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AD-A266 094

NTATION PAGE

Form Approved
OPM No. 0704-0188

1. AGENCY USE ONLY *(Leave Blank)*	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	28 January 1993	Final, 28 January 1993

4. TITLE AND SUBTITLE
The Army Research Laboratory presents proceedings of the Advance Planning Briefing for Industry "Providing Technology to the Soldier"

5. FUNDING NUMBERS

6. AUTHOR(S)
Editor - Mr. Melvyn J. Shichtman

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
U.S. Army Research Laboratory
ATTN: AMSRL-CP
2800 Powder Mill Road
Adelphi, Maryland 20783-1145

8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

11. SUPPLEMENTARY NOTES
Proceedings APBI held at the Naval Surface Warfare Center, White Oak, Maryland on 27 - 28 January 1993

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for Public Release;
Distribution is unlimited

93-13681

13. ABSTRACT *(Maximum 200 words)* The theme of the Advance Planning Briefing for Industry is "The Army Research Laboratory - Providing Technology for the Soldier." The objectives of the Advance Planning Briefing for Industry are to: a. Introduce the U.S. Army Research Laboratory (ARL); b. Present technologies in which ARL has an interest and is planning to pursue for the mid-and long term; c. Show planning budgets for these new technologies; e. Give the private sector and the academic community a preview in order to make sure that industrial and academic research and development investments coincide with the needs of the U.S. Army; f. Give the private sector and the academic community an opportunity to meet with the directorate executives, engineers and scientists who are responsible for the ARL business areas and are working on the new technologies.
This briefing was designated for industry executives and academic research manager involved in advance planning along with scientific and engineering management responsible for cooperative and independent R&D efforts.

14. SUBJECT TERMS
AMC: Battle Labs; Weapons Technology; Sensors, Signatures and information processing (S3I), Materials, Propulsion; Battlefield Environment; Electronics and Power Sources-Human Research

15. NUMBER OF PAGES
224

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT
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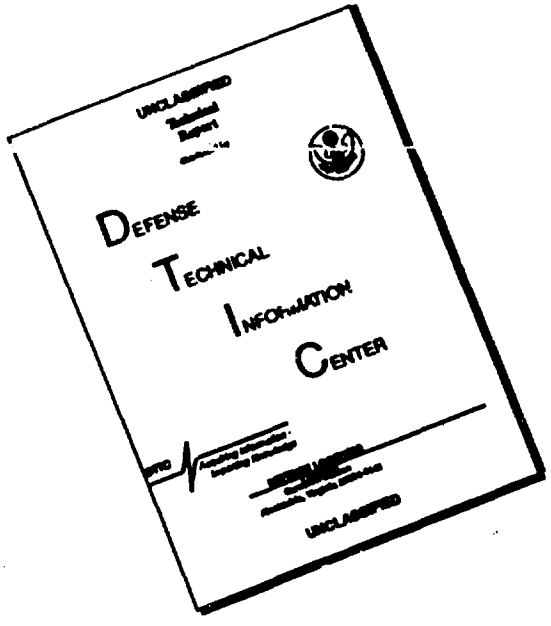

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G	- Grant	**TA**	- Task
PE	- Program Element	**WU**	- Work Unit Accession No.

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Hosted By
The Advanced
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Plans Directorate

The
Army Research Laboratory
presents

Proceedings of the
Advance Planning Briefing
for Industry

Providing Technology to the Soldier

at the
US Naval Surface
Warfare Center
White Oak, Md
27–28 January 1993

U.S. ARMY RESEARCH LABORATORY (ARL)
ADVANCE PLANING BRIEFING FOR INDUSTRY (APBI)
27-28 JANUARY 1993
NAVAL SURFACE WARFARE CENTER AUDITORIUM
WHITE OAK, MARYLAND

27 JANUARY 1993

4:00-6:00	Early Registration Maryland Inn-Laurel Laurel, Maryland	
6:00-8:00	Reception Maryland Inn-Laurel	

28 JANUARY 1993

7:00-9:00	Registration Naval Surface Warfare Center, White Oak, Maryland	
7:50	Administrative Remarks	**Mr. Melvyn J. Shichtman,** Technical and Industrial Liaison Officer
8:00-8:05	Welcome	**COL William J. Miller,** Deputy Director, U.S. Army Research Laboratory
8:05-8:25	Keynote, Reshaping Our Business	**LTG Leo J.Pigaty,** Deputy Commander, U.S. Army Materiel Command
8:25-8:45	Battle Labs - The User's Perspective on Technology	**COL William D. Hubbard** Director, Battle Lab Integration and Technology Directorate, U.S. Army Training and Doctrine Command
8:45-9:15	ARL Overview	**Mr. Bruce M. Fonoroff** Directorate Executive, Advanced Concepts and Plans (ACAP)
9:15-9:45	Interfacing with ARL	**Dr. Alan J. Goldman,** Chief, Technology Transfer Division, Advanced Concepts and Plans Directorate
9:45-10:00	Break	
10:00-10:30	Weapons Technology	**Dr. John Frasier,** Directorate Executive, Weapons Technology

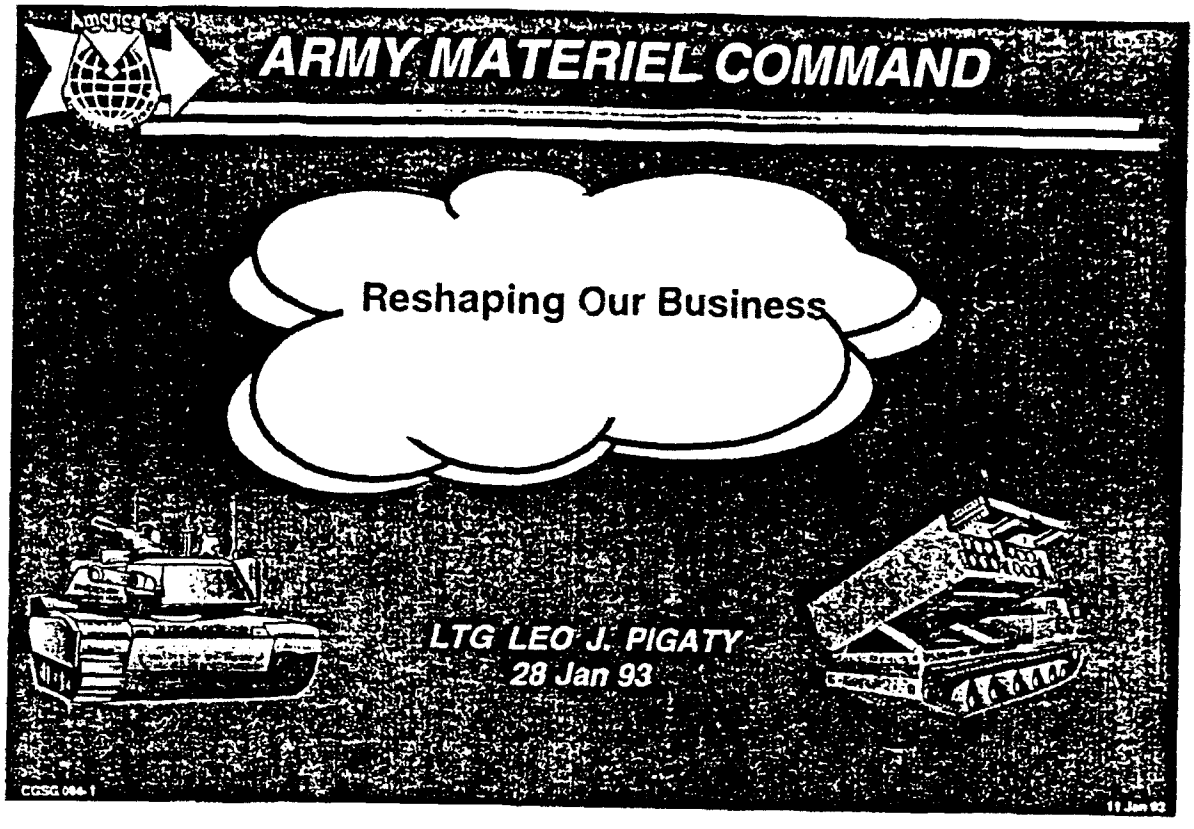
10:30-11:10	Sensors, Signatures, Signal and Information Processing and Battlefield Combat Identification	**Mr. Richard D. Slife** Assistant Director for Programs, Sensors, Signatures, Signal and Information Processing
11:10-11:40	Materials	**Mr. Lawrence D. Johnson** Directorate Executive, Materials
11:40-12:10	Vehicle Propulsion	**Mr. George A. Bobula,** Directorate Executive (acting), Vehicle Propulsion
12:10-12:40	Battlefield Environment	**COL Ronald Evans,** Directorate Executive, Battlefield Environment
12:40-1:45	Lunch	
1:45-2:15	Electronics and Power Sources	**Dr. Clare Thornton,** Directorate Executive, Electronics and Power Sources
2:15-2:45	Human Research and Engineering	**Dr. Robin L. Keesee,** Directorate Executive, Human Research and Engineering
2:45-3:15	Vehicle Structures	**Dr. Wolf Elber,** Directorate Executive, Vehicle Structures
3:15-3:30	Break	
3:30-4:00	Advanced Computational and Informational Science	**Dr. Andrew Mark** Chief (acting), Simulation Technology Division, Advanced Computational and Informational Science Directorate
4:00-4:30	Survivability/Lethality Analysis	**Dr. Jack Wade,** Directorate Executive (acting), Survivability/ Lethality Analysis
4:30-4:45	Wrap up	**COL Miller**

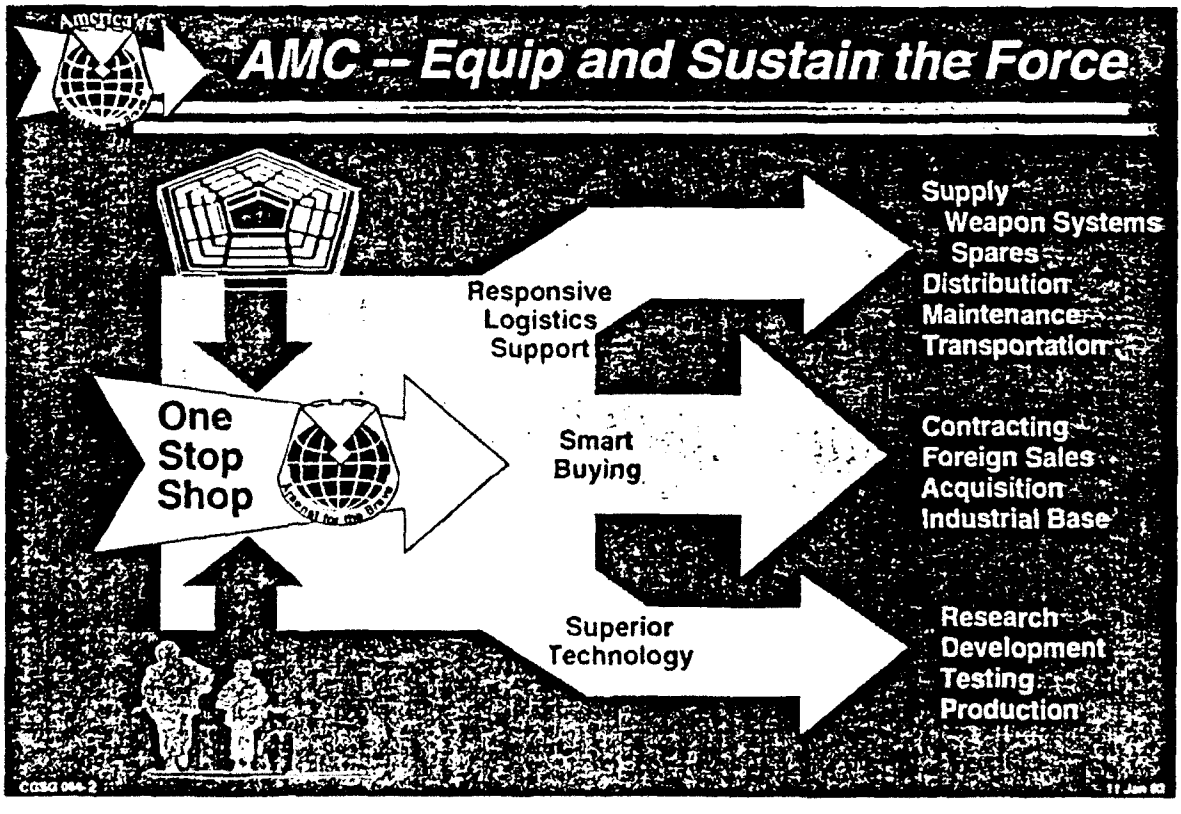
ARMY MATERIEL COMMAND

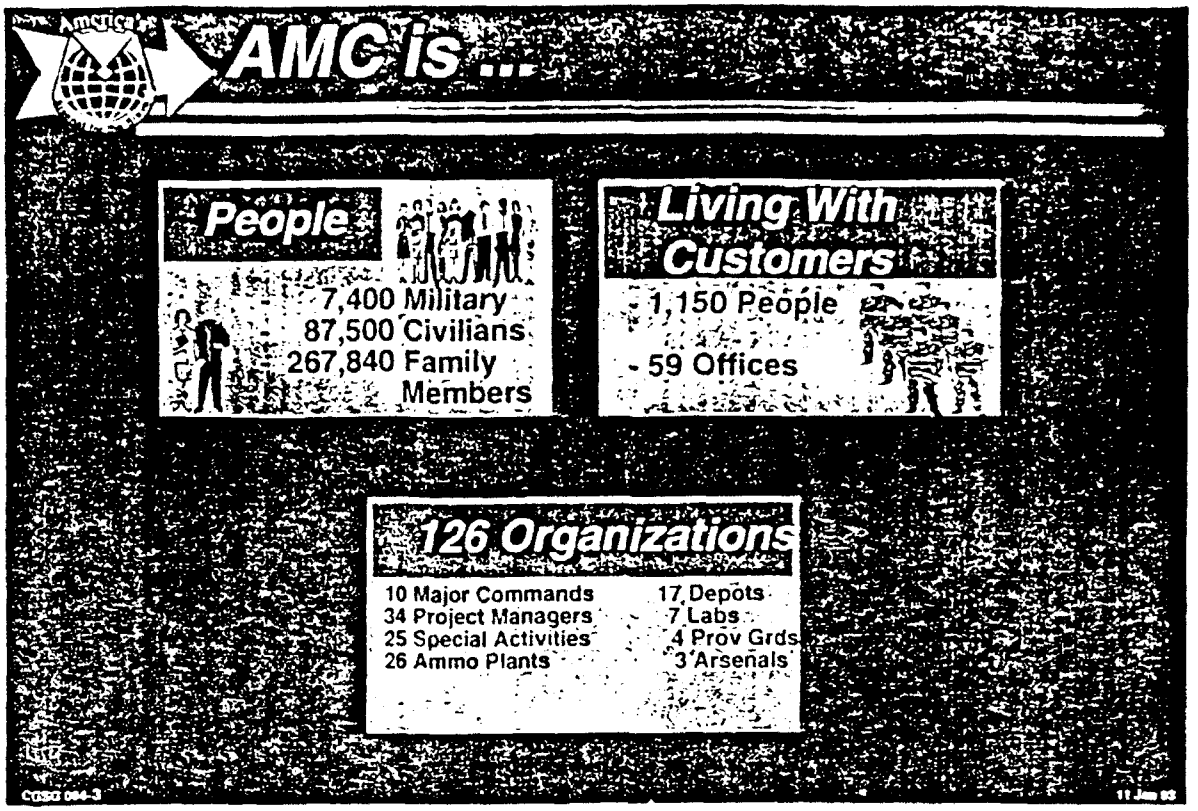
KEYNOTE ADDRESS

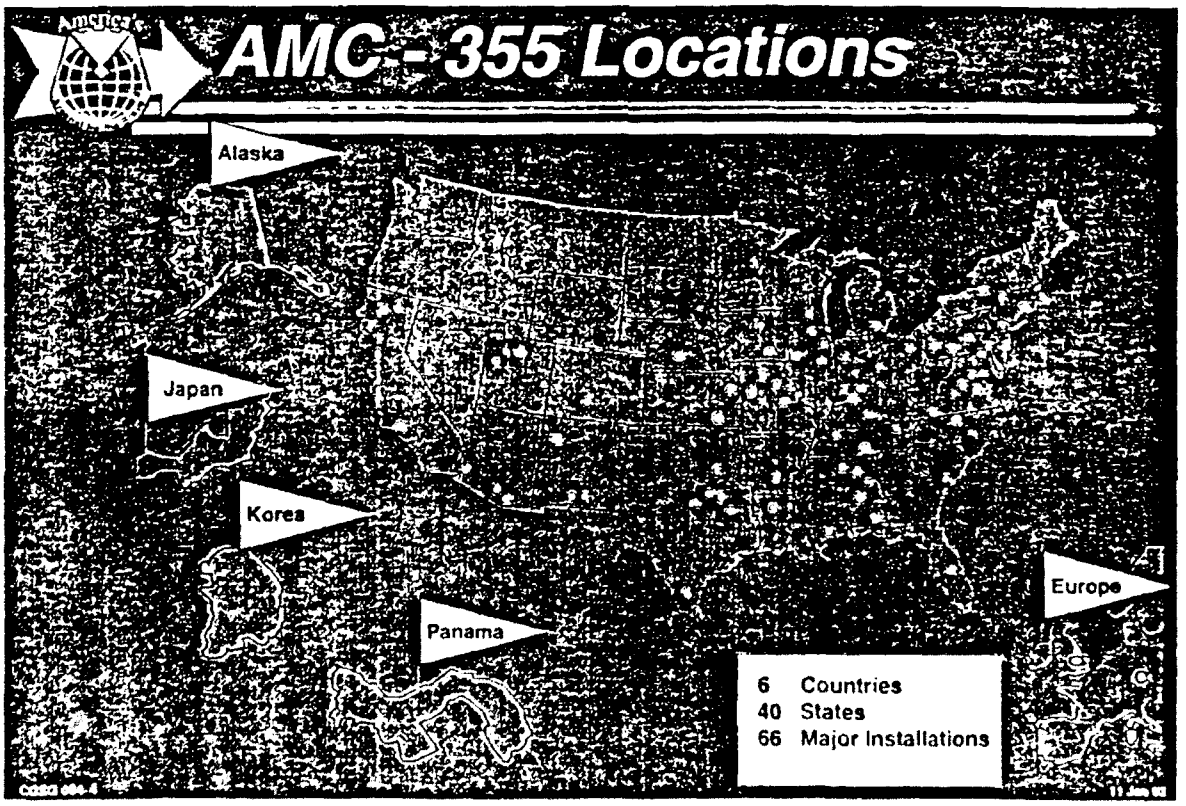
Reshaping Our Business

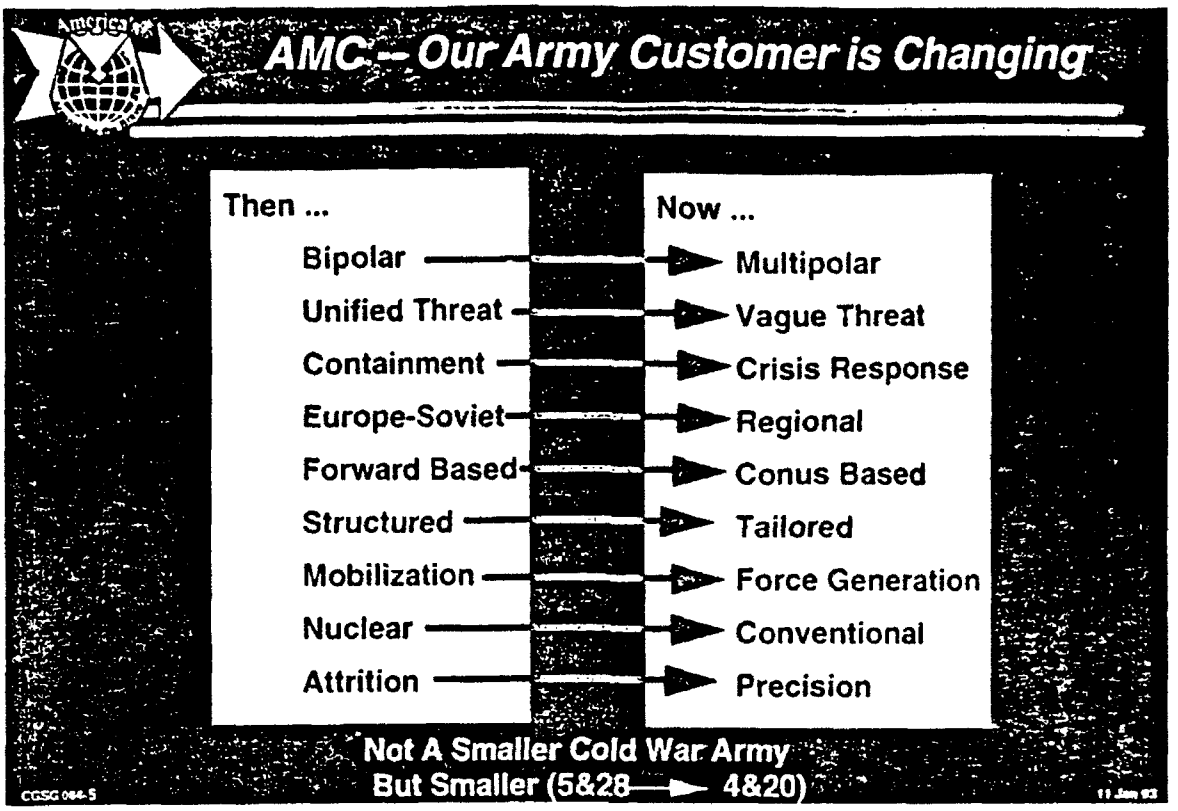
LTG Leo J. Pigaty
Deputy Commander
U.S. Army Materiel Command

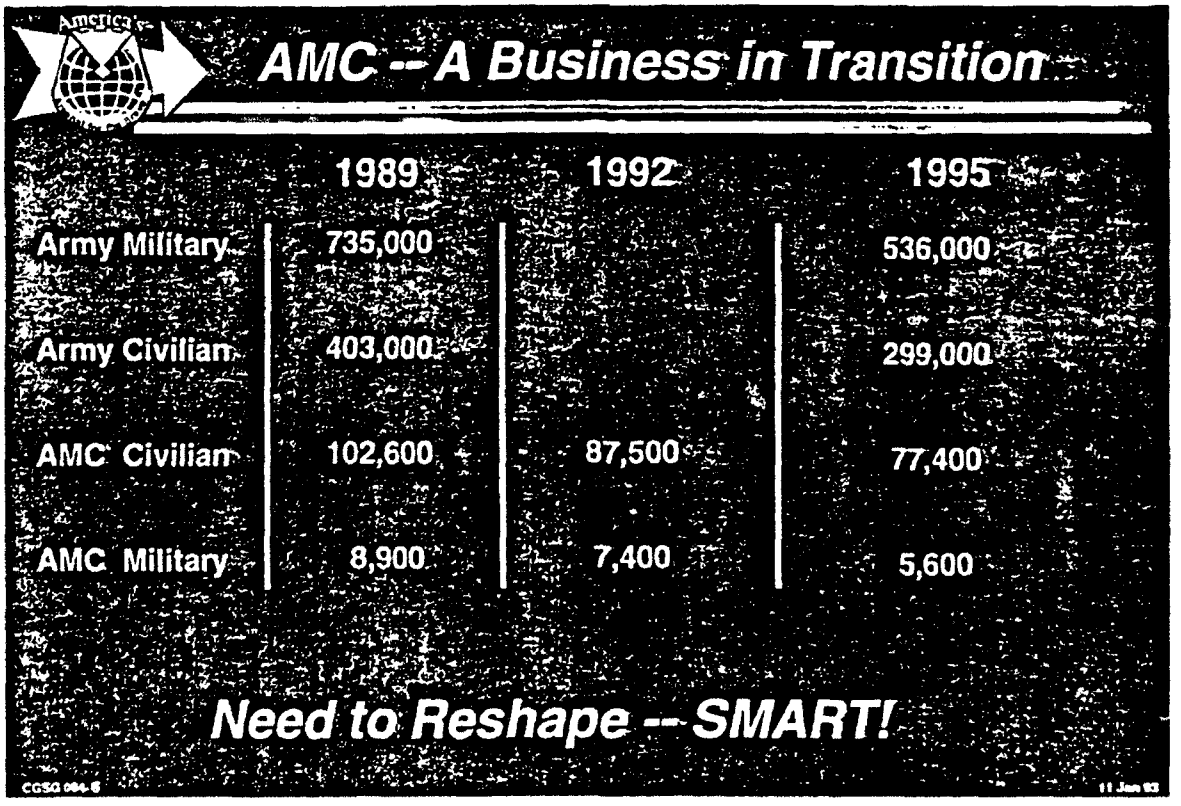

America's Army
ARMY MATERIEL COMMAND
Reshaping Our Business
LTG LEO J. PIGATY
28 Jan 93
CGSC 094-1
11 Jan 93


America's Army
AMC -- Equip and Sustain the Force
Supply
Weapon Systems
Spares
Distribution
Maintenance
Transportation
Responsive
Logistics
Support
One
Stop
Shop
Smart
Buying
Contracting
Foreign Sales
Acquisition
Industrial Base
Superior
Technology
Research
Development
Testing
Production
CGSC 094-2


AMC is ...
People
7,400 Military
87,500 Civilians
267,840 Family Members
Living With Customers
1,150 People
59 Offices
126 Organizations
10 Major Commands
34 Project Managers
25 Special Activities
26 Ammo Plants
17 Depots
7 Labs
4 Prov Grds
3 Arsenals


AMC - 355 Locations
Alaska
Japan
Korea
Panama
Europe
6 Countries
40 States
66 Major Installations


America's
AMC -- Our Army Customer is Changing
Then ...
Bipolar
Unified Threat
Containment
Europe-Soviet
Forward Based
Structured
Mobilization
Nuclear
Attrition
Now ...
Multipolar
Vague Threat
Crisis Response
Regional
Conus Based
Tailored
Force Generation
Conventional
Precision
Not A Smaller Cold War Army
But Smaller (5&28 → 4&20)
CGSC 094-5

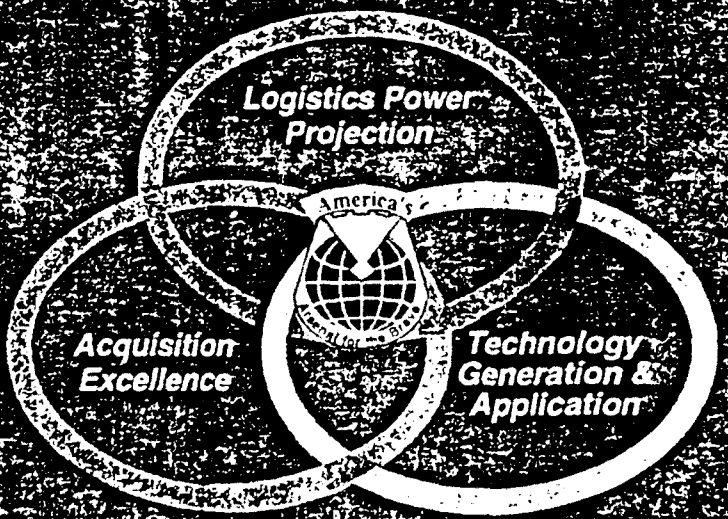

America's
AMC -- A Business in Transition
1989
1992
1995
Army Military
735,000
536,000
Army Civilian
403,000
299,000
AMC Civilian
102,600
87,500
77,400
AMC Military
8,900
7,400
5,600
Need to Reshape -- SMART!

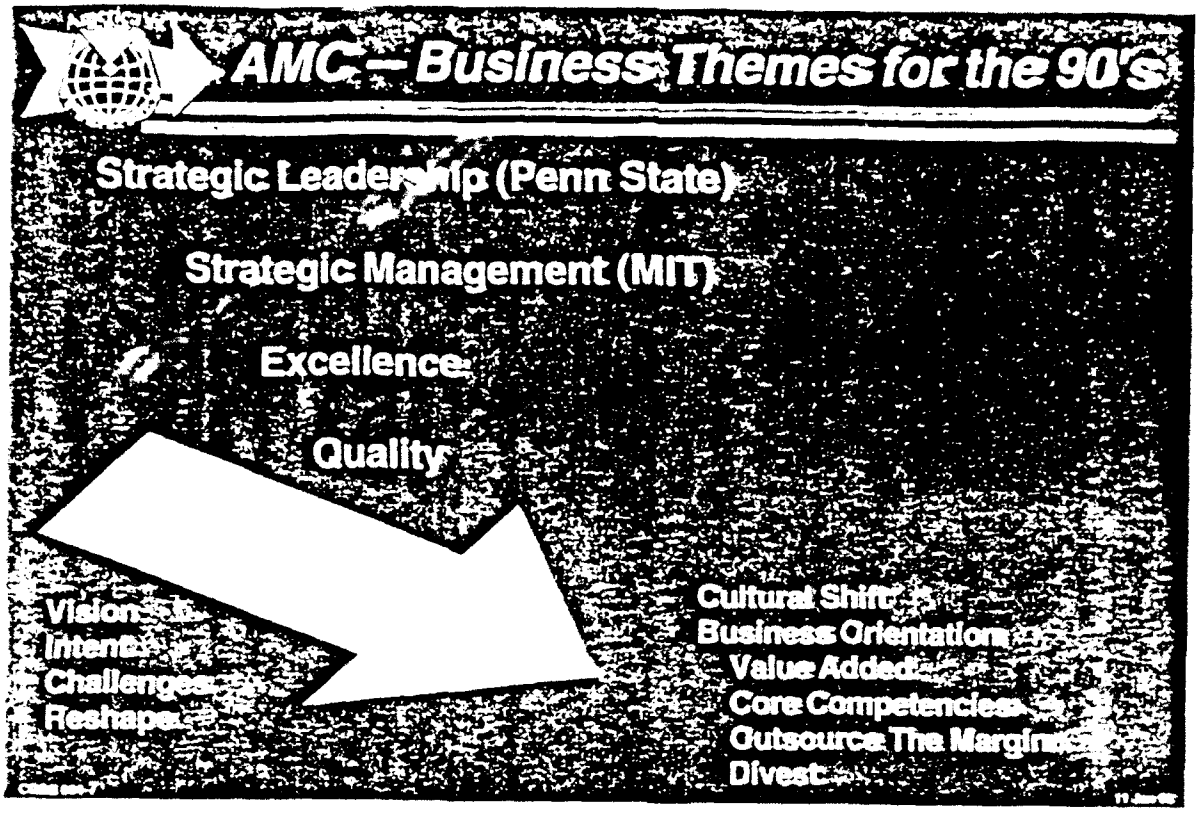
Core Competencies

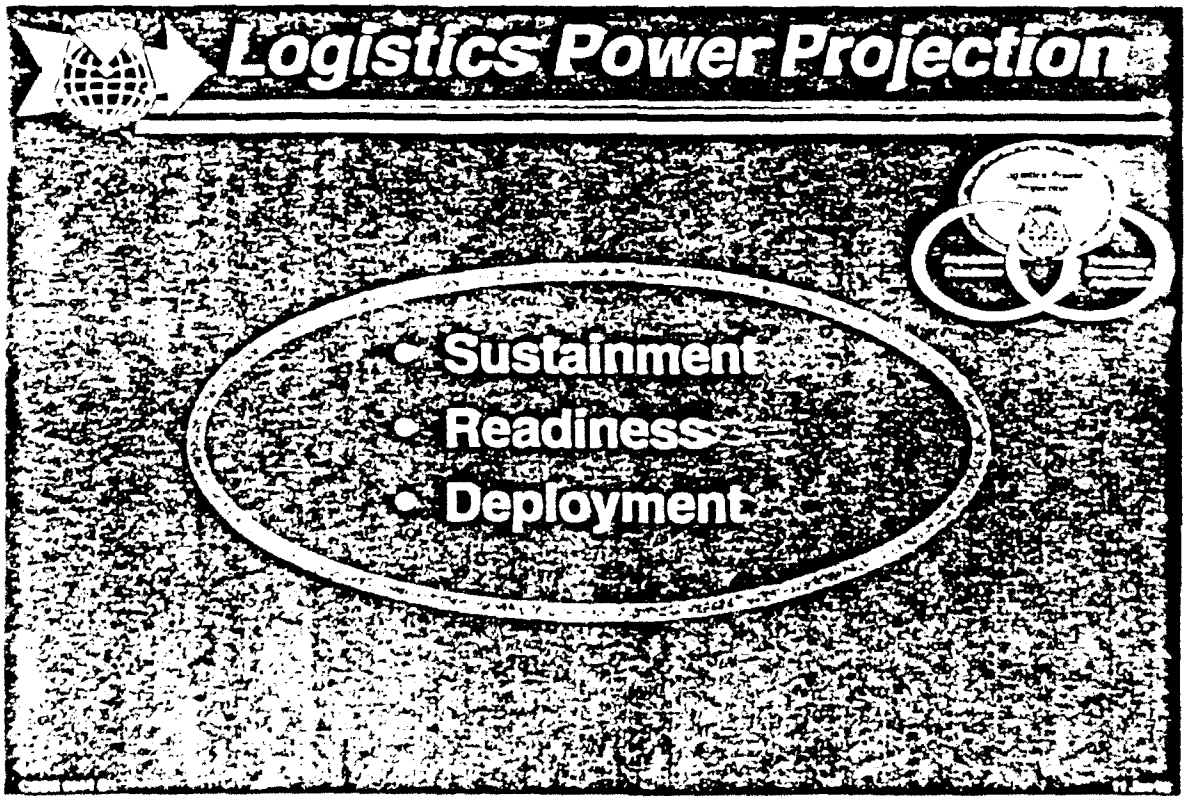
Definition

- Makes significant contribution to Army
- Value difficult to imitate or duplicate
- Absence of which presents unacceptable risk

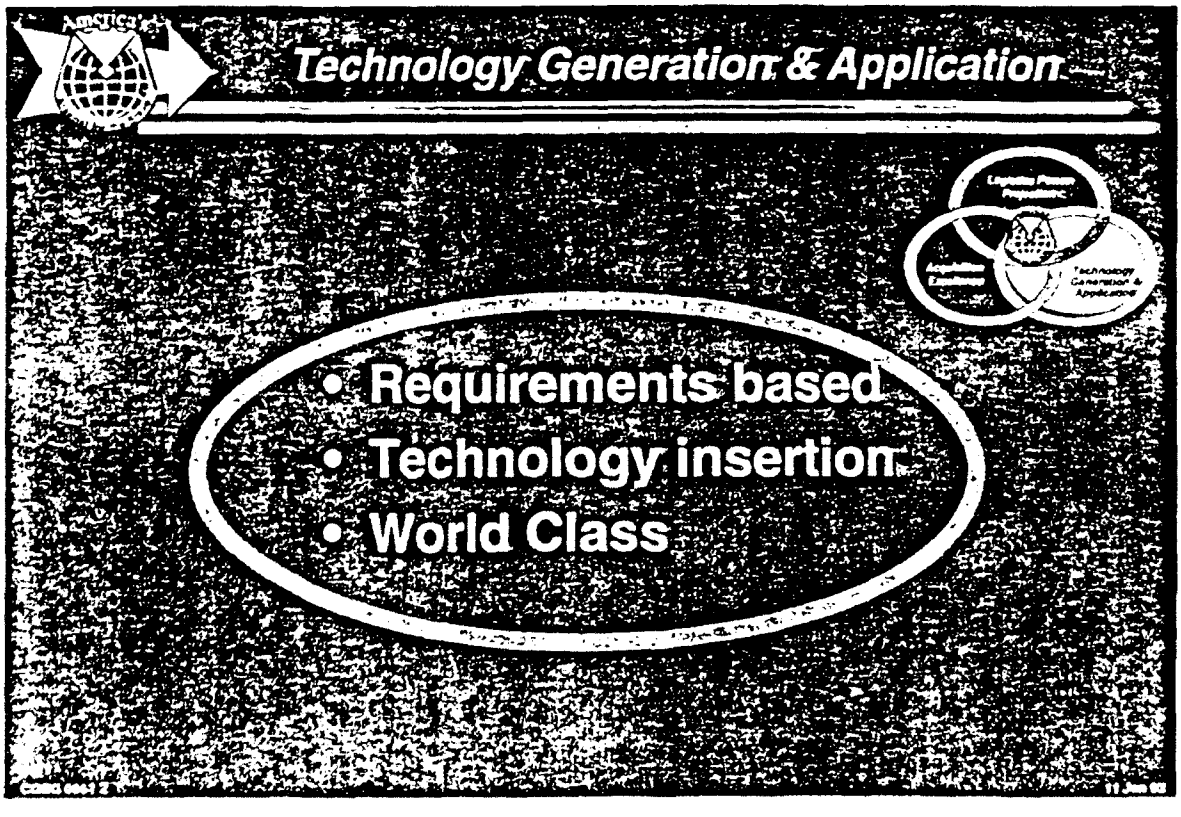
Core Competencies




AMC – Business Themes for the 90's
Strategic Leadership (Penn State)
Strategic Management (MIT)
Excellence
Quality
Vision
Intent
Challenges
Reshape
Cultural Shift
Business Orientation
Value Added
Core Competencies
Outsource The Marginal
Divest


Logistics Power Projection
• Sustainment
• Readiness
• Deployment


Acquisition Excellence
• Best Value
• Army-Industry Team
• Quality


Technology Generation & Application
• Requirements based
• Technology insertion
• World Class

Technology Generation & Application

Vision: A technologically superior Army equipped and sustained with innovative, advanced technologies for rapid power projection and the achievement of decisive victory.

Strategies:

- Technology Generation
  - balanced
  - focused
  - smart buyer
  - leveraging
  - partnering
- Technology Application
  - reduce cycle time
  - ATD
- User Interaction
- Simulation
  - integrated environment
  - internetting
- Quality
- O & S Cost Reduction
- Work Force & Infrastructure

- Continuous Modernization
- Faster Application
- Seamless (Army - Industry - User - Academia)
- High Payoff
- World Class

AMC-Planning for Tomorrow's Business

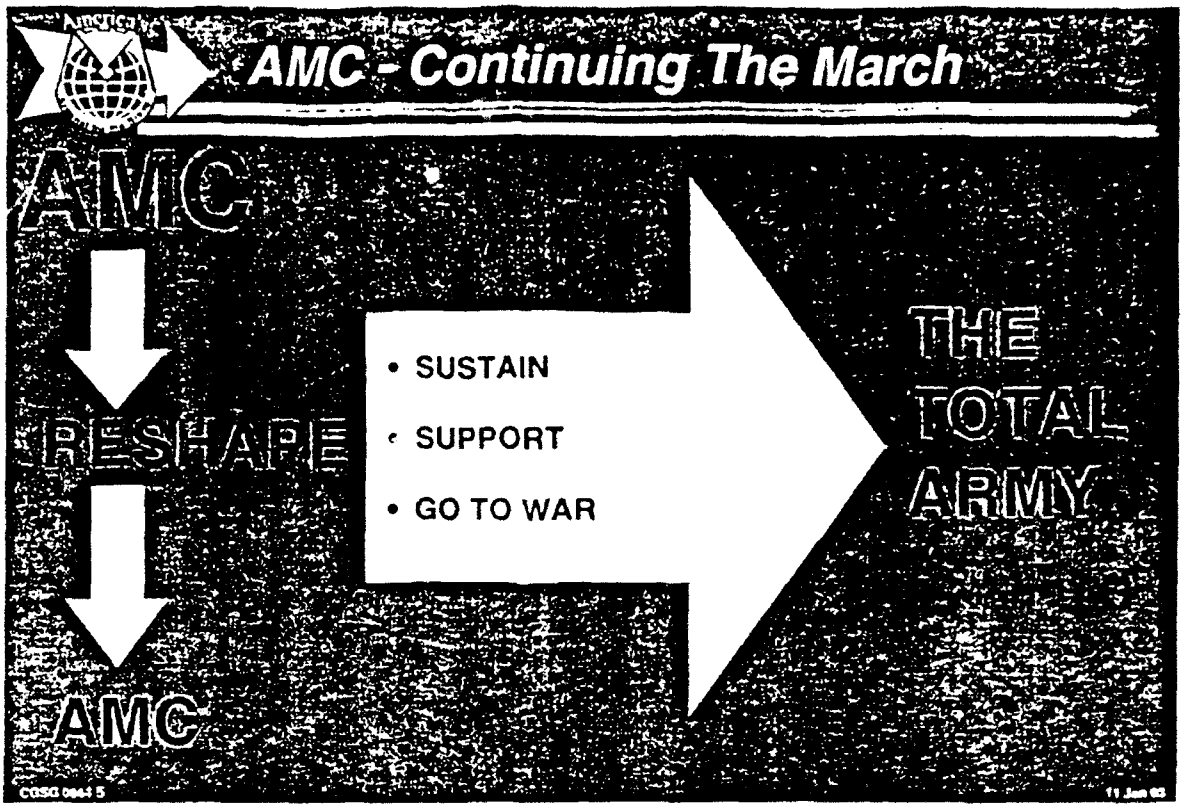
- Core Competencies
- Missions
- Business Plan
- Business Processes

Reshape

95 - 96
- customers
- revenue
- costs
- work force

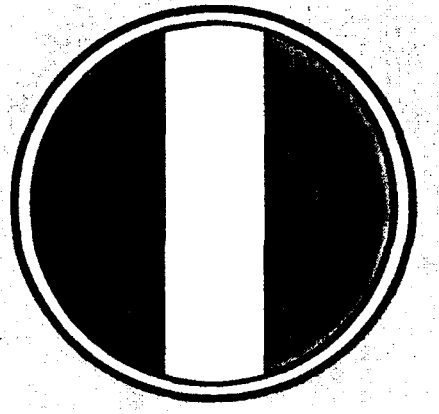
available

Must look to the future to ensure our actions today will get us to the right place


AMC - Continuing The March
AMC
RESHAPE
AMC
• SUSTAIN
• SUPPORT
• GO TO WAR
THE TOTAL ARMY

U . S . A R M Y

T R A I N I N G & D O C T R I N E C O M M A N D



Battle Labs
The User's Perspective on Technology

COL Willam D. Hubbard
Director, Battle Lab
Integration and Technology Directorate,
U.S. Army Training and Doctrine Command
(804) 728-5850

BATTLE LABS

–AN OVERVIEW–

MAINTAINING THE EDGE

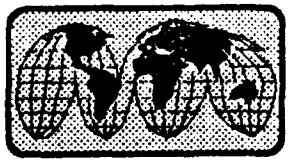
CONTEXT FOR CHANGE

STRATEGY/DOCTRINE

- FORCE PROJECTION STRATEGY
- GLOBAL RESPONSIBILITY
- AMBIGUOUS SCENARIOS
- LOW - TO - HIGH TECH THREAT
- DYNAMICS OF BATTLE IN TRANSITION
- MIXED AC/RC FORCE

RESOURCES

- REDUCED DEFENSE RESOURCES
  - MOST DOD S&T DOLLARS ARE NOT SERVICES'
  - DEFENSE R&D DOWN 30% BY 1997
- MAJOR INVESTMENT IN EXTANT FLEET
- NEED TO REDUCE O&S COSTS



MODERNIZATION

- TECHNOLOGICAL OPPORTUNITIES
- NEED TO MODERNIZE
- FEWER NEW STARTS
- CURRENT PROCESS ALLOWS FLEXIBILITY...BUT UNTESTED

SOLDIERS-LEADERS

AN ELITE FORCE OF TRAINED & READY SOLDIERS AND LEADERS WITH UNLIMITED CAPACITY TO RAPIDLY MASTER CHANGES IN:

- DOCTRINE
- EQUIPMENT
- TACTICS

TRADOC: WHERE TOMORROW'S VICTORIES BEGIN

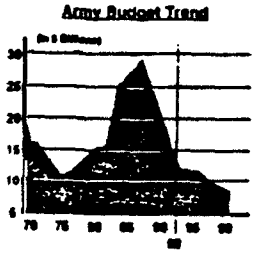
TRADOC ANALYSIS OF THE FUTURE BATTLEFIELD

FACTOR	IMPACT	IMPLICATIONS
• Force Projection	• Early vulnerability • Greater unpredictability	• Greater early entry lethality & survivability required
• Hi lethality indirect (precision) direct • Extended range indirect direct	• Battles finish faster - higher tempo • Class III drives LOG - not ClassV • Close at extended range • Reduced casualties (?)	
• Improved intelligence	• Deal a knock-out blow • Increased vulnerability at depth • Importance of RSTA/counter RSTA	• Evolving notion of Depth & Simultaneous Attack
• Improved C2	• Take the initiative - freeze the enemy • Reduced reaction time • Improve synchronization • Temptation to centralize	
• Lower force density	• Increased opportunity to avoid close battle: interpenetration, flanking • Greater scope for initiative • Greater reliance on quality soldiers	• Expanding battle space - Continuing the historic trend
• Weapons of mass destruction	• Possibility of catastrophic losses from single engagement • Limits ability to concentrate forces • Presses for geographic expansion • Greater threat from mobile TBMS	• Controlling the Tempo of the fight - C2 on the move
• CNN / broadcast news	• Links political and tactical echelons • Become a point of leverage by both sides	• Sustaining the fight - CSS

OUR CHALLENGE

Importance of Technology to Cold War and Desert Storm Victories

+



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High Tech Transfer

⬇

Unstable Regional Powers

MUST MAINTAIN THE EDGE

THE ARMY'S RESPONSE

– AN APPROACH THAT FITS OUR ARMY –

BATTLE LABS - - A means to develop capabilities for a Force Projection Army that begins where *BATTLE APPEARS TO BE CHANGING* and that encourages experimentation via simulations or prototypes to determine technology insertion or new requirements

SUCCESSFUL PRECEDENTS

- ✓ HOWZE BOARD
- ✓ 11TH AIR ASSAULT
- ✓ TRICAP
- ✓ 9TH DIV TEST BED
- ✓ 2 AD NIGHT EXPERIMENTS

- Early Entry with increased Lethality and Survivability
- Depth & Simultaneous Attack
- Battle Space
- Battle Command
- Combat Service Support

TRADOC: WHERE TOMORROW'S VICTORIES BEGIN

BATTLE LAB APPROACH

GENESIS
- Warfighting ideas
- Doctrine

PROCESS
- Conceptualize
- Analyze
- Simulate
- Experiment
- Evaluate
- Prioritize

ORGANIZATION
- Permanent core
- Matrix management
- Located with troops
- Electronic links

SCOPE
- Specific battle dynamic
- Horizontal integration
- S&T thrusts linkage
- Warfighting at all echelons
- Technology insertion
- Senior leader involvement
- Advanced opn'l concepts

SOLUTIONS
Expressed in terms of:
- Doctrine
- Training
- Leadership
- Organizations
- Materiel
- Soldiers

BATTLE LABS ESTABLISHED MAY 92

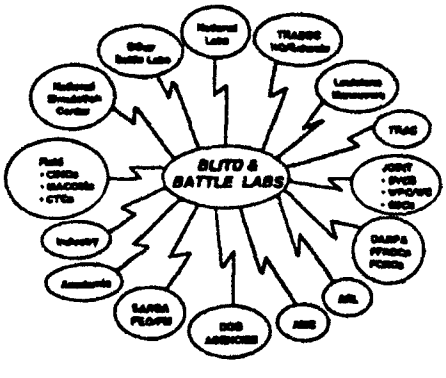
BENEFITS
- Brings together users, S&T, & other players
- Louisiana Maneuvers interface

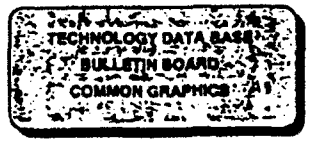
TRADOC: WHERE TOMORROW'S VICTORIES BEGIN

AMC SUPPORT TO BATTLE LABS

BATTLE LAB	LEAD RDEC	+ SUPPORTING ALL BATTLE LABS
EARLY ENTRY	MISSILE	ARMY RESEARCH LABORATORIES (ARL)
MOUNTED	TANK & AUTOMOTIVE	ARMY RESEARCH OFFICE (ARO)
DISMOUNTED	NATICK	AVIATION RDEC
DEEP & SIM ATTACK	ARMAMENTS	EDGEWOOD RDEC
BATTLE COMMAND	COMMUNICATIONS & ELECTRONICS	STRICOM
CSS	BELVOIR	

