

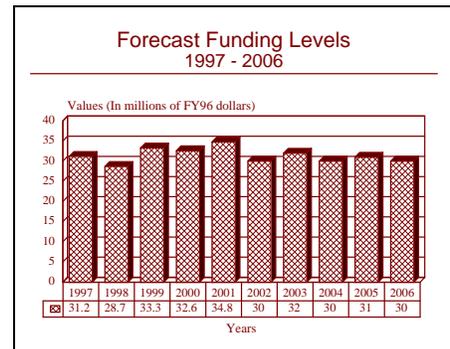
ARCHIVED REPORT

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Survivability/Lethality Analysis (Army) - Archived 2/98

Outlook

- Ongoing technology development efforts
- A significant effort is being made to catch up with the requirements for system survivability and vulnerability
- Program is expected to have relatively stable funding



Orientation

Description. This program, PE#0605604A, provides a funding base for efforts which will determine the vulnerability of US Army and potentially hostile equipment to radio electronic combat techniques. The title has changed from Technology & Vulnerability Assessment.

Sponsor

US Army

Army Communications-Electronics Command
(CECOM)

AMSEL-IO

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Contractors. Varies with R&D effort changes.

Status. This is an ongoing program.

Total Produced. This is a technology development program only.

Application. To determine the vulnerability of US Army close support/fire support/combat aviation weapons systems, air defense/space weapon systems and command, control, communications & intelligence systems to radio electronic combat threats. The program also evaluates selected hostile system vulnerabilities and provides ECCM recommendations to system developers.

Price Range. Indeterminate.

Technical Data

This program element is made up of efforts transferred from PE0603270A, Electronic Warfare Technology, and PE0604270A, Electronic Warfare Development; it emphasizes support, test and evaluation activities and database development as opposed to the development of a pure technology base. It funds a critical portion of the Army's Survivability/Lethality Analysis Program to determine the best means for coping with lethal weapons effects and countermeasures against a system/soldier. The goal is to assist the materiel developer in improving survivability of the system/soldier on the battlefield of the future.

The relative severity of threats and hazards is gauged, and experimental information integrated to form a comprehensive prescription for a combat-survivable system or soldier. The results are used to predict the requirements for systems under combat conditions, to help the program manager translate requirements into system technical specifications and features to develop investment strategies with substantial survivability payoff, and ensure that survivability performance issues are developed for testing. The objectives of this program are to:

- Develop and maintain the necessary technology, facilities, and expertise to assess the performance of Army systems against current and projected threats.

- Conduct theoretical analyses, modeling, simulations, and field experiments to provide a survivability/ lethality (S/L) data base.
- Perform actual survivability/lethality analysis to quantify system effectiveness in a realistic environment.
- Review supporting operational requirements documentation, threat countermeasure (CM) performance, the level of counter-countermeasure/survivability (CCM/SURV) required when encountering threat countermeasures and lethal weapons; and provide technology support for signature measurement, and survivability/lethality/vulnerability (SLV). Activities include assessing the effects of lasers; high-power microwave, electro-optic/radio frequency (EO/RF) jammers; decoys; conventional ballistic; and nuclear/biological/chemical (NBC) effects on Army systems and fuzes.

Other activities include providing advice and technical support to developers to apply technology or tactics to mitigate the effects of threat attack on Army systems and enhance survivability on the battlefield. The program provides technical data and information required for the independent evaluator and DA decision makers for milestone reviews.

Variants/Upgrades

This program develops technology that can be used to upgrade existing systems.

Program Review

Background. The following information is based on the latest program Descriptive Summary. Although the efforts are many and often small (funded at under US\$1 million), the descriptions establish the priorities and timing of the work. It provides a good identification of which systems are to receive what kind of attention and when. This has serious implications for the industry by revealing the size of the Army's investment and its focus. The information also has implications for the future and is indicative of issues which will have to be addressed in program development.

PROJECT DC10 — AVIATION SYSTEMS SURVIVABILITY/LETHALITY/VULNERABILITY (SLV). This project investigates Army aviation system vulnerability to battlefield threats, including conventional ballistic, electronic warfare, and directed energy, as well as chemical, biological, and nuclear systems. Aircraft deficiencies and hardening fixes are identified. SLV

analysis directly supports major decision reviews, acquisition documentation, test and evaluation master plans, and cost/operational effectiveness analyses. Through FY95, the project has provided assessments of acoustic technology which might be developed to exploit the potential susceptibilities of helicopters.

FY90 saw the completion of an Army guide on Live Fire Test and Evaluation. Additional guidance documents for life-cycle vulnerability assessments were completed. Initiatives to develop and refine criteria for electromagnetic environmental effects continued. An acoustic oversight committee was formed to focus on the RSTA technology program.

In FY91, the Army developed a full-spectrum signature model and distributed it to industry and the other services. Planners reviewed the applicability of a multi-mission area sensor concept at division level for RSTA missions, and prepared the Army wide Automatic Target Recognition

(ATR) technology development plan. Engineers supported the DoD Tri-Service ATR steering committee to develop and initiate EW vulnerability assessment support for the Armored Systems Modernization Program and Acoustic/Seismic Program.

The Army began the Computer Vulnerability Methodology Program, developed the Army RF Threat to Fuzes Program, and continued supporting the development of EW and conventional ballistic assessment techniques. Planners established an investment strategy and multi-year program plan for assessments, and conducted V/L reviews on NJ OS, LOS-F-H, LOSAT, Stingray, LONGBOW, and UAV (Close) systems to support major milestone reviews.

In FY92, the project established an IAT pilot program for AFAS, Comanche, ATCCS, THAAD, and BAT. Program personnel managed the US Army RF Threat to Fuse program and supported the Unmanned Aerial Vehicle (UAV) Close, THAAD, GPS, AGS, AFAS, Comanche, ATCCS, BAT, and SCAMP/SMART-T programs. They supported the development and improvement of SLV evaluation capabilities in Army Research Laboratory models, simulations and instrumentation. Engineers conducted an analysis and trade-off study of advanced tracking algorithms for acoustic detection systems. They completed an analysis of technical progress on ATR algorithms and signal processor technology. Planners formulated the joint sensor program plan for the joint directors of laboratories. They assessed algorithms for correlation of multiple sensor data.

Notable FY 1993 accomplishments included the development of an EW survivability analysis program for Army aviation systems, including Comanche and Apache helicopters (US\$1.790 million). Planners developed a ballistic vulnerability/lethality analysis program for Army aviation systems (US\$1.177 million), and expanded the integrated analysis program to include the full spectrum of battlefield threats and to address additional Army aviation systems (US\$974,000). They conducted a successful demonstration of a long-range acoustic tracking and identification system (part of a joint US/Israeli field exercise) with potential application to helicopters (US\$1.850 million).

