PROCEEDINGS
for the
ADVANCE PLANNING
BRIEFING FOR INDUSTRY

US ARMY
LABORATORY COMMAND
HARRY DIAMOND LABORATORIES

at
U.S. Army Adelphi Laboratory Center
Adelphi, Maryland
23–24 January 1990

APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION UNLIMITED

90 08 11 078
The objective of the Advance Planning Briefing for Industry (APBI) was to:

a. Present technologies in which the U.S. Army Laboratory Command (LABCOM) and Harry Diamond Laboratories (HDL) have interest in and are planning to pursue for the mid- and long-term.

b. Show the private sector a preview in order to assure that industry research and development investments coincide with the needs of the Army.

HDL performs and provides basic and applied research, explanatory and advanced development, technology leadership and evaluation and initial procurement to support the following mission areas: Nuclear Survivability, High-Power Microwave Survivability and Source Technology, Electronic Fuzing and Smart Munitions, Radar Technology, Anti-Radiation Missile Countermeasures and Information/Signal Processing.

The proceedings for the APBI provides advance planning information in the following areas: Global Position System, Fuzing, Battlefield Automation, (see continuance).
18. SUBJECT TERMS - continued

ATACMS - Army TACTical Missile System
Broad Agency Announcement
Electronic Countermeasures
Electronic Counter-Countermeasures
EMP - ElectroMagnetic Pulse
Electronic Safing and Army Guidance Integrated Fuzing
Global Positioning System
HDL - Harry Diamond Laboratories
LABCOM
LB/TS - Large Blast/Thermal Simulator
Liquid Crystal Display
MMIC - Monolithic Millimeter wave Integrated Circuit
Multi-Option Fuze for Artillery
NSAT - Nuclear Survivability Assessment Team
OEIC - OptoElectronic Integrated Circuits
RDTE
RSTA - Reconnaissance, surveillance and Target Acquisition
SADBU - Small and Disadvantaged Business Utilization
SAR - Synthetic Aperture Radar
Standing Acoustic Wave
TILO - Technical and Industrial Liaison Office

19. ABSTRACT - continued

MEMORANDUM FOR Administrator, Defense Technical Information
Center, ATTN: DTIC-FDAC, Building 5, Cameron
Station, Alexandria, VA 22304-6145

SUBJECT: Advance Planning Briefing for Industry Proceedings.

1. Enclosed are two (2) copies of the Proceedings for the
U.S. Army Laboratory Command (LABCOM), Harry Diamond Laboratories
(HDL) Advance Planning Briefing for Industry (APBI), held at the
Adelphi Laboratory Center on 23-24 January 1990. This publication
is unclassified and approved for public release; distribution
unlimited.

2. Point of contact is Mr. Melvyn J. Shichtman, LABCOM Technical
and Industrial Liaison Officer, (202) 394-3883.

FOR THE COMMANDER:

JOYCE E. SWEASY
Competition Advocate

2 Encls
1. 2 copies of proceedings
2. DD Form 1473

CF (wo/encls):
AMSLC-PA (Ms. Singleton) SLCHD-D-PA (Ms. Coleman)
AMSLC-MI-SS (Ms. Richeson) SLCHD-PO-P (Mr. Polimadei)
Headquarters, Laboratory Command
and
Harry Diamond Laboratories
present

1990 Advance Planning Briefing for Industry (APBI)

Melvyn J. Shichtman,
Technical and Industrial Liaison Officer,
Headquarters, Laboratory Command

and

Mary S. Binseel
and
Dorothy J. Aldrich,
Plans Branch,
Harry Diamond Laboratories

Supported by:
American Defense Preparedness Association

APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION UNLIMITED
Ladies and Gentlemen:

I am excited about the opportunity the next two days will bring to everyone participating in this session of advance planning.

The future is full of challenges for all of us who are concerned with the defense of our nation. The recent events around the world have kept us on the edges of our seats, wondering what will happen next. In many ways, it’s a whole new world out there, and we are going to be tested on our flexibility, and on the vigor with which we respond to these new challenges.

I have immense confidence, not only in the talents and dedication of the people of Harry Diamond Laboratories and all of Laboratory Command, but also in the abilities of our counterparts in the private sector.

As we exchange information during these days, I hope that the synergism created here will inspire all of us to rededicate ourselves to ensuring that our armed forces have the highest quality equipment. Even with the reduced tensions that appear to lie ahead, the people who have committed themselves to protecting our country and our world deserve the best we can give them.

Welcome to all of you. Harry Diamond Laboratories is pleased to host these two days, and we look forward to a pleasant and productive interchange and constructive future relationships with you.

JERRY L. REED
Director
ACKNOWLEDGMENTS

The organizers of this Advance Planning Briefing for Industry wish to acknowledge and thank the following personnel:

Ms. Jackie Richeson, LABCOM Office of the Deputy Chief of Staff for Intelligence, Security/Counterintelligence Division, for her advice and assistance regarding conference security concerns;

Ms. Sherrie Curtis and Mrs. Maryann Biggins, ISA Physical Security Office, for their advice and assistance regarding visitor control;

Ms. Marian Singleton, LABCOM Public Affairs Office, for her advice and assistance in clearing the LABCOM briefings for public release; and

Ms. Cathy Coleman, HDL Public Affairs Officer, for her advice and assistance in clearing the HDL briefings for public release.

Further, the organizers of this event wish to thank MG Jerry Harrison, Commander, LABCOM; Mr. Richard Vitali, LABCOM Director of Corporate Laboratories; Mr. Jerry Reed, Director, Harry Diamond Laboratories; Dr. John Scully, Deputy Director, Harry Diamond Laboratories; and Dr. Joseph Sattler, Chief Scientist, Harry Diamond Laboratories for their support which ensured the success of the Advance Planning Briefing for Industry and to Mr. David Overman, Chief, Mechanical Systems Branch, Harry Diamond Laboratories, and Mr. Raymond Femenias, Plans Branch, Harry Diamond Laboratories for their assistance in the initial planning phases of this event.
GLOSSARY OF ACRONYMS

A/C - Aircraft
AFAS - Advanced Field Artillery System
AI - Artificial Intelligence
AMC - Army Materiel Command
AMCCOM - Armaments, Munitions and Chemical Command
AO - Acousto-Optic
APBI - Advance Planning Briefing for Industry
APCP - Army Potential Contractor Program
ASL - Atmospheric Sciences Laboratory
ATACMS - Army Tactical Missile System
ATM - Anti-Tactical Missile
BAA - Broad Agency Announcement
BRL - Ballistic Research Laboratory
CBD - Commerce Business Daily
CM - Configuration Management
DSREDS - Digital Storage and Retrieval Engineering Data System
DLA - Defense Logistics Agency
DNA - Defense Nuclear Agency
DSSP - Defense Standards and Specifications Program
DTIC - Defense Technical Information Center
ECM - Electronic Countermeasures
ECCM - Electronic Counter-Countermeasures
EMP - Electromagnetic Pulse
ERA II - Extended Range Artillery Projectile II
ESA - Electronic Safing and Arming
ETDL - Electronic Technology and Devices Laboratory
FAADS-LOS-F-H - Forward Area Air Defense - Line Of Sight - Forward - Heavy
GIF - Guidance Integrated Fuzing
GPS - Global Positioning System
HDL - Harry Diamond Laboratories
HEL - Human Engineering Laboratory
HEMP - High altitude ElectroMagnetic Pulse
HIMADS - HIgh to Medium Altitude Air Defense System
ILS - Integrated Logistic Support
INR - Initial Nuclear Radiation
IRAD - Independent Research And Development
LABCOM - Laboratory Command
LB/TS - Large Blast/Thermal Simulator
LCD - Liquid Crystal Display
LICRS - Low Intensity Conflict Rocket System
LOS - Line Of Sight
LPI - Low Probability of Intercept
LSAA - Long-Standoff Anti-Armor
MIL-STD - Military Standard
MLRS - Multiple Launch Rocket System
MMAAWS - Multimode Antiarmor Weapon System
MMIC - Monolithic Millimeter wave Integrated Circuit
MMT - Manufacturing Methods and Technology
MOB - MOBilization
MOFA - Multi-Option Fuze for Artillery
MSAM - Medium range Surface to Air Missile
NAVAID - NAVigational AID
NC - Numerical Control
NDI - Non-Developmental Item
NSAT - Nuclear Survivability Assessment Team
OEIC - OptoElectronic Integrated Circuits
PM-AAWS-M - Program Manager, Advanced Antitank Weapon Systems - Medium
PM-AFAS - Program Manager, Advanced Field Artillery System
PM-TOW - Program Manager, Tube launched Optically tracked Wire guided missile
POC - Point of Contact
RDTE - Research, Development, Test and Evaluation
RSTA - Reconnaissance, Surveillance and Target Acquisition
SADBU - Small And Disadvantaged Business Utilization
SAR - Synthetic Aperture Radar
SAW - Standing Acoustic Wave
SLMs - Surface Launched Missiles
TACAWS - The Army Counter-Air Weapon System
TDP - Technical Data Package
TILO - Technical and Industrial Liaison Office
TOD - Technical Objective Documents
TSR - Tactical Source Region
UAV - Unmanned Aerial Vehicle
UGT - UnderGround nuclear Test
AGENDA
TUESDAY, 23 JANUARY 1990

0700- Late Registration and Security Check-in.
0830  Lob., building 205, U.S. Army Adelphi Laboratory Center, 2800 Powder Mill Road, Adelphi, Maryland

OPENING SESSION
0830  Administrative Remarks. Melvyn J. Shichtman, Technical and Industrial Liaison Officer, U.S. Army Laboratory Command
0840  Security Considerations. Office of the Deputy Chief of Staff for Intelligence
0845  Welcome Remarks. Major General Jerry C. Harrison, Commander, U.S. Army Laboratory Command
0855  Symposium Purpose and Overview. Richard Vitali, Director of Corporate Laboratories
0905  User Requirements. James F. Fox, Scientific Advisor, Combined Arms Combat Development Activity, U.S. Army Training and Doctrine Command
1000  Overview of Harry Diamond Laboratories. Jerry L. Reed, Director, Harry Diamond Laboratories
1030  Break

SESSION I
TECHNOLOGY APPLICATIONS
Session Chairman:
Philip F. Ingersoll
Director, Technology Applications Laboratory
1100  Introduction. Philip F. Ingersoll, Session Chairman
1105  Global Positioning System. John S. Eick, Electronics Engineer, Tactical Systems Branch
1135  Fuzing. William L. Konick, Fuzing Manager
1210  Battlefield Automation. Dr. Philip J. Emmerman, Chief, Advanced Sensor Systems
1240  Lunch, Cafeteria

SESSION II
NUCLEAR SURVIVABILITY
Session Chairman:
Dr. John C. Ingram
Deputy Director, Nuclear Survivability Laboratory
1350  Overview. Dr. John C. Ingram, Session Chairman
1405  Nuclear Survivability Technology. James H. Gwaltney, Chief, Nuclear Survivability Program Office
- High-Altitude EMP
- Blast/Thermal Radiation
- Tactical Source Region
1435  Break
1540  Nuclear Weapons Effects Hardening Technology. John J. Comgan, Nuclear Survivability Program Office
- Hardness Assurance/Hardness Maintenance
- Nondevelopmental Items (NDI)
- Defense Standards and Specifications Program
- Large Blast/Thermal Simulator

1535  Nuclear Survivability Assessments. Roland A. Polimades, Nuclear Survivability Program Office
- Nuclear Effects Support Term
- Nuclear Survivability Assessment Team
1555  Aurora/Radiation Simulation Technology. Dr. Forrest J. Agee, Chief, Simulation Technology Branch
1705  Adjourn
1800- Reception, Holiday Inn - Calvert - , 4805 Powder Mill Rd., Adelphi, MD
1930  Road, Beltsville, MD

WEDNESDAY, 24 JANUARY 1990

0730- Security Check-In. Lobby - Building 205, U.S. Army Laboratory Center, 2800 Powder Mill Rd., Adelphi, MD
0830  Adelphi Laboratory Center, 2F, Powder Mill Rd., Adelphi, MD
0830  Opening Session
0830  Administrative Remarks. Melvyn J. Shichtman, Technical and Industrial Liaison Officer, U.S. Army Laboratory Command
0835  Domestic Technology Transfer Opportunities. Clifford E. Lanham, Army Domestic Technology Transfer Manager

SESSION III
TARGET SENSORS AND SIGNAL PROCESSING
Session Chairman:
Peter B. Johnson
Director, Target Sensors and Signal Processing Laboratory
0800  Introduction. Peter B. Johnson, Session Chairman
0805  Radar Technology. John M. David, Chief, Radar Branch
0835  Fuzing Technology. Dr. Z. G. Szankay, Chief, Sensor Physics Branch
1005  Signal Processing Technology. Dr. John M. Pellegrino, Chief, Optical Processing Technology Branch
1035  Break

SESSION IV
ENGINEERING AND TECHNICAL SUPPORT
Session Chairman:
Ira R. Marcus
Associate Director, Engineering and Technical Support Division
1100  Introduction, Ira B. Marcus, Session Chairman
1105  Automated Assembly of Electronics Circuits. George K. Lucay, Jr., Chief, Systems Engineering Branch
1135  U.S. Army Laboratory Command Small Business Programs. Thomas K. Rogers, Chief Small and Disadvantaged Business office
1205  Industrial Liaison Programs. Melvyn J. Shichtman, Technical and Industrial Liaison Officer, U.S. Army Laboratory Command
1230  Symposium Wrap-Up. Jerry L. Reed, Director, Harry Diamond Laboratories
1235  Adjourn
OVERVIEW

OF

HARRY DIAMOND LABORATORIES

ADVANCE PLANNING BRIEFING FOR INDUSTRY

23 JANUARY 1990

PRESENTED BY

MR. JERRY L. REED
DIRECTOR
OVERVIEW

- Organization
- Mission
- FY 90 Funding Profile
HDL MISSION

HDL performs and provides basic and applied research, exploratory and advanced development, technology leadership and evaluation and initial procurement to support the following mission areas:

- **Nuclear Survivability**
- **High-Power Microwave Survivability and Source Technology**
- **Electronic Fuzing and Smart Munitions**
- **Radar Technology**
- **ARM/CM**
- **Information/Signal Processing**

As agents for Program Executive Officers, Project Managers and Research, Development and Engineering Centers, HDL implements transfer of mission area technologies.
HDL MAJOR FIELDS OF TECHNICAL ENDEAVOR

- Sensor Technology
- Signal Processing
- Information Processing & Sensor Fusion
- Fuze Applications
- Nuclear Survivability
- Radio Frequency Directed Energy Weapons Technology
- Producibility Technology
ACCOMPLISHMENTS
(LAST 5 YEARS)

- Developed the Patriot fuze, Chaparral target detecting device, a nuclear artillery fuze, a mortar fuze, and the MLRS time fuze.
- Fuze technology (LSAA, electrostatics...)
- Created and demonstrated a combat information processor.
- Constructed and fielded two test bed acousto-optic based processing systems for wide band signal detection and analysis.
- Demonstrated MTI radar for UAV.
- Completed PIP for high altitude EMP protection.
- Developed hardened electrical/electronic shelters for nuclear survivable C3I tactical systems.
- Basic R&D for HPM (World's record for pulsed power)
- ARM/CM
- Signature simulations and modeling
HARRY DIAMOND LABORATORIES

Optoelectronics and Electromagnetics Research

Signal Processing and Sensor Fusion

Fuze Applications

Sensors
• Guidance Integrated Fuzing
• Multi-static radar
• Wideband (impulse) radar
• Radar target models
• ARM-threat simulations
- High dynamic range optical signal processing
- Optoelectronics
- Neural nets
- Radar, electro-optical SIGINT, and other sensor information integration, with terrain knowledge

- Advanced multi-sensor fusion algorithm & expert systems

- Target acquisition theory
• XM450 Medium Altitude Proximity/Time MLRS Binary Chemical Fuze

• Multi-Option Fuze for Artillery (MOFA)
• Near term emphasis on resolving soldering problems and establishing meaningful inspection criteria

• Broad interest in automated assembly of electronics

• Specific interest in novel assembly concepts and circuit assembly of future circuits such as photonic information processing systems
FUNDING PROFILE

FY 90
FY90 CONTRACT OBLIGATIONS
TOTAL ($K)

INFO PROCESSING 1,870
NUCLEAR SURVIVE 4,300
RF/DEW 8,235
SIGNAL PROCESSING 4,000
SENSOR TECHNOLOGY 8,181
PRODUCIBILITY 250

TOTAL: $124,881 K
FY90 CONTRACT OBLIGATIONS ($K)

TOTAL: $28,876 K

- RF/DEW: 8,236
- PRODUCIBILITY: 1,870
- INFO PROCESSING: 2,040
- FUZING: 4,000
- SIGNAL PROCESSING: 4,300
- NUCLEAR SURVIV: 8,181

EXCLUDES $98,005 K FUZE PRODUCTION
FY90 SUPPLIES/EQUIPMENT ($K)

TOTAL: $16,125 K
FY 90 CONTRACT PLAN

LESS THAN 100K: 35%
100K TO 600K: 49%
500K TO 1M: 8%
GREATER THAN 1M: 8%

ACTIONS (273 TOTAL)
FY90 COMPETITIVE ACTIONS ($K)

COMPETITIVE 54% 76,515
NON COMPETITIVE 46% 64,491

TOTAL: $141,006 K
FY90 COMPETITIVE ACTIONS ($K)

TOTAL: $76,515 K
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• HDL anticipates stable R&D funding for the future.

• Many business opportunities exist in several diverse technical areas.