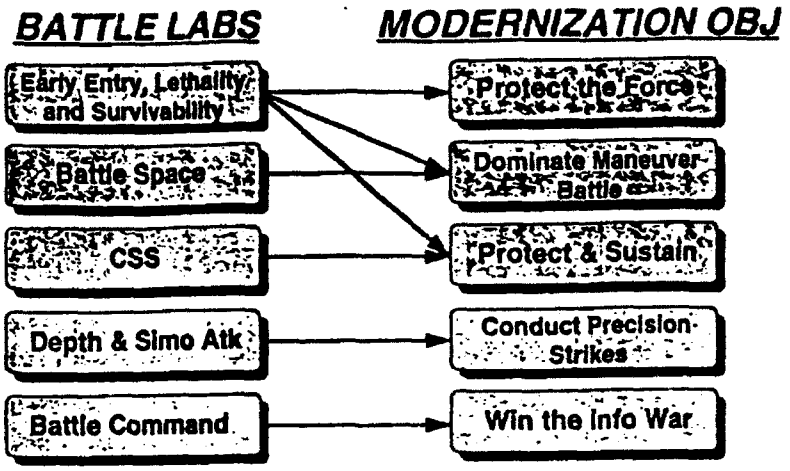
BATTLE LAB COMMUNICATIONS NETWORKING





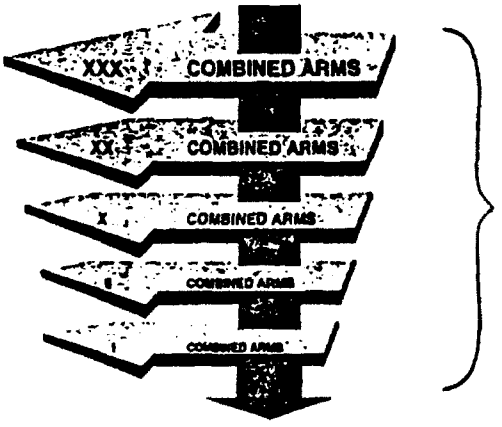
- Electronic interconnection is key
  - Remote access to joint models and simulations
  - Virtual prototyping with industry and academia
  - Support to Louisiana Maneuvers
- DSI is critical link

ARMY MODERNIZATION VISION
BATTLE LAB LINKS



INTEGRATION - KEY

AS A FORCE WE FIGHT AS
AN INTEGRATED COMBINED ARMS TEAM



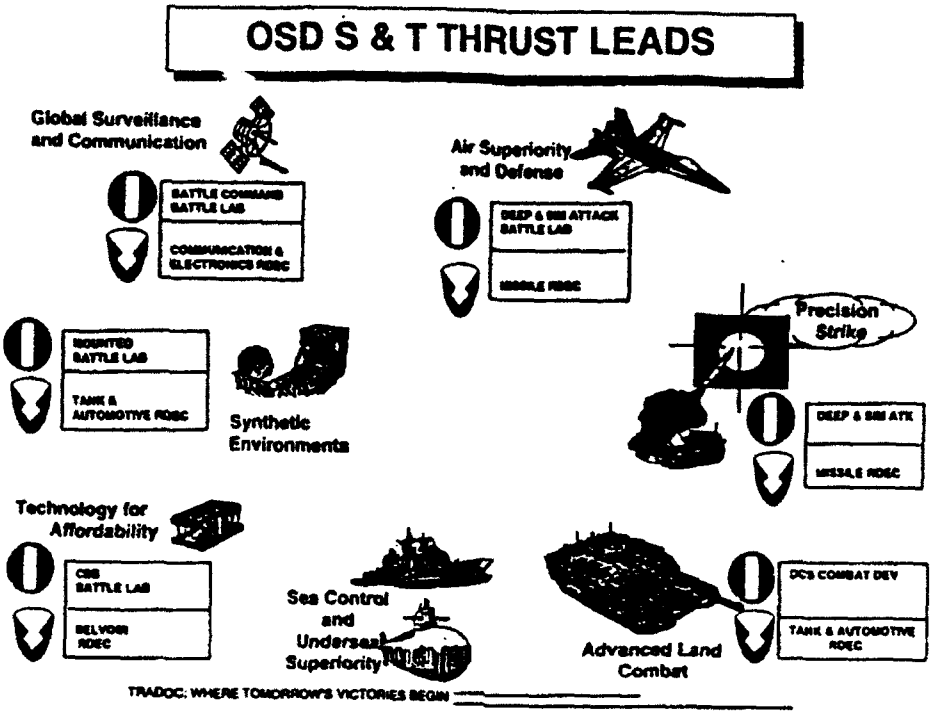
VERTICALLY

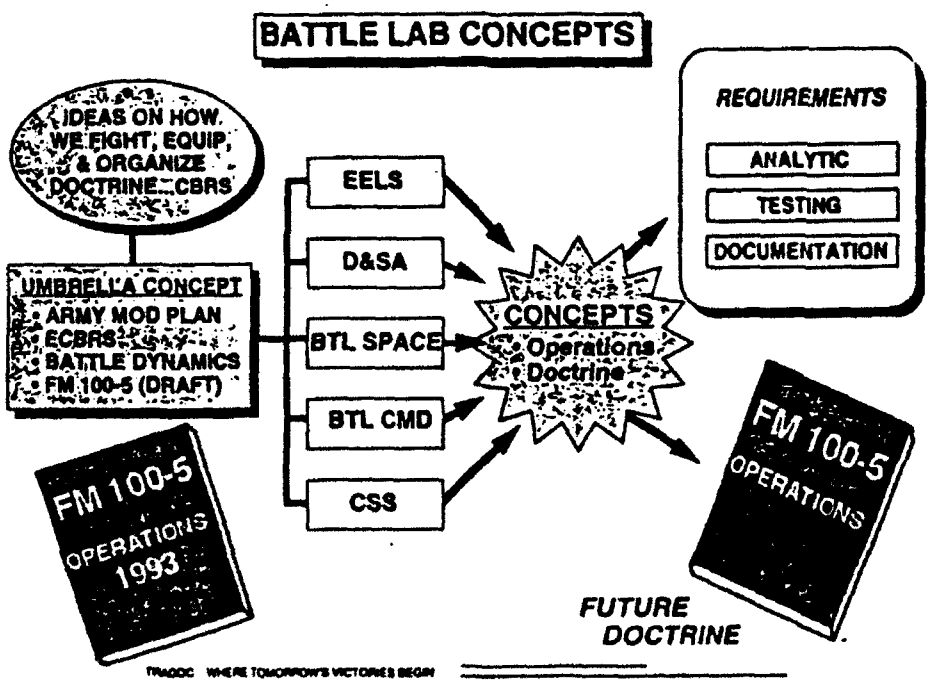
- WITHIN THE FIGHTING FORCE AND EACH B.O.S.
  - TAILOR, REORGANIZE, RESUPPLY, REALIGN BETWEEN ECHELONS
    - NESTED INTENTS WITHIN A UNIFIED CONCEPT

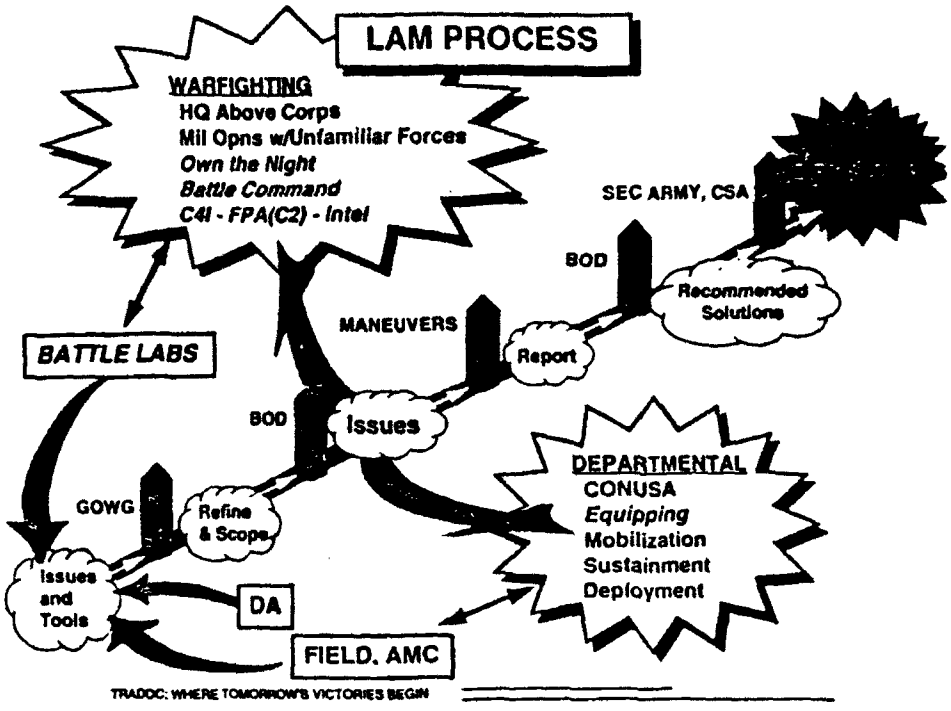
BATTLE LABS MUST BE INTEGRATED....FROM A VERTICAL AND HORIZONTAL INTEGRATION PERSPECTIVE

HORIZONTALLY

- WITHIN A WFX TEAM
  - FROM CO → CORPS
  - ACROSS ALL B.O.S.
    - MANEUVER
    - INTEL
    - FIRES
    - AVIATION
    - AIR DEFENSE
    - CSS
    - ENGINEERS


OSD S & T THRUST LEADS
Global Surveillance and Communication
BATTLE COMMAND BATTLE LAB
COMMUNICATION & ELECTRONICS RDEC
Air Superiority and Defense
DEEP & SEE ATTACK BATTLE LAB
MISSILE RDEC
MOUNTED BATTLE LAB
TANK & AUTOMOTIVE RDEC
Synthetic Environments
Precision Strike
DEEP & SEE ATK
MISSILE RDEC
Technology for Affordability
CBS BATTLE LAB
BELVOIR RDEC
Sea Control and Undersea Superiority
Advanced Land Combat
DCS COMBAT DEV
TANK & AUTOMOTIVE RDEC
TRADOC: WHERE TOMORROW'S VICTORIES BEGIN


BATTLE LAB CONCEPTS
IDEAS ON HOW WE FIGHT, EQUIP, & ORGANIZE DOCTRINE - CBRS
UMBRELLA CONCEPT
ARMY MOD PLAN
ECBRS
BATTLE DYNAMICS
FM 100-5 (DRAFT)
EELS
D&SA
BTL SPACE
BTL CMD
CSS
CONCEPTS
Operations
Doctrine
REQUIREMENTS
ANALYTIC
TESTING
DOCUMENTATION
FM 100-5 OPERATIONS 1993
FM 100-5 OPERATIONS
FUTURE DOCTRINE
TRADOC WHERE TOMORROW'S VICTORIES BEGIN



BATTLE LABORATORY

PROVIDE OPPORTUNITIES FOR

✓ **INTEGRATED REQUIREMENTS AND DEVELOPMENTS**
- INTEGRATE MULTIPLE BATTLEFIELD OPERATING SYSTEMS
- SIMULATION
- PROTOTYPING
- EXPERIMENTATION & TESTING
- EVALUATION

PRODUCES
SMART & AFFORDABLE ALTERNATIVES

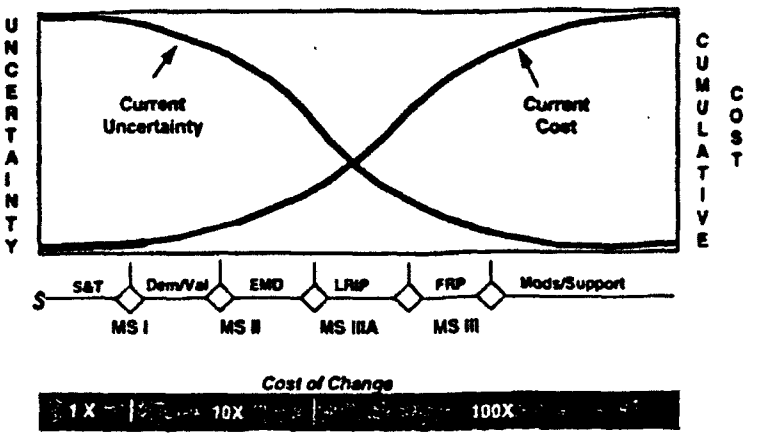
✓ **MATERIEL DEVELOPER PARTICIPATES IN REQUIREMENTS DEFINITION**
- INDUSTRY
- ACADEMIA

✓ **FREEDOM TO EXPLORE**
- CREATIVITY & INNOVATION
- LEVERAGE TECHNOLOGICAL OPPORTUNITIES
- AVOID SUFFOCATION AND ATROPHY BY BUREAUCRATS

RISK REDUCTION OPPORTUNITIES FOR RDA PROCESS

TRADOC: WHERE TOMORROW'S VICTORIES BEGIN

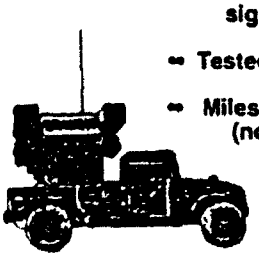
Risk Reduction During High Spending Phases is Expensive



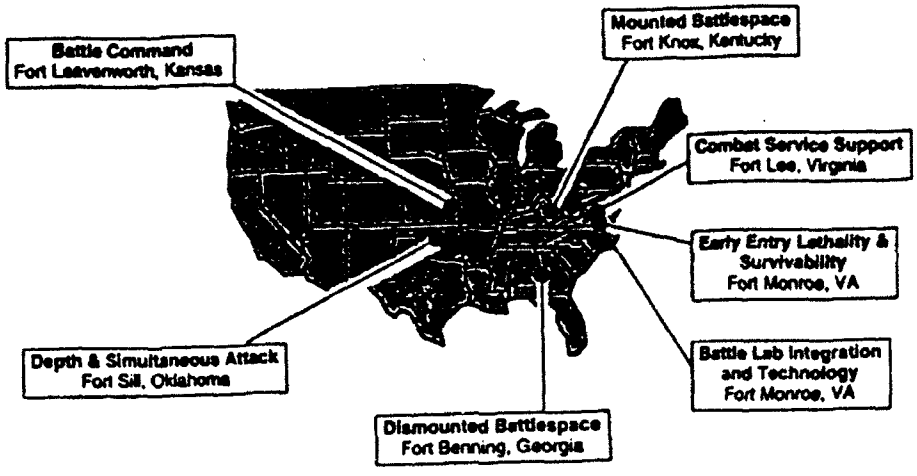
AVENGER

An Example of Historical Experimentation

- Existing chassis - HMMWV
- Existing weapon system - Stinger
- Integrated - Mount and Advanced FLIR
- Expedited Acquisition Process
  - Contractor built prototype for 9ID / ADEA using off-the-shelf components in Army inventory... documentation, spares and manufacturing costs significantly reduced
  - Tested in field by soldiers (9ID / ADEA)
  - Milestone IIIA to fielding in 36 months (no milestone 0 thru III)



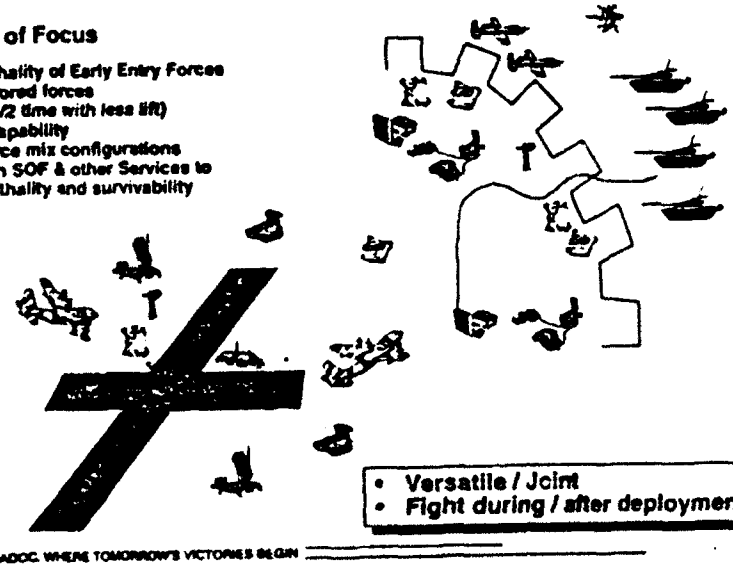
Battle Labs



EARLY ENTRY LETHALITY & SURVIVABILITY

Areas of Focus

- Optimize lethality of Early Entry Forces
- Lighten armored forces (deploy in 1/2 time with less lift)
- Offset IPB capability
- Optimize force mix configurations
- Capitalize on SOF & other Services to enhance lethality and survivability



- Versatile / Joint
- Fight during / after deployment

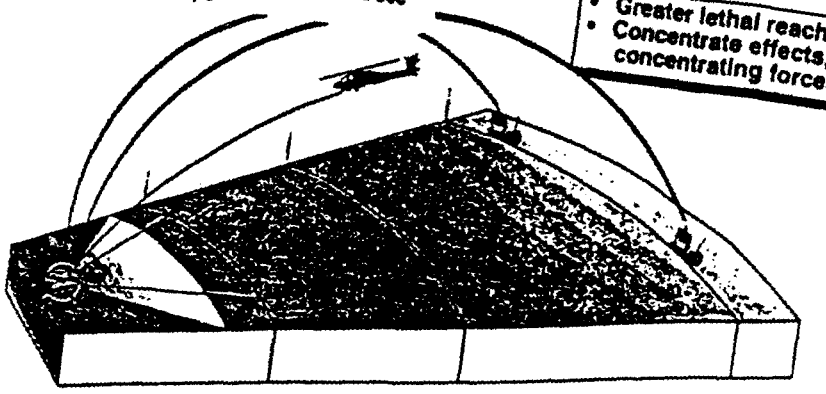
MOUNTED BATTLE SPACE
THE TALE OF THE TAPE

Areas of Focus

- Optimize situational awareness and target handoff
- Optimize survivability of mounted force
- Expand multiple capabilities to acquire/kill armored targets, day/night, at long range
- Optimize horizontal integration of digitized information flow (Bde ↑)
- Determine optimum force design of recon & sec elements, Bde thru Corps

"I only knew the Americans were out there when the tank to the left of me, then the tank to the right of me, exploded"
An Iraqi Commander

- Greater lethal reach
- Concentrate effects, w/o concentrating forces



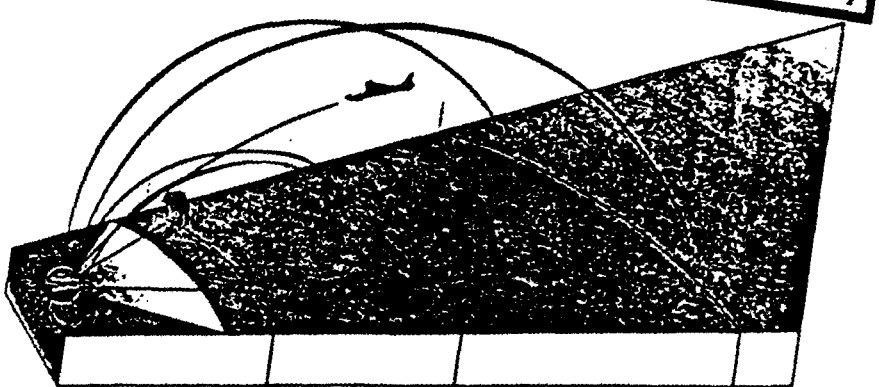
TRADOC: WHERE TOMORROW'S VICTORIES BEGIN

DISMOUNTED BATTLE SPACE
THE TALE OF THE TAPE

Areas of Focus

- Optimize night fighting capability of combined arms force
- Improve target acquisition capabilities for combined arms force
- Enhance lethality of dismounted force
- Improve survivability of soldiers

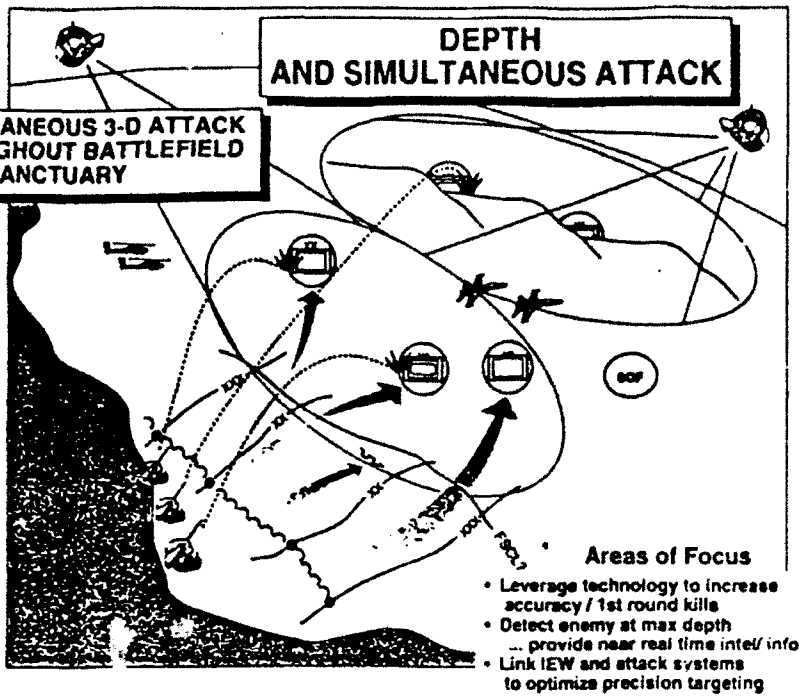
- Greater lethality
- Improved survivability



TRADOC: WHERE TOMORROW'S VICTORIES BEGIN

DEPTH AND SIMULTANEOUS ATTACK

- SIMULTANEOUS 3-D ATTACK THROUGHOUT BATTLEFIELD
- DENY SANCTUARY

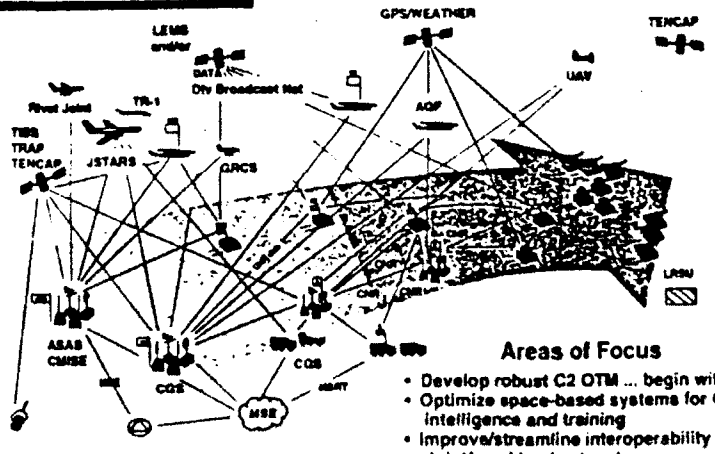


Areas of Focus

- Leverage technology to increase accuracy / 1st round kills
- Detect enemy at max depth ... provide near real time intel/ info
- Link IEW and attack systems to optimize precision targeting

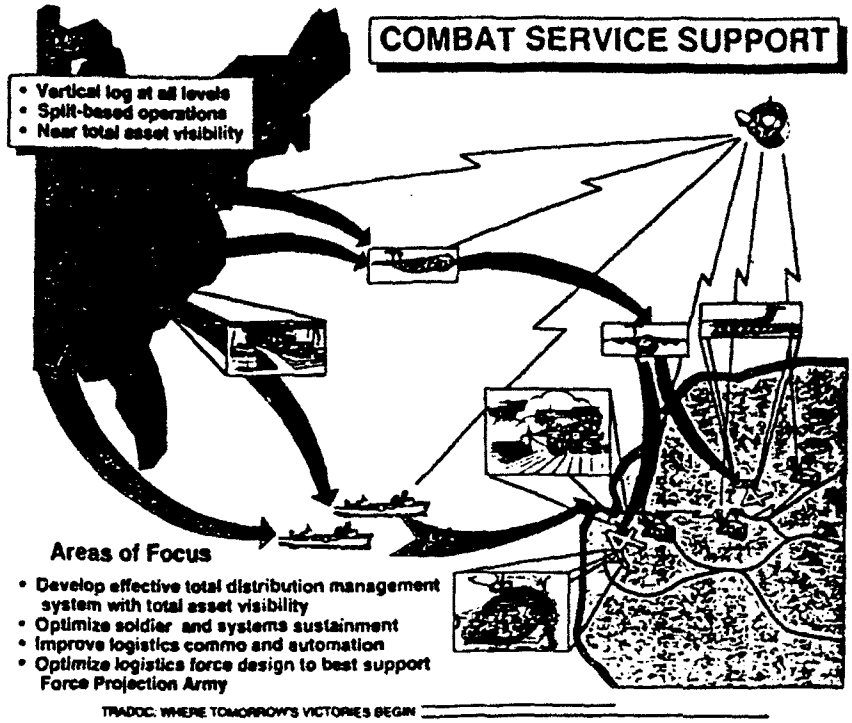
BATTLE COMMAND

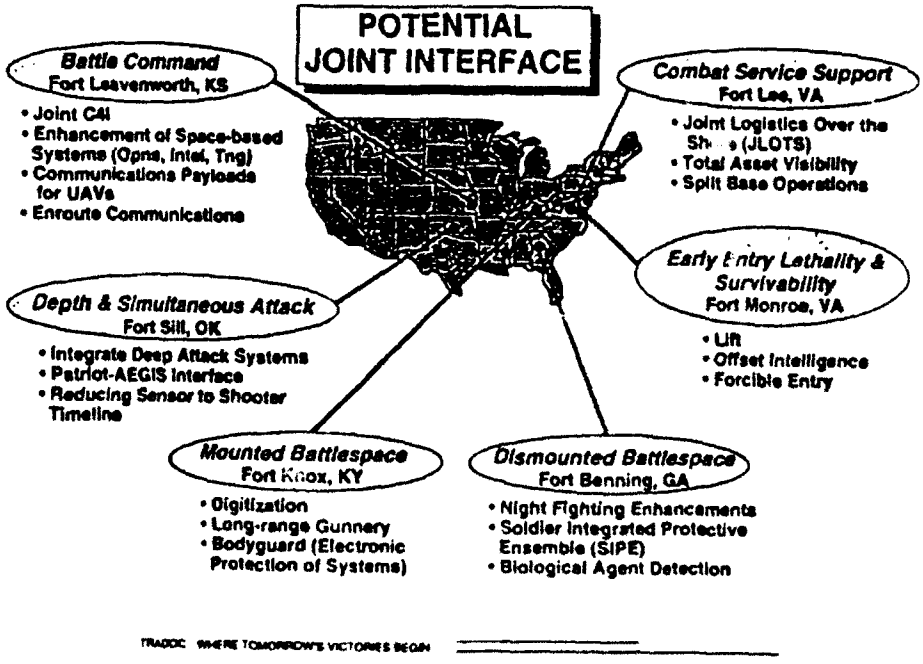
- SPACE BASED C3I
- LEADERSHIP / HUMAN DIMENSION
- DIGITIZATION

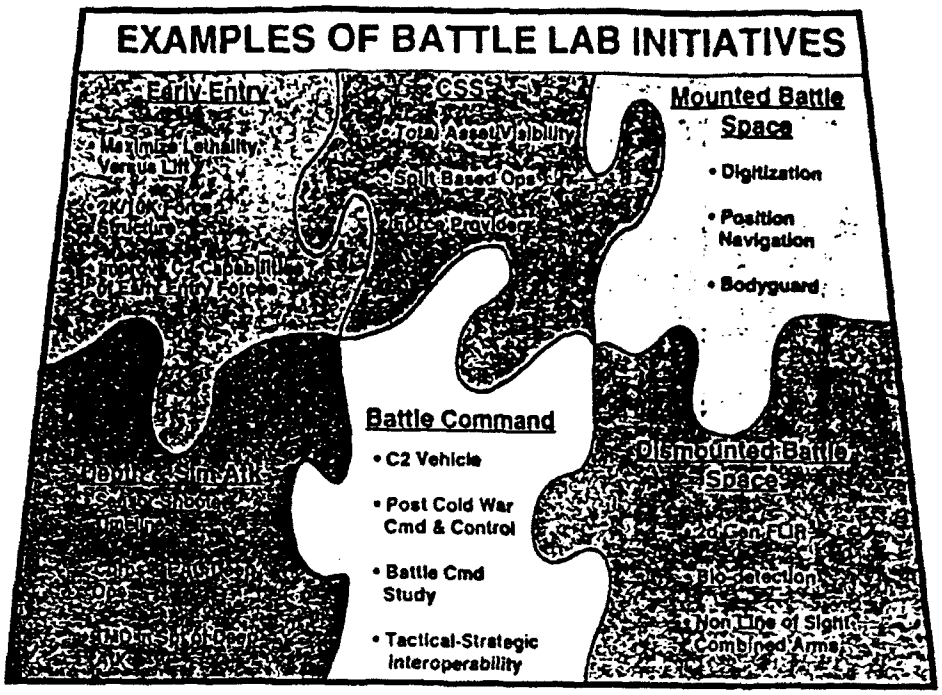


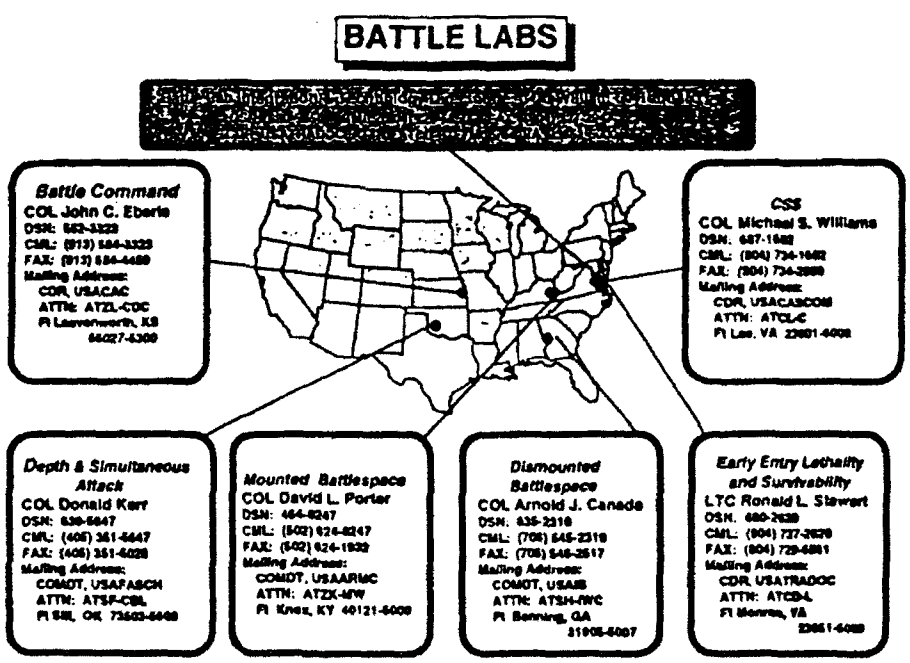
Areas of Focus

- Develop robust C2 OTM ... begin with C2V
- Optimize space-based systems for OPS, intelligence and training
- Improve/streamline interoperability with Joint/combined networks
- Optimize broadcast technology
- Optimize CSS battlefield automation


COMBAT SERVICE SUPPORT
• Vertical log at all levels
• Split-based operations
• Near total asset visibility
Areas of Focus
• Develop effective total distribution management system with total asset visibility
• Optimize soldier and systems sustainment
• Improve logistics commo and automation
• Optimize logistics force design to best support Force Projection Army
TRADOC: WHERE TOMORROW'S VICTORIES BEGIN


POTENTIAL JOINT INTERFACE
Battle Command
Fort Leavenworth, KS
• Joint C4I
• Enhancement of Space-based Systems (Opns, Intel, Tng)
• Communications Payloads for UAVs
• Enroute Communications
Combat Service Support
Fort Lee, VA
• Joint Logistics Over the Shore (JLOTS)
• Total Asset Visibility
• Split Base Operations
Early Entry Lethality & Survivability
Fort Monroe, VA
• Lift
• Offset Intelligence
• Forcible Entry
Depth & Simultaneous Attack
Fort Sill, OK
• Integrate Deep Attack Systems
• Patriot-AEGIS Interface
• Reducing Sensor to Shooter Timeline
Mounted Battlespace
Fort Knox, KY
• Digitization
• Long-range Gunnery
• Bodyguard (Electronic Protection of Systems)
Dismounted Battlespace
Fort Benning, GA
• Night Fighting Enhancements
• Soldier Integrated Protective Ensemble (SIPE)
• Biological Agent Detection
TRADOC: WHERE TOMORROW'S VICTORIES BEGIN


EXAMPLES OF BATTLE LAB INITIATIVES
Early Entry
Maximize Lethality Versus Lift
CSS
Total Asset Visibility
Split Based Ops
Mounted Battle Space
• Digitization
• Position Navigation
• Bodyguard
Battle Command
• C2 Vehicle
• Post Cold War Cmd & Control
• Battle Cmd Study
• Tactical-Strategic Interoperability
Dismounted Battle Space
Non Line of Sight
Combined Arms


BATTLE LABS
Battle Command
COL John C. Eberle
DSN: 552-3323
CML: (913) 684-3323
FAX: (913) 684-4469
Mailing Address:
CDR, USACAC
ATTN: ATZL-CDC
Ft Leavenworth, KS
66027-6300
CSS
COL Michael S. Williams
DSN: 687-1682
CML: (804) 734-1682
FAX: (804) 734-3999
Mailing Address:
CDR, USACASCOM
ATTN: ATCL-C
Ft Lee, VA 23801-6000
Depth & Simultaneous Attack
COL Donald Kerr
DSN: 639-5647
CML: (405) 351-5647
FAX: (405) 351-5028
Mailing Address:
COMDT, USAFASCH
ATTN: ATSF-CBL
Ft Sill, OK 73503-5600
Mounted Battlespace
COL David L. Porter
DSN: 464-9247
CML: (502) 624-9247
FAX: (502) 624-1932
Mailing Address:
COMDT, USAARMC
ATTN: ATZK-MW
Ft Knox, KY 40121-5000
Dismounted Battlespace
COL Arnold J. Canada
DSN: 835-2318
CML: (706) 545-2318
FAX: (706) 545-2517
Mailing Address:
COMDT, USAIB
ATTN: ATSH-IWC
Ft Benning, GA
31905-5007
Early Entry Lethality and Survivability
LTC Ronald L. Stewart
DSN: 680-2638
CML: (804) 727-2638
FAX: (804) 728-6851
Mailing Address:
CDR, USATRADOC
ATTN: ATCD-L
Ft Monroe, VA
23651-5000

SUMMARY

Battle Labs are a *pragmatic approach to problem-solving that allows experimentation – first in simulation and later with soldiers on ranges and manuever areas – with new ideas and emerging technologies.*

GEN FRANKS
TRADOC: *Seeding Future Victories,*
The Army Green Book, Oct 92

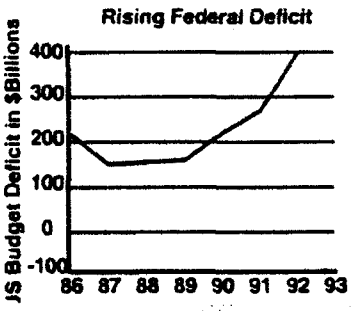
ARMY RESEARCH LABORATORY

Overview of the United States Army Research Laboratory

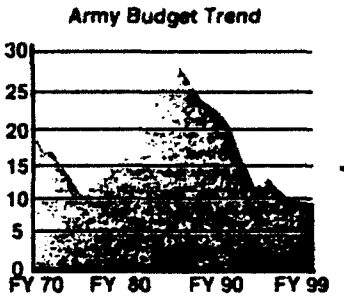
Mr. Bruce M. Fonoroff
Directorate Executive
Advanced Concepts anf Plans (ACAP)
(301) 394-4106

Our Challenge

Cold War and Desert Storm Victories +



+



+ High Tech Transfer ⇩ Unstable Regional Powers

- **Less Predictable, Rising Threat**
- **Public Demands Swift, Decisive, Low Casualty Victory**
- **Less $**

But a smaller Army and defense industry

ISC 93 CI
F 2 Our Challenge

Strategic Vision

U.S. Army

A Total Force trained and ready to fight...
Serving the nation at home and abroad...
A strategic force capable of decisive victory.

Army Materiel Command

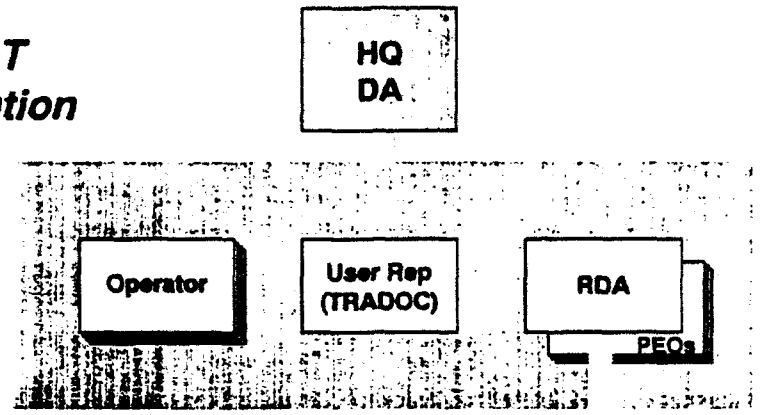
The Army's leader in equipping and sustaining the Total Force through superior technology and responsive support assuring worldwide power projection and decisive victory.

Army Research Laboratory

An efficient, world-class laboratory with the critical mass and flexibility to satisfy the science, technology, and analysis needs of the Army for the 1990s and beyond.

ISC 93 CI
D FONOROFF Strat Vision

Army S&T Organization



Materiel	*Medical*	*Infrastructure/ Environmental*	*Personnel*	*Information*	*Strategic Defense*
HQ AMC	HQ MRDC	HQ USACE	DCSPER	ISC	SSDC

J-Army S&T Organization

AMC Organization

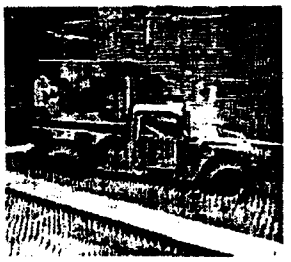
HQ AMC

Aviation & Troop Command ATCOM	Armaments Command AMCOM	Army Research Laboratory ARL	Army Research Office ARO	Chemical/ Biological Defense Agency CBDA	Communications & Electronics Command CECOM
Aviation RDEC Belvoir RDEC Natick RDEC	Armaments RDEC			Edgewood RDEC	Communications & Electronics RDEC
Depot Systems Command DESCOM	Missile Command MICOM	Simulation, Training & Instrumentation Command STRICOM	Tank Automotive Command TACOM	Test & Evaluation Command TECOM	US Army Security Assistance Command USASAC
	Missile RDEC		Tank Automotive RDEC		

J-AMC Organization

Mission

The United States Army Research Laboratory will provide America's soldiers the technology edge through scientific research, technology development, and analysis.



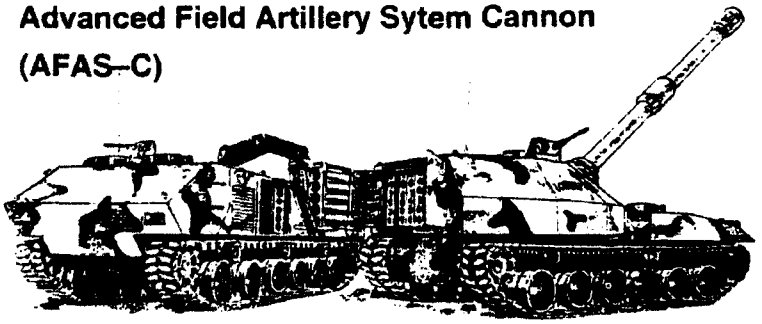
Army–Wide Management Responsibilities

Technology Transfer

- Independent Research & Development (IR&D)
- Domestic Technology Transfer
  - Cooperative R&D Agreements (CRDAs)
  - Patent Licensing Agreements (PLAs)
- Small Business Innovation Research (SBIR)
- Advanced Concepts and Technology (ACT)

Stabilized Mast Mount

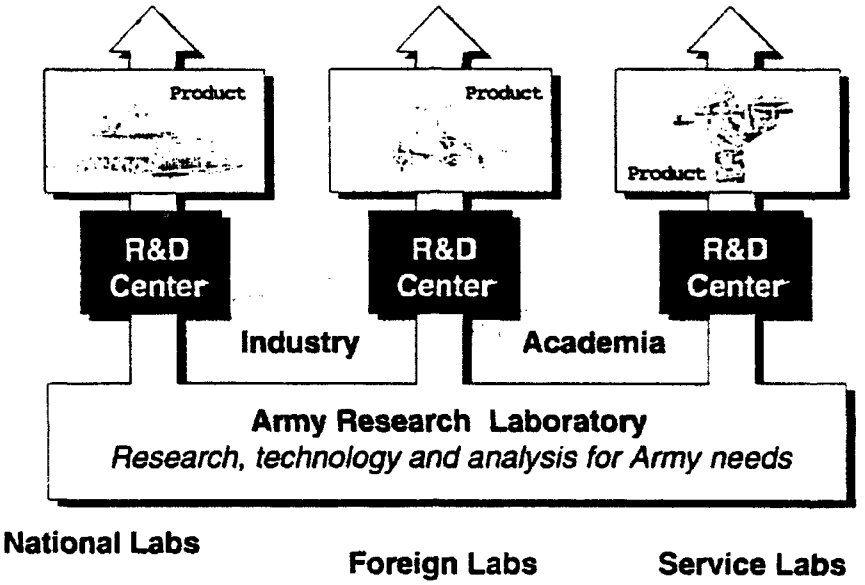
Advanced Field Artillery Sytem Cannon (AFAS–C)



ACT

IR&D

Corporate Laboratory Role



Revision 1 Chart 7 Jan 93

Army Tech Base Elements

CECOM—CNVEO Optical/IR Research
ARI—MANPRINT for Systems Research
AVSCOM—Aviation Aerostructures Directorate
AVSCOM—Aviation Propulsion Directorate
TACOM—Ground Vehicle Propulsion Research
BRDEC—Tech Base Materials Research
AIRMICS
CRDEC—Chemical & Biological Vulnerability/Lethality Assessment

LABCOM

Atmospheric Sciences Laboratory
Ballistic Research Laboratory
Electronics Technology & Devices Laboratory
Harry Diamond Laboratories
Human Engineering Laboratory
Materials Technology Laboratory
Vulnerability Assessment Laboratory
Special Technhnology Offices

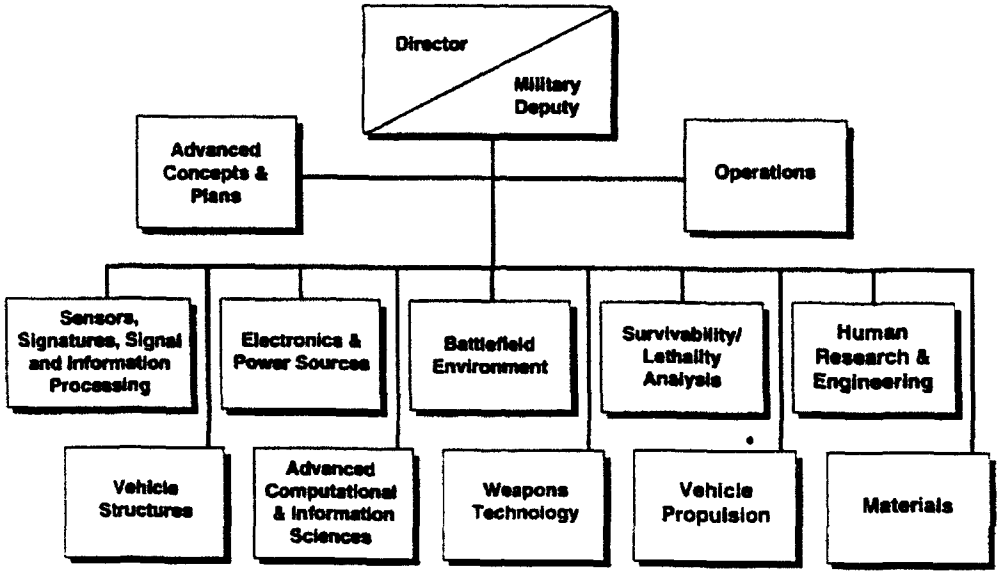
Divestitures

ARO and others

Transition to Army Research Laboratory

Stong in-house capability
Primarily 6.1, 6.2, 6.5
Institutional funding
Limited customer and contract programs
Board of directors oversite
Minimal overhead

ARL Organization



Revision 1 Chart 3, Jan. 93

ARL Locations

O Transition sites: EPS at Ft. Monmouth, NJ and MAT at Watertown, MA

Revision 1 Chart 4, Jan. 93

ARL Personnel Profile

As of Sept. 1992

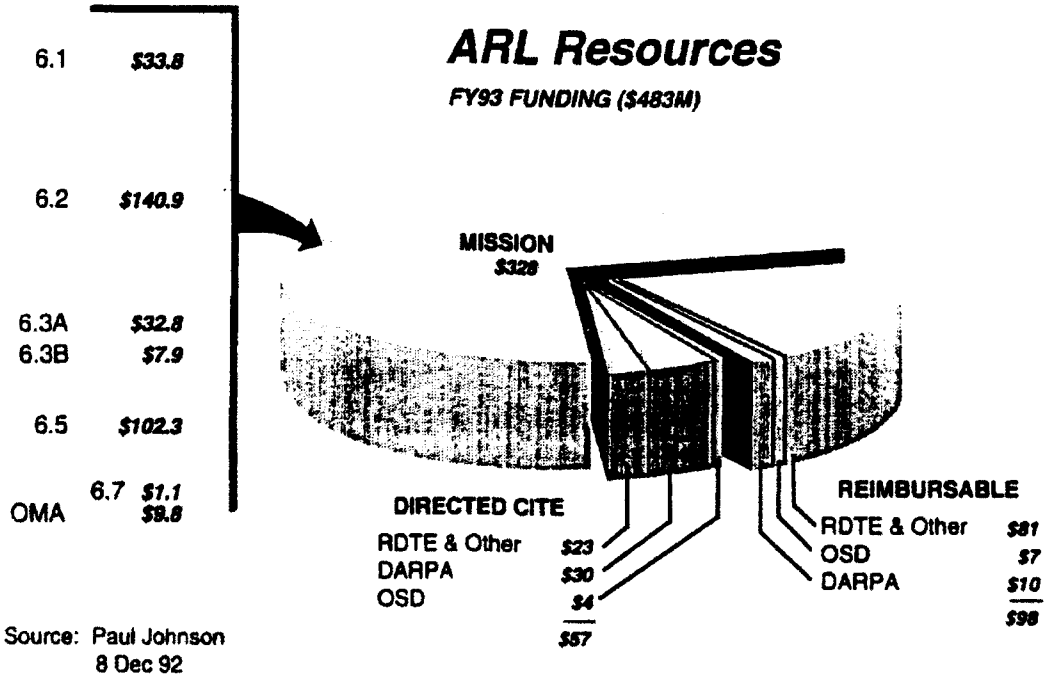
Scientists & Engineers	*1744*
Electrical/Electronics Engineers	527
Physicists	228
Mechanical Engineers	179
Material Engineers/Metallurgists	112
General/Industrial Engineers	120
Human Factors Engineers	37
Aerospace Engineers	34
Chemical Engineers/Chemists	97
Mathematicians/Statisticians	92
Computer Scientists	50
Meteorologists	34
Physical Scientists	126
Operations Research Analysts	57
Other	51

Total Workforce	*3653*
Bachelors	1207
Masters	528
Doctorates	354

Revision 2 Chart 20, Jan 93

ARL Resources

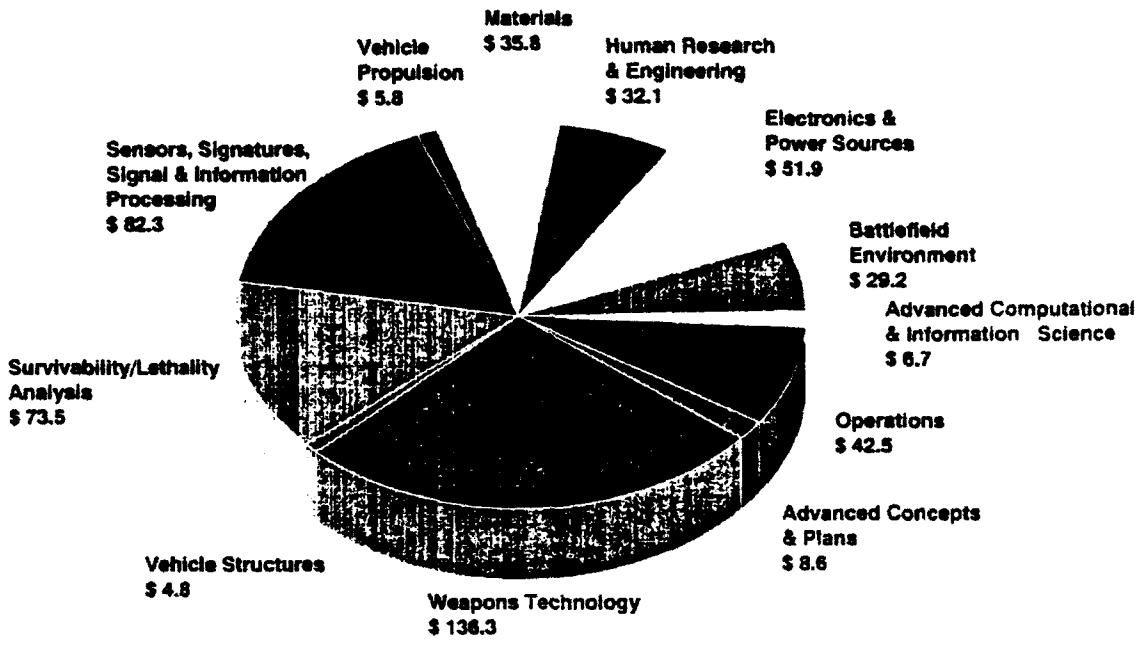
FY93 FUNDING ($483M)



Source: Paul Johnson
8 Dec 92

Revision 1 Chart 5, Jan 93

ARL FY 93 Funds By Business Area
Total $509.5M



ISC 93 CI
D FONOROFF F-15

Major ARL Focus Programs

Target Acquisition

Advanced Armored Vehicle Technology

Autonomous Systems Science and Technology

Advanced Artillery Technology

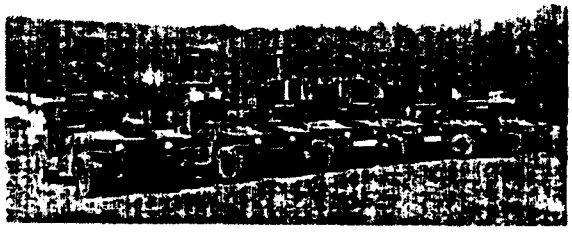
Warrior's Edge

Definition

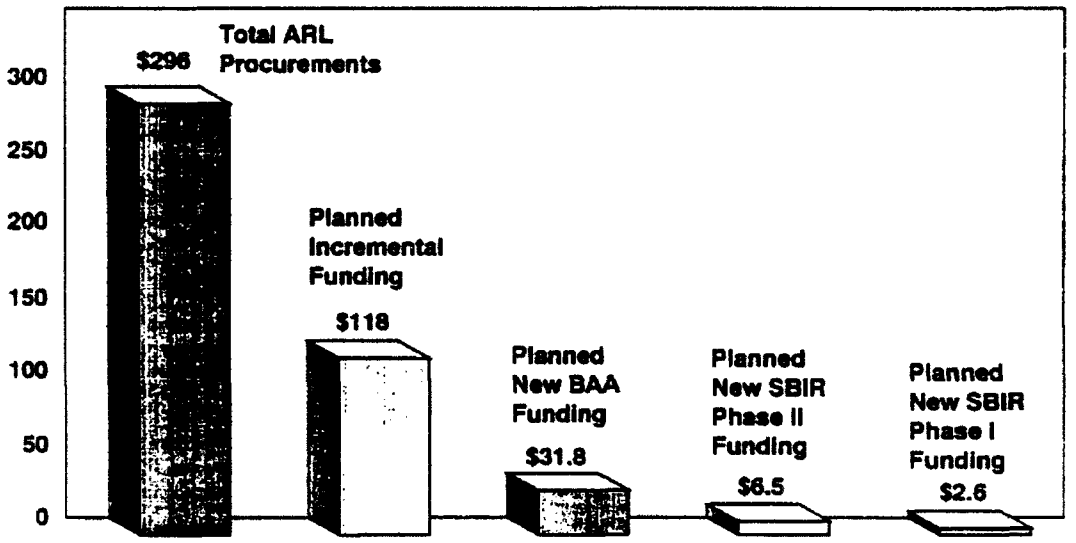
A multidisciplinary team approach for developing and evaluating key technical capabilities and concepts.