In FY95, the project was restructured to Project D672.

PROJECT D089 — AIRCRAFT CERTIFICATION. This project performs the engineering functions essential for certifying the airworthiness of assigned Army aircraft. It performs safety-of-flight investigations/assessments and issues messages to the field. It also manages/executes the Army's Aeronautical Design Standards (ADS) Program. The ADS is a continuously evolving process incorporating revisions for each change to the standard design of an aircraft system. It manages airworthiness approval of new-vendor

qualification/testing on field aircraft and material changes for all assigned Army aircraft systems. It provides airworthiness engineering support to the Aviation Program Executive Office and Aviation and Troop Command Program/Project/Product Manager requirements for major development/modification and any future systems/subsystems. It manages the test and evaluation process to support the airworthiness qualification of developmental and fielded aircraft systems.

Details are not applicable to this report.

PROJECT D181 — ANTI-RADIATION MISSILE COUNTER-COUNTERMEASURES (ARM-CCM). The ARM-CCM project objectives are to understand the capabilities of threat ARMs and how they work. This project provides simulation and hardware tools for both proposed and fielded ARM countermeasures, as well as techniques and methodologies which support ARM-CCM investigations.

In FY90 through FY91, funding was provided to complete the emulator, conduct an ongoing NATO DART test, and perform a joint US/Israeli test.

In FY92, the effort was not funded.

In FY93, the Army terminated the Advanced Flyable Generic Arm Seeker (AFGAS) program and the ARM-CCM survivability program under the Signals, Sensors, Signatures, and Information Processing (S3I) Directorate of ARL (US\$453,000). Planners transitioned the ARM-CCM survivability program to the Survivability/Lethality Analysis Directorate of the Army Research Laboratory (US\$863,000).

Beginning in FY96, work and funds were restructured into Projects D670, D671, D672, D675, and D68 within this program element.

PROJECT D190 — INTEGRATED ANALYSIS. This project provides supporting technology and data for the Army's integrated survivability analysis program and funds the investigation of the lethality and vulnerability of smart munitions to the full spectrum of battlefield threats. The analysis is integrated across all battlefield threats, i.e. conventional ballistic, electronic warfare, directed energy, nuclear weapons effects, and nuclear and chemical/biological contamination effects.

This project supports development of the Army initiative to reduce system susceptibility to out-of-band radio frequency countermeasure effects. This project also includes the Army's electronic warfare signature measurement program, and the assessment of laser countermeasure effects on Army optical and electro-optical systems. This project supports investigation of new technologies and methodologies required for SLV analyses.

In FY90, the Army conducted laser countermeasures investigations of the OH-58D mast-mounted sight and the AH-64 Target Acquisition Designator System. Engineers performed countermeasures experiments supporting the Forward Area Air Defense System (FAADS) and conducted EM hardening assessments of Apache and Hellfire. Special Electro-Magnetic Interface (SEMI)/High-Power microwave (HPM) assessments included most Army missile and aviation programs.

Other efforts included infrared, ultraviolet, and radio frequency signature measurements to support the FAADS, Stinger, other Army, and foreign material exploitation programs. Stingray development continued, and C³I vulnerability assessments as well as low-power microwave assessments were conducted.

In FY91, the Army conducted SEMI investigations of three Army weapon/communication-electronic systems and platforms, began high-power microwave (HPM) evaluation of shielding techniques for computers and communications systems, and assessed missile hardening techniques for millimeter wave weapon systems. HPM assessments of three foreign missile systems and one US Army system were also performed, as well as the low power microwave (LPM) characterization of three foreign missiles. Engineers performed infrared, ultraviolet, and radio frequency signature measurements to support FAADS, Stinger, Line-of-Sight Anti-Tank (LOSAT), other Army development programs, foreign material exploitation programs, and EW technology development.

Program personnel continued exploration and development of EW technology to support current and future vulnerability assessments of weapon/communications, command, control, computers and intelligence systems, and also performed ultra wideband RF (UWBRF) susceptibility investigations of three foreign systems.

Planners and engineers supported Desert Shield/Storm through signature characterizations of developmental missile CM devices and missile guidance beacons and by providing consultation concerning CM/CCM aspects of the combat Identification Friend or Foe (IFF) effort. They reported the results of laser countermeasures investigations of the OH-58D mast-mounted sight and AH 64 Target Designation System (TADS) and reported laboratory measurements in support of the Stingray development program.

In FY92, the project conducted a special electromagnetic interference (SEMI) investigation of US Army fuzes and two advanced anti-tank weapon systems. Engineers conducted a high-powered microwave (HPM) investigation of generic missiles and conducted special RF susceptibility investigations of four foreign systems, one US Air Force system and two US Army helicopters. They

provided laser vulnerability assessments to support countermeasures hardening, and investigated the Combat Identification Technology Program through analyses and field experiments of candidate systems.

Planners also continued EO/IR, ultraviolet, and RF signature measurements to support Army weapon system and electronic countermeasures/electro-optics countermeasures (ECM/EOCM) technology development activities and foreign material exploitation.

FY93 accomplishments included the establishment and management of the integrated survivability/lethality analysis program (US\$1.958 million). Planners conducted RF susceptibility investigations and High Power Microwave (HPM) investigations of Javelin, the Wide Area Mine (WAM), and Hellfire LONGBOW Missile (US\$2.282 million). The program provided data and conducted laser CM investigations in support of EW CCM hardening of missile systems such as Javelin and Hellfire LONGBOW (US\$1.304 million). The engineers conducted EO, IR, UV, and RF signature measurements to support Army development activities and foreign material exploitation (US\$976,000).

In FY94, the Army managed the Army survivability/lethality integrated analysis programs (Air Defense, Aviation Systems, C4/IEW, Ground Systems, Munitions, and Integrated Soldier System) and participated in ARL FOCUS programs, Battle Labs and ATD initiatives, and special projects for ARL, AMC, and HQDA (US\$1.855 million). Through laboratory simulations, computer modeling, and field experiments, planners conducted electronic warfare and ballistic survivability/vulnerability analysis of Army munitions systems that are in development, production, or undergoing product improvements. Systems then under investigation to support decision milestones were Javelin, Hellfire LONGBOW, and the Wide Area Mine (US\$2.496 million). In keeping with advances in technology, analysts exploited state-of-the-art computer science and graphics techniques to improve the processing and display of materiel systems for ballistics lethality analysis (US\$661,000). They established a computer virus laboratory and analyzed security models in operating systems and the effects of malicious electronic attack on imbedded processors (US\$302,000).