• HDL advocates development of Government - Industry - Academia partnerships.
ACCOMPLISHMENTS
(LAST 5 YEARS)

HARRY DIAMOND LABORATORIES

- Developed the Patriot fuze, Chaparral target detecting device, a nuclear artillery fuze, a mortar fuze, and the MLRS time fuze.
- Fuze technology (LSAA, electrostatics...)
- Created and demonstrated a combat information processor.
- Constructed and fielded two test bed acousto-optic based processing systems for wide band signal detection and analysis.
- Demonstrated MTI radar for UAV.
- Completed PIP for high altitude EMP protection.
- Developed hardened electrical/electronic shelters for nuclear survivable C3I tactical systems.
- Basic R&D for HPM (World’s record for pulsed power)
- ARM/CM
- Signature simulations and modeling
USER REQUIREMENTS

23 JANUARY 1990

ADVANCED PLANNING BRIEFING FOR INDUSTRY

LABCOM & HARRY DIAMOND LABS

JAMES F. FOX
COMBINED ARMS CENTER
ATZL-SCI
FT. LEAVENWORTH, KS 66027
AV 552-2962
COMM 913-684-2962
TOPICS

SPEAKER IDENTIFICATION

NEW CD PROCESS

OTHER INITIATIVES

EXAMPLE REQUIREMENTS
REVISE OUR TRADITIONAL APPROACH TO CBRS BY PROVIDING CONDUIT TO ARMY COMPONENT COMMANDERS (ACC) AND MACOM COMMANDERS

- WORK WITH ACC/MACOM TO OBTAIN ARMY REQUIREMENTS
- INTEGRATE INPUT INTO CBRS
- COORDINATE CBRS PRODUCTS WITH ACC/MACOM
PLANNING PROCESS

- Planning, Programming, Budgeting, and Execution System
CAC CBRS RESPONSIBILITIES

WARFIGHTING CONCEPTS  →  BATTLEFIELD DEVELOPMENT PLAN  →  ARMY MODERNIZATION MEMORANDUM

→ DOC MOD STRAT
→ TNG MOD STRAT
→ LDR DEV MOD STRAT
→ ORG MOD STRAT
→ FIELD LRRDAP

OCT 89  →  SEP 91
LIC OPERATING SYSTEMS (LOS)

- Maneuver
- Security
- Development
- Coalition
- Training
- Intelligence
- Command & Control
- Force Protection
- Communication
- Force Maintenance
POTENTIAL TECHNOLOGY APPLICATIONS IN LIC

DISCRIMINATE WEAPONS SYSTEMS
MINIATURIZED EXPLOSIVES & NARCOTICS DETECTION EQUIPMENT
SMART ELECTRONIC CARDS FOR PERSONAL IDENTIFICATION
X-RAY MACHINES FOR NON-METALLIC OBJECTS
CULTURAL-SPECIFIC PACKAGED RATIONS
COMPUTER SIMULATIONS FOR MISSION REHEARSALS
LOW-COST, EFFECTIVE NIGHT VISION EQUIPMENT
LOW-COST, SIMPLE COUNTERMINE EQUIPMENT
1. WHAT IS VALUE OF BDP DONE UNDER OLD "RULES"

2. CAN CBRS CYCLE REACT TO NEW "RULES"
OBJECTIVE: LEVERAGE TECHNOLOGY
FOR WINNING ---

TECH BASE SEMINAR GAMING

ALBF - C

TECH BASE
MASTER PLAN

NEXT GENERATION SYSTEMS
FUTURE SYSTEMS

AMM

TRADOC  AMC
TECH BASE INVESTMENT STRATEGY REVIEW

PHASES I & II: Tech Base Investment Strategy Conf '90

ESTABLISH SETTING – 2010

- GEOPOLITICAL BRIEF
- REGIONAL BRIEFS
- ALBF – CONCEPT
- CONTINGENCY FORCE PKG
- THREAT BRIEFS

EQUIP THE FORCE

PHASE I:

CONCEPT OF NGS/FS APPLICATIONS

- NGS/FS SOURCE BOOK
- SEMINAR DISCUSSIONS
  TECHNOLOGISTS
  TACTICIANS

PHASE II:

BUY NGS/FS

- PROMISING NGS/FS
- COST CONSTRAINED
- R&D, ACQ, O&S

TRADOC AMC
TECH BASE INVESTMENT STRATEGY REVIEW

PHASE III: Tech Base Seminar Game II

3 REGIONAL SETTINGS

LATAM  SWA  EUR

6 WAR DAYS FOR EACH SETTING

M-day  D-day  D+6  D+15  ... Six Snapshots

CONTINGENCY MISSION XX

EVALUATE THE FORCE

SEMINAR GAMING

- SELECTED NGOS/FS
- SEMINAR DISCUSSIONS
- TECHNOLOGISTS
- TACTICIANS
- COMPUTER ASSISTED

AMC  TRADOC
NATIONAL ACADEMY OF SCIENCE
BOARD ON ARMY SCIENCE & TECHNOLOGY (BAST)
STRATEGIC TECHNOLOGY FOR THE ARMY (STAR) STUDY

OBJECTIVE

RECOGNIZE NOW, HIGH-PAYOFF TECHNOLOGIES THAT CAN:

- BE INSERTED INTO 21ST CENTURY ARMY EQUIPMENT & DOCTRINE
- YIELD GREATLY IMPROVED WARFIGHTING CAPABILITY
STRATEGIC TECHNOLOGIES FOR THE ARMY (STAR) STUDY
SCOPE

- DURATION: TWO YEARS
- MANY YEARS OF EFFORT REQUIRED:
  - 150 PER YEAR FOR BAST MEMBERS
  - 150 PER YEAR FROM ARMY
    (ASA, AMC, TRADOC, COE, MRDC, ARI, SDC, SOCOM)
- BAST PRINCIPALS:
  - DR MARTIN A. GOLAND, BAST CHAIRMAN
  - DR WILLIS HAWKINS, STUDY CHAIRMAN
  - MR. RAY L. LEADABRAND, INTEGRATION SUBCOMMITTEE
  - MR. MICHAEL D. RICH, TECH MGMT & DEV PLANNING
    SUBCOMMITTEE
  - MR. ROBERT R. EVERETT, SCIENCE & TECHNOLOGY
    SUBCOMMITTEE
STRATEGIC TECHNOLOGY FOR THE ARMY (STAR) STUDY APPROACH

• IDENTIFY THE ADVANCED TECHNOLOGY MOST LIKELY TO BE IMPORTANT IN GROUND WARFARE IN THE 21ST CENTURY

• OFFER TECHNOLOGY STRATEGIES THAT THE ARMY SHOULD CONSIDER IN DEVELOPING THEIR FULL POTENTIAL

• SUGGEST, WHERE POSSIBLE, THE IMPLICATIONS FOR FORCE STRUCTURE MODERNIZATION AND STRATEGY
STRAATEGIC TECHNOLOGY FOR THE ARMY (STAR)

BAST STUDY ORGANIZATION

BAST, S&T, SUBCOMMITTEE

1-COMPUTER SCI/AI & ROBOTICS
2-ADV MATERIALS & ENERGETIC MTLs
3-BIO-TECHNOLOGY & BIOCHEMISTRY
4-ELECTRONICS & SENSORS
5-PROPULSION & POWER
6-DIRECTED ENERGY/PHOTONICS/OPTICS
7-ENVIRONMENTAL & ATMOSPHERIC SCI
8-MANUFACTURING TECH
9-BASIC SCIENCES

GENERAL CHAIRMAN EXECUTIVE COMMITTEE

STAR STUDY COMMITTEE

BAST INTEGRATION SUBCOMMITTEE

SENIOR ARMY ADVISORY GROUP

TECH MANAGEMENT & DEV PLANNING SUBCOMMITTEE

ARMY MISSION AREA ADVISORY GROUP

ARMY INTELLIGENCE SOURCES

1. ELECTRONIC SYS
2-AIRBORNE SYS
3-LETHAL SYS
4-MOBILITY SYS
5-SUPPORT SYS
6-PERSONNEL PERFORMANCE
7-HEALTH & MEDICINE
8-SPECIAL TECH & SYS

AMC
CURRENT STATUS

ARMY

- APPROVED DIRECTED ENERGY MASTER PLAN

- RF CONCEPTS

  ◦ ATACM RF MUNITION AND LOITERING RF DRONE
  ◦ COUNTERMINE - RF DEVICE
  ◦ AREA DENIAL - RF MINE
  ◦ PROXIMITY FUZE/SENSOR JAMMER
  ◦ COMBAT VEHICLE/AIRCRAFT PROTECTION
  ◦ RF AIR DEFENSE SYSTEM

AIR FORCE/NAVY

- DRAFT DIRECTED ENERGY MASTER PLANS

- OPERATIONAL CONCEPTS NOT YET IDENTIFIED
"DEWING THE DEWABLE" -- SURVIVABILITY --

RADIO FREQUENCY

NEAR TERM

● IDENTIFY VULNERABILITIES

● RF HARDEN EQUIPMENT

● PLAN FOR ADDITIONAL PROTECT

MID TERM

● DEV HARDER, CHEAP MICROCIRCUITS

● DEV ALT FOR SOFT COMPONENTS
CONCEPT

● DEFEAT

● DESTROY

● DISRUPT

ENEMY COMBAT POWER USING EM RADIATION
(CONCERT WITH C/A TEAM)
ATACM/RF MUNITION & LOITERING/RF DRONE

PURPOSE: ATTACK DEEP TARGETS
- FOLLOW ON MVR
- C2
- HIGH PAYOFF

SUPPORTS: IN CONCERT WITH
CDR's OPN'L AND TACTICAL PLAN
Session 1
Technology Applications

Session Chairman:
Philip F. Ingersoll
Director, Technology Applications Laboratory
The Harry Diamond Laboratories
Technology Applications Laboratory

Personnel
Approximately 200 employees: Mostly Electronic, Chemical and Mechanical Engineers, Physicists, Mathematicians, Chemists, and technicians. Supplemented by about 30 on-site contract technical employees.

Facilities
Facilities include electronic, computer, chemistry and material testing laboratories, mechanical shops and computer aided design and drafting.

Budget
Over $40 million per year, split between in-house expenses and contractor support. In addition, approximately $300 million in on-going production contracts.

Customers
LABCOM, other Army commands, Army Project Managers, and Navy and Air Force organizations.

Projects
Chaparral Missile Fuze. Fabricated sixty fuzes at HDL in past couple of years and flight tested them at White Sands Missile Range (WSMR) with 100% score. Contractor has been competitively selected to produce 9000 fuzes to HDL technical data package.

MLRS Medium Altitude Proximity/Time Fuze. Fabricated over one hundred fuzes at HDL and flight tested them at WSMR and Dugway Proving Ground. Contractor recently selected to manufacture Engineering Development quantity of fuzes for further testing.

M732E2 Artillery Proximity Fuze. Fabricated 150 fuzes at HDL for tests at Yuma Proving Ground. Contractor fabricated 1500 fuzes for further testing. Production contractor to be competitively

PATRIOT Missile Fuze, M749 Nuclear Artillery Fuze, Long Stand-off Anti-armor Fuze, Multi-Option Fuze for Artillery, M734/M745 Mortar Fuzes, and other HDL designed fuzes. Fuzes under various stages of development and/or production.

Long Stand-off Anti Armor Fuze. Tech base developed magnetic/optical fuze for application to TOW-like weapons.

Electronic Safety and Arming. Continuing research into cost and component size reduction to make ESA's practical for rocket, mortar, and artillery fuzing.

VISTA/CIP Command Information Processor. Vehicle mounted expert system to aid field commanders in tactical decision making. Contains 17 computers, color graphics and flat panel text displays, graphics tablets, remote terminals, and sensor communications. Designed and fabricated at HDL. Follow-on work under way for Marines and USAICS.

TEAM project. Autonomous target recognition vehicle with armament. Designed as experimental research platform.

ISOPADS. Super sensitive fluidic microphones for application as soldier listening devices such as helmet mounted "bionic" ears.

Navigator. Low cost fluidic navigation system for Army vehicles. Three axis system scheduled for delivery to NTC this year.

Other Projects: Hand and Foot powered generators. Liquid and thermal reserve power supplies. Materials research and mechanical design in support of HDL projects.
Global Positioning System

John S. Eicke
Electronics Engineer
Tactical Systems Branch
Technology Applications Laboratory
TITLE: Applications of Global Positioning System Technology

TECHBASE INVESTMENT STRATEGY AREA

The Global Positioning System (GPS) has potential applications in Army Next Generation/Future Systems, including the Advanced Field Artillery System and Lightweight 155mm Towed Howitzer.

DESCRIPTION

Develop a variety of components and systems utilizing GPS which can be integrated into Army systems to establish location and velocity information. Systems to utilize such capabilities might include radiosondes and artillery registration fuzes, as well as guidance systems, search and rescue beacons, etc. Harry Diamond Laboratories is seeking industry inputs on existing as well as future technology.

OBJECTIVE/APPROACH

The objective is to use GPS to provide new and enhanced capabilities, improved accuracy, and lethality of field artillery systems.

Technical Barriers are:

- Miniaturization: Packaging GPS receiver/repeater and antenna in projectile fuze volume, MMIC components, miniature antennas
- Receiver Dynamics: Fast acquisition receivers in high dynamic environments, receivers utilizing NAVAID inputs
- High-G: Receiver/repeater and components for use in artillery projectile environment
- Processing: Near real-time data processing, differential measurement systems
- Survivability: Steerable null antennas, signal processing to enhance ECM performance, techniques, GPS/Glonass compatible systems

REMARKS

In direct support of:

- LABCOM GPS Artillery Spotter Round Cooperative program
- LABCOM GPS Radiosonde Cooperative program

Technical POCs: Mr. John Miller Telephone: 301-394-2620 Mr. John Eicke Telephone: 301-394-2620
GPS MILITARY APPLICATIONS

- En Route Navigation
- Low-Level Navigation
- Target Acquisition
- Close Air Support
- Missile Guidance
- Command & Control
- All-Weather Air Drop
- Sensor Emplacement
- Precision Survey
- Instrument Approach

- Rendezvous
- Coordinate Bombing
- Remotely Piloted Vehicle Operations
- Barebase Operations
- Search and Rescue
- Photo-Reconnaissance
- Range Instrumentation
- Mine Emplacement & Countermeasure
CURRENT HDL GPS PROGRAMS

* GPS ARTILLERY REGISTRATION ROUND

Provide trajectory data to gun position
Packaged in standard fuze
GPS Translator approach
HDL, HEL and BRL cooperative program

* GPS RADIOSONDE

Provide wind velocity data
GPS translator and receiver approaches considered
HDL, ASL and ETDL cooperative program
STATUS OF GPS PROGRAMS

* FY90-91: FEASIBILITY STUDIES & EVALUATIONS
* FY92: FIELD DEMONSTRATIONS
* FY93: TRANSITION TO FULL SCALE DEVELOPMENT
* PRODUCTION

RADIASONDE - 50,000 UNITS OVER 5 YEARS
REGISTRATION FUZE - 50,000 UNITS OVER 5 YEARS
AREAS OF INTEREST IN GPS

* CUSTOM GPS COMPONENTS
* SPECIALIZED GPS RECEIVERS
* GPS RECEIVER ANALYSIS TOOLS
* GPS TRANSLATORS
* GPS ANTENNAS
TECHBASE INVESTMENT STRATEGY AREA

Fuzing will continue to have applicability to the broad spectrum of munitions systems from inexpensive ammunition items through sophisticated missile systems. Fuzes are used to keep the munition item safe to handle and store while providing optimum warhead lethality against the target after sensing the correct launch environment. Fuzing systems developed in the Technology Applications Laboratory at Harry Diamond Laboratories (HDL) are generically applicable to Next Generation / Future Systems (NG/FS) in the following Battlefield Functional Mission Areas: Fire Support, Air Defense, Close Combat Light, and Close Combat Heavy. An exhaustive list of specific systems will not be attempted here. However, three representative NG/FS are associated with each techbase work package in the briefing.

DESCRIPTION

Develop a variety of fuzing components, such as electronic safing and arming devices and power supplies, and fuzing systems for Army munitions. Pack as much sophistication as possible into physically small fuzing systems to enhance overall system lethality, and deal with countermeasures of all types. Simultaneously, satisfy other important constraints such as safety, reliability, cost, human engineering, and fire control system interface. Other important issues that must be dealt with in fuzing development include use of insensitive munitions, and understanding the effects of long-term storage. The HDL Technology Applications Laboratory not only performs techbase development of fuzes, but also has strong customer-funded fuzing programs in engineering development, engineering in support of production, and product improvement programs.

OBJECTIVE/APPROACH

The objective is to continuously improve the effectiveness of the fuzes that are provided to the Army for its munitions.

Technical barriers are:

- Miniaturization: Packaging sophisticated sensors and signal processors into standardized ammunition fuze contours and into vanishingly small volumes in precision guided munitions and missiles.
- Signal processing and algorithm development: Signal processors must be able to handle the increased quantity and rates of data that the new sensors can provide. Targets must be discriminated from clutter at extended detection ranges.

- Pre-launch power: Certain ammunition items will require the presence of electrical power for hand setting before use. How will this be accomplished while satisfying long-term storage requirements?

- Encounter simulation: Modeling and hardware-in-the-loop capabilities must be upgraded to accommodate new sensors and encounter scenarios.

- Low energy fire set components: Critical for achieving electronic safing and arming performance and cost goals.

REMARKS

Customer programs in direct support of:

- PM-Patriot
- PM-Chaparral
- PM-Mortar Systems
- PM-Nuclear Munitions
- AMCCOM
- PM-MLRS

Techbase in direct support of:

- PM-Fuzes
- PM-AFAS
- PM-TOW
- PM-AAWS-M

Technical POC: Mr. William Konick
SLCHD-TA
(202)394-2400
"FUZING"

Presented By
William L. Konick
(202)394-2400

SESSION I ~ 23 JANUARY 1990
In accordance with applicable regulations, the information in this briefing is conditioned by the following:

- The estimates are based on the best information available.

- The information is subject to modification and is in no way binding on the Government.