Attributes

- Major visibility
- Clear objective - product/capability
- Finite time frame
- Single directorate executive has lead

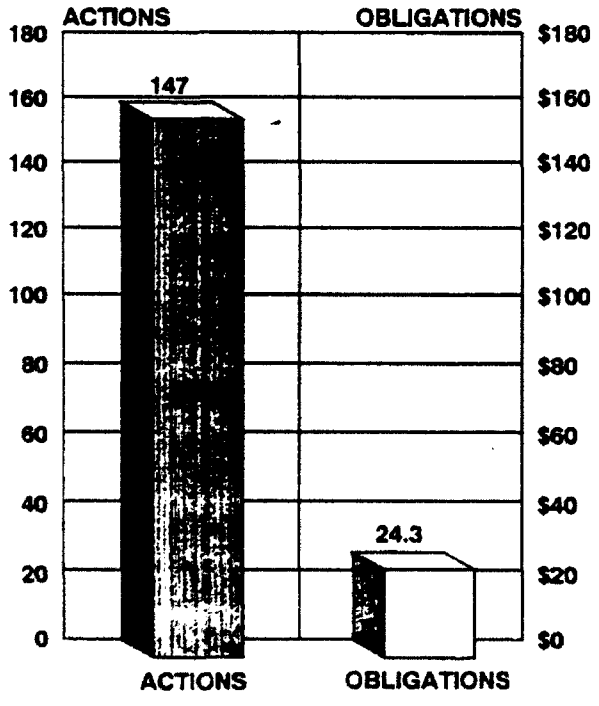


Advanced Procurement Plan
SUMMARY



Estimated obligations in millions

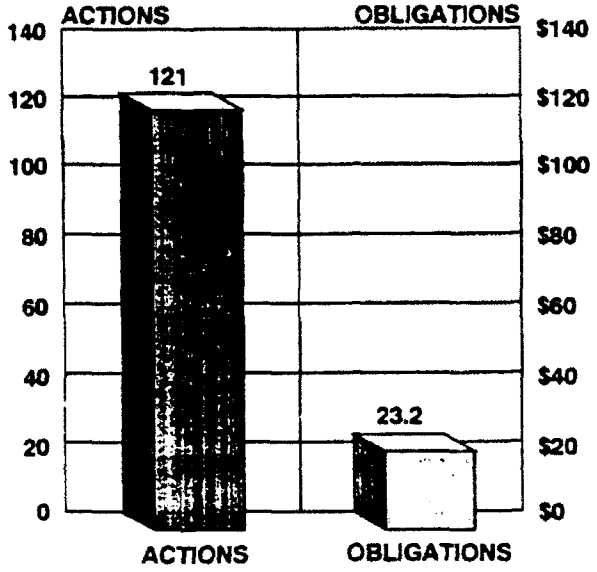
WT Directorate
FY 93 Acquisition Plan
(Estimated obligations in millions)



Two new, competitive actions estimated to exceed $1M each

Plan includes 18 new BAA functions

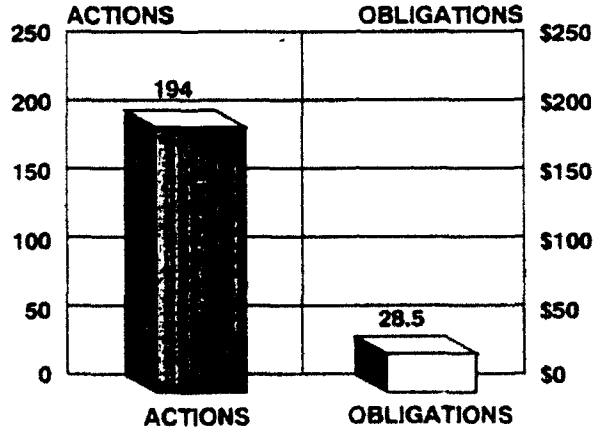
SLAD Directorate
FY 93 Acquisition Plan
(Estimated obligations in millions)



Competitive contracts planned computer simulation

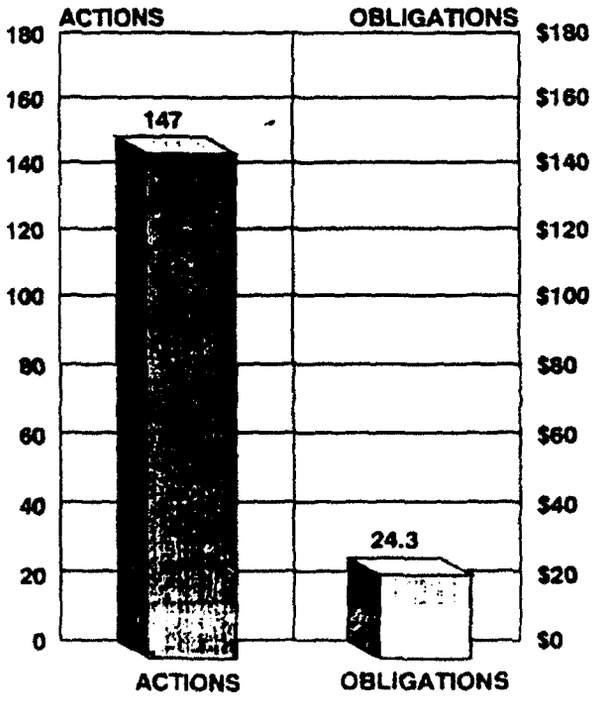
Over half of actions are incremental funding

S3I Directorate
FY 93 Acquisition Plan
(Estimated obligations in millions)



Planning numerous competitive actions under $100K, extensive use of BAA and SBIR

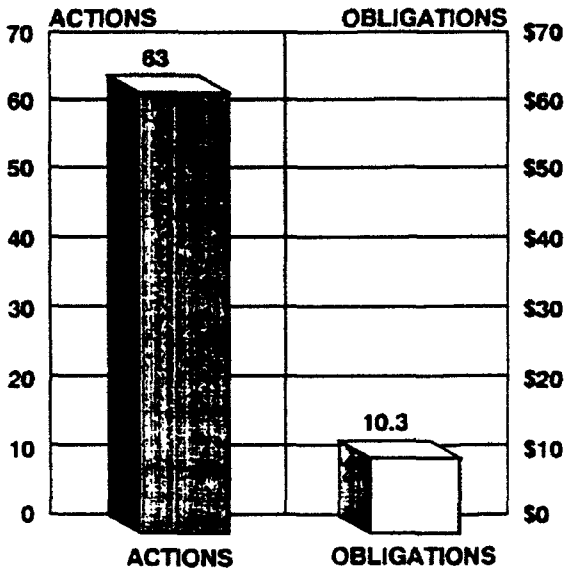
MAT Directorate
FY 93 Acquisition Plan
(Estimated obligations in millions)



Planning significant SBIR, BAA usage

Most larger obligations are modifications to existing contracts

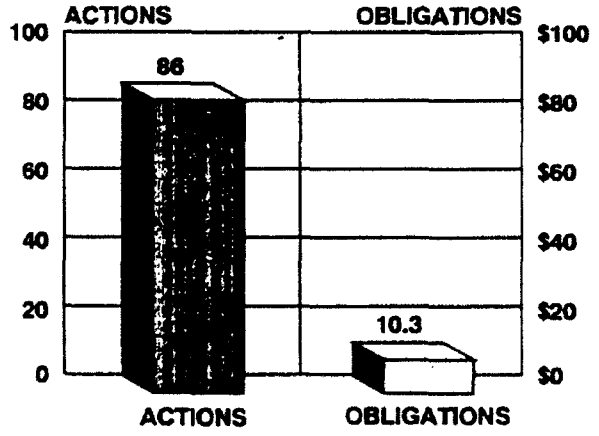
BE Directorate
FY 93 Acquisition Plan
(Estimated obligations in millions)



Most other funded actions are modifications

J-FY93 F-17e

HRE Directorate
FY 93 Acquisition Plan
(Estimated obligations in millions)

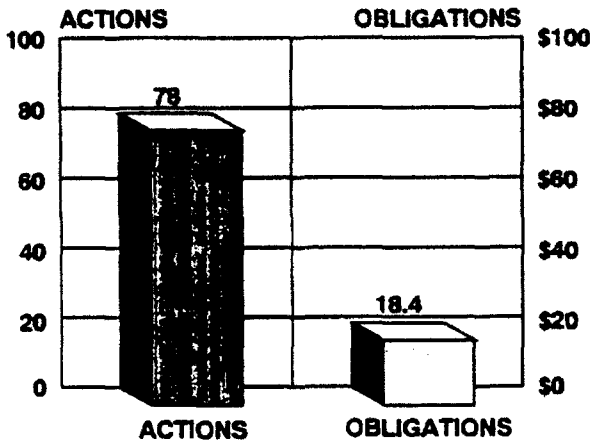


No new contracts estimated to exceed $500K in plan

Numerous smaller Broad Agency Announcement actions planned

J-FY93 F-17e

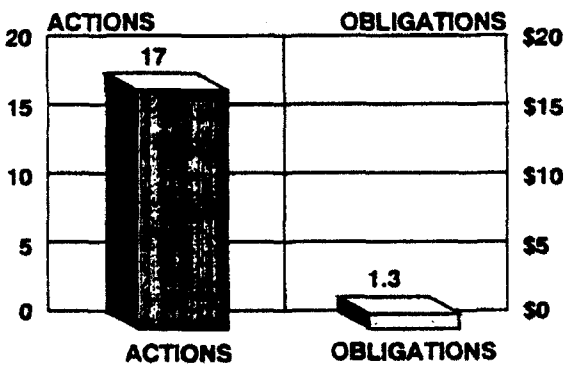
ACIS Directorate
FY 93 Acquisition Plan
(Estimated obligations in millions)



Most obligations shown are modifications to exisiting contracts or currently unfunded actions

J-FY93 F-17a

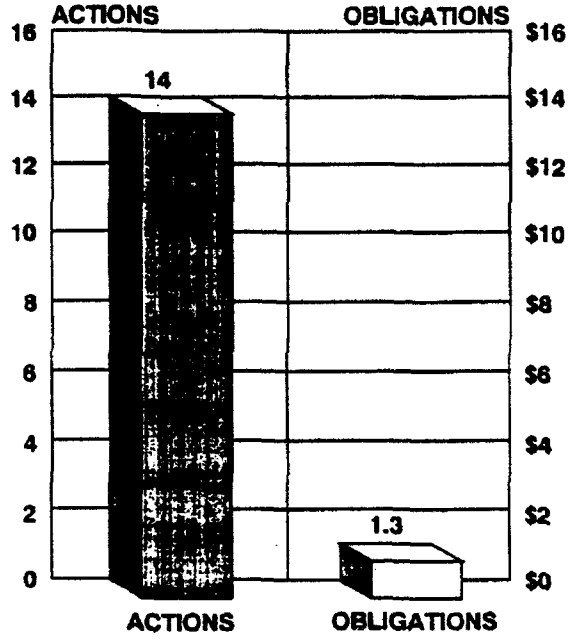
Vehicle Propulsion Directorate
FY 93 Acquisition Plan
(Estimated obligations in millions)



Most actions are grants to colleges and universities.

J-FY93 F-17b

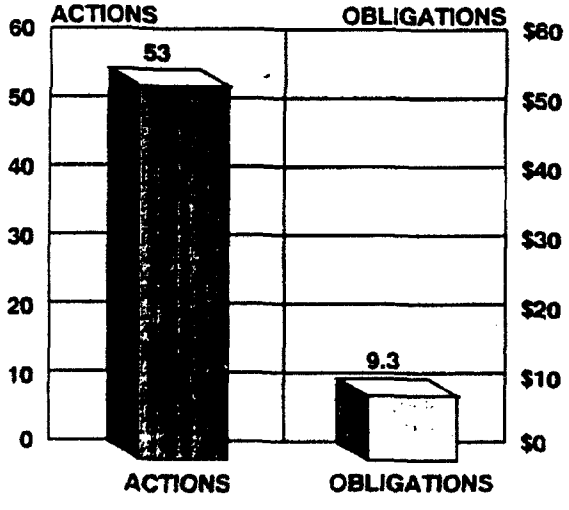
Vehicle Structures Directorate
FY 93 Acquisition Plan
(Estimated obligations in millions)



Most actions are planned for colleges and universities.

J-FY93 F-17b

ACAP Directorate
FY 93 Acquisition Plan
(Estimated obligations in millions)

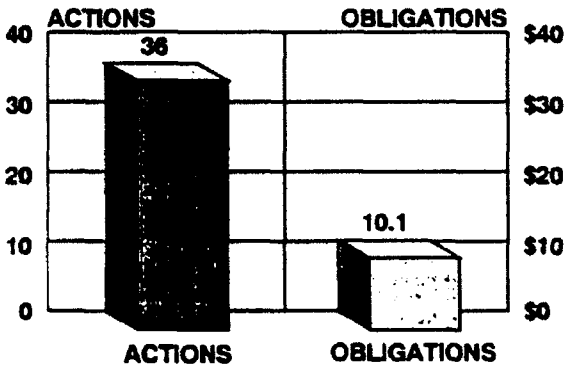


Omnibus Tech Base Contract, 4th Quarter Award

Most others are modifications

J-FY93 F-17a

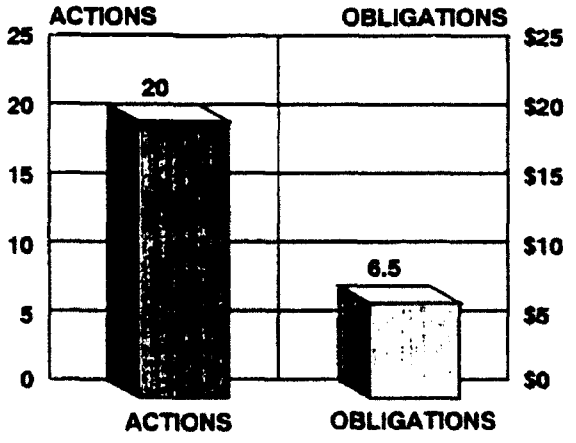
OPS Directorate
FY 93 Acquisition Plan
(Estimated obligations in millions)



Most competitive actions are estimated under $100K, larger actions are modifications.

J-FY93 P-179

Technical Directors Office
FY 93 Acquisition Plan
(Estimated obligations in millions)



Most actions are modifications to existing contracts

J-FY93 P-171

National Technology Policy

... My technology policy consists of six broad initiatives aimed at helping Americans develop and quickly utilize new technologies:

1. **Investing in 21st century infrastructure**
2. **Establishing education and training programs for a high skill workforce ;**
3. **Investing in technology programs that empower America's small businesses ;**
4. **Refocusing Federal R&D programs on critical technologies that enhance industrial performance ;**
5. **Leveraging the national R&D investment; and**
6. **Creating a world class business environment for private sector investment and innovation.**

President Bill Clinton
Technology: The Engine of Economic Growth
September 21, 1992

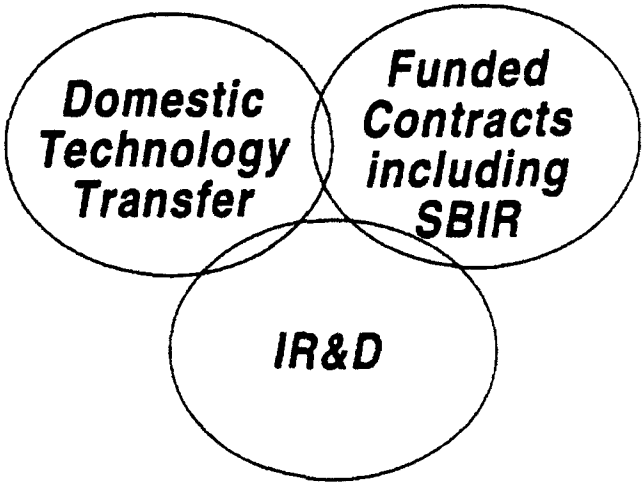
ARMY RESEARCH LABORATORY

Interfacing with ARL

Dr. Alan J. Goldman
Chief
Technology Transfer Division,
Advanced Concepts and Plans Directorate
(301) 394-2410

Purpose

- Mechanism for learning about ARL interests and potential contracts
- Formal programs involving contractor efforts
- Identify points of contact to get additional information



Agenda

TILO	• Technical and Industrial Liaison Programs
DTT	• Domestic Technology Transfer – CRDAs and PLAs
SBIR	• Small Business Innovation Research
IR&D	• Independent Research and Development
ACT	• Advanced Concepts and Technology

Technical & Industrial Liaison Office

- Advanced planning information
  - APBI
  - Broad Agency Announcement
  - Descriptive Information
- Match-making
- Unsolicited Proposal guidance
- Potential contractor program
- R&D unfunded studies

GRAPHICS-ARL - 90
5-TILO APBI/G (GB)

Current Broad Agency Announcement (BAA)

- Issued October 1992
- Open for 1 year or until superseded
- Ninety research topics described in detail
- Technical areas of interest delineated
- Minimum five percent of funds for institutions of higher learning set aside for HBCU/MI

GRAPHICS-ARL - 93
5-Current Broad APBI/G (GB)

Domestic Technology Transfer

Federal Technology Transfer Laws

The Stevenson Wydler Act (1980) and the Federal Technology Transfer Act (1986) (15 USC 3701 et seq) mandate active technology transfer from all Federal Laboratories to the to the Private Sector.

- **Provides authority to enter Cooperative R&D Agreements and exclusively license intellectual property (15 USC 3710a)**
- **Charters the Federal Lab Consortium network to help locate technology**
- **Emphasizes cooperation/support for Small Businesses**
- **Provides minimum 15% of royalties to inventors and the majority of the balance to labs**

Technology Transfer Mechanisms

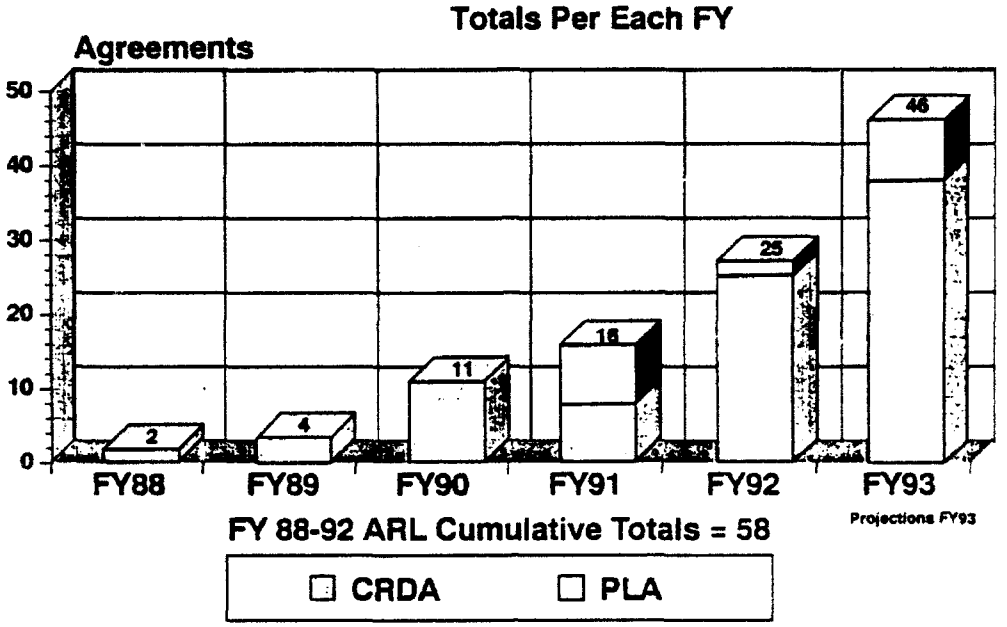
CRDA: Cooperative Research and Development Agreements

- **A pledge by a government laboratory and industry/ academia to conduct joint R&D**
- **Government provides technical personnel, services, facilities, equipment and other resources, but no funds**
- **Industry / academia provide funds (if necessary), technical personnel, services, facilities, equipment and other resources**
- **Agreement defines sharing of intellectual property**

PLA: Patent Licensing Agreements

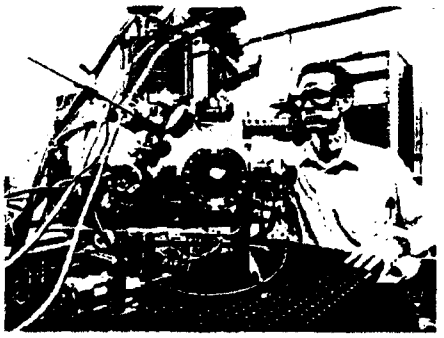
- **Provide financial incentive to inventors and labs**
- **Assure transition of technology to private sector**

ARL Approved CRDAs/PLAs



Selected Examples

CRDA



- Martin Goffman Associates with Army Electronics and Power Sources Directorate
- E&PS Eximer Laser used by Goffman for R&D in Superconductors
- Applications:
  - High Temp Superconductor for Infrared Detection
  - Low Temp Superconductor for Electronic Devices

PLA

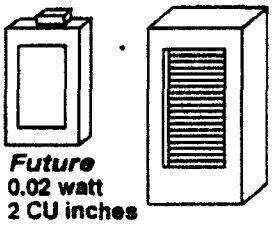
Crystal Oscillator Technology

Patent Licensing

Present
0.4 watt
5 CU inches

Technology Trends:

- Lower Power Consumption
- Lighter and Smaller
- More Stable (Better Compensated) Frequency Output
- Immune to Vibrations
- Immune to Radiation



Future
0.02 watt
2 CU inches

Past
power: 0.5 watt
volume: 16 CU inches

CRDA: Potential Research Areas

- Microelectronic Materials, Devices & Circuit Research
- Advanced Aerospace Materials Research & Analysis
- New Materials Stress-Strength-Inspection Technologies (For Both Air & Ground Vehicles)
- High Capacity Batteries & Energy Storage Technologies
- Sensor Fusion Technology

GRAPHICS-ARL - 93
S-Polen. Research APB/G (R11)

CRDA: Potential Research Areas (Continued)

- Autonomous/Robotic Vehicle Research
- Vehicle Structure & Propulsion Systems Research
- Atmospheric Characterization at all Acoustic & Electromagnetic Wavelengths
- Solderability Techniques
- Survivability/Lethality Analysis

GRAPHICS-ARL 93
S-Polen. Research (Cont.) APB/G (R12)

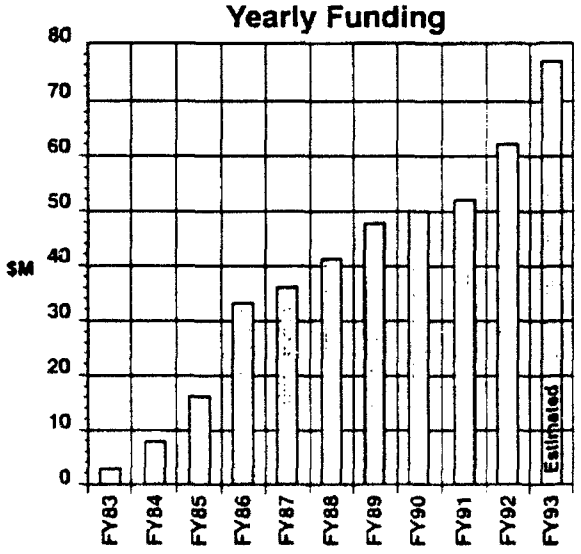
ARL Unique Facilities Suitable for Potential CRDAs

- Microwave/Millimeter wave Design Center
- Nanoelectronics Fabrication Facility
- Cray 2 Facility
- Pulse Power Facility
- Fifty Wind Tunnel Configurations (Sub-, Trans-, Supersonic Flow Rates)
- Small/Medium/Large Caliber Research Facility
- Robotics and Automated Control Laboratory
- Adhesive Bonding Microfactory
- One of the largest (250') Crash Towers in Existence
- Molecular Beam Epitaxy Facility
- Triaxis Vibrator Facility
- High Power Microwave/Flash X-Ray/EMP Facilities
- Electro-Optical Vulnerability Assessment Facility (EOVAF)

ARL CI
D-Goldman 13ARL Unique facilities

Army SBIR Program History

Leverage Small Business Capabilities



Phase I
Technical Feasibility ($100K Max, 6 months)

Phase II
R&D Effort ($750K Max, 2 years)

Phase III
Transition (No SBIR $)
- Commercialize Products
- Other Government Funding

ARL CI
D-Goldman SBIR Prog Hist

SBIR

Composite Materials Braider
US Composites Corporation

Fabrication of Fiber Reinforced
Polymer Composite Curved Parts

MILITARY USES	COMMERCIAL USES
Howitzer Parts	Golf Shafts
Rocket Launch Tubes	Surgical Tools
Rocket Motor Cases	Satellite Structures
Lightweight Bridging	Aircraft Propellors

SBIR

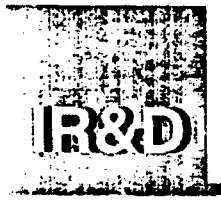
FY93 Schedule

- **Issue Solicitation. . . . . 1 May**
  (announced in Commerce Business Daily)
- **Proposals Due . . . . . 1 July**
- **Phase I winners selected. . . . . 1 September**
- **Phase II winners selected . . . . . Approx. 9 months after Phase I award**

Industry Independent Research & Development

- Company Funded, Reimbursed as Overhead
- Still Very Important
- Recent Improvements
  - Full Reimbursement
  - Reduced Reporting
  - More Frequent Guidance
- Concern--Dwindling Procurement $

GRAPHICS-ARL - 93
J-IR&D Indust. Indep. (G17)



An IR&D Success

Patriot

1960s–Basic Technology Established
- Ferrite Materials
- Ferrite Base Shifters
- Space Fed Phased Array

1970–1984–Basic ATM Capability Established
- Missile and Radar Sensitivity and Sub-Clutter Visibility Enhancements
- Warhead Redesign
- Corelation Subsystem Clutter Canceler
- Fuze Signal Processing
- Software Upgrades
- Warhead Redesign
- Microelectronics Insertion

Result ... *Desert Storm Success*

ARL CI
D-Goldman IRD Success

Advanced Concepts and Technology

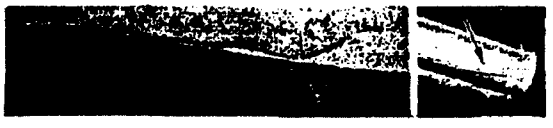
- Encourage Innovation
- Alternative Channel for Good Ideas
- Approximately 2 yrs./$1M max.
- Funded at $4-6 Million per year

GRAPHICS-ARL - 99
J-ACT Advanced Con. (G19)

Computer-Aided Process Design

Steel Heat Treat Process Modeling
Replaces Empirical Approach

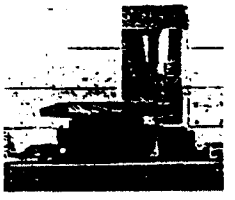
- Reduce Development Time/Cost
- Improve Quality
- Reduce Reject/Rework



Quenched Cracked Barrel

Initial Successful Effort

- Large, Gun Barrels
- ACT, ARDEC Benet Lab & ADLittle
- Problem
  - Quench too quickly–cracks
  - –Quench too slowly–soft steel
- Solution
  - –Modelling for process optimization



Helicopter Gear Dimensional Measurements

Current Effort

- Helicopter Gears
- ACT, AVSCOM, ,ADLittle, Sikorsky
- Commercial Applications
  - Automotive, Nat'l Center for Manufacturing Science
- Problem
  - Heat treat distortion
  - –Causes reject/rework
- Solution
  - –process design by modelling

ARL CI
D-Goldman CAPD

Challenge to Industry

- **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
- **Seek Cooperative Research and Development Agreements (CRDAs) and Patent Licensing Agreements (PLAs)**
- **Inform Army of Accomplishments**
  - Brief Labs & Centers
  - Demonstrate new technologies

GRAPHICS-ARL - 60
J-Challenge to Industry (0321)

POINTS OF CONTACT
"INFORMATION FOR INDUSTRY PROGRAM"

PROCUREMENT	MR. ROBERT M. TOMKO (301) 394-3690
TECHNICAL AND INDUSTRIAL LIAISON OFFICER (TILO)	MR. MELVYN J. SHICHTMAN (301) 394-5075
DOMESTIC TECHNOLOGY TRANSFER COOPERATIVE R&D AGREEMENTS (CRDAs) PATENT LICENSE AGREEMENTS (PLAs)	ARL - MR. MICHAEL CLAFFY (301) 394-4210 ARMY WIDE - MR. CLIFFORD LANHAM (301) 394-4210
SMALL BUSINESS INNOVATION RESEARCH (SBIR)	ARL - MR. M. DEAN HUDSON (301) 394-4808 ARMY WIDE - MR. J. PATRICK FORRY (301) 394-4602
INDEPENDENT RESEARCH AND DEVELOPMENT (IR&D)	ARL - MR. BRYAN D. JOHNSON (301) 394-2410 ARMY WIDE - DR. ALAN J. GOLDMAN (301) 394-2410
INTERNATIONAL PROGRAMS	DR. DAVID C. HODGE (410) 278-5865 MR. FRED ADLER (301) 394-1400

Date: 12/23/92

ARMY ACCEPTED CRDAs/PLAs (ARL)

TOTAL CRDAs: 48 TOTAL PLAs: 10 TOTAL CPAR CRDAs: 0

CONTROL NO: 9211-A-C234 TYPE: CRDA ACCEPTED: 12/07/92
LAB: ARL ORTA POC: Mike Claffy PHONE NO.: 301-394-4210
COMPANY: Adv Lithography Grp
PURPOSE: For development of ion projection lithography.

CONTROL NO: 9209-A-C222 TYPE: CRDA ACCEPTED: 09/30/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: Delco Electronics
PURPOSE: For R&D of Sequential Electrochemical Reduction Analysis procedures and equipment in a production environment.

CONTROL NO: 9209-A-C221 TYPE: CRDA ACCEPTED: 09/30/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: Texas Instruments
PURPOSE: For R&D of Sequential Electrochemical Reduction Analysis procedures and equipment in a production environment.

CONTROL NO: 9209-A-C220 TYPE: CRDA ACCEPTED: 09/30/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: Johns Hopkins Univ
PURPOSE: For R&D on the monitoring and control of printed circuit board plating thickness.

CONTROL NO: 9209-A-C217 TYPE: CRDA ACCEPTED: 09/29/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: Univ of MD
PURPOSE: To develop Mossbauer Spectroscopy into a process control tool for composite solders.

CONTROL NO: 9208-A-C209 TYPE: CRDA ACCEPTED: 12/17/92
LAB: MTL ORTA POC: Dr. Hamed El-Bisi PHONE NO.: 617-923-5396
COMPANY: Assembly Guidance
PURPOSE: For development of improved processing methods for fabricating parts from composite materials.

CONTROL NO: 9208-A-C207 TYPE: CRDA ACCEPTED: 09/01/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: Washington Univ
PURPOSE: For development of composite solders.

CONTROL NO: 9207-A-C200 TYPE: CRDA ACCEPTED: 08/10/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: Univ of MD
PURPOSE: For development of computerized design models for solder behavior as a function of microstructure.

CONTROL NO: 9207-A-P199 TYPE: PLA ACCEPTED: 08/05/92
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Hewlett-Packard Co
PURPOSE: For a partially exclusive license for U.S. Patent No. 4,410,902, entitled "Planar Doped Barrier Semiconductor Device".

CONTROL NO: 9207-A-C198 TYPE: CRDA ACCEPTED: 07/23/92
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Techtrol Cyclonetics
PURPOSE: For R&D of ultra-stable low phase noise dielectric resonator oscillators.

CONTROL NO: 9206-A-C194 TYPE: CRDA ACCEPTED: 07/24/92
LAB: MTL ORTA POC: Dr. Hamed El-Bisi PHONE NO.: 617-923-5396
COMPANY: Composite Dvlpmnt
PURPOSE: For full scale fabrication and optimization of composite cylinder processing.

CONTROL NO: 9205-A-C184 TYPE: CRDA ACCEPTED: 06/02/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: Raynet Corp
PURPOSE: For R&D of a surface oxide evaluation system.

CONTROL NO: 9204-A-C176 TYPE: CRDA ACCEPTED: 05/21/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: Harris Corp
PURPOSE: To study the Sequential Electrochemical Reduction Analysis (SERA) technique for measuring solderability of electronic components.

CONTROL NO: 9204-A-C175 TYPE: CRDA ACCEPTED: 05/21/92
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: Motorola, Inc
PURPOSE: To study the Sequential Electrochemical Reduction Analysis (SERA) technique for measuring solderability of electronic components.

CONTROL NO: 9204-A-C173 TYPE: CRDA ACCEPTED: 05/01/92
LAB: ASTD ORTA POC: John Cline PHONE NO.: 804-864-3966
COMPANY: McDonnell Douglas
PURPOSE: For development of a design analysis methodology for a composite helicopter rotor hub.

CONTROL NO: 9203-A-C162 TYPE: CRDA ACCEPTED: 04/17/92
LAB: ASTD ORTA POC: John Cline PHONE NO.: 804-864-3966
COMPANY: McDonnell Douglas
PURPOSE: For wind tunnel testing of the British Program - Type Rotor.

CONTROL NO: 9203-A-C161 TYPE: CRDA ACCEPTED: 04/17/92
LAB: ASTD ORTA POC: John Cline PHONE NO.: 804-864-3966
COMPANY: McDonnell Douglas
PURPOSE: For experimental and analytical impact dynamics research for composite rotorcraft structures.

CONTROL NO: 9203-A-C160 TYPE: CRDA ACCEPTED: 05/29/92
LAB: ASTD ORTA POC: John Cline PHONE NO.: 804-864-3966
COMPANY: Bell Helicopter
PURPOSE: For research on composite flexures for rotor hub applications.

CONTROL NO: 9201-A-C143 TYPE: CRDA ACCEPTED: 02/05/92
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Alpha Industries
PURPOSE: For development of novel semiconductor devices based on planar doped barrier structures.

CONTROL NO: 9111-A-C136 TYPE: CRDA ACCEPTED: 12/19/91
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: MCNC
PURPOSE: For development of a plasma assisted dry soldering procedures and equipment.

CONTROL NO: 9110-A-C128 TYPE: CRDA ACCEPTED: 11/22/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: NJ Inst of Tech
PURPOSE: For development of ultra-high speed and millimeter wave electronic devices.

CONTROL NO: 9110-A-C126 TYPE: CRDA ACCEPTED: 11/22/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Stevens Inst of Tech
PURPOSE: For R&D on optoelectronic device physics and engineering with applications to microwave and optical integrated circuits.

CONTROL NO: 9110-A-C125 TYPE: CRDA ACCEPTED: 11/22/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Rutgers Univ
PURPOSE: For development of smart ceramic materials.

CONTROL NO: 9110-A-C124 TYPE: CRDA ACCEPTED: 11/22/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Rutgers Univ
PURPOSE: For R&D on laser ablation of ferroelectric and high-temperature superconducting thin films.

CONTROL NO: 9110-A-C123 TYPE: CRDA ACCEPTED: 11/22/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Rutgers Univ
PURPOSE: For development of hermetic coatings for optical waveguides.

CONTROL NO: 9107-A-C113 TYPE: CRDA ACCEPTED: 08/20/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Electronics Concepts
PURPOSE: To design and evaluate state-of-the-art high energy density film capacitors.

CONTROL NO: 9107-A-C107 TYPE: CRDA ACCEPTED: 08/01/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Neocera, Inc
PURPOSE: For the development of processes for preparing films of high transition-temperature (high-Tc) superconducting materials on single cyrstal.

CONTROL NO: 9107-A-P106 TYPE: PLA ACCEPTED: 12/02/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Alpha Industries
PURPOSE: For a partially exclusive license for U.S. Patent No. 4,410,902, entitled "Planar Doped Barrier Semiconductor Device".

CONTROL NO: 9103-A-C093 TYPE: CRDA ACCEPTED: 04/09/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Shipley Co, Inc
PURPOSE: For the development of improved electron beam sensitive resists for use in the microelectronics industy.

CONTROL NO: 9102-A-C086 TYPE: CRDA ACCEPTED: 03/04/91
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: Intgrt Tech for Med
PURPOSE: For fabrication and evaluation of microfluidic components.

CONTROL NO: 9101-A-C083 TYPE: CRDA ACCEPTED: 02/08/91
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: VPI & State Univ
PURPOSE: To jointly develop, test and evaluate the use of fluidic technologies coupled with fiber optic systems.

CONTROL NO: 9101-A-P082 TYPE: PLA ACCEPTED: 01/23/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Ball Corp
PURPOSE: For a partially exclusive license for a Dual Mode Quartz Thermometric Sensing Device, U.S. Patent No. 4,872,765.

CONTROL NO: 9101-A-P081 TYPE: PLA ACCEPTED: 01/23/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Frequency Electronic
PURPOSE: For a partially exclusive license for a Dual Mode Quartz Thermometric Sensing Device, U.S. Patent No. 4,872,765.

CONTROL NO: 9101-A-P080 TYPE: PLA ACCEPTED: 01/23/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Motorola, Inc
PURPOSE: For a partially exclusive license for a Dual Mode Quartz Thermometric Sensing Device, U.S. Patent No. 4,872,765.

CONTROL NO: 9101-A-P079 TYPE: PLA ACCEPTED: 01/23/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Piezo Crystal Co
PURPOSE: For a partially exclusive license for a Dual Mode Quartz Thermometric Sensing Device, U.S. Patent No. 4,872,765.

CONTROL NO: 9101-A-P078 TYPE: PLA ACCEPTED: 01/23/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Piezo Technology
PURPOSE: For a partially exclusive license for a Dual Mode Quartz Thermometric Sensing Device, U.S. Patent No. 4,872,765.

CONTROL NO: 9101-A-P077 TYPE: PLA ACCEPTED: 01/23/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Q-Tech Corp
PURPOSE: For a partially exclusive license for a Dual Mode Quartz Thermometric Sensing Device, U.S. Patent No. 4,872,765.

CONTROL NO: 9101-A-P076 TYPE: PLA ACCEPTED: 01/23/91
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Vectron Labs
PURPOSE: For a partially exclusive license for a Dual Mode Quartz Thermometric Sensing Device, U.S. Patent No. 4,872,765.

CONTROL NO: 9011-A-C073 TYPE: CRDA ACCEPTED: 03/04/91
LAB: MTL ORTA POC: Dr. Hamed El-Bisi PHONE NO.: 617-923-5396
COMPANY: PPG Industries, Inc
PURPOSE: For characterization and possible further development of oxynitride glass fibers.

CONTROL NO: 9010-A-C071 TYPE: CRDA ACCEPTED: 11/06/90
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Norden Systems, Inc
PURPOSE: For development of a portable flat panel display workstation.

CONTROL NO: 9009-A-P066 TYPE: PLA ACCEPTED: 11/29/90
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: Defense Res Tech
PURPOSE: For an exclusive license for fluidic mud pulsers, U.S. Patent Nos.: 4,276,943; 4,291,395; 4,323,991; 4,391,299; 4,557,295.

CONTROL NO: 9008-A-C062 TYPE: CRDA ACCEPTED: 09/06/90
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Rutgers Univ
PURPOSE: To advance the development of ultra high speed and millimeter wave electronic devices.

CONTROL NO: 9006-A-C056 TYPE: CRDA ACCEPTED: 07/20/90
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: M/A-COM
PURPOSE: To perform cooperative research, test and evaluate the operation and damage characteristics of solid-state PIN diodes.

CONTROL NO: 9006-A-C055 TYPE: CRDA ACCEPTED: 07/20/90
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: McDonnell Douglas
PURPOSE: To design, develop, evaluate and test Artificial Intelligence/expert computer software systems and their supporting technologies such as terrain reasoning.

CONTROL NO: 9006-A-C053 TYPE: CRDA ACCEPTED: 07/12/90
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: Rockwell Intntl Corp
PURPOSE: To test and evaluate automated 3-D X-Ray equipment in a production environment.

CONTROL NO: 9005-A-C052 TYPE: CRDA ACCEPTED: 07/02/90
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: Grumman Aerospace
PURPOSE: To test and evaluate an analog electronic device to clip or limit the amplitude of a transmission signal.

CONTROL NO: 9002-A-C038 TYPE: CRDA ACCEPTED: 03/06/90
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Martin Marietta Corp
PURPOSE: For development of a permanent magnet system for a microwave tube.

CONTROL NO: 8912-A-C036 TYPE: CRDA ACCEPTED: 01/18/90
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: J&S Software Dvlpmt
PURPOSE: For development of systems operation software which would be applicable for large IMB compatible environments.

CONTROL NO: 8912-A-C035 TYPE: CRDA ACCEPTED: 01/09/90
LAB: MTL ORTA POC: Dr. Hamed El-Bisi PHONE NO.: 617-923-5396
COMPANY: WAMDP, Inc
PURPOSE: For development of advanced automated manufacturing systems.

CONTROL NO: 8911-A-C033 TYPE: CRDA ACCEPTED: 12/29/89
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANIES: Emcore Corp; American Cyanamid; Polytechnic Univ
PURPOSE: To investigate how to improve the quality of OMVPE-grown structures and to attempt to find substitutes for highly toxic gases.

CONTROL NO: 8909-A-C029 TYPE: CRDA ACCEPTED: 10/03/89
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Martin Goffman Ascts
PURPOSE: For development of optical, infrared, and microwave detectors using superconducting technology.

CONTROL NO: 8909-A-C028 TYPE: CRDA ACCEPTED: 10/06/89
LAB: HDL ORTA POC: Norma Vaught PHONE NO.: 301-394-2952
COMPANY: LTS Corp
PURPOSE: For development of a laser microscopy system for the commercial market.

CONTROL NO: 8908-A-C024 TYPE: CRDA ACCEPTED: 09/22/89
LAB: MTL ORTA POC: Dr. Hamed El-Bisi PHONE NO.: 617-923-5396
COMPANY: Owens-Corning
PURPOSE: For conducting tensile testing and chemical analysis of specimens of novel oxynitride glass fibers.

CONTROL NO: 8908-A-C023 TYPE: CRDA ACCEPTED: 09/22/89
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: EMC Technology, Inc
PURPOSE: For designing, developing and evaluating high performance digitally programmable attenuators, components, circuits and subassemblies.

CONTROL NO: 8905-A-C018 TYPE: CRDA ACCEPTED: 06/21/89
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Res Triangle Inst
PURPOSE: For E-Beam Probing of Differential Cascode Voltage Switch (DCVS).

CONTROL NO: 8809-A-C005 TYPE: CRDA ACCEPTED: 10/21/88
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Electromagnetic Sci
PURPOSE: For millimeter wave high power ferrite control devices.

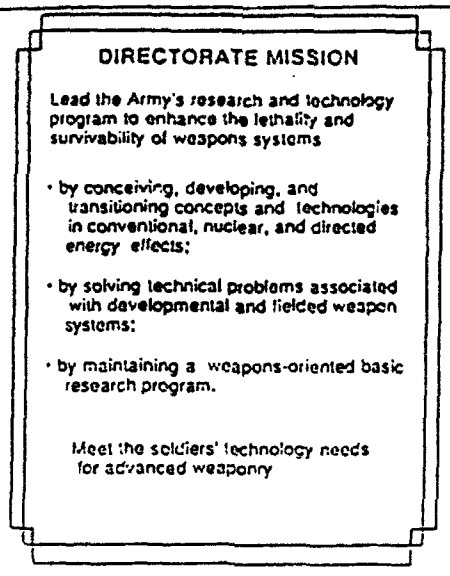
CONTROL NO: 8806-A-C003 TYPE: CRDA ACCEPTED: 07/11/88
LAB: ETDL ORTA POC: Dick Stern PHONE NO.: 908-544-4666
COMPANY: Trontech
PURPOSE: For development of high frequency oscillators and amplifiers.

CONTROL NO: 8804-A-C002 TYPE: CRDA ACCEPTED: 07/11/88
LAB: MTL ORTA POC: Dr. Hamed El-Bisi PHONE NO.: 617-923-5396
COMPANY: Dow Chemical
PURPOSE: For development of advanced ceramic engine components and advanced lightweight armor applications.

ARMY RESEARCH LABORATORY

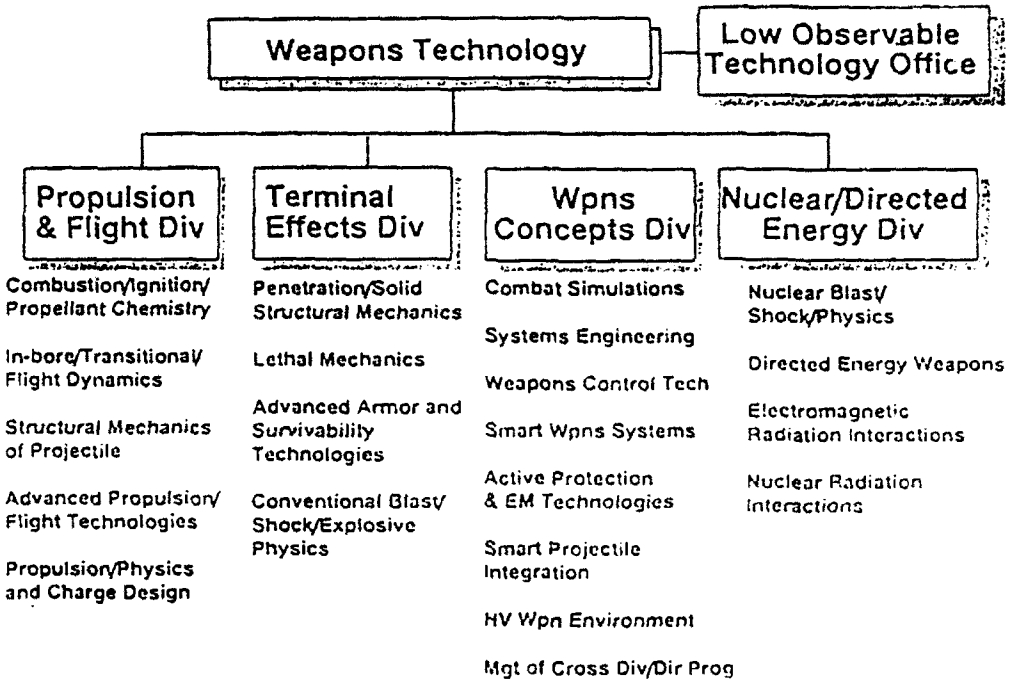
Weapons Technology

Dr. John Frasier
Directorate Executive
Weapons Technology (WTD)
(410) 278-6244



The mission is detailed on this chart. Research is pursued in energetic materials dynamics, propulsion/flight physics, projectile/warhead mechanics, terminal effects phenomena, armor/survivability technologies, advanced munition/weapons concepts, nuclear weapons effects/survivability technologies, directed energy effects, low observable technologies and system effectiveness analysis. The primary customers are those who develop weapons systems which enhance the lethal defense posture. WTD supports the Army RDE Centers, other Commands, other Services, and various PEOs and PMs such as PEO Armored Systems Modernization, PEO for Intelligence and Electronic Warfare, PM for Tank Main Armament Systems and PM for Advanced Field Artillery Systems. Major efforts include support for the liquid propellant and unicharge candidate selection and studies on electrothermal chemical propulsion.