Designers developed computer control codes, digital simulation models, and methods to increase power spectral density waveforms for EW vulnerability analysis (US\$591,000). They conducted an integrated survivability analysis in support of the Enhanced Integrated Soldier System (TEISS) (US\$239,000).

In FY95 the Army spent US\$3.273 million on laboratory simulations, computer modeling, and field experiments. They also conducted, EWVA and ballistic

survivability/lethality investigations/analysis of US Army ground systems such as AFAS/FARV, AGS, Breacher, Bradley, M1 Abrams, and M109 Howitzer systems. Planners allocated US\$1.510 million to conduct EWVA investigations on SADARM, STAFF, M829A2, BAT, LOSAT, TOW ITAS, and ATACMS (APAM) munitions. US\$2.067 million was used to provide signature measurements and computer modeling and simulation for integrated survivability/lethality analyses of US Army ground systems and smart munitions.

Beginning in FY96, work and funding was restructured to Projects D670, D671, D672, D675, D677, D678, and D679 within the PE.

PROJECT D234 — CLOSE COMBAT/FIRE SUPPORT SURVIVABILITY/LETHALITY. This project investigates the survivability and vulnerability of Army ground combat systems to the full spectrum of battlefield threats; and the lethality of Army smart and conventional fire support munitions. Analysis is used to support weapon requirements, test and evaluation master plans, cost/operational effectiveness analysis, and major decision milestones.

In FY90, the Army performed preliminary lab/field investigations of the TOW-2B sensor, AAWSM advanced hardware, and LOSAT dirty battlefield experiments. Other vulnerability assessments were reported on the Smart Target Fire and Forget as well as LONGBOW systems. Fuses for the MLRS binary chemical and multi-option artillery as well as FAADS were investigated. Smart mines were evaluated for seismic and acoustic threats.

In FY91, the Army continued evaluating proximity fuzes and smart weapon systems for neck-down decisions; continued vulnerability assessments of TOW-2B, SADARM, Multiple Launched Rocket System Terminally Guided Warhead (MLRS-TGW), and STAFF; and supported full-scale development of JAVELIN, LOSAT, and LONGBOW. Engineers continued seismic/acoustic EW investigations of smart mines/countermines, EWVA of JAVELIN, STAFF, Armored Munition System - Heavy (AMS-H), LOSAT and LONGBOW; initiated EW vulnerability analysis of Armored Systems Modernization efforts; and supported Desert Shield/Storm operations by evaluating missile countermeasures devices.

In FY92, the project initiated the Survivability/Lethality Integrated Analysis Program for the Advanced Field Artillery System/Future Armored Resupply Vehicle (AFAS/FARV) and Brilliant Anti-Tank (BAT) submunition programs. Engineers conducted susceptibility and laboratory/captive-carry EW analysis of BAT, Sense and Destroy Armor (SADARM), Wide Area

Mine, and the Multiple Launch Rocket System Terminally Guided Warhead (MLRS-TGW). Engineers continued upgrades on millimeter wave (MMW), acoustic, seismic, EO and IR capabilities and improved ballistic evaluation methodolog and databases. They initiated the S/L Integrated Analysis Program for the RAH-66 Comanche helicopter and provided EW technical support for LONGBOW Apache and combat identification.

FY93 accomplishments included establishing the Ground Combat and Fire Support integrated analysis programs (US\$1.074 million), conducting acoustic, seismic, IR, EO, special electromagnetic interference (SEMI), high-power microwave (HPM), etc., susceptibility/lethality analysis of BAT, SADARM, Advanced Field Artillery System/Field Artillery Resupply Vehicle (AFAS/FARV), Line-of-Sight Antitank (LOSAT) and Smart Target Activated Fire and Forget (STAFF) programs (US\$1.611 million). The program provided upgrades to millimeter wave, acoustic, seismic, EO, and IR capabilities, as well as improved ballistic vulnerability/lethality analysis methodologies and enlarged data bases (US\$806,000).

Program personnel provided vulnerability/vulnerability reduction and lethality/lethality enhancement analyses in support of AFAS/FARV, Armored Gun System (AGS), Armored Systems Modernization (ASM), and BAT (US\$698,000). They also provided live fire test and evaluation support for Paladin, SADARM, and BAT (US\$644,000). Engineers provided nuclear survivability/hardening and nuclear/biological/chemical survivability analysis for program management and milestone decision reviews (US\$537,000).

In FY94, the Army used laboratory simulations, computer modeling, and field experiments to conduct ballistic survivability/lethality investigations/analysis of US Army ground systems including the AFAS/FARV, AGS, Breacher, Bradley Fighting Vehicle System (BFVS), M1 Abrams Main Battle Tank, and M109 Howitzer systems (US\$1.655 million). In addition to comparing live fire and computer survivability test results, analysts conducted an EW vulnerability analysis of the Army ground systems, including AFAS/FARV and Breacher (US\$1.426 million). They also conducted EW vulnerability investigations on SADARM, STAFF, M829A2, BAT, LOSAT, TOW ITAS, and ATACMS (APAM) munitions (US\$1.391 million). Designers provided signature measurements and computer modeling and simulation of the EW vulnerability of US Army ground systems and smart munitions (US\$953,000).

In FY95, the Army used laboratory simulations, computer modeling, and field experiments, conducted, EWVA and ballistic survivability/lethality investigations/analysis of US Army ground systems such as AFAS/FARV, AGS, Breacher, Bradley, M1

Abrams, and M109 Howitzer systems, at a cost of US\$3.273 million. US\$1.510 million went into EWVA investigations on SADARM, STAFF, M829A2, BAT, LOSAT, TOW ITAS, and ATACMS (APAM) munitions. Program personnel spent US\$2.067 million to provide signature measurements and computer modeling and simulation for integrated survivability/lethality analyses of US Army ground systems and smart munitions.

In FY96, work and funding for this project was moved to Projects D677 and D678.

PROJECT D235 — MISSILE COUNTER-COUNTERMEASURE TECHNOLOGY. This project supports the development of CM/CCM hardening techniques that missile systems can use against laser, radio frequency (RF), and directed energy threats. It provides modeling to investigate vulnerabilities to air defense systems and investigates missile signatures and exploitability. The effort also investigates technology that can be used to harden optical windows against lasers, RF and directed energy threats.

In FY90, the project expanded the ability to model battlefield effects on MOF-M and other missiles. It continued development of signature reduction techniques and updated modeling efforts, along with evaluating generic missile system CCM technology.

In FY91, the Army used an improved model to evaluate battlefield effects on Fiber Optic Guided-Munition (FOG-M) and other missile systems. Planners continued to develop nonlinear materials to protect O/EO sensors from frequency agile directed energy weapons. They continued signature measurement and reduction programs, conducted field tests to determine the effectiveness of the techniques, and developed generic missile system CCM technology.