- More specific information relating to the procurement of any individual item or class of items will not be furnished until the proposed acquisition is synopsized in the Commerce Business Daily or the solicitation is issued.
Outline

- Background
- Existing fuze production contracts
- Fuzes that are soon to go into production
- Fuzing tech base programs in the Technology Applications Laboratory
Background

Fuzing Mission at HDL

LABCOM Regulation 10-1:

HDL has Army leadership for -

Providing assistance to hardware developers through the design and application of advanced electronic fuzing and radar technologies
Fuzes in Production

- Patriot
- Chaparral
- M734 Mortar Fuze
- M745 Mortar PD/Practice Fuze
- M749 Fuze - 155mm Nuclear Artillery
Patriot M818E2

- Description: Fuze for surface-to-air missile
- Status: In production
- Current contractor -
  Allied Signal, Bendix Communications Division
  Contract award Nov 88, $50M for 1027 units
  First article: Jan 90
  Delivery schedule: through Apr 91
- Next contract to award: approx 31 Jan 90
  FY90 quantity: 912 units
  Priced options for FY91 & FY92: 1765 units max
  Year:    FY91    FY92
  Max Quan: 1065    700
- POC name, office symbol, phone:
  David Thier, SLCHD-TA-SE, (202)394-2703
• Description: Fuze for surface-to-air missile
• Status: In production
• Current contractor -
  Loral (Fairchild Weston Systems Inc)
  Contract award May 89, $3.6M for 390 units
  First article (TDD): May 90
  Basic delivery schedule: May 90 - Nov 90
• Options:
  Year:    FY90  FY91  FY92  FY93  FY94
  Max Quan: 1200  2000  2000  2000  2400
• POC name, office symbol, phone:
  Les Kitchman, SLCHD-TA-SE, (202)394-2703
• Description: Multi-option fuze for mortar cartridges
  Functions: proximity, near-surface-burst, impact, delay
• Status: In production
• Key milestones
  TC 1977 on 60mm ctg, TC 1987 on 81mm ctg
  FY90 will TC on 4.2in and 120mm ctgs
• Current contractors: Accudyne, Eastman Kodak
• FY90 buy for 187K units on the street, award Mar 90
• Future requirements:
  Year   FY91   FY92   FY93   FY94
  Units(K) 124   54    128   39
• POC name, office symbol, phone:
  Frank Blodgett, SLCHD-TA-FD, (202)394-3193
• Description: Fuze, PD, Dual Purpose for mortar cartridges
• Status: In production
• Key milestones
  TC 1988 on 60mm WP and HE ctgs
  FY90 will TC on M888 60mm HE ctg
  FY90 will TC on 4.2in and 120mm smoke ctgs
• Current contractor: Accudyne, FY89 buy, 185K units
• FY90 buy for 47K units on the street, award Mar 90
• Future requirements:

<table>
<thead>
<tr>
<th>Year</th>
<th>FY91</th>
<th>FY92</th>
<th>FY93</th>
<th>FY94</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units(K)</td>
<td>124</td>
<td>54</td>
<td>128</td>
<td>39</td>
</tr>
</tbody>
</table>

• POC name, office symbol, phone:
  Frank Blodgett, SLCHD-TA-FD, (202)394-3193
- Description: Fuze for 155mm nuclear artillery projectile
- Status: In production
- Current contractor - Motorola
  Contract award Mar 88, $34.5M for 527 units
  Option exercised Nov 89, $15.3M for 248 units
  Delivery schedule: Aug 89 - 1Q FY92
- POC name, office symbol, phone:
  Bill Webster, SLCHD-TA-SE, (202)394-2703
Fuzes to go into Production

- M732E2 PIP Artillery Fuze
- XM450 MAP/T Fuze for MLRS
• Description: Proximity fuze for artillery unitary warhead burster projectiles, including rocket-assisted projectiles
• Status: Production to start FY91
• Key milestones
  IPR Dec 89
  TC Jan 90
• Contract opportunities: AMCCOM will attempt to limit procurement to MOB base
• Future requirements:
  Year  FY91  FY92  FY93  FY94
  Units(K)  190+   0    0    0
• POC name, office symbol, phone:
  Bob Goodman, SLCHD-TA-ES, (202)394-3710
• Description: Proximity and time fuze for MLRS binary chemical warhead
• Status: Full scale development (6.4)
• Key milestones
  PRR Feb 90, PQT FY91
  Milestone III IPR 1Q FY92
  Production FY92
• Current contractor: (FSD) 500 units
  Joint venture of KDI Precision Products and Electronic Development Corporation
• Production contract to be full and open competition
  Years: FY92 - FY97
  Quantities: Classified
• POC name, office symbol, phone:
  Bob Goodman, SLCHD-TA-ES, (202)394-3710
Fuzing Tech Base

- MOFA (Multi-Option Fuze for Artillery)
- LSAA (Long-Standoff Anti-Armor)
- ESA (Electronic Safing and Arming)
• Description: Single fuze for use on all burster projectiles in all current and developmental field artillery systems
• Next generation / future systems supported:
  Advanced Field Artillery System (AFAS)
  Extended Range Artillery Projectile II (ERA II)
  Lt Wt 155mm Towed Howitzer
• Key technologies:
  MIMIC
  Flexible LCD
  Active Battery for pre-launch power
• Status: in last year of 6.2
• Key milestones - to be managed by PM-AFAS
  Proof of Principle (6.3a): FY91 - FY92
  Full Scale Development (6.4): FY93 - FY96
  Production start: FY97
• HDL contract opportunities - limited to component development
• POC name, office symbol, phone:
  Bob Goodman, SLCHD-TA-ES, (202)394-3710
- Description: Low-cost magnetic / optical anti-armor standoff fuze
- Next generation / future systems supported:
  - Line of Sight Antitank
  - Multimode Antiarmor Weapon System (MMAAWS)
  - Future Smart Munition
- Key technologies:
  - Low-cost optics
  - Triple-axis magnetometer
  - Signal processing
- Status: Tech base (6.2)
- Key milestones:
  - FY89 - Transferred technology to PM-TOW
  - FY90 - Perform smoke and countermeasures field tests
  - FY91 - Investigate methods to extend standoff distance
- Contract opportunities - none, in-house effort
- POC name, office symbol, phone:
  Bob Christopherson, SLCHD-TA-SS, (202)394-3720
Description: Development of miniaturized electronic saffing and arming (ESA) technology with emphasis on insertion into low-cost systems (missiles, rockets, artillery, mortars)

Next generation / future systems supported:

- Very broad range of applicability, including -
  - Patriot 2000
  - Multimode Antiarmor Weapon System
  - Low Intensity Conflict Rocket System (LICRS)

Key technologies: Efficient, low-cost, rugged and reliable components

- Capacitors - high voltage
- Miniaturized DC to DC converters
- High voltage switches
- Low-energy slapper bridges

Status: Tech base (6.2)

Key milestones:

- FY90 - Zuni flight test (modified ATACMS) and mortar technology demos; Support PM-AAWS-M risk reduction ESA development
- FY91 - Flight test generic low-cost missile ESA

HDL contract opportunities - component development

POC name, office symbol, phone:

Bob Goodman, SLCHD-TA-ES, (202)394-3710
PRESENTED BY

DR. PHILIP J. EMMERMAN

ADVANCED SENSORS SYSTEMS BRANCH

Harry Diamond Laboratories
2800 Powder Mill Road
Adelphi, Md 20783-1197
(301) 394-3000
MULTI-SENSOR PROCESSING

- REMOTE, COMBAT INFORMATION PROCESSOR
- LOCAL, AUTOMATIC TARGET ACQUISITION
<table>
<thead>
<tr>
<th>PROGRAM</th>
<th>SPONSOR</th>
<th>FOCUS</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMBAT INFORMATION PROCESSOR</td>
<td>LABCOM/BRL</td>
<td>FIRE SUPPORT</td>
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<tr>
<td>SMART WEAPONS SYSTEM</td>
<td>MARINES</td>
<td>COMMAND AND CONTROL</td>
</tr>
<tr>
<td>CIP TESTBED</td>
<td>DCSINT</td>
<td>INTELLIGENCE</td>
</tr>
<tr>
<td>AI MODULE</td>
<td>PM-TAAWS</td>
<td>AIR DEFENSE</td>
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<tr>
<td>MULTI-MISSION AREA SENSOR</td>
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<tr>
<td>ROBOTIC (ATR)</td>
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<tr>
<td>TECHBASE ENHANCEMENTS FOR AUTONOMOUS MACHINES</td>
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<tr>
<td></td>
<td>LABCOM/HEL</td>
<td>CLOSE COMBAT</td>
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<tr>
<td>(TAAWS) TARGET ACQUISITION FOR ARMY WEAPON</td>
<td></td>
<td>LIGHT AND HEAVY</td>
</tr>
<tr>
<td>SYSTEMS (ATR)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AUTOMATIC TARGET RECOGNITION</td>
<td></td>
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</tbody>
</table>
OVERALL GOAL

DETERMINE THE OPERATIONAL BENEFITS WHICH RESULT FROM PROVIDING NEAR-REAL-TIME COMBAT INFORMATION TO THE TACTICAL COMMANDER
OBJECTIVES

- DETERMINE AND EVALUATE OPERATIONAL REQUIREMENTS
  - BRIGADE LEVEL PROCESSING AND INTERFACE REQUIREMENTS
  - SENSOR PROCESSING AND INTEGRATION REQUIREMENTS
  - COLLATERAL DATA BASE REQUIREMENTS

- VALIDATE OPERATIONAL BENEFITS OF ADVANCED TECHNOLOGIES
  - KNOWLEDGE BASED DECISION AIDS
  - MULTIPROCESSING
  - SPECIALIZED DATA BASES
  - PROGRAMMABLE COMMUNICATION INTERFACES

- PROVIDE LESSONS LEARNED AND DATA TO SUPPORT FUTURE PLANNING
  OF ARMY COMMAND AND CONTROL SYSTEMS
CURRENT FUNCTIONALITY

- ELECTRONIC MAPS (VECTOR FEATURES)
- TERRAIN ANALYSIS (PLANNING AND EXECUTION)
  - LINE OF SIGHT
  - FIELD OF VIEW
  - MOBILITY CORRIDORS
  - ROUTE PLANNING
- THREAT ANALYSIS
  - TARGET CLUSTERING
  - TARGET PREDICTION
- TACTICAL MESSAGE SUPPORT
  - PROTOCOLS (MTS, TACFIRE, MISMART)
  - AUTOMATIC PARSING
  - AUTOMATIC STORAGE
  - SELECTED RETRIEVAL
  - CONFIGURABLE AUTOMATIC DISTRIBUTION
CURRENT FUNCTIONALITY (CONTINUED)

• UNITS DATABASE
  — TRACKING
  — CORRELATION
  — SHARED AMONG ALL USERS
  — AUTOMATIC UPDATING FROM MESSAGES
  — SUPPORTS STANDARD MILITARY SYMBOLS (FM 101-5-1)

• CONTROL MEASURES DATABASE
  — SHARED AMONG ALL USERS
  — SUPPORTS STANDARD MILITARY SYMBOLS (FM 101-5-1)
  — EVENT DETECTION

• HARD COPY
  — PAPER
  — OVERLAY (STANDARD SCALES)
TEST BED FEATURES

- Flexible, powerful, and mobile real-time tool for multi-functional area and multi-sensor integration.
- Enhances the tracking of entities/targets by utilizing terrain and doctrinal knowledge.
- Automatically detects events of entity movement into or out of a military area of interest.
- Supports multiple cooperating expert systems.
- Excellent growth potential hardware: open to semiconductor industry advances. (VME standard)

Software: open to advances in real-time operating systems, languages, and applications. (Unix and real-time kernels)
AUTOMATIC TARGET ACQUISITION AND INTEGRATION GOALS

- EXTREMELY LOW PROBABILITY OF FALSE ALARM CONSISTENT WITH ROBOTIC MISSIONS
- VEHICLE SURVIVABILITY, AFFORDABILITY, SIZE
- REAL WORLD SCENARIOS - DAY/NIGHT, CLUTTER, OBSCURANTS
- NAVIGATION AND ATA INTEGRATION
- HIGH OVERALL SYSTEM RELIABILITY/FAILSAFE OPERATION
FUTURE CAPABILITIES

- WEATHER/NBC MODEL
- MOBILITY MODEL
- SMALLER, LIGHTER SYSTEMS
- COLLECTION MANAGEMENT
- SITUATION ASSESSMENT
- TARGET DEVELOPMENT
- ADVANCED MULTI-SENSOR CORRELATION
- FUTURE USER DEFINED REQUIREMENTS
Session II

Nuclear Survivability

Session Chairman:
Dr. John C. Ingram
Deputy Director, Nuclear Survivability Laboratory
NUCLEAR SURVIVABILITY PROGRAM

The Harry Diamond Laboratories, Nuclear Survivability Program develops a full range of verified and demonstrated technology products and methodologies required to assure the future survivability of U.S. Army materiel during and after a nuclear exchange. HDL as the AMC Lead Laboratory for nuclear weapons effects survivability is charged to formulate, budget and execute this broad technology program that is required so that mission essential Army equipment can be made as survivable as the soldier. This is needed so Army can avoid the potentially disastrous situation of having soldiers who are willing and able to fight after a nuclear attack, but are unable to do so because combat systems fail to withstand hostile nuclear environments.

The 6.2 Nuclear Survivability Technology part of the overall Army Nuclear Survivability Program provides technology products for all nuclear effects areas (e.g. EMP, radiation and blast/thermal) including the simulation of these effects and the development of nuclear hardening methods and techniques needed for designing nuclear-survivable equipment, testing it and assessing and validating systems survivability and maintaining that survivability throughout the life cycle. The continuing evaluation of emerging technologies that are being introduced into new and product improved military system designs make this tech base an iterative program that provides the Army with affordable hardening solutions for development and fielded system use.

Nuclear weapons effects and simulators are studied and developed, maintained and improved for use in designing survivable equipment. Radiation shielding technology is developed and demonstrated for protection of crews in armored vehicles.

There are several major areas of concern in this program. First is the high altitude electromagnetic pulse (HEMP) in which advanced protection devices are being developed to prevent the loss of the entire inventory of electronic military systems from a HEMP nuclear weapon burst. Additionally, this task area develops analysis methods and techniques for hardening tactical Army systems to EMP effects and the capability to simulate the new military standard, MIL-STD-2169. Free field current injection and computer simulation techniques are being used to assess the impact of this new environment on past and future EMP hardening approaches.
The next major area of interest is Air Blast and Thermal radiation. Mobile tactical systems are particularly vulnerable to being overturned by the blast wave. This task will develop advanced techniques like lightweight outriggers and other overturning restraints for use with Army vehicles that carry mobile C3I systems. Additionally, the program will conduct Large Blast/Thermal Simulator (LB/TS) cost reduction research in cooperation with DNA. Non-ideal blast will also be investigated.

Finally the Tactical Source Region (TSR) area is concerned with an annular area around the burst point of a low yield nuclear weapon beyond the range where personnel and equipment are disabled by the blast and thermal radiation. In this area, nuclear radiation is being deposited in the air creating a complex, time varying radiation, ionizing electron and electromagnetic pulse (EMP) environment. This task objective is to develop the analytical methods and basic technology necessary to ensure the survivability of Army equipment in this environment. Resolution of the tactical source region problem will involve above ground tests in AURORA and underground nuclear tests (UGT) and will help develop tactical source region hardening requirements and lead to approaches for TSR simulation.

The Nuclear Effects Support Team is a 6.3b AMC sponsored program funded to facilitate transfer of nuclear survivability information from the research community to systems under development. NEST assistance is available to meet the needs of project managers.

The Nuclear Survivability Assessment Team (NSAT) Program, has the goal of facilitating Army nuclear survivability by analysis and test and where required the hardening of unhardened equipment fielded. The Army equipment list for this program has been prioritized by the Training Doctrine Command for test, evaluation, and hardening retrofit. Based on the work NSAT does, a database has been established for future Army use.

The 6.2 nuclear survivability technology products are developed by HDL and fed into demonstration packages that integrate into standard nuclear survivability hardening modules for use by project managers and major subordinate command elements working the nuclear survivability of future generation military systems. The major areas being worked on are covered in the following paragraphs.
The high altitude EMP (HEMP) Defense Standards and Specifications Program (DSSP) is directed at providing support to high priority time sensitive, strategic ground based mobile C3I systems. The program demonstrates low risk EMP hardening for these systems and develops associated specifications, standards, hardening guidelines and practices.

The development of hardness assurance/hardness maintenance (HA/HM) techniques and procedures is being developed for application to the acquisition and the operational phases of a nuclear hardened system. The Army needs these techniques and procedures so that systems can be kept survivable. The increasing numbers of Army systems that have nuclear hardening criteria make this and future derivative efforts an area of important and continuing concern.

HDL has pursued a non-developmental item (NDI) advanced system hardening effort for the past several years that has the objective of generating techniques and methods for selecting or modifying NDI equipment so that it can survive in a nuclear battlefield environment containing initial nuclear radiation (INR), electromagnetic pulse (EMP), and blast/thermal radiation. Survivability problems for different NDI categories have been identified and approaches developed on how these problems can be solved. Guidelines for selection of nuclear survivable NDI technologies are output of this program. Because of the increasing use of the NDI procurement route, this and its future derivative efforts are clearly going to be more important to the Army in the coming years.

Finally, there is the Large Blast/Thermal Simulator (LB/TS) related program whose objectives and approach have been developed by BRL with HDL and DNA support to provide realistic cost-effective means of simulating the response of tactical systems to the full threat yield spectrum of blast/thermal environments. DNA has agreed to build the LB/TS and finance its characterization and operation by AMC on an Army site. This task will support the BRL "probative tube", which is a small scale model of the LB/TS where tube/target interaction can be studied along with instrumentation and potential LB/TS improvements. Using the probative tube, improvements can be demonstrated and the technology transferred to the full scaled LB/TS. If successful, these efforts can reduce the original cost of the LB/TS and the subsequent operating costs by millions of dollars. Additionally, BRL can use it as a modern blast simulator in its own right.
SPECTRUM OF CONFLICT

PROBABILITY

WHY THE ARMY

TERRORISM

UNCONVENTIONAL WARFARE

MINOR CONVENTIONAL WARFARE

MAJOR CONVENTIONAL WARFARE

TACTICAL NUCLEAR

STRATEGIC NUCLEAR

WHY NUCLEAR SURVIVABILITY

- TO SUPPORT A CREDIBLE DETERRENCE
  TO YIELD GAINS IN COMBAT EFFECTIVENESS
NUCLEAR SURVIVABILITY

CAPABILITY OF SYSTEM TO WITHSTAND INITIAL NUCLEAR WEAPONS EFFECTS (BLAST, THERMAL, RADIATION, EMP) AND STILL ACCOMPLISH ITS MISSION.

CAN DO BY --

○ HARDENING
○ REDUNDANCY
○ TIMELY RESUPPLY
○ MITIGATION TECHNIQUES
## How the Treaty Affects the Superpowers

<table>
<thead>
<tr>
<th>WHAT WILL BE ELIMINATED</th>
<th>UNITED STATES</th>
<th>SOVIET UNION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deployed Missiles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate Range (600-3,400 miles)</td>
<td>429</td>
<td>470</td>
</tr>
<tr>
<td>Short Range (300-600 miles)</td>
<td>0</td>
<td>387</td>
</tr>
<tr>
<td>Non-deployed Missiles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intermediate Range</td>
<td>260</td>
<td>358</td>
</tr>
<tr>
<td>Short Range</td>
<td>170</td>
<td>539</td>
</tr>
<tr>
<td><strong>TOTAL:</strong></td>
<td><strong>859</strong></td>
<td><strong>1,752</strong></td>
</tr>
</tbody>
</table>

### Verification Provisions
- Initial inspections 60 days after the treaty enters into force.
- Close-out inspections after three years to ensure that the missiles have been destroyed.
- 20 short-notice inspections in the first three years.
- 15 short-notice inspections in the next five years.
- 10 short notice inspections in the following five years.
- U.S. inspectors to be based at a Soviet military factory in Votkinsk for 13 years.
- Soviet inspections to be based at a U.S. military factory in Utah for 13 years.

