UNITED STATES ARMY
COMMUNICATIONS-ELECTRONICS COMMAND

COMBAT POWER FOR LEADERS

FORT MONMOUTH, NEW JERSEY

ADVANCE PLANNING BRIEFING FOR INDUSTRY

"FOCUSING INDEPENDENT RESEARCH *and* DEVELOPMENT TECHNOLOGY"

SHERATON EATONTOWN HOTEL AND CONFERENCE CENTER
OCTOBER 11-12, 1995

25 OCT 1995

AMSEL-PE-OD

MEMORANDUM FOR Ms. Barbara Lesser, Office of User Services, Cameron Station, Bldg. 5, #5D162, Alexandria, VA 22304-6145

SUBJECT: Proceedings Book for Advance Planning Briefing for Industry (APBI)

1. On 11-12 October 1995 a Level II APBI entitled, "Focusing Independent Research and Development Technology," was held at the Sheraton Eatontown Hotel and Conference Center, Eatontown, New Jersey. Request that the enclosed copy (Encl 1) of the proceedings be microfiched and catalogued. These proceedings have been cleared by our Public Affairs Office (Encl 2).

2. When an accession number has been assigned to this document, request that you call Mari Aufseeser, DSN 992-5054/Comm, 908-532-5054, so that this office can relay the information upon request to Industry representatives.

3. Point of contact for this action is Mari Aufseeser.

4. CECOM Bottom Line: THE SOLDIER.

2 Encl
as

for ROBERT M. CALVELLO
Chief, Operations Division

AMSEL-IO 24 Oct 95

MEMORANDUM FOR Director, Program Analysis and Evaluation,
ATTN: AMSEL-PE (Mari Aufseeser)

SUBJECT: Clearance of Paper
TITLE: Advanced Plan Briefing for Industries (APBI) Briefings

The above mentioned Paper has been cleared by this office with the following determination:

--X-a. No further clearance is necessary unless substantial changes/additional information is incorporated during future revision.

----b. Clearance of the paper for this occasion does not constitute approval for other publications/presentations. Requests for future dissemination must be submitted through the Public Affairs Office for clearance.

----c. Clearance of the abstract only. Clearance of the abstract does not constitute clearance of the completed paper which must be submitted through channels to the Public Affairs Office.

----d. In accordance with DOD Regulation 5230.25, Distribution Statement "D" is imposed limiting disclosure to Department of Defense and DOD contractors only. Other requests must be submitted through channels to the Public Affairs Office.

2. The POC for this office is Ms. Patricia A. Hutt, X21258.

3. CECOM Bottom Line: THE SOLDIER.

Henry T. Kearney

HENRY T. KEARNEY
Chief, Public Affairs

2 Encls
1. SEL Form 1012
2. Manuscript

CLEARANCE OF INFORMATION FOR PUBLIC RELEASE

SUBMIT FORM IN TRIPLICATE

TO: Commanding General
U.S. Army CECOM
ATTN: AMSEL-IO
Fort Monmouth, NJ 07703

FROM: Director, USACECOM
IEW Directorate
ATTN:
Vint Hill Farms Station
Warrenton, VA 22186-5100

DATE: 27 September 1995

In compliance with AR 360-5, Public Information Policies, as supplemented, the attached manuscript/abstract is submitted for clearance for public release. (Material should be in triplicate if local clearance is requested, in 6 copies if clearance through Headquarters, AMC, is required. See paragraphs (A) through (J) below.)

Section I. DESCRIPTION

TITLE

PAPER

ABSTRACT

BRIEFING - LEVEL II Advanced Planning Briefing for Industry

AUTHOR(S) See attached list

EXT NO. See attached list

NAME OF PERIODICAL: Level II APBI
(If for publication): include country if outside CONUS

NAME OF CONFERENCE OR SYMPOSIUM: Level II Advanced Planning Briefing for Industry

DATE AND PLACE OF CONFERENCE: 11&12 October, Sheraton Hotel, Eatontown, New Jersey

DATE CLEARANCE REQUIRED: 11 October 1995

PAPER ______ **DOES**
__X__ **DOES NOT CONTAIN CLASSIFIED INFORMATION**

MATERIAL ______ **DOES** __X__ **DOES NOT CONTAIN ANY OF THE FOLLOWING MATTER REQUIRING AMC CLEARANCE. IF SO, INDICATE AND EXPLAIN ON SEPARATE SHEET:**

(A) Information which is, or has the potential to become an item of national or international interest.

(B) Information on subjects of potential controversy among the military services or with other federal agencies.

(C) Information on new weapons or weapon systems or significant modifications or improvements to existing weapon systems, equipment or techniques. Unofficial prior publication of such information does not constitute authority for official release.

(D) Information on significant military operations, potential operations, operations security, and military exercises.

(E) Information on military applications in space; nuclear weapons and the components of such weapons, including nuclear weapons effects research; chemical warfare and defensive biological and toxic research; high-energy lasers and particle beams technology; and nuclear, biological, chemical (NBC) defense testing and production, policy, programs and activities.

(F) Information and materials involving critical military technology.

(G) Information concerning communications security, electronic warfare, signal intelligence, and computer security.

(H) Subject matter involving or referring to other service interests or those of other government activities outside AMC.

(I) Information on tests, studies or experiments not yet officially approved by appropriate echelon concerned. For example, studies or tests directed by DA, AMC, or other agencies outside CECOM.

(J) Subject matter which by its nature implies official positions or scientific attitudes of higher headquarters or agencies outside CECOM.

Section II. DISTRIBUTION CONTROL

If document contains technical data and information, a Distribution Statement must be applied. Indicate the appropriate statement in this section.

Section III. VERIFICATION

The attached manuscript does not contain classified information. Additionally, understanding the hostile intelligence interest in open source publications, the undersigned have individually conducted an OPSEC review, find its release clearly consistent with the AMC OPSEC Program, and verify that it ____ DOES _X_ DOES NOT contain any of the matter itemized in paragraphs (A) through (J).

Linda Roseboro

Activity OPSEC Officer
LINDA ROSEBORO
OPSEC Officer

for [signature]

Director, USAIEWD
DOUGLAS S. WOOD
Director, USAIEWD

[signature]

Activity Security Manager
WILLIAM M. WHITFORD
Security Officer

HISA-FM 76-86

Briefings
Signal Processing
NON-COMM EW Receivers
ADV IEW Antenna Tech.
TACTICAL INTELL. DATA FUSION

CLEARANCE OF INFORMATION FOR PUBLIC RELEASE

SUBMIT FORM IN TRIPLICATE

TO: Commanding General
U.S. Army CECOM
ATTN: AMSEL-IO
Fort Monmouth, N.J. 07703

FROM Night Vision
E/O

DATE 26 Sept 95

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Section I. DESCRIPTION

TITLE Advanced optics
PAPER Smart Focal Plane Arrays
ABSTRACT open Architecture

AUTHOR(S) Air/Land Enhanced Recon
Mine Dectection

EXT NO. Adv. Countermeasure Techniques

NAME OF PERIODICAL (If for publication): include country if outside CONUS

NAME OF CONFERENCE OR SYMPOSIUM (If for presentation): APBI IR&D Symposium

DATE AND PLACE OF CONFERENCE: 11 & 12 October

DATE CLEARANCE REQUIRED:

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Activity OPSEC Officer (Typed name and title) Signature	W. Self III Branch Chief (Typed name and title) Signature WILLIAM M SELF III
Activity Security Manager (Typed name and title) Signature	Kathleen Yamarik Division Director (Typed name and title) Signature KATHLEEN A. YAMARIK

CLEARANCE OF INFORMATION FOR PUBLIC RELEASE

SUBMIT FORM IN TRIPLICATE

TO: Commanding General
U.S. Army CECOM
ATTN: AMSEL-EA-PA (C. Zizos)
Fort Monmouth, N.J. 07703

FROM AMSEL-RD-SE-SED

DATE 21 Sep 95

In compliance with AR 360-5, Public Information Policies, as supplemented, the attached manuscript/abstract is submitted for clearance for public release. (Material should be in triplicate if local clearance is requested, in 6 copies if clearance through Headquarters, AMC, is required. See paragraphs (A) through (J) below.)