In FY92, the program performed Unintentional Radiation Emissions (URE) testing of domestic and foreign systems. They developed NLOS thin-film dome coating, initiated development of a new coating hardening technique (surface current dissipation), and designed a frequency selective/heater filter for LONGBOW.

In FY93, the program continued research on surface dissipation coatings and evaluated patterning techniques (US\$308,000). Engineers assessed missile system CM/CCM requirements for current and future system threats and conducted missile performance analysis in a CM/CCM environment (US\$310,000). They continued testing and analysis on missile systems and subcomponents for radar cross section (RCS), unintentional radiated emissions (URE), high-power microwave (HPM), and special electromagnetic interference (SEMI) effects relative to counter-countermeasures hardening (US\$311,000).

In FY94, the Army continued developing surface current dissipation coatings and selective surfaces patterning techniques for CCM applications (US\$198,000). Analysts began testing and analysis of surface current dissipation coatings for hardening of missile systems (US\$198,000). They also continued testing and analysis of missile systems and subcomponents for RCS, URE, SEMI effects, and HPM in the context of weapon systems hardening (US\$100,000). Designers improved existing thin film materials for Army missile systems hardening (US\$50,000), assessed missile system CM/CCM requirements for current and projected system threats, and conducted missile performance studies and analysis in an EW environment (US\$61,000). They developed a one-on-one simulation for analysis of missile systems against known and projected threats (US\$50,000).

FY95 accomplishments included 175 continued improvements and upgrades of hardening techniques, along with investigating, and developing new technology for advanced CCM applications (US\$175,000). Planners 307 continued to conduct tests and analyses to determine the susceptibility characteristics of selected weapon systems to specific environments and to specify the appropriate CCM techniques and validate the CCM effectiveness. This was budgeted at US\$307,000. For US\$177,000 engineers verified and validated the one-on-one simulation with measured data to determine the region of validity.

The project was not funded in FY96 and beyond.

PROJECT D267 — AIR DEFENSE/MISSILE DEFENSE SURVIVABILITY/LETHALITY. Provides the survivability/lethality analysis of US Army air defense and missile defense systems to the full spectrum of battlefield threats, and recommends upgrades to improve their survivability. The results are used by each Project Manager (PM) and the Program Executive Officer (PEO) to direct weapon-system development efforts, and structure product improvement programs to develop doctrine and tactics; and by decision makers in formulating program/production decisions.

In FY90, analysts provided assessments for the PATRIOT Post Deployment Build-3 IPR, Stinger, Chaparral, FAADS, FOG-M, and Hawk, as well as recommendations for the FAADS LOS-F-H low-rate production decision. The Army developed new and evolutionary ECM and EO techniques for field experiments. Program personnel developed a critical subsystems concept investigation for the next-generation stand-off jammer threat emulator.

In FY91, program personnel supported Desert Shield/Storm with special quick-reaction investigations to enhance PATRIOT Anti-Tactical Missile (ATM) system capabilities. They completed assessments of PATRIOT

and HAWK vulnerability to specific ECM techniques and provided improvement recommendations. The Army initiated an EW vulnerability assessment program for the Theater High Altitude Area Defense (THAADs) and PATRIOT Quick Reaction Programs, and performed EW susceptibility studies of strategic defense. Planners validated simulation models and accomplished a performance assessment for STINGER RMP Mod IV. The Army actively participated in Ground Based Sensor (GBS) source selection evaluation tests, and conducted EW susceptibility studies of the Multiple Role Survivable Radar and the FAADS components.

In FY92, the program office initiated the Survivability/Lethality (S/L) Integrated Analysis Program for Theater High Altitude Area Defense/Ground Based Radar (THAAD/GBR). It updated the Radio Electronic Combat (REC) and penetration aid threats for electronic warfare vulnerability assessment (EWVA) investigations of air defense and strategic defense systems. Engineers initiated the EW vulnerability assessment of Corps Surface-to-Air Missile (SAM) and HAWK Hostile Aircraft Identification Equipment (HAIDE). They performed EW susceptibility studies and threat characterization for THAAD and PATRIOT. Planners completed an EW performance assessment report for Stinger reprogrammable microprocessor (RMP) Mod IV and completed a susceptibility study of ARMs for the Ground Base Sensor (GBS) program and developed EW field experiment plans for the Multiple Role Survivable Radar (MRSR).

FY93 established the Survivability/Lethality Analysis Program for Army air defense and missile defense systems (US\$933,000). Engineers provided EW environment generation, monitoring, and validation for missile firing programs and data base development (US\$1.200 million). They conducted theoretical studies, field experiments, and an analysis of the PATRIOT PDB-4's multi-mode seeker, and radar/guidance enhancement improvements (US\$1.0 million). The program performed theoretical analysis, field experiments, and validated the missile flight simulation model for Stinger-RMP Block I Mod V IRCCM upgrades (US\$1.333 million).

Engineers conducted EW susceptibility investigations of selected National Missile Defense/Theater Missile Defense (NMD/TMD) systems and Forward Area Air Defense (FAAD) systems (US\$867,000), and provided EWVA conclusions and recommendations to the Corps Surface-to-Air (CORPSAM) design concept needed to support a Milestone I decision (US\$800,000).

In FY95 CORPSAM became the United States portion of the multi-national Medium Extended Air Defense System (MEADS) program. Planners used US\$2.956 million to conduct EWVA of US Army air defense systems including PATRIOT, Stinger-RMP, Avenger, Corp

SAM, HAWK, GBS, and MRSR. US\$1.559 million went to conduct EWVA of US Army missile defense systems including THAAD, ERINT, and GBR. Using US\$808,000, engineers conducted ballistic susceptibility/vulnerability/lethality analyses of US Army air defense/missile defense systems.

US\$2.030 million was budgeted to provide EWVA and ballistic modeling and simulation support for survivability/vulnerability/lethality analysis of US Army air defense/missile defense systems. Planners developed the necessary SLV analyses, methodologies, capabilities and techniques to ensure soldier survivability, US\$557,000.

Beginning in FY 1996 work and funds were restructured to Projects D670 and D671.

PROJECT D462 — TECHNICAL VULNERABILITY REDUCTION. This project develops counter-countermeasure/survivability (CCM/SURV) annexes to Operation Requirements Documents (ORDs) as a way of quantifying threat countermeasure performance, and specifying the level of CCM/SURV required of Army systems. It analyzes system concepts and proof-of-principle prototypes to ensure that new approaches address deficiencies in survivability.