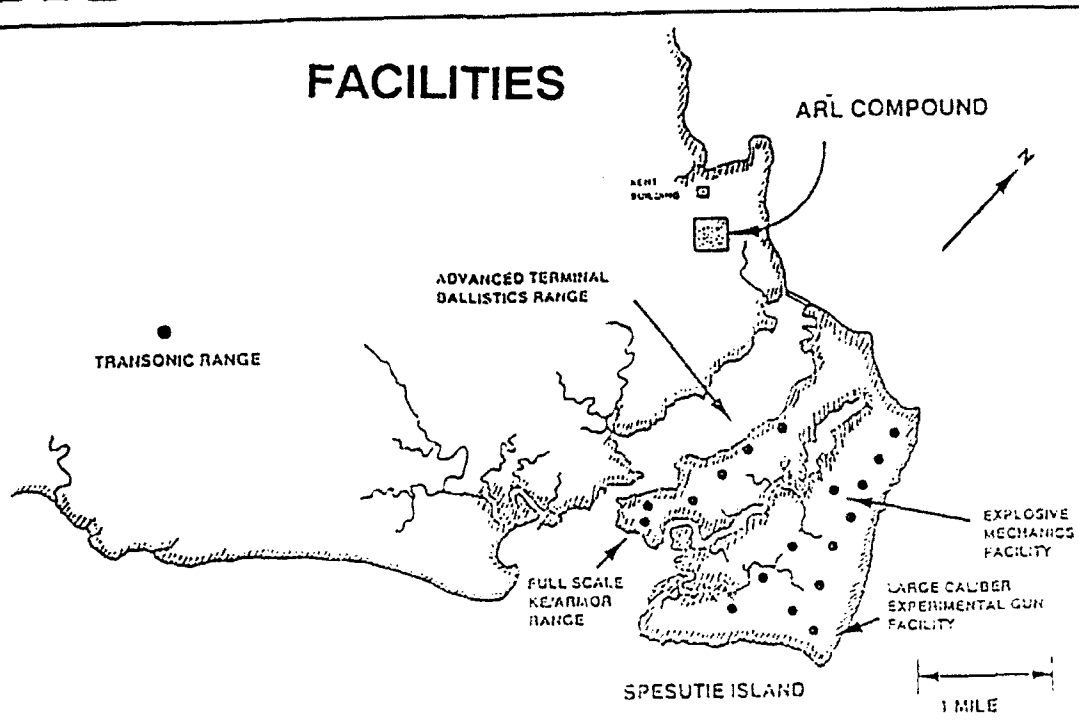
WEAPONS TECHNOLOGY DIRECTORATE



DIRECTORATE SNAPSHOT

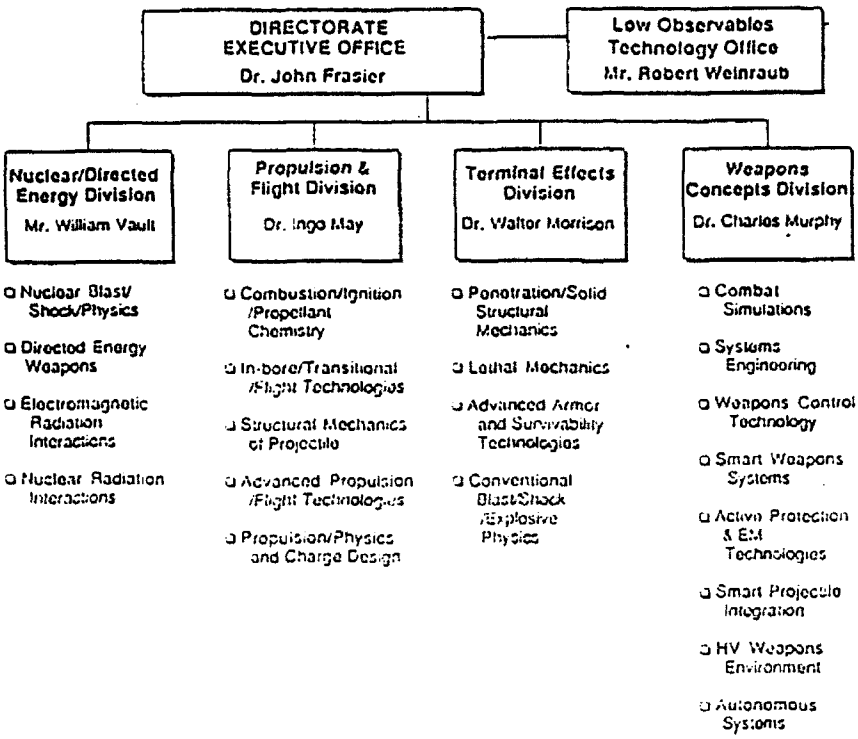
This is as good as any way to quickly get an understanding of the current organization. While keeping the "traditional" ballistic mission of BRL, WTD has surrendered the high performance computing mission and the ballistic survivability/ lethality assessment mission. Low observable technology and the nuclear and directed energy missions were added. We have already noticed some interesting collaboration opportunities as a result of these new communication channels in ARL.

FACILITIES



WTD has a number of experimental test facilities, most of which are located on Spesutie Island in the flats of the Susquehanna River. They include energetics/ explosive test facilities, high pressure facilities, shock tubes, a transonic ballistic facility, a closed facility for containing depleted uranium shote. The Adelphi Site of ARL houses the Aurora gamma ray facility and EMP simulators are located at the Woodbridge Site.

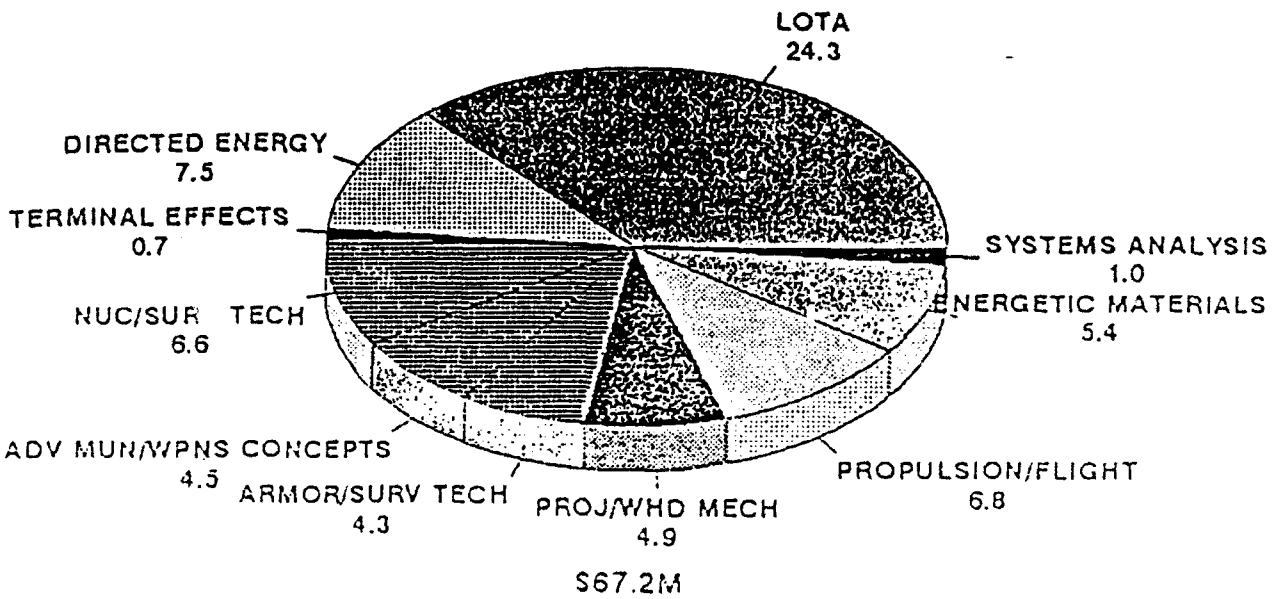
WEAPONS TECHNOLOGY DIRECTORATE



FLOW OF THE BRIEFING

Today I will start with two general funding charts. Then I will generally move left to right through the technical focus of each division. At the end I'll finish with a few real and immediate business opportunities that are important to us and may be of interest to you.

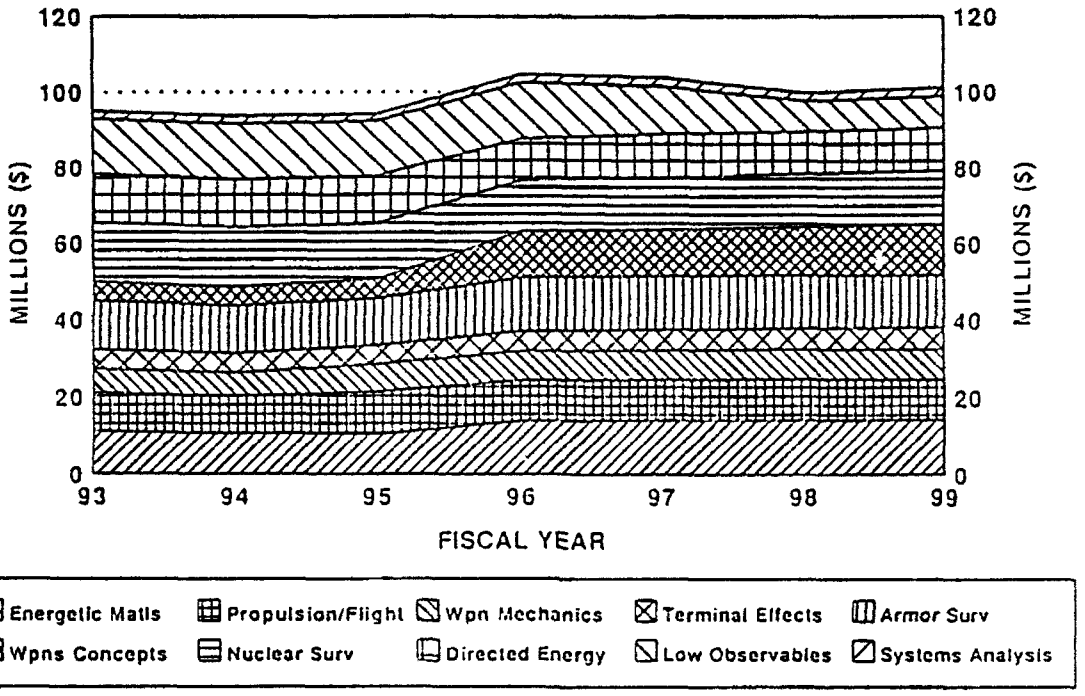
WEAPONS TECHNOLOGY DIRECTORATE
FUNDING BY BUSINESS SUB-AREA ($M)



FUNDING PIE

By business area, you can see that the low observable technology area has significant current funding levels. The rest is relatively equally divided among the traditional ballistic and nuclear/directed energy lines.

WEAPONS TECHNOLOGY DIRECTORATE
TOTAL REVENUE BY COMPETENCY SUB-ELEMENT



FUNDING PROJECTIONS

If you care to have faith in future funding projections or in stable world political and economic events this may be of value. Only one comment here , the weapons concepts work which I will talk to later shows a trend upward from FY95-FY96.

NUCLEAR AND DIRECTED ENERGY DIVISION

Technical Focus

- RF/DIRECTED ENERGY WEAPON RESEARCH
  - HPM SOURCES, ANTENNAS, MODE CONVERTERS
  - COMPACT, RUGGED PULSE POWER SOURCES
  - HPM TESTING OF MILITARY SYSTEMS
  - HPM HARDENING TECHNOLOGY AND DEVICES
  - HPM WEAPONS EFFECTIVENESS MODELING
- NUCLEAR SURVIVABILITY RESEARCH
  - SURVIVABILITY ENHANCEMENT TECHNOLOGY
  - ELECTROMAGNETIC SHIELDING AND BLAST/THERMAL RESPONSE OF NONMETALLIC MATERIALS
  - IMPROVED PREDICTION AND ANALYSIS CODES
  - SURVIVABLE ELECTRONICS AND MATERIALS

WEAPONS TECHNOLOGY DIRECTORATE NDED

The focus of NDED is listed here. Both the feasibility and effectiveness of DE weapons are of interest as well as measures to protect U.S. systems. This includes HPM sources, antemmas and pulsed power, testing, modeling and hardening. Nuclear hardening of future systems includes state-of-the-art electronics and nonmetallic structures which pose a special challenge for prediction and analysis codes necessary to evaluate future weapons environments and design trade-offs.

PROPULSION & FLIGHT DIVISION

Technical Focus

- Interior, exterior and transitional ballistics
- Mechanics and dynamics of projectiles
- Advanced projectile, propulsion and flight concepts for chemically and electrically-powered guns
- State-of-the art models and design methodologies
- Transition of Projectile, Propulsion, and Flight Technologies to RDEC's, PEO's/PMs and Industry

WEAPONS TECHNOLOGY DIRECTORATE PFD

Emphasis here is in the state-of-the-art models and design methodologies. Novel concepts being explored are low vulnerability propellants, electrothermal gun propulsion, drag-reducing propulsion for KE projectiles, bulk-loaded and regenerative liquid propellant guns, laser initiation for large caliber guns, ram accelerators, and composites for lightweight ballistics.

TERMINAL EFFECTS DIVISION

Technical Focus

- Lethality
  - KE Penetrators
  - Ballistic Shock Damage
- Survivability
  - Armors (Passive, Reactive, Special)
  - Electromagnetic Armor
  - Insensitive Munitions
  - Ammunition Compartmentalization
- Computational Terminal Ballistics
  - Material Modeling
  - Simulation of DE/EFP/KE Target Interactions
  - Simulation of Advanced Armor Configurations
  - Simulation of Vehicle Response to Ballistic Events

WEAPONS TECHNOLOGY DIRECTORATE
TED

Here we look at both sides of the lethality-survivability issue with a combination of experiments, models, theory, and simulations.

WEAPONS CONCEPTS DIVISION

Technical Focus

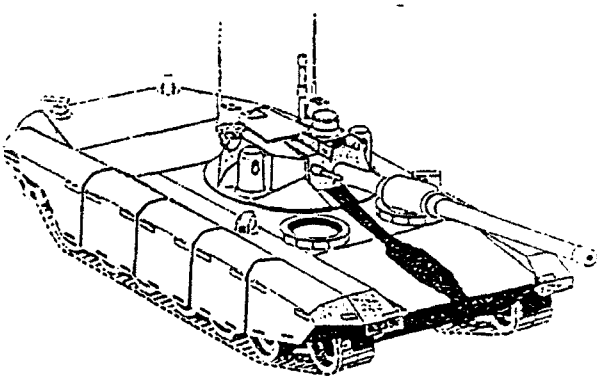
- **Active Protection Systems**
- **Hypervelocity Ballistics**
- **Hybrid In-bore Ramjet Technology**
- **Low Vulnerability Ammunition**
- **Robotics and Autonomous Systems**
- **Combat / Technology Simulations**
- **Generic Systems Effectiveness**

WEAPONS TECHNOLOGY DIRECTORATE
WCD

Emphasis here is in the novel leap-ahead technologies and systems. If there is an area of growth or increased emphasis it is in weapons concepts and systems analysis. It is in this Directorate that you will find three of the ARL focus programs that were discussed by Mr. Vitali.

ARL Focus Programs

Advanced Armored Vehicle Technology



KEY PLAYERS

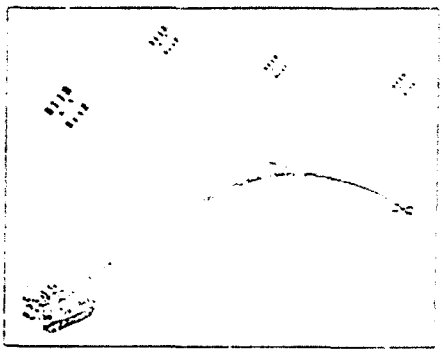
ARL	
(WTD)	Weapons Technology Directorate (lead)
(HRED)	Human Research & Engineering Directorate
(MATD)	Materials Directorate
(VSD)	Vehicle Structures Directorate
(SLAD)	Survivability/Lethality Analysis Directorate
(EPSD)	Electronics & Power Sources Directorate
(SID)	Sensors, Signatures, Signal & Information Processing Directorate
(VPD)	Vehicle Propulsion Directorate
Other Army	
(TACOM)	Tank-Automotive Command
(ARDEC)	Armament RDE Center

Key to the focus programs is the across ARL scope of the research. By bringing the diverse expertise of ARL together, novel future systems can be evaluated. We certainly cannot work in a vacuum in these areas and as you can see we want to get all the right technologists involved from other government labs and the private sector.

WEAPONS TECHNOLOGY DIRECTORATE

ARL Focus Programs

Advanced Artillery Technology



KEY PLAYERS

ARL

(WTD)	Weapons Technology Directorate	(Lead)
(HRED)	Human Research & Engineering Directorate	
(BED)	Battlefield Environment Directorate	
(SSID)	Sensors, Signatures, Signal & Information Processing Directorate	
(MATD)	Materials Directorate	
(SLAD)	Survivability/Lethality Analysis Directorate	

Other Army

(Ft. Sill)	Artillery Center & School
(ARDEC)	Armament RDE Center
(MICOM)	Missile Command
(AMSAA)	Army Material Systems Analysis Activity
(SARDA)	Office of Secretary of the Army (RDA)

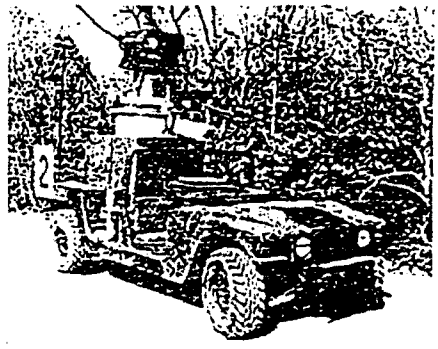
Other Government

Sandia National Laboratories

WEAPONS TECHNOLOGY DIRECTORATE

ARL Focus Programs

Autonomous Systems Science and Technology



KEY PLAYERS

ARL

(WTD)	Weapons Technology Directorate (lead)
(HRED)	Human Research & Engineering Directorate
(SID)	Sensors, Signatures, Signal & Information Processing Directorate
(EPSD)	Electronics & Power Sources Directorate

Other Army

(CRDEC)	Chemical RDE Center
(TACOM)	Tank-Automotive Command
(CSTA)	Combat Systems Test Activity Tooele Army Depot
(CAC)	Combined Arms Center

Other Government

(JPO-UGV)	Joint Project Office for Unmanned Ground Vehicles
(ORNL)	Oak Ridge National Laboratory
(NIST)	National Institute for Standards & Technology
(JPL)	Jet Propulsion Laboratory

Industry

FMC Corporation

Odetics, Inc.
Alliant Tech, Inc.

Dynamic System Technology, Inc.

BROAD AGENCY ANNOUNCEMENT

Low Observable Technology
High Power Microwave Technology
Non-nuclear EMP Technology
Nuclear Survivability

The Weapons Technology Directorate topics in the current BAA are limited to the Low Observable Technology Office and the Nuclear/Directed Energy Division areas of interest. 10 research areas are related to low observables, 5 are in the radio frequency directed energy area and 3 involve nuclear survivability research. These topics are open through September 30, 1993. Instructions on how to submit proposals are in the solicitation.

SMALL BUSINESS INNOVATION RESEARCH (SBIR)

- Magnetic Launch Coils for Flat Plates
- Algorithmic Aspects of Computational Terminal Ballistics
- Material Modeling in Computational Terminal Ballistics
- Geometry & Vulnerability Descriptions for Helicopters

The next SBIR solicitation is concerned with the above subjects. We are striving to make progress in terminal ballistics as we did in the free flight computational fluid dynamics. Active protection systems need to consider electromagnetic launch rather than explosive launch and the associated problems. A quick-look to get an idea of the effectiveness of a weapons system against a helicopter before an in-depth assessment is made would be a useful evaluation tool.

WEAPONS TECHNOLOGY DIRECTORATE

COOPERATIVE R&D OPPORTUNITIES

Laser Technology Applications
Computational Fluid Dynamics
Explosive Synthesis of Ceramics
New Technologies, Weapons & Concepts
Composites

Technology applications in WTD do not often directly relate to commercial products of great economic importance, however we do contribute to the state-of-the-art in several areas. Here is a list of a few technologies we feel are suitable for joint pursuit. A variety of teaming approaches are possible. If we can leverage our R&D money with outside talent and resources, get a better defense product, and help the economy of the country, or maintain the technical infrastructure, WTD is definitely interested in talking with you.

WEAPONS TECHNOLOGY DIRECTORATE

INTERFACE w/ ARL @ APG

Advanced Concepts and Plans (ACAP)
Technology Transfer Division

Rich Dimmick (410) 278-6955

Mike Rausa (fax) 278-7962

- Industry Programs
- Commercialization of Technology

If you need to know more about opportunities with ARL, Directorates located at Aberdeen Proving Ground or any of the technologies mentioned in the briefing, the Technology Transfer Division is the best place to start.

ARMY RESEARCH LABORATORY

Sensors, Signatures, Signal & Information Processing and Battlefield Combat Identification

Mr. Richard D. Slife
Assistant Director
for Programs, Sensors, Signatures,
Signal and Information Processing (S^3I)
(301) 394-2002

SENSORS, SIGNATURES, SIGNAL AND INFORMATION PROCESSING

PRESENTED AT:

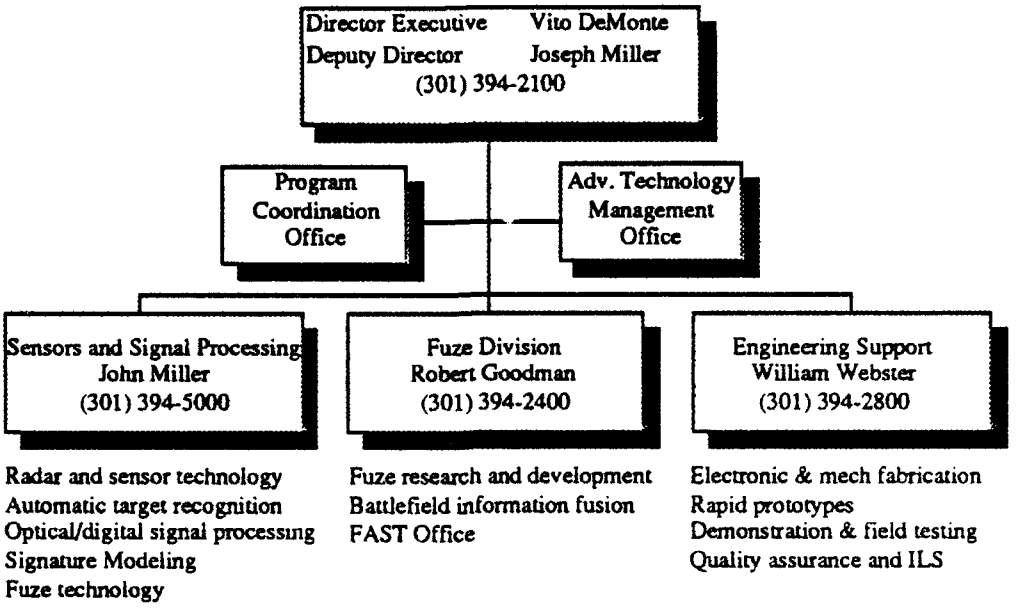
U.S. ARMY RESEARCH LABORATORY
ADVANCE PLANNING BRIEFING
FOR INDUSTRY (APBI)
28 JANUARY 1993

MR. RICHARD SLIFE
ASSISTANT DIRECTOR FOR PROGRAMS
SENSORS, SIGNATURES, SIGNAL AND
INFORMATION PROCESSING

S3I MISSION

Conduct research to create sensor and signal/data processing technologies and concepts capable of adaptive operation and automated fusion as well as supporting real-time information distribution to enable the Army to acquire, locate, identify and engage the enemy in real time and under all battlefield environmental conditions.

S3I ORGANIZATION (FY93)



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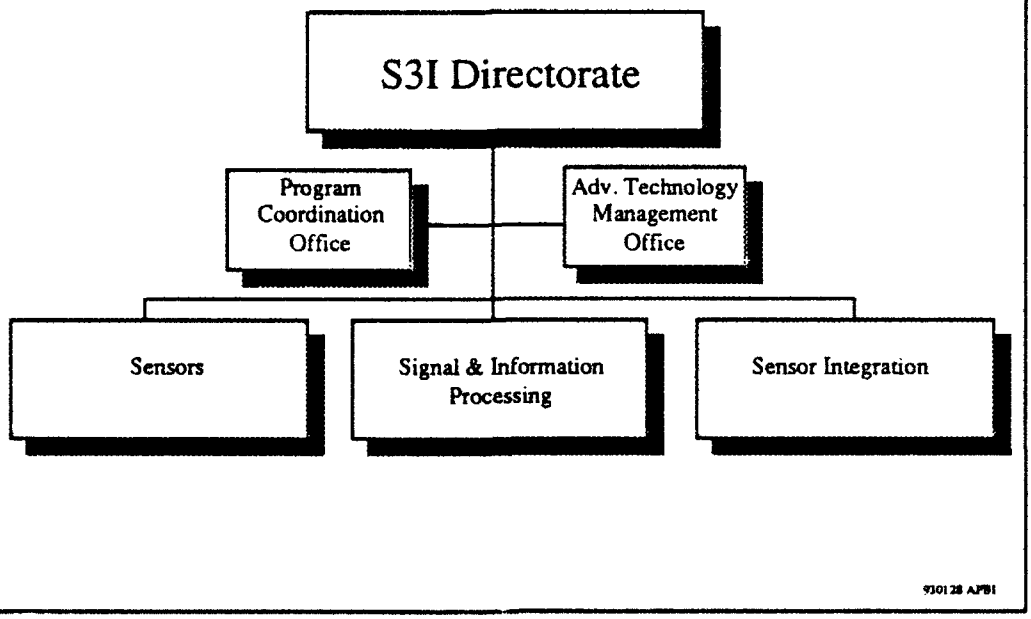
S3I ORGANIZATION (FY97)



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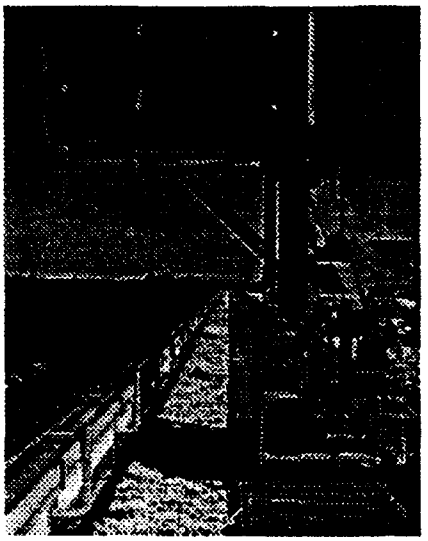
SENSOR TECHNOLOGY

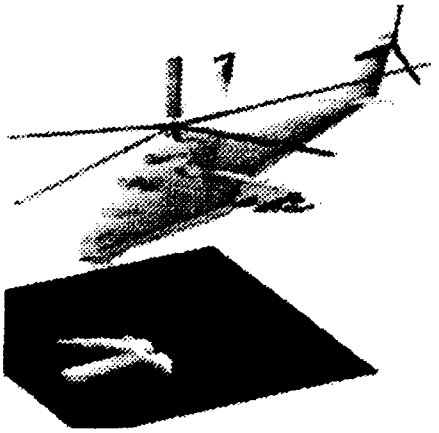


Ultra Wideband Foliage Penetration SAR

Sensor technology developed by S3I enables the detection and engagement of enemy forces. Specific applications developed here include:

- MTI radar for unmanned aerial vehicles
- Synthetic Aperture Radar
- Millimeter Wave Radar
- Guidance Integrated Fuzing

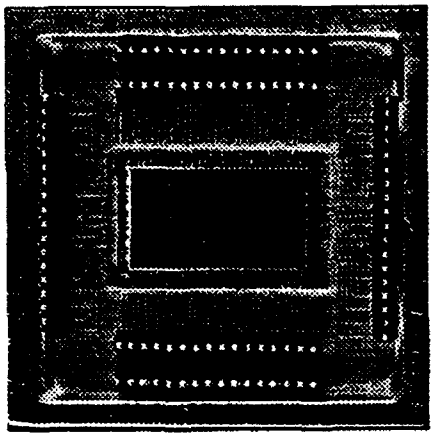
SIGNATURES



Target Signature Modeling

To support the development of advanced sensors and algorithms for future weapon systems, we are researching techniques to improve signature prediction for FLIR, visible, MMW, LADAR, radar, and SAR sensors. As the complexity and degree of these advanced sensor systems increase, the importance of signature modeling in controlling the costs of testing these system concepts becomes significant.

SIGNAL PROCESSING



CCD Array

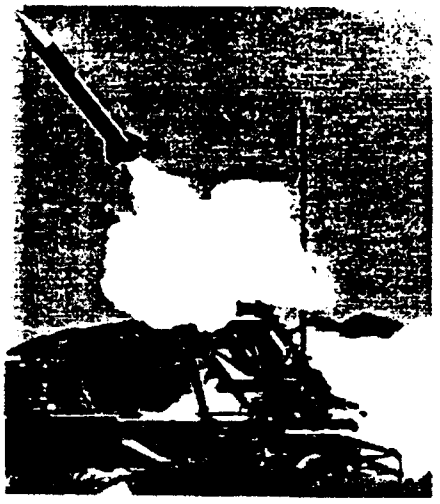
Optical processing modules provide high throughput capability in compact packages. When configured in hybrid optical/digital systems, real-time operation can be achieved for radar, communications, and target recognition applications.

INFORMATION PROCESSING & SENSOR FUSION

Combat Information Processor

The battlefield commander's staff needs to gather, integrate, and process combat information. We have designed the Combat Information Processor and the AI Module to integrate near-real-time information from many sensors and sources to assist the battlefield commander in the decision making process.

FUZE DEVELOPMENT/PRODUCTION

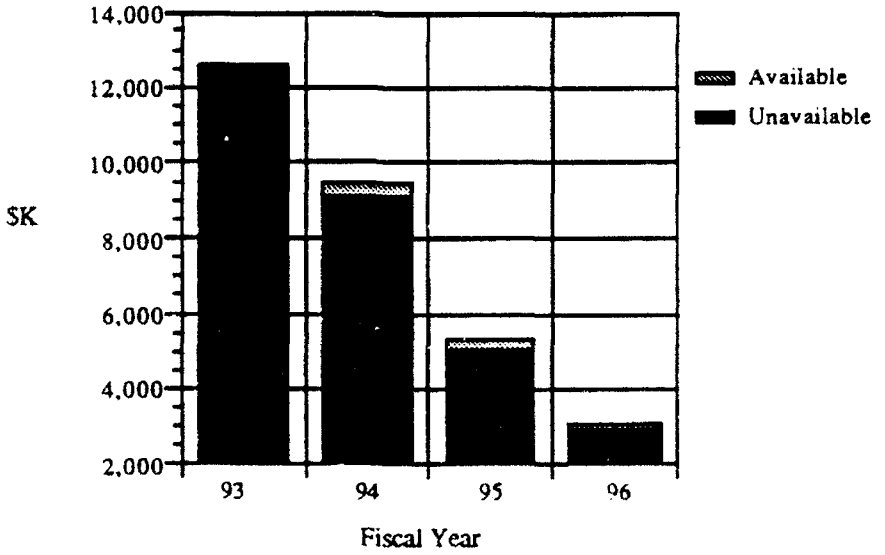


PATRIOT

S3I performs engineering development and production support for fuzes on a selective basis. Fuzes developed here include:

PATRIOT (M818E2)
Chaparral (M817E1)
MOFA (XM773)
M732A2
M734E1

S3I CONTRACT PLAN



RADAR

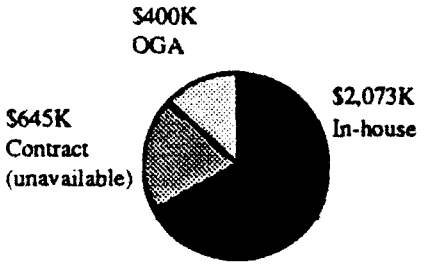
Real Aperture Stationary Target Radar - Detect, discriminate, and classify stationary targets using a low depression angle real aperture radar.

Moving Target Radar Technology - All-weather long-range wide area detection, location, and classification of moving targets.

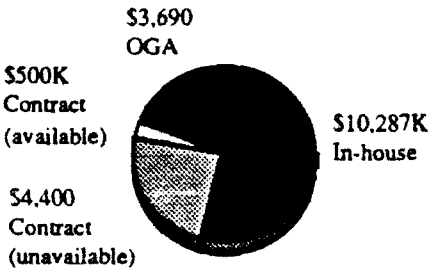
Ultra Wideband Foliage Penetration Synthetic Aperture Radar - All-weather, wide area detection, location and classification of stationary tactical ground targets concealed by foliage, including surface and buried mines.

Jeffrey Sichina, (301) 394-2530
U.S. Army Research Laboratory
ATTN: AMSRL-SS-SG
2800 Powder Mill Road
Adelphi, MD 20783-1145

RADAR FUNDING



FY 93



FY 94-96

PHOTONIC PROCESSING

Develop and demonstrate optical techniques, devices, and modules for real-time, high throughput signal processing applications, with module integration into processing systems.

Research efforts focused in these areas: diffractive optics, optical scale-space processing, higher order statistics, photorefractive processors, integrated photonic processing systems, and coherence and photonic processing.

Dr. John Pellegrino (301) 394-2520
U.S. Army Research Laboratory
ATTN: AMSRL-SS-SF
2800 Powder Mill Road
Adelphi, MD 20783-1145

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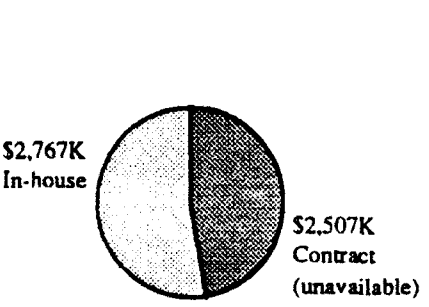
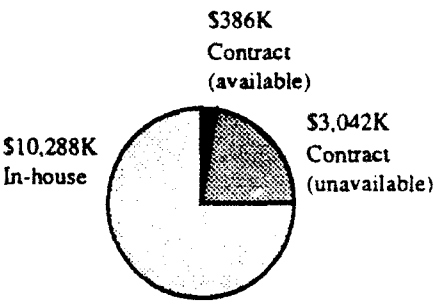
PHOTONIC PROCESSING FUNDING



FY 93



FY 94-96

930128 APBI

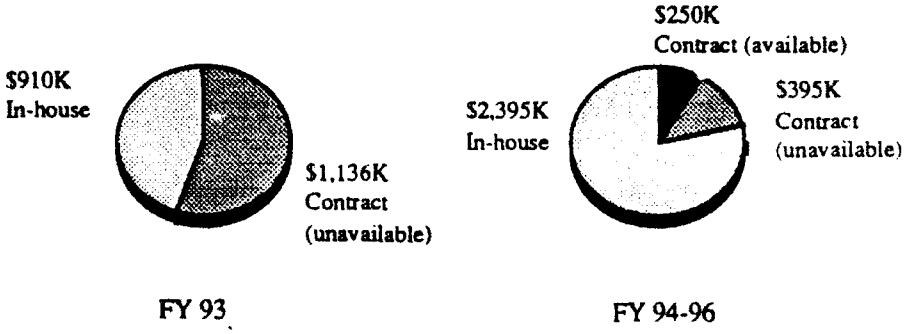
S3I TECHNOLOGY ASSESSMENT

Develop and maintain cognizance of signature data, sensor, and signal processing technology efforts throughout the DoD community. Identify and recommend appropriate balance of these efforts and emphasize the most promising technical approaches to new sensor and signal processing technology for next generation automated sensor systems.

Dr. Norman Berg, (301) 394-2500
U.S. Army Research Laboratory
ATTN: AMSRL-SS-M
2800 Powder Mill Road
Adelphi, MD 20783-1145

S3I TECHNOLOGY ASSESSMENT FUNDING

Battlefield Acoustic Technology



TARGET ACQUISITION & BATTLE MANAGEMENT

ARL Focus Program -- S3I has lead

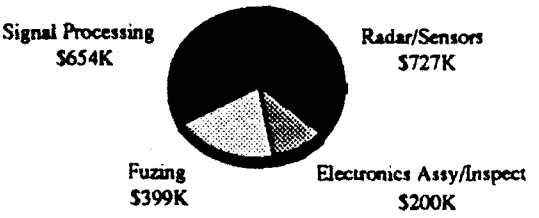
Technology Areas:

- Ultra Wideband Synthetic Aperture Radar Technology
- EO/Radar Sensor Technology for Multi-sensor Stationary Target Indication
- Radar Sensor Technology for Multi-sensor Moving Target Indication
- Ground-based Passive Multi-sensor ID & Classification Technology
- Staff Tactical Operations Center Work Station

930128 APBI

S3I SMALL BUSINESS INNOVATION RESEARCH
FY 93 Funding and Topics

$1,980K



Impulse radiating antenna	Miniature RF filters & low power oscillators
Digital waveform generator	Low power MMIC
Angular rate sensor	Surface-relief diffractive lenses
Electronically scanned antenna	PC-based diffractive optical element mask generator
Knowledge-based target classification	Laser pattern generator for diffractive optical elements
Oxygen pump for low noise fluidics	Noise filters
RF diode laser modulator	Microscale fluid devices
Multi-layer microstrip antenna	High speed solder paste printer
Acceleration sensing module	Panoramic image translation of microelectronic assy
GPS frequency translator IC	Automated composite inspection system

930128 APBI

FY93 BROAD AGENCY ANNOUNCEMENT

Materials	John Pellegrino, (301) 394-2520
Devices and Modules	John Pellegrino, (301) 394-2520
Processing Algorithms	John Pellegrino, (301) 394-2520
Novel Optical Processing Systems	John Pellegrino, (301) 394-2520
Optical System Performance	Mike Patterson, (301) 394-2520
High-Density DSP Circuitry	Mike Patterson, (301) 394-2520
Analog/Digital Conversion	Mike Patterson, (301) 394-2520
Frequency Selective Filter	Mike Patterson, (301) 394-2520
RF Signal Processing	Mike Patterson, (301) 394-2520
Advanced Acoustic Sensors	Bruce Weber, (301) 394-2500
Automatic Target Recognition	Mark Hamilton, (703) 704-1677
Artificial Intelligence	Philip Emmerman, (301) 394-3000
Multistatic Radar Technology	Mike Kolodny, (301) 394-3110
Safety and Arming Systems	Greg Sztankay, Bill Konick
Sensors	(301) 394-3130, (301) 394-2525
Signal Processing	"
Global Positioning System	"
Environmental & Interior Ballistic Simulation	"

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POINTS OF CONTACT

Broad Agency Announcement	Beth Bowen, (301) 394-2964
Unsolicited Proposals	Mel Shichtman, (301) 394-5075
SBIR	Dean Hudson, (301) 394-4808
SBIR (S3I)	Shirley Corbett, (301) 394-4602
Small & Disadvantaged Business	Tom Rodgers, (301) 394-1076
Competition Advocate	Mary Ellen Caldwell, (301) 394-3882
Technology Transfer	Mike Claffy, (301) 394-4210
Technology Transfer (S3I)	Norma Vaught, (301) 394-2952
Public Affairs	Marian Singleton, (301) 394-3590

930128 APBI

Combat Identification Briefing
to
APBI

28 January 1993
Mr. Dick Slife
ARL S3ID

28 JAN 93

MISSION

From GEN Sullivan:

Pull Together and Establish a TRADOC/AMC Task Force (TRADOC LEAD) to lay out a Comprehensive Army Program, addressing both short and long term requirements and solutions, and detailing the interfaces necessary with other Services and Allies. For near term, concentrate on tactical level for surface-to-surface and air-to-surface. For far term, expand on operational level and include air-to-air and surface-to-air.

CSA

"The Army cannot accept casualties that can be prevented by our own actions to improve identification in combat."

AAE

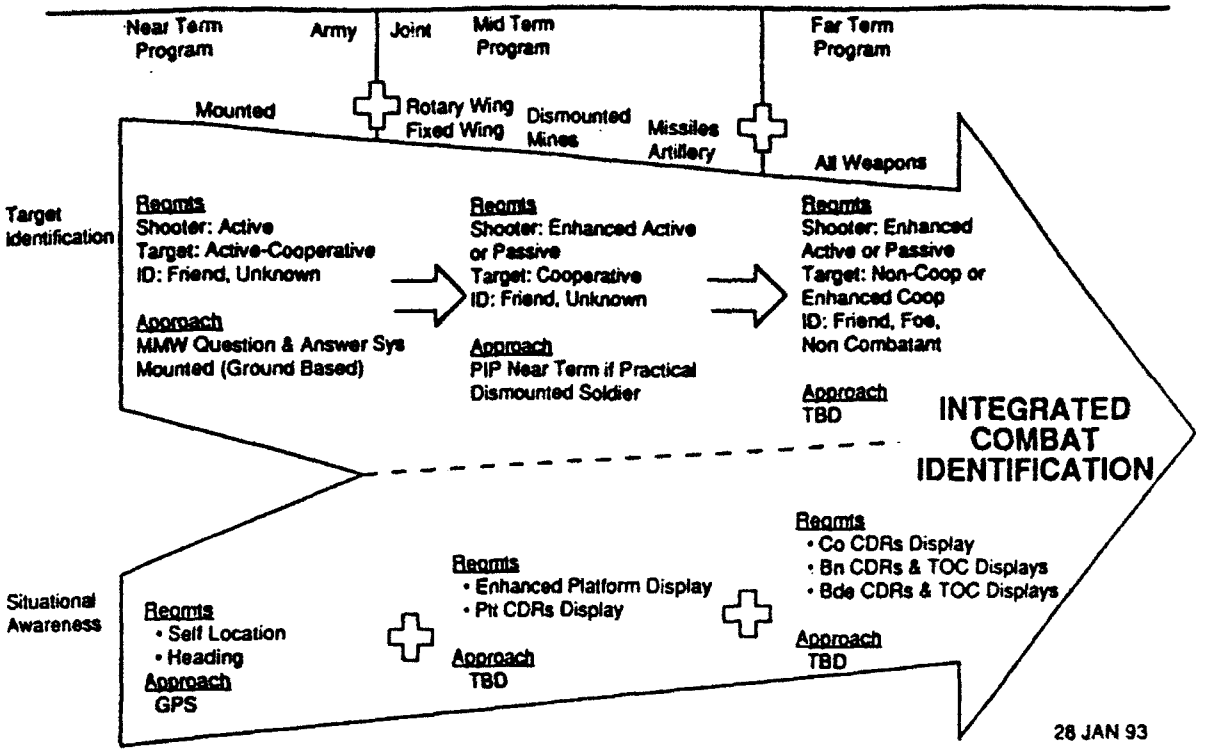
"I want to make sure that we are properly organized to focus our efforts in this area."