### What Will Remain

<table>
<thead>
<tr>
<th>Strategic Nuclear Weapons</th>
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<tbody>
<tr>
<td>Launchers</td>
<td>2,001</td>
<td>2,515</td>
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<tr>
<td>Warheads</td>
<td>13,002</td>
<td>10,595</td>
</tr>
<tr>
<td>Nonstrategic Nuclear Weapons (number of warheads)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land-Based Battlefield Nuclear Weapons</td>
<td>7,073</td>
<td>9,043</td>
</tr>
<tr>
<td>Strategic Defensive Nuclear Warheads</td>
<td>-</td>
<td>5,100</td>
</tr>
<tr>
<td>Naval Battlefield Nuclear Weapons</td>
<td>3,645</td>
<td>2,705</td>
</tr>
<tr>
<td><strong>TOTAL (nonstrategic)</strong></td>
<td><strong>10,718</strong></td>
<td><strong>16,848</strong></td>
</tr>
</tbody>
</table>

**Sources:** U.S. Arms Control and Disarmament Agency and the Natural Resources Defense Council
### REQUIREMENTS

<table>
<thead>
<tr>
<th>DODI 4245.4</th>
<th>AR 70-60</th>
<th>AMC SUPPLEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INCLUDE NUCLEAR SURVIVABILITY IN DESIGN...OF MAJOR AND NONMAJOR SYSTEMS CRITICAL TO NUCLEAR CONFLICTS</strong></td>
<td><strong>IMPLEMENT DODI</strong></td>
<td><strong>IMPLEMENT AR 70-60</strong></td>
</tr>
<tr>
<td></td>
<td><strong>MAKE MISSION-ESSENTIAL SYSTEMS SURVIVE NUCLEAR EFFECTS</strong></td>
<td><strong>HEIGHTEN AWARENESS, INTERE AND SUPPORT FOR NUCLEAR SURVIVABILITY</strong></td>
</tr>
<tr>
<td></td>
<td><strong>HARDEN ESSENTIAL COMPONENTS</strong></td>
<td><strong>DISSEMINATE INFORMATION THROUGHOUT COMMAND</strong></td>
</tr>
<tr>
<td></td>
<td><strong>CONSIDER NUCLEAR SURVIVABILITY EARLY IN CONCEPT PHASE</strong></td>
<td><strong>ESTABLISH MECHANISM TO REVIEW SYSTEM NUCLEAR SURVIVABILITY STATUS</strong></td>
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<td><strong>ESTABLISH SURVIVABILITY CRITERIA AND DEMONSTRATE SURVIVABILITY DURING DEVELOPMENT</strong></td>
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<td><strong>MANAGE NUCLEAR SURVIVABILITY THRU LIFE CYCLE</strong></td>
<td><strong>ESTABLISH CAPABILITY TO CONDUCT REASSESSMENT OF FIELDED SYSTEMS</strong></td>
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<td><strong>CONSIDER SOFT FIELDED EQUIPMENT FOR RETROFIT</strong></td>
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TECHNOLOGY

REQUIREMENTS

ARMY
Qualitative Research Requirements
for
NUCLEAR WEAPONS EFFECTS INFORMATION (U)

FY 89/90
FINAL EDITION
February 1988

Deputy Chief of Staff for Operations and Plans
Prepared By: U.S. Army Nuclear and Chemical Agency
NUCLEAR SURVIVABILITY PROGRAM

Technology Program Drivers

- New Threats/Next Generation Weapons
- System Life Cycle Considerations
  - Hardness, Maintenance and Surveillance
  - Integrated Logistics
- Advances in Automation and Robotics
- Commercial Products and Non-Developmental Items
- Next Generation Materials, Electronics, Photonics
REQUIREMENTS STRATEGY FOR MANAGING THE ACQUISITION

HQ DA
DCSOPS  ASARDA
PRIORITIES/FUNDING

NCSC
GUIDANCE
PRORITIES
FUNDING REQUIREMENTS

NCSC—NUCLEAR AND CHEMICAL SURVIVABILITY COMMITTEE
NUCLEAR SURVIVABILITY PROGRAM

Technology Development Areas of Interest

- Effects Generation Mechanisms
  - EMP (High Altitude, Source Region, System Generated)
  - Non-ideal Blast
  - Forest Blowdown

- Coupling & Loading
  - Experimental Techniques
  - Theoretical Modeling and Validation
  - Advanced Analytical Capabilities
  - Tailored Parallel/Pipelined Processing Architectures

- Component, Subsystem and System Response
  - Testing and Test Analysis
  - Modeling and Simulation
  - Tailored Component Fabrication
  - Database (Creation and maintenance)

- Survivability/Vulnerability Assessment
  - Standard Methodologies
  - AI Expert Assistants
  - Stochastic Modeling and Operations Research Considerations
  - Effects Synergisms
NUCLEAR SURVIVABILITY PROGRAM

Technology Development Areas of Interest
(continued)

- Hardening Capabilities
  - Advanced Materials for Blast/Thermal Protection
  - Integrated Electromagnetic Protection
  - Terminal Protection Devices
  - Electromagnetic Shielding
  - Shock Isolation
  - Radiation Hard Components

- Simulation/Instrumentation
  - Advanced EMP Simulator Designs and Components
  - LB/TS Improvements
  - Wide Bandwidth, Large Dynamic Range Sensors
NUCLEAR SURVIVABILITY PROGRAM

Survivability Applications

- Standards and Specifications Development and Validation
- Hardness Maintenance and Surveillance Testing Demonstration
- Life Cycle Survivability Demonstrations (NG/FS)
- NDI Survivability Demonstrations
- LB/TS Product Improvements
- Next Generation EMP Simulators
- Fielded Systems Product Improvements
NUCLEAR SURVIVABILITY PROGRAM

SURVIVABILITY SUPPORT

- PEO/PM Support of Developmental Systems
- Independent Assessments of Critical Systems
- Support to DA and DoD Customers
NUCLEAR SURVIVABILITY

GOAL

SUMMARY

GOOD TECHNOLOGY BASE

GOOD MANAGEMENT/ENGINEERING
PRACTICES AT THE PM LEVEL

COST-EFFECTIVE
APPROACH FOR PROVIDING
NUCLEAR SURVIVABLE EQUIPMENT
FOR THE MODERN INTEGRATED BATTLEFIELD
6.2 TECHNOLOGY DEVELOPMENT

- ELECTROMAGNETIC PULSE
- TACTICAL SOURCE REGION
- BLAST/THERMAL
- HARDENED ELECTRONICS

PROJECTED FUNDING: $ IN MILLIONS

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6.2 TECHNOLOGY DEVELOPMENT

- ELECTROMAGNETIC PULSE
- TACTICAL SOURCE REGION
- BLAST/Thermal
- HARDENED ELECTRONICS
ELECTROMAGNETIC PULSE EFFECTS PROGRAM

OBJECTIVE
- DEVELOP TECHNOLOGY TO HARDEN ARMY TACTICAL SYSTEMS TO HIGH ALTITUDE BURST ELECTROMAGNETIC PULSE EFFECTS
- MAINTAIN STRONG ANALYTIC AND EXPERIMENTAL CAPABILITIES TO VERIFY SYSTEM HARDNESS TO HAEMP

PROGRAM MILESTONES
- DIRECT DRIVE FACILITY FOR NON-RADIATING EMP SIMULATION
- RELOCATION OF RADIATING EMP SIMULATORS
- TERMINAL PROTECTION DEVICE DEVELOPMENT
- ISOLATION TRANSFORMER DEVELOPMENT
- NEW ANALYTIC TECHNIQUES FOR CALCULATING SYSTEM COUPLING
- DEDICATED MICROCOMPUTER FOR ADVANCED EMP CALCULATIONS
EMP HARDENING TECHNOLOGY

OBJECTIVE

Provide the theoretical, experimental, and instrumental means to harden Army tactical equipment against HEMP

- Analytic Algorithms
- Terminal Protection Devices
- Isolation Power Transformers
- Device Damage Characterization
- Modern Test Maintenance and Diagnostic Equipment

POTENTIAL CONTRACT SUPPORT

- Damage Analysis
- Device and Transformer Development
- Semiconductor Damage Characterization
- Test Equipment

15 KVA ISOLATION TRANSFORMER

PROGRAM MILESTONES

- Terminal Protection Device Development
- Isolation Transformer Development
- Exploitation of Foreign Technology
OBJECTIVE
DEVELOP HARDWARE AND ANALYTICAL TECHNIQUES CAPABLE OF NON-RADIATING EMP TESTING OF GENERAL TACTICAL SYSTEMS
- EVALUATE HARDENING APPROACHES
- DEMONSTRATE OVERALL SYSTEM HARDNESS
- LIFE CYCLE HARDNESS SURVEILLANCE

POTENTIAL CONTRACT SUPPORT
- COUPLING ANALYSIS AND TESTS
- DRIVER DESIGN

SYNCHRONOUS INJECTION SYSTEM

PROGRAM MILESTONES
- DIRECT-DRIVE FACILITY SYSTEM REQUIREMENTS
- SYSTEM DESIGN AND PROTOTYPE DEVELOPMENT
- FACILITY DEVELOPMENT
- ACCEPTANCE TESTING
EMP SIMULATION

OBJECTIVE

OPERATE, MAINTAIN, AND UPGRADE THE ARMY'S RESEARCH AND DEVELOPMENT HIGH ALTITUDE ELECTROMAGNETIC PULSE (EMP) SIMULATION FACILITY ASSETS.

RELOCATE HIGH POWER RADIATING EMP SIMULATORS TO THE WESTERN U.S.

POTENTIAL CONTRACT SUPPORT

- SCALE MODEL FACILITY IMPROVEMENT
- INSTRUMENTATION
- SIMULATOR RELOCATION
- COMPLETE FABRICATION AND INSTALLATION OF VEMPS II

PROGRAM MILESTONES

- AESOP FACILITY RELOCATION
- CONTINUOUS WAVE FACILITY OPERATION
- IVAN II FACILITY OPERATION
- SCALE MODEL FACILITY OPERATION
- DEVELOPMENT OF VEMPS II FACILITY FOR DEPLOYMENT IN WESTERN U.S.
EMP COUPLING AND ANALYSIS

OBJECTIVE

- DEVELOP ANALYTIC TECHNIQUES TO IMPROVE CAPABILITY FOR HARDENING SYSTEMS TO HIGH ALTITUDE BURST EMP
- REFINES CALCULATIONAL TECHNIQUES FOR DETERMINING EMP COUPLING AND SHIELDING

POTENTIAL CONTRACT SUPPORT

- COMPLETE THE DEFINITION OF THE E2 AND E3 WAVEFORMS FOR DOD-STD-2169
- IMPROVED EMP SHIELDING METHODS
- COUPLING ANALYSIS METHODS

PROGRAM MILESTONES

- DEFINE EMP ENVIRONMENTS PRODUCED BY NEW WEAPONS
- NEW ANALYTIC TECHNIQUES FOR CALCULATING SYSTEM COUPLING
- DEDICATED MINICOMPUTER FOR ADVANCED EMP CALCULATIONS
- EMP SHIELDING GUIDELINES
OBJECTIVE
DEVELOP TECHNOLOGY TO HARDEN ARMY TACTICAL SYSTEMS TO THE SOURCE REGION EMP THREAT USING ABOVE GROUND TEST FACILITIES AND ANALYTIC CAPABILITY.

PROGRAM MILESTONES

- ABOVE GROUND TEST PROGRAM AND AURORA UPGRADE
- UNDERGROUND TEST TO VERIFY TACTICAL SOURCE REGION THREAT
- TSR HARDENING GUIDELINES
- NEW TSR SIMULATOR AVAILABLE FOR SYSTEM TESTING
OBJECTIVE

- VALIDATE ANALYTICAL AND ABOVE GROUND EXPERIMENTAL TACTICAL SOURCE REGION SIMULATION
- VALIDATE TACTICAL SOURCE REGION HARDENING PROCEDURES
- GENERATE A DATABASE FOR A TACTICAL SOURCE REGION SIMULATOR DESIGN

POTENTIAL CONTRACT SUPPORT

- HARDWARE FABRICATION
- ANALYSES AND RESPONSE PREDICTIONS
- TEST PLANNING
- SYSTEM TESTS AT SIMULATORS
- UNDERGROUND NUCLEAR TESTING

PROGRAM MILESTONES

- SYSTEM RESPONSE PREDICTIONS
- PRELIMINARY SGEMP HARDENING GUIDELINES
- ABOVE GROUND TESTS TO VERIFY ANALYTIC PREDICTIVE TECHNIQUES AND ESTABLISH VALIDATION PROCEDURES
- UNDERGROUND TEST TO VERIFY THE ABILITY OF ABOVE GROUND TESTING AND ANALYSIS TO VALIDATE THE HARDNESS OF ARMY SYSTEMS
OBJECTIVE

- DEVELOP A CAPABILITY FOR EFFECTIVE SIMULATION OF THE SREMP/SGEMP THREAT ON THE TACTICAL BATTLEFIELD.
- PROVIDE RADIATION HARDNESS ASSURANCE FOR ARMY TACTICAL SYSTEMS.

TACTICAL SOURCE REGION EFFECTS

HARDENING AGAINST HIGH ALTITUDE EMP IS IN GENERAL INEFFECTIVE AGAINST SGEMP

PROGRAM MILESTONES

- AURORA RISE TIME REDUCED FROM 50NS TO 10NS; PULSE WIDTH REDUCED TO 30NS
- TACTICAL SREMP ENVIRONMENT SIMULATED INSIDE COMMUNICATIONS SHELTER
- FOUR AURORA DRIFT TUBES OPTIMIZED TO INCREASE OUTPUT AND UNIFORMITY; DECREASE RISE TIME FOR SCALE MODELING
- VALIDATE ANTENNA AND CABLE COUPLING CODES

POTENTIAL CONTRACT SUPPORT

- SIMULATOR DESIGN STUDIES
- PULSE POWER COMPONENTS
- TEST SUPPORT
OBJECTIVE

• PROVIDE A COST EFFECTIVE BREMP/SGEMP TESTING CAPABILITY FOR ARMY TACTICAL SYSTEMS
• BREMP PHENOMENOLOGY TEST BED
• PROVIDE RADIATION HARDNESS ASSURANCE

PROGRAM MILESTONES

INTERIM TEST CAPABILITY AT AURORA
• LOW JITTER SWITCHES
• ELECTRON BEAM DRIFT TUBES
• MIXED GAMMA AND ELECTRON ENVIRONMENT

NEW TSR SIMULATION FACILITY
• TEST 100 ARMY SYSTEMS TO THEIR TSR SPECIFICATIONS

POTENTIAL CONTRACT SUPPORT

• SIMULATOR DESIGN
• ENVIRONMENTAL STUDIES
• PULSE POWER COMPONENTS
• FACILITY CONTROLS AND INSTRUMENTATION
OBJECTIVE
- DEVELOP TECHNOLOGY TO HARDEN ARMY TACTICAL SYSTEMS TO NUCLEAR BLAST AND THERMAL EFFECTS
- IMPROVE AND MAINTAIN SIMULATION AND MODELING CAPABILITIES TO DESIGN AND TEST HARDENED SYSTEMS

OVERTURN PROTECTION

PROGRAM MILESTONES
- HIGH EXPLOSIVE TESTS
- 1/6 SCALE TEST BED FOR LARGE BLAST/ THERMAL SIMULATOR
- BLAST OVERTURN PROTECTION DEVICES
- FOREST BLOWDOWN AND FIRE HAZARD
- NON-IDEAL BLAST SIMULATION
**Objective**

- Determine vulnerability limits of tactical Army systems/subsystems
- Recommend hardening and shielding solutions for blast, thermal and related effects

---

**Potential Contract Support**

- Analyses and Tests
- Material Evaluations
- Equipment Design
- Hardening Guidelines

---

**Program Milestones**

- Damage Assessments
- Blast/Thermal hardened shelter
- Blast Overturn Protection Devices
- Shock Isolation Methods
- Thermal Protective Coatings
- PIP Program on Mobile Electric Power
1/6 SCALE TEST BED FOR LARGE BLAST/ THERMAL SIMULATOR

HARRIS DIAMOND LABORATORIES

OBJECTIVE

• DEVELOP A TEST BED FOR SCALED TESTING OF CRITICAL DESIGN ELEMENTS FOR THE LB/TS 66% DESIGN

• IMPROVE BLAST/ THERMAL SIMULATION CAPABILITY FOR SMALL ARMY SYSTEMS

LARGE SCALE LB/TS TEST BED

PROGRAM MILESTONES

• TEST DRIVER SYSTEM
  • PEBBLE BED HEATER
  • DOUBLE DIAPHRAGM SYSTEM

• PROTOTYPE RAREFACTION WAVE ELIMINATOR

• THROAT VALVE EVALUATION

• INERTIAL REFERENCE SYSTEM PROTOTYPE

• LB/TS PERFORMANCE CHARACTERIZATION

• LIFE CYCLE SUPPORT FOR LB/TS OPERATION AND IMPROVEMENT
NON-IDEAL BLAST SIMULATION

OBJECTIVE
- CHARACTERIZE NON-IDEAL BLAST/ THERMAL PHENOMENOLOGY FOR TACTICAL ARMY SYSTEMS
- DETERMINE INCREASE IN VULNERABILITY RADIUS FOR TACTICAL ARMY SYSTEMS

POTENTIAL CONTRACT SUPPORT
- ANALYSES AND TESTS
- FLUID DYNAMICS STUDIES
- SIMULATOR DESIGN CALCULATIONS
- SYSTEM RESPONSE ANALYSES

PROGRAM MILESTONES
- DETERMINE INCREASED VULNERABILITY RADIUS
- INCORPORATE NON-IDEAL TESTING CAPABILITY INTO LB/T8 TEST BED
- INCORPORATE NON-IDEAL BLAST EFFECTS INTO LB/T8 FACILITY
- CHARACTERIZE LIMITS OF LB/T8 NON-IDEAL PERFORMANCE

NON-IDEAL BLAST
(2-4 TIMES THE LOAD)
**FOREST BLOWDOWN**

**OBJECTIVE**
- Characterize physical phenomenology of tree and debris transport
- Develop computerized predictive methodology
- Incorporate into effect manual for field application

**POTENTIAL CONTRACT SUPPORT**
- Data on tree characteristics
- Test support
- System damage analysis
- Forest fire models

**REPRESENTATIVE FOREST DAMAGE**

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<td>50% casualties</td>
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<td>15%</td>
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<td>20%</td>
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<tr>
<td>Fire</td>
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<tr>
<td>Fire</td>
</tr>
<tr>
<td>Total destruction</td>
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<tr>
<td>Severely limited mobility</td>
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<td>Limited mobility</td>
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| **Natural**  |
| 90%  |
| 50% casualties |

**RANGE - KM**

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**PROGRAM MILESTONES**

- MIBERS gold experiment
- **STEM fracture analysis**
- **Debris lethality**
- **Cluster effects**
- Mobility impairment studies
- Lethality of debris on army equipment
- Live forest experiment (1kt at HOB)
- Fire spread prediction methods
EMERGING TECHNOLOGIES

OBJECTIVE
Determine the effects of the tactical nuclear radiation environment on emerging/advanced technologies and to make recommendations on enhancing survivability
- Composite materials
- Microelectronics
- Fiber optics/electro-optics
- Robotics
- Sensors
- Computers
- Communication

POTENTIAL CONTRACT SUPPORT
- Component response data
- Hardening methods
- System and equipment hardness estimates
- Operations research

PROGRAM MILESTONES
- Advanced hardened microelectronics testing procedures
- CCD/CID imaging detector response to nuclear radiation
- Survivability enhancements for robotic systems
- Fighting unit survivability evaluation
6.1 RADIATION SPECIAL EFFECTS

OBJECTIVE

- Understand time-dependent radiation response of microelectronic circuits.
- Develop thin film ferroelectric technology for radiation resistant non-volatile memories for missile and space applications.
- Correct uncertainty in EMP prediction capabilities due for example to air conductivity/electron mobility inaccuracies.

