published classified and unclassified M&S Center web page.
- Continued support of Director of Military Support (DOMS) and USMC/Chemical Biological Incident Response Force with hazard prediction and consequence assessments regarding military/domestic threats involving WMD.

Project AE - Weapon Safety and Operational Support (cont'd)

Nuclear Weapons Effects Phenomenology ($1,333K)

- Delivered an operational, automated, adaptive, user-friendly, high resolution 36-hour weather forecast capability in-theater for the CINCs and Services, for hazard prediction, specifically Hazard Prediction and Assessment Capability (HPAC) users.

US/Allied Survivability & Operability in Nuclear/Designated Advanced Weapons Environments ($5,093K)

- Delivered subsystem vulnerabilities guide to support CINCs and intelligence community in functionally defeating hard and deeply buried targets.
- Conducted Balanced Survivability and Integrated Vulnerability Assessments as tasked by CINCs and DoD Agencies.
- Developed and applied sensor technology for target characterization and battle damage assessments.
- Developed functional defeat effectiveness computation tool.

Weapon/Target Interaction ($1,665K)

- Integrated additional Agency peculiar weapon effects and target response models into High Level Architecture (HLA) and CINC planning tools.
- Integrated weapons effects and target response models in a live virtual and constructive environment which can be visualized for training, exercises and Bomb Damage Assessment using weapons effects Federates to satisfy customer requirements.

FY 1999 Plans

Nuclear Operations ($16,843K)

- Complete the safety assessment for the dual capable fighter aircraft in Europe.
- Complete the safety assessment of the B–52H aircraft.
- Begin B-2 ongoing Weapon System Safety Assessment (WSSA) at the request of the Air Force Safety Center.
- Analyze and quantify DoE Nuclear Detonation Safety Exceptions (NDSEs).
- Conduct Fuel Fire Modeling and Testing to support ongoing WSSAs.
- Begin Weapon Storage Vault Blast Testing.

Project AE - Weapon Safety and Operational Support (cont'd)

- Develop a WSSA data base to archive completed WSSAs.
- Begin storage vault blast effects testing and analysis at the request of the Air Force Safety Center.
- Conduct Forces Support nuclear and WMD technical analyses as required by OSD, Services, Joint Staff, and NWC on force structure, weapons safety and security, theater missile defense, counterproliferation, planning, and international military and political security issues.
- Conduct technical analyses to support CINCs, concerning nuclear and WMD operational force planning, counterproliferation, nuclear forces, command and control, and regional security issues in light of the changing international security environment.
- Complete an adaptive planning system software program to develop a deployable strategic planning capability for STRATCOM and initiate a modernized software interface between data collection sources and NPES. Accept and test the first incremental delivery of the NPES.
- Complete and transition the nuclear planning system target data feed which provides intelligence planning data in support of NATO.
- Complete analytical support assessing STRATCOM's capability to effectively meet national objectives involving the Single Integrated Operations Plan (SIOP) while reducing its complexity.
- Continue utilization of the analytical framework that facilitates alternative WMD deterrence approaches to the needs of multi-regional scenarios.
- Conduct an annual force-on-force exercise to evaluate and validate policy standards as designated by the Security Policy Verification Committee (SPVC).
- Continue to provide quick turn analysis on WMD consequence issues for OSD, Services, and Joint Staff and provide weapons effects analysis to weapons Project Officer's Groups and weapons modification programs as required.
- Continue development of an integrated reporting system for automated reporting of NBC activity and hazard predictions.

Project AE - Weapon Safety and Operational Support (cont'd)

- Provide support to the CINC planning staffs on NBC capability and impacts on warfighting capability.
- Develop mission and consequence analysis for HQ ACC's Agent Defeat Weapon phase studies and Analysis of Alternatives (AOAs).

Education/Training to Maintain Core Competencies ($1,038K)

- Provide nuclear operational training support to CINCs, Services, and OSD.
- Continue development of general interest DoD nuclear training program.
- Continue development, improvement, and integration of course materials for the DNWS.
- Support DoD and CINC exercises and wargames with WMD/target response analysis.
- Expand expertise outreach program to OSD and War Colleges.
- Initiate a nuclear/WMD "train-the-trainer" program for the DNWS.
- Provide vulnerability assessment training to critical infrastructure components.

Nuclear Weapons Stockpile Programs ($537K)

- In support of stockpile stewardship and reliability, continue participation in, and support to, the Dual Revalidation program with research, technical analysis, and assessment reports.
- Provide technical support and recommendations to OSD, Joint Staff, Services, STRATCOM and other Combatant Commanders related to weapons safety, reliability, and performance.
- Continue support to the Annual Certification program and support to the service weapons life-extension programs.
- Provide management and technical support to DoD programs for sustainment of the nuclear deterrent, to include development of a DoD-wide Nuclear Mission Management Plan (NMMP).

Modeling and Simulation ($3,464K)

- Upgrade and refine operations of the M&S Center.
- Continue integration of the lethality tool set with weather modules, underground target data, and the effects of enhanced payloads.

Project AE - Weapon Safety and Operational Support (cont'd)

- Continue technical and advanced M&S support to CINC sponsored exercises world-wide.
- Provide an integrated program for analysis and testing of alternate strategies, force employment options and technologies.
- Continue to provide technical and operational consequence analysis support for exercises and wargames.
- Include WMD use and effects in a joint theater-level simulation.
- Implement the Analysis and Assessments program to provide real-time support to Services through enhanced infrastructure, deployment teams, integrated models, and technical support.
- Update and refine support database per CINCs, Services, and Joint Staff guidance and continue development of consequence analysis of WMD counterproliferation programs.
- Establish permanent (virtual) presence at the Joint Warfare Simulation Center (JWARS) and Joint Simulation System (JSIMS).
- Continue to develop EADSIM based scenarios for additional studies to support STRATCOM requests.

Nuclear Weapons Effects Phenomenology ($1,171K)

- Transition 36-hour weather forecast modeling capability to the CINCs and Services for use in WMD consequence predictions.
- Integrate the services global and regional scale models with in-theater high resolution capability to provide seamless weather input for hazard prediction assessment from continental to local scale.

US/Allied Survivability & Operability in Nuclear/Designated Advanced Weapons Environments ($5,754K)

- Conduct Balanced Survivability and Integrated Vulnerability Assessments on DoD facilities as tasked by CINCs, Joint Staff, and OSD.
- Assist CINCs and Intelligence community in target planning against hard and deeply buried facilities.

Project AE - Weapon Safety and Operational Support (cont'd)

- Conduct integrated vulnerability assessments of defense and critical national infrastructure facilities.
- Apply sensor technology for target detection, target characterization and battle damage assessments.

Weapon/Target Interaction ($1,364K)

- Develop visualization tools for weapon effects models that are compatible with the High Level Architecture (HLA).
- For a particular legacy model or simulation, continue to define a Simulation Object Model (SOM), integrate the Runtime Infrastructure (RTI) and HLA functionality into that model, and transform the model's data structure into the SOM data representation.
- Establish a Weapons Effects Federation Object Model to allow interaction between SOMs and to effect the passing of weapons effects data between simulations.