28 JAN 93

COMBAT IDENTIFICATION CONCEPT

- Improved Situational Awareness
  - Mission, Enemy, Terrain, Troops - Time
  - Know Where I Am
  - Know Other Friendly Locations
  - Know Neutral and Enemy Locations
- Improved Target Identification
  - Thru-Sight Target ID Indication to Maximum Weapons Range
  - Make Less Sensitive to the Environment
  - Work for Passive, Non-Cooperative Identification

Architecture for CID System



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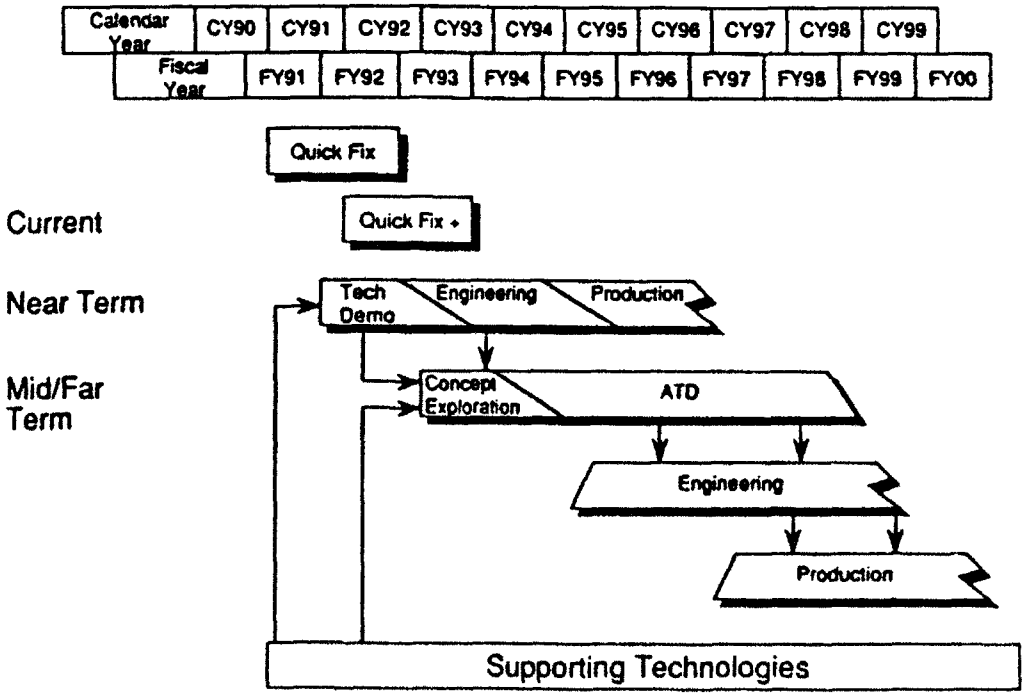
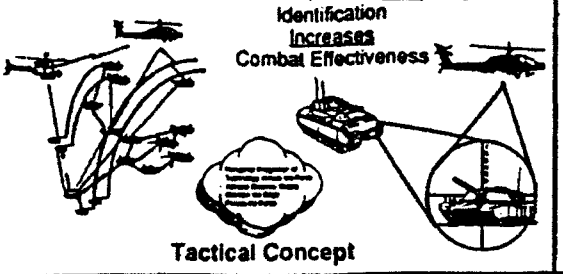
Combat ID
Materiel Program Plan



Battlefield Combat Identification Program Summary

ARL Task Leader:

CECOM POC:



Tactical Concept

Objective
- Quick Fix - Go To War Capability 1 Year
- Quick Fix Plus - POS/NAV Situational Awareness and Thermal TGT ID Device (TID) 18 Months
- Near Term - Enhanced TGT ID 3 Years
- Mid/Far Term - Integrated Imbedded TGT ID/Situational Awareness System by FY2000

Technical Approach
- Quick Fix - IR Lights, Thermal Tape
- Quick Fix Plus - SLGR/PLGR, Compass, TID
- Near Term - Enhanced Active, Passive
- Mid/Far Term - Enhanced Active/Passive Cooperative ID; Active or Passive Non-Cooperative ID; Integrated, Imbedded TGT ID/Situational Awareness

Funding

	93	94	95	96	97	98
6.2	10.0	5.0	5.0	5.0	5.0	4.9
6.3A	5.0	15.4	16.8	15.7	8.5	4.0
6.3B	----	----	----	----	----	----
6.4	6.8	14.4	14.9	14.9	14.8	14.8
PROC	----	11.9	17.8	24.7	29.6	34.3

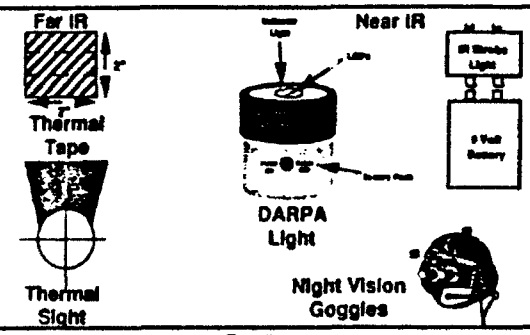
Plans/Status
- Quick Fix - Complete Development Integration
- Quick Fix Plus - FY92 Tech DEMO
  FY93-94 Development/Integration
- Near Term - FY92 Tech DEMO, FY93-94 EMD
  FY95-96 Production/Fielding
- Mid/Far Term - FY92 MSO, FY93 Concept Exploration
  FY94-96 ATD, FY96 EMD, FY98 Production

Technical Approach
- Quick Fix, Quick Fix Plus - none
- Near Term - Army Combat Aviation Platform
- Mid/Far Term - Active/Passive Non-Cooperative Target ID, Information Transport, Information Presentation

Battlefield Combat Identification Quick Fix

ARL Task Leader:

CECOM POC:



Objective
- Go To War Capability in 1 Year

Technical Approach

BUDD Light - Infrared Transmitter
- Near IR
- Ground-to-Ground ID

DARPA Light - Anti-Fratricide Infrared Device
- Near IR
- Air-to-Ground ID

Thermal Tape - Low Emissivity Tape
- Far IR
- Ground-to-Ground ID

Funding

	93	94	95	96	97	98
BUDD Light	162	----	----	----	----	----
DARPA Light	--0--	----	----	----	----	----
Thermal Tape	288	----	----	----	----	----
Total PROC	450	----	----	----	----	----

Performing Activities: ARL, BRDEC, NVEOD, PM NVEO

Plans/Status

BUDD Light
- Fast Flash Model - DLA Inventory
- Slow Flash Model - Army CISPO Control
- FY93 - Contract Option Awarded

DARPA Light
- 7300 in Army CISPO Controlled Inventory
- No Plan to Acquire Additional Quantities

Thermal Tape
- Available Through Sole Source
- Government Comp Procurement on Hold Due to "Responsibility" Issue with Low Bidder
- Battleboard Concept Being Evaluated
- 2093 - Contract Award Planned

Technical Issues
- Thermal Tape - Gloss

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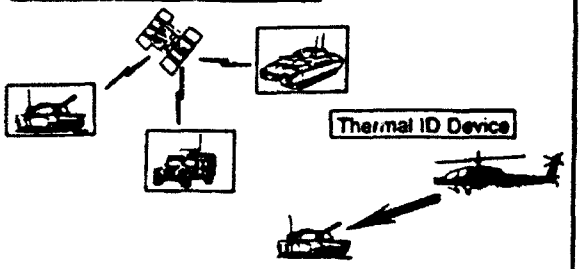
Battlefield Combat Identification
Quick Fix Plus

ARL Task Leader:

CECOM POC:

SLGR/PLGR/Compass Integration



Objective
Provide POS/NAV Situation Awareness and Thermal Target ID Device in 18 Months
- SLGR/PLGR
- Compass
- Target ID Device

Technical Approach
- SLGR/PLGR integration for M1A1/M2/M3/HMMWV
- Select Compass: Integration for M1A1/M2/M3
- Thermal ID Device
  - Laser Activated
  - Far IR

Funding

	93	94	95	96	97	98
6.7	2.2	-----	-----	-----	-----	-----
PROC	-----	6.5	0.5	-----	-----	-----

Performing Activities: ARL, BRDEC, TACOM, PM NVEO, PM Abrams, PM Bradley, PM GPS

Plans/Status
- FY92 - Technical Demonstration
- FY93-94 - Development/Integration

Technical Issues
None

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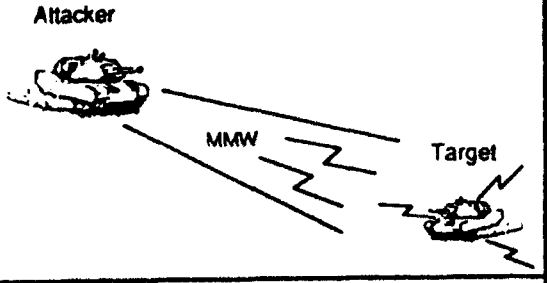
Battlefield Combat Identification
Near Term Program

ARL Task Leader:

CECOM POC:



Objective
Enhanced Target ID Capability
In 3 Years

Technical Approach
MMW Q&A

Funding

	93	94	95	96	97	98
6.2	-----	-----	-----	-----	-----	-----
6.3A	-----	-----	-----	-----	-----	-----
6.3B	-----	-----	-----	-----	-----	-----
6.4	6.8	14.4	14.9	10.9	-----	-----
PROC	-----	11.9	17.8	24.7	-----	-----

Performing Activities: PM CID, ARL, CECOM, PEO-ASM, PEO-AVN, PEO-Combat Support, PEO-COMM

Plans/Status
- FY92 - Technology Demonstration
- FY93-94 - EMD
- FY95-96 - Production and Fielding

Technical Issues
- Army Combat Aviation Platforms

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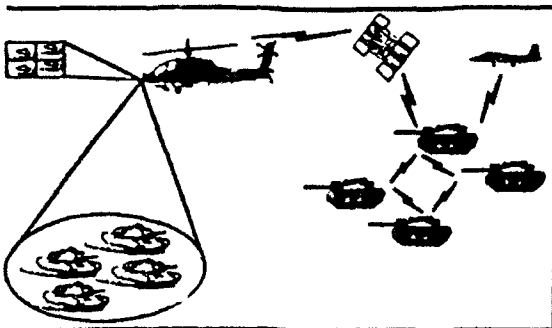
Battlefield Combat Identification
Mid/Far Term Program

ARL Task Leader:

CECOM POC:



Objective
Integrated, Imbedded Situational Awareness/ Target ID Capability by FY2000

Technical Approach
- Enhanced Active Cooperative ID System
- Passive Cooperative ID System
- Active or Passive Non-Cooperative ID System

Funding

	93	94	95	96	97	98
6.2	10.0	5.0	5.0	5.0	5.0	4.9
6.3A	5.0	15.4	13.8	15.7	8.5	4.0
6.3B	-----	-----	-----	-----	-----	-----
6.4	-----	-----	-----	4.0	14.8	14.8
PROC	-----	-----	-----	-----	29.6	34.3

Performing Activities: ARL, CECOM, PM-CID, PEO-IEW, PEO-ASM, PEO-AVN, PEO-Comm, PEO-Combat SPT

Plans/Status
- FY92 - MS "0"
- FY93 - Concept Exploration
- FY94 - ATD
- FY96 - EMD
- FY98 - Production

Technical Issues
- Active/Passive NCTR
- Data Fusion
- Data Distribution/Display

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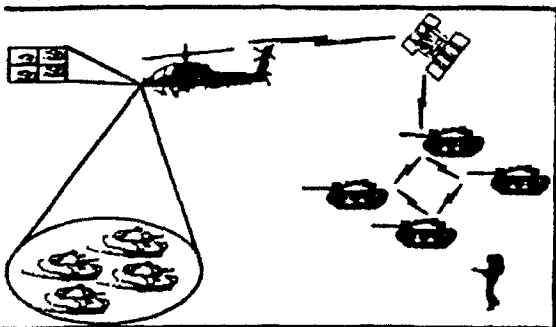
Architecture Study

ARL Task Leader:

CECOM POC:



Project Objectives:
- Define Primary Mid and Far Term Combat ID System Architecture Options
- Determine Key Technologies for Development
- Determine S&T Investment Plan for Combat ID
- Provide Technical Foundation for COEA

Technical Objectives:
- Determine Measures of Effectiveness and Technical Risks of Candidate Technologies
- Investigate Integration with Existing and Developmental Systems/Platforms
- Investigate Situational Awareness and Target ID Synergism
- Manage with Government Steering Committee

Schedule

Activity	FY93	FY94
SOW	▭	
Award	△	
IPR	△ △	△
Prelim Rpt	△	
Final Rpt		△

28 JAN 93

Far Term CID Tech Base

Leverages Ongoing Technology Programs In:

- Automated Target Recognition Algorithms
  - Acoustic
  - EO
  - Radar
  - Multi-Sensor
- Photonic Processing
- Scalable Digital Processing Architectures
- Advanced Sensor and Processor Component Technology
- Display Technology
- Human Factors Research
- LO Target Modelling

28 JAN 93

Summary

Combat ID Program Must:

- Provide Robust Combination of Integrated Target ID and Situational Awareness
- Develop Technologies Which Provide High Confidence and Low Vulnerability Solutions
- Provide Affordable Solutions Which Can Be Integrated Across the Force
- Maximize Dual Use Capabilities (i.e. Acquisition, Survivability, C2)
- Provide Tools Which Can Assess Operational Effectiveness of Potential Solutions

ARMY RESEARCH LABORATORY

Materials

Mr. Lawrence D. Johnson
Directorate Executive
Materials Directorate (MAT)
(617) 923-5275

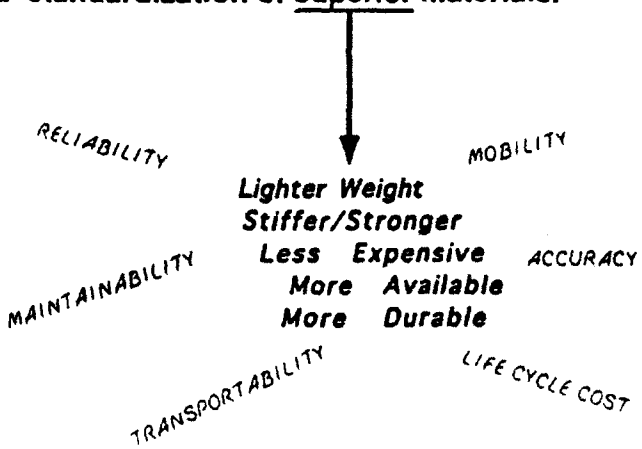
MATERIALS DIRECTORATE - APBI OVERVIEW

- MTL → ARL MATERIALS DIRECTORATE
- FUNDING PROFILE AND INVESTMENT STRATEGY
- WORKING TOGETHER
- TECHNOLOGY AREA HIGHLIGHTS
- "1-800-MATERIALS"

Materials Directorate

Mission

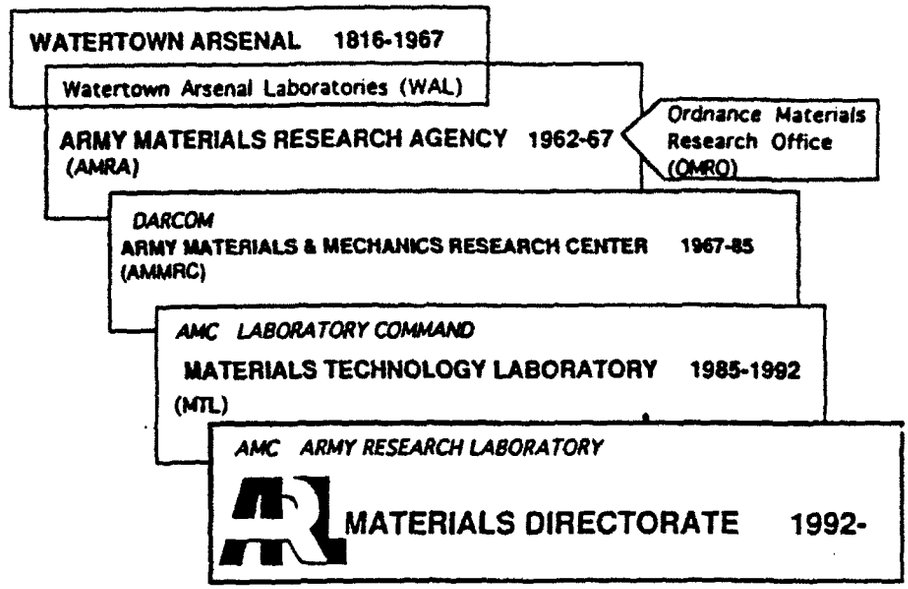
Provide the United States Army with a technology edge by research, development, processing and manufacturing technology, and standardization of superior materials.



Army Materials Research--

Organizational History

Materials Directorate



MATERIALS DIRECTORATE - APB! TRANSITION

1993 - 1995

"YEARS OF CHANGE AND CHALLENGE"

THE MATERIALS DIRECTORATE WILL:

- **CHANGE ITS CORPORATE IDENTITY FROM MTL - TO ARL**
- **CLOSE DOWN A MAJOR FACILITY (WATERTOWN)**
- **BUILD A NEW, WORLD CLASS LABORATORY (ABERDEEN)**
- **MAINTAIN AN ONGOING, HIGHLY FOCUSED, PRODUCTIVE IN-HOUSE AND EXTERNAL R&D PROGRAM - WITHIN A HIGHLY CONSTRAINED BUDGET**

Assets: Personnel

Materials Director Ae

Staff of 321

Skill Mix

73% Technical
18% Professional Support
8% Admin/Clerical

= *92 % Professional*

Educational Profile - Scientists & Engineers

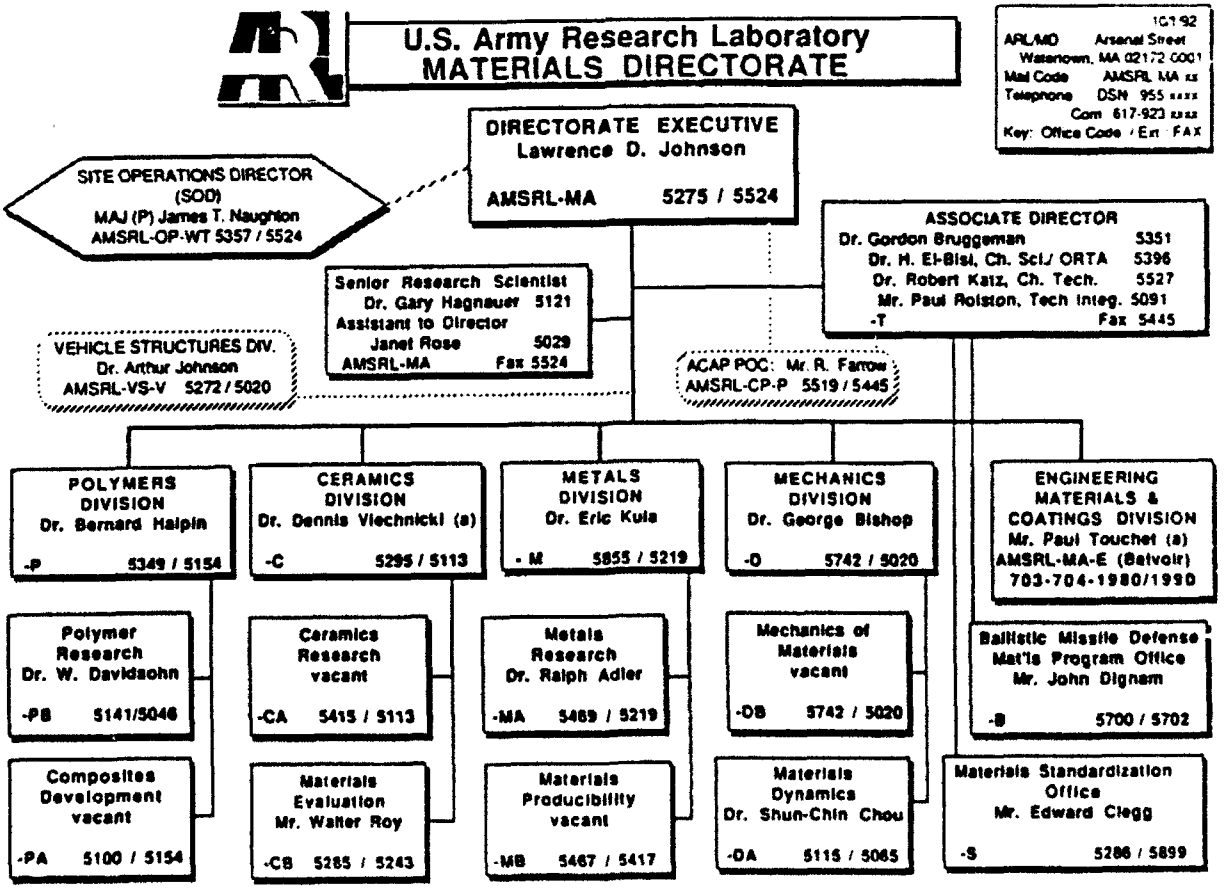
14% Bachelors Degree
40% Masters
46% PhD's

= *Well Educated*

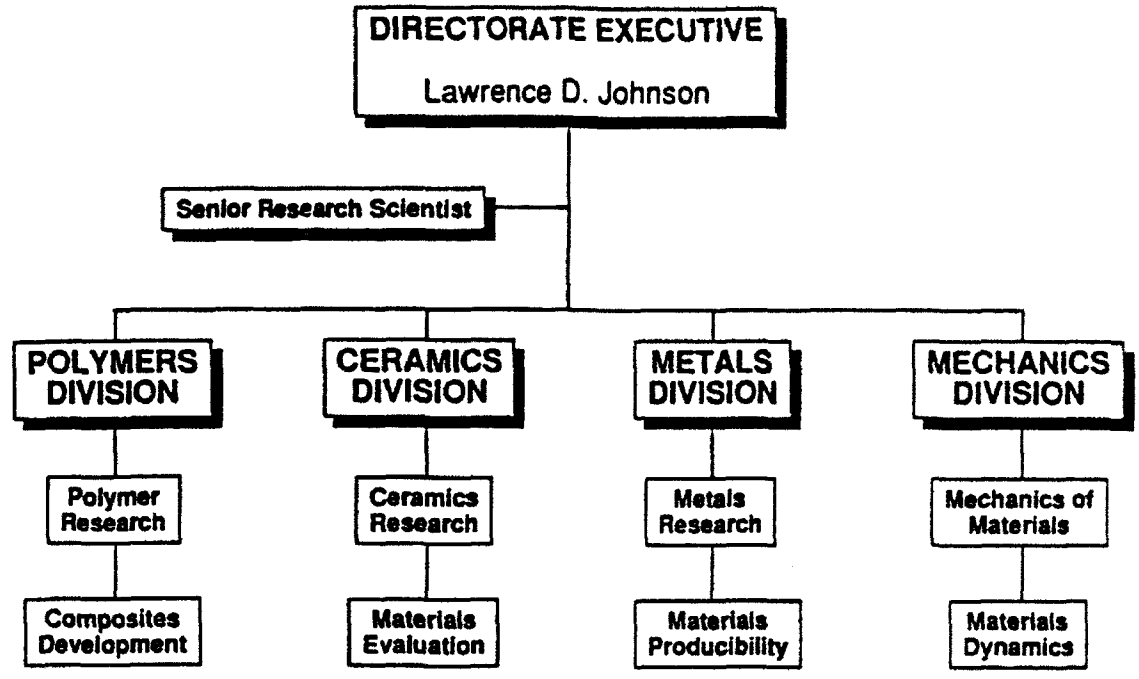
Federal Experience Profile

0 - 9 years -- 43.7%
10 - 19 years -- 21.1%
20 - 29 years -- 17.6%
29+ years -- 17.6%

Average age 44



U.S. Army Research Laboratory
MATERIALS DIRECTORATE - End State



MATERIALS DIRECTORATE - APBI
ANTICIPATED REVENUES ($M)

	FY '93	FY '94	FY '95	FY '96
6.1	4.5	3.6	3.8	3.8
6.2	17.0	16.5	16.9	17.5
6.3	1.3	0	0	0
OTHER	3.8	3.8	3.7	3.9
CUSTOMER (EXCLUDING DIRECT CITE CONTRACTS)	6.3	7.3	4.9	4.4
	32.9	31.2	29.3	29.6

FY '93 - FY '96 ANTICIPATED EXPENDITURE PROFILE

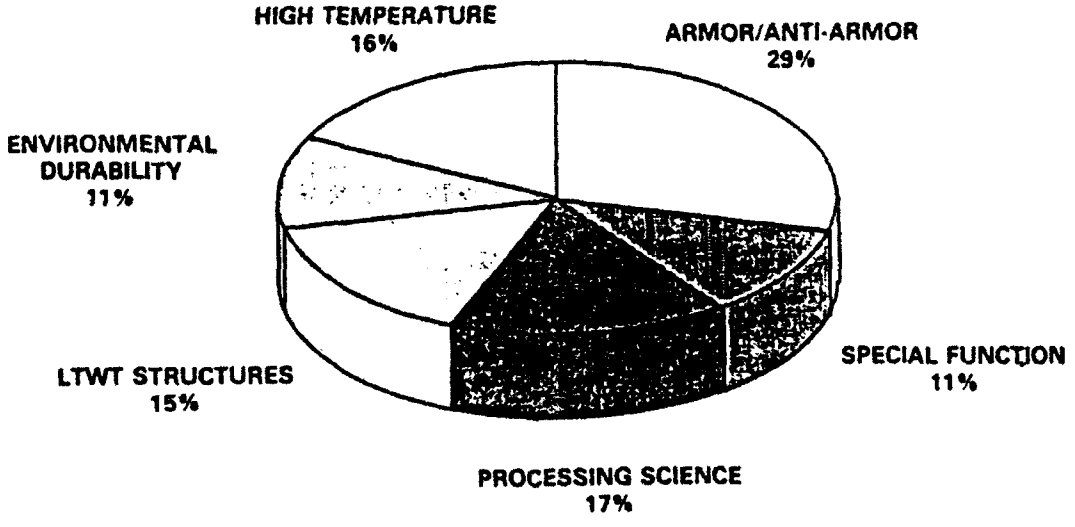
84% IN-HOUSE
15% R&D CONTRACTS
1% OGA

MATERIALS DIRECTORATE - APBI

CORE COMPETENCIES
(BUSINESS AREAS)

AREA	AREA MANAGER(S)
• ARMOR/ANTI-ARMOR	DR. BISHOP/MR. DOWDING
• HI TEMPERATURE MATERIALS	DR. FLETCHER
• MATERIALS FOR LT. WEIGHT STRUCTURES	MR. HASKELL
• ENVIRONMENTAL DURABILITY	DR. HAGNAUER
• MATERIALS PROCESSING & MANUF. TECH.	DR. ADLER
• SPECIAL FUNCTION MATERIALS - CHEMICAL & LASER PROTECTION - SIGNATURE REDUCTION - EM & OPTICAL MATERIALS	DR. KATZ

MATERIALS DIRECTORATE - APBI
FY '93 - '96 INVESTMENT STRATEGY
BY BUSINESS AREAS



GIVEN AN ENVIRONMENT OF CONSTRAINED FISCAL RESOURCES - "HOW CAN WE WORK TOGETHER TO CONTINUE TO DEVELOP TECHNOLOGY FOR THE ARMY'S FUTURE?"

- CRDA's
  MATCH OUR STRENGTHS WITH YOUR NEEDS
- UNFUNDED STUDIES
  JOINT R&D PROJECTS - EACH PARTY PERFORMS ITS PORTION AT ITS OWN EXPENSE (AUTHORITY AR-70, PARA 2-3)
- BAA
  TRADITIONAL CONTRACT MODE
- SBIR's
- UNIVERSITY - INDUSTRY - GOVERNMENT CONSORTIA (A MULTI - PARTICIPANT VERSION OF THE UNFUNDED STUDY)

MATERIALS DIRECTORATE
1993 - APBI

HIGHLIGHTS OF

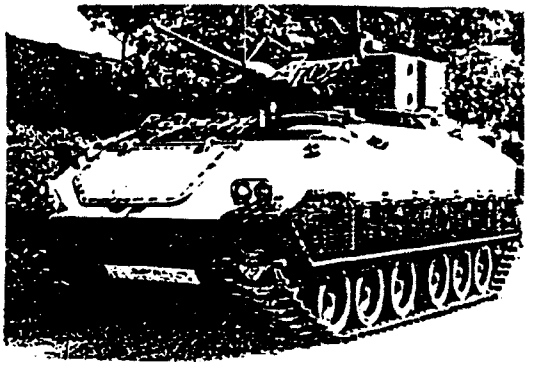
THE TECHNICAL PROGRAM

MATERIALS DIRECTORATE - APBI
LIGHTWEIGHT STRUCTURES/PROCESSING
COMPOSITE HULL DEMONSTRATION PROGRAM

SUCCESS TO DATE:

For Light-to-Medium Class (IFV) Hull

- Completed materials development, FEA design, process identification, fabrication of IFV hull
- Completed static and dynamic test; outfitted and 6000-mi. field tested
- Delivered validated materials data package supporting CAV et al



RESULTS

LIGHTWEIGHT —25% weight savings for hull & armor

HIGHER SURVIVABILITY — 99% elimination of spall & better blast resistance

LOWER SIGNATURE & CREW STRESS —5-10 dBA less noise, less vibration

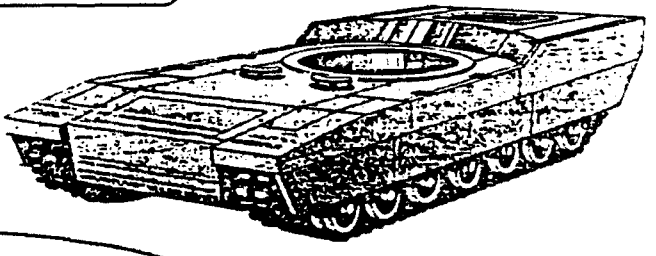
LESS LOGISTICS BURDEN/COST —lower maintenance than metals

MATERIALS DIRECTORATE - APBI
LIGHTWEIGHT MATERIALS/PROCESSING
COMPOSITE HULL DEMONSTRATION PROGRAM

SUCCESS TO DATE:

For Medium-to-Heavy (40-55 ton) Hull

- Completed materials development, design, process ID
- Fabricated one heavy-class hull



FUTURE PLANS:

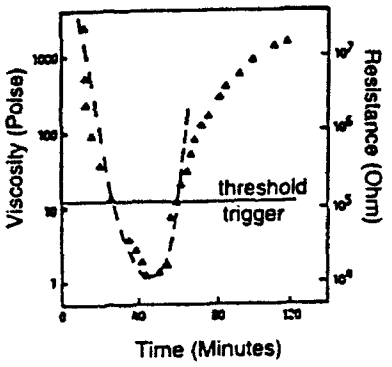
- Outfit and field test
- Transfer validated technology to TACOM/Industry

MATERIALS DIRECTORATE - APBI
PROCESSING & MANUFACTURING TECHNOLOGY
"SMART" WEAVE

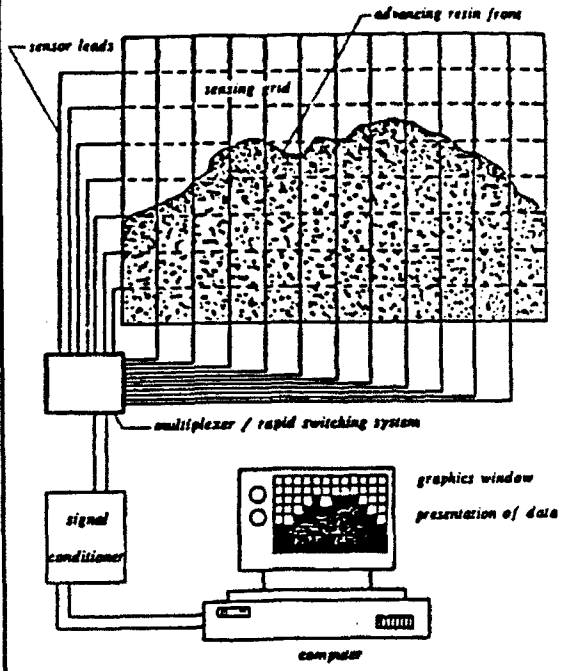
SENSORS MOUNTED AS ROVING THREADS

PROVIDES: - 3-D FLOW & CURE MONITORING DURING RESIN TRANSFER MOLDING OF THICK SECTIONS
- EMBEDDED SENSORS FOR IN-SERVICE CONDITION MONITORING

- TECHNOLOGY HAS BEEN DEMONSTRATED (GLASS FIBER PREFORM, C-FIBER GRID, POLYESTER)
- PATENT HAS BEEN ALLOWED



U-SHAPED Q vs. t CURVE ENABLES CURE MONITORING

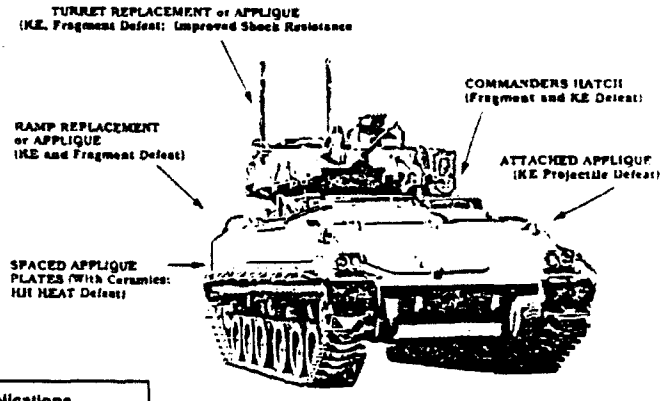


SHOWS FLOW MONITORING (MOLD FILL MONITOR) MODE (i.e., ADVANCING RESIN FRONT)

MATERIALS DIRECTORATE - APBI
ARMOR
LO COST Ti-ALLOY FOR ENHANCED COMPOSITE HULL

Titanium

Lightweight, 40% Lighter than Steel
Low Cost, $6 to $7/Lb vs. $20/Lb
Ballistically Tolerant
Structural Integrity
No Major Technological Barriers
Need To Optimize:
Ballistic Performance
Weldability
Mechanical Properties



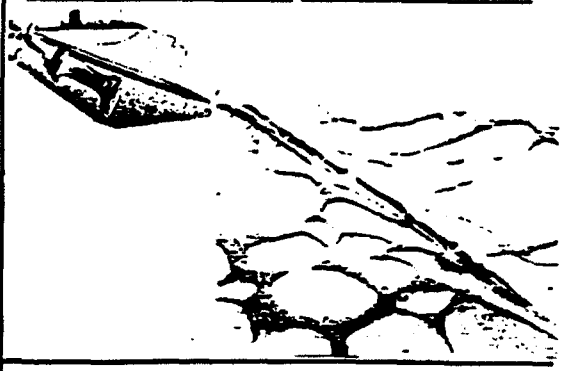
Current Application	Possible Applications
Commander's Hatch, BFV	Armor Structure Suspension System Track

MATERIALS DIRECTORATE - APBI
ANTI-ARMOR
TUNGSTEN PENETRATORS

OPPORTUNITIES/BENEFITS

- COST AVOIDENCE OF DU CLEAN-UP IN FUTURE ACTIONS (EST. COST OF $1/2 BIL. FOR KUWAIT)
- ELIMINATE ISSUES ASSOCIATED WITH MANUFACTURING & FIELDING α-EMITTING MATERIAL
- EQUAL BALLISTIC PERFORMANCE TO DU APPEAR TO BE ATTAINABLE

SHEAR LOCALIZATION (ADIABATIC SHEAR)



STATUS

- IMPORTANCE OF ADIABATIC SHEAR IN PENETRATOR PERFORMANCE IS UNDERSTOOD
- IDENTIFIED CANDIDATE W-COMPOSITE SYSTEMS TO PROMOTE ADIABATIC SHEAR
- $NiFe_{12}Al_{40}$ MATRIX PROMOTES HIGHLY LOCALIZED SHEAR IN TEST SAMPLES

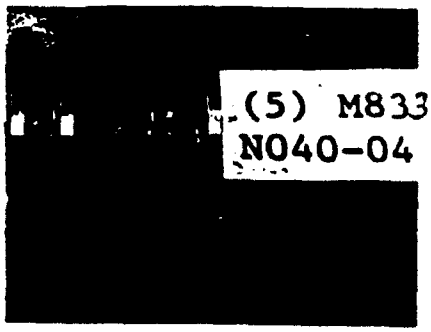
NEEDS

- LOW COST PROCESSES
- FULLY DENSE MATERIAL
- PROCESSING TECHNOLOGY FOR NON-TRADITIONAL W-ALLOYS & COMPOSITES

MATERIALS DIRECTORATE - APBI
MATERIALS DURABILITY

CORROSION RESISTANT COATING FOR DU-3/4TI PENETRATORS

- Potential applications: 919, 929 projectiles
- Al-Zn Alloy deposited by cathodic arc plasma PVD
- Provides galvanic protection to DU-3/4-Ti alloy
- Sacrifical coating can tolerate defects
- Exhibits better mechanical strength, adhesion and cohesion, than the other leading candidate coating



Corrosion and pitting on 105mm M833 penetrator buttress grooves after 6 years of field exposure in European theater

COATING	COHESIVE LOAD Lc (N)	ADHESIVE LOAD La (N)
Al-Zn	43.72	68.64
TiN-Ti-TiN	27.18	32.55

M919 DU-3/4-Ti penetrator coated with Al-Zn

MATERIALS DIRECTORATE - APBI
MULTI-FUNCTIONAL MATERIALS
CERAMIC PHASE SHIFTER MATERIALS

- DEVELOPED A FAMILY OF CERAMIC COMPOSITES/DOPED $Ba_xSr_yTiO_3$'s WITH TAILORABLE DIELECTRIC PROPERTIES
- COMBINATION OF ε, tan δ, TUNABILITY & REPRODUCIBILITY SUPERIOR TO PREVIOUS MATERIALS

MAT-DIR IS:
- SUPPLYING MATERIALS TO ESP-DIR FOR USE IN ELECTRO-OPTIC DISCRETE ELEMENT PHASE SHIFTERS
- SUPPLYING MATERIALS TO CECOM FOR ANTENNA DEVELOPMENT
- APPLYING FOR PATENT
- IN VARIOUS LEVELS OF CRDA NEGOTIATION/DISCUSSIONS WITH SEVERAL RADAR MANUFACTURERS

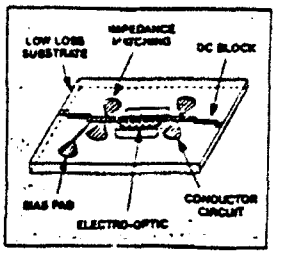
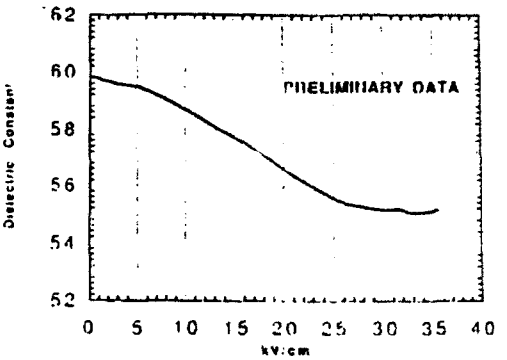


Fig. 7 A schematic diagram of a realized electro-optic phase shifter.

FROM BABBITT, KOSCICA, & DRACH
MICROWAVE J., JUNE 1992, p-63



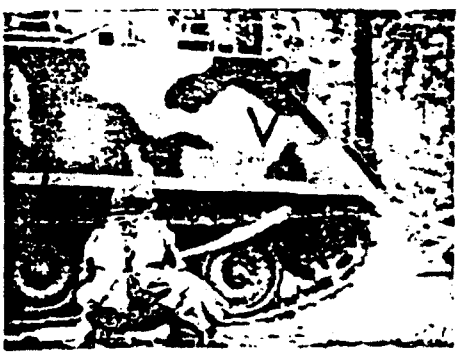
MATERIALS DIRECTORATE - APBI
MULTI-FUNCTIONAL MATERIALS
CHEMICAL PROTECTION

BARRIER MATERIALS	APPLICATIONS
POLYURETHANES	MASKS
POLYSILICONES	HOODS
BUTYL-RUBBERS	GLOVES
FLUORO-ELASTOMERS	BOOTS
POLYMER-BLENDS	SEALS
	COATINGS (rigid& flexible)

PROGRAM FOCUS

EFFECTS OF CHEMICAL AGENTS AND DECONTAMINANTS ON PERSONNEL AND VEHICLE MATERIALS

DEVELOPMENT OF ADVANCED CLOTHING MATERIALS, PROTECTIVE COATINGS, NON-CORROSIVE DECONTAMINANTS AND SELF-DECONTAMINATING MATERIALS



MATERIALS DIRECTORATE - APBI
GENERIC NEEDS

- QUALITY ASSURANCE & NDE TECHNOLOGY
- JOINING - ESPECIALLY DISSIMILAR MATERIALS
- LOWER COST PROCESSING
- FUNDAMENTAL UNDERSTANDING OF MATERIALS DEFEAT MECHANISMS
  - BALLISTIC
  - CHEMICAL AGENT PERMEATION
  - WEAR & CORROSION
- REPAIRABILITY
- STANDARDIZATION

MATERIALS DIRECTORATE - APBI
HOW TO REACH US:
MA-D KEY STAFF

Mr. Lawrence Johnson Director	AMSRL-MA	(617) 923-5275
Dr. Gordon A. Bruggeman Associate Director	AMSRL-MA-T	(617) 923-5351
Dr. Hamid El-Bisi Chief Scientist (Tech Transfer POC)	AMSRL-MA-T	(617) 923-5396
Dr. Robert Nathan Katz Chief Technologist Multi-Functional Materials, Area Manager	AMSRL-MA-T	(617) 923-5527
Dr. Gary Hagnauer Sr. Scientist Materials Durability, Area Manager	AMSRL-MA	(617) 923-5121
Dr. George Bishop Chief, Mechanics Division Armor Materials, Area Manager	AMSRL-MA-M	(617) 923-5742
Dr. Bernard Halpin Chief, Polymers Division	AMSRL-MA-P	(617) 923-5349
Dr. Eric Kula Chief, Metals Division	AMSRL-MA-M	(617) 923-5469
Dr. Dennis J. Viechnicki Chief, Ceramics Division	AMSRL-MA-C	(617) 923-5295
Mr. John Dignam Chief, Ballistic Missile Defense Materials Office	AMSRL-MA-B	(617) 923-5519
Dr. Ralph Adler Processing & Manufacturing Science, Area Manager	AMSRL-MA-MA	(617) 923-5469
Mr. Robert Dowding Anti-Armor Materials, Area Manager	AMSRL-MA-MA	(617) 923-5340
Dr. Martha Fletcher Hi Temperature Materials, Area Manager	AMSRL-MA-C	(617) 923-5049
Mr. William Haskell Lightweight Structures, Area Manager	AMSRL-MA-PA	(617) 923-5172
Mr. Robert Morrison SBIR Program Manager	AMSRL-CP-TT	(617) 923-5522

A R M Y R E S E A R C H L A B O R A T O R Y

Vehicle Propulsion

Mr. George A. Bobula
Directorate Executive (acting)
Vehicle Propulsion (VPD)
(216) 433-3698

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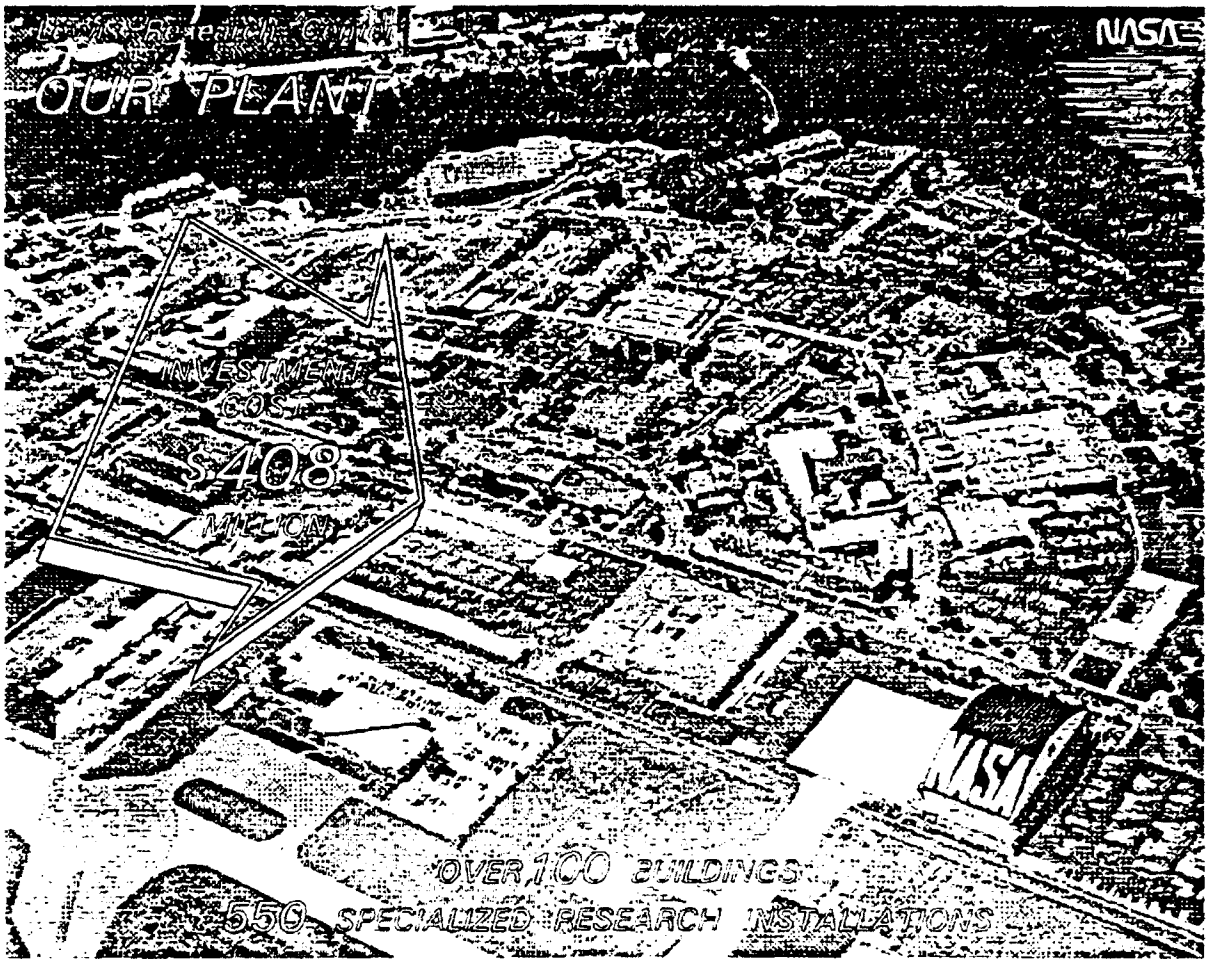
VEHICLE PROPULSION DIRECTORATE

ADVANCED PLANNING BRIEFING for INDUSTRY

by
George A. Bobula

The Vehicle Propulsion Directorate, collocated at the NASA Lewis Research Center, has been the Army Aviation community's focal point for basic research and advanced development programs on gas turbine engines and power transmission systems. With its inclusion into the Army Research Laboratory complex, our mission has been expanded to include ground vehicle propulsion system research, already an element of our NASA host's mission. Our programs originate in a laboratory environment which has fostered the growth of recognized experts in their fields. Our established partnerships, providing access to world-class facilities, experts and capabilities, enables the VPD to fill the Army's vehicle propulsion research and technology niche.

VEHICLE PROPULSION DIRECTORATE



The Vehicle Propulsion Directorate is located at the NASA Lewis Research Center, adjacent to the Cleveland Hopkins Airport in Cleveland, Ohio. NASA Lewis, as part of its charter, defines and develops advanced technology directed at propulsion and power for application to aeronautics. As a result, the Vehicle Propulsion Directorate has at its disposal a significant portion of the more than 100 buildings and 550 specialized research rigs and internationally recognized researchers devoted to scientific and engineering research excellence. Since its founding in 1970, the VPD has emphasized interests of Army Aviation, due to our origination in the Army Aviation Research and Development community. The Directorate has, however, participated in propulsion work for other than air vehicles at the request of other government agencies and also through involvements with our NASA hosts. Under the Army Research Laboratory, our ground vehicle propulsion emphasis will grow. This has begun through expansion of existing NASA programs and resurrection of previous Propulsion Directorate activities.

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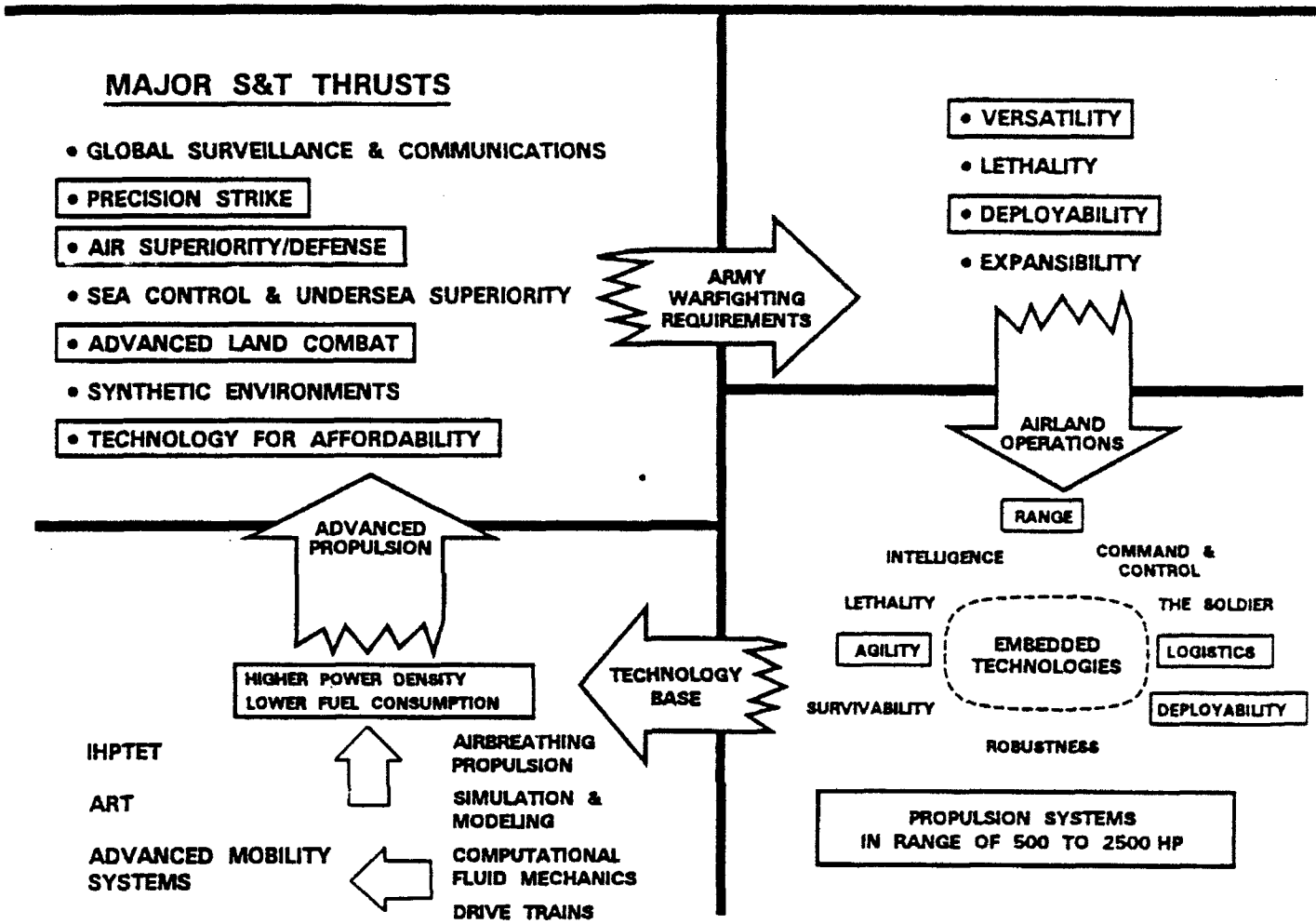
VEHICLE PROPULSION DIRECTORATE



The work product of the Vehicle Propulsion Directorate is advanced propulsion technology derived through the conduct of a strong tech base program. Program drivers may be traced back through Airland Operation, to the Army Warfighting Requirements, and even to the major Science and Technology thrusts. The objective of advancing technology for higher power density and lower fuel consumption vehicle propulsion systems is addressed by conducting airbreathing propulsion and drive train research and development programs which support the goals of the Integrated High Performance Turbine Engine Technology (IHPTET) program, Advanced Mobility Systems and the Advanced Rotorcraft Transmission (ART) program.