Section I. **DESCRIPTION**

TITLE Software Reuse
PAPER
ABSTRACT

AUTHOR(S)

EXT NO.

NAME OF PERIODICAL (If for publication): include country if outside CONUS

NAME OF CONFERENCE OR SYMPOSIUM (If for presentation):

DATE AND PLACE OF CONFERENCE: APBI, 11-12 Oct 95, Sheraton, Eatontown, NJ

DATE CLEARANCE REQUIRED:

PAPER _____ **DOES**
_____ **DOES NOT CONTAIN**
CLASSIFIED INFORMATION

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JOSEPH C. ARETINO, OPSEC OFC	MYRON S. SAMUEL, Asso Dir, ROM
Activity OPSEC Officer	**Branch Chief**
(Typed name and title) Signature	(Typed name and title) Signature
JOSEPH C. ARETINO, Ch, SEcurity Ofc	DENNIS J. TURNER, Dir, SED
Activity Security Manager	**Division Director**
(Typed name and title) Signature	(Typed name and title) Signature

CLEARANCE OF INFORMATION FOR PUBLIC RELEASE

SUBMIT FORM IN TRIPLICATE

TO: Commanding General
U.S. Army CECOM
ATTN: AMSEL-IO
Fort Monmouth, N.J. 07703

FROM SPACE & TERRESTRIAL COMMUNICATIONS DIRECTORATE (S&TCD)

DATE 20 SEP 95

In compliance with AR 360-5, Public Information Policies, as supplemented, the attached manuscript/abstract is submitted for clearance for public release. (Material should be in triplicate if local clearance is requested, in 6 copies if clearance through Headquarters, AMC, is required. See paragraphs (A) through (J) below.)

Section I. DESCRIPTION

TITLE Future Digital Radio
PAPER High Capacity Trunk Radio
ABSTRACT
ATM Technology

AUTHOR(S) Personal Comm. System
Gobal Broadcast System

EXT NO.

NAME OF PERIODICAL (If for publication): include country if outside CONUS

NAME OF CONFERENCE OR SYMPOSIUM (If for presentation): ADVANCED PLANNING BRIEFING TO INDUSTRY

DATE AND PLACE OF CONFERENCE: 11-12 OCT 95 SHERATON, EATONTOWN, NJ

DATE CLEARANCE REQUIRED:

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SEL FORM 1012, 1 Oct 1985
(Supersedes SEL Form 1011 and SEL Form 1012, 1 Jan 79)

(E) Information on military applications in space; nuclear weapons and the components of such weapons, including nuclear weapons effects research; chemical warfare and defensive biological and toxic research; high-energy lasers and particle beams technology; and nuclear, biological, chemical (NBC) defense testing and production, policy, programs and activities.

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Barry S. Salis

Activity OPSEC Officer		Branch Chief	
(Typed name and title)	Signature	(Typed name and title)	Signature
BARRY S. SALIS DEP DIRECTOR, S&TCD			
Activity Security Manager		**Division Director**	
(Typed name and title)	Signature	(Typed name and title)	Signature

CLEARANCE OF INFORMATION FOR PUBLIC RELEASE

SUBMIT FORM IN TRIPLICATE

TO: Commanding General
U.S. Army CECOM
ATTN: AMSEL-IO
Fort Monmouth, N.J. 07703

FROM Command, Control & Systems Integration Directorate

DATE 26 Sept 95

In compliance with AR 360-5, Public Information Policies, as supplemented, the attached manuscript/abstract is submitted for clearance for public release. (Material should be in triplicate if local clearance is requested, in 6 copies if clearance through Headquarters, AMC, is required. See paragraphs (A) through (J) below.)

Section I. DESCRIPTION C2SID

(10) TITLE Battle Planning
PAPER Log C2
ABSTRACT Nav. Tech.
Mission Rehearsal
AUTHOR(S) Interactive speech
EXT NO.

Briefings & Point Papers for the APBI.

NAME OF PERIODICAL
(If for publication): include country if outside CONUS

NAME OF CONFERENCE OR SYMPOSIUM (If for presentation): APBI

DATE AND PLACE OF CONFERENCE: 11-12 Oct 95, Sheraton, Eatontown NJ

DATE CLEARANCE REQUIRED:

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Activity OPSEC Officer (Typed name and title)	Signature	Branch Chief (Typed name and title)	Signature
Activity Security Manager (Typed name and title)	Signature	X Anthony J. Mancanell Division Director (Typed name and title) Anthony J. Mancanelli LTC, AD	Signature

DEPARTMENT OF THE ARMY
HEADQUARTERS, US ARMY COMMUNICATIONS-ELECTRONICS COMMAND
AND FORT MONMOUTH
FORT MONMOUTH, NEW JERSEY 07703-5000

REPLY TO
ATTENTION OF

Office of the Commanding General

Ladies and Gentlemen:

On behalf of the Communications-Electronics Command (CECOM), I am pleased to present these proceedings of the "Focusing Independent Research and Development Technology" Advance Planning Briefing for Industry (APBI). The objective of this publication is to provide industry with a thorough understanding and update on our major technology program needs to facilitate the integration and focus of industry's Independent Research and Development (IR&D).

It is imperative that we continue to work together and maintain an open dialogue to ensure the Department of the Army is kept abreast of industry's IR&D and that future IR&D efforts are focused on the technology needs of tomorrow's Army.

I welcome your participation in our APBI program.

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DTIC TAB	☐
Unannounced	☐
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Sincerely,

Gerard P. Brohm
Major General, U.S. Army
Commanding

NOTICE

This publication contains the briefings presented during this Advance Planning Briefing for Industry (APBI). Following the APBI, you may obtain a Proceedings Book for a minimum fee by contacting the Defense Technical Information Center (DTIC). The telephone number is (800) 225-3842 (Option 5).

We hope that the above publication proves beneficial to your long-range planning efforts. If you have any additional questions and/or suggestions, please contact the Program Analysis and Evaluation Directorate, AMSEL-PE-OD, ATTN: Mari Aufseeser, (908) 532-5054.

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The information provided is accurate as of the time of publication, and may be subject to change.