POTENTIAL CONTRACT SUPPORT

- Basic Physics Mechanisms
- Component Response Data

PROGRAM MILESTONES

- Radiation problems in buried oxides and trenches for isolation between transistors
- Polarizability, retention, and endurance properties of thin ferroelectric films
- Models for charging grain boundaries in ferroelectrics to predict film degradation
- Model for time dependent distribution function for electron mobilities
6.3B SYSTEM DEVELOPMENT SUPPORT

- NUCLEAR EFFECTS SUPPORT TEAM
- NUCLEAR SURVIVABILITY ASSESSMENT TEAM
- NUCLEAR SURVIVABILITY OF FIELDED SYSTEMS

PROJECTED FUNDING: $ IN MILLIONS

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6.3B SYSTEM DEVELOPMENT SUPPORT

- NUCLEAR EFFECTS SUPPORT TEAM
- NUCLEAR SURVIVABILITY ASSESSMENT TEAM
- NUCLEAR SURVIVABILITY OF FIELDDED SYSTEMS
OBJECTIVE

PROVIDE AD HOC NUCLEAR SURVIVABILITY TECHNICAL AND MANAGEMENT SUPPORT TO MATERIEL DEVELOPERS AND THEIR CONTRACTORS THROUGHOUT THE MATERIEL ACQUISITION LIFE CYCLE

POTENTIAL CONTRACT SUPPORT

- AD HOC TEAM MEMBERS
- SYSTEM HARDENING
- EXPERT SYSTEM DEVELOPMENT

PROGRAM MILESTONES

- HARDENING STRATEGY FOR NEXT GENERATION AND FUTURE SYSTEMS (HFM, GBCS, SASS)
- HARDNESS MAINTENANCE/SURVEILLANCE TECHNOLOGY TRANSFER
- HARDNESS AWARENESS COURSE FOR MSC/RDEC ADVISORS
- COMPLETE PROTOTYPE EXPERT SYSTEMS MANAGEMENT SUPPORT FOR MATERIEL DEVELOPERS
NUCLEAR EFFECTS SUPPORT TEAM FUNCTIONS

ADVISES AND ASSISTS IN:

- MANAGEMENT AND TECHNICAL GUIDANCE
- REQUEST FOR PROPOSAL FORMULATION
- PRE-BIDDERS CONFERENCES
- SOURCE SELECTION EVALUATION BOARDS
- CONTRACT NEGOTIATIONS
- TEST INTEGRATION WORKING GROUPS
- CONTRACTOR REVIEWS
6.3b NUCLEAR SURVIVABILITY ASSESSMENT TEAM

OBJECTIVE

- Support AMC in management of the Nuclear Survivability Program
- Conduct independent technical evaluations of Nuclear Survivability Programs as directed by AMC
- Coordinate the Nuclear Survivability Program inside and outside of AMC

M60A3 TANK BATTALION

PROGRAM MILESTONES

- INR Testing of QRG's (6KW and 30KW)
- INR Testing of Scott 3KW Generator Set
- Served on SAG for COEA Protocol Report
- Restructure Program for Assessing Fielded Systems
- Continue Assessments
- Enter Survivability Data into Data Base

POTENTIAL CONTRACT SUPPORT

- System and Equipment Assessments
- Data Collection and Management
6.3b NUCLEAR SURVIVABILITY OF FIELDED SYSTEMS

OBJECTIVE

- Assess nuclear survivability of fielded systems in priority order established by HQ TRADOC
- Identify hardening requirements
- Recommend product improvements
- Maintain nuclear survivability database for tactical army equipment

MLRS SYSTEM

PROGRAM MILESTONES

- FY86-FY89 Assessments:
  - M1 Battalion
  - Fire control C3
  - 4 Infantry Battalions
  - MLRS Battery
  - Lance Battery
  - M60 Battalion
  - M109 Battalion
  - Patriot

- FY89 - Restructure program for continuation

- FY90-FY91 - Develop hardening requirements

POTENTIAL CONTRACT SUPPORT

- System survivability assessments
- Hardening recommendations
NUCLEAR SURVIVABILITY ASSESSMENTS

M109 HOWITZER

OTHER SUPPORT EQUIPMENT
- Survey Pads
- Radar O36/G37
- AM Radio Sets
- HEMTT
- Cargo
- Fuel
- Trucks
- CUCV
- HMMWV
- 2 1/2 T
- 5 T
- Trailers
- TACMS (Tac Army CSS Computer Sys)

CANNON BATTERIES
- M109 Howitzer & Ammunition
- M982 FAASV/M548 Cargo Carrier
- M578 Recovery Vehicle
- AN/PVS-5/AN-TV5 Night Vision Devices
- AN/PRC 68 SUT
- Gun Display Unit

BATTERY FDC
- M577 CP Carrier
- GKY-28 BCS
- Backup Computer Sys
- Radios, Antennas, & Mounts

EXTERNAL SUPPORT
- ORDNANCE
  - Ammune
  - Maintenance
- TRANSPORTATION
  - Resupply
- QUARTERMASTER
  - Logistics
- DIVERSITY ASSETS
  - Met Data

MVR CN/FSI
- M981 FIST
- DMD
- GLID
- Radios
- Generators

MVR BN/BOE FSO
- M577 CP Carrier
- VFMED
- Radios

FA BATTALION TACFIRE
- GSG-10V TACFIRE
- Radios, Antennas & Mounts
- AN/VRC 12
- AN/VRC 125
- Speech Secure Equipment
- 5 Ton Trucks
FY88 ACCOMPLISHMENTS

- SOURCE SELECTION/EVALUATION BOARD
  (MELIOS, TAGJAM, AGCS, FAAD NLOS)

- HARDNESS TESTING
  (OQ-174, AJCM, SCOTT SKW GENERATOR,
  M749 FUZE COMPONENTS, FORKLIFT TRUCK)

- NUCLEAR SURVIVABILITY ASSESSMENTS
  (HAB, SCOTT SKW GENERATOR, QUIET
  RELIABLE GENERATOR SETS)

- JOINT SERVICES PROGRAM SUPPORT
  (JSTARS, DWT8, CSCE, JTIDS, V-22 OSPREY)

- HARDNESS ASSURANCE/HARDNESS
  MAINTENANCE STRATEGY
  (SINGCARS, CWAS/Maps, SADARM, JSTARS
  S8T, CSCE)

FY89 STATUS

- SOURCE SELECTION/EVALUATION BOARD
  (AAWS-M, NBCRS, IRV, HAIDE-II, LAMS, JSTARS)

- HARDNESS TESTING
  (QUIET RELIABLE GENERATOR SET, FORKLIFT
  TRUCK, SINGCARS, VEMASID, SCOTT SKW
  GENERATOR, M749 FUZE)

- NUCLEAR SURVIVABILITY ASSESSMENTS
  (FOTL, QBCS, EFVS, QUIET RELIABLE
  GENERATOR SETS, TDFD)

- INITIATE JOINT AMC/TRADOC INVESTIGATION
  OF SURVIVABILITY ALTERNATIVES

- INITIATE JOINT DNA/HDL EXPERT SYSTEMS
  MANAGEMENT SUPPORT FOR DEVELOPERS

- LIFE CYCLE NUCLEAR SURVIVABILITY
  STRATEGY
  (AFV, SINGCARS, JSTARS, FOTL, HAIDE-II,
  SADARM, BCS, CSCE, VEMASID)
DEMONSTRATIONS - 6.3a

- DEFENSE STANDARDIZATION AND SPECIFICATION PROGRAM (DSSP)

- NON-DEVELOPMENTAL ITEMS (NDI)

- HARDNESS ASSURANCE/HARDNESS MAINTENANCE (HA/HM)

- LARGE BLAST/Thermal Simulator (LB/TS)

PROJECTED FUNDING: $ in millions

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DEMONSTRATIONS - 6.3a

- DEFENSE STANDARDIZATION AND SPECIFICATION PROGRAM (DSSP)

- NON-DEVELOPMENTAL ITEMS (NDI)

- HARDNESS ASSURANCE/HARDNESS MAINTENANCE (HA/HM)

- LARGE BLAST/HEAT/HERMAL SIMULATOR (LB/TS)
NUCLEAR HARDENING TECHNOLOGY

WILL COVER:

- PROGRAM BACKGROUNDS
- BUDGETARY INFORMATION
- STATUS
- PLANS
- TECHNICAL BARRIERS
- INTERFACES
DEFENSE STANDARDS AND SPECIFICATIONS PROGRAM

HARRY DIAMOND LABORATORIES

OBJECTIVE

- DEVELOP NEAR-TERM FIRM HARDENING GUIDELINES AND PRACTICES TO DOD-STD-2169 FOR SYSTEMS WHICH SUPPORT TIME SENSITIVE FUNCTIONS

- DEMONSTRATE TECHNOLOGY TO SUPPORT A LOW-RISK HARDENING PROGRAM FOR MBc3i SYSTEMS

- TRANSFER TECHNOLOGY INTO DSSP FORMAT

- PROVIDE TECHNOLOGY TRANSFER AND APPLICATION ASSISTANCE TO USERS

POTENTIAL CONTRACTOR SUPPORT

- Collection/Analyses of Testbed Demonstration Data

- Update of Guidelines & Procedure Documentation

- New Standards

PROGRAM MILESTONES

- TEST BED DEMONSTRATOR AND CW SYSTEM FIELD

- ACTIVE TECHNOLOGY TRANSFER INITIATED

- DEVELOPMENT OF TRANSPORTABLE HANDBOOK AND SECTION OF MIL-STD-188-125

- UPDATE GUIDELINES AND PROCEDURES FOR DESIGN AND HARDNESS
INTRODUCTION

ARMY RESPONSIBILITIES

ATSD(AE) DESIGNATED THE ARMY TO BE RESPONSIBLE FOR
STANDARDIZATION AND SPECIFICATION OF HEMP
PROTECTION FOR TGBCl STRATEGIC TIME-URGENT
SYSTEMS

SPECIFICALLY, THE ARMY WAS TASKED TO:

- INITIATE SELECTIVE SHORT-RUN MEASURES TO BRIDGE
  GAP UNTIL LONG-RANGE OBJECTIVES CAN BE MET

- COMPOSE A FRAMEWORK FOR EMP STANDARDS AND
  SPECIFICATIONS FROM EXISTING PROGRAMS AND
  SPECIFIC NEAR-TERM EMP INITIATIVES

- ADDRESS SCOPE AND TIMING OF ACTIONS LEADING TO
  DEVELOPMENT OF GUIDELINES AND PRACTICES AND
  DESIGNATE LEAD ACTIVITY THROUGH ARMY
  STANDARDIZATION OFFICE

ARMY PROGRAM OBJECTIVES

- TO DEVELOP NEAR-TERM FORMAL HARDENING
  GUIDELINES AND PRACTICES FOR TGBCl SYSTEMS
  WHICH SUPPORT TIME SENSITIVE FUNCTIONS

- TO DEVELOP (DEMONSTRATE) TECHNOLOGY TO
  SUPPORT A HEMP HARDENING PROGRAM FOR TGBCl
  SYSTEMS

- TO TRANSFER THE TECHNOLOGY INTO DEFENSE
  STANDARDIZATION AND SPECIFICATION PROGRAM
  (DSSP) FORMAT

- TO PROVIDE TECHNOLOGY TRANSFER AND APPLICATION
  ASSISTANCE TO USERS
PROGRAM ACCOMPLISHMENTS

TEST PROGRAM SUMMARY

TESTS PERFORMED
- HORIZONTAL POLARIZATION CALIBRATION - CW
- SIMPLE DISTRIBUTED SYSTEM
- HORIZONTAL POLARIZATION BASELINE - TB/D
- PENETRATION PROTECTION DEVICE BENCH TESTING
- SYSTEM RESPONSE - PHASE I - TB/D
- HM/HS - PHASE I

TECHNICAL ISSUES ADDRESSED
- ENVIRONMENT SPEC-E1
- NUMBER OF SHIELDS
- EXTERIOR STRESS
- STRESS ALLOCATION
- SPECIFICATION/ALLOCATION
- SPECIFICATION/LAYER SHIELD
- SURGE PROTECTION DESIGN
- HM/HS BASELINE
- VERIFICATION PROTOCOL
- BULK/INDIVIDUAL WIRE
- ESA PERFORMANCE
- EXTRAPOLATION TO THREAT
- HM/HS SIMULATORS
- HM/HS TEST METHODS
- LIFE CYCLE ANALYSIS
- STRESS BOUND ANALYSIS
PROGRAM ACCOMPLISHMENTS

CW/PULSE COMPARISONS

10 METER DIPOLE

SYSTEM GROUND CABLE
# Future Plans

**Schedule**

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<th>R &amp; D</th>
<th>Demonstration</th>
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<td>FY 90</td>
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**MIL-STD-188-125 (Transportable)**

**MIL-HDBK-423 (Vol II)**

**Guidelines and Practices**

**Tests**

- HM/HS I & II
- PPD Bench Test I & II
- System Response II, III & IV
- Vertical CW Cal/B.I.
- HS Techniques/Bite I & II
## HARDNESS ASSURANCE
### HARDNESS MAINTENANCE

**HARRY DIAMOND LABORATORIES**

### OBJECTIVE
- Develop technology to ensure life cycle nuclear survivability of Army tactical systems
- Develop reliability and maintainability analytics for maximum HCI/HCP availability
- Obtain HCI/HCP failure mode rate data bases from fielded systems for new systems development
- Develop generic NWE TMDE for depot and forward maintenance echelons

### POTENTIAL CONTRACTOR SUPPORT
- Collection/Analyses of Failure Data
- Generic TMDE Prototype Design for Different System Types

### PROGRAM MILESTONES
- Develop fielded systems failure data base
- Generic TMDE prototype
- TMDE technology demonstration
THRUSTS CONVERGING ON COORDINATED SOLUTION

- EXAMINE MATERIEL ACQUISITION PROCESS
- EXAMINE OPERATIONS AND SUPPORT PROCESS
- EVALUATE NS TECHNOLOGY BASE
- INTEGRATE NS THROUGHOUT LIFE-CYCLE
HARDNESS TIME HISTORY
WITHOUT HM/HS

HARRY DIAMOND LABORATORIES

DEGRADATION
MECHANISMS

PRODUCTION
SURVIVABILITY
LEVEL

SURVIVABILITY
REQUIREMENT

AGING & WEAR

PART FAILURE

REPLACE WITH
"SOFT" PART

TIME
SUMMARY

- A Viable LCNS program is essential if critical systems are to perform their assigned missions on the nuclear battlefield.

- The Army is seeking an effective LCNS program at an affordable price.

- Success is enhanced through coordination and key player participation.
NON DEVELOPMENTAL ITEMS

OBJECTIVE

• PRODUCE GUIDELINES FOR SELECTING NUCLEAR SURVIVABLE TECHNOLOGIES IN NDI PROCUREMENT
• DEMONSTRATE NUCLEAR HARDENING TECHNIQUES THAT CAN BE COST EFFECTIVELY INCORPORATED INTO NDI

POTENTIAL CONTRACTOR SUPPORT

• Techniques for Decreasing Nuclear Vulnerability on NDI
• Identification of Emerging Technologies NDI Survivability Problems
• Updated Guidelines for NDI Procurement

PROGRAM MILESTONES

• INR SUSCEPTIBILITY OF NDI CANDIDATE TECHNOLOGIES DETERMINED
• FEASIBILITY OF ADD-ON CIRCUMVENTION TO NDI FOR INR HARDENING SHOWN
• ANALYSIS OF EMP EFFECTS ON NDI
• DEMONSTRATION OF NDI HARDENED TO INR AND EMP
• GUIDELINES FOR HARDENING NDI
THE PROBLEM

- INCREASED USAGE OF ELECTRONICS ON TACTICAL BATTLEFIELD
- MILITARY DEVELOPMENT TIMES LAG RAPIDLY ADVANCING TECHNOLOGY
- COMMERCIAL EQUIPMENTS USE STATE-OF-THE-ART BUT ARE NOT HARDENED
OBJECTIVES:

- PRODUCE GUIDELINES FOR SELECTING TECHNOLOGIES IN NDI PROCUREMENTS.

- DEMONSTRATE HARDENING TECHNIQUES THAT CAN BE COST EFFECTIVELY INCORPORATED INTO NDI.
NDI NUCLEAR SURVIVABILITY APPROACH:

- DETERMINE THE NUCLEAR SUSCEPTIBILITY OF NDI CANDIDATE TECHNOLOGIES.

- INVESTIGATE AND DEMONSTRATE SURVIVABILITY ENHANCEMENT TO NDI SYSTEMS THROUGH:

  MINOR MODIFICATIONS
  ADD-ON HARDENING KITS
  USE OF PREFERRED SYSTEM TECHNOLOGIES OR CONFIGURATIONS
NDI NUCLEAR SURVIVABILITY BENEFITS:

- NUCLEAR SURVIVABLE NDI EQUIPMENT CAN RESULT IN A LARGE SAVINGS OF BOTH MONEY AND TIME OVER THAT REQUIRED FOR THE NORMAL DEVELOPMENT AND FIELDING OF ARMY EQUIPMENT.