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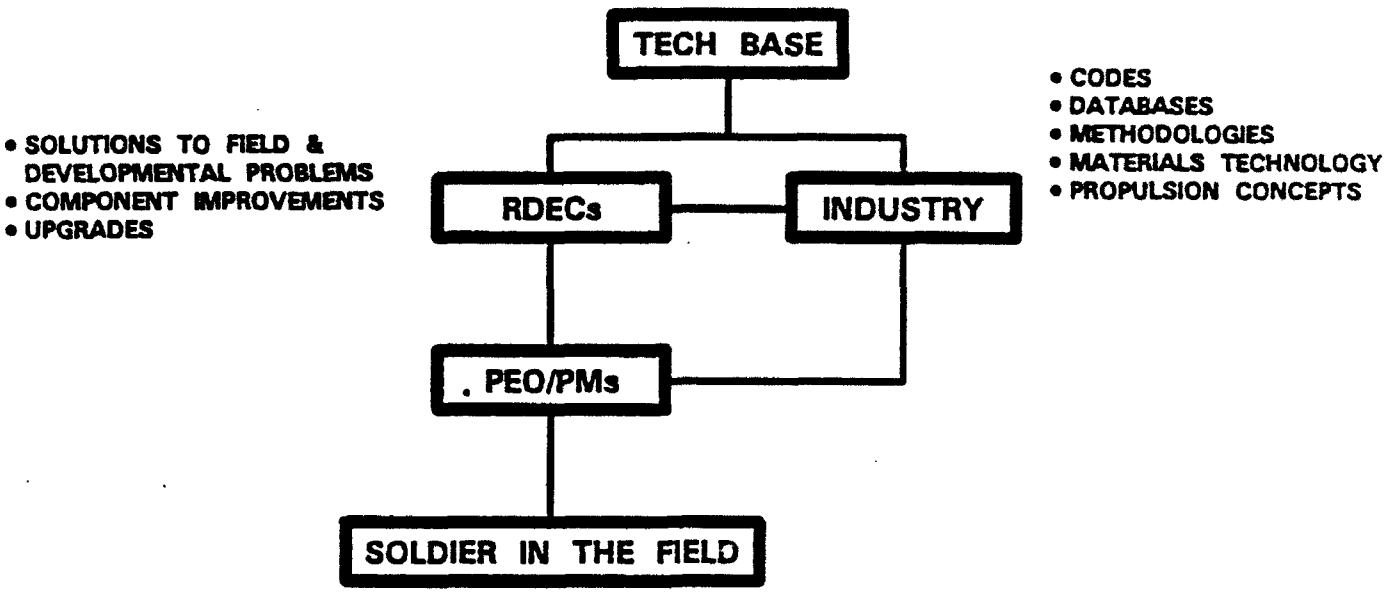
ULTIMATE CUSTOMER IS THE SOLDIER



- PRIMARY TECH BASE PRODUCTS DISSEMINATED TO INDUSTRY VIA
  - INTERACTIVE PROGRAMS
  - CONFERENCES/SEMINARS
  - PUBLICATIONS
  - WORKING LEVEL COMMUNICATION

The ultimate customer of the Vehicle Propulsion Directorate is the soldier in the field. Our work product generally reaches the soldier from the PEO/PMs by way of the Research and Development Engineering Centers (RDECs) or the industry. The VPD traditionally works with the RDECs on the solution of field and developmental problems, component improvement activities and upgrades. Our involvement with industry is most often through shared links in the tech base programs, whether in the form of technical reports or in cooperative programs. On occassion, support is also provided directly to the PEO/PMs through participation on boards and assistance during system qualification programs.

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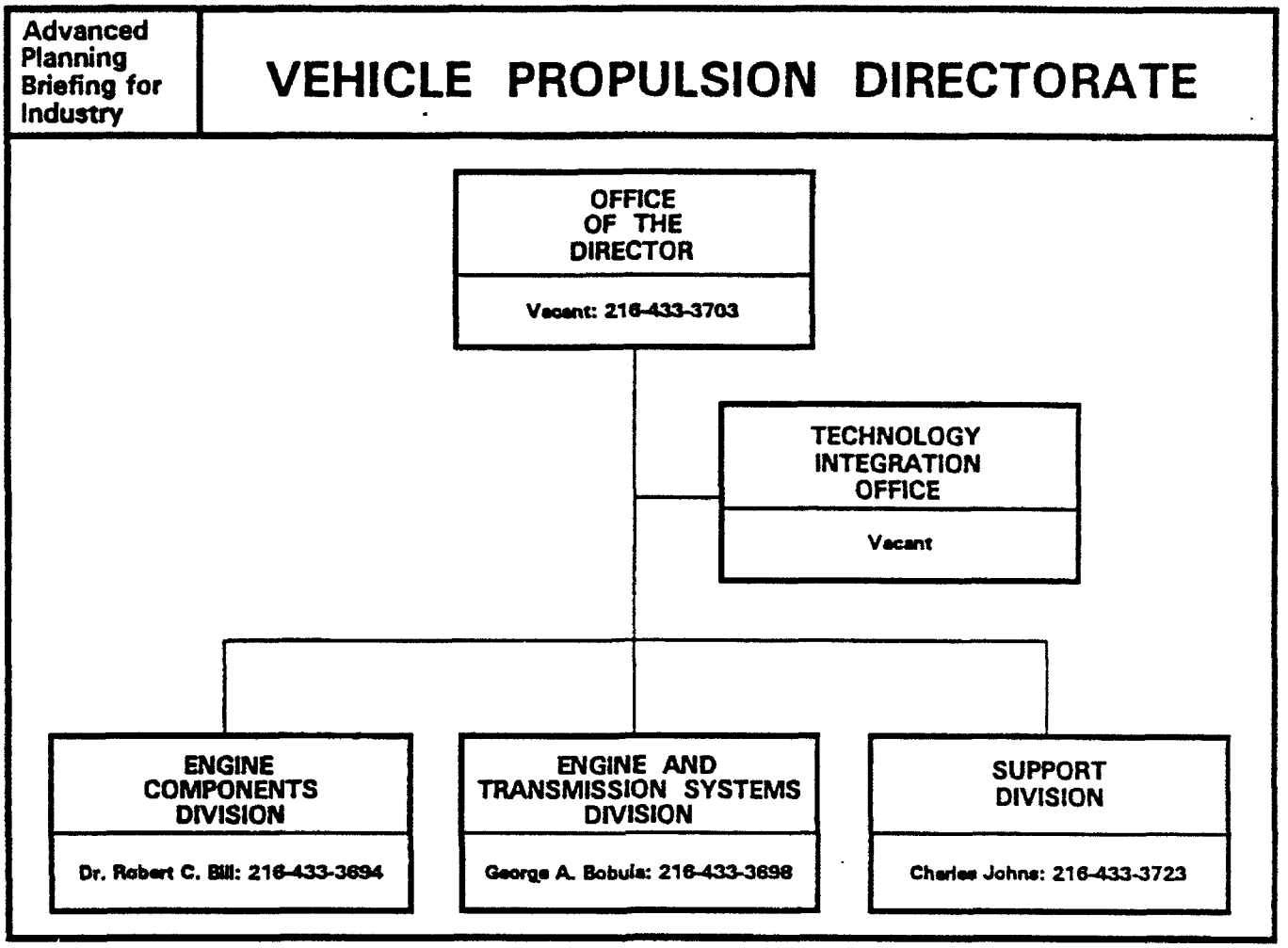


The Vehicle Propulsion Directorate is structured as shown with two technical divisions, a support division and an integration office supporting the director. The Technology Integration Office, not yet staffed, will operate as the interface between the VPD and the RDECs. Their coordination will assist the directorate in establishing the direction of new technical programs. The Support Division provides administrative program management and technical program management services, as well as technical support, to ensure the continued conduct of a propulsion research activity at the VPD in concert with our NASA hosts. Technical programs are managed and/or conducted by individual Army scientists and engineers, from either the Engine Components Division or the Engine and Transmission Systems Division, operating within the framework of the NASA Lewis Research Center's organizational units. Technical activities range from analytical code development, analyses and investigations, to component testing, to complete system experiments in all areas relating to vehicle propulsion. Component and system experiments are performed in-house in NASA owned rigs. Programs are generally conducted with the investment of both Army and NASA resources.

VEHICLE PROPULSION DIRECTORATE

Technical Areas of Interest	*Science & Technology Areas*	*Specific Examples*
Small gas turbine engines Reciprocating engines Power transfer	Aerothermodynamic Components Rotating Reciprocating Static Mechanical Components Rotating Reciprocating Static Propulsion Sciences Materials Control Systems Systems (Engines/Drive Systems) Component Interactions System Phenomena Unique System Configurations	• 2-stage, 5:1 CPR axial compressor • Wave engine cycle • 3000°F CMC combustor • Stability Enhancement • Ceramic piston coatings • Active vibration control • Reconfigurable engine control • Torque splitting transmissions • Face gears • Compound Cycle Engine

The Vehicle Propulsion Directorate plans, manages, and executes basic research and exploratory development programs of the Army Research Laboratory aimed at vehicle propulsion concepts, components, and systems technology. The programs are both in-house research and contracted activities. Significant activity and progress has been seen in gas turbine engine and power transfer technologies over the past 20+ years. Advances such as utilization of PMR-15, active compressor stabilization, compliant layer strain isolation in ceramic gas turbine shrouds and ceramic combustors, and test techniques to understand the effects of inlet temperature distortion on engine operation, among others, had their genesis under VPD/NASA-Lewis. Under ARL's banner, the same pressures that were exerted on aviation propulsion technologies will now be extended to ground vehicles.

VEHICLE PROPULSION DIRECTORATE

FACILITIES USED IN ARMY PROGRAMS (OWNED BY HOST: NASA-LEWIS)

SOME SPECIAL EQUIPMENT AND FULL-SIZE
HARDWARE FURNISHED BY THE ARMY

FACILITIES	COMMENTS
SYSTEM LEVEL/MAJOR ITEMS	
3000-5000 HP TRANSMISSION STAND	UH-60 & AH-64 SIZE
300-500 HP TRANSMISSION STAND	OH-58/AHIP SIZE
ENGINE COMPONENTS RESEARCH LAB	T55, T700, T800 SMALL TURBOSHAFT ENGINE RESEARCH (STER) TEST BED
PROPULSION SYSTEMS LABORATORY (*)	ALTITUDE AND DISTORTION TESTING IN SUPPORT OF LH PEO/T800 QUALIFICATION
ICING RESEARCH TUNNEL (*)	ROTORCRAFT SYSTEMS (BLADES, WEAPONS, INLETS)
1 x 1 SUPERSONIC TUNNEL	SPECIAL TEST FOR PICATINNY (ARTILLERY ROUND)
COMPONENT LEVEL	
COMPRESSOR RESEARCH	3 RIGS (AXIAL, CENTRIFUGAL, AND MULTISTAGE)
TURBINE RESEARCH	2 RIGS (AXIAL, RADIAL)
COMBUSTOR RESEARCH	4 RIGS (BASIC COMBUSTION SCIENCES AND SMALL COMBUSTORS)
LUBRICATION/TRIBOLOGY RESEARCH	12 RIGS (SURFACE SCIENCE, FRICTION, LUBRICATION, WEAR)
MECHANICAL COMPONENT RESEARCH	9 RIGS (GEARS); 5 RIGS (BEARINGS); 1 RIG (SEALS); 2 RIGS (CLUTCHES)
COMPUTATIONAL SCIENCES	
FLUID MECHANICS/FLUID DYNAMICS	1 COMPRESSIBLE FLOW RIG; 1 TRANSONIC CASCADE RIG
DATA PROCESSING	MAINFRAMES.....2 CRAY (XMP & YMP); ALLIANT PARALLEL PROCESSOR; 2 AMDAHL; 2 IBM (3070 & 3090); 2 VAX CLUSTERS; TRANSIENT DATA ACQUISTION AND RECORDING

(*) CATEGORIZED AS NATIONAL FACILITY

All of the facilities used to conduct the Vehicle Propulsion Directorate program are owned by the NASA Lewis Research Center, our host. The facility assets run the full range of complexity from simple gear material fatigue rigs, requiring little operator interaction once the test specimen is installed, to complete engine system altitude chambers, requiring over a dozen operators. The facilities cover the full spectrum of experimental requirements for airbreathing engines and power transfer systems. State-of-the-art data acquisition and reduction capabilities are provided in most of the facilities along with all necessary test support hardware. Several recognized national facilities are included in this inventory.

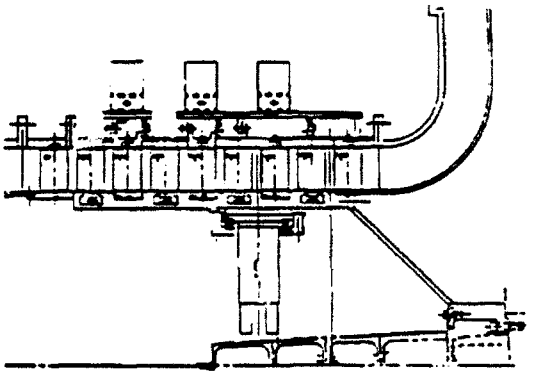
WORK UNIT TITLE: Compressors - Large, Low-Speed Compressor Facility
PE/PRJ: 61102/AH45
CONTRACTOR: In-house
POC/PHONE: M. Hathaway (216) 433-6250

OBJECTIVE/PROBLEM STATEMENT:

- Centrifugal compressor design capabilities are hampered by lack of understanding of the fundamental flow physics.
- Axial design/analysis methods are based on assumed asymmetric and steady flow conditions, while the actual flow for imbedded stages is asymmetric and unsteady.

DELIVERABLES:

- Detailed measurements of centrifugal flows (in the LSCC - Low-Speed Centrifugal Compressor) and axial flows (in the LSAC - Low-Speed Axial Compressor), leading to a more complete understanding of the relevant flow physics, and ultimately to improved design capabilities.
- Benchmark data for 3D viscous, steady and unsteady flow solvers now being developed
- Data for flow physics modeling



PROGRAM SCHEDULE

TASKS	92	93	94	95	96
Install LSAC					
Low-speed multistage axial tests					
Install low-speed centrifugal compressor					
Test LSCC with rotor & diffuser installed					

ACCOMPLISHMENTS:

FY 90: - Completed LSCC rotor only aero performance surveys and diffuser exit flow visualization
FY 91: - Completed LSCC rotor only laser and hot-wire anemometer measurements plus ammonia/ozalid flow visualization on blade surfaces
FY 92: - Install LSAC and complete check-out/initial testing

PLANS:

FY 93: - LSAC performance characteristics, hot-wire anemometry data, flow visualization on blade and endwall surfaces
FY 94: - Rotating frame instrumentation fabrication and measurement
- Investigate endwall mixing
FY 95: - Install and test LSCC with diffuser

The objective of the Large, Low-Speed Compressor research project is to obtain detailed measurements to: (1) improve our fundamental understanding of the unsteady flow physics which characterize blade row interactions in multistage compressors; and (2) aid in the development of closure models required for the Averaged-Passage approach to predicting multistage compressor flow fields. The LSAC is a four foot diameter, four-stage axial compressor with inlet guide vanes, and is patterned after the General Electric Low Speed Research Compressor. Both use a four-stage design and concentrate research in the third stage. The first two stages, preceded by a long inlet duct, build up thick endwall boundary layers and a representative multistage flow field, while the fourth stage buffers the third stage from the downstream diffuser and collector flow field. The LSAC became operational in June, 1992 and initial measurements were obtained. The results indicated the need for slight restaggering of the inlet guide vanes and the first stage rotor to achieve repeatable stage performance characteristics.

WORK UNIT TITLE: Compressors - Advanced Multi-Stage Small Axial Compressor
PE/PRJ: 62211/A47A
CONTRACTOR: Joint Program (Army/NASA/Allison)
POC/PHONE: G. Skoch (216) 433-3396

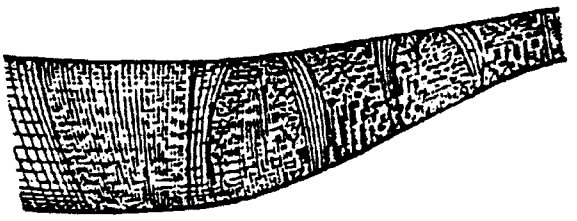
OBJECTIVE/PROBLEM STATEMENT:

- Develop a compression system that will meet IHPTET performance requirements
- Increased power/weight ratio and lower SFC from higher pressure ratios but fewer compressor stages

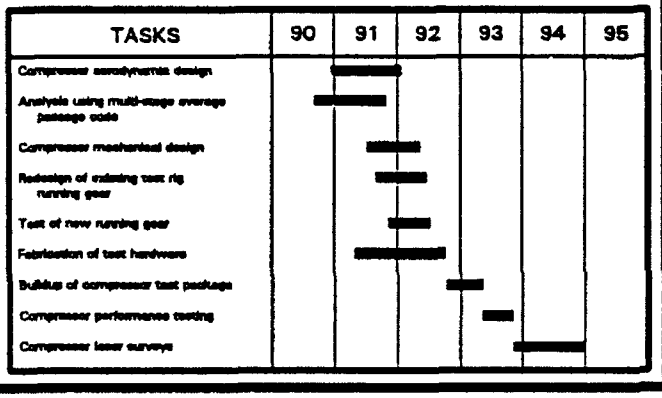
DELIVERABLES:

- An axial compression system that produces a pressure ratio of 5:1 using only two axial stages
- Validation of advanced analysis code for multi-stage configurations

SIMULATED AXIAL COMPRESSOR FLOW PATH



PROGRAM SCHEDULE



ACCOMPLISHMENTS:

FY 91/ FY92:
- Completed compressor aero design
- Completed 3D viscous flow analysis of the two stage compressor (operating in a true multi-stage environment)
- Initiated fabrication of the test compressor
- Redesigned an existing axial compressor shaft and bearing support structure, to accomodate the new hardware

PLANS:

FY 93:
- Testing of the redesigned running gear will be completed
- Buildup of the test package will be completed
- Compressor testing will be initiated

The 2-stage, 5:1 axial compressor program is a cooperative effort involving the U.S. Army Vehicle Propulsion Directorate, NASA Lewis, and the Allison Gas Turbine Division of General Motors. Multistage CFD analyses of two preliminary designs were conducted at Lewis under Army support, and recommended changes, based on the analytical resuts, were incorporated in the final detailed design. This compressor is expected to demonstrate the highest pressure ratio yet achieved (5:1) using only two axial stages, while maintaining efficiency and surge margin. Compressor hardware has been fabricated and delivered to Lewis Research Center for testing in the Small Compressor Test Facility. Facility modifications and instrumentation preparations are nearing completion. Testing is scheduled to commence during the second quarter of FY93.

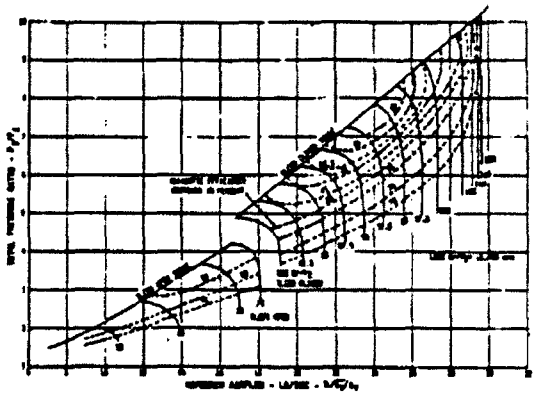
WORK UNIT TITLE: Compressors - Non-Recoverable Stall
PE/PRJ: 61102/AH45
CONTRACTOR: In-house
POC/PHONE: K. Owen (216) 433-5895

OBJECTIVE/PROBLEM STATEMENT:

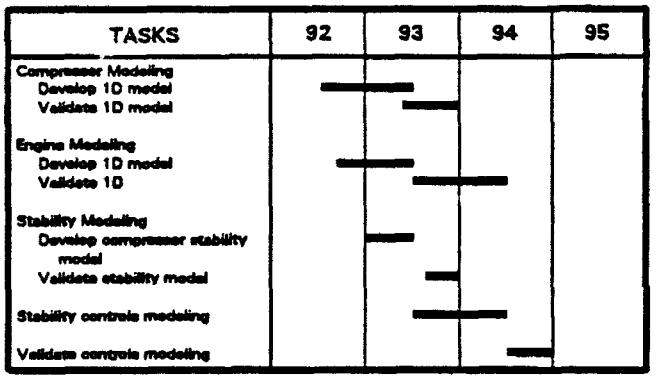
- Improved understanding of the engine dynamics and aerodynamics leading to rotating stall
- Determine relative sensitivity of engine operation in stable rotating stall to design parameters
- Explore the potential of compressor stability enhancement devices

DELIVERABLES:

- Design criteria for axial-centrifugal engine operability
- Methodology for solving start-up and low-speed stall problems on existing Army engines
- Stability enhancement methodology and device for axial/centrifugal turboshaft engines



PROGRAM SCHEDULE



ACCOMPLISHMENTS:

FY 91/ - 1D compressor model initiated
FY92: - Engine experimental verification program planning initiated and hardware/cell modification layouts begun

PLANS:

FY 93/ - 1D compressor model complete
FY94: - 1D compressor model validated with experimental data begun
- Develop engine model
- Engine model validated
- Develop/validate compressor stability enhancement model
- Develop stability enhancement methodology using model

The Lycoming T55-L-712 turboshaft engine has experienced an intermittent stall problem since its entry into service. The VPD has initiated a detailed analytical/experimental program to define the nature of this stall problem and to explore corrective measures to prevent its occurrence in future engines. A dynamic compressor model has given preliminary indications that the problem exists in the first stage rotor. A grant continues with Virginia Polytechnical Institute for the development of an advanced post-stall modeling code. A joint three year effort has begun with AEDC (Arnold Engineering Development Center) to develop an advanced dynamic/transient engine model. Facility modifications for a 1993 in-house engine test, to be conducted as part of the Small Turboshaft Engine Research (STER) activity, have begun. Instrumentation of the test rig and the engine has also been started. A joint NASA/Army effort is underway to explore an advanced compressor stability enhancement concept for the T55-L-712 compressor. NASA will be involved in the controls development and MIT (Massachusetts Institute of Technology) will provide an appropriate compressor model.

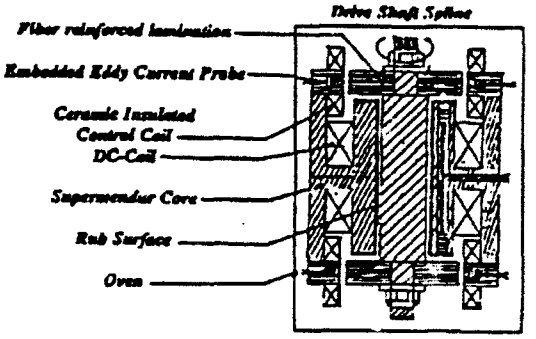
WORK UNIT TITLE: Mechanical Components - High Temperature Magnetic Bearing
PE/PRJ: 61102/AH45
CONTRACTOR: In-House
POC/PHONE: A. Kascak (216) 433-6024

OBJECTIVE/PROBLEM STATEMENT:

- IHPTET Phase III requires high temperature bearings

DELIVERABLES:

- Determination of the temperature limit of a magnetic bearing in an engine environment



PROGRAM SCHEDULE

TASKS	92	93	94	95	96
Ceramic insulated coil					
Extend temperature range of core					
Embedded probe					
Fiber reinforced lamination					
Rig demonstration					
Engine demonstration					

ACCOMPLISHMENTS:

FY92:
- Begin high temperature insulation evaluations
- Begin evaluation of high temperature core materials
- Predict stability limits of bearing rig with active control stability code

PLANS:

FY 93:
- Extend test temperature range of Co-Fe material

FY 94:
- Develop embedded probe
- Develop fiber reinforced lamination

FY 95:
- Rig demonstration of high temperature magnetic bearing

FY 96:
- Engine test in-house or in cooperative program

The objective of the IHPTET (Integrated High Performance Turbine Engine Technology) program is to greatly increase the performance, while simultaneously reducing the weight of conventional gas turbine engines. Magnetic bearings offer the opportunity to eliminate the lubrication system and oil seals, extend bearing life and DN (size*speed parameter), allow for adaptive vibration control, in addition to compatibility with the goal for all-electric engine accessories. The NASA Lewis Research Center and the Vehicle Propulsion Directorate have started a joint, high temperature magnetic bearings program, which will be investigating high temperature probes, compact wire insulation, and fiber reinforced laminates. High temperature materials and insulation testing has been started, as well as 3D magnetic bearing modeling. In addition, an in-house active control stability code has been used to predict the stability limits of the magnetic bearing rig. A cooperative program has been started between NASA/Army, Allison Gas Turbine Division, the University of Virginia, and Texas A&M University. It is a focused effort to build and test a 1000°F-1200°F magnetic thrust bearing.

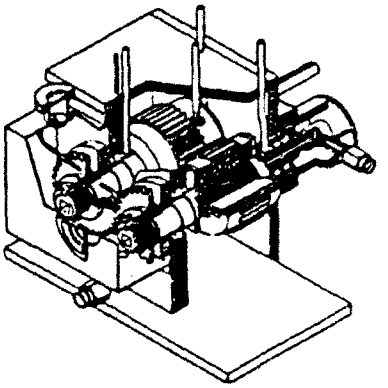
WORK UNIT TITLE: Mechanical Components - Drive System Components
PE/PRJ: 61102/AH45
CONTRACTOR: In-house/Universities/Industries/Navy
POC/PHONE: R. Handschuh (216) 433-3969

OBJECTIVE/PROBLEM STATEMENT:

- Conduct experimental component testing to understand and quantify improvements and validate analytical predictions

DELIVERABLES:

- Improved understanding of operational and design parameters on component life, reliability, and noise
- Experimental validation of advanced designs



PROGRAM SCHEDULE

TASKS	91	92	93	94	95	96
Spiral Bevel						
Spur Gears						
Lubricants						
Materials						

ACCOMPLISHMENTS:

FY 91/FY92:
- Completed preliminary spiral bevel gear lubrication experiments
- Completed spur gear pitting fatigue testing with two synthetic lubricants
- Initial face gear evaluation complete

PLANS:

FY 93/: FY 94
- Complete face gear evaluation
- Complete spiral bevel gear lube studies
- Complete M50NiL gear material tests
- Complete joint Army/NASA/Navy lube tests

A recent evaluation in the drive system components area investigated the feasibility of using face gears in a high-speed and high power environment such as found in rotorcraft transmissions. Helicopter transmissions are usually required to redirect the engine power output from the horizontal direction to the vertical in order to power the main rotor. This turning has traditionally been accomplished with spiral bevel gears. The use of face gears in this application (in a torque sharing arrangement) has been projected to reduce the main rotor transmission weight by up to 25 percent. Face gears, however, have previously been used only at low speeds and torques. In this effort, four half-scale face gear sets were tested in a closed-loop test stand at pinion rotational speeds to 19,100 rpm and to 271 kW (364 hp). All four sets of gears successfully ran at 100 percent of design torque and speed for 30 million pinion cycles, and two sets successfully ran at 200 percent of torque for an additional 30 million cycles. These results were a positive indication of the potential for using face gears in helicopter transmissions.

WORK UNIT TITLE: Compressors - Wave Engine Cycle
PE/PRJ: 61102/AH45
CONTRACTOR: Cornell University
POC/PHONE: G. Skoch (216) 433-3396

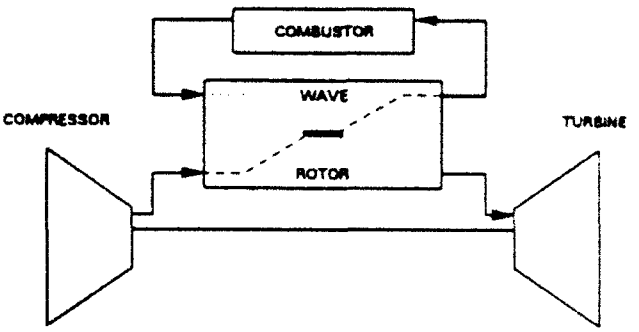
OBJECTIVE/PROBLEM STATEMENT:

- Increased power/weight ratio and lower SFC can be achieved only through higher pressure ratios and higher turbine inlet temperatures with fewer and lighter components
- Explore a technology that has the potential to meet these requirements and contribute to the IHPTET goals

DELIVERABLES:

- One stage of compression and expansion in a single, light weight device
- Higher combustor temperatures and higher "effective" turbine inlet temperatures without the need for exotic turbine materials
- Potential reductions in loss caused by small size of final stage in multistage compression systems
- CFD analysis capability for wave rotor applications
- Unbiased determination of optimum engine cycles for wave rotor applications

WAVE ENGINE CYCLE



PROGRAM SCHEDULE

TASKS	92	93	94	95	96
Grant with Cornell University					
Code Development					
Build Wave Rotor Test Rig					
Engine Cycle Analysis With Wave Rotor					
Wave Rotor Experiment					

ACCOMPLISHMENTS:

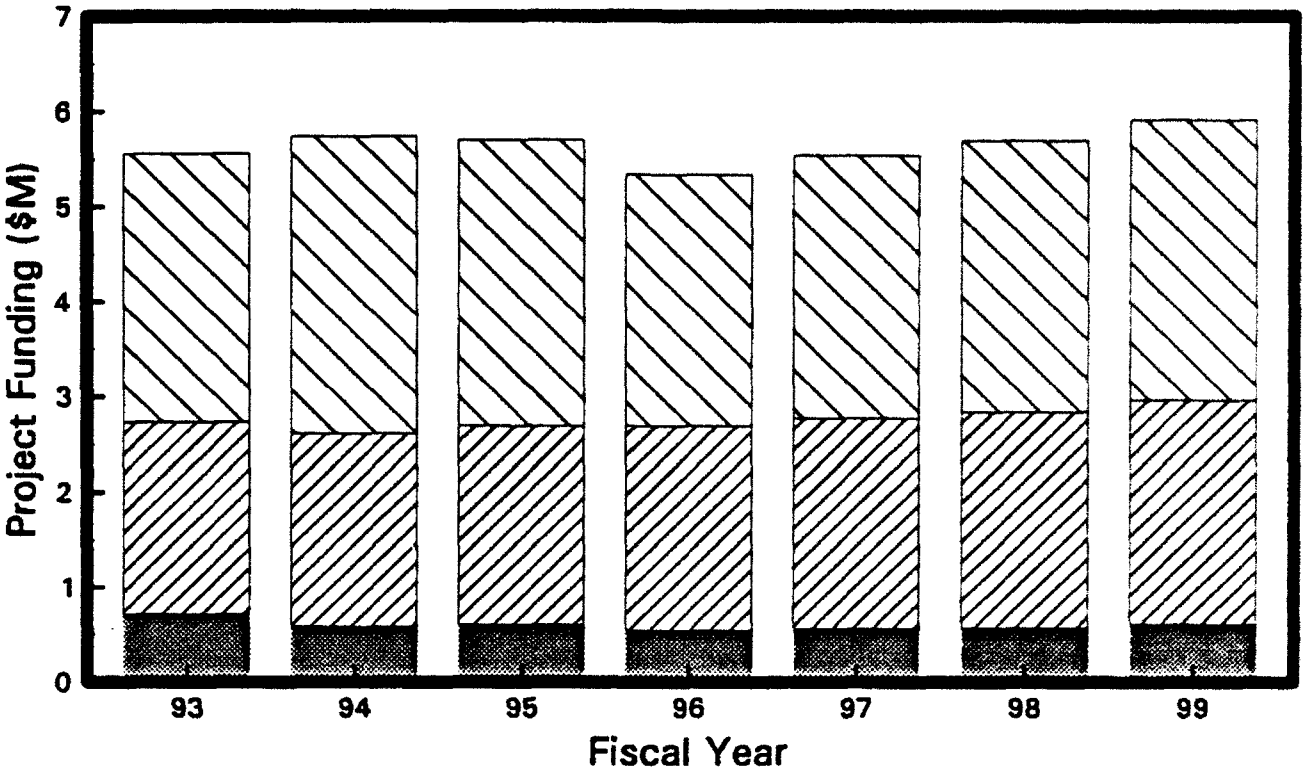
FY 91/ - Continued grant activity with Cornell University
FY92: - Two computer codes were completed to calculate wave rotor performance
- Preliminary engine cycle studies were begun
- Fabricated wave rotor test package
- Build up of the test facility was completed

PLANS:

FY 93/ - Computer code development will continue
FY 94: - Begin wave rotor experiment
- A cycle study of an existing engine with a wave rotor topping cycle will be completed

A joint NASA Lewis/Vehicle Propulsion Directorate program is underway to examine the wave rotor as a potential topping cycle for gas turbine engines, which would allow them to operate more efficiently at significantly higher pressures and temperatures. A wave rotor consists of many tubes placed around the outside of a rotating drum. The flow in each tube alternates between combustor gas and fresh air from a conventional compressor. When combustor gas enters the tube, it drives a shockwave through the fresh air, causing additional compression. The charge of highly compressed fresh air is then delivered to the combustor. The combustor gas still in the tube is exhausted by an expansion wave which forms to balance the energy that was used in compression. The expansion wave cools the combustion gas, so that it can be allowed to flow out through a conventional turbine. Because each tube is intermittently cooled by fresh air, very high combustion temperatures can be achieved without the use of complex cooling schemes. By replacing the high spool(s) of a gas turbine engine with a wave rotor, significant performance improvements could be achieved. Computer codes have been developed to predict the wave motion and performance of wave rotors. An experimental facility has been designed and constructed to verify code predictions. Initial results show very good agreement between experiment and prediction.

VEHICLE PROPULSION DIRECTORATE



The Vehicle Propulsion Directorate is a relatively small organization. Thus, its budget is also small in comparison to other ARL directorates. The FY93 budget, after accounting for costs of opening our doors (e.g., salaries, travel, training, assessments,...) leaves approximately $1.5M program funding. There is essentially no growth projected through FY99. Under ARL, our charter has been enlarged from its original aviation emphasis to include ground vehicle basic research. The funding projection related to ground vehicle propulsion basic research is constant. It has also been projected that staffing at the VPD will increase slightly, to deal with the new ground vehicle propulsion role. There is not sufficient funding to permit increasing the staff while also maintaining a vibrant, technology pushing program.

Cooperative Research and Development Program with Industry

- SHARING OF EACH OTHER'S CAPABILITIES, IDEAS, AND RESOURCES TO ACHIEVE COMMON OBJECTIVES
- NO FUNDS EXCHANGE HANDS
- BENEFITS TO THE ARMY PROPULSION COMMUNITY
  - LEVERAGES NASA AND INDUSTRY RESOURCES
  - MINIMIZES ARMY COST FOR TECHNOLOGY DEVELOPMENT
  - PERMITS US TO DO TOGETHER, WHAT OTHERWISE COULD NOT BE DONE ALONE

CONDUCTED UNDER NON-REIMBURSABLE SPACE ACT AGREEMENT

Being used with increasing frequency in the present financial atmosphere

The Vehicle Propulsion Directorate has been entering into an increasing number of cooperative research and development programs with industry in the past few years. These programs are conducted under non-reimbursable space act agreements, wherein the parties share with each other their capabilities, ideas, and resources to achieve common objectives. No funds are exchanged. Rather, the parties contribute to the common task what they can best bring to the program. Generally, the Army's contribution is an analytical effort or test activity in one of our unique facilities. Industry's contribution is generally in the form of design and manufacture of hardware. In this way, the Army, NASA Lewis and industry leverage each other and minimize the cost to any one party for technology development. We accomplish together what none of us could accomplish alone.

VEHICLE PROPULSION DIRECTORATE

PROPOSED SBIR TOPICS FOR FY93

- Advanced High Temperature Strain Isolator Material System
- Depleted Oxygen Gas Turbine Combustor Design
- Brush Seal Shaft Wear Resistant Coating
- Electromotive Propulsion Concepts for Rotorcraft
- Fast Acting Valves for Turbomachinery Bleed Applications

POC for SBIR activities: Mr. Pete Meitner, 216-433-3715

Another medium for pursuing tech base programs is through Small Business and Innovative Research programs. The topics proposed by the Vehicle Propulsion Directorate for solicitation in FY93, which have a reasonable chance for being solicitated, are listed in the figure.

8301-GAB APBI APBI_06 921231

VEHICLE PROPULSION DIRECTORATE

SUMMARY

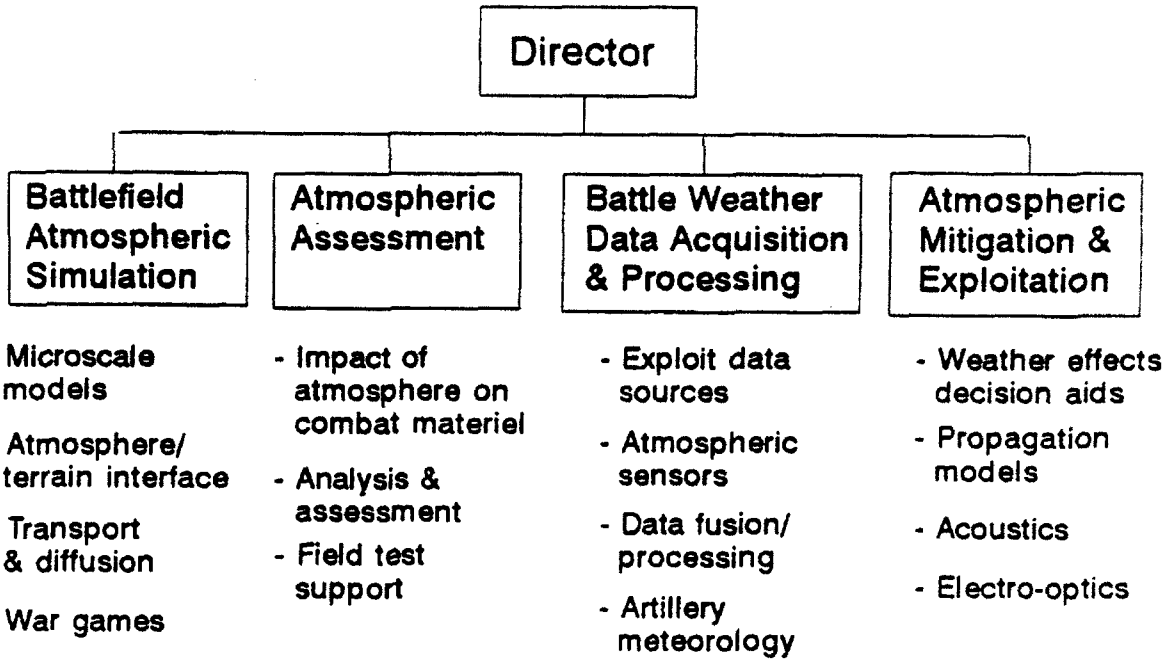
- VPD CONDUCTS A TECH BASE PROGRAM THAT IS DRIVEN BY THE NEEDS OF THE SOLDIER
- PROGRAM CONDUCTED USING WORLD CLASS RESOURCES, (SPECIALISTS AND FACILITIES) FOR ALL ENGINE AND TRANSMISSION TECHNOLOGIES
- VPD HAS ESTABLISHED A CENTER OF EXPERTISE FOR VEHICLE PROPULSION THAT IS SOUGHT BY OTHERS (CONSULTATION, COOPERATION, ...)
- VPD WILL CONTINUE TO CONDUCT A VIBRANT PROGRAM WITH AVAILABLE RESOURCES USING ANY VEHICLE AT OUR DISPOSAL

ARMY RESEARCH LABORATORY

Battlefield Environment

COL Ronald L. Evans
Directorate Executive
Battlefield Environment (BE)
(505) 678-1225

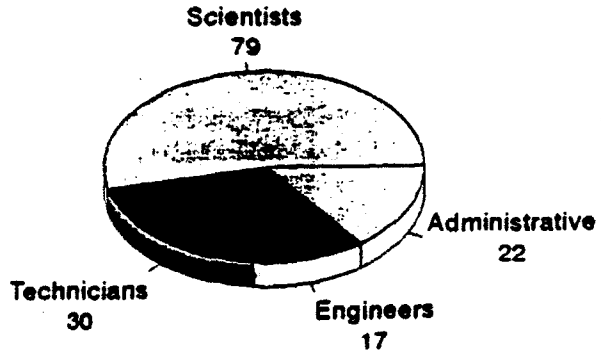
Battlefield Environment Directorate

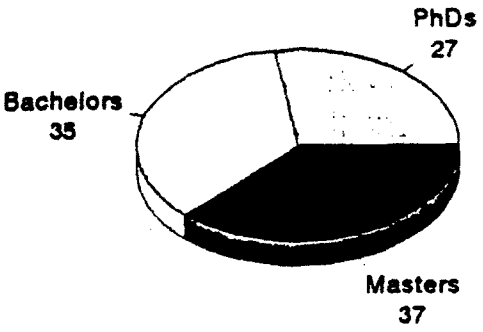


Battlefield Environment Directorate Mission

- Develop battlefield atmospheric modeling and simulation capabilities to represent battlefield atmospheric conditions.
- Investigate aerosol physics properties related to the propagation of electromagnetic energy through battlefield atmospheres contaminated by natural and combat induced obscurants.
- Research and develop atmospheric characterization techniques and instrumentation, assess the susceptibility of Army materiel and operations to atmospheric conditions, and support such assessments as required.
- Research, develop, and exploit atmospheric sensing technology to collect battlefield weather data, including remote detection of various aerosol and gaseous components in the atmosphere.
- Develop battle weather data processing techniques for quantifying the meteorology over the battle area.
- Create methods and techniques to mitigate effects of battlefield atmospheres on friendly materiel and operations and exploit the knowledge of atmospheric effects on threat systems.

PERSONNEL BY CATEGORY AND DEGREE





TOTAL ASSIGNED: 148

S&E's ASSIGNED: 99

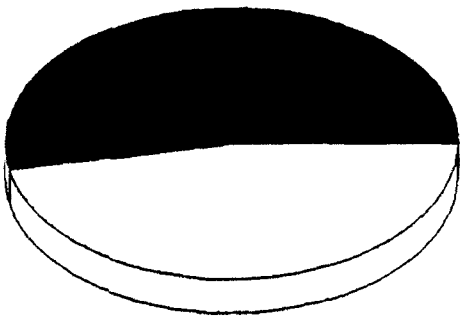
31 Dec 92

OVERALL FUNDING STATUS ($K)

CATEGORY	FY92	FY93	FY94	FY95	FY96
BASIC RESEARCH (6.1)	5311	5654	6153	6431	6469
EXPLORATORY DEVELOPMENT (6.2)	4953	5895	6396	7074	7046
MET EFFECTS ASSESSMENT (6.5)	9936	9552	9922	9578	8663
SMALL BUSINESS INNOVATION RSCH (6.5)	1045	1065	TBD	TBD	TBD
OTHER	308	TBD	TBD	TBD	TBD
SUBTOTAL	21553	22166+	22471+	23083+	22178+
CUSTOMER	6740	TBD	TBD	TBD	TBD
TOTAL	28293	22166+	22471+	23083+	22178+

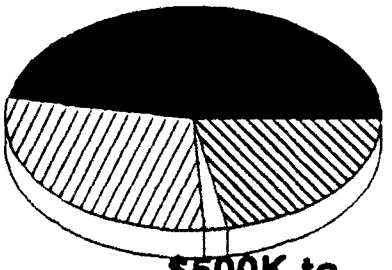
Subject to change based upon DoD and Congressional action

FY92 FUNDING PROFILE
IN-HOUSE VS CONTRACTS



TOTAL: $28,293 K

ACTIVE CONTRACTS
FY 92



BATTLEFIELD ATMOSPHERIC SIMULATION
FUTURE EFFORTS

FY94
- Weather/Obscuration Effects in Wargames
  -- 4D Weather & Obscuration
- Transport & Diffusion
- Optical Simulator for Real Time Turbulence Effects

FY95
- Battlefield Obscuration Modeling
  -- Exotic Battlefield Aerosols
  -- Artificial Fogs
- Enhanced Physical Basis for Optical Turbulence Simulator

FY96
- Miniaturized Real Time Optical Turbulence Simulator for General Army Applications

POC: Dr. D. Brown
Phone 505-678-2412, Fax 505-678-2053
AMSRL-BE-S, White Sands Missile Range, NM 88002-5501

ATMOSPHERIC ASSESSMENT
FUTURE EFFORTS

- FY94
  - Upper Atmospheric Models for Theater Missile Defense
  - Millimeter Wave Imager Capability
  - Electro-Optical Systems Performance Models
- FY95
  - Mobile Spectroscopy Facility
  - Characterization of Tailored Broad Band Screeners
- FY96
  - Validation and Verification of EOSAEL models
  - Obscurant Characterization by LIDAR
  - Smoke Cloud Tomography
- * Continuing Support to Atmospheric Characterization (Smokes, Obscurants, etc.)

POC: Mr. D. R. Veazey
Phone 505-678-3331, Fax 505-678-7919
AMSRL-BE-A, White Sands Missile Range, NM 88002-5501

BATTLE WEATHER DATA AQUISITION & PROCESSING FUTURE EFFORTS

- FY94
  - UltraViolet Chem-Bio Warfare Detection Techniques
  - SATCOM Weather Broadcasting Tech Demonstration
  - Mobile Profiler Technology Demonstration
  - Technology for Deriving Atmospheric Profiles from Multi-frequency Sensors
  - Computer Assisted Artillery Meteorology for Tech Demonstration
- FY95
  - Improved Data Acquisition/Distribution/Forecaster Aid Software
  - 12-Hr Target Area Meteorology Forecasting Capability
- FY96
  - Prototype Horizontal Path Adaptive Optics Technology
  - Non-hydrostatic Battle Scale Forecast Model on Army Tactical Command & Control System (ATCCS) Common Hardware/Software

POC: Dr. M. A. Seagraves
Phone 505-678-1339, Fax 505-678-3385
AMSRL-BE-W, White Sands Missile Range, NM 88002-5501

ATMOSPHERIC MITIGATION & EXPLOITATION FUTURE EFFORTS

- FY94
  - Two Stream Acoustic Propagation Model
  - Characterization Techniques for Weather Effects on Camouflage
- FY95
  - Advanced Electro-Optical Target Acquisition Model
  - Aerial Intelligence Preparation of the Battlefield Automation
  - Weather Decision Aids on Portable Weather Workstation
- FY96
  - 3-D Two-way Acoustic Propagation Model
  - Real-time Obscurant Scene Visualization

POC: Dr. F. E. Niles
Phone 505-678-3721, Fax 505-678-8366
AMSRL-BE-M, White Sands Missile Range, NM 88002-5501

Battlefield Environment Directorate

Potential CRDA Areas

- Atmospheric Numerical Modeling
- Atmospheric Remote Sensing

Some Recent SBIR Efforts

- Portable FM-CW Doppler Radar to Provide Meteorological Data
- Water and Temperature Profiles in the Turbulent Surface Layer
- Acoustic Scattering by a Vortex Model of Turbulence
- Saltation & Suspension of Sediment by Turbulent Wind
- Atmospheric Boundary Layer Stability Estimator for Urban Areas
- Four Dimensional Mesoscale Non-Gaussian Multispectral Smoke Model

BATTLEFIELD ENVIRONMENT DIRECTORATE
Points of Contact
White Sands Missile Range, NM 88002-5501

SUBJECT	POC	OFFICE SYMBOL	PHONE
Small Business	Mr. Luis Sosa	STEWS-SA-B	(505)678-1401
SBIR	Mr. Odell Johnson	AMSRL-CP-TT	(505)678-3608
HBCU/MI	Mr. Odell Johnson	AMSRL-CP-TT	(505)678-3608
Tech Transfer/CRDA	Mr. Odell Johnson	AMSRL-CP-TT	(505)678-3608
Unsolicited Proposals	Mrs. Maria Briseno	AMSRL-OP-PR	(505)678-2617
Contracting	Mrs. Barbara Gerace	AMSRL-OP-PR	(505)678-8110
Public Affairs	Mrs. Ann Rider	AMSRL-CP-S	(505)678-3652
Competition Advocate	Mrs. Barbara Gerace	AMSRL-OP-PR	(505)678-8110

as of 7 Jan 93

A R M Y R E S E A R C H L A B O R A T O R Y

Electronics & Power Sources

Dr. Clarence G. Thornton
Directorate Executive
Electronics and Power Sources (EPSD)
(908) 544-2541

ELECTRONICS and POWER SOURCES

ARL APBI

NAVAL SURFACE WARFARE CENTER
WHITE OAK, MARYLAND

PRESENTED BY:

DR. C.G. THORNTON
DIRECTORATE EXECUTIVE
ELECTRONICS and POWER SOURCES DIRECTORATE
U.S ARMY RESEARCH LABORATORY
FORT MONMOUTH, NEW JERSEY

28 JANUARY 1993

ELECTRONICS and POWER SOURCES BUSINESS AREAS

ELECTRONICS and POWER SOURCES

MICROWAVE/MILLIMETER/MIMIC DEVICES

ACOUSTO/FERROELECTRONICS

NANO/OPTOELECTRONIC/PHOTONIC DEVICES

OPTICAL MATERIALS/DEVICES AND FOCAL PLANE ARRAYS

ADVANCED SENSOR/ACTUATOR DEVICES

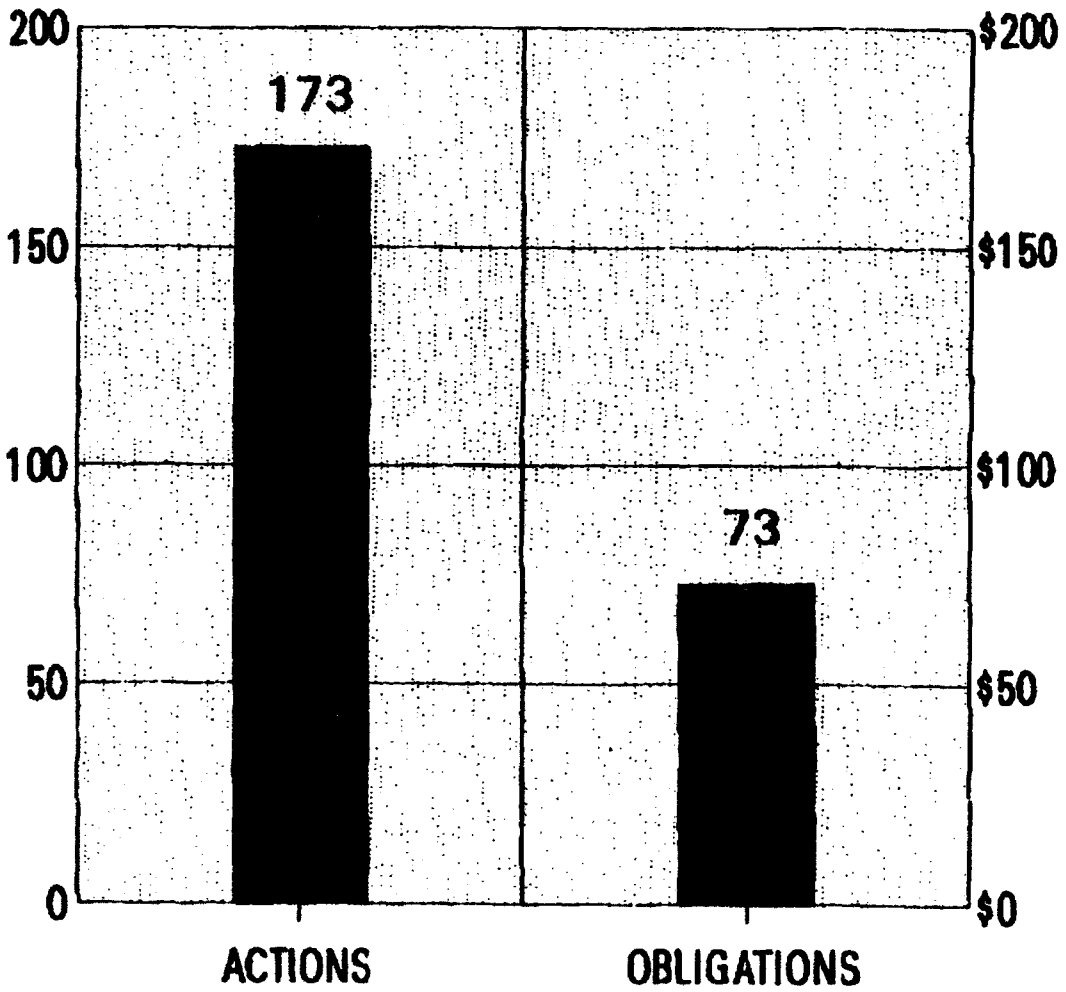
DESIGN/SIMULATION, MODELING, CONCURRENT ENGINEERING, AND PROTOTYPING

RELIABILITY AND MANUFACTURING SCIENCE

POWER SOURCES (INCLUDING PULSE POWER)

VIRTUAL ENVIRONMENT (DISPLAY) DEVICES

EPS Directorate
FY 93 Acquisition Plan
(Estimated obligations in millions)



76 % INCREMENTAL FUNDING MODIFICATIONS.