THE OVERALL CLASSIFICATION

OF THIS PUBLICATION IS

UNCLASSIFIED

ADVANCE PLANNING BRIEFING FOR INDUSTRY

"FOCUSING INDEPENDENT RESEARCH AND DEVELOPMENT TECHNOLOGY"

OCTOBER 11-12, 1995
SHERATON EATONTOWN HOTEL AND CONFERENCE CENTER
EATONTOWN, NEW JERSEY

MEETING CHAIRMAN
MR. ROBERT F. GIORDANO
DIRECTOR, RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
CECOM

AGENDA

WEDNESDAY, OCTOBER 11, 1995

0700	REGISTRATION
0800	ADMINISTRATIVE REMARKS
0810	WELCOMING REMARKS MG Gerard P. Brohm Commanding General, CECOM
0830	A "WIN WIN" CONCEPT FOR GOVERNMENT & INDUSTRY Mr. Robert F. Giordano Director, Research, Development and Engineering Center CECOM
0910	INTEGRATION OF DEFENSE AND COMMERCIAL INDUSTRIAL TECH BASES Dr. Lance A. Davis Deputy Director, Defense Research and Engineering Office of the Secretary of Defense
0950	QUESTION AND ANSWER PERIOD
1000	BREAK
1020	DIGITAL INTEGRATED LAB AS A TESTBED Dr. Myron Holinko Digital Integrated Lab Manager Special Projects Office for Digitization, CECOM

SESSION I: SOFTWARE ENGINEERING

1100 SOFTWARE TECHNOLOGY OVERVIEW
Mr. Myron S. Samuel
Associate Director, Software Engineering
CECOM

TACTICAL SOFTWARE TECHNOLOGY

1110 SOFTWARE REUSE
Mr. John Willison
Project Leader
Software Engineering Directorate, CECOM

1125 QUESTION AND ANSWER PERIOD

1135 LUNCH

SESSION II: SPACE & TERRESTRIAL (S&T) COMMUNICATIONS

1300 BITS STRATEGY AND OVERVIEW
COL Kenneth A. Thomas
Acting Director, Space & Terrestrial Communications, CECOM

COMMUNICATIONS TECHNOLOGY

1315 FUTURE DIGITAL RADIO
Mr. Michael DiJulio
Chief, Wireless Networks Division
Space & Terrestrial Communications Directorate, CECOM

1330 HIGH CAPACITY TRUNK RADIO (HCTR)
Mr. Kenneth Brockel
Product Development Engineer
Space & Terrestrial Communications Directorate, CECOM

TACTICAL C3 TECHNOLOGY INTEGRATION

1345 ASYNCHRONOUS TRANSFER MODE (ATM) TECHNOLOGY
Mr. Larry Levine
Chief, High Speed Networks Division
Space & Terrestrial Communications Directorate, CECOM

1400 PERSONAL COMMUNICATIONS SYSTEM (PCS)
Dr. Howard Wichansky
Chief, Advanced Wireless Technology Branch
Space & Terrestrial Communications Directorate, CECOM

SATELLITE COMMUNICATIONS (SATCOM)

1415 DIGITAL BROADCAST SATELLITE/GLOBAL BROADCAST SERVICE
Mr. Jeffrey Ozimek
Chief, Systems and Technology Division
Space & Terrestrial Communications Directorate, CECOM

1430 QUESTION AND ANSWER PERIOD

1440 BREAK

SESSION III: COMMAND, CONTROL (C2) AND SYSTEMS INTEGRATION TECHNICAL PROGRAMS

1500 STRATEGY AND OVERVIEW
Mr. George R. Oliva, Jr.
Acting Director, Command, Control and Systems Integration
CECOM

TACTICAL AUTOMATION

1510 BATTLE PLANNING
Mr. Harold Gorman
Project Engineer
Command, Control and Systems Integration Directorate, CECOM

1525 LOGISTICS COMMAND & CONTROL
LTC Anthony J. Manganiello
Total Distribution ATD Manager
Command, Control and Systems Integration Directorate, CECOM

AVIATION INTEGRATION TECHNOLOGY

1540 NAVIGATION TECHNOLOGY
Dr. John Niemela
Chief, Electronic Systems Division
Command, Control and Systems Integration Directorate, CECOM

1555 MISSION REHEARSAL
Mr. Peter Csiky
Project Engineer
Command, Control and Systems Integration Directorate, CECOM

1605 INTERACTIVE SPEECH TECHNOLOGY
Mr. Lockwood Reed
Project Engineer
Command, Control and Systems Integration Directorate, CECOM

TACTICAL POWER

1615 FUEL CELLS
Mr. Richard Jacobs
Project Engineer
Command, Control and Systems Integration Directorate, CECOM

1630 QUESTION AND ANSWER PERIOD

1700 RECEPTION

THURSDAY, OCTOBER 12, 1995

0755 ADMINISTRATIVE REMARKS

SESSION IV: INTELLIGENCE AND ELECTRONIC WARFARE (IEW)

0800 STRATEGY AND OVERVIEW
Dr. Francis Williams
Associate Director for Systems
Intelligence and Electronic Warfare Directorate, CECOM

ADVANCED NON-COMMUNICATIONS ELECTRONIC WARFARE

0825 SIGNAL PROCESSING
Dr. Frank J. Elmer
Senior Technical Advisor
Intelligence and Electronic Warfare Directorate, CECOM

ADVANCED COMMUNICATIONS ELECTRONIC COUNTERMEASURES DEMOS

0840 NON-COMMUNICATIONS ELECTRONIC WARFARE RECEIVERS
Dr. Frank J. Elmer
Senior Technical Advisor
Intelligence and Electronic Warfare Directorate, CECOM

0855 ADVANCED IEW ANTENNA TECHNOLOGY
Mr. John T. Dizer
Chief, Information Warfare Technology Branch
Intelligence and Electronic Warfare Directorate, CECOM

WARFARE PROCESSING TECHNIQUES

0910 TACTICAL INTELLIGENCE DATA FUSION
Mr. Richard Antony
Computer Scientist
Intelligence and Electronic Warfare Directorate, CECOM

0930 QUESTION AND ANSWER PERIOD

0940 BREAK

SESSION V: NIGHT VISION ELECTRONIC SENSORS

1000 STRATEGY AND OVERVIEW
Mr. Larry L. Fillian
Director, Technical Support and Operations
Night Vision and Electronic Sensors Directorate, CECOM

NIGHT VISION ELECTRO-OPTICS TECHNOLOGY

1025 ADVANCED OPTICS AND DISPLAY APPLICATIONS
Mr. William P. Markey
Chief, Advanced Optics
Night Vision and Electronic Sensors Directorate, CECOM

1035 SMART FOCAL PLANE ARRAYS
Mr. David J. Bohan
Chief, Advanced Infrared Technology
Night Vision and Electronic Sensors Directorate, CECOM

NIGHT VISION ADVANCED TECHNOLOGY

1050 OPEN ARCHITECTURE ATR PROCESSING
Mr. David J. Bohan
Chief, Advanced Infrared Technology
Night Vision and Electronic Sensors Directorate, CECOM

1105 AIR/LAND ENHANCED RECONNAISSANCE AND TARGETING
Dr. Donald A. Reago
Chief, Airborne Applications
Night Vision and Electronic Sensors Directorate, CECOM

1120 QUESTION AND ANSWER PERIOD

1130 LUNCH

SESSION V: NIGHT VISION ELECTRONIC SENSORS (CON'T)

MOBILITY EQUIPMENT TECHNOLOGY

1300 MINE DETECTION AND NEUTRALIZATION
Mr. Robert L. Barnard
Chief, Mine Detection
Night Vision and Electronic Sensors Directorate, CECOM