- RESULTS ARE ALSO APPLICABLE TO UNHARDENED ARMY SYSTEMS.
GRID PORTABLE COMPUTER
WITH ADDED NUCLEAR EVENT DETECTOR (NED) MODULE

Electroluminescent Flat panel Graphics Display (folds down)

384K bytes Bubble Memory

256K or 512K bytes Random Access Memory (RAM)

57-key Keyboard

Rugged, Lightweight Magnesium Case

NUCLEAR EVENT DETECTOR
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<th>Activity 4</th>
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<td>Survivability Validation (Grid)</td>
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<td>State-of-the-art Guideline Document</td>
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<td>Preliminary HemP Guidelines</td>
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<td>Final Guidelines</td>
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<td>Protective Coating Guidelines</td>
<td>Test Weathered Coatings</td>
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LARGE BLAST/THERMAL SIMULATOR

OBJECTIVE

- Acquire DOD facility for Nuclear Blast/Thermal Survivability Testing of Full Scale Equipment to Threat Levels

POTENTIAL CONTRACTOR SUPPORT

- Probatve Tube Control System Design
- Analytical Codes for Tube/Target Response
- Instrumentation

PROGRAM MILESTONES

- Construct Test Bed Facility
- 1/2 Scale Throat Valve Test
- LB/TS Construction
- Throat Valve Retrofit
- Facility Characterization
- Full Scale Equipment Testing
OBJECTIVE

- Acquire DOD facility for Nuclear Blast/Thermal Survivability testing of full scale equipment to threat levels

POTENTIAL CONTRACTOR SUPPORT

- Probative Tube Control System Design
- Analytical Codes for Tube/Target Response
- Instrumentation

PROGRAM MILESTONES

- Construct Test Bed Facility
- 1/2 Scale Throat Valve Test
- LB/T8 Construction
- Throat Valve Retrofit
- Facility Characterization
- Full Scale Equipment Testing
Large Blast/Thermal Simulator

Current Concepts

- Yield Range: 1 to 600 kt
- Overpressure (Maximum): 2 to 35 psi
- Coupled Thermal Source: up to 320 cal/sq cm
- Large Cross Sectional Area: 163 sq m
- Multiple Heated Nitrogen Drivers: 9
- Pebble Bed Evaporator/Superheater
- Double Diaphragm System for Gas Release
- Movable Hydraulic Packers for Volume Changes
- Active Rarefaction Wave Eliminator
Figure 4. Blast capabilities of LB/TS and large HE detonations
LARGE BLAST/ THERMAL SIMULATOR

PROBABLE TEST SECTION

HEIGHT — 10.3 METERS

AREA = 163 M²

20 METERS

10 METERS RADIUS

0.3 M

STRAIGHT SECTION

0.3 M
CONCEPT FOR CONTROL AND VENTING OF THERMAL SIMULATOR COMBUSTION PRODUCTS

VENT NOZZLE WALL

AIR JETS TO INDUCE FLOW OUT OF TUNNEL

VENT OPENING HAS FAST-CLOSING SHUTTERS (NOT SHOWN)

DIRECTION OF SHOCK PROPAGATION

CURTAIN AIR JETS / LINE OF TORCHES / CURTAIN AIR JETS
Large Blast/Thermal Simulator

Research and Development Schedule

<table>
<thead>
<tr>
<th>Year</th>
<th>LB/TS Design</th>
<th>LB/TS Construction</th>
<th>Control System Design</th>
<th>Fast Acting Throat Valve Research</th>
<th>Advanced Instrumentation Techniques</th>
<th>Non-Ideal Blast Simulation Techniques</th>
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Aurora/Radiation Simulation Technology

Dr. Forrest J. Agee
Chief, Radiation Simulation Technology Branch
Nuclear Survivability Laboratory
Aurora and Proposed Tactical System Radiation (TSR) Facility

TECH BASE INVESTMENT STRATEGY AREA: S002 Modeling/Simulation

Aurora can be used to produce radiation in the form of both high-energy X rays and electron beams. Both types of radiation can be tailored to meet the needs of test objects.

DESCRIPTION:

Aurora's versatility makes it useful for a broad range of investigators. For example, Aurora produces X rays in the Gamma spectrum, allowing experimenters to assess the effects of transient radiation on electronics ranging from tiny chips to entire weapons systems. Aurora can also be used to test small objects at extremely high doses (for example, it can produce 300,000 RAD(Si) over 250 cm$^3$) or, it can irradiate with good dose uniformity, a volume as large as 14m$^3$ at a dose of 675 RAD(Si). Currently, no test facility is capable of testing complete deployed systems at high levels of X rays or with multiple pulses (proposed TSR).

OBJECTIVE/APPROACH:

The objective is to provide the Army with the means to test completely deployed systems as large as "Peacekeeper" with multiple Gamma-ray simulators producing X rays in the 10 MeV range.

TECH BARRIERS:

The technical barriers are:

a. conceptual design for the facility: type of construction, design criteria, test area enclosure and utilities requirements, office area security systems approach and safety considerations;

b. NEPA: review of scope, technical approach, risks, etc.;

c. simulator design, drift tube design, drift tube fabrication;

d. facility detail design, drift tube testing; and

e. facility construction and simulator fabrication.
In direct support of: space and strategic systems, tactical systems, systems technology, nuclear effects simulation technology.

The Tactical System Radiation (TSR) facility represents a multimillion dollar investment of capital assets.

TECHNICAL POCs: Dr. Forrest J. Agee or Mr. Mark G. Caruso
Harry Diamond Laboratories
ATTN: SLCHD-NW-RS
2800 Powder Mill Road
Adelphi, MD 20783-1197
(301) 394-2290
• PROVIDE DNA SIMULATOR OF \( \gamma \) RAY INDUCED TREE EFFECTS TO SUPPORT DOD DEVELOPMENT OF

- SPACE AND STRATEGIC SYSTEMS
- TACTICAL SYSTEMS
- SYSTEMS TECHNOLOGY
- NUCLEAR EFFECTS SIMULATION TECHNOLOGY
• 45 krad GAMMA DOSE AND $3 \times 10^{11}$ r/s DOSE RATE (OVER BASKETBALL SIZE VOLUME)

• BOTH INTENSE AND DIFFUSED E-BEAM CAPABILITIES

• HI-INTENSITY BREMSSTRAHLUNG CAPABILITY ($\geq 500$ krad)

• MODERATE ENERGY BREMSSTRAHLUNG WITH BACKSCATTER

• MULTIPLE PULSE (TWO PULSES, 20 K-rad each)

• MICROWAVE RADIATION AT 1 GHz (8GW IN WAVEGUIDE SO FAR)

• COMBINED ELECTRON AND GAMMA (SREMP)

• FAST RISE, SHORT PULSE SGEMP
- PROVIDE THE ARMY THE CAPABILITY TO TEST THE HARDNESS AND VULNERABILITY OF ARMY TACTICAL SYSTEMS TO THE TACTICAL NUCLEAR BATTLEFIELD ENVIRONMENT

- PROVIDE THE ARMY THE CAPABILITY FOR RESEARCH AND TESTING TO INSURE THE HARDNESS OF DEVELOPMENTAL FUTURE ARMY C³ SYSTEMS
AURORA TESTING SUPPORTS TRI-SERVICE PROGRAM

HARRY DIAMOND LABORATORIES

1984-1988
- PEACEKEEPER MISSILE (12 TESTS)
- ARMY TACTICAL CONVERTER
- ARMY SINGARS (4 TESTS)
- OSD-PIF AURORA MODERNIZATION
- SANDIA NATIONAL LABS CAPACITORS
- ARMY TACTICAL SREMP (4 TESTS)
- DNA-SNL SIMULATION FIDELITY
- AFWL SOIL CONDITIONS
- ARMY AN/UGT-74
- SDIO OPTICAL WINDOWS (3 TESTS)
- ARMY TACTICAL SGEMP (2 TESTS)
- DNA UGT GAGE
- NAVY UGT
- ARMY GRID COMPUTER (2 TESTS)
- SDIO HPM (3 TESTS)

- ARMY INDENTED DIODE
- DSCS III
- ARMY TACTICAL 3KW GENERATOR
- ARMY LOW JITTER SWITCH
- DNA MISTY ECHO UGT (2 TESTS)
- ARMY M-109 HOWITZER SGEMP
- NAVY CID STAR TRACKER
- ARMY/SNL XM785 FUZE/W82 PROJECTILE (4 TESTS)
- ARMY SBIR SOFTENED X-RAYS (4 TESTS)
- ARMY A TO D CONVERTERS
- ARMY PHOTOCONDUCTIVE DIAMOND TEST
- ARMY TACTICAL POWER SUPPLIES (2 TESTS)
- ARMY XM42 FUZE SETTER (3 TESTS)
- ARMY XM749 FUZE
- NSA KOK-13 RUTTER COMSEC (3 TESTS)
1989

- ARMY TACTICAL SREMP
- ARMY TACTICAL QUIET MOTOR GENERATOR
- ARMY LOW JITTER SWITCH (2 TESTS)
- PEACEKEEPER MISSILE (2 TESTS)
- ARMY TACTICAL GENERIC ENCLOSURES
- SDIO HIGH POWER MICROWAVES
- NSA RUTTER
- TRIDENT II
- MARX GENERATOR INSTALLATION AND TESTING

1990-1994

- PEACEKEEPER MISSILE (15 TESTS)
- ARMY FUZE UPGRADE
- ARMY DISTANT LIGHT UGT (6 TESTS)
- ARMY TACTICAL SOURCE REGION PROGRAM
- ARMY TSR SIMULATOR PROGRAM
- NSA COMSEC
- NAVY UHF FOLLOW-ON (2 TESTS)
- SDIO HIGH POWER MICROWAVES
- SMALL ICBM
- NUMEROUS OTHER ARMY, NAVY, USAF, DOD AGENCY AND DOE PROGRAMS
  YES TO BE SCHEDULED
GOVERNMENT
HARRY DIAMOND LABORATORIES
NAVAL RESEARCH LABORATORIES
NAVAL SURFACE WEAPONS CENTER
US ARMY MICOM
DOE NATIONAL LABORATORIES
SANDIA
LOS ALAMOS
LAWRENCE LIVERMORE

INDUSTRY
MCDONNELL DOUGLAS
SPERRY
UNISYS
MARTIN MARIELTA
BELL TELEPHONE LABORATORIES
HONEYWELL INT.
HUGHES AIRCRAFT
SRI
BALL AEROSPACE

BERKELEY RESEARCH ASSOCIATES
SIMULATION PHYSICS INC.
GENERAL Electric
RCA
NORTHROP
APPLIED PHYSICS LABORATORY - JOHNS HOPKINS
AEROJET ELECTRO SYSTEMS
BENDIX
LOCKHEED MISSILES & SPACE CO.
RAYTHEON
MISSION RESEARCH CO.
AVCO
SAIC
JAYCOR
ITT
ROCKWELL
PHYSICS INTERNATIONAL
PULSE SCIENCES INC.
DESIGN ANALYSIS CONSULTANTS
Aurora

- Electron beam drift tube sharpens rise time
- Diverter switches shorten pulse width
AURORA HIGH-INTENSITY BREMSSTRAHLUNG UPGRADE

NORMAL AURORA DOSE RATE rads(si)/s

Aurora

HIGH-INTENSITY BREMSSTRAHLUNG ENVIRONMENT
SOFTENED X-RAY CAPABILITY AT AURORA

PRESENT CAPABILITY

- 1600 EM² TEST AREA
- 2.6 KRADS (Si) WITH 2:1 UNIFORMITY

"LARGE ANODE TIP MODIFICATIONS"

- NEW ANODE TIPS TO GIVE 10,000 CM² TEST AREA
- 2 KRADS (Si) WITH 2:1 UNIFORMITY

[Spectrum comparable to 1.5 MeV bremsstrahlung graph]

[Vacuum test chamber diagram]

[Shield diagram]
AURORA PULSE SHAPE ENHANCEMENT UPGRADES

NORMAL SINGLE RADIATION PULSE (45 KRAD)

VARIABLE INTERVAL

MULTIPLE PULSE CAPABILITY (20 KRAD)*
AURORA Reflex Diode Microwave Generation Experiment

LANL Wire Calorimeter to Measure Axial Microwave Energy
SNLA Space Cloth Calorimeter to Measure Radial Microwave Energy
SNLA Directional Coupler to Measure Radial Power Waveform

Cross-Section View of Reflex Diode and Diagnostics
Domestic Technology Transfer Opportunities

Clifford E. Lanham
Army Domestic Technology Transfer Program Manager
ARMY

DOMESTIC TECHNOLOGY TRANSFER PROGRAM

US ARMY
LABORATORY COMMAND

US ARMY
NATIONAL SCIENCE FOUNDATION
PROGRAM GOALS

THE DOMESTIC TECHNOLOGY TRANSFER PROGRAM IS INTENDED TO MAXIMIZE THE BENEFIT FROM THE INVESTMENT IN ARMY R&D BY:

• ACHIEVING MORE RAPID TECHNOLOGY SPINOFF FOR IMPROVED PRODUCTS AND PROCESSES IN DOMESTIC INDUSTRY

• PROVIDING TECHNICAL ASSISTANCE TO STATE AND LOCAL ECONOMIC DEVELOPMENT

• PROVIDING TECHNICAL ASSISTANCE TO STATE AND LOCAL GOVERNMENTS FOR IMPROVED PRODUCTIVITY (> $100 BILLION SECTOR OF ECONOMY)
IMPROVING TECHNOLOGY TRANSFER FROM FEDERAL LABORATORIES IS CONSIDERED IMPORTANT IN ADDRESSING THE "COMPETITIVENESS ISSUE". AS A RESULT:

- THERE WAS STRONG BI-PARTISAN SUPPORT FOR THE NEW LEGISLATION AND ITS AGGRESSIVE IMPLEMENTATION.

- RAPID IMPLEMENTATION WAS REQUIRED BY EXECUTIVE ORDER 12591 (10 APRIL 1987).

- THERE HAVE BEEN NUMEROUS CONGRESSIONAL HEARINGS AND A GAO FOLLOW-UP.
PRINCIPAL PROVISIONS OF SEC. 11

• STATED THAT THE FEDERAL GOVERNMENT WILL STRIVE TO TRANSFER ITS TECHNOLOGY

• REQUIRED EACH FEDERAL LABORATORY TO ESTABLISH AN OFFICE OF RESEARCH AND TECHNOLOGY APPLICATIONS (ORTA)

• RECOMMENDED STAFFING AND FUNDING LEVELS FOR ORTA’S

• DELINEATED FOUR FUNCTIONS FOR ORTA’S

• REQUIRED BIENNIAL REPORTING THROUGH THE CENTER FOR THE UTILIZATION OF FEDERAL TECHNOLOGY IN COMMERCE DEPT.
FEDERAL TECHNOLOGY TRANSFER ACT OF 1986

PRINCIPAL POINTS

- AMENDS THE STEVENSON-WYDLER ACT OF 1980
- STRENGTHENS POLICY WHICH MAKES TECHNOLOGY TRANSFER PART OF THE LAB MISSION
- REQUIRES THAT LABS WITH MORE THAN 200 S&E PERSONNEL HAVE A FULL TIME ORTA
- DEFINES ARMY, NAVY, AND AIR FORCE AS AGENCIES
- REQUIRES EACH AGENCY TO REPORT ANNUALLY WITH BUDGET SUBMISSION TO OMB
- EXPANDS NUMBER OF ORTA FUNCTIONS TO FIVE
- CHARTERS THE FEDERAL LABORATORY CONSORTIUM
- PROVIDES AUTHORITY FOR GOVERNMENT LABS TO ENTER INTO COOPERATIVE R&D AGREEMENTS
- PROVIDES 15% OF ROYALTIES TO INVENTORS AND THE MAJORITY OF THE BALANCE TO LABS
TECHNOLOGY AND TECHNICAL ASSISTANCE

- TECHNICAL INFORMATION AND ASSISTANCE
  - DIRECT ASSISTANCE
  - REFERRAL TO OTHER FEDERAL LABS

- COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS

- PATENT LICENSES
  - EXCLUSIVE
  - NON-EXCLUSIVE
ARMY DOMESTIC TECHNOLOGY TRANSFER

Clifford E. Lanham
Army Domestic Technology Transfer
Program Manager
U.S. Army Laboratory Command
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<table>
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<th>Laboratory</th>
<th>Phone</th>
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<td>U.S. Army Ballistic Research Laboratory</td>
<td>(301) 278-6955</td>
<td>(301) 278-7962</td>
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<td>ATTN: SLCBR-DS (Mr. Richard Dimmick)</td>
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<tr>
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<td>(202) 394-4902</td>
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<tr>
<td>U.S. Army Human Engineering Laboratory</td>
<td>(301) 278-5817</td>
<td>(301) 278-7675</td>
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<td>ATTN: SLCHE-SS-IR (Mr. Dean Westerman)</td>
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<td>U.S. Army Materials Technology Laboratory</td>
<td>(617) 923-5091</td>
<td>(617) 923-5524</td>
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<td>ATTN: SLCMT-TMT (Mr. Paul Rolston)</td>
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<td>U.S. Army Vulnerability Assessment Laboratory</td>
<td>(505) 678-2650</td>
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<td>ATTN: SLCVA-DPC (Mr. Tom Reader)</td>
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Session III
Target Sensors and Signal Processing

Session Chairman:
Peter B. Johnson
Director, Target Sensors and Signal Processign Laboratory
PERFORM RESEARCH IN SENSOR TECHNOLOGY, BACKSCATTER MODELING AND SYSTEM DESIGN. INTEGRATE SENSOR TECHNOLOGY INTO SMALL, LIGHT WEIGHT, LOW COST, SURVIVABLE SENSORS TO SUPPORT ARMY TACTICAL REQUIREMENTS FOR:

- SURVEILLANCE RADARS
- FUZE SENSORS
- ANTI-RADIATION MISSILE COUNTER MEASURE TECHNOLOGY
Signal Processing Technology

Dr. John M. Pellegrino
Chief, Optical Processing Technology Branch
Target Sensors and Signal Processing Laboratory
TITLE: OPTICAL SIGNAL PROCESSING

TECHBASE INVESTMENT STRATEGY AREA: EMERGING TECHNOLOGIES — ADVANCED SIGNAL PROCESSING AND COMPUTING

Optical processing modules, combined with digital processing hardware, provide advanced, high-throughput processing capability for real-time applications. Such signal processing systems are for ground and air based missions involving radar processing, communications intercept, and target recognition.

DESCRIPTION

Develop optical processing modules with low weight, power consumption, and volume, possessing high throughput/high processing gain characteristics for real-time signal processing applications. Combined in hybrid testbed systems with digital and rf analog processing capabilities; demonstrations will encompass processing of wideband, complex radar and communications signals, and offer extensive processing capacity for image processing/target recognition problems.

OBJECTIVE/APPROACH

The objective is to provide the battlefield commander with real time analysis and interception of the prevailing signal environment. Key optical devices, algorithms, and architectures, along with new electro-optic implementations are examined to enhance current signal processing capabilities.