70 % CUSTOMER FUNDED (DARPA, ETC.)

ELECTRONICS AND POWER SOURCES
FUTURE DIRECTIONS

PAST	PRESENT	FUTURE
MICROELECTRONICS	MICRO/QUANTUM ELECTRONICS	NANOELECTRONICS (Quantum Transport, Atomic Transitions, Mesoscopic, 3D, Multi-Material, Manufacturing Science)
MICROWAVE/ MILLIMETER-WAVE	MICROWAVE/MILLIMETER-WAVE DEVICES, IR ARRAY TECHNOLOGY, MIMIC DEVICES	INTEGRATED MW/MMW/PHOTONIC (Multimode Focal Plane, Smart/Adaptive)
DISPLAYS	INFORMATION INTERFACE	VIRTUAL ENVIRONMENT DEVICES (Micro, High Definition, Retinal, Large Screen)
POWER SOURCES PULSE POWER	POWER SOURCES	ALTERNATIVE ENERGY SOURCES (Mini-Fuel Cells, Micro-Generators, SMEPS, Hi-Density Energy Storage)
PHOTONICS	OPTOELECTRONICS, OPTICAL MATERIALS, FOCAL PLANE ARRAYS	INTEGRATED MICROPHOTONIC DEVICES (OICs, Optical Devices/ Bench-on-a-Chip, Smart Pixels)
FREQUENCY CONTROL/ ACOUSTICS	ACOUSTOELECTRONICS MAGNETICS FERROELECTRONICS BIO SENSORS SUPERCONDUCTORS	MICROSENSOR/ACTUATOR/ CONTROL DEVICES (Microelectromechanical, Bioelectronic and Magnetic, Ferroelectronic Superconductivity)

ELECTRONICS and POWER SOURCES
FY93 PROGRAM

1 JANUARY 1993

US ARMY
RESEARCH LABORATORY

MAJOR NEW PROGRAM INITIATIVES

US ARMY RESEARCH LABORATORY

ELECTRONICS and POWER SOURCES

- MIMIC PHASE II
- MICROWAVE ANALOG FRONT-END TECHNOLOGY (MAFET)
- RAPID PROTOTYPING OF APPLICATION SPECIFIC SIGNAL PROCESSORS (RASSP)
- MICROWAVE HARDWARE DESCRIPTION LANGUAGE (MHDL)
- APPLICATION-SPECIFIC ELECTRONIC MODULES (ASEM)

HIGH LEVERAGE PIVOTAL TECHNOLOGY

US ARMY RESEARCH LABORATORY

ELECTRONICS and POWER SOURCES

MICROWAVE/MILLIMETER/MIMIC DEVICES

- INTEGRATED PHOTONIC - MMIC's
- QUASI-OPTICAL MILLIMETER WAVE ELECTRONICS
- MICROWAVE/MILLIMETER WAVE IMAGING TECHNOLOGY
- PHYSICS BASED MODELLING OF MW + PHOTONIC DEVICES
- MICROWAVE HARDWARE DESCRIPTION LANGUAGE (MHDL)
- MICROWAVE/MILLIMETER WAVE RELIABILITY

ACOUSTO/FERROELECTRONICS

- SURFACE ACOUSTIC WAVE DEVICES
- FERROELECTRONIC DEVICES
- LOW-NOISE/VIBRATION-IMMUNE CRYSTAL OSCILLATORS
- MICROSENSORS

DESIGN/SIMULATION, MODELING, CONCURRENT ENGINEERING AND PROTOTYPING

- ELECTRONIC MODULES & COMPONENTS
- DEVICES AND PROCESSING
- PACKAGING

HIGH LEVERAGE PIVOTAL TECHNOLOGY

US ARMY RESEARCH LABORATORY

ELECTRONICS and POWER SOURCES

DEVICE RESEARCH

- NANO/OPTOELECTRONIC/PHOTONIC DEVICES
- OPTICAL MATERIALS/DEVICES AND FOCAL PLANE ARRAYS
- ADVANCED SENSOR/ACTUATOR DEVICES
- INFRARED DETECTOR TECHNOLOGY
- HIGH TEMPERATURE SUPERCONDUCTING DEVICES
- PERMANENT MAGNET DESIGN

RELIABILITY AND MANUFACTURING SCIENCE

POWER SOURCES (INCLUDING PULSE POWER)

- HIGH-RATE, HIGH-ENERGY, ENVIRONMENTALLY-BENIGN THROWAWAY BATTERIES
- HIGH-ENERGY RECHARGEABLE (MULTICAPABLE) BATTERIES
- ADVANCED ENERGY STORAGE CONCEPTS
- HIGH-ENERGY, HIGH-REP RATE CAPACITORS
- HIGH-REP RATE, HIGH-ENERGY PULSER SWITCHES
- HIGH-ENERGY PULSER COMPONENTS

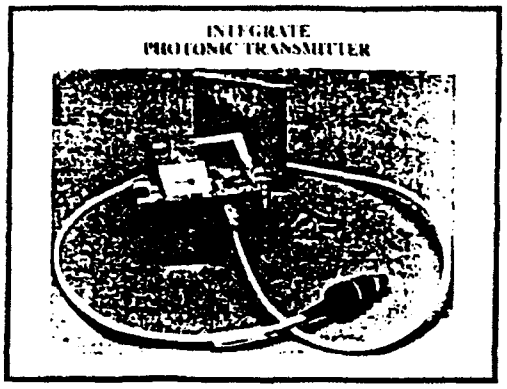
VIRTUAL ENVIRONMENT (DISPLAY) DEVICES

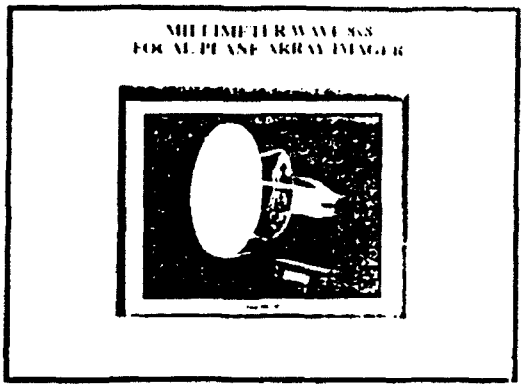
- ELECTRONIC MODULES AND HIGH RESOLUTION DISPLAY COMPONENTS
- HI-RESOLUTION MULTICOLOR DISPLAYS

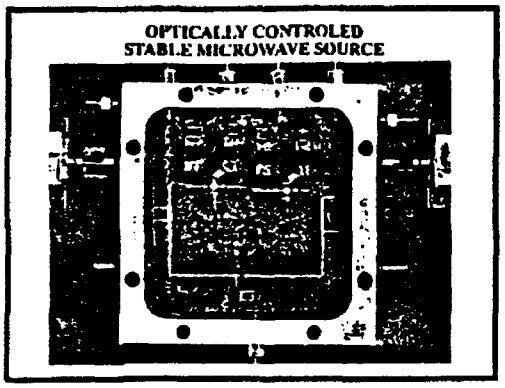
MIMIC PROGRAM STATUS (January 1993)

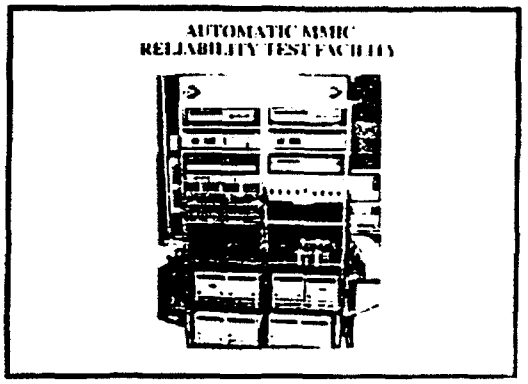
- PHASE 1 - 93 UNIQUE CHIPS FOR 20 MILITARY SYSTEMS DESIGNED AND 60% RF FUNCTIONAL ON FIRST ITERATION
- PHASE 2 - 76 COMPLEX CHIPS FOR MORE THAN 20 PRIMARY APPLICATIONS ARE BEING DEVELOPED
- ADVANCED POWER PROCESSES (HBT, HFET AND PHEMT) ARE INTRODUCED FOR HIGH PERFORMANCE (MORE THAN 10% EFFICIENCY IMPROVEMENT, 1W POWER AT Ka BAND AND 100 mW AT W BAND
- HBT TECHNOLOGY UTILIZED FOR LOW PHASE NOISE VCO APPLICATONS
- MAJOR IMPROVEMENT IN FIRST PASS DESIGN HAS BEEN DEMONSTRATED DURING PHASE 2 BY USING CAD TOOLS (DESIGN CENTERING, EM SIMULATION, ETC.) AND IMPROVED MODELS
- DISTRIBUTED RELATIONAL DATA SUPPORTS DESIGN, PROCESSING AND TESTING FOR IMPROVED PRODUCIBILITY
- MAJOR IMPROVEMENT IN ON-WAFER TESTING (FROM 5 hours, TO 6 minutes EXTENDED TO ON WAFER TEMPERATURE TESTING, AUTOMATED PULSED RF POWER TESTING AND TO HIGHER FREQUENCIES AT W BAND)
- COST OF QUALIFIED CHIPS REDUCED FROM $500 TO $8 PER MM SQUARE
- MORE THAN 100 CHIP TYPES DEVELOPED UNDER THE MIMIC PROGRAM OFFERED FOR SALE

MICROWAVE/MILLIMETER WAVE









MICROWAVE/MILLIMETER WAVE DEVICES

TECHNOLOGY AREAS OF INTEREST

- INTEGRATED PHOTONIC - MMIC's
- QUASI-OPTICAL MILLIMETER WAVE ELECTRONICS
- MICROWAVE/MILLIMETER WAVE IMAGING TECHNOLOGY
- PHYSICS BASED MODELLING OF MW + PHOTONIC DEVICES
- MICROWAVE HARDWARE DESCRIPTION LANGUAGE (MHDL)
- MICROWAVE/MILLIMETER WAVE RELIABILITY

OBJECTIVES:

- MEET PERFORMANCE REQUIREMENTS OF MW/MMW ELECTRONICS FOR MISSILE GUIDANCE, RADAR, JAMMERS, AND SENSORS.
- DEVELOP OPTICAL/MW ICs FOR DISTRIBUTION OF CONTROL SIGNALS FOR NEXT GENERATION ACTIVE PHASED-ARRAY RADAR AND COMMUNICATIONS.
- DEVELOP MODELING AND SIMULATION TECHNIQUES FOR MW/MMW DEVICES AND PROCESSES.

DESIGN/SIMULATION, MODELING, CONCURRENT ENGINEERING

TECHNOLOGY AREAS OF INTEREST

- ELECTRONIC MODULES & COMPONENTS
  - RAPID PROTOTYPING OF APPLICATON - SPECIFIC SIGNAL PROCESSORS (RASSP)
  - APPLICATION-SPECIFIC ELECTRONIC MODULES (ASEM)
  - DIRECT DIGITAL SYNTHESIZERS
  - NEURAL NETWORKS
- DEVICES AND PROCESSING
  - SILICON TECHNOLOGY
  - III - V DEVICES
- PACKAGING
  - 3-DIMENSIONAL PACKAGING
  - HIGH-POWER-MICROWAVE-IMMUNE PACKAGING

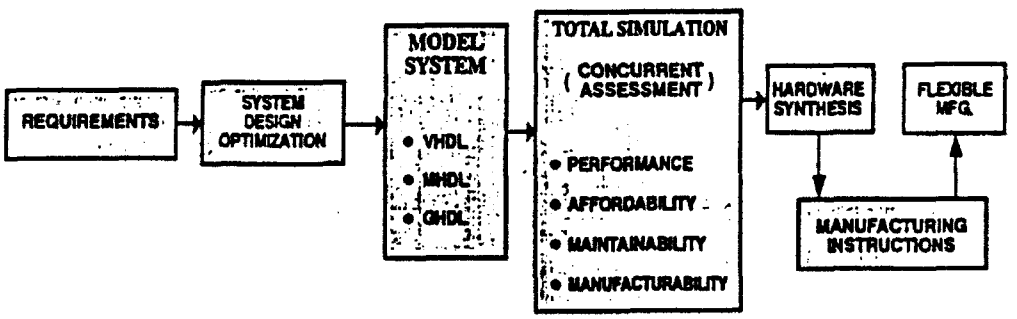
OBJECTIVE:

- MAINTAIN DoD S&T LEAD IN APPLICATION OF THE NEXT MAJOR ADVANCES IN MICROELECTRONICS, REDUCING SIZE & WEIGHT BY A FACTOR OF 20 WHILE INCREASING THROUGHPUT TO MULTI-GIGAFLOP LEVELS. IMPLEMENT THE ARMY PORTION OF THE RASSP AND ASEM PROGRAMS.
- ACHIEVE FAILURE-FREE MICROELECTRONICS.

DESIGN/SIMULATION, MODELING, CONCURRENT ENGINEERING

US ARMY RESEARCH LABORATORY

ELECTRONICS and POWER SOURCES



RAPID PROTOTYPING OF APPLICATION SPECIFIC SIGNAL PROCESSORS (RASSP)

VIRTUAL ENVIRONMENT (DISPLAY) DEVICES

TECHNOLOGY AREAS OF INTEREST

- ELECTRONIC MODULES AND HIGH RESOLUTION DISPLAY COMPONENTS
- HI-RESOLUTION MULTICOLOR DISPLAYS

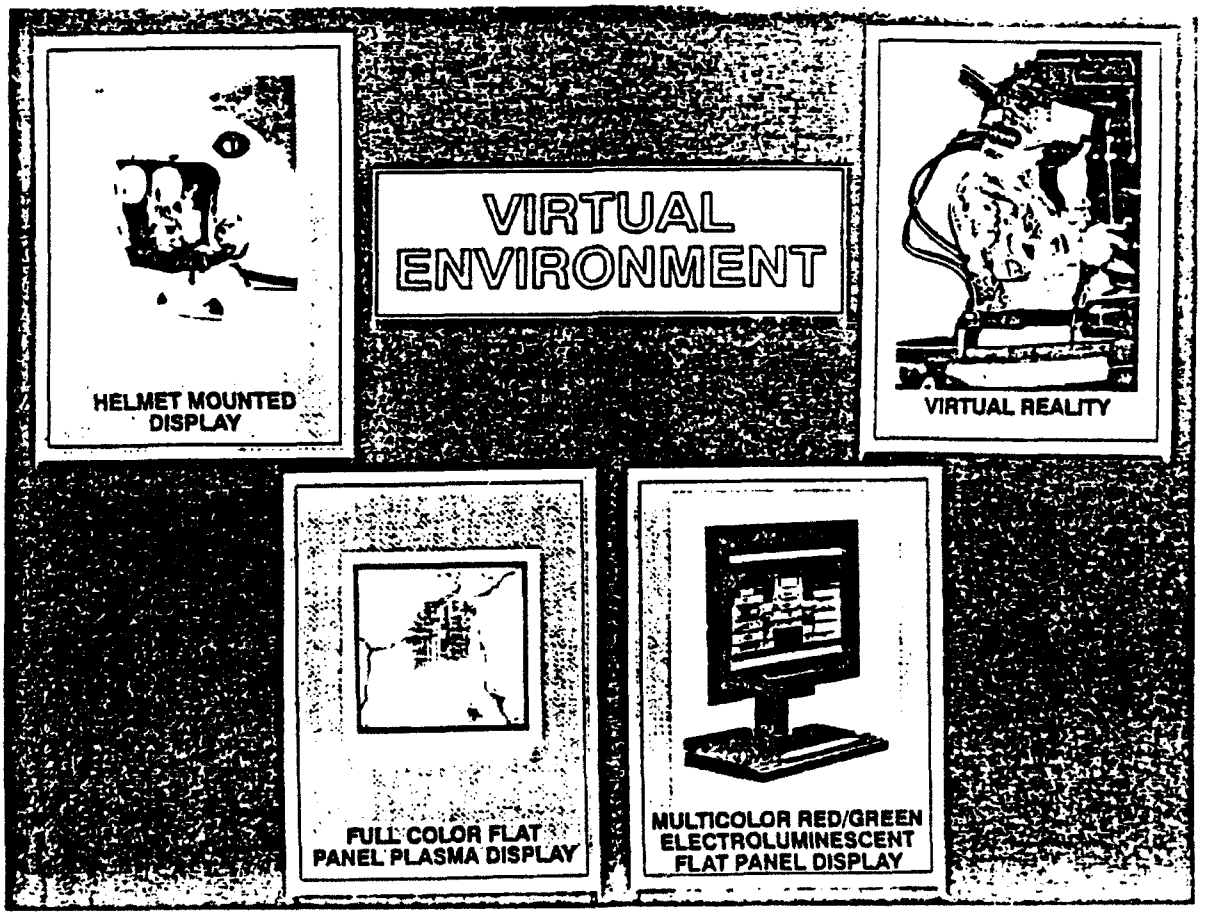
OBJECTIVE:

- PROVIDE SOLDIER/DISPLAY INTERACTIVE INTERFACES TO SERVE AS A FORCE MULTIPLER IN INFORMATION INTENSIVE BATTLEFIELD APPLICATIONS.
- DEVELOP PROTOTYPE, HIGH-RESOLUTION, RUGGED, LOW POWER, DISPLAY PANELS IN SIZES RANGING FROM MINIATURE PERSONAL VIEWERS TO LARGE SCREEN DISPLAYS
- DEVELOP, DEMONSTRATE, AND EVALUATE PROTOTYPE MULTICOLOR, HIGH RESOLUTION FLAT PANEL INTERACTIVE DISPLAYS FOR MAN PORTABLE, VEHICLE, AIRCRAFT AND GROUND APPLICATIONS

PRINCIPAL USERS:

- CENTERS/LABS: CECOM, MICOM, TACOM, CACDA, HEL, NAVY, AIR FORCE, MARINES
- PMs: AMMOLOG, TMDE, OPTADS, AFATDS

DISPLAYs/010693/APB(1-29-93)/257/BP



ACOUSTO/FERROELECTRONICS

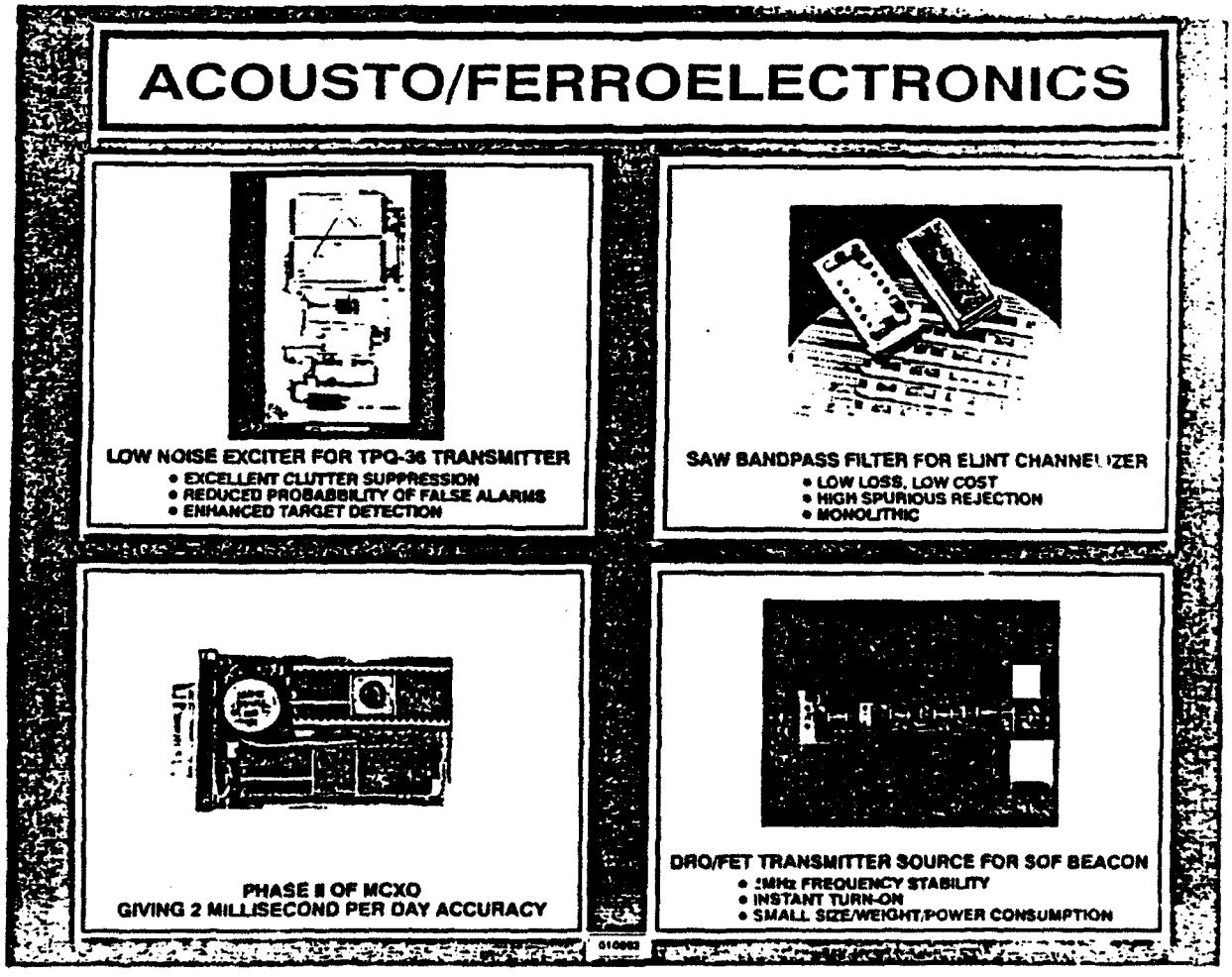
TECHNOLOGY AREAS OF INTEREST

- SURFACE ACOUSTIC WAVE DEVICES
  - SIGNAL PROCESSORS
  - LOW-NOISE OSCILLATORS
  - CHANNELIZERS
- FERROELECTRONIC DEVICES
  - SENSORS
- LOW-NOISE/VIBRATION-IMMUNE CRYSTAL OSCILLATORS
  - QUARTZ CRYSTAL RESONATORS
  - NEW PIEZOELECTRIC DEVICES/RESONATORS
- MICROSENSORS

OBJECTIVE:

- DEVELOP ULTRA-STABLE, LOW NOISE FREQUENCY SOURCES AND CLOCKS FOR IFF, RADAR AND COMMUNICATIONS.
- PROVIDE ACOUSTIC-WAVE ANALOG SIGNAL PROCESSING DEVICES FOR REAL-TIME MULTIPLE EMITTER AND PASSIVE TARGET DETECTION IN HIGH DENSITY/HIGH-CLUTTER SIGNAL ENVIRONMENTS.

FREQ/010693/APB/(1-29-93/SP



POWER SOURCES (INCLUDING PULSE POWER)

TECHNOLOGY AREAS OF INTEREST

- HIGH-RATE, HIGH-ENERGY, ENVIRONMENTALLY-BENIGN THROWAWAY BATTERIES
- HIGH-ENERGY RECHARGEABLE (MULTICAPABLE) BATTERIES
- ADVANCED ENERGY STORAGE CONCEPTS
- HIGH-ENERGY, HIGH-REP RATE CAPACITORS
- HIGH-REP RATE, HIGH-ENERGY PULSER SWITCHES
- HIGH-ENERGY PULSER COMPONENTS

OBJECTIVE:

- PROVIDE PORTABLE POWER FOR THE FULL RANGE OF ARMY EQUIPMENTS.
- IMPROVE PULSE POWER CONDITIONING COMPONENTS AND TECHNIQUES FOR DIRECTED ENERGY/KINETIC ENERGY WEAPONS, AND ELECTRIC DRIVES/ACTUATORS FOR COMBAT VEHICLES.

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PROPOSED POWER SOURCES BAA

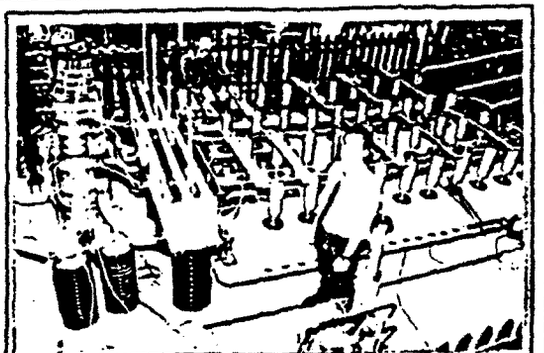
US ARMY RESEARCH LABORATORY

ELECTRONICS and POWER SOURCES

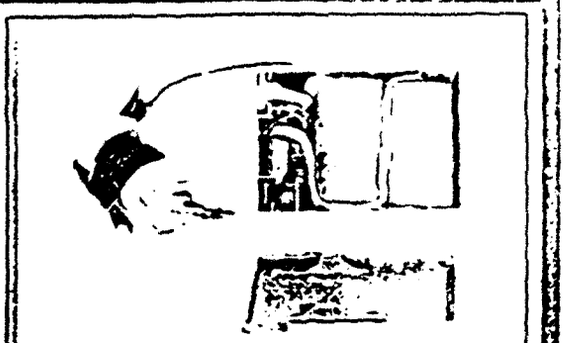
- LOW COST RECHARGEABLE PRIMARY BATTERY FOR GENERAL MILITARY APPLICATION
- RECHARGEABLE LITHIUM-LIKE BATTERIES (RLLB)
- IMPROVED MAGNESIUM BATTERIES
- PRIMARY BATTERY FOR SOLDIER SYSTEM, MAXIMUM ENERGY DENSITY
- PRIMARY BATTERY FOR SOLDIER SYSTEM, MAXIMUM POWER DENSITY

PPSBAA/010993/APB(1-14-93)SP

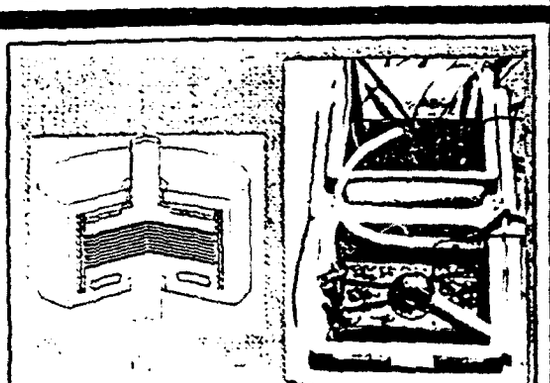
POWER SOURCES
(INCLUDING PULSE POWER)



2 MEGAJOULE MODULE OF 6 MJ PULSER FOR (ETC) GUN TO EVALUATE COMPONENTS

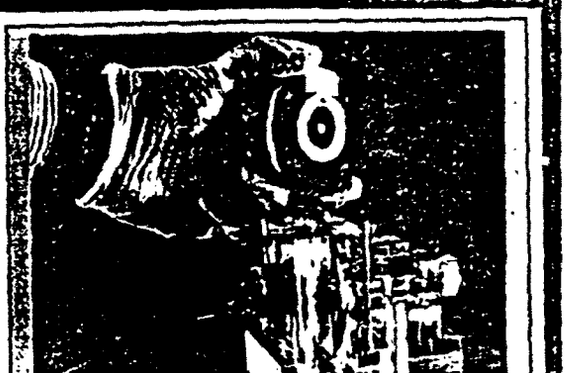


ADVANCED PROTOTYPE "D" SIZE LITHIUM RECHARGEABLE BATTERY FOR THERMAL WEAPON SIGHT



PULSE BATTERIES

HI ENERGY CAPACITORS



MONOLITHIC PHOTOCONDUCTIVE PULSER

ELECTRONIC DEVICE RESEARCH

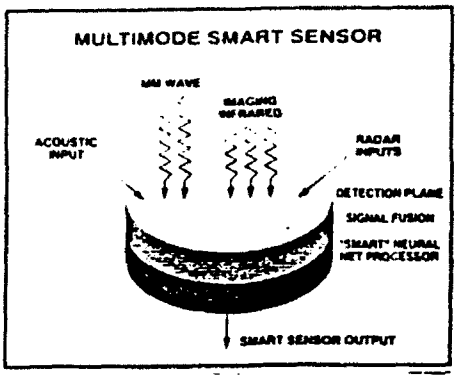
TECHNOLOGY AREAS OF INTEREST

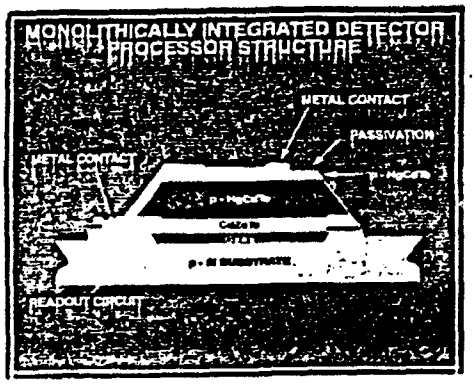
- NANO/OPTO/PHOTOELECTRONIC DEVICES
- OPTICAL MATERIAL/DEVICES AND FOCAL PLANE ARRAYS
- ADVANCED SENSORS AND ACTUATORS (MEMs)
- INFRARED DETECTOR TECHNOLOGY
- HIGH TEMPERATURE SUPERCONDUCTING DEVICES
- PERMANENT MAGNET DESIGN

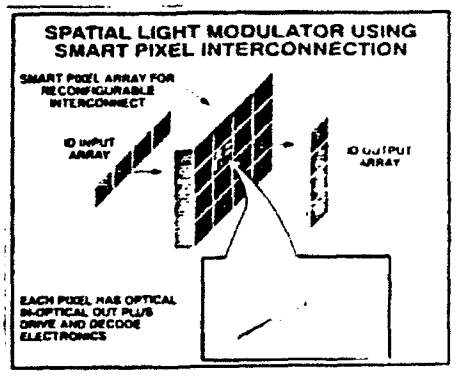
OBJECTIVE:

- DEVELOP THE MATERIAL AND DEVICE TECHNOLOGY FOR NANO SCALE ELECTRONIC AND OPTOELECTRONIC DEVICES REQUIRED FOR HIGH FREQUENCY MICROELECTRONICS, RADAR AND OPTICAL SIGNAL PROCESSING. CREATE BOTH COOLED AND UNCOOLED INFRARED TECHNOLOGY FOR LOW-COST LARGE MULTI-COLOR INFRARED STARING ARRAYS. PROVIDE HIGH TEMPERATURE SUPERCONDUCTING DEVICES FOR RADAR RECEIVERS.

ELECTRONIC DEVICE RESEARCH







EPSD SPONSORED CONSORTIA/COOPERATIVES

SUBJECT	*MEMBERS*
• LOG R&D - COST REDUCTION	• AT&T, TRW, RTI, INTERMETRICS, IBM, HONEYWELL, GOULD
• METEOROLOGICAL DATA SYSTEM	• TRW, SAWTEK, TRACOR, BENDIX, VIZ
• SYSTEM DESIGN METHODOLOGY	• RTI, TELEDYNE BROWN, UVA, GTE, CSC, JERSEY CITY STATE COLLEGE
• TFEL COLOR DISPLAY	• PLANAR, SARNOFF, SUPERTEX, NORDEN, ELDEC
• ULTRAPURE QUARTZ CRYSTAL	• OK STATE U, LAWRENCE LIVERMORE LABORATORY, SAWYER RESEARCH
• PRECISION OSCILLATOR	• GE NEUTRON DEVICES, PIEZO TECH., INC.
• QUARTZ STUDIES	• PRINCETON U, RENSSELAER, MCI, RAYTHEON
• MLRS MM WAVE TRANSCEIVER	• TRW, HUGHES, (MARTIN MARIETTA, DIEHL, THOMPSON CSF, THORN)
• DUAL MODE SEEKER	• CHANG INDUSTRIES, NORTHROP, MICOM RDEC
• SADARM MM WAVE TRANSCEIVER MM WAVE ANTENNAS	• HONEYWELL, VARIAN, HUGHES, AEROJET, ALPHA, BALL AEROSPACE, TRW, FLAM & RUSSELL
• MM WAVE IMAGING RADARS	• WTD, MICOM RDEC
• SATCOM-SCOTT TRANSMITTER	• STEINBRECHER, M-A/COM, HUGHES, FLAM & RUSSELL, GE E-LAB
• NOISE SOURCE FOR 94 GHZ	• NOISE COM, M-A/COM
• TANK DEFENSE RADAR	• TACOM, TRW, TI, BALL, MILLITECH, MICOM, BRL, HUGHES, GEORGIA TECH, PREDICTION SYSTEMS, CHANG INDUSTRIES
• PARTS EMULATION	• ITD, SYNOPSYS, QUICKTURN, SIGNETICS, GD
• HIGH PERFORMANCE DAC	• RADC
• VEHICLE SELF-PROTECTION	• WTD, MICOM RDEC, ARMAMENTS RDEC
* • MIMIC HDL	• ESSOF, INTERMETRICS, PERII

* NEWLY FORMED

STERN/010593.APBK(1-14-93)SP

EPS LABORATORY IMPLEMENTATION OF THE TECHNOLOGY TRANSFER ACT OF 1986

COOPERATIVE R&D AGREEMENTS (CRDAs) IN EFFECT

US ARMY RESEARCH LABORATORY

ELECTRONICS and POWER SOURCES

PARTICIPANTS	AREA OF TECHNOLOGY TRANSFER	FOTE/SUB-FOTE
EPSD - ELECTROMAGNETIC SCIENCES	HIGH POWER MILLIMETER WAVE EVALUATION OF FERRITE DEVICES	ADV. ELECTRONICS/ M/MM WAVES
EPSD - TRONTECH	HIGH FREQUENCY OSCILLATORS AND AMPLIFIERS	ADV. ELECTRONICS/ M/MM WAVES
EPSD - AM. CYANAMID, EMCORE, POLYTECHNIC UNIVERSITY	OMVPE GROWTH TECHNOLOGIES	ADV. ELECTRONICS/ M/MM WAVES
EPSD - MARTIN MARIETTA CORPORATION	MAGNETIC BIASING SYSTEM FOR MICROWAVE TUBES	ADV. ELECTRONICS/ M/MM WAVES
EPSD - MARTIN GOFFMAN ASSOCIATES	MILLIMETER WAVE SUPERCONDUCTOR DETECTORS	ADV. ELECTRONICS/ M/MM WAVES
EPSD - CECOM, BELLCORE	EPITAXIAL LIFT-OFF PROCEDURES FOR FIBER OPTIC APPLICATIONS	ADV. ELECTRONICS/ M/MM WAVES
EPSD - NORDEN	FLAT PANEL DISPLAYS	ADV. ELECTRONICS/ DISPLAYS
EPSD - NEOCERA CORPORATION	SUPERCONDUCTOR TECHNOLOGY	ADV. ELECTRONICS/ M/MM WAVES
EPSD - RTI	E-BEAM CIRCUIT ANALYSIS	ADV. ELECTRONICS/ DISPLAYS
EPSD - EMC TECHNOLOGY	PROGRAMMABLE MICROWAVE ATTENUATORS	ADV. ELECTRONICS/ MICROELECTRONICS
EPSD - ADVANCED LITHOGRAPHY GROUP	ION PROJECTION LITHOGRAPHY	ADV. ELECTRONICS/ MICROELECTRONICS

TTA3/01093/APB(1-14-93)SP

EPS DIRECTORATE IMPLEMENTATION OF THE TECHNOLOGY TRANSFER ACT OF 1986

COOPERATIVE R&D AGREEMENTS (CRDAs) IN EFFECT (CONTINUATION)

US ARMY RESEARCH LABORATORY

ELECTRONICS and POWER SOURCES

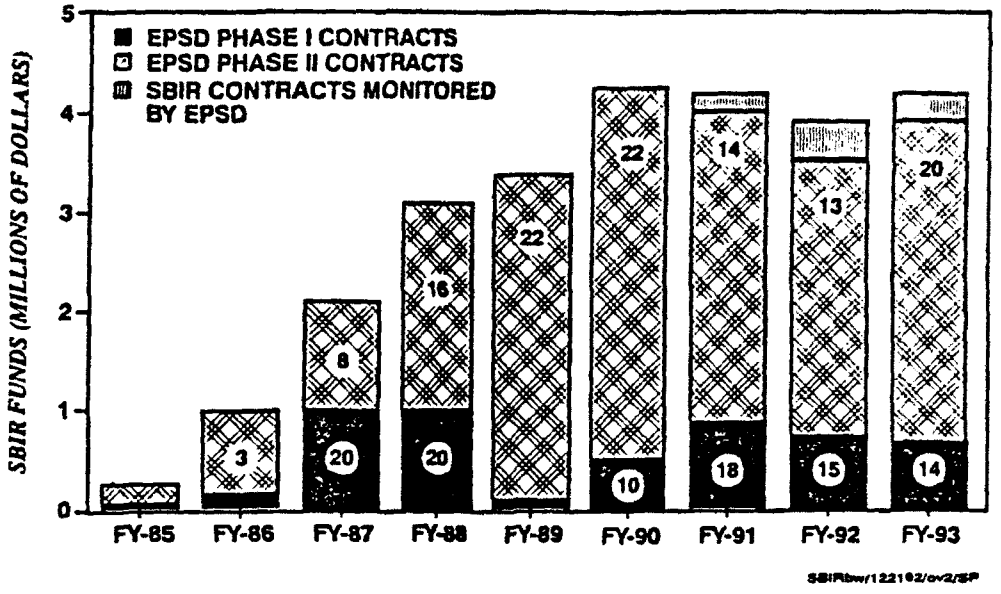
PARTICIPANTS	AREA OF TECHNOLOGY TRANSFER	FOTE/SUB-FOTE
EPSD - ALPHA INDUSTRIES	PLANAR DOPED BARRIER DIODE TECHNOLOGY	ADV. ELECTRONICS/ M/MM WAVES
EPSD - ELECTRONIC CONCEPT, INC.	HIGH ENERGY DENSITY CAPACITOR TECHNOLOGY	POWER SOURCES
EPSD - SHIPLEY CORPORATION	DEVELOPMENT OF E-BEAM RESISTS	ADV. ELECTRONICS/ MICROELECTRONICS
EPSD - CECOM- RUTGERS UNIVERSITY	ULTRA-HIGH SPEED AND MM WAVE ELECTRONIC DEVICES	ADV. ELECTRONICS/ M/MM WAVES
EPSD - RUTGERS UNIVERSITY	FERROELECTRICS AND HIGH TEMPERATURE SUPERCONDUCTING THIN FILMS	ADV. ELECTRONICS/ M/MM WAVES
EPSD - RUTGERS UNIVERSITY	HERMETIC COATINGS FOR OPTICAL WAVEGUIDES	ADV. ELECTRONICS/ M/MM WAVES
EPSD - RUTGERS UNIVERSITY	SMART CERAMIC MATERIALS	ADV. ELECTRONICS/ M/MM WAVES
EPSD - CECOM-PRINCETON UNIVERSITY	PHOTONIC DEVICES	ADV. ELECTRONICS/ M/MM WAVES
EPSD - STEVENS INSTITUTE OF TECHNOLOGY	OPTOELECTRONIC DEVICES	ADV. ELECTRONICS/ M/MM WAVES
EPSD - N.J. INSTITUTE OF TECHNOLOGY	ULTRA-HIGH SPEED AND MM WAVE ELECTRONIC DEVICES	ADV. ELECTRONICS/ M/MM WAVES
EPSD - TECHTROL CYCLONETICS, INC.	LOW NOISE DIELECTRIC RESONATOR OSCILLATORS	ADV. ELECTRONICS/ M/MM WAVES

TTA4/072092/GTS/227 SP

EPSD - SBIR FUNDING

US ARMY
RESEARCH LABORATORY

ELECTRONICS and POWER SOURCES



SBIRbw/122192/ov2/SP

ELECTRONICS AND POWER SOURCES LIST OF POC's

Fort Monmouth, New Jersey 07703-5601
Area Code (908) DSN (995/992)

DR. CLARENCE G. THORNTON
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MR. VINCENT ROSATI
Program Coordination Office
AMSRL-EP-C
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MR. RICHARD STERN
Advanced Concepts and Plans
Directorate AMSRL-CP-TA
Technology-Transfer, Small Business,
SBIR Manager
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MS. REGINA R. VENEZIA
Operations Directorate
AMSRL-OP-PR-FM
Chief, Contracting and Acquisition
(908) 544-4919 (995)

MR. CHARLES D. BOYLAN
Operations Directorate
AMSRL-OP-PR-FM
Competition Advocate
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MS. CAROL A. WIDMAIER
Advanced Technology Management Office
Information/Publications/Exhibits
AMSRL-EP-T
(908) 544-4808 (995)

DR. MICHAEL TOMPSETT
Electronics Devices
AMSRL-EP-E
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MR. RANDOLPH A. REITMEYER
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MR. VALDIMIR GELNOVATCH
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AMSRL-EP-M
(908) 544-4883 (995)

MR. JOSEPH KEY
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Division
AMSRL-EP-R
(908) 544-4258 (995)

DR. ROBERT HAMLEN
Power Sources Division
AMSRL-EP-P
(908) 544-2084 (995)

ARMY RESEARCH LABORATORY

Human Research & Engineering

Dr. Robin L. Keesee
Directorate Executive
Human Research and Engineering (HRED)
(410) 278-5800

U. S. Army Research Laboratory
Human Research & Engineering Directorate

Research Directions in ARL's Human Research & Engineering Directorate

RSRCH DIRS HRED

U. S. Army Research Laboratory
Human Research & Engineering Directorate

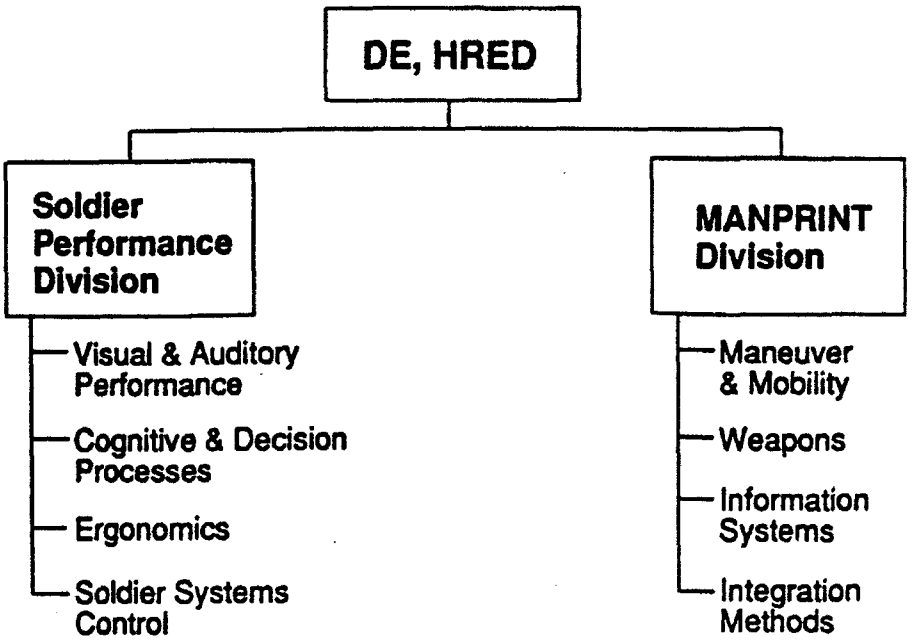
OUTLINE

1. The HRED Organization
2. Visual Search & Target Acquisition
3. Visual Control
4. Auditory Performance
5. Cognition and Decision Performance
6. Human Factors of the Individual Soldier
7. Crew Station Design
8. MANPRINT Manpower, Personnel, and Training Estimation
9. SBIR's
10. BAA's
11. Resource Distribution

RSRCH DIRS outline

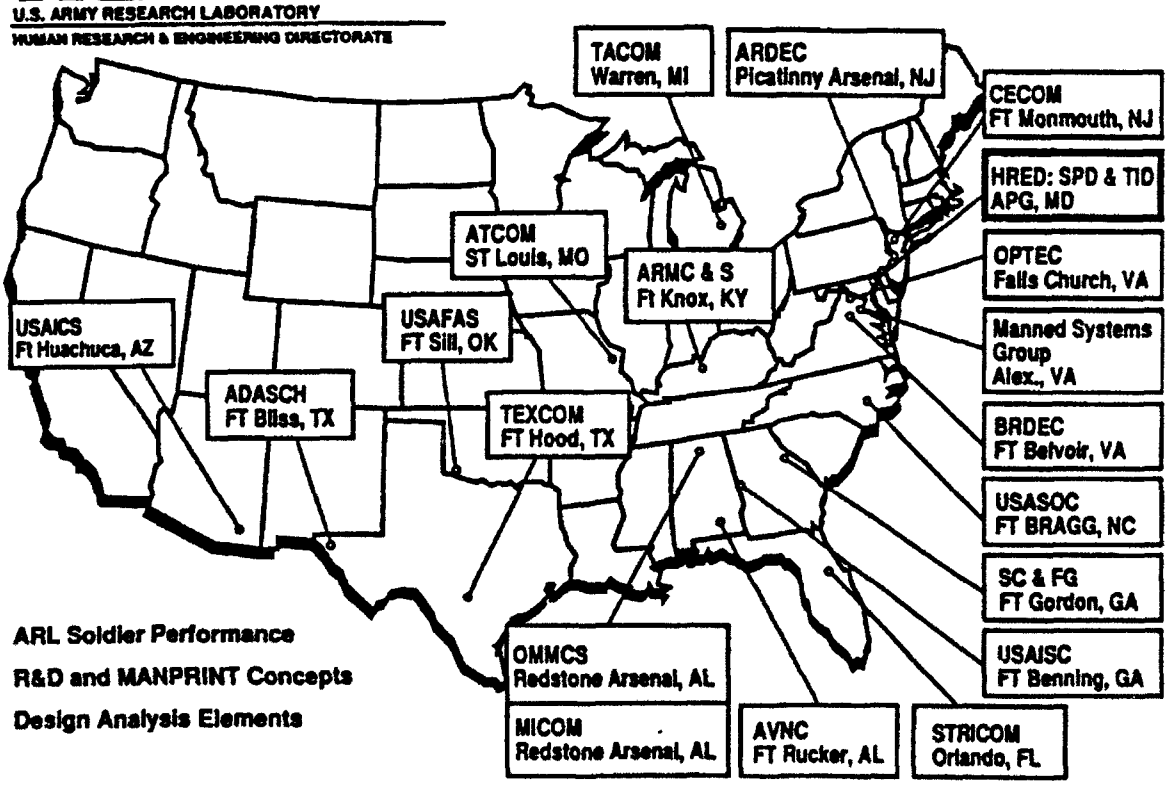
U.S. ARMY RESEARCH LABORATORY
HUMAN RESEARCH & ENGINEERING DIRECTORATE

HRED Structure



Rsrch Dirs. HRED fb (s)

U.S. ARMY RESEARCH LABORATORY
HUMAN RESEARCH & ENGINEERING DIRECTORATE



MANPRINT Div Map Oct 92 (s)

U.S. ARMY RESEARCH LABORATORY
Human Research & Engineering Directorate

HUMAN RESEARCH & ENGINEERING DIRECTORATE

MISSION

- Conduct broad-based program of scientific research and technology directed toward optimizing soldier performance and soldier-machine interactions to maximize battlefield effectiveness.