TACTICAL ELECTRONIC WARFARE TECHNOLOGY

1315 ADVANCED COUNTERMEASURE TECHNIQUES
Mr. Joseph C. O'Connell
Chief, EO/IR Countermeasures
Night Vision and Electronic Sensors Directorate, CECOM

1330 QUESTION AND ANSWER PERIOD

1345 CLOSING REMARKS

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WELCOMING REMARKS

MG GERARD P. BROHM

COMMANDING GENERAL
CECOM

NOTES

U.S.ARMY
COMMUNICATIONS - ELECTRONICS COMMAND

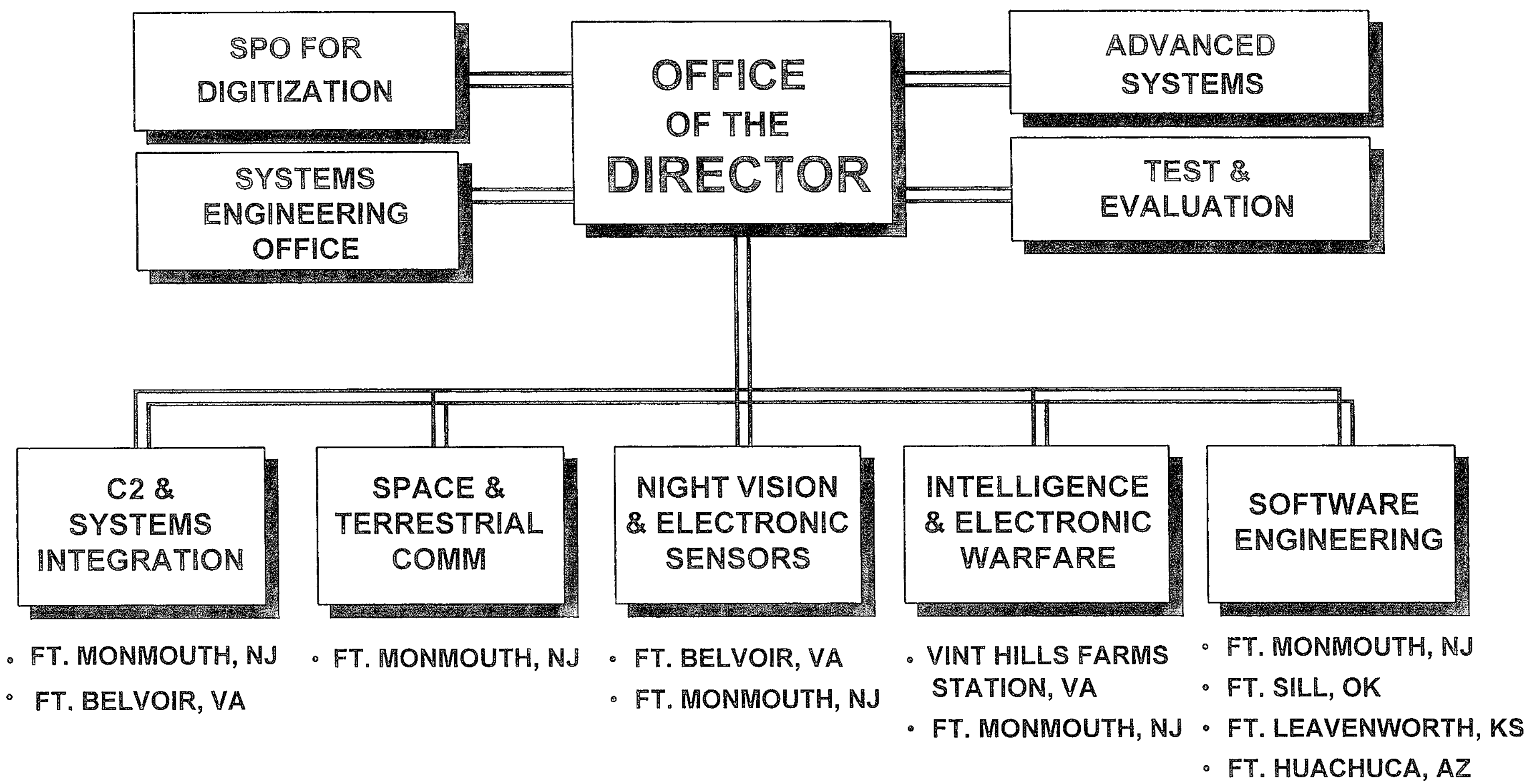
RESEARCH, DEVELOPMENT & ENGINEERING CENTER

A "*WIN WIN*" Concept
For
Government & Industry

Presented by

Robert F. Giordano
Director

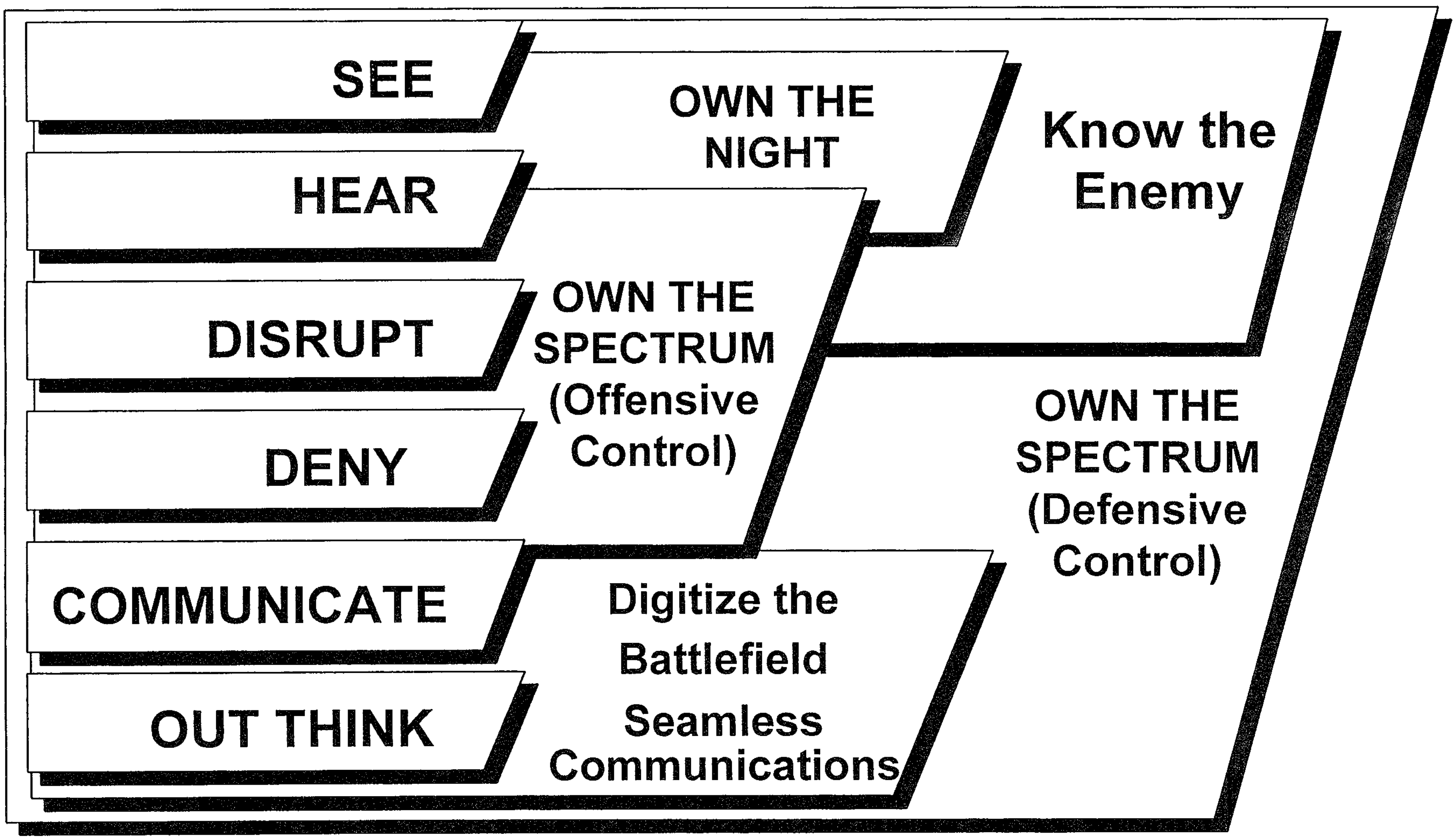
CECOM
Research, Development & Engineering Center