Tech barriers are:

- Materials and Devices: Larger time apertures, greater efficiency
- Detector Arrays: Increased dynamic range in two dimensions
- Diode Lasers: Visible, high power, narrower linewidth
- Spatial Light Modulators: Higher resolution
- Sophisticated Algorithms and Architectures for Exotic Signal Types: Exploit parallel/multi-dimensional architectures for greater processing power
- Rugged, Compact Modular Units: More universal environmentally rugged designs
- System Interfaces: Greater compactness, increased processing power
- Advanced GaAs Optoelectronic Structure for Neural Networks
REMARKS

In direct support of:

- Integrated Intercept System
- Integrated Jammers
- Integrated Sensors
- Distributed IEW Fusion
- Intelligence and Electronic Warfare Vehicle

Technical POC: Mr. John Pellegrino
Telephone: (202) 394-2520
For the 1990's and beyond, signal processing systems designed for the Army's tactical applications must be able to handle large numbers of signals with exotic modulation types. This involves:

- Wide Bandwidth
- Fine Resolution
- Large Dynamic Range
- High Throughput
- Ultra Fast Update Capability
- Sophisticated Algorithms and Signal Recognition Capability
- Advanced Hardware for System Interfacing

Processors must also be capable of operating over a wide range of environmental conditions and have size, weight, and power requirements appropriate for shelter-based and UAV-based implementation. Optical processors have demonstrated present and potential capability to address these issues.
OPTICAL SIGNAL PROCESSING

TASK: FAST, ACCURATE DETECTION AND PROCESSING OF WIDE BANDWIDTH SIGNALS WITH COMPACT HARDWARE

- OPTICAL PROCESSING
  - POTENTIAL SPEED OF PARALLEL PROCESSING
  - COMPACT SIZE
  - WIDE INSTANTANEOUS BANDWIDTH
  - HIGH RESOLUTION
** Support component development for Bragg cells, SLM's, laser diodes, photodetector arrays (one and two dimensional), and development of optically sensitive materials

** Support development of optical algorithms and architectures for rugged, compact modular building block processors and system interfaces
TECHNOLOGICAL BARRIERS COMPONENTS

KEY COMPONENT AREAS WHICH NEED DEVELOPMENT IN ORDER TO ENHANCE PROCESSOR SPECIFICATIONS AND SO MEET PROCESSING REQUIREMENTS:

MATERIALS:

III-V OPTOELECTRONICS
ACOUSTO-OPTIC, MAGNETO-OPTIC, ELECTRO-OPTIC,...

DEVICES:

HIGH POWER (>100mW) RED, SINGLE MODE LASER DIODES
HIGH RESOLUTION MODULATORS, ONE- AND TWO-DIMENSIONAL
HIGH DYNAMIC RANGE (>70dB), HIGH FRAME RATE (>100Hz) OPTICAL DETECTORS
Key areas for optical processor development to enhance processing capabilities and so meet Army processing system requirements:

**SOPHISTICATED ALGORITHMS AND ARCHITECTURES FOR EXOTIC SIGNAL TYPES**
Currently high success with one-dimensional (and some 2-D) architectures; need to develop these further and exploit parallel/multi-dimensional nature of optics for greater processing power.

**RUGGED, COMPACT MODULAR UNITS**
Take application specific units and generalize to make more universal designs. Advanced architectures must also be environmentally rugged.

**SYSTEM INTERFACES**
Current electronic interfaces large; both digital and analog interfaces can be made much more compact and with greater processing power.
LONG TERM PROSPECTS:

- Inherently parallel, high throughput, high bandwidth, small processing structures for a wide variety of applications
  - hybrid bulk/ integrated optics structures for multidimensional processing capabilities
  - optoelectronic integrated circuits (OEIC) for wideband processing

- III-V optoelectronics for neural networks

- Complementary use of optical/digital technology in systems
Fuzing Technology

Dr. Z. G. Sztankay
Chief, Sensor Physics Branch
Target Sensors and
Signal Processing Laboratory
**TITLE:** FUZING TECHNOLOGY

**TECH BASE INVESTMENT STRATEGY AREA**

Emerging Technologies -- Protection/Lethality

Next Generation/Future Systems --
- Deep-Fire Smart Munition
- Median Surface-to-Air Missile
- The Army Counter-Air Weapon System
- Future Smart Munition
- Long-Range Artillery Missile
- Patriot 2000
- LOS-F-H Block II
- Multi-Mode Anti-Armor Weapon System

**DESCRIPTION**

This topic covers applied research and exploratory development on proximity fuze sensors for air defense and anti-armor applications. Because the bulk of the effort is focused on guidance-integrated fuzing, the terminal phase of missile guidance, including aim-point wander, is also a program focus. Technologies being investigated for air-target fuzing include rf, electro-optical, electrostatic, and millimeter wave guidance-integrated. The anti-armor program is focused on millimeter-wave guidance-integrated fuzing. Special problem areas are fuzing in a high clutter environment, countermeasures, and low-observable targets. Strong emphasis is placed on obtaining basic data on targets, clutter, and countermeasures, and on using the data to develop and validate computer models for encounter simulations used to develop and evaluate fuzing and terminal homing designs and algorithms.

**OBJECTIVE/APPROACH**

The objective is to meet new proximity fuzing requirements and reduce the cost of future proximity fuzes.

The approach and technology barriers are:

--- Clutter-Resistant Air-Target Fuzing: The current primary goal of this program is to provide proximity sensing against air targets near the tree line without prefunctioning on clutter. Measurements have been and are being made of foliage and target returns with rf, electro-optical, and electrostatic sensors, and fuzing concepts are being evolved and tested. The threat of countermeasures, such as chaff and ECM for rf sensors and smoke for electro-optical sensors, must continue to be overcome. Fuzing against low-observable targets will be a strong consideration in the future. Applications include FAADS-LOS-F-H, MSAM, TACAWS, Stinger Follow-On.
Guidance-Integrated Air-Target Fuzing: The goal of this program is to eliminate the need for a separate proximity fuze by obtaining the fuzing information from the guidance sensor. The current effort is concentrated on the 35-GHz active seeker program for Patriot. An instrumentation radar system is being developed for use in obtaining basic data during end-game encounter simulations against suitable targets. The data will yield target signatures and seeker aim points, and will be used to develop encounter models, which in turn will be used to conceive and evaluate seeker wave forms and algorithms that will yield minimum aim-point wander and optimum fuzing. ECM and chaff resistance and low-observable targets are also prime concerns. Future systems applications include MSAM.

Guidance-Integrated Anti-Armor Fuzing: This program is currently investigating the feasibility of using seeker information to provide standoff fuzing for advanced shaped-charge warheads on 95-GHz anti-armor smart weapons. Fully-polarimetric ISAR images and dual-plane monopulse seeker signals are being obtained and analyzed to predict and optimize seeker aim-points and to explore and develop fuzing concepts. Computer target models are being developed and will be used in end-game encounter simulations, and breadboard guidance-integrated standoff fuzing sensors will be developed and tested. Technology barriers include aim-point wander, different seeker and fuzing time constants, clutter, and countermeasures, especially target cross-section reduction. Potential applications are millimeter wave smart weapon seekers like MLRS-TGSM and APGM.

REMARKS

These programs are carried out in close cooperation with, and in some cases in direct support of, MICOM and ARDEC. Development and higher level funding originates with these and other non-LABCOM agencies.

Technical POCs:

-- Overall: Dr. Z. G. Sztankay Telephone 202-394-3130
  RF and Electrostatic Clutter-Resistant Air-Target Fuzing:
    Barry Stann Telephone 202-394-3140
  Guidance-Integrated Air-Target Fuzing:
    Dave Rodkey Telephone 202-394-2610
  Guidance-Integrated Anti-Armor Fuzing:
    Dr. Joseph Nemarich Telephone 202-394-3130
OUTLINE

- Clutter-Resistant Air-Target Fuzing
  
  RF
  
  Electro-Optical
  
  Electrostatic

- Guidance-Integrated Air-Target Fuzing

- Guidance-Integrated Anti-Armor Fuzing
Address enhanced requirements for and reduce the cost of electronic fuzing sensors for air and ground targets. Required performance improvements are:

- Optimize burst point control
- Increase resistance to countermeasures
- Detect targets in clutter
- Detect low observable targets
- Increase reliability
# Clutter-Resistant Air-Target Fuzing

**Technical**

- **Critical Technology:**
  - Target/Clutter Signatures
  - Signal Processing
  - Algorithms
  - Encounter Simulation
  - VHSIC/MIMIC

- **Risks/Problems:**
  - Low Observables (L.O.)
  - Prefire on Clutter
  - Burst Point Control
  - ECM
  - Chaff
  - Obscurants

- **Related Programs:**
  - FAADS-LOS-F-N, MSAM, Stinger Follow-On, TACAWS
  - TMAA, 30-MM Air-to-Air Cartridge

- **Performing Organizations:**

- **Contractor:**
  - In-House: HDL

### Program Milestone Schedule

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<tr>
<th>Milestones</th>
<th>FY89</th>
<th>FY90</th>
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Barriers:

- Targets in Clutter
- Countermeasures
  - Chaff, ECM, Smoke
- Low-Observable Targets

Approach:

- Various Sensor Technologies
- Obtain Basic Data
  - Clutter, Targets, Countermeasures
- Develop Computer Models for Encounter Analysis
- Conceive and Analyze Concepts
- Build and Test Breadboards
# Guidance-Integrated Air-Target Fuzing

**HIMADS**

**ATM**

*Improve lethality and reduce cost of air defense missiles*

## Program Milestone Schedule

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<th>Milestones</th>
<th>FY88</th>
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## Technical

**Critical Technology:**
- Seeker Sensors
- Signal Processing Algorithms
- Aimable Warheads
- VHSIC/MIMIC
- Low Observables

**Risks/Problems:**
- Sensor Selection
- Discriminate Target from Clutter
- ECM Resistance
- Organizational Separation

**Related Programs:**
- Patriot, Hawk/MSAM

**Performing Organizations:**
- Contractor: HAC, Raytheon
- In-House: HDL, MICOM

## Funding ($M)

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*LETAC008-1067*
GUIDANCE-INTEGRATED
ANTI-ARMOR FUZING

LETHALITY REQUIRES MAXIMIZING WARHEAD, REDUCING FUZE SPACE & WEIGHT ALLOCATIONS, OPTIMIZING AIMPOINT

PROGRAM MILESTONE SCHEDULE

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TECHNICAL

CRITICAL TECHNOLOGY:
- TARGET/CLUTTER SIGNATURES
- ENCOUNTER SIMULATION
- SIGNAL PROCESSING ALGORITHMS
- AIM POINT ALGORITHMS
- VHSC/MMIC

RISKS/PROBLEMS:
- SENSOR SELECTION
- DISCRIMINATE TARGET IN CLUTTER
- ECM RESISTANCE
- ORGANIZATIONAL SEPARATION

RELATED PROGRAMS:
- MLRS-TGW, NATO 155/COPPERHEAD III

PERFORMING ORGANIZATIONS:
CONTRACTOR: IN-HOUSE: HDL

FUNDING ($M)

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TITLE: RSTA Radar Technology

TECHBASE INVESTMENT STRATEGY AREA: Next Generation/Future Systems

DESCRIPTION:

Radar technology that:

a. improves all weather detection, location, classification and identification of targets employing camouflage, concealment and deception;

b. enhances platform survivability and reduces sensor susceptibility; and

c. reduces system cost, weight, prime power or enhances reliability and maintainability.

OBJECTIVE/APPROACH:

To provide radar technology that meets the requirements of Next Generation/Future Systems. A phased approach will be used where Phase I is primarily analysis leading to concept definition. Phase II involves implementation and evaluation of concept testbeds, and Phase III will transition the technology to Army Research Development and Engineering Centers.

TECHNICAL BARRIERS:

New concepts and components are required that provide a significant enhancement in radar technology to meet the requirements of the Next Generation/Future Systems.

TECHNICAL POCs: John David or Barry Schiener
Harry Diamond Laboratories
ATTN: SLCHD-ST-R
2800 Powder Mill Road
Adelphi, MD 20783-1197

Telephone: (301) 394-2530
HDL RSTA RADAR CHARTER.

- PURSUE RADAR TECHNOLOGY NEEDED FOR THE ARMY'S NEXT GENERATION/FUTURE SYSTEMS.

- TRANSITION THE TECHNOLOGY TO THE ARMY'S RD&ECs.
TECHNOLOGY GOALS.

- RADAR TECHNOLOGY THAT IMPROVES ALL WEATHER DETECTION, LOCATION, CLASSIFICATION, AND IDENTIFICATION OF TARGETS EMPLOYING CAMOUFLAGE, CONCEALMENT, AND DECEPTION.

- RADAR TECHNOLOGY THAT ENHANCES PLATFORM SURVIVABILITY AND REDUCES SENSOR SUSCEPTIBILITY.

- RADAR TECHNOLOGY THAT REDUCES SYSTEM COST, WEIGHT, AND PRIME POWER OR ENHANCES RELIABILITY AND MAINTAINABILITY.
CURRENT INTEREST:

- RSTA of personnel, ground vehicles and low and slow A/C.
- Enhanced platform survivability and reduced sensor susceptibility.
- Buried mine detection.
ACTIVE PROGRAMS:

- EVALUATION OF STATIONARY RADARS FOR SURVEILLANCE AND TARGET ACQUISITION OF MOVING PERSONNEL, GROUND VEHICLES, AND HELICOPTERS.

- EVALUATION OF MOVING RADARS FOR SURVEILLANCE AND TARGET ACQUISITION OF MOVING GROUND VEHICLES AND HELICOPTERS.

- DETECTION OF STATIONARY TARGETS CONCEALED IN FOLIAGE.

- EVALUATION OF SEVERAL MULTISTAGE PROCESSING AND CFAR CONCEPTS.

- ANALYSIS OF 3D SAR CONCEPT.

- ANALYSIS OF MULTISTATIC CONCEPTS.
APPRAOCH.

- COMPONENTS. PURCHASE ONE OR TWO FOR EVALUATION AS A MODULE OR AS PART OF A SYSTEM.

- CONCEPTS.
  - DETAIL REVIEW BY HDL
  - PHASED PROGRAM
    - PHASE I. COOPERATIVE PROGRAM WITH HDL WITH LIMITED FUNDING TO DEFINE CONCEPT.
    - PHASE II. IMPLEMENTATION AND EVALUATION OF CONCEPT TESTBEDS.
    - PHASE III. TRANSITION TO ARMY RD&ECS.
SELECTION CRITERIA.

- APPLICABILITY TO TECHNOLOGY GOALS.
- APPLICABILITY TO CURRENT INTEREST.
- PAYOFF.
- PROBABILITY OF SUCCESS.
**RADAR RSTA TECH BASE CONTRACT FUNDING**

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- FY90 AND 91 FUNDING OUTLOOK IS NOT GOOD.
- IT WILL CHANGE.
Session IV
Engineering and Technical Support

Session Chairman:
Ira R. Marcus
Director, Technical Support Laboratory
The HDL performs a variety of inhouse technical activities to support its ongoing technical projects. The activities are in the general area of mechanical parts and electronics fabrication, environmental testing, field testing, S&E computer automation, product assurance, integrated logistical support, configuration management and special programs including manufacturing studies. Most fabrication programs are for prototype quantities and facilities are therefore configured for quick response and for flexibility.

To operate these facilities efficiently and smoothly it is necessary for HDL to procure supplies, equipment and materials for daily operation and to keep them modern through the procurement of modern equipment and software.

Points of contact for each area are as follows:

- Mechanical Fabrication: Harry Hill 301-394-3124
- Electronic Fabrication: Albert Lee 301-394-2820
- Environmental Testing: Ami Frydman 301-394-2804
- Field Testing: Ed Carney 301-394-2434
- S&E Computer Automation: Robert Rosen 301-394-2917
- Product Assurance, ILS, Configuration Mgt: John Maristch 301-394-2230

Specific capabilities of each of these support areas are as follows:

**MECHANICAL FABRICATION**

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* Nine Numerical Control Machines (Three Mills, three Lathes, one EDM Machine, one Sheet Metal Punch and one Drill)
## ELECTRONIC FABRICATION

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<tr>
<td>Mask Fab</td>
<td>Drill/Profile</td>
<td>Parylene Coat</td>
<td>Inspection</td>
</tr>
<tr>
<td>Drill In</td>
<td>Multi-layer</td>
<td></td>
<td>Test</td>
</tr>
<tr>
<td>Drawings</td>
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<tr>
<td>Wire Wrap</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Tape Prep</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reports</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

## ENVIRONMENTAL TEST AND SIMULATION

### CLIMATIC TEST
- Temperature
- Humidity
- Altitude
- Salt Spray
- Waterproofness

### DYNAMIC TEST

#### LOW SHOCK
- Jolt
- Tumble
- Free Fall
- Complex Signal
- Shock Spectrum

#### HIGH SHOCK*
- Interior
- Angular
- Acceleration
- Balloting
- Transitional
- Muzzle Exit
- Exterior
- Spin
- Spin Decay
- Drag
- Terminal
- Approach
- Sensitivity
- Impact
- Delay after impact
- Graze impact

* High Shock environments are simulated using a unique set of air guns built into our building, one gun is 300 feet long and has an eight inch bore.

** The 3-D vibration facility is a recent innovation.
DEMONSTRATION AND FIELD TESTING

The HDL Demonstration Support and Field Testing branch works at Army Proving Grounds located in the continental United States, Alaska, Panama, and overseas locations. Local testing is at the HDL Blossom Point Test area in southern Maryland. The Branch has facilities to support the following activities:

- Fuze Explosive Loading and Downloading
- Explosive Storage
- Fuze Explosive Laboratory Testing
- Range Firing
- Range Support
- Special Range Testing
- Data Acquisition
  - Electronic-Fleet of Data Acquisition Trucks
  - Photographic-High Speed video and Movies
  - Data Reduction-Telemetry
- Helicopter Drop Tests

SCIENTIFIC AND ENGINEERING AUTOMATION SERVICES

The S & E Automation Services group provides technical computer services to all HDL scientists and engineers. This group maintains and operates a VAX 8800 computer which is available to the HDL staff via an in-house network. A current facilities project of this group is the design and procurement of an HDL-wide Local Area Network. Their most recent accomplishment has been the successful procurement of the LABCOM IBM mainframe. The primary mission of the this group is special computer programming assistance to S & E's. Equipment capability is focused on interactive computer graphics.