During FY90, the project supported system survivability enhancements of the Joint Tactical Missile Defense (JTMD) passive defense methods used in the Guardrail Improved Processing Facility (IPF), Patriot, AH-64 Forward Area Refueling Point, and Extended Air Defense cooperative programs.

Accomplishments for FY91 included providing laser protection and thermal image support for Operation Desert Shield/Storm participants. The Army developed balanced survivability examples for combat vehicles against post-Desert Storm threats and supported Training and Doctrine Command (TRADOC) and PEO/PMS in LOSAT, NJ OS, LONGBOW, MLRS-TGW, JAVELIN, and WAM Operational Requirement Document appendices and value added analysis for AH-1 Cobra C-Nite. The program developed a vulnerability reduction guide for fielded Guardrail IPFs and managed the Army Optical Improvement (OIP) and Advanced Laser Protection Programs (ALPP).

In FY92, this project managed the Optical Improvement Program (OIP) and Advanced Laser Protection Program (ALPP). It conducted Enhanced Position Location and Reporting System (EPLRS) and Mobile Subscriber Equipment (MSE) network survivability analyses for the Program Managers. Planners developed/updated survivability/CCM annexes for LONGBOW, CORPS SAM and updated the RAH-66 Automatic Target Recognition (ATR) CM/CCM analysis. They developed a

plan to transition work to the Army Research Laboratory, Survivability/Lethality Analysis Directorate, or other activities.

In FY93, personnel completed a plan to transition work to the Army Research Laboratory (ARL), Survivability/Lethality Analysis Directorate or other activities. The Army terminated or transitioned all tasks to other projects within this program element (US\$2.659 million).

The project was not funded in FY94 and beyond.

PROJECT D626 — C4I SURVIVABILITY. This supports the survivability analysis of Army communications and electronic equipment when facing the full spectrum of friendly and enemy threats. It provides field threat environment support for EWVA and analyzes the vulnerabilities of foreign threat weapons and command, control, communications, computers and intelligence (C4I), as well as Intelligence Electronic Warfare (IEW) systems to US Army EW systems. D626 provides threat weapon electronic design data to countermeasure developers and technical-capability information to the intelligence community. The effort supports Army initiatives in vulnerability reduction of C4I/IEW systems.

In FY90, personnel chaired a DoD foreign-missile analysis effort and coordinated participation in international cooperative programs with Canada and the UK. Analysts completed a vulnerability assessment of nine foreign missiles and US Mobile Subscriber Equipment (MSE) improvements. They supported JSTARS, FIREFINDER, space-defense emerging smart weapons and ground surveillance concepts evaluations.

In FY91, the Army supported Operation Desert Storm and began developing the DoD's first real-time, hardware-in-the-loop simulation of a new foreign surface-to-air missile. Planners completed EWVAs of four foreign surface-to-air missiles, one foreign anti-tank guided missile, and one foreign air-to-surface missile, during its participation in an international cooperative program with the Canadian and UK Ministries of Defense.

Engineers significantly upgraded existing software ECM simulation modules and completed field investigations, providing initial EWVA results to support FAADS GBS source selection. The program Office initiated a JSTARS block I phase I EW laboratory assessment and completed a relay deployment aids predictive model to support further testing and fielding of MSE and EPLRS. Personnel initiated EWVA on the Joint Advanced Special Operations Radio System (JASORS), Global Positioning System (GPS), and Wide Area Mines Remote Control Unit (RCU). They continued development of EWVA methodology and simulations in support of ATCCS demonstration and provided EWVA results to support the

SINCGARS Second Source Production Decision. Engineers completed EWVA of two foreign C3I systems.

In FY92, the project initiated the Survivability/Lethality Integrated Analysis Program for the Army Tactical Command and Control System/Maneuver Control System (ATCCS/MCS). Planners completed the MSE network deployment optimization analysis for MCS and ATCCS. They completed an Army Research Laboratory Computer Vulnerability Study team report and provided JSTARS vulnerability reports and hardening recommendations for EW, Nuclear, Bio-chemical and vulnerability/validation post-test analysis. Program personnel provided EW environments for the vulnerability assessments of MSE, the Joint Tactical Information Distribution System (JTIDS), Global Positioning System (GPS), JSTARS, AEGIS and Single Channel Ground and Airborne Radio Systems (SINCGARS-V).

In FY93, program managers established the integrated survivability and lethality analysis program for Army communications and electronic equipment against the full spectrum of friendly and enemy threats (US\$1.022 million). They conducted the integrated SLA program for the Army Tactical Command and Control System (ATCCS) and the Maneuver Control System (MCS) (US\$1.533 million), and performed a Mobile Subscriber Equipment (MSE) network performance and nuclear effects analysis (US\$1.277 million). Engineers performed the survivability analysis of a Combat Identification (CID) system (US\$766,000). The project expanded the SLA program to include the following C4I/IEW systems: Common Hardware/Software (CHS), Command Post Shelters, communications systems — Single Channel Ground and Airborne Radio System (SINCGARS), Single Channel Anti-Jam Man Portable (SCAMP) system, the Secure Mobile Anti-Jam Reliable Terminal (SMART-T) - Global Positioning System (GPS), and the Joint Surveillance and Target Attack Radar System (JSTARS) (US\$511,000).

Listed FY94 accomplishments included the conduct an integrated survivability/lethality analysis for ATCCS and all of its functional area systems (US\$1.342 million). Through laboratory simulations, computer modeling, and field experiments, analysts performed EWVA and ballistics SLA on Army communications systems including SCAMP, SMART-T, MSE, and SINCGARS (US\$1.338 million) and on the Army Intelligence Electronic Warfare (IEW) systems, including JSTARS and Battlefield Combat Identification System (BCIS) (US\$1.062 million). Engineers enhanced the techniques for and provided a Special Electromagnetic Interference analysis of Army C4I systems (US\$597,000). They also enhanced the capabilities for measuring target signatures and analyzed the susceptibility of the systems to RF countermeasures (US\$1.327 million).

In FY95, personnel spent US\$2.298 million to conduct integrated survivability/lethality analysis for the Army Battlefield Command System (ABCS) and all of its functional area systems and their improvements. Another US\$2.201 million was used to perform EWVA and ballistics SLA on Army communications systems and their improvements. Through laboratory simulations, computer modeling, and field experiments, performed EWVA and ballistics SLA on Army IEW systems such as BCIS, JSTARS, and enhanced Firefinder. This was budgeted at US\$1.792 million.

Beginning in FY 1996 work and funding was restructured to Projects D670 and D675.