- Provide the Army and ARL with Manpower and Personnel Integration (MANPRINT) leadership to ensure that soldier performance requirements are adequately considered in technology development and system design.

Rsrch Dirs. HRED 1a (s)

U.S. ARMY RESEARCH LABORATORY
Human Research & Engineering Directorate

VISUAL SEARCH AND TARGET ACQUISITION

1. Effect of Target and Scene Characteristics
   e.g. contract, size, shape, range and complexity

2. Display Characteristics
   e.g. resolution, stereo, symbology, field of view

3. Observer Characteristics
   e.g. training, experience, spatial and visual abilities

Rsrch Dirs. HRED 2 (s)

U.S. ARMY RESEARCH LABORATORY
Human Research & Engineering Directorate

VISUAL CONTROL

1. Visual requirements for vehicular control
   - FOV
   - Resolution
   - Color
   - 3-D
2. Optimization of visual displays for special applications
   - Bandwidth limited teleoperations
   - Night, nap-of-the-earth flight
3. Enhancement of operator's capabilities and reduction of vision-driven workload
   - Perform multiple tasks
   - Control several vehicles

Rsrch Dirs. HRED 3 (s)

U. S. Army Research Laboratory
Human Research & Engineering Directorate

AUDITORY PERFORMANCE

1. Auditory Displays

Relates to enhanced transmission of information, situational awareness, design of warning and informational signals, etc. Should also be conceived of as symbiotically combined with visual displays.

2. Modeling and Empirical Verification of Auditory Target Detection, Identification and Localization

Important for stealth/low observable issues - includes both psychoacoustic as well as physical acoustic modeling and research.

3. Soldier/System Performance as a Function of Psychoacoustic Factors

e.g. - if I don't hear so well (because of wearing hearing protection or hearing loss or noise around me) how does this affect the time to fire, agree on IFF issues, detect the presence of the enemy, etc.

RSRCH DIRS.4

Cognitive and Decision Performance

U. S. Army Research Laboratory
Human Research & Engineering Directorate

1. **Predicting tactical decision making performance with decision aids**

2. **Measuring staff planning and command decision making performance at:**

   - tactical level and
   - operating level

   for - logistics
   - maneuver
   - fire support
   - and other functional areas

3. **Concepts for intelligent interfaces**

4. **Concepts for predicting soldier performance in unaided and aided materiel fault diagnosis**

RSRCH DIRS. 5

Human Factors of the Individual Soldier

U.S. ARMY RESEARCH LABORATORY
Human Research & Engineering Directorate

- **Sensory Enhancement and Encapsulation:**
  - Replacement of normal sensory modalities with the output of advance sensors (I2, IR, Audio and multimeter radar) thru advanced display media (Flat Plate and CRT).
  - Information display content, fidelity and control
- **Motor and Strength Enhancement:**
  - Kinematic degrees of freedom
  - Proprioceptive cueing
  - Force & speed feed back loops
  - Balance and gait constraints
- **Virtual Environments:**
  - Feasibility of VR and V interface technologies to improve system performance
  - Ergonomic adaptation of VR technologies for individual soldier interactions w/virtual environments
- **Human Figure Modeling:**
  - Analysis tool development compatible w/CAD/CAE and virtual environment simulations
  - Adaptation of HFM with AI attributes for inclusion of soldiers in the computer generated force environment

Rsrch Dirs. HRED 6

Crew Station Design (CSD)

- Broaden & Improve Methods for CSD Process
- CSD for 50 Ton Tank
- Operator Control Units for Unmanned Ground Vehicles

MHE & PLS Enhancements

- MHE & PLS Enhancements
- Field Trials for FARV Resupply of LP Projectiles & Fuel to AFAS
- Control & Supervision of Robots & Precision Manipulators

MANPRINT Manpower, Personnel and Training Estimation

- Methods are needed for estimating operator and maintenance factors in automated information systems.

U. S. Army Research Laboratory
Human Research & Engineering Directorate

93.2 SBIR Solicitations Topics

- Fire Support Suppression Effects in Battlefield Simulation
- Human Performance Issues in Automatic Target Recognition and Situation Awareness Displays
- Development of Performance and Effectiveness Measures to Support Evaluations of Unmanned Ground Vehicles (UGV) Technologies and Operations
- Development of an Unmanned Ground Vehicle (UGV) Simulator

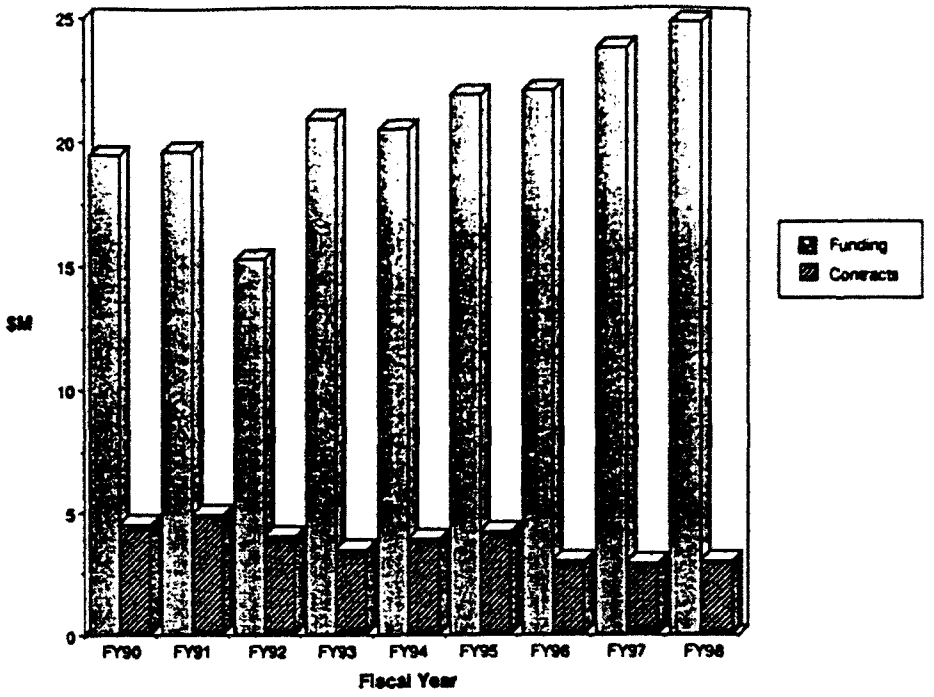
U. S. Army Research Laboratory
Human Research & Engineering Directorate

93 ARL BAA HRED Research Topics

- Simulation and Human Modeling
- Intelligent Decision Aids and Interfaces
- Human Information Processing
- Perceptual, Cognitive and Psychomotor Performance
- Knowledge-Based Reasoning
- MANPRINT Assessment Techniques for Maintenance Activities
- MANPRINT Integration Methods
- MANPRINT Design Analysis

U.S. ARMY RESEARCH LABORATORY
Human Research & Engineering Directorate

Resource Distribution
HRED Mission Funding $ & Mission Contracts for FY90 - FY98 (Historical-Estimated)



Note: Does not include Direct Cite Fund $ or Direct Cite Contract $

ARMY RESEARCH LABORATORY

Vehicle Structures

Dr. Wolf Elber
Directorate Executive
Vehicle Structures (VSD)
(804) 864-3949

ARMY RESEARCH LABORATORY
VEHICLE STRUCTURES DIRECTORATE

AT

NASA LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA

BY

DR. WOLF ELBER

1

VEHICLE STRUCTURES DIRECTORATE
DR. WOLF ELBER, DIRECTOR

Loads & Dynamics Division
Dan Hoad, Acting Chief

Structural Dynamics
- Application of Elastically-Coupled Structures
- Smart Materials Application for Active Control
- Crashworthy Design of Aircraft Structures
- Structural Acoustic Wave Propagation
- Interior Noise Reduction

Aeroelasticity (Rotorcraft Loads and Vibration)
- Aeromechanical/Aeroelastic Stability
- High-Speed Rotorcraft Vibration Reduction
- Validation of Advanced Comprehensive Analyses
- Active Control of Rotorcraft for Vibration Control

Vehicle Structures Division
Dr. Felton Bartlett, Acting Chief

Structural Integrity (Thick Composites)
- Durability
- Stress Analysis
- Nondestructive Inspection

Advanced Design Methodology (Ground)
- Structural Concepts
- Optimization Methods

Structural Dynamics (Ground)
- Smart Materials Application for Active Control
- Interior Noise Reduction
- Structural Dynamics Applications to Robotics

Structural Mechanics Division
Dr. Felton Bartlett, Chief

Structural Integrity
- Durability
- Stress Analysis
- Nondestructive Inspection

Advanced Design Methodology
- Structural Concepts
- Optimization Methods

2

ARMY ~ NASA JOINT AGREEMENT

ARMY RESEARCH LABORATORY/NASA LANGLEY RESEARCH CENTER

PURPOSE: Joint participation in vehicle structures research

ARMY AGREES: Participate in rotary wing/structures research
Establish an Army Office
Provide Army employees
Conform to all Langley operational requirements
- Safety
- Security
- Work procedures

NASA AGREES: Make available facilities
Provide equipment, services, supplies, offices
Publish research results
Provide necessary accounting information
Provide contractual and personnel support

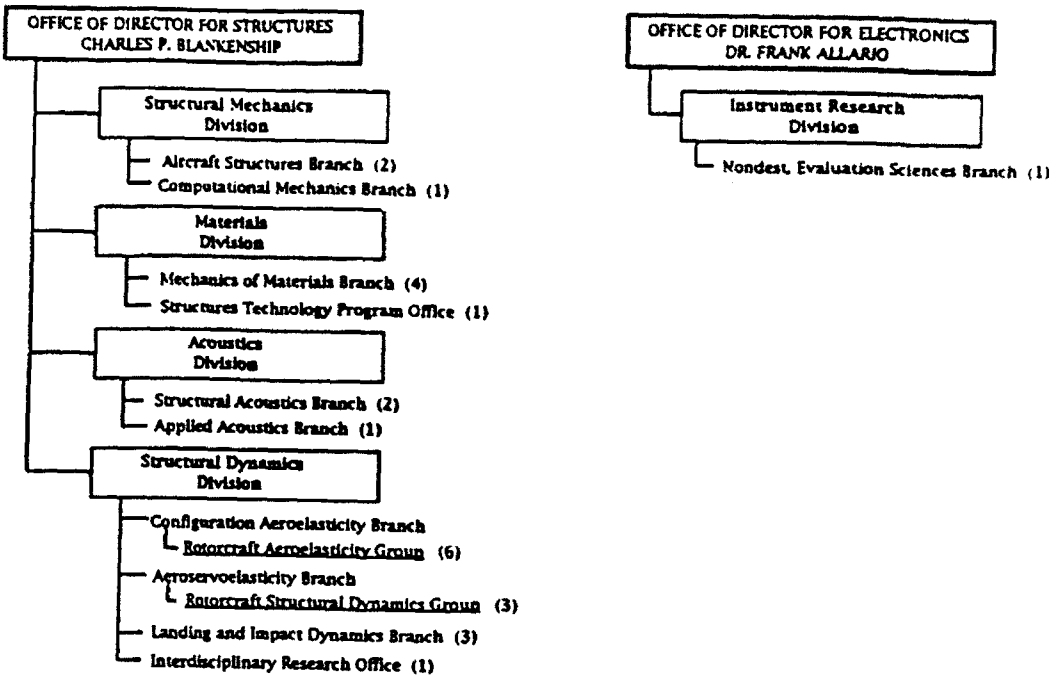
3

AERIAL VIEW OF

NASA LANGLEY RESEARCH CENTER

4

NASA LANGLEY RESEARCH CENTER
PAUL HOLLOWAY, DIRECTOR



5

5-YEAR TECHNICAL THRUSTS

Structural Integrity

Provide integrated stress-strength-inspection technology for life-extension of existing and durability of future aero and ground vehicles

Advanced Design

Provide new ideas in composites/hybrid applications technology together with formal analytical design optimization tools

Structural Dynamics

Validate and refine analytical models for multi-body kinematics and dynamics to support vehicle loads analysis and vibration reduction

Aeroelasticity

Refine testing capability and analytical prediction methodology for vibration-free rotorcraft designs

6

STRUCTURAL INTEGRITY THRUST

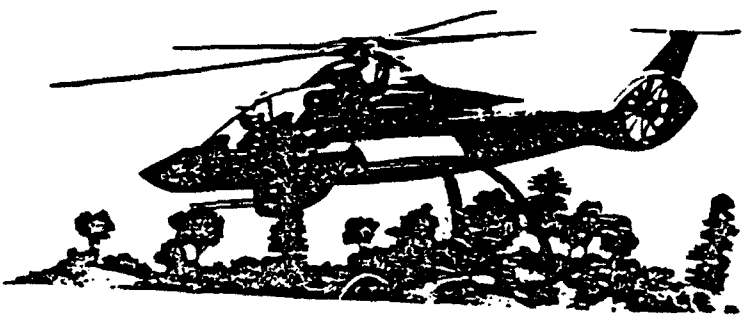
PROVIDE INTEGRATED STRESS-STRENGTH-INSPECTION TECHNOLOGY FOR LIFE EXTENSION OF EXISTING AND DURABILITY OF FUTURE ARMY AVIATION AND GROUND VEHICLES

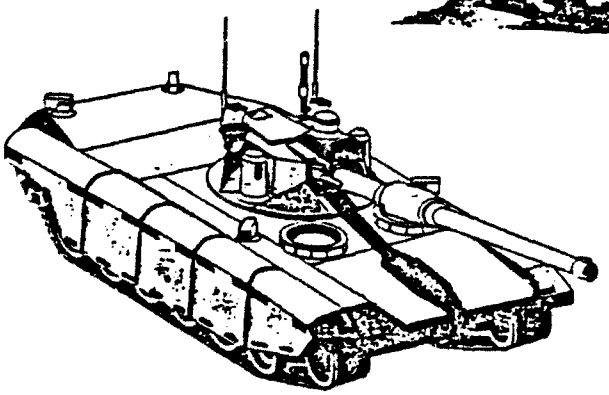
OBJECTIVES:

- ADVANCED STRUCTURAL ANALYSIS APPLICATIONS TO VALIDATE DESIGN TOOLS FOR COMPOSITE STRUCTURES
- COMPOSITE DELAMINATION FAILURE CRITERIA TO PREDICT ONSET AND PROGRESSION OF DAMAGE, FATIGUE DURABILITY, AND DAMAGE TOLERANCE
- ADVANCED NDE METHODS FOR FIELD INSPECTION AND MANUFACTURING QA TO ENHANCE STRUCTURAL INTEGRITY AND TO REDUCE O&S COSTS OF ARMY VEHICLES

7

STRUCTURES TECHNOLOGY FOR AVIATION AND GROUND VEHICLES





ADVANCED DESIGN THRUST

PROVIDE NEW IDEAS IN COMPOSITES/HYBRID APPLICATIONS TECHNOLOGY TOGETHER WITH FORMAL ANALYTICAL DESIGN OPTIMIZATION TOOLS

OBJECTIVES:

- DESIGN, FABRICATE, AND TEST ADVANCED AIRFRAME STRUCTURES TO ACHIEVE IMPROVED OPERATIONAL CAPABILITIES AT LOWER WEIGHT, LESS COST, AND INCREASED DURABILITY

- DEVELOP MANUFACTURING TECHNOLOGY WHICH MAKES THROUGH-THE-THICKNESS REINFORCED COMPOSITES COST EFFECTIVE TO PRODUCE WITH EXISTING TEXTILE MACHINERY

- DEVELOP OPTIMIZATION AND DISCIPLINE INTEGRATION TECHNIQUES INTO ROTORCRAFT DESIGN TO IMPROVE PRODUCT PERFORMANCE

9

PHOTO OF IMPACT DYNAMICS FACILITY

10

STRUCTURAL DYNAMICS THRUST

VALIDATE AND REFINE ANALYTICAL MODELS FOR MULTI-BODY KINEMATICS AND DYNAMICS TO SUPPORT VEHICLE LOADS ANALYSIS AND VIBRATION REDUCTION

OBJECTIVES:

- CONDUCT A COMPREHENSIVE TEST PROGRAM TO CHARACTERIZE DAMAGE DEVELOPMENT IN SCALED COMPOSITE TENSILE COUPONS
- DEVELOP AND VERIFY SCALING LAWS FOR COMPOSITE MATERIALS AND LAMINATES TO IMPROVE SMALL SCALE TEST CAPABILITIES
- EVALUATE BENEFITS TO INTERIOR NOISE BY INNOVATIVE USE OF ACTIVE NOISE CONTROL AND ADVANCED MATERIALS
- DEMONSTRATE FEASIBILITY OF USING ENERGY ABSORBING COMPOSITE STRUCTURES BY MODIFYING METAL SUBFLOORS ON COMPOSITE AIRCRAFT

11

AERIAL PHOTO OF TRANSONIC DYNAMICS TUNNEL (TDT)

12

AEROELASTICITY THRUST

REFINE TESTING CAPABILITY AND ANALYTICAL PREDICTION METHODOLOGY FOR VIBRATION-FREE ROTORCRAFT DESIGNS

OBJECTIVES:

- ENHANCE EXPERIMENTAL HARDWARE CAPABILITY IN THE TRANSONIC DYNAMICS TUNNEL (TDT) TO IMPROVE VERSATILITY AND EFFICIENCY OF MODELING ADVANCED ROTORCRAFT.
- DEVELOP ANALYTICAL AND EXPERIMENTAL TOOLS TO UNDERSTAND AND MINIMIZE FIXED AND ROTATING SYSTEM HELICOPTER VIBRATORY LOADS.
- VALIDATE FINITE ELEMENT PREDICTION (MSC-NASTRAN) OF MODAL PROPERTIES OF EXISTING TDT ROTORCRAFT ROTATING SYSTEMS.

VEHICLE STRUCTURES DIRECTORATE

TECHNOLOGY TRANSFER OPPORTUNITIES

1992 Tech Transfer Meeting
(Over 50 Industry/Academia/Government Attendees)

IR&D Plans/Reviews
(Rotorcraft and Ground Vehicle Industry)

VSD's Quadchart Program Descriptions

Cooperative Research & Development Agreements
(Six in Place)

PHOTO OF SMOKE TEST IN TUNNEL

15

SUMMARY

Joint Army-NASA Agreement gives Army maximum research capabilities at minimum cost

VSD pro-active in technology transfer efforts (Tech Transfer Office)

Research opportunities expanding

16

A R M Y R E S E A R C H L A B O R A T O R Y

Advanced Computational & Information Sciences

Dr. Andrew Mark
Chief (acting)
Simulation Technology Division
Advanced Computational and
Information Sciences Directorate (ACIS)
(410) 278-9760

Advanced Computing, Simulation & Software

ACISD

Briefing to Industry

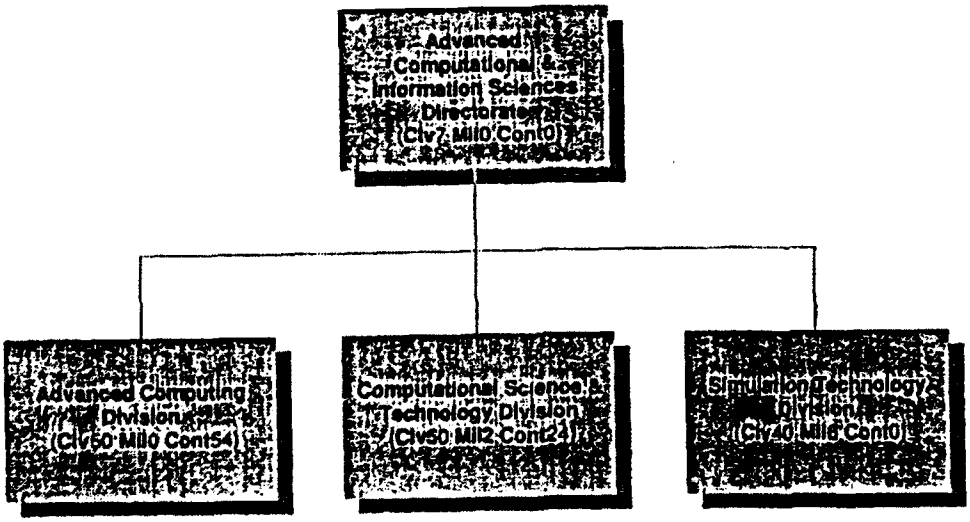
Presented By

Dr. Andrew Mark
Chief, Simulation Technology Division
Advanced Computational & Information Sciences Directorate

ARMY RESEARCH LABORATORY

Organization

ACISD



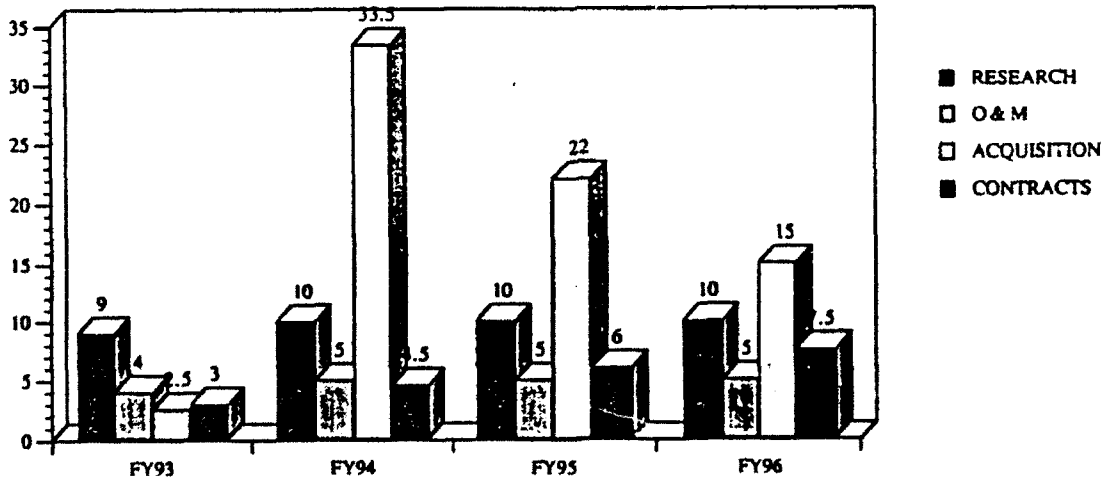
Thrusts

ACISD

* High Performance Computing/Communications
* Software Technology
* Simulation Technology

Projected ACIS Budget

HIGH PERFORMANCE COMPUTING



Technical Areas

ACISD

High Performance Computing/Communications

Vector & Massively Parallel Processing
Local and Wide Area HP Networks
Distributed Computing
Scientific Visualization

Software Technology

Artificial Intelligence
Expert Systems
Information Systems
Information Distribution Technology

Simulation Technology

Technology and Material/Materiel Assessment
Virtual Factory
Virtual Reality for the Individual Soldier
Louisiana Maneuvers

Unique Facilities

SOFTWARE TECHNOLOGY

- **Existing**
  - Cray-2 Vector Processor
  - Cray X-MP/48 Vector Processor
  - Touchstone Gamma Machine
  - Various Mini/Superminis (Convex, Digital, Encore, etc.)
  - Access to CM-200, CM-5
  - ASNET, DISNET, ARLNET
- **Soon to be Realized**
  - Access to major vector processor (unclassified)
  - Upgrade to major vector processor (classified)
  - Scalable MPP with novel architecture
  - DREN

High Performance Computing/Communication

HIGH PERFORMANCE COMPUTING

LONG RANGE GOALS:

- Develop technology in the form of strategies, techniques, algorithms, and the assessment of architectures to provide high performance computing for the solution of scientific and engineering problems of interest to ARL, AMC and the Army.
- Provide ARL and the Army with state-of-the-art computational capability, particularly in classified and massively parallel processing.
- Make significant contributions to the President's initiative on Strategic Computing.
- Provide ARL and the Army with state-of-the-art high speed technical data communications.

High Performance Computing Project Details

HIGH PERFORMANCE COMPUTING

- <u>High Performance Computing</u>
  - Objective: To best position the ARL and the Army to understand, assess, acquire and exploit the best large scale scientific computer technology for application to problems of interest and concern to the technology base.
  - A diverse set of activities.
  - Provides funding for:
    - Classified and unclassified visualization centers,
    - Collaborative efforts with U. of Md. (CM-2),
    - Undergraduate program in HPC at Howard U.,
    - CEM and CFD codes with Industry Partners,
    - Collaborative efforts with AHPCRC (SciVis, MPP),
    - Collaborative efforts with DOE labs (MESA, PAGOSA, CTH, PCTH),
    - Collaborative efforts with DARPA (iPSC/860, NCHPC),
    - General MPP and HPC support to Directorates of ARL and RDEC's of AMC.

Programs in HPC/C

HIGH PERFORMANCE COMPUTING

DoD HPC/C Modernization Program:
- Replace existing SC assets with stable systems
- Acquire early access to advanced systems
- Establish HPC-Networking Capability
- Provide Tri-Service prepaid computing

Infrastructure to support HPC/C and Distributed Computing

Army High Performance Computing Research Center

Specific HPC/C Programs

HIGH PERFORMANCE COMPUTING

Acquire Stable Systems:
- FY93/4 - Network-Robotic Mass Storage - $1.5M
- FY94 - Replacement Classified System - $30M
- FY95 - Augmentation - $15M

Acquire Early Access Systems:
- FY94 - BAA for Scalable Architectures - $2.5M
- FY95 - BAA for Scalable Architectures - $5M

Establish DREN Networking Capability:
- FY93 - Phase I - $6M
- FY94 - Phase II - $10M

POC: Mr. Tony Pressley
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Army Research Laboratory
Aberdeen Proving Ground, MD 21005-5067
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Basic Research - ARO Program

SOFTWARE TECHNOLOGY

- Provides 6.1 funding for basic research in mathematics and computer science to support High Performance Computing Initiative.
- Provides the funding and contract monitoring support for the Army High Performance Computing Research Center (AHPCRC).
- Provides the infrastructure for proposal review, contract awards, and contract performance monitoring in the area of basic research.
- Research topics are most general and include algorithms, data structures, high level languages, etc.

Software Technology

SOFTWARE TECHNOLOGY

LONG RANGE GOALS:

- Provide the Army and ARL with research into state-of-the-art information systems software products and modernized software systems.
- Develop distributed group decision support systems.
- Devise and apply expert systems to Army applications.
- Perform research into and apply Information Distribution Technology to Army systems.
- Develop scientific computing algorithms for scalable parallel architectures.

Programs in Software Technology

SOFTWARE TECHNOLOGY

- Experiments in information distribution technology with high level applications
- Re-engineering research program
- Research in collaborative work environments
- MPP algorithm development
- Specific-applications for expert systems

Specific Projects in Software Technology

SOFTWARE TECHNOLOGY

ACTS/IDSN Satellite Experiment
FY93 - Evaluate commo capability ~ $0.2M

Group Decision Support Systems
FY93 - Apply consolidated system to ARL ~ $0.3M
FY94 - Develop distributed GDSS ~ $0.4M

Re-engineering
FY93 - Select significant system for re-engineering ~ $0.2M
FY94 - Complete re-engineering demo ~ $0.2M

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115 O'Keefe Building
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Simulation Technology

SIMULATION TECHNOLOGY

LONG RANGE GOALS

- Develop a capability for the assessment of materiel/materials and novel technologies in a simulated battlefield environment through a Technology Assessment Center.
- Develop valid, verified physical and engineering models for the evaluation of advanced and emerging ARL technologies in wargame settings.
- Perform research into physical and process models to enable the development of a virtual factory.
- Develop and create a virtual environment for the individual soldier which will enable technology development and training.

Programs in Simulation Technology

SOFTWARE TECHNOLOGY

- Technology Assessment Center
- Tech Base Seminar Wargames
- I-PORT (Individual Portal into Simulation)
- Louisiana Maneuvers
- Virtual Factory
- Virtual Environments for ARL

Specific Projects in Simulation

SOFTWARE TECHNOLOGY

Virtual Factory
- FY93 - Composite Materials R&D Modeling ~ $0.3M
- FY93 - Matrix Metals R&D Modeling ~ $0.3M
- FY94 - Weapon Component Mfg Process Modeling ~ $0.5M

Virtual Environments
- FY93 - Hardware for simulation ~ $1.4M
- FY94 - Develop simulation environment ~ $1.0M

The Louisiana Manuevers (ARL Support)
- FY93 - Weather simulation, KBLPS, etc to LAM ~ $1.0M
- FY94 - Other ARL products to LAM ~ $1.0M

Design the 93 TBSWG ~ $1.0M

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(410) 278-6858 FAX (410) 278-5075

Cooperative and Collaborative Programs

SOFTWARE TECHNOLOGY

- National Consortium for High Performance Computing
  - NCHPC = DARPA <-> DoD Labs <-> Industry <-> Academe
- Virtual Factory
  - ARL <-> U. of Del. <-> U. Minn <-> Industry
  - CRADA's between ARL & Industry

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ARMY RESEARCH LABORATORY

Survivability/Lethality Analysis

Dr. Jack Wade
Directorate Executive (acting)
Survivability/Lethality Analysis (SLAD)
(505) 678-1196
(410) 278-6342

MISSION

- Determine the survivability and lethality of Army systems to the *full spectrum* of battlefield threats:
  - Ballistic
  - Electronic Warfare
  - Nuclear
  - Chemical and Biological
  - Directed Energy

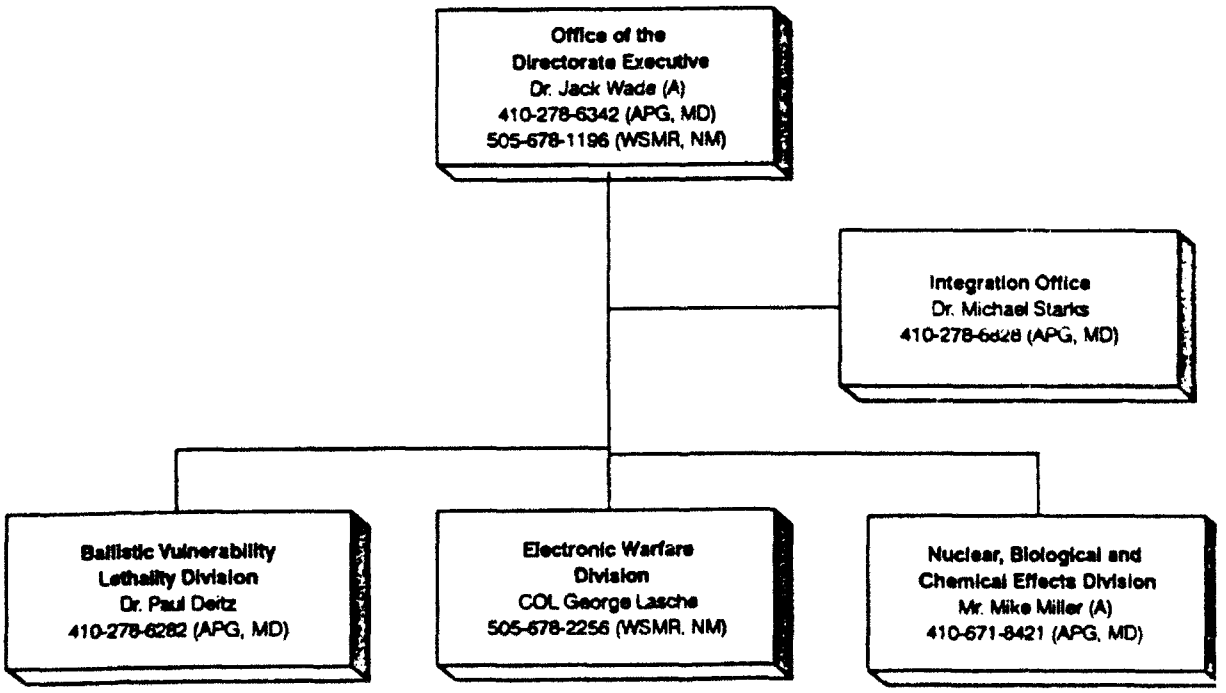
GOALS AND OBJECTIVES

- Understand how systems function in a *multi-threat* environment.
- Enhance system survivability and lethality through the application of the best available technology.
- Provide technical assistance to Army managers and decision makers throughout the system acquisition process.

MAJOR FUNCTIONS

- Conduct investigations, laboratory and field experiments, simulations and analyses to quantify system survivability and lethality.
- Provide objective judgements on complex technical issues regarding system survivability and lethality.
- Serve as the Army focal point for technical advise and consultation on survivability and lethality issues.
- Conduct studies and make recommendations regarding design and/or operational techniques to enhance system survivability/lethality.

DIRECTORATE ORGANIZATION



PROGRAM EXECUTION CONCEPT

Survivability/Lethality Analysis Directorate

- System analyses planned and executed through an integrated analysis team (IAT) process.
- Threat and technical disciplines will be integrated at the working level instead of at the system management level.
- Current IAT structure:
  - Air Defense
  - Aviation
  - C4/IEW
  - Ground Systems
  - Munitions

MODELS/SIMULATIONS

Survivability/Lethality Analysis Directorate

- Ballistic Component and Compartment
- Stochastic Component (SQUASH)
- Stochastic Processor of Artillery Effectiveness (SPRAE)
- Army Unit Resiliency Analysis (AURA)
- Surface-to-Air Missile Sites Mean Area Effectiveness (SAMSMAE)
- Non-Uniform Simple Surface Evaporation (NUSSE)
- EPLRS/MSE System Performance
- EOCM missile flight simulation
- Open-loop Tracking Complex
- Air-to-Surface Missile Simulation
- Anti-Tank Guided Missile Simulation
- Electromagnetic coupling

UNIQUE FACILITIES/CAPABILITIES

Survivability/Lethality Analysis Directorate

- SEMIVAF (WSMR)
- Millimeter Wave Measurement Facility (WSMR)
- BIG CROW (Kirtland AFB)
- Combat Vehicle Ballistic Range (APG)
- Aircraft Ballistic Vulnerability Experimental Facility (APG)
- Smoke Week

TECHNICAL AREAS

Ballistic Vulnerability/Lethality Division

Survivability/Lethality Analysis Directorate

- Vulnerability analysis:
  - Armored systems
  - Air systems
- Lethality analysis:
  - Anti-armor and artillery munitions
  - Air defense systems
- Armor/anti-armor concepts evaluation.
- Live Fire/Joint Live Fire - ground and air systems.
- Geometric and materiel modeling.
- Computer aided vulnerability/lethality analysis.
- Advanced computer technology.
- Analysis of unit level operations.
- Personnel vulnerability analysis.
- Spare parts requirements predictions.
- Foreign materiel exploitation.

INDUSTRY OPPORTUNITIES

Ballistic Vulnerability/Lethality Division

- Vibrational analysis and wind tunnel testing of helicopters with damaged rotor blades.
- Formulation of algorithms for flight dynamics analysis.
- Evaluation of flight dynamics and controllability of aircraft with damaged flight controls and/or surfaces. (Video output showing aircraft behavior)
- Generation of geometric target descriptions.
- Develop database to catalog and annotate existing vulnerability data.
- Conduct sensitivity analyses to determine the influence of component PK/H quality on analysis results.

TECHNICAL AREAS

Electronic Warfare Division

- Electronic warfare vulnerability assessment (EWVA):
  - Theoretical analyses
  - Laboratory measurements
  - Field experiments
- Signature measurements:
  - Spatial, spectral, and temporal
  - RF, IR, visible, acoustic and seismic
  - U.S., threat targets, and countermeasure devices
- Electronic warfare support:
  - EW environments
  - Data acquisition, processing and analysis
  - Simulators/emulators
  - Known, expected and reactive threats

- Programs which may require industry support include:
  - Missile defense
  - Air defense
  - Aviation
  - Close combat
  - C4I

- Programs range form small to large and include:
  - National/Theater Missile Defense - GBI/GBR, THAAD, PAC-3
  - Commanche, Longbow Apache
  - C4I - ATCCS, MSE, SICPS, CHS
  - Mines - FASCAM, WAM
  - Munitions - BAT, SADARM
  - JSTARS

- Engineering services to support ongoing EWVA.
- Improved analysis tools, techniques, methodologies.
- Computer virus protection concepts.
- Concepts to effectively make multi-spectral measurements.
- Concepts/approaches to measure signatures in all three (spatial, spectral and temporal) dimensions simultaneously.
- Wavelet coupling theory.
- High power microwave diagnostics and antenna characterization.

INVESTMENT STRATEGY

- ***80 %*** of mission funding (6.5) to be allocated to systems analyses through the SLA process.
- ***20 %*** of mission funding (6.2) to be used to develop tools, techniques and methodologies in direct support of system analysis efforts.
- Customer funding (PEO/PM, RDEC, etc.) to be used to support specific customer requirements.

FINANCIAL OUTLOOK

- **Mission funding**: $50 million per year.
- **Customer funding**: $15 - $20+ million per year.
- **Internal costs:** approximately 85 % of total funding. (Includes approximately $20 million for multi-year support contracts.)

TECHNICAL AREAS

Nuclear/Biological/Chemical Effects Division

- PEO/PM support:
  - Program management
  - Technical and analytical
  - Expert system development
- Database development and management.
- Chemical Defense Materials Database.
- Materials test methodology development.
- Smoke/obscurant effectiveness studies.
- Smoke Week.
- Agent dispersion models.
- Analysis methodology development.
- Electromagnetic coupling models.
- Soldier vulnerability.

INDUSTRY OPPORTUNITIES

Nuclear/Biological/Chemical Effects Division

- Multi-disciplinary analytical support (blast/thermal radiation, initial nuclear radiation, electromagnetic pulse, and chemical/biological) for planned efforts in air defense, aviation, C4I, ground systems and munitions.

- Support to PEO/PM:
  - Awareness training
  - Expert system (s)
  - Program management tools/documentation

POINTS OF CONTACT

Survivability/Lethality Analysis Directorate

- **General Information:** Dr. Jack Wade, 410-278-6342 or 505-678-1196
  Dr. Michael Starks ,410-278-6828
  Army Research Laboratory, AMSRL-SL-I
  Aberdeen Proving Ground, MD 21005-5001

- **Ballistics:** Dr. Paul Deitz, 410-278-6282
  Army Research Laboratory, AMSRL-SL-B
  Aberdeen Proving Ground, MD 21005-5001

- **Electronic Warfare: Directed Energy** COL George Lasche, 505-678-2256
  Army Research Laboratory, AMSRL-SL-E
  White Sands Missile Range, NM 88002-5513

- **NBC:** Mr. Mike Miller, 410-671-8421
  Army Research Laboratory, AMSRL-SL-N
  Aberdeen Proving Ground, MD 21010-5423

U.S ARMY RESEARCH LABORATORY
FY 93 ADVANCE PLANNING BRIEFING FOR INDUSTRY

OPERATIONS DIRECTORATE
PROCUREMENT DIVISION

INFORMATION PACKET
JANUARY 28, 1993
WHITE OAK, MD

U.S ARMY RESEARCH LABORATORY
FY 93 ADVANCE PLANNING BRIEFING FOR INDUSTRY

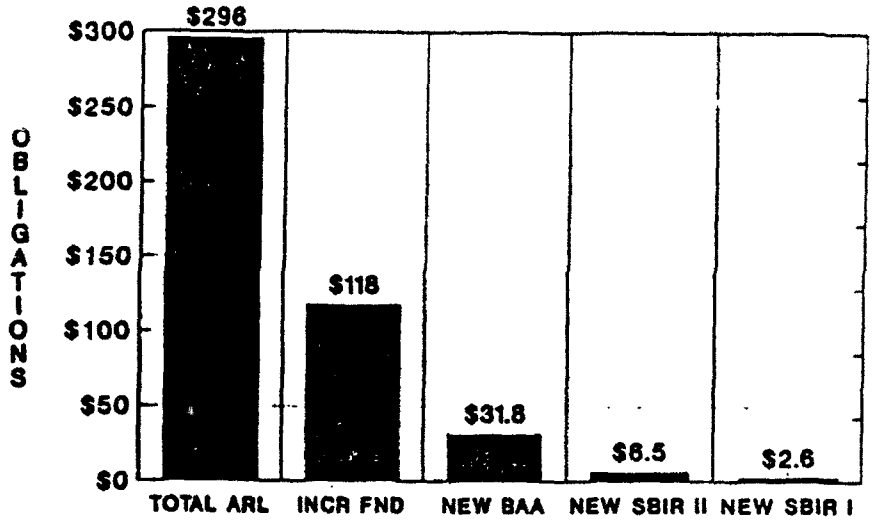
OPERATIONS DIRECTORATE
PROCUREMENT DIVISION

INFORMATION PACKET
JANUARY 28, 1993
WHITE OAK, MD

FY 93 ACQUISITION PLAN
ARL SUMMARY

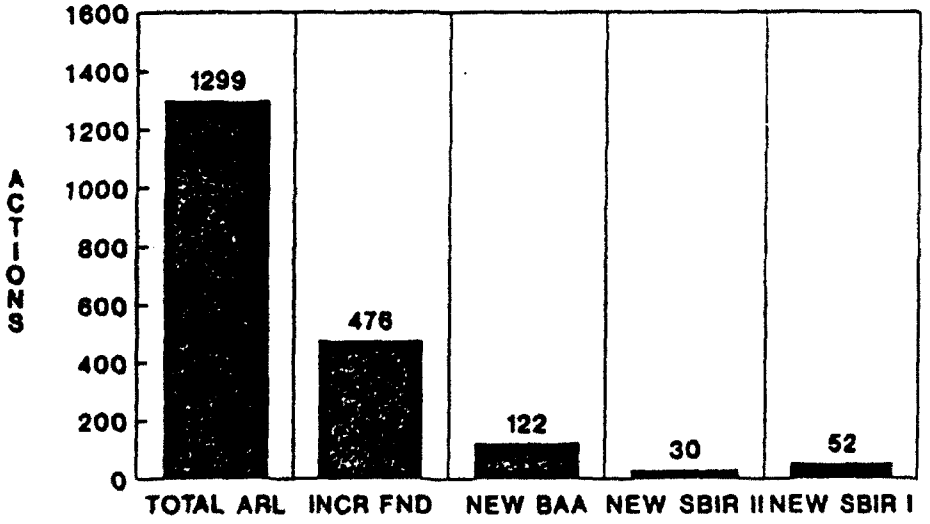
- TOTAL ESTIMATED OBLIGATIONS: $296 MILLION, 1299 PLANNED PROCUREMENT ACTIONS
- OF THIS AMOUNT, 476 ACTIONS AND $118 MILLION ARE INCREMENTAL FUNDING MODIFICATIONS
- THE PLAN INCLUDES 52 NEW SBIR PHASE I CONTRACTS, ESTIMATED AT ABOUT $2.6 MILLION
- ARL PLANS 30 NEW SBIR PHASE II CONTRACTS, ESTIMATED OBLIGATION OF ABOUT $6.5 MILLION
- ARL PLANS 122 NEW BAA CONTRACTS, ESTIMATED OBLIGATION OF ABOUT $31.8 MILLION

FY 93 ACQUISITION PLAN
ARL SUMMARY



ESTIMATED OBLIGATIONS IN MILLIONS

FY 93 ACQUISITION PLAN
ARL SUMMARY



NUMBER OF ACTIONS

RECURRING ARL
CONTRACT REQUIREMENTS

CONTRACTOR:	General Dynamics Corp., Ft. Worth, TX
DESCRIPTION:	Design, Fabrication, and Maintenance of SADS
CONTRACT AMT:	$4,661,849
EXPIRATION DATE:	052293
COMPETITIVE:	YES

CONTRACTOR:	Colsa Inc., Huntsville, ALA
DESCRIPTION:	Engineering Support for FMD ATGM
CONTRACT AMT:	$2,493,272
EXPIRATION DATE:	013093
COMPETITIVE:	UNKNOWN

CONTRACTOR:	Optimetrics, Inc., Ann Arbor, MI
DESCRIPTION:	Measurement Support
CONTRACT AMT:	$2,946,909
EXPIRATION DATE:	083194
COMPETITIVE:	UNKNOWN

RECURRING ARL
CONTRACT REQUIREMENTS

CONTRACTOR:	Regents of NMSU, Las Cruces, NM
DESCRIPTION:	Air Defense & Space Systems EW Support
CONTRACT AMT:	$9,930,760
EXPIRATION DATE:	063095
COMPETITIVE:	UNKNOWN

CONTRACTOR:	Syndetix, Inc. Las Cruces, NM
DESCRIPTION:	Engineering Services and Materials
CONTRACT AMT:	$3,344,537
EXPIRATION DATE:	041595
COMPETITIVE:	YES

CONTRACTOR:	Science & Technology Corporation Hampton, VA
DESCRIPTION:	Directed Energy & Electro-Optical Atmospheric Research Support
CONTRACT AMT:	$$30,550,860
EXPIRATION DATE:	100394
COMPETITIVE:	YES

RECURRING ARL
CONTRACT REQUIREMENTS

CONTRACTOR:	Concurrent Computer Corporation Richardson, TX
DESCRIPTION:	Computer Maintenance of FMMS System
CONTRACT AMT:	$155,206.92
EXPIRATION DATE:	093097
COMPETITIVE:	YES
CONTRACTOR:	Management Assistance Corp of America
DESCRIPTION:	Financial/Administrative Management Information Services, El Paso, TX
CONTRACT AMT:	$3,251,206
EXPIRATION DATE:	093094
COMPETITIVE:	YES
CONTRACTOR:	Regents of NMSU, Las Cruces, NM
DESCRIPTION:	Scientific, Engineering and Technical Support Services
CONTRACT AMT:	$8,478,412
EXPIRATION DATE:	063094
COMPETITIVE:	UNKNOWN

RECURRING ARL
CONTRACT REQUIREMENTS

CONTRACTOR:	Geocenters, Inc. Newton Centre, MA
DESCRIPTION:	Equipment and Facility Maintenance
CONTRACT AMT:	$4,474,093
EXPIRATION DATE:	011894
COMPETITIVE:	UNKNOWN
CONTRACTOR:	Vitronics, Inc. Eatontown, NJ
DESCRIPTION:	On site operation and maintenance support of laboratory equipment
CONTRACT AMT:	$5,629,029
EXPIRATION DATE:	011795
COMPETITIVE:	UNKNOWN
CONTRACTOR:	General Technical Services, Inc. Wall Township, NJ
DESCRIPTION:	Technical & Administrative Support Service
CONTRACT AMT:	$803,415
EXPIRATION DATE:	061495
COMPETITIVE:	UNKNOWN

RECURRING ARL CONTRACT REQUIREMENTS

CONTRACTOR:	Vitronics, Inc. Eatontown, NJ
DESCRIPTION:	Equipment, test bed & facility operation and maintenance support services
CONTRACT AMT:	$1,941,039
EXPIRATION DATE:	093095
COMPETITIVE:	UNKNOWN
CONTRACTOR:	Applied Dynamics International Ann Arbor, MI
DESCRIPTION:	Hardward & Software Maintenace
CONTRACT AMT:	$150,157.50
EXPIRATION DATE:	093095
COMPETITIVE:	NO
CONTRACTOR:	Compatible Micro Solutions, El Paso, TX
DESCRIPTION:	ADP Services to develop, maintain and utilitze software & hardware tools
CONTRACT AMT:	$609,921
EXPIRATION DATE:	043095
COMPETITIVE:	NO

ARL PROCUREMENT SITE FORECAST OBLIGATIONS

ADELPHI	FORT MONMOUTH	WATERTOWN	WHITE SANDS
$92.7	$89.5	$22.1	$22.2

FY 93 SMALL BUSINESS FORECAST

SMALL BUSINESS	$54.6M(28%)
SMALL DISADVANDAGED BUSINESS	$11.7M (6%)

USING THE ARL BROAD AGENCY ANNOUNCEMENT (BAA)

Each attendee at this conference will receive a copy of the ARL BAA (FY93). The ARL BAA is a comprehensive listing of research and development topics of interest to ARL technical directorates. You are encouraged to review this document and submit proposals for those topics that are of interest to you. Each topic in the BAA lists a technical point of contact. You may contact them with any technical questions. Non-technical questions regarding the BAA should be directed to:

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Watertown, MA 02172-0001
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