FY 2000 Plans

Nuclear Operations ($17,105K)

- Continue B-2 WSSA.
- Analyze and Quantify DOE NDSEs.
- Conduct Fuel Fire Modeling and Testing to support ongoing WSSAs.
- Continue the development and population of the WSSA data base to archive completed WSSAs.
- Transition Aircraft Crash into Structures (ACCIS) risk analysis code to fast running format.
- Complete Storage Vault Blast Effects Testing and Analysis.
- Conduct Forces Support nuclear and WMD technical analyses as required by OSD, Services, Joint Staff, and NWC on force structure, weapons safety and security, theater missile defense, counterproliferation, planning and international military and political security issues.

Project AE - Weapon Safety and Operational Support (cont'd)

- Conduct technical analyses to support CINCs concerning nuclear and WMD operational force planning, counterproliferation, nuclear forces, command and control, and regional security issues in light of the changing international security environment.
- Continue utilization and refinement of the analytical framework that facilitates alternative WMD deterrence approaches to the needs of multi-regional scenarios.
- Provide analytical support in assessing STRATCOM's capability to effectively meet national objectives involving the SIOP based on potential changes to the threat, national policy, and force structure.
- Conduct an annual force-on-force exercise to evaluate and validate policy standards as designated by the SPVC.
- Continue to provide quick turn analysis on WMD consequences issues for OSD, Services, and Joint Staff and provide weapons effects analysis to weapons Project Officer's Groups and weapons modification programs as required.
- Continue development of an integrated reporting system for automated reporting of NBC activity and hazard predictions.
- Provide support to the CINC planning staffs on NBC capability and impacts on warfighting capability.
- Develop mission and consequence analysis for HQ ACC Agent Defeat Weapon phase studies and AOA's.
- Continue to provide analysis to the CINCs in support of their counterproliferation development missions.

Education/Training to Maintain Core Competencies ($1,046K)

- Provide nuclear operational training support to CINCs, Services, and OSD.

Project AE - Weapon Safety and Operational Support (cont'd)

Continue development of general interest DoD nuclear training program.
Continue development, improvement, and integration of course materials for the DNWS.
Support DoD and CINC exercises and wargames with WMD/target response analysis.
Continue expanding expertise outreach program to OSD and War Colleges.
Continue the nuclear/WMD "train-the-trainer" program for the DNWS.

Nuclear Weapons Stockpile Programs ($1,000K)

In support of stockpile stewardship and reliability, continue participation in, and support to, the Dual Revalidation program with research, technical analysis, and assessment reports.
Provide technical support and recommendations to OSD, Joint Staff, Services, STRATCOM and other Combatant Commanders related to weapons safety, reliability, and performance.
Continue support to the Annual Certification program and support to the service weapons life-extension programs.
Provide management and technical support to DoD programs for sustainment of the nuclear deterrent update NMMP as directed.

Modeling and Simulation ($4,570K)

Upgrade and refine operations of the M&S Center.
Continue integration of the lethality tool set with weather modules, underground target data, and the effects of enhanced payloads.
Continue technical and advanced M&S support to CINC sponsored exercises world-wide.
Provide an integrated program for analysis and testing of alternate strategies, force employment options and technologies.
Continue to provide technical and operational consequence analysis support for exercises and wargames.
Include WMD use and effects in a joint theater-level simulation.

Project AE - Weapon Safety and Operational Support (cont'd)

- Implement the Analysis and Assessments program to provide real-time support to Services through enhanced infrastructure, deployment teams, integrated models, and technical support.
- Update and refine support database per CINCs, Services, and Joint Staff guidance and continue development of consequence analysis of WMD counterproliferation programs.
- Maintain permanent (virtual) presence at the JWARS and JSIMS.
- Continue to develop EADSIM based scenarios for additional studies to support STRATCOM requests.

Nuclear Weapons Effects Phenomenology ($1,030K)

- Complete uncertainty information for weather models to HPAC to provide best estimate hazard and how good they are to the warfighter.

US/Allied Survivability & Operability in Nuclear/Designated Advanced Weapons Environments ($5,643K)

- Conduct Balanced Survivability and Integrated Vulnerability Assessments on DoD facilities as tasked by CINCs, Joint Staff, and OSD.
- Assist CINCs and Intelligence community in target planning against hard and deeply buried facilities.
- Conduct integrated vulnerability assessments of defense and critical national infrastructure facilities.
- Apply sensor technology for target detection, target characterization and battle damage assessments.

Weapon/Target Interaction ($1,309K)

- Develop visualization tools for weapon effects models that are compatible with the HLA.
- For a particular legacy model or simulation, continue to define a Simulation Object Model (SOM), integrate the Runtime Infrastructure (RTI) and HLA functionality into that model, and transform the model's data structure into the SOM data representation.

Project AE - Weapon Safety and Operational Support (cont'd)

FY 2001 Plans

Nuclear Operations ($17,676K)

- Complete B-2 at request of the Air Force Safety Center.
- Continue Fuel Fire Modeling and Testing to support ongoing WSSAs.
- Continue population of WSSA data base to archive completed WSSAs.
- Analyze and quantify DoE NDSEs.
- Conduct Forces Support nuclear and WMD technical analyses as required by OSD, Services, Joint Staff, and NWC on force structure, weapons safety and security, theater missile defense, counterproliferation, planning and international military and political security issues.
- Conduct technical analyses to support CINCs concerning nuclear and WMD operational force planning, counterproliferation, nuclear forces, command and control, and regional security issues in light of the changing international security environment.
- Continue utilization of the analytical framework that facilitates alternative WMD deterrence approaches to the needs of multi-regional scenarios.
- Provide analytical support in assessing STRATCOMs capability to effectively meet national objectives involving the SIOP based on potential changes to the threat, national policy, and force structure.
- Initiate study for requirements development to integrate the Air Vehicle Planning System, as the aircraft and cruise missile nuclear planning system, with the NPES.
- Conduct an annual force-on-force exercise to evaluate and validate policy standards as designated by the SPVC.
- Continue to provide quick turn analysis on WMD consequences issues for OSD, Services, and Joint Staff and provide weapons effects analysis to weapons Project Officer's Groups and weapons modification programs as required.

Project AE - Weapon Safety and Operational Support (cont'd)

- Continue development of an integrated reporting system for automated reporting of NBC activity and hazard predictions.
- Provide support to the CINC planning staffs on NBC capability and impacts on warfighting capability.
- Develop mission and consequence analysis for HQ ACC Agent Defeat Weapon phase studies and AOA's.
- Continue to provide analysis to the CINCs in support of their counterproliferation development missions.