PROJECT D670 — EMERGING TECHNOLOGY SYSTEMS. This project performs the integrated survivability/lethality analysis of several systems, including Horizontal Technology Integration systems, Advanced Technology Demonstration initiatives, and Anti-Radiation Missile (ARM) Counter-ARM systems. It identifies survivability deficiencies and makes recommendations to Program Executive Officer (PEO) and Program Managers (PM) so they can provide hardening improvements early in the program development cycle. The work is accomplished through theoretical and engineering analyses, signature measurements, modeling, simulations, laboratory experiments and field investigations.

This effort also supports Army HQ, PEOs, PMs and independent evaluators with EW, chemical, biological, nuclear, meteorological, and ballistic expertise to conduct special studies, support TIWGs and program reviews, acquisition documentation review, and provides government testers with technical support.

Horizontal Technology Integration systems include Second Generation FLIR (2ND GEN FLIR), the Battlefield Combat Identification System (BCIS), Global Positioning System (GPS), and the Enhanced Position Location Reporting System (EPLRS). Advanced Technology Demonstration initiatives include Active Protection Systems (APS), Missile Countermeasure Devices (MCD) and the Advanced Laser Protection Program (ALPP). Counter-Anti-Radiation Missile efforts assess threat technologies against Theater Missile Defense (TMD), PATRIOT, JSTARS, Corps SAM, and FAAD-C21 ground-based sensors.

Work from other areas was restructured into this project in FY96.

In FY96, the plan was to conduct EW performance analyses, to include infrared, radio frequency, and electro-optical spectrums to support integrated survivability and lethality analyses. Planners would develop the necessary test beds to conduct laboratory and field investigations, and prepare interim

survivability analysis reports. This work supports 2ND GEN FLIR, BCIS, GPS, APS, EPLRS, and E3 and was budgeted at US\$2.696 million. US\$1.420 million would be used to conduct analyses to determine ballistic effects, develop system description models, perform damage simulations and collect experimental data to support integrated survivability, and lethality analyses. Develop necessary test beds to conduct experiments, and prepare interim survivability analysis reports. This work would support 2ND FLIR, BCIS, GPS, APS, and EPLRS.

The Army budgeted US\$1.144 million to conduct analyses to address nuclear hardening and survivability, chemical and biological warfare contamination and decontamination, and dirty battlefield conditions. Planners would develop the necessary test beds to conduct laboratory and field investigations, and prepare interim survivability analysis reports. This work supports 2ND GEN FLIR, BCIS, GPS, APS, EPLRS, and E3. US\$120,000 would be reprogrammed for SBIR/STTR Programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992. US\$38,000 would not be available due to a Revised Economic Assumption.

FY97 plans were to conduct EW vulnerability assessments to support integrated survivability and lethality analyses of emerging technology systems and horizontal technology applications. Engineers would develop the necessary test beds to conduct laboratory and field investigations, and prepare interim survivability analysis reports. Support the Army's E3 program. This was budgeted at US\$2.397 million. US\$1.485 million was dedicated to conducting ballistic effects investigations, developing system description models, performing damage simulations, and collecting experimental data to support integrated survivability and lethality analysis reports.

Planners set aside US\$997,000 to conduct engineering investigations addressing nuclear hardening and survivability, chemical and biological warfare contamination and decontamination, and dirty battlefield conditions to support integrated survivability/lethality analyses of emerging technology systems and horizontal technology applications. Designers would develop the necessary test beds to conduct laboratory and field investigations, and prepare interim survivability analysis reports.

PROJECT D671 — AIR DEFENSE/MISSILE DEFENSE SYSTEMS: This effort provides the survivability and lethality analysis of Army air defense and missile defense systems and their vulnerability to a wide spectrum of battlefield threats. It recommends fixes to improve their battlefield survivability. The results are used by PM and

PEOs to direct weapon system development efforts and structure product improvement programs; by the user to develop doctrine and tactics; and by decision makers in formulating program/production decisions.

Work was restructured to this project in FY96.

The FY96 planned program carried US\$3.852 million to conduct the electronic warfare vulnerability assessment for US Army air defense and missile defense systems that are in development, undergoing P3I, or have been recently fielded. These included PATRIOT, Corps SAM/MEADS, Stinger-RMP, Avenger, GBS, TMD- GBR, THAAD, and BSFV-E. US\$ 917,000 was allocated to conduct the ballistic survivability/lethality analysis for US Army air defense and missile defense systems. For US\$1.150 million, the Army would conduct the chemical, biological, nuclear, and atmospheric effects survivability analysis for US Army air defense and missile defense systems.

US\$253,000 would provide integrated survivability/lethality analyses to support scheduled air defense/missile defense program decision milestones in FY 96. US\$142,000 would be reprogrammed for SBIR/STTR Programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992. Due to Revised Economic Assumption US\$45,000 would not be available.

In FY97, planners would 3370 conduct the electronic warfare vulnerability assessment for U.S. Army air defense and missile defense systems that are in development, undergoing P3I, or have been recently fielded for US\$3.370 million. This included PATRIOT, Corp SAM/MEADS, Stinger-RMP, Avenger, GBS, TMD-GBR, BSFV-E, and THAAD. US\$1.208 was planned to conduct the chemical, biological, nuclear, and atmospheric effects survivability analysis for US Army air defense and missile defense systems; and US\$966,000 was allocated to conduct the ballistic survivability/lethality analysis for US Army air defense and missile defense systems. Planners budgeted US\$274,000 to provide integrated survivability/lethality analyses to support scheduled air defense/missile defense program decision milestones in FY97.

PROJECT D672 — AVIATION SYSTEMS. This project investigates Army aviation system vulnerability to battlefield threats. Deficiencies and hardening improvements are identified. The analyses directly support major decision milestones reviews, acquisition documentation, test and evaluation master plans, and cost/operational effectiveness analyses. In FY96, it provides for assessment of acoustic technology which might be developed to exploit potential susceptibilities of helicopters.

Work in this area was restructured to this project in FY96.

In FY96, the planned budget contained US\$2.406 million to conduct the electronic warfare vulnerability assessments for US Army aviation systems that are in development, undergoing P3I, or have been recently fielded. Examples of such systems are RAH-66 Comanche, AH-64D LONGBOW Apache, MH-60K & MH-47E Special Operations Aircraft, OH-58D Kiowa Warrior, CH-47D Chinook, and UH-60Q Ambulance.

US\$1.021 million was planned to conduct the ballistic survivability/lethality analysis for US Army aviation systems, with US\$601,000 earmarked for the conduct of chemical, biological, nuclear, and atmospheric effects survivability analysis for US Army aviation systems. Another US\$190,000 would go to providing integrated survivability/lethality analyses to support scheduled aviation systems program decision milestones in FY96.