CECOM RDEC

- Key Part of Today's Army
- Essential Part of Tomorrow's Army

Technology Changing the Face of the Battlefield



OPERATING PRINCIPLES

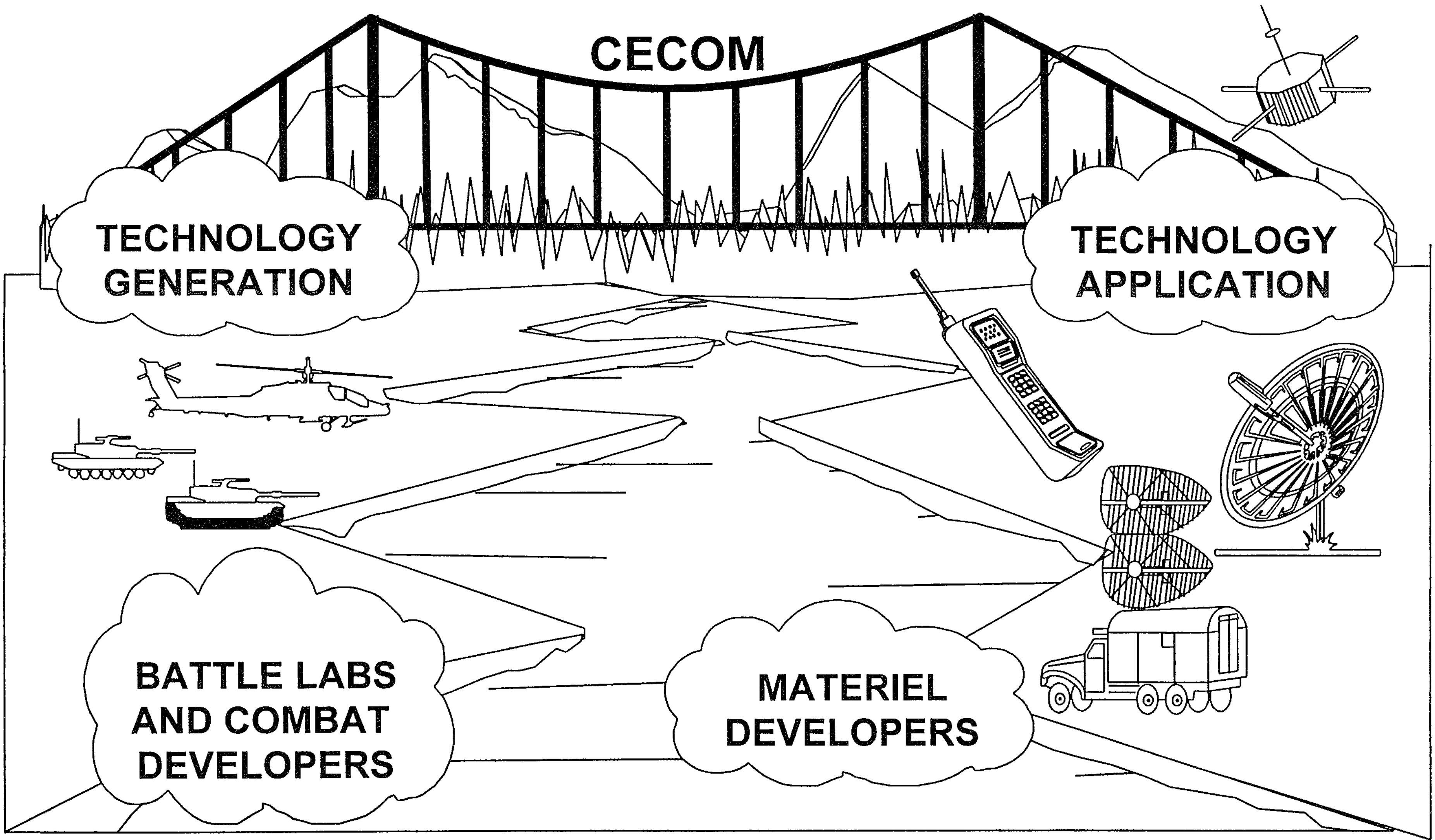
- Expedite Insertion of Key Technology: be the Technical Bridge between PEO/PMs; Basic Research; Early Technology; Industry; Battlelabs

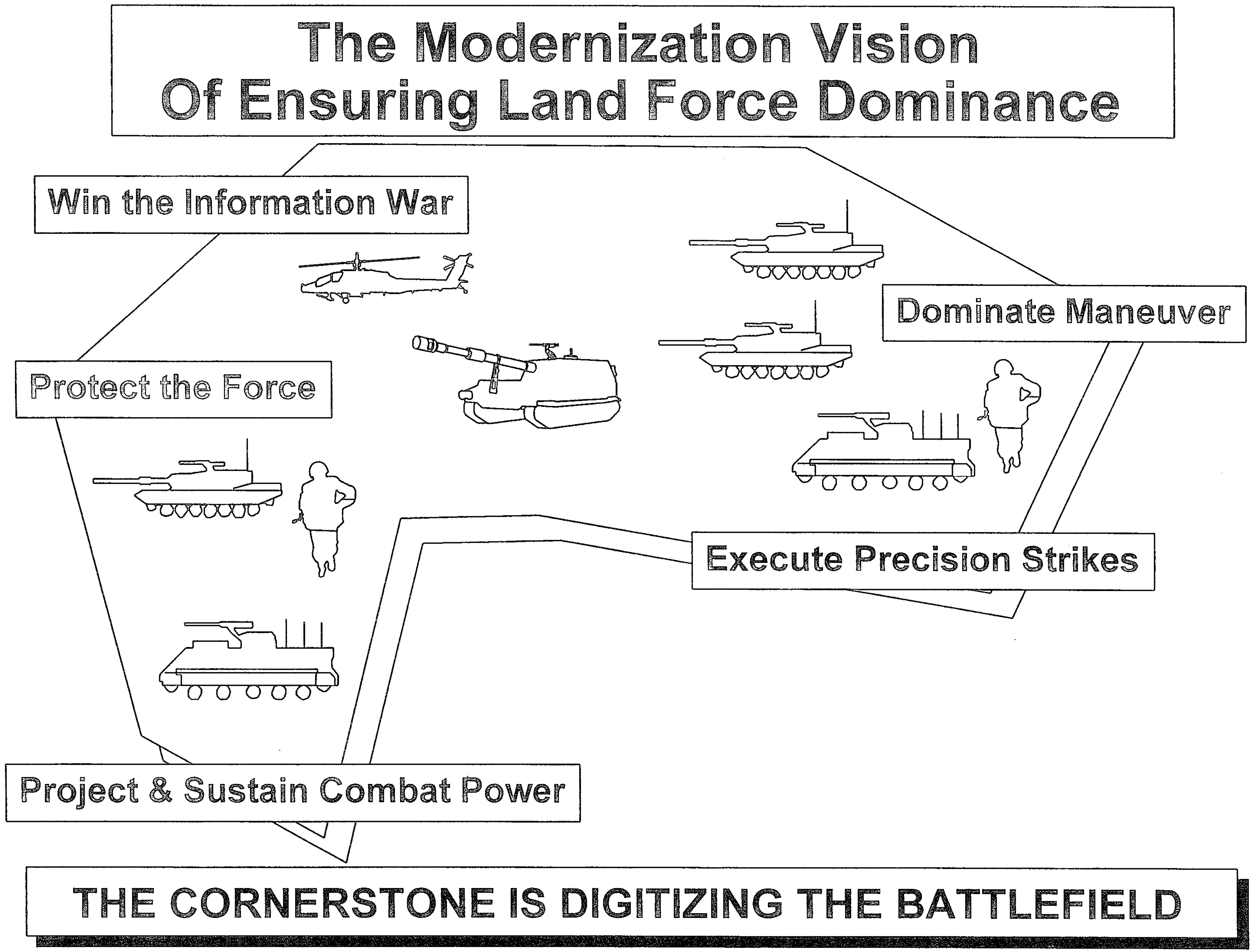
- Harness Potential of Automation and Digital Technology for Near Term and Future Use
  - Capitalize on "power" in Information Technology
  - Evolve Technical Architecture
  - Build Flexible Infrastructure
  - Integrate Military and Commercial Technology