Education/Training to Maintain Core Competencies ($1,150K)

- Provide nuclear operational training support to CINCs, Services, and OSD.
- Continue development of general interest DoD nuclear training program.
- Continue development, improvement, and integration of course materials for the DNWS.
- Support DoD and CINC exercises and wargames with WMD/target response analysis.
- Continue expanding expertise outreach program to OSD and War Colleges.
- Continue the nuclear/WMD "train-the-trainer" program for the DNWS.

Nuclear Weapons Stockpile Programs ($1,000K)

- In support of stockpile stewardship and reliability, continue participation in, and support to, the Dual Revalidation program with research, technical analysis, and assessment reports.
- Provide technical support and recommendations to OSD, Joint Staff, Services, STRATCOM and other Combatant Commanders related to weapons safety, reliability, and performance.
- Continue support to the Annual Certification program and support to the service weapons life-extension programs.
- Provide management and technical support to DoD programs for sustainment of the nuclear deterrent update NMMP as directed.

Modeling and Simulation ($5,054K)

- Upgrade and refine operations of the M&S Center.

Project AE - Weapon Safety and Operational Support (cont'd)

- Continue integration of the lethality tool set with weather modules, underground target data, and the effects of enhanced payloads.
- Continue technical and advanced M&S support to CINC sponsored exercises world-wide.
- Provide an integrated program for analysis and testing of alternate strategies, force employment options and technologies.
- Continue to provide technical and operational consequence analysis support for exercises and wargames.
- Include WMD use and effects in a joint theater-level simulation.
- Implement the Analysis and Assessments program to provide real-time support to Services through enhanced infrastructure, deployment teams, integrated models, and technical support.
- Update and refine support database per CINCs, Services, and Joint Staff guidance and continue development of consequence analysis of WMD counterproliferation programs.
- Maintain permanent (virtual) presence at the JWARS and JSIMS.
- Continue to develop EADSIM based scenarios for additional studies to support STRATCOM requests.

Nuclear Weapons Effects Phenomenology ($1,061K)

- Provide weather models, capable of producing 36-hour forecasts, for high-resolution hazard prediction (1 km) in 4 hours to meet required operational tempo.

US/Allied Survivability & Operability in Nuclear/Designated Advanced Weapons Environments ($6,797K)

- Conduct Balanced Survivability and Integrated Vulnerability Assessments on DoD facilities as tasked by CINCs, Joint Staff, and OSD.
- Assist CINCs and Intelligence community in target planning against hard and deeply buried facilities.
- Conduct integrated vulnerability assessments of defense national and critical infrastructure facilities.

Project AE - Weapon Safety and Operational Support (cont'd)

Apply sensor technology for target detection, target characterization and battle damage assessments.

Weapon/Target Interaction ($1,191K)

Develop visualization tools for weapon effects models that are compatible with the HLA.

For a particular legacy model or simulation, continue to define a Simulation Object Model (SOM), integrate the Runtime Infrastructure and HLA functionality into that model, and transform the model's data structure into the SOM data representation.

Project AF - Weapon System Operability - Current and future warfighters and weapon systems, including the associated Command, Control, Communications, Computers and Intelligence (C4I) and support systems/equipment, must be able to tolerate and operate effectively through a spectrum of hostile environments. Planned efforts emphasize the development and demonstration of innovative and cost effective technologies to sustain the operability of U.S. and Allied Forces and systems to advanced conventional weapons, special weapons and limited nuclear attack. The military systems of interest include those that support military missions in the air, on land, at sea, or in space.

This project constitutes the DoD's resident science and technology expertise in nuclear and related operability matters. It develops and demonstrates affordable strategies and hardening technologies for U.S. systems; transfers the technical products toacquisition program offices; conducts component, subsystem, system and end-to-end performance tests and assessments as requested by the Services and CINCs; and provides support to the Office of the Secretary of Defense on technical and policy matters that relate to the acquisition of survivable systems and strategic system sustainment. Specific programs in the project include: development and demonstration of the enabling technologies for ensuring the continued availability of special materials and radiation tolerant microelectronics and photonic devices; development and demonstration of affordable hardening and mitigation methods that treat the adverse effects from electromagnetic, natural space and nuclear weapons engendered radiation (i.e., ionizing radiation and displacement damage), nuclear electromagnetic pulse (EMP), high power microwave (HPM) and nuclear atmospheric environments; direct support to warfighters by predicting and quantifying the operational impact of nuclear, biological and chemical (NBC) and conventional battlefield environments on systems and personnel; development and demonstration of cost effective system design and test certification techniques for testable hardware that do not require underground nuclear tests; methods for measuring
and increasing soldier effectiveness on NBC battlefields; performance and cost analysis to support the Defense Acquisition Board; and joint efforts with system program offices to apply the Agency's expertise and technologies to specific Service applications.

Project AF - Weapon System Operability (cont'd)

This project provides the testable system design rules and protocols for users of nuclear effects simulators that are funded in Project AB. It also supports the following JCS Joint Warfighting Capabilities: Information Superiority, Counterproliferation, Electronic Warfare, and Precision Force.

FY 1998 Accomplishments

Nuclear Weapons Effects Phenomenology ($11,778K)

- Supported Air Force Office of Testing and Evaluation Center (AFOTEC) Space Based Infrared Satellite (SBIRS) Low Earth Orbit (LEO) COMM link evaluation (continuing into 1999).
- Developed and integrated fast running detailed radar model into System Planning Intercept Evaluation Tool-DSWA (SPIET-D).
- Included Jammer model into Communication Link testing Code (COMLNK) simulations of satellite communications systems.
- Continued Optical Environment Support to SBIRS Program.
- Distributed new releases of Nuclear Optical Radar Simulation Environment (NORSE97) and Advanced Systems Survivability Integrated Simulation Tool Set (NORSE/ASSIST) and initial development of Nuclear Simulation (NUCSIM) Nuclear Weapons Effects (NWE) codes.
- Reviewed Russian EMP test data and developed a framework for an EMP Vulnerability Number (EMPVN) model and Source Region EMP Targeting & Planning System (SREMPTAPS) "smart system" for target planning design.
- Developed an initial NWE Human Response Simulation.
- Completed development of a new browser-based software tool Integrated Nuclear Computational Tools (INCA) to be used to calculate six different direct nuclear effects including EMP.

Project AF - Weapon System Operability (cont'd)

- Completed the development of Strategic C4 Assessment Tool (STRATCAT) Version 2 as a top level, quick C3I Assessment Tool and installed on STRATCOM's Top Secret LAN System.