US\$97,000 of these funds would be reprogrammed for SBIR/STTR Programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992. US\$31,000 would not be available due to Revised Economic Assumptions.

The FY97 program plan budgeted US\$2.126 million to conduct the electronic warfare vulnerability assessment for US Army aviation systems that are in development, undergoing P3I, or have been recently fielded. Another \$ 774,000 would be used to conduct the ballistic survivability/lethality analysis for US Army aviation systems. US\$634,000 was budgeted to conduct the chemical, biological, nuclear, and atmospheric effects survivability analysis for US Army aviation systems and US\$205,000 would provide integrated survivability/lethality analyses to support scheduled aviation systems program decision milestones in FY97.

PROJECT D675 — C4/IEW SYSTEMS. This project supports the survivability analysis of Army communications and electronic equipment against friendly and enemy threats. It provides field threat environment support for the analyses, and studies the vulnerabilities of foreign threat weapons, C4I, and Intelligence Electronic Warfare (IEW) systems to US EW. It provides threat weapon electronic design data to countermeasure developers and technical capability information to the intelligence community, supporting Army initiatives in vulnerability reduction of C4I/IEW systems against the full spectrum of battlefield threats.

Work in this area was restructured to this project in FY96.

In FY96 plans the Army would conduct integrated electronic, ballistic, and chemical/biological/nuclear/atmospheric effects survivability analysis for US Army command and control systems. This effort supports Maneuver Control System, Common Hardware and

Software, Standard Integrated Command Post Shelter, Advanced Field Artillery Tactical Data System, FAAD-C21, and Combat Service Support Control System and was funded at US\$2.073 million. US\$1.589 million went into conducting integrated electronic, ballistic, and chemical/biological/nuclear/atmospheric effects survivability analysis for U.S. Army communications systems such as Mobile Subscriber Equipment, SINCGARS, Global Positioning System, Single Channel Anti-jam Man Portable radio, Secure Mobile Anti-jam Reliable Tactical Terminal, and Enhance Manpack UHF-Terminal.

US\$996,000 was allocated to conduct integrated electronic, ballistic, and chemical/biological/nuclear/atmospheric effects survivability analysis for U.S. Army intelligence and electronic warfare (IEW) systems such as the Battlefield Combat Identification System, enhanced Firefinder radar, and Joint Surveillance Target Attack Radar System/Ground Station Module. US\$194,000 would provide integrated survivability/lethality analyses to support scheduled C4I/IEW systems program decision milestones in FY96. US\$112,000 would be reprogrammed for SBIR/STTR Programs in accordance with the Small Business Innovation Research Program Reauthorization Act of 1992. As a result of Revised Economic Assumption, US\$35,000 was not available for Execution.

The FY97 planned program put US\$2.073 million into integrated electronic, ballistic, and chemical/biological/nuclear/atmospheric effects survivability analysis for US Army command and control systems. This effort supports the Advanced Field Artillery Tactical Data System, Common Hardware and Software, Maneuver Control System, FAAD-C21, Standard Integrated Command Post Shelter, and Combat Service Support Control System. US\$1.684 million was planned to conduct integrated electronic, ballistic, and chemical/biological/nuclear/atmospheric effects survivability analysis for U.S. Army communications systems such as SINCGARS, Global Positioning System, Mobile Subscriber Equipment, Single Channel Anti-jam Man Portable radio, Secure Mobile Anti-jam Reliable Tactical Terminal, and Enhance Manpack UHF Terminal. US\$1.058 million would be used to conduct integrated electronic, ballistic, and chemical/biological/nuclear/atmospheric effects survivability analysis for US Army intelligence and electronic warfare (IEW) systems such as the Battlefield Combat Identification System, Joint Surveillance Target Attack Radar System/Ground Station Module, and enhanced Firefinder radar.

US\$212,000 was programmed to provide integrated survivability/lethality analyses to support scheduled C4I/IEW systems program decision milestones in FY97.

PROJECT D677 — GROUND COMBAT SYSTEMS: This project investigates the survivability and vulnerability of Army ground combat systems. Analysts will support weapon requirements, the preparation of test and evaluation master plans, cost/operational effectiveness analysis, and major decision milestones.

Work in this area was restructured to this project in FY96.

In FY96, the project office is scheduled to conduct electronic warfare vulnerability assessments of such systems as the Bradley A3 Command and Control Vehicle (C2V), Armored Gun System (AGS), AFAS/ FARV, ABRAMS M1A2, Breacher, and Heavy Assault Bridge (US\$1.758 million). It supported ballistic survivability with US\$2.367 million and CBN analysis for ground combat systems with US\$1.327 million. Support for program decision milestones in FY96 was requested at US\$223,000. US\$130,000 would be reprogrammed for SBIR/STTR Programs and US\$41,000 not available for Execution due to the Revised Economic Analysis.

The FY97 program requested US\$1.398 million to conduct the electronic warfare vulnerability assessment for U.S. Army ground combat systems such as Crusader (AFAS/FARV), Bradley A3, Command and Control Vehicle, ABRAMS M1A2, Breacher, Heavy Assault Bridge and the Family of Medium Tactical Vehicles (FMTV). US\$2.296 of the request was to conduct the ballistic survivability/lethality analysis for U.S. Army ground combat systems. Another US\$1.401 million was allocated to support conducting the chemical, biological, nuclear, and atmospheric effects survivability analysis for US Army ground combat systems. Another US\$242,000 would provide integrated survivability/lethality analyses to support scheduled ground combat systems program decision milestones in FY97.

PROJECT D678 — MUNITIONS SYSTEMS. This project funds the investigation of the lethality/vulnerability of Army fire support weapons (smart and conventional) to the full spectrum of battlefield threats. The analysis is integrated across all battlefield threats, i.e., conventional ballistic, electronic warfare, directed energy, nuclear weapons effects, and nuclear and chemical/biological contamination effects. This work is accomplished through theoretical and engineering analyses, signature measurements, modeling, simulations, laboratory experiments, and field investigations.

Work is restructured to this project in FY96.

The FY96 planned program is to conduct the electronic warfare vulnerability assessment of such munitions systems as the Hellfire Longbow Missile, BAT/BAT P3I, Wide Area Mine, STAFF, and Javelin. US\$4.033 million would be used for this effort. Ballistic survivability/lethality analysis funding was put at US\$686,000 and CBNA analysis US\$741,000. Milestone support is programmed to run US\$188,000. US\$SBIR/STTR re-programmed funds were US\$130,000 and US\$41,000 was not available.