- Integrate Emerging Technology with Evolving Doctrine

- Build the Technological Foundation for the Future

WE MUST
BRIDGE *TECHNOLOGY* TO *APPLICATIONS*




The Modernization Vision
Of Ensuring Land Force Dominance
Win the Information War
Protect the Force
Dominate Maneuver
Execute Precision Strikes
Project & Sustain Combat Power
THE CORNERSTONE IS DIGITIZING THE BATTLEFIELD

OUR MISSION FOCUSED ON THE ARMY OBJECTIVES

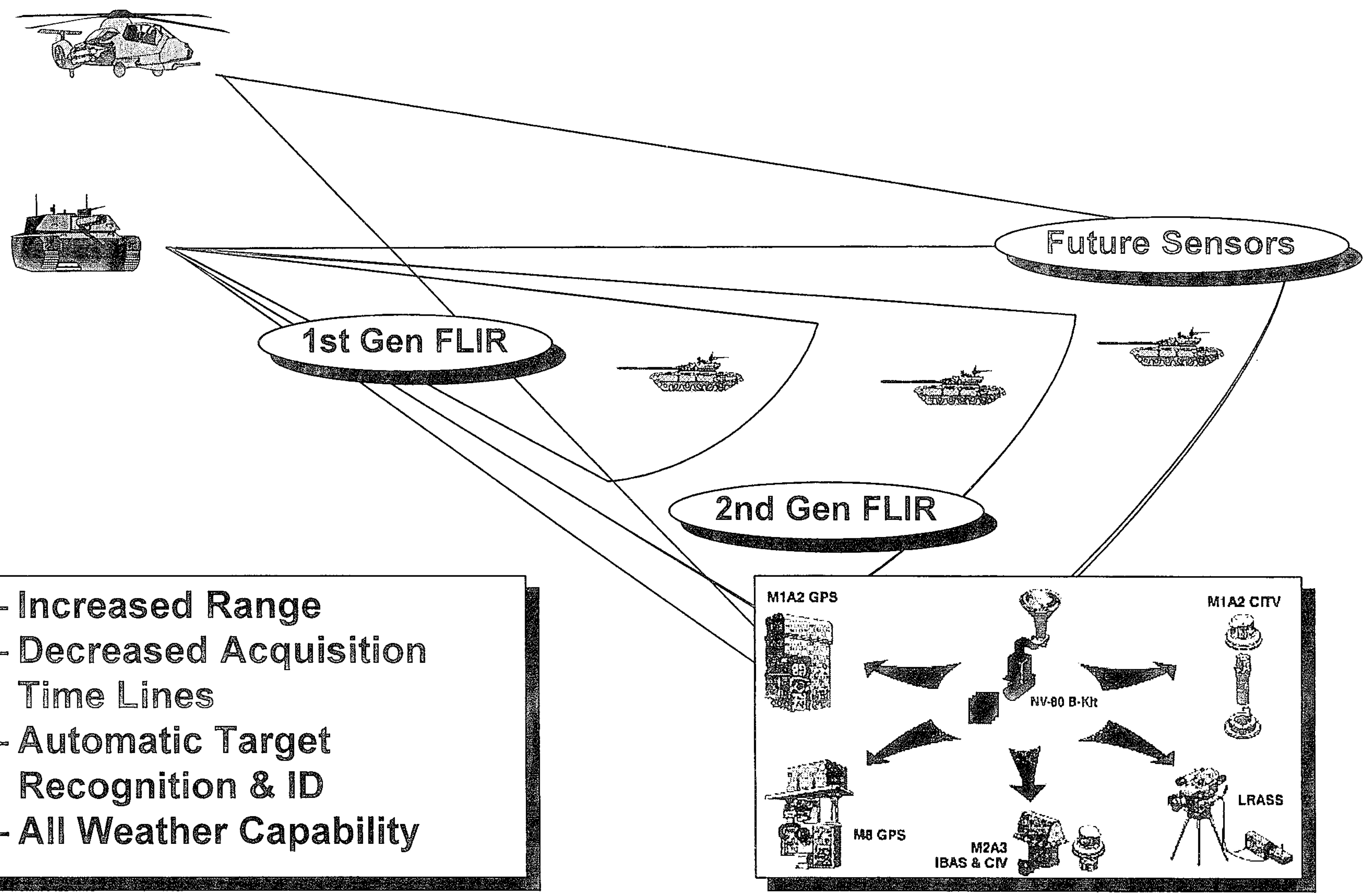
Provide the Technology/Products for the Army To Sustain Operational Superiority in Any Environment Around the World

HORIZONTAL AND VERTICAL INTEGRATION

ARMY OBJECTIVES	CERDEC MISSION						
	OWN THE NIGHT	OWN THE SPECTRUM	KNOW THE ENEMY	DIGITIZE THE BATTLE-FIELD	PROVIDE SOFTWARE FORCE MULTIPLIER	LOGIS-TICS TECH-NOLOGY	ENHANCED SURVI-VABILITY
WIN THE INFO WAR	X	X	X	X	X	X	X
PROTECT THE FORCE	X	X	X	X	X	X	X
DOMINATE MANEUVERS	X	X	X	X	X	X	X
PROJECT & SUSTAIN MANEUVERS	X	X	X	X	X	X	
EXECUTE PRECISION STRIKES	X	X	X	X	X	X	