US/Allied Survivability & Operability in Nuclear/Special Weapon Environments ($16,694K)

- Initiated capture of Underground Test (UGT) and Aboveground Test (AGT) structural response data for missiles and reentry vehicles.
- Upgraded testable hardware protocols based on validation testing of sensor subsystems in nuclear environments.
- Tested radiation- and laser- hardened rugate rejection filters.
- Upgraded spacecraft missile design and test protocols.
- Continued testing for validation of sensor design and test protocols.
- Continued development and evaluation of low-level radiation standards and equipment for NATO review.
- Completed new standards for operations in low-level radiation environments.
- Continued development and evaluation of low-level radiological instrumentation support for warfighters/peacekeepers operating in post-Cold-War settings (i.e., <70 rem scenarios).
- Began development of first ever fly-away dosimetry lab.
- Initiated evaluation of the end-to-end operability of National Missile Defense (NMD)/Theater Missile Defense (TMD) architectures/elements in a nuclear-disturbed environment.
- Demonstrated ability to validate nuclear hardness of satellite/interceptor systems by testing at less than system threat levels.
- Completed operability assessment of the North American Air Defense (NORAD)/U.S. Space Command (USSPACECOM) Tactical Warning/Attack Assessments (TW/AA) System as it transitions to MILSTAR and SBIRS.
- Completed optical rugate filter radiation and laser testing to develop a first pass material response model.

Project AF - Weapon System Operability (cont'd)

- Demonstrated affordable EMP/HPM design and test technologies, developed system hardening technology against advanced HPM techniques, and continued assessment and testing of critical fixed-ground-based C4I facilities.
- Updated High Altitude Electromagnetic Pulse (HEMP) protection/test standards.
- Updated software depicting HEMP field contours.
- Performed initial demonstration of radiation-tolerant, 16-megabit Static Random Access Memory (SRAM) integrated circuit technology required by USAF and Ballistic Missile Defense Organization (BMDO).

Radiation-Hardened Microelectronics, Materials, and Photonics ($14,791K)

- Completed test and evaluation of radiation-hardened analog and digital microelectronics.
- Demonstrated radiation-hardened 4M SRAM prototype.
- Evaluated advanced photonics and compound semiconductor technology for DoD space-based applications.
- Demonstrated radiation-hardened, ultra-low-power Silicon-on-Insulator (SOI) microelectronics technology in support of USN, USAF and BMDO requirements.

FY 1999 Plans

Nuclear Weapons Effects Phenomenology ($10,662K)

- Support AFOTEC SBIRS LEO COMM link evaluation.
- Continue Optical Environment Support to SBIRS Program.
- Upgrade SPIET-D version to include trapped radiation and HEMP effects.
- Support NMD analyses and development of System Requirement Document (SRD) and system operation in nuclear environments.
- Update ASSIST PC shell for phenomenology codes.
- Develop advanced versions of COMLNK, Radio Wave Propagation in a Structured Ionized Medium (PRPSIM) & Performance Simulation (PERSIM).
- Improve models for Short Wave Infrared Radiation (SWIR) optical emission predictions.

Project AF - Weapon System Operability (cont'd)

- Revise U.S.-NATO standard Radiation Transport Code to include distributed hazards.
- Upgrade INCA to include Source Region EMP and five other new nuclear weapons effects.
- Complete beta testing in the first quarter of FY 1999.
- Proof-of-concept Demonstration of EMPVN Model for Long lines connected Power and Telecommunications System of the Military.
- Develop Simulation & Modeling of EMP Targeting of WMD using coherent pulsed power and nuclear EMP Simulator Source based on air, land, and sea mobile platforms.
- Upgrade STRATCAT tool set for STRATCOM and for Regional Commands specific C3I assessment mission requirements.
- Upgrade the source region EMP target assessment and planning system (SREMPTAPS) to include new and war planners required weapon designs parameters.
- Develop 3-D Simulation of new Nuclear Weapon Effects (NEW) and Asymmetric Threat via SHYPS code using the DoD high performance computing (HPC) capability and in collaboration with Lawrence Livermore National Laboratory (LLNL).

US/Allied Survivability & Operability in Nuclear/Special Weapon Environments ($17,297K)

- Finalize configuration control electronics database for qualification testing.
- Begin development of protection technologies for sensor system hardening.
- Initiate development of circumvention and recovery implementations technology for hardened systems based on testable hardware protocols.
- Continue radiation response characterizations methodology for materials used in strategic systems.
- Complete AGT/UGT data search for missile and reentry vehicle materials/structures for strategic systems.
- Finalize sensor design and test protocols.
- Complete development and nuclear weapons exercise evaluation of first ever fly-away dosimetry lab.
- Initiate development of an end-to-end operability assessment tool for evaluation of families of systems in nuclear-disturbed environments.

Project AF - Weapon System Operability (cont'd)

- Continue development and evaluation of low-level radiological instrumentation support for war fighters/peacekeepers operating in post-Cold-War settings (i.e., <70 rem scenarios).
- Begin the evaluation of complex modeling and vulnerability testing results to reduce design margins in survivable systems.
- Complete HEMP test of Mobile Consolidated Command Center (MCCC).
- Circulate draft sampling identification of radiological agent standards for comment.
- Continue to assess the nuclear survivability of the NORAD/USSPACECOM Warfighting Support System (N/UWSS) architecture operability.
- Continue application of innovative, low-cost EMP/HPM hardening technology and propose candidate Electromagnetic standards and guidelines in accordance with the new technology.
- Continue assessment and testing of critical, fixed-ground-based and mobile C4I facilities.
- Evaluate the effects of non-ideal airblast on Army armored vehicles.

Radiation-Hardened Microelectronics, Materials, and Photonics ($16,562K)

- Demonstrate, test and evaluate a radiation-hardened, low-power 400K gate array for USAF.
- Demonstrate, test and evaluate radiation-hardened, 16M SRAM integrated circuit technology (e.g., $\leq$ 0.25 micron critical feature size) for USAF and BMDO.
- Demonstrate, test and evaluate a radiation-hardened 1m non-volatile memory using Giant Magneto Resistive (GMR) material for USAF and BMDO.
- Investigate and characterize single event effects in photonic devices and deep-submicron microelectronics for USAF and BMDO.
- Demonstrate radiation-hardened digital Electronic Design Automation (EDA) System for USAF and BMDO.
- Evaluate defects as a limiter to material response model.
- Complete assessment of NMD/TMD nuclear environment/survivability requirements.

Project AF - Weapon System Operability (cont'd)

Deliver nuclear, optical, and electronics analysis tool and guidelines for systems evaluation.

FY 2000 Plans

Nuclear Weapons Effects Phenomenology ($10,860K)

Support NMD analyses and development and system operation in nuclear environments.
Improve cell resolution for optical emission predictions.
Update early time Magnetohydrodynamic (MHD) Extended to Global Scale (MEGS) version for Collisionless MHD (CMHD) and Magnetic Containment Regime (MCR) replacement.
Support SBIRS and NMD system analysis and operational development.
Replicate Consequence Assessment Tool Set in non-DoD Emergency Operations Centers.
Implement STRATCAT: v.3 on STRATCOM TS LAN and Global Command and Control System (GCCS).
Update HEMP and Source Region EMP (SREMP) Vulnerability Number (VN) model for long-line coupled targets (Power & Telecom systems).
Implement HEMP and SREMPTAPS for DIA-specified potential threat weapons.
Integrate Nuclear Computational Tools (INCA) to run ten lethality models covered by all of the nuclear effects covered in INCA.
Upgrade EMPVN Model for specific WMD Targets.
Upgrade and transfer SREMPTAPS Smart system for WMD Target Planning.
Develop end-to-end Targeting Models of WMD for the simulated nuclear EMP stress on targets via the new initiative.
Complete the Development of STRATCAT Tool and transfer the tool to CINC Commands.
Develop Shock Acceleration Model for nuclear burst pumped Radiation Belts.