In FY97, this effort would conduct the electronic warfare vulnerability assessment for U.S. Army munitions systems such as BAT/BAT P3I, Hellfire Longbow Missile, STAFF, Wide Area Mine, Javelin, EFOG-M, FOT TOW and MSTAR for US\$4.026 million. US\$725,000 was budgeted to conduct the ballistic survivability/lethality analysis for US Army munitions systems and US\$778,000 would be spent to conduct the chemical, biological, nuclear, and atmospheric effects survivability analysis for US Army munitions systems. US\$200,000 was set aside to provide integrated survivability/lethality analyses to support scheduled munitions systems program decision milestones in FY97.

PROJECT D679 — SOLDIER SYSTEMS. This project provides the Soldier Survivability Assessments (SSvA) required for the MANPRINT Soldier Survivability Domain. The survivability of soldier systems is investigated and reported to milestone decision reviews

and covers fratricide reduction, soldier detectability reduction, attack prevention if detected, damage prevention, medical injury reduction, the reduction of mental and physical fatigue as it relates to the operation, maintenance and support of the system being evaluated; and how these factors might impact the system's pre-established manpower, personnel, and training goals and constraints.

A major thrust of this project is to identify any problems in design characteristics which should be corrected to assure or enhance operational effectiveness.

Work in this area is being restructured to this project in FY96.

The FY96 program will conduct an integrated electronic, ballistic, and chemical/biological/nuclear/atmospheric effects survivability analysis for the US Army Land Warrior System (US\$555,000) and coordinate preparation and direct execution of MANPRINT Soldier Survivability Assessments and Reports (US\$114,000). Milestone support is set at US\$115,000, with US\$18,000 set aside for SBIR/STTR programs and US\$6,000 no available due to economic revisions.

The FY97 program programmed US\$576,000 for the Land Warrior System analysis, including the Computer and Communications gear, and US\$119,000 for MANPRINT. US\$119,000 would go to milestone support.

Funding

	<u>US FUNDING</u>							
	FY94		FY95		FY96		FY97	
	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>
<u>RDT&E (USA)</u>								
PE0605604A								
Survivability/Lethality								
Analysis								
DC10 Aviation Sys	-	3.7	-	4.6	-	0.0	-	0.0
DC067 AW Qual	-	2.8	-	0.0	-	0.0	-	0.0
D089 Acft Certif.	-	0.0	-	3.0	-	0.0	-	0.0
D181 ARM CCM	-	0.0	-	1.0	-	0.0	-	0.0
D190 Int. Anal	-	6.1	-	6.8	-	0.0	-	0.0
D234 CC/Fire Spt	-	6.6	-	6.9	-	0.0	-	0.0
D235 Missile CCM	-	0.7	-	0.7	-	0.0	-	0.0
D267 AD/MD Anal	-	6.4	-	8.0	-	0.0	-	0.0
D262 C4I Surv	-	5.7	-	6.3	-	0.0	-	0.0
D670 Emerg Tech	-	0.0	-	0.0	-	5.4	-	4.9
D671 Air/Missile Def		0.0	-	0.0	-	6.4	-	5.8
D672 Aviation Sys		0.0	-	0.0	-	4.3	-	3.7
D675 C4I/IEW Sys		0.0	-	0.0	-	5.0	-	5.0
D677 Grnd Cmbt Sys		0.0	-	0.0	-	5.8	-	5.3
D678 Munitions Sys		0.0	-	0.0	-	5.8	-	5.7
D679 Soldier Sys		0.0	-	0.0	-	0.8	-	0.8
RDT&E Total	-	32.0	-	37.3	-	33.5	-	31.2
<u>RDT&E</u>								
			FY98 (Req)	FY99 (Req)	FY00 (Req)	FY01 (Req)		
(USA estimate)	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>	<u>QTY</u>	<u>AMT</u>
DC670	-	5.3	-	5.3	-	5.0	-	5.6
D0671	-	6.2	-	6.6	-	6.5	-	6.9
D672	-	3.7	-	3.8	-	3.8	-	3.9
D675	-	4.9	-	4.8	-	4.7	-	5.2
D677	-	5.7	-	6.3	-	6.2	-	6.2
D678	-	5.8	-	5.7	-	5.6	-	6.2
D679	-	0.8	-	0.8	-	0.8	-	0.8
RDT&E Total	-	28.7	-	33.3	-	32.6	-	34.8

Congress approved full requested funding for FY97.

All US\$ are in millions.

Recent Contracts

No recent contracts identified.

Timetable

No milestone information has been released.

Worldwide Distribution

This is a **US Army** only program.

Forecast Rationale

Survival is the key to the battlefield. When first created, this program established projects that would give better visibility and control of vulnerability assessment efforts, something sorely needed in what had long been a weak area. Survivability and vulnerability analysis tended to be based on real-life experience, something that can be hard on the involved parties.

New technology creates new vulnerabilities in existing equipment and inadequate protection built in to developing systems. A major early emphasis was on newly developing IR/EO vulnerabilities. The Persian Gulf War proved that IR/EO capabilities had become critical for future combat.

An important early result of the program was the establishment of databases and evaluation techniques to support engineering development efforts, and the distribution of these data to other services and industry. This is helping program managers decide what is needed and engineers to design protection into systems as they are being developed. The Army has come to capitalize on a broad spectrum of abilities and expertise in the selection of

contractors to conduct the analyses and develop program plans.

In FY96, the Army reorganized the entire program to include new efforts and thrusts to replace analyses that were completed or could be combined with other efforts. Support for this program continues to be good.

Major concentrations in the future will be in the electro-optical and signature reduction efforts, as well as evaluation of the susceptibility of electronics systems to an increasingly sophisticated threat. Because of changes in the international threat climate, fewer new systems will be introduced over the decade; but new information on what had been "enemy" equipment is making it possible to re-evaluate current equipment in a new light and against actual characteristics.

The forecast was based on this program element continuing as currently established and is based primarily on work to be done. In the out years, planners may revise the PE and some of the forecast work may be moved to other programs. If this happens, the funding estimated for that work will be transferred as well.

Ten-Year Outlook

<u>FORECAST FUNDING LEVELS</u>													
(FY96 US \$ Millions)													
		<u>High Confidence</u>				<u>Good Confidence</u>				<u>Speculative</u>			
		<u>Level</u>				<u>Level</u>							
<u>Designation</u>	<u>Application</u>	<u>thru 96</u>	<u>97</u>	<u>98</u>	<u>99</u>	<u>00</u>	<u>01</u>	<u>02</u>	<u>03</u>	<u>04</u>	<u>05</u>	<u>06</u>	<u>Total</u>
PE0605604A	TECHNOLOGY & VULNERABILITY												
	ASSESSMENT												
	(US ARMY)	314.77	31.20	28.70	33.30	32.60	34.80	30.00	32.00	30.00	31.00	30.00	313.60