PRODUCT ASSURANCE, INTEGRATED LOGISTIC SUPPORT, AND CONFIGURATION MANAGEMENT

This office provides Product Assurance, ILS, and CM services to HDL development and production programs. Recent facilities improvements have been the acquisition of QA instrumentation to support the office. The primary facilities of this office is the data repository which house HDL's Technical Data Packages. Complete storage and reproduction equipment complements the management of the TDP's. Current activities are to transfer our 150,000 drawings to the Army's new DESREDS optical storage system.
<table>
<thead>
<tr>
<th>COMPUTER AIDED DESIGN</th>
<th>PRINTED CIRCUIT FABRICATION</th>
<th>HYBRID-THICK FILM</th>
<th>ASSEMBLY</th>
</tr>
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<tbody>
<tr>
<td>P.C. DESIGN</td>
<td>PHOTOGRAPIHC REDUCTION STEP AND REPEAT</td>
<td>DESIGN</td>
<td>CUSTOM FABRICATION</td>
</tr>
<tr>
<td>MANUAL LAYOUT</td>
<td>WET CHEMISTRY – ETCHING – PLATING</td>
<td>FABRICATION</td>
<td>WIRE WRAPPING</td>
</tr>
<tr>
<td>AUTOMATIC LAYOUT</td>
<td>BOARD DRILLING &amp; PROFILING</td>
<td>PACKAGING</td>
<td>ENCAPSULATION</td>
</tr>
<tr>
<td>MASK GENERATION</td>
<td>MULTILAYER BOARDS</td>
<td>PARYLENE COATING</td>
<td>PARTS HI-G QUAL.</td>
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<tr>
<td>DRILL TAPE PREPARATION</td>
<td></td>
<td></td>
<td>INCOMING INSPECTION</td>
</tr>
<tr>
<td>DRAWINGS</td>
<td></td>
<td></td>
<td>BOARD TESTING</td>
</tr>
<tr>
<td>WIRE WRAP</td>
<td></td>
<td></td>
<td>WAVE SOLDERING</td>
</tr>
<tr>
<td>CONTROL TAPE PREPARATION</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>REPORTS</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ENVIROMENTAL TEST AND SIMULATION TECHNOLOGY BRANCH

AMI FRYDMAN, CHIEF

CLIMATIC
TEMPERATURE
HUMIDITY
ALTITUDE
SALT SPRAY
WATERPROOFNESS
CAN ARRANGE FOR
DESERT (DUST)
FUNGUS
VACUUM-STEAM PRESSURE

DYNAMIC
LOW SHOCK
JOLT
TUMBLE
FREE FALL
COMPLEX SIGNAL
SHOCK SPECTRUM

VIBRATION
FLIGHT (RANDOM)
TRANSPORTATION/VIBRATION
SINE, RANDOM
3-D VIBRATION
CENTRIFUGAL
PUSH/PULL/BOUNCE
MATERIALS

HIGH SHOCK
INTERIOR
ANGULAR
ACCELERATION
BALLOTING
TRANSITIONAL
MUZZLE EXIT
EXTERIOR
SPIN
SPIN DECAY
DRAG
TERMINAL
APPROACH SENSITIVITY
MEASUREMENTS
IMPACT
DELAY AFTER IMPACT
GRAZING IMPACT
Data Acquisition

Electronic - Fleet of Trucks
Photographic - High Speed Video and Movies

Data Reduction
Range Firing - Blossom Point
Special Setups - Blossom Point
Explosive Loading and Downloading
Explosive Storage
Explosive Testing
Helicopter Tests
VAX 8800 Computer Services for S&E's

Special Programming Assistance

HDL Local Area Network - Procurement
PRODUCIBILITY TECHNOLOGY BRANCH

GEORGE LUCEY, CHIEF

MAJOR PROGRAMS

TRAFFIC JAM

MMT - Soldering

Support to DCS for Production, AMC
Automated Assembly of Electronics Circuits

George K. Lucey

Chief, Systems Engineering Branch

Technical Support Laboratory
TITLE: AUTOMATED ASSEMBLY OF ELECTRONIC CIRCUITS

TECHBASE INVESTMENT STRATEGY AREA

The Harry Diamond Laboratories is the LABCOM activity responsible for the U.S. Army Manufacturing Methods and Technology (MMT) Soldering Technology Program. MMT supports the LABCOM Producibility Mission, but is separate and distinct from the Tech Base. One HDL intent is to integrate areas of common interest, such as:

Systemic Issues: Manufacturing Science (I005)
Supporting Capabilities: Special Purpose Equipment (S005)
Modeling and Simulation (S002)
Test and Evaluation (S004)
Emerging Technologies: Robotics (E002)
Artificial Intelligence (E001)
Advanced Materials (E005)
Advanced Signal Processing (E006)
Next Generation Systems: All electronics manufactured to soldering standards; e.g.
PATRIOT (N057)
SADARM (N053)

DESCRIPTION

The DoD ManTech Program provides a means for the Tri-Services and the Defense Logistics Agency to invest in new manufacturing technologies which are essential to the affordability and quality of DoD products. These investments are made to agencies within both government and industry, but they focus on items of unacceptable risk to private investors. The Army program strategy (entitled Year-2010) is to establish Thrust Areas that emphasize issues identified in the DoD Critical Technologies Plan. Soldering Technology occupies the foreground in the electronics discipline within this plan, and the Harry Diamond Laboratories is the responsible agency within the U.S. Army Laboratory Command.

OBJECTIVE/APPROACH

The objective of the Soldering Technology Program is to improve the affordability and quality (producibility) of electronic systems on a national rather than a program basis. The approach is to establish a Joint Service center of excellence at the U.S. Navy NAVSEA Naval Weapons Support Center, Crane, Indiana, as a high-tech focal point of Tech Base scientists nationwide to interact with the production, quality, development, and standardization communities and thereby more effectively: 1) Introduce producibility considerations into next generation weapons systems; and 2) Resolve gaps in manufacturing science
which are currently inhibiting producibility of electronic systems. Examples of science issues relevant to the manufacturing cost of electronic systems are as follows: 1) Component solderability is presently gauged by dipping sample leads into solder and performing subjective visual inspection for anomalies. X-Ray spectroscopy could automate the process and remove subjectivity by measuring inhibiting intermetallics such as Cu$_3$Sn; 2) Wetting after soldering is presently gauged by visual inspection of the angle of solder contact. An automated and quantitative approach may be to use X-Ray for detecting the presence of intermetallics that signify chemical bonding, such as Cu$_6$Sn$_5$; 3) The significance of manufacturing anomalies that occur in the assembly of electronic components is presently gauged by subjective visual inspection for defects perceived as risks to reliability. An automated approach may be to use 3-D Laser Imaging to detect the occurrence of anomalies and then automatically generate 3-D Finite Element computer models that calculate significance relative to field loading.

Roughly two million dollars will be invested yearly in MMT activities that require a complete understanding of X-Ray theory, lasers, electronic controllers, computers, robotics, etc. Contracting for scientific studies and one-of-a-kind machines will emphasize the Small Business 8A Set-Aside Program, Value Engineering Program, Army Research Office Scientific Services Program, and Engineering Services clauses of existing contracts. Cooperative exchanges which do not involve funding will utilize the Technology Transfer Program.

REMARKS

Soldering Technology currently does not have a strong scientific foundation. A zero-defect philosophy based upon perceptions of risk to field reliability has instead been imposed upon the electronics manufacturing industry. The national cost is billions of dollars yearly, and changes in these business practices will not be resolved by MMT funding. Contractors with common interests are encouraged to participate as consortium, avoid duplication of effort, and share resources, planning, facilities, etc.

Technical POC: Mr. George Lucey
Telephone: (202) 394-2680
OVERVIEW

- ARMY MANTECH PROGRAM
- HDL ROLE
- INDUSTRY OPPORTUNITIES
MANTECH

permits the tri-services to invest in manufacturing technologies that are critical to DOD production but are of unacceptable risk to industry investment.
ARMY MANTECH PROGRAM

- WEAPONS COSTS ARE GROWING
- NEW BUSINESS PRACTICES NEEDED
- AMC HAS A MANTECH INITIATIVE
  - FOCUS ON CRITICAL TECHNOLOGIES
  - REMOVE MANAGEMENT LAYERS
HDL ROLE

US ARMY MMT THRUST AREA

FOR

SOLDERING TECHNOLOGY
FOCUS

NATIONALLY PERVERSIVE

ELECTRONICS MANUFACTURING PROBLEMS

REQUIRING WORLD CLASS SCIENTISTS

USING HIGH-TECH FACILITIES
INVESTMENT PLANS

$ 2 MILLION YEARLY
BUSINESS OPPORTUNITIES

INTRODUCE TO ARMY PRODUCTION LINES
NEW AUTOMATION TECHNOLOGIES NOT NOW INCLUDED IN SOLDERING STANDARDS
GUIDELINES

DE-EMPHASIZE VISUAL INSPECTION
FOCUS ON PROCESS CONTROLS
CRITICAL TO FIELD RELIABILITY
CONCLUSION

MANUFACTURING SCIENCES MUST BE IMPROVED TO REDUCE COST OF ELECTRONIC ASSEMBLIES
SMALL BUSINESS ACT - 1953
- Started program - "Fair Share"
- Created Small Business Administration
- 1958 Amendment - 8(a) Minority Business Assistance

P L 95-507 - Major Revision
- Required Subcontract Goals
- Explanation to congress on goal achievement
- Small purchase set aside

P L 99-661 - Defense Authorization Act Section 1207
- 5% Goal - Disadvantaged Business
- 5% Objective - HBC/MI
- Pay 10% above Fair Market price
<table>
<thead>
<tr>
<th>Type of Business</th>
<th>Not to Exceed</th>
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</thead>
<tbody>
<tr>
<td>Construction</td>
<td>$17 million/yr.</td>
</tr>
<tr>
<td>SIC 1521</td>
<td></td>
</tr>
<tr>
<td>R&amp;D</td>
<td>500 employees</td>
</tr>
<tr>
<td>SIC 8731</td>
<td>$13.5 million/yr.</td>
</tr>
<tr>
<td>Engineering Services</td>
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<tr>
<td>SIC 8711</td>
<td>$7.0 million/yr.</td>
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<tr>
<td>Computer Programming</td>
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<tr>
<td>SIC 7371</td>
<td>$3.5 million/yr.</td>
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<tr>
<td>Service – N.E.C.</td>
<td></td>
</tr>
<tr>
<td>Manufacturing Industries – N.E.C.</td>
<td>500 employees</td>
</tr>
</tbody>
</table>
P L 100–180 – Section 806 – Defense Authority Act

- Small Disadvantaged Business Set Asides
- Maintain 8(a) Level/SDB – 50% cost
- Additional SADBUs duty – HBCU/MI


- Major change – Micro management
- 5% goal applicable Government-wide
- Liquidated damages – Subtract plan
- SBA Right of Appeal on 8(a) contracting
- 9 year 8(a) term
CATEGORIES

TOTAL SMALL BUSINESS
SMALL BUSINESS SET-ASIDES
DISADVANTAGED BUSINESS
SMALL BUSINESS RESEARCH AND DEVELOPMENT
WOMAN OWNED BUSINESS
SMALL BUSINESS SUB-CONTRACTING
DISADVANTAGED BUSINESS SUB-CONTRACTING
HISTORIC BLACK COLLEGES UNIVERSITIES/MINORITY INSTITUTIONS
<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>TOTAL DOLLARS</td>
<td>$296M</td>
</tr>
<tr>
<td>TOTAL SMALL BUSINESS (%)</td>
<td>24.6%</td>
</tr>
<tr>
<td>SMALL BUSINESS SET-ASIDE (%)</td>
<td>10.3%</td>
</tr>
<tr>
<td>DISADVANTAGED BUSINESS (%)</td>
<td>4.5%</td>
</tr>
<tr>
<td>SMALL BUSINESS RESEARCH &amp; DEVELOPMENT (%)</td>
<td>16.7%</td>
</tr>
<tr>
<td>WOMAN OWNED BUSINESS (MILLIONS)</td>
<td>$1.1M</td>
</tr>
<tr>
<td>HISTORIC BLACK COLLEGES &amp; UNIVERSITIES /MINORITY INSTITUTIONS</td>
<td>1.4%</td>
</tr>
</tbody>
</table>
Industrial Liaison Programs

Melvyn J. Shichtman
Technical and Industrial Liaison Officer
U.S. Army Laboratory Command
AMSLC-CM
(202) 394-3880
IF YOU FIRST FIND OUT ABOUT IT
IN THE COMMERCE BUSINESS DAILY

IT'S TOO LATE
WHAT'S IN IT FOR INDUSTRY?

- FEWER BLIND ALLEYS
- MORE EFFICIENT MARKETING
- VECTORED IR&D
- MORE UNSOLICITED PROPOSAL WINNERS
- SUPPORT FOR STRATEGIC PLANNING
"T I L O" = ONE-STOP SHOPPING

- ADVANCE PLANNING INFORMATION
- DESCRIPTIVE INFORMATION
- MATCH-MAKING
- UNSOLICITED-PROPOSAL GUIDANCE
- POTENTIAL CONTRACTOR PROGRAM
- R&D UNFUNDED STUDIES
- BROAD AGENCY ANNOUNCEMENTS
- SMALL BUSINESS INNOVATION RESEARCH
- HAND-OUTS
TOPICS COVERED—

- Technical & Industrial Liaison Offices
- Army Potential Contractor Program
- R&D Unfunded Studies
- Unsolicited Proposals
- Broad Agency Announcements
- Small Business Innovation Research
- Advance Planning Briefings for Industry
- Technology Symposia
- Industry Days
- Technical Objective Documents
- Competition Advocates
- Small & Disadvantaged Business Utilization
- Challenge to Industry
POTENTIAL CONTRACTOR PROGRAM

BENEFITS

- CERTIFICATION OF NEED-TO-KNOW
- SPONSORSHIP WITH DTIC
- LISTING IN DLA'S DISSEMINATION AUTHORITY LIST
- ACTS IN LIEU OF AN ACTIVE DOD CONTRACT
  - Registrants may receive information
  - Basis for obtaining clearance
  - Maintain classified library between contracts
ESSENTIALLY A NO-COST CONTRACT

PROVIDES GREATER ACCESS TO ARMY INFORMATION

STUDY HAS GREATEST MUTUAL BENEFIT

BASIS FOR EXPANDED NEED-TO-KNOW
UNSOLICITED PROPOSALS

TALK TO ARMY SCIENTIST OR ENGINEER
IDENTIFY ARMY PROBLEMS
IDENTIFY ADDITIONAL SOURCES OF INFORMATION

OBTAIN INSTRUCTIONS ON SUBMISSION
TILO
UNSOLICITED PROPOSAL PAMPHLET

ASK:
"WHO IS YOUR UNSOLICITED PROPOSAL COORDINATOR?"
"DO YOU HAVE AN ACTIVE BROAD AGENCY ANNOUNCEMENT?"
• DESCRIBES RESEARCH INTERESTS
• INCLUDES SELECTION CRITERIA
• EXPLAINS HOW TO PREPARE PROPOSALS
• SAYS WHEN PROPOSALS MAY BE SUBMITTED
• BAAs ANNOUNCED IN CBD

PROPOSALS ARE COMPETITIVE!
ISSUE SOLICITATION ................ OCTOBER
(ANNOUNCED IN COMMERCE BUSINESS DAILY)

PROPOSALS DUE ......................... JANUARY

PHASE I WINNERS SELECTED ......... MAY
(SIX-MONTH, ONE-MANYEAR EFFORT)

PHASE II WINNERS SELECTED ......... 9 MONTHS AFTER
(24-MONTH, FIVE-MANYEAR EFFORT)  PHASE II AWARD
HOW TO RESPOND:

1. READ COMMERCE BUSINESS DAILY
2. ORDER SOLICITATION
3. READ CAREFULLY
4. SELECT TOPICS IN YOUR AREA OF EXPERTISE ONLY
5. ORDER BACK-UP INFO FROM DTIC
6. PREPARE PROPOSAL (WATCH PAGE NUMBERS, ETC)
7. SUBMIT ON TIME TO CORRECT ACTIVITY
ADVANCE PLANNING BRIEFINGS FOR INDUSTRY

TECHNOLOGY SYMPOSIA

INDUSTRY DAYS

CAN MIX & MATCH CHARACTERISTICS
to satisfy goals
ADVANCE PLANNING BRIEFINGS FOR INDUSTRY

- MID- & LONG-RANGE PLANNING
- THREAT & DOCTRINE DESCRIPTIONS
- EACH RDTE PROGRAM COVERED ONCE IN THREE YEARS
- PROVIDE FOR INDUSTRY FEED-BACK
- ANNOUNCED IN COMMERCE BUSINESS DAILY
TECHNOLOGY SYMPOSIA

APPROACH

- ARMY BRIEFS THREAT, DOCTRINE, & TECH PROGRAM
  - CURRENT PROBLEMS / CRITICAL TECHNOLOGIES
- INDUSTRY BRIEFS GOVERNMENT-ONLY AUDIENCE
- DOCUMENT PROCEEDINGS & FOLLOW UP
- COMBINE WITH BROAD AGENCY ANNOUNCEMENT

RESULTS

- IDENTIFY TECHNOLOGY FOR EARLY DEMONSTRATION
- IMPROVE TECH-BASE PRIORITIZATION
- IMPROVED GOVERNMENT & INDUSTRY PROGRAMS
TELL INDUSTRY WHAT THE LAB / CENTER DOES

• MISSION

• POCs

• FACILITIES

“REVERSE IR&D ON-SITE REVIEW”
Contents

- Mission
- Investment Strategy
- Research Programs
- Technology Programs

Purpose

- Stimulate Discussions
- Encourage Participation in Army R&D
- Focus Unsolicited Proposals and IR&D
COMPETITION ADVOCATE

PROMOTE FULL AND OPEN COMPETITION

CHALLENGE BARRIERS TO COMPETITION

FORCE EARLY PLANNING FOR COMPETITION

CHALLENGE RESTRICTIVE SPECIFICATIONS

PROMOTE / ENSURE MARKET RESEARCH
PROVIDE SMALL BUSINESSES EQUITABLE OPPORTUNITY TO COMPETE

ENSURE FAIR PROPORTION OF AWARDS TO SMALL BUSINESSES

WHY?
INCREASE COMPETITION
REDUCE PRICE
EXPAND MOBILIZATION BASE
CHALLENGE TO INDUSTRY

US ARMY
LABORATORY COMMAND

• MAINTAIN AWARENESS OF ARMY TECHNOLOGY NEEDS
  REQUIREMENTS & PLANNING DOCUMENTS
  INTERACTIONS WITH LABS & CENTERS

• FOCUS IR&D ON ARMY NEEDS / OPPORTUNITIES
  RESPOND TO TECHNICAL EVALUATIONS & ON-SITE REVIEWS

• INFORM ARMY OF ACCOMPLISHMENTS
  BRIEF LABS & CENTERS
  DEMONSTRATE NEW TECHNOLOGIES