Project AF - Weapon System Operability (cont'd)

US/Allied Survivability & Operability in Nuclear/Special Weapon Environments ($17,854K)

- Continue to assess the nuclear survivability of the NORAD/USSPACECOM Warfighting Support System (N/UWSS) architecture operability, and evaluate its performance in nuclear-disturbed environments.
- Demonstrate integrated EMP/HPM test methods, techniques, and technologies that produce improvements over existing electromagnetic protection methodologies.
- Continue assessment and testing of critical national security assets.
- Upgrade non-upsettable processor controller for circumvention and recovery (C&R) for testable hardware protocol complementation.
- Develop Thermal Structural Response (TSR) test methodology for strategic systems.
- Begin development of Airborne Nuclear Survey system with Army using existing Army Radiation Detection Indication and Computation (RADIACs).
- Begin development of internal and biodosimetry functions of fly-away dosimetry lab.
- Assess NMD/TMD nuclear survivability testing and validation plans.
- Complete the evaluation of the combination of computer modeling and verification and validation to reduce design margins required for survivable systems.

Radiation-Hardened (RH) Microelectronics, Materials, and Photonics ($19,124K)

- Demonstrate qualified RH 4M SRAM for USAF and BMDO.
- Demonstrate RH deep submicron (0.18 micron) technology for very-low-power, ultra-large-scale integrated circuits (ULSIC), e.g., 4M gate array, etc., for USAF and BMDO.
- Test and evaluate photonics signal processing technology for USAF.
- Publish sampling and identification of radiological agents standards.
- Field a web-based version of consequence assessment tools for rapid assessment and initial detection teams.
- Demonstrate RH star tracker/visible imager.

Project AF - Weapon System Operability (cont'd)

FY 2001 Plans

Nuclear Weapons Effects Phenomenology ($11,061K)

- Provide support for future SPACECOM, STRATCOM and BMDO operational and developmental analyses.
- Develop advanced version of Antenna/Channel Impulse Response Function (ACIRF) and Communications Standards.
- Begin development of new, fast-running, all-altitude phenomenology for engagement modeling.
- Complete expanded/integrated human response algorithms for other than war effects/applications.
- Begin development of detailed Electron Injection Model for trapped radiation modeling.
- Upgrade STRATCAT: v.3 according to STRATCOM/J6 specified operational Final Operational Capability (FOC).
- Develop and test HEMP and SREMP VN models for STRATCOM hard target defeat program.
- Incorporate new targeting tool into INCA.

US/Allied Survivability & Operability in Nuclear/Special Weapon Environments ($18,314K)

- Continue to assess and evaluate the vulnerability of C4I systems exposed to nuclear disturbed environments.
- Transfer proven EMP/HPM hardware and software technologies and test techniques.
- Continue assessment and testing of critical national security assets.
- Complete development of airborne Nuclear Survey System with Army.
- Continue development of internal and biodosimetry functions of fly-away dosimetry lab.
- Develop nuclear environment injection software modules for integration with the hardware-in-loop (HWIL) facilities.

Project AF - Weapon System Operability (cont'd)

Radiation-Hardened Microelectronics, Materials, and Photonics ($21,847K)

Demonstrate RH 4M gate array for USAF and BMDO.
Demonstrate RH systems-on-a-chip (SOC) technology for USAF and BMDO.
Demonstrate prototype RH 16M SRAM Standard Evaluation Circuit for USAF.
Test and evaluate photonics wideband data transfer technology for USAF.
Provide model for thermal structural response of reentry vehicles.

Project AG—Scientific Computations & Information Systems. This project provides High Performance Computing (HPC), computational databases, information products, and advanced numerical models that enable the Agency's customers, researchers, and RDT&E contractors to answer questions about nuclear and advanced special weapons effects. Models, codes, and information products are developed to aid the design of experiments, predict types and levels of measurements required, establish system design requirements, assess performance, and provide system-specific predictions of weapons effects to DoD planners. Nuclear issues often require use of advanced computational resources, e.g., for investigation of the physics of weapon-target interactions, and for extrapolating test results into areas for which tests are no longer possible. This has required the development of a world-class high performance computing architecture with high bandwidth communications. This capability, currently with a hub at Los Alamos National Laboratory, is scheduled to transition to the new DoE and DoD HPC architecture over the FYDP. The Data Archival and Retrieval Enhancement (DARE) information system (a digital archive and retrieval system tailored to the specific needs of the researcher, the system designer, and developer) is supported by this project. This project funds the "Graybeard" efforts for collection of unique and potentially perishable nuclear data with appropriate prioritization based on technical value. The principal thrusts respond to warfighter requirements for survivable systems and effective weapons in the Joint Warfighting Technology Areas of Discriminate Attack, Global Reach, and Counterproliferation.

FY1998 Accomplishments

Nuclear Weapons Effects Phenomenology ($5,986K)

- Completed master plan for ionization and electromagnetic (EM) effects areas of Graybeard knowledge capture program. Initiated archival of electronics/environmental interaction test data.
- Provided scientific and technical information services and products as the DoD-wide repository for test photos, films, data, test records and other information products.

Project AG—Scientific Computations & Information Systems (cont'd)

- Continued revision of Glasstone's book, The Effects of Nuclear Weapons, the standard reference for nuclear weapons effects.
- Disseminated Science and Technology Digest.
- Reviewed, approved, and archived nuclear test data.
- Continued operation of web site providing radiation response of electronic parts.
- Hosted workshops on groundshock, thermal damage, structures damage to identify data locations, extent, and breakout of data commentary and workshop on vulnerability assessment methods.
- Completed compendium of nuclear weapon effect event objects.
- Continued development of master plan for thermo structural data review/commentary/archival.
- Continued development of master plan for biological data review/commentary/archival.

Infrastructure ($9,924K)

- Provided computer operations support through centralized CRAY resources. Provided continuous technical assistance for users of CRAY and other DoD High Performance Computing (HPC) platforms and high performance networks to supply display of supercomputer results.
- Continued DATACOM computational support by providing annual support for Wide Area Network.
- Provided broad-based science and technology Information Analysis Center research support.
- Continued computational support by providing annual support for the communication network and upgrade/acquire the network management equipment for the Agency hubsite.
- Integrated the Agency's network with the DoD's HPC Defense Research and Engineering Network (DREN) network.