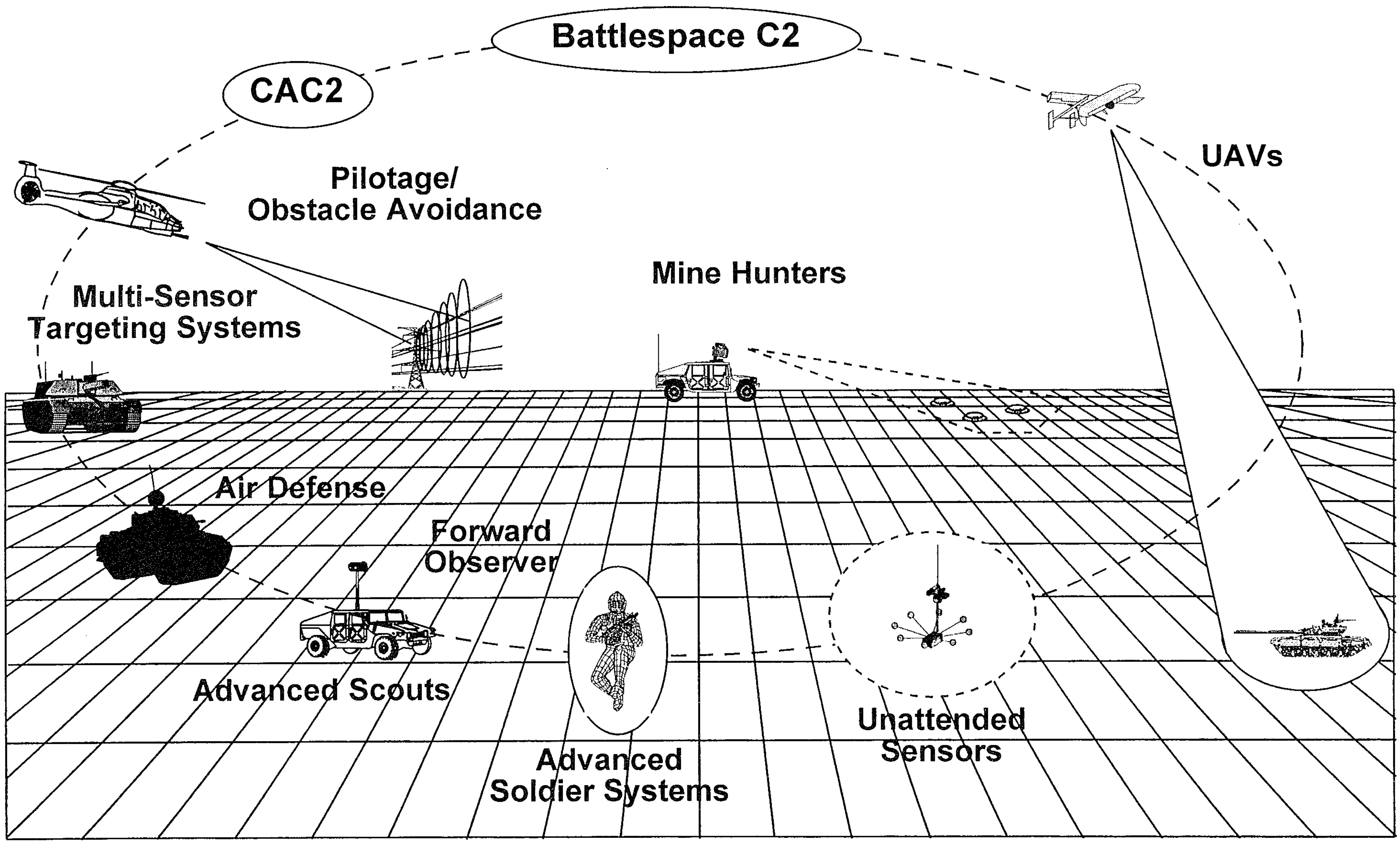
Own the Night

Sensor Fusion > Common ATR Processor > Smart Sensors

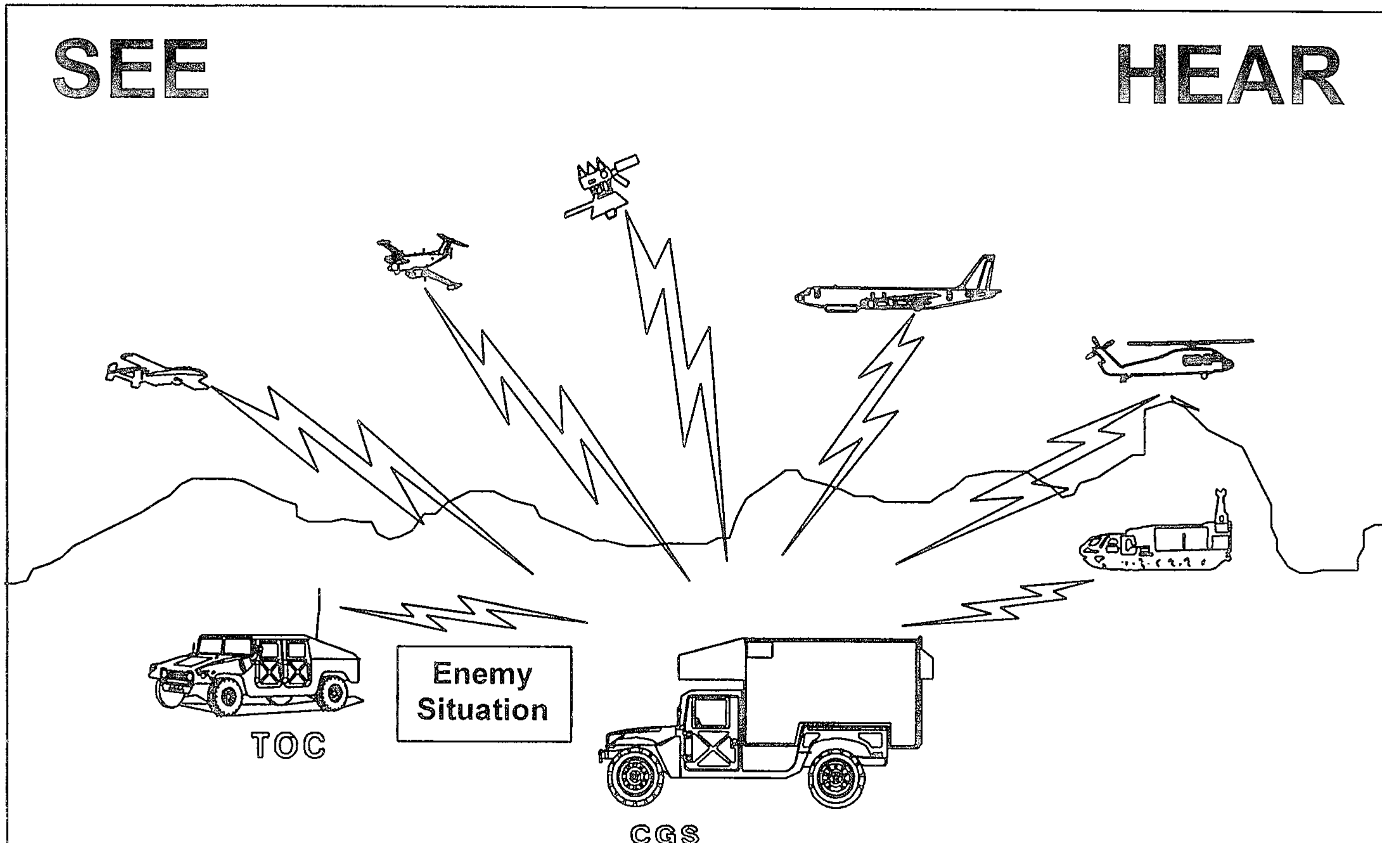


- Increased Range
- Decreased Acquisition Time Lines
- Automatic Target Recognition & ID
- All Weather Capability