Project AG—Scientific Computations & Information Systems (cont'd)

Applications of Nuclear Weapons Expertise ($692K)

- Provided Advanced Computational Methods support to the International Shockwave Congress and demonstrated the Agency's advanced modeling techniques.
- Concluded development of integrated nuclear weapons effects computational aids.
- Continued to develop and upgrade computational aids of nuclear weapons effects on various electronic media.
- Disseminated individual nuclear weapons effects computational aids.
- Concluded development and data inclusion to nuclear effects data management assessment system. Installed system on DARE and at the United Kingdom's Atomic Weapons Establishment.
- Provided Advanced Computational Methods support by validating code work on explicit radiation modeling.
- Continued combustion/afterburning modeling for incendiary devices.
- Validated advanced numerical models for complex flow/chemistry.
- Performed a numerical study for the Advanced Radio Frequency Payload concept in support of DoD programs.
- Provided Advanced Computational Support by hosting the International Shockwave Conference.
- Added a reactive turbulent premixed combustion model to the Adaptive Mesh Refinement (AMR) code and validated against precision experimental data.

Data Archival and Retrieval Enhancement (DARE) ($2,482K)

- Expanded archival of information and knowledge of nuclear weapons, other Weapons of Mass Destruction (WMD) and Agency mission areas for retrieval in DARE as outlined in DARE Master Plan.
- Developed and tested computational tools and system enhancements which provide greater search, retrieval, storage and analysis capability to the DARE customer.
- Continued development of video/text interrelationship with hyperlink, and other

Project AG—Scientific Computations & Information Systems (cont'd)

FY1999 Plans

Nuclear Weapons Effects Phenomenology ($7,999K)

- Continue review/commentary/archival of electronics/environmental test data.
- Initiate Graybeard knowledge capture efforts for thermomechanical and biological effects.
- Provide scientific and technical information services and products as the DoD-wide repository for test photos, films, data, test records and other information products, through operation of the Information Analysis Center.
- Continue computer operations support by providing centralized CRAY resources to researchers, Agency customers and RDT&E contractors.
- Continue operation of web site providing radiation response of electronic parts.
- Complete high-altitude nuclear effects data commentary/archival.
- Initiate transient radiation effects on electronics data review/commentary/archival.
- Continue review/commentary/archival of cratering, ejecta, dust and fallout test data.
- Initiate review/commentary/archival of nuclear effects test data for thin-film optics.
- Initiate review/commentary/archival of biological nuclear weapon effects test data.
- Continue DATACOM computational support by providing wide area connections.
- Disseminate Science and Technology Digest.
- Review, approve, and archive perishable nuclear test data.
- Coordinate draft update The Effects of Nuclear Weapons prior to distribution.
- Review draft Nuclear Weapon Effects textbook.
- Establish new Graybeard domain for nuclear devices.
- Accelerate Graybeard document review activities on ionization and electromagnetic (EM) effects.
- Complete graybeard free field airblast data commentary.
- Begin preparation of DARE guide to blast effects on structures.

Infrastructure ($9,770K)

- Continue to provide broad-based science and technology Information Analysis Center research support.

Project AG—Scientific Computations & Information Systems (cont'd)

- Continue computational support by providing annual support for the Scientific Computing Communications Network and by acquisition and upgrade of HPC equipment for the Data Center.
- Provide annual support for existing DTRA owned computing equipment located at Los Alamos National Laboratory.
- Provide for increased processor speed and disk I/O for Data Center HPC equipment.
- Provide for classified access capabilities for the Data Center.
- Continue monitoring and assessment of circuit utilization and investigation of new communication technologies.

Data Archival and Retrieval Enhancement (DARE) ($3,707K)

- Expand archival of information and knowledge of nuclear weapons and other Weapons of Mass Destruction (WMD) and Agency mission areas for retrieval in DARE as outlined in DARE Master Plan.
- Develop and test computational tools and system enhancements, which provide greater search, retrieval, storage and analysis capability to the DARE customer.
- Initiate development of video/text interrelationship with hyperlink and other innovative knowledge enhancement and preservation tools.
- Continue legacy document population.
- Continue incorporation of atmospheric and underground nuclear test data.
- Establish an intrinsic radiation transition repository.

Application of Nuclear Weapons Expertise ($517K)

- Complete validation of Advanced Numerical Methods. Compare results to precision test data.
- Develop a 3D atmospheric code with column physics based on the AMR code.

FY2000 Plans

Nuclear Weapons Effects Phenomenology ($7,399K)

- Complete Graybeard work on High Altitude Nuclear Effects.
- Initiate Graybeard mentoring program.

Project AG—Scientific Computations & Information Systems (cont'd)

- Provide scientific and technical information services and products as the DoD-wide repository for test photos, films, data, test records, and other information products.
- Disseminate Science Technology Digest.
- Operate web site providing radiation response of electronic parts.
- Continue review, commentary, approval, and archival of nuclear weapon effects test data.
- Publish and distribute The Effects of Nuclear Weapons.
- Publish and distribute Nuclear Weapons Effects textbook.

Infrastructure ($9,257K)

- Provide computational support for the Scientific Computing Communications Network; upgrade HPC equipment for the Data Center and access to scalable DoD HPCMP Systems and systems compatibility with DoE ACSI program.
- Provide sustainment and enhancement of classified access capabilities to the Scientific Computing Resources.
- Provide monitoring and assessment of circuit utilization and investigation of new communication technologies to support remote visualization and analysis of full physics, full fidelity, 3-dimensional calculations.
- Provide broad-based science and technology Information Analysis Center research support.

Data Archival and Retrieval Enhancement (DARE) ($4,112K)

- Continue to expand archival of information and knowledge of nuclear weapons and other Weapons of Mass Destruction (WMD) and Agency mission areas for retrieval in DARE as outlined in DARE Master Plan.
- Continue to develop and test computational tools and system enhancements, which provide greater search, retrieval, storage, and analysis capability to the DARE customer.

Project AG—Scientific Computations & Information Systems (cont'd)

- Continue development of video/text interrelationship with hyperlink and other innovative knowledge enhancement and preservation tools.
- Continue legacy document population.
- Begin entry of nuclear simulation data.
- Enhance data visualization tools.
- Expand online access to DARE classified and unclassified resources.
- Integrate automated test data recorder interface into DARE archive.

Application of Nuclear Weapons Expertise ($719K)

- Continue to supply authoritative data and provide requested analysis of the effects of nuclear weapons testing, and other DTRA mission areas.
- Continue efforts to ensure that Nuclear Weapons Effects test data and results are preserved as DoD downsizes and laboratories with nuclear test data close.
- Validate the AMR code using field atmospheric data.

FY2001 Plans

Nuclear Weapons Effects Phenomenology ($7,164K)

- Complete Graybeard work on Biological Effects.
- Complete Graybeard work on Airblast, Cratering & Ejecta, and Dust/Fallout areas.
- Provide scientific and technical information services and products as the DoD-wide repository for test photos, films, data, test records, and other information products.
- Disseminate Science and Technology Digest.
- Operate web site providing radiation response of electronic parts.
- Continue review, commentary, approval, and archival of nuclear weapon effects test data.

Infrastructure ($9,498K)

- Continue computational support by providing annual support for the Scientific Computing Communications Network and by acquisition and upgrade of High Performance

Project AG—Scientific Computations & Information Systems (cont'd)

Computing equipment for the Data Center, such as increased memory and additional PCU's to extend the life of existing systems and enable them to accommodate additional workload from decommissioning of the Cray M98.

Provide sustainment and enhancement of classified access capabilities for the Data Center. Deploy new communications technologies to support remote visualization and analysis of full physics, full fidelity, 3-dimensional calculations.

Continue to provide broad-based science and technology Information Analysis Center research support.

Data Archival and Retrieval Enhancement (DARE) ($4,013K)

Continue to expand archival of information and knowledge of nuclear weapons and other Weapons of Mass Destruction (WMD) and Agency mission areas for retrieval in DARE as outlined in DARE Master Plan.

Continue to develop and test computational tools and system enhancements, which provide greater search, retrieval, storage and analysis capability to the DARE customer.

Continue development of video/text interrelationship with hyperlink and other innovative knowledge enhancement and preservation tools.

Complete incorporation of reviewed nuclear testing data.

Develop initial DARE interface to external data archives, including search/retrieve capability (e.g. DTIC, DoE, etc.).

Applications of Nuclear Weapons Expertise ($866K)

Perform validation of combined combustion atmospheric model with field data.

Continue to supply authoritative data and provide requested analysis for the effects of nuclear weapons testing, and other DTRA mission areas.

Continue efforts to ensure that Nuclear Weapons Effects test data and results are preserved as DoD downsizes and laboratories with nuclear test data close.

Validate the scalable AMR code with precision combustion data.

Project AI - Hard Target/Tunnel Defeat & Nevada Test Site (NTS) Sustainment

The United States and its allies face a growing threat related to critical military targets hidden within and shielded by hardened, deeply buried tunnel complexes which house battle management facilities, command, control, and communications facilities, theater ballistic missiles and their transporter-erector-launchers (TELs), and biological/chemical/ nuclear weapons production or storage facilities. An objective of this program is to examine the existing U.S. and Allied capabilities to hold hardened, deeply buried tunnel targets at risk, thereby defining a current performance baseline. Any deficiencies will be identified and the ability of planned systems to address these deficiencies will be assessed. Finally, new technologies needed to mitigate remaining shortfalls will be evaluated as candidates for new hard target defeat acquisitions. Activities respond to priorities by the Office of the Under Secretary of Defense for Acquisition and Technology (OUSD(A&T)), Hard and Deeply Buried Target Defeat Capability Initiative and warfighting CINCs. Efforts in this program provide part of the technology base needed for counterproliferation activities conducted in other DoD programs.

The Presidential Decision Directive (PDD) on Stockpile Stewardship implemented an indefinite moratorium on underground nuclear testing while requiring retention of the capability to resume testing at Presidential direction. DoD has complied with this policy by realigning the previously existing underground test program to emphasize non-nuclear weapons test technology and facility development, and to conduct a program for an orderly decommissioning and mothballing of the national underground nuclear test assets. The following major tasks will satisfy this requirement: (1) continue test complex shutdown, and tunnel stabilization and preservation; (2) continue environmental characterization; (3) document testbed design and construction methodology; (4) maintain underground test readiness through joint test organization activities at NTS including counterproliferation and hard target defeat testing; and (5) support SOCOM efforts to develop tactics and techniques for JCS Joint Warfighter Capabilities of Discriminate Attack and Counterproliferation. Project AI is linked to Project AB, through which its testing is conducted, and to Project AC which leverages its weapons work.

Project AI - Hard Target/Tunnel Defeat & Nevada Test Site (NTS) Sustainment (cont'd)

FY 1998 Accomplishments

Functional Defeat Characterization ($2,100K)

- Developed geological database for tunnel facilities.
- Continued compiling a database of Balanced Survivability Assessments and began applying the data to identify vulnerable nodes in underground facilities.

Defeat Technology ($4,735K)

- Conducted a scale model multi-burst experiment to evaluate the effects of simultaneous detonations.
- Completed penetration studies in granite and weathered granite.
- Initiated live weapon testing of hardened tunnels at the Nevada Test Site (NTS).
- Continued testing of methods to defeat tunnels with penetrators and other conventional weapons.
- Continued support for USD(A&T)'s Hard Target Defeat Capability program.
- Evaluated weapon/target interactions for new weapon concepts, enhanced payloads, and target fragility.
- Initiated construction of a full scale tunnel facility.

Planning Tool Development ($500K)

- Continued development of an automated weaponeering tool for structural and functional damage to tunnels.

NTS Sustainment ($2,534K)

- Maintained Agency activities at NTS in support of environmental remediation activities.
- Provided on-site personnel to plan and supervise environmental remediation of Agency facilities.
- Maintained one tunnel complex in support of the stockpile stewardship program.

Project AI - Hard Target/Tunnel Defeat & Nevada Test Site (NTS) Sustainment (cont'd)

FY 1999 Plans

Functional Defeat Characterization ($1,454K)

- Continue development and validation of remote site geologic characterization technology.
- Initiate functional characterization and modeling of tunnel facilities.
- Identify mission critical equipment and vulnerabilities for functions modeled.

Defeat Technology ($5,804K)

- Continue to evaluate weapon/target interactions for new weapon concepts, enhanced payloads, and target fragility.
- Initiate penetration testing on other tunnel geologies.
- Conduct weapon/payload testing to identify/quantify defeat mechanisms and evaluate effectiveness.
- Develop improved/new weapon/target interaction models to include penetration, portal damage, in-tunnel airblast and fragments, in-tunnel equipment response, and reconstitution.
- Continue support for USD(A&T)'s Hard Target Defeat Capability program.
- Begin readiness testing of live weapons at NTS in preparation for tunnel defeat demonstrations.
- Complete construction and outfitting of the full-scale tunnel facility and initiate demonstrations.
- Initiate planning for and construction of a second tunnel facility representing a different target function.

Planning Tool Development ($1,000K)

- Continue automated weaponeering tool development by enhancing the Munitions Effects Assessment (MEA) tunnel module for structural and functional damage and battle damage assessment.
- Initiate development of new planning tools to improve deliberate planning capabilities for hard target defeat.

Project AI - Hard Target/Tunnel Defeat & Nevada Test Site (NTS) Sustainment (cont'd)

NTS Sustainment ($1,925K)

- Maintain Agency activities at NTS in support of environmental remediation efforts.
- Provide on-site personnel to plan and supervise environmental remediation of Agency facilities.
- Maintain one tunnel complex.

FY 2000 Plans

Functional Defeat Characterization ($2,100K)

- Continue development and validation of remote site geologic characterization technology.
- Continue functional characterization and modeling of tunnel facilities.
- Identify mission critical equipment and vulnerabilities for functions modeled.