Sensors for the Battlefield



Common Ground Station Concept



- Delivers Intel On Time To Influence Battles
- Close Dissemination Gap Between EAD Systems and Brigade Warfighter
- Allows Syntheses of Voluminous Data Into Relevant Visually Oriented Intelligence

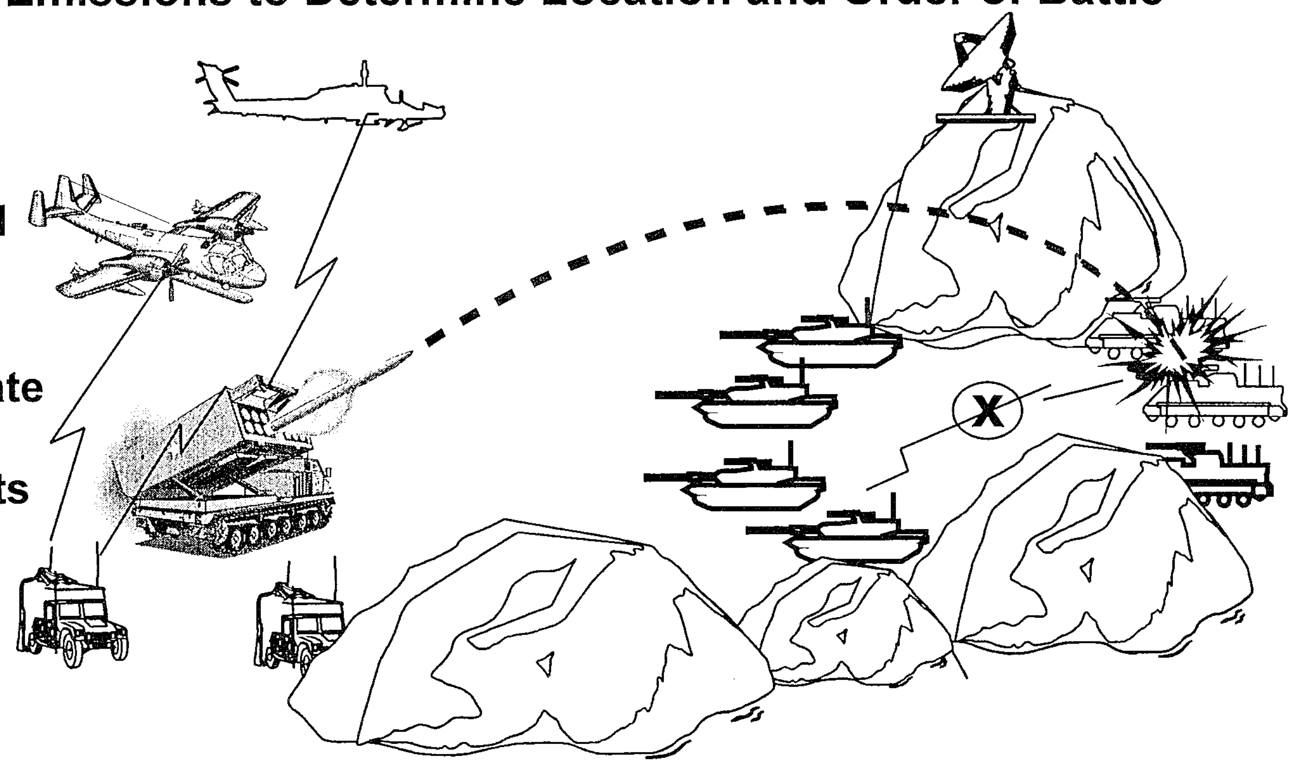
OWNING THE ELECTROMAGNETIC SPECTRUM

OFFENSIVE CONTROL - *Exploit the Enemy's Use of the Spectrum*

Exploit Enemy Emissions to Determine Location and Order of Battle

Utilize Electronic Attack to Deny Timely Command and Control

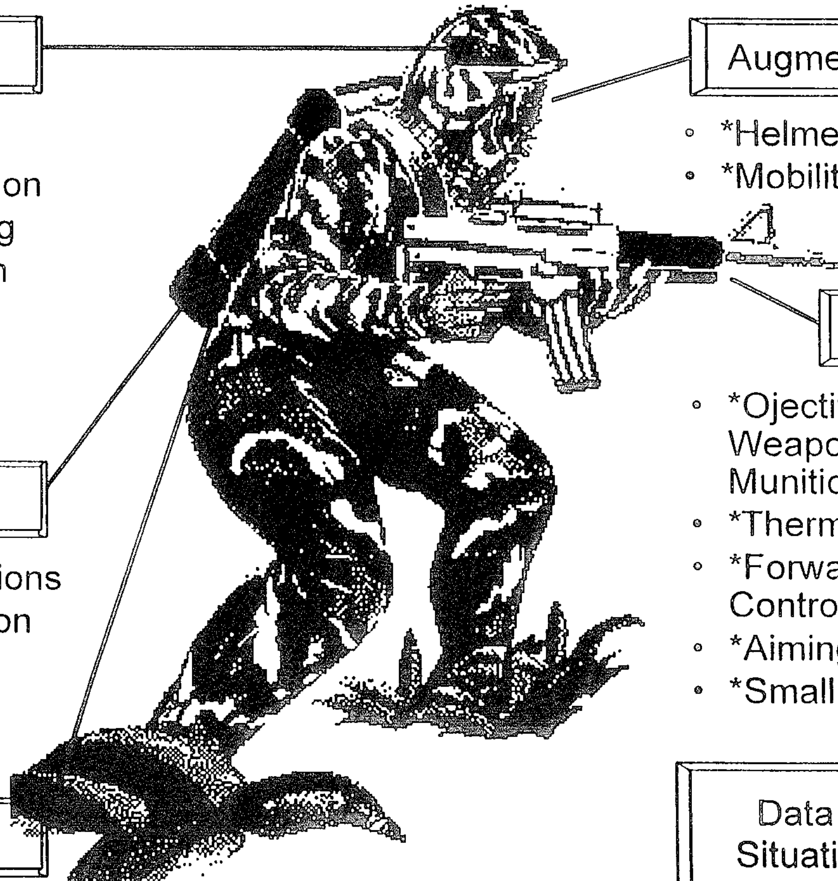
Identify and Locate Command Posts as Priority Targets for Physical Destruction



DECIMATE THE ENEMY'S COMMAND STRUCTURE

DOMINATE MANEUVER
21st CENTURY LAND WARRIOR

Focus: Data Network & Survivability



Life Support:

- Ballistic Protection
- Laser Flash Protection
- Microclimate Cooling
- *Chemical Detection
- Mine Detection
- *Medical Sensors
- Individual Power

Individual C3:

- *Voice Communications
- *Combat Identification
- *Image Transfer
- *Individual Position/ *Navigation

Computer:

- *Software Modules

Augmented Day/Night Vision:

- *Helmet Mounted Display
- *Mobility Sensor