Defeat Technology ($6,207K)

- Continue to evaluate weapon/target interactions for new weapon concepts, enhanced payloads, and target fragility.
- Continue penetration testing on other tunnel geologies.
- Continue weapon/payload testing to identify/quantify defeat mechanisms and evaluate effectiveness for other tunnel functions.
- Develop improved/new weapon/target interaction models to include in-tunnel equipment response, and reconstitution for different tunnel functions.
- Continue support for USD(A&T)'s Hard Target Defeat Capability program.
- Continue readiness testing of live weapons at NTS in preparation for tunnel defeat demonstrations.
- Conduct functional defeat demonstrations on the full-scale tunnel facility.
- Complete construction of a second tunnel facility representing a different target function.

Project AI - Hard Target/Tunnel Defeat & Nevada Test Site (NTS) Sustainment (cont'd)

Planning Tool Development ($1,100K)

- Continue automated weaponeering tool development by enhancing the MEA tunnel module for structural and functional damage and battle damage assessment for different tunnel functions.
- Continue development of new planning tools to improve deliberate planning capabilities for hard target defeat.

NTS Sustainment ($2,732K)

- Maintain Agency activities at NTS in support of environmental remediation activities.
- Provide on-site personnel to plan and supervise environmental remediation of Agency facilities.
- Maintain one tunnel complex.

FY 2001 Plans

Functional Defeat Characterization ($2,250K)

- Continue development and validation of remote site geologic characterization technology.
- Continue functional characterization and modeling of tunnel facilities.
- Identify mission critical equipment and vulnerabilities for functions modeled.

Defeat Technology ($6,148K)

- Continue to evaluate weapon/target interactions for new weapon concepts, enhanced payloads, and target fragility.
- Continue penetration testing on other tunnel geologies.
- Continue weapon/payload testing to identify/quantify defeat mechanisms and evaluate effectiveness for other tunnel functions.
- Continue to develop improved/new weapon/target interaction models to include in-tunnel equipment response, and reconstitution for different tunnel functions.
- Continue support for USD(A&T)'s Hard Target Defeat Capability program.

Project AI - Hard Target/Tunnel Defeat & Nevada Test Site (NTS) Sustainment (cont'd)

Continue readiness testing of live weapons at NTS in preparation for tunnel defeat demonstrations.

Conduct functional defeat demonstrations on the second full-scale tunnel facility.

Initiate planning for and construction of a third tunnel facility representing a different target function.

Planning Tool Development ($1,120K)

Continue automated weaponeering tool development by enhancing the MEA tunnel module for structural and functional damage and battle damage assessment for different tunnel functions.

Continue development of new planning tools to improve deliberate planning capabilities for hard target defeat.

NTS Sustainment ($2,733K)

Maintain Agency activities at NTS in support of environmental remediation efforts.

Provide on-site personnel to plan and supervise environmental remediation of Agency facilities.

Maintain one tunnel complex.

Project AN - Thermionics - Meeting national objectives in both the military and civilian areas will require large capacity (40-100kW) nuclear space power systems having long lifetimes. Potential applications have been identified by the Air Force and NASA. The Air Force "New World Vistas" study, dated 15 December 1995, cites specific requirements for space nuclear power to accomplish force projection from space. NASA has identified requirements for power and propulsion for contemplated deep space missions and manned exploration. The objectives of the Advanced Thermionics Program are to advance the state of the art of thermionic power conversion in the United States, to develop high performance and highly reliable thermionic converters that provide high output power per unit of system mass, to demonstrate the capabilities of these thermionic converters, to show their feasibility for use in thermionic systems, and to develop corresponding system level conceptual designs. This effort supports the Defense Technology Area Plan for Space Platforms.

FY 1999 Plans

In-core thermionic development ($1,800K)

Continue work on test of high-performance and high-reliability converters for in-core thermionic fuel elements. Award a contract for development of close-spaced multi-cell converter module.

Microminiature Thermionic Converters (MTCs) ($1,200K)

Continue to apply trial tricarbonate coatings on the emitter portion of the converters, and continue work on scandate coatings.

Project AQ - Deep Digger - This project proposes to develop a "Deep Digger" design for attacking hard targets such as leadership or C3 Bunkers, underground factories, or weapon storage facilities. The U.S. Services have identified a need to defeat such hard and buried targets. Current weapons have only limited capability against these targets. A more effective penetrator capability such as that claimed by the inventor of "Deep Digger" is required.

This effort is responsive to Special Operations Forces interests as well as the consolidated Mission Need Statement of the U.S. Air Force Combat Command and the U.S. Strategic Command. The deep digger system would be delivered by a guided munition airframe such as used by the Air Force and the Navy. As an integrated weapon, this concept has application as a breeching tool.

FY 1999 Plans ($2,000K)

Design and build a system that will penetrate rock, explosively fracture, and remove muck.

Construct a prototype for FY 2000 testing.

Field and test the prototype at Nevada Test Site.

Project AY - Bioenvironmental Hazards Research - This is a Congressionally mandated project that provides for research on bioenvironmental hazards of specific DoD concern. Areas of research include human health effects and risk evaluation, pollution preventions, waste stream treatment, remediation, and impact assessment of atmospheric emissions. Funds were provided as a Congressional addition in FY 1994, FY 1995, FY 1997 and FY 1998 and were intended to continue efforts begun by a grant in FY 1989 to Tulane and Xavier Universities. Additional funding was made available from existing Agency resources to comply with Congressional direction to continue this effort through FY 1996.

FY 1998 Accomplishments ($5,000K)

Awarded two research grants to study and understand mechanisms involving synergism between contaminants and their effect on the human and ecological systems based on biosensors and biomarkers to assist in risk-based DoD evaluations.

Collected and analyzed information and data on current remediation efforts, such as bioremediation, to ensure their effectiveness.

RDT&E BUDGET ITEM JUSTIFICATION SHEET (R-2 Exhibit)	DATE February 1999
APPROPRIATION/BUDGET ACTIVITY RDT&E, Defense-Wide/Applied Research - BA2	R-1 ITEM NOMENCLATURE WMD Related Technologies; 0602715BR

B. Program Change Summary

	FY98	FY99	FY00	FY01
Previous President's Budget	203.7	203.6	206.6	209.7
Current Budget Submit/President's Budget	203.8	211.4	203.5	206.5

Change Summary Explanation:

In accordance with the November 1997 Defense Reform Initiative, resources for FY 1999 and out which were previously addressed in PE 0602715H have been transferred to this PE. The budget request represents a highly leveraged science and technology program, consistent with departmental strategic objectives. Significant adjustments are associated with congressional ads FY 1999 for Deep Digger, Thermionics, and Nuclear Weapons Efforts and technology efforts. Outyear adjustments are primarily associated with the termination of RDT&E efforts supporting the Electro-Thermal Chemical Gun program.

C. Other Program Funding Summary

	FY 98	FY 99	FY 00	FY 01	FY 02	FY 03
0602715H Defense Special Weapons Agency	203.8	0.0	0.0	0.0	0.0	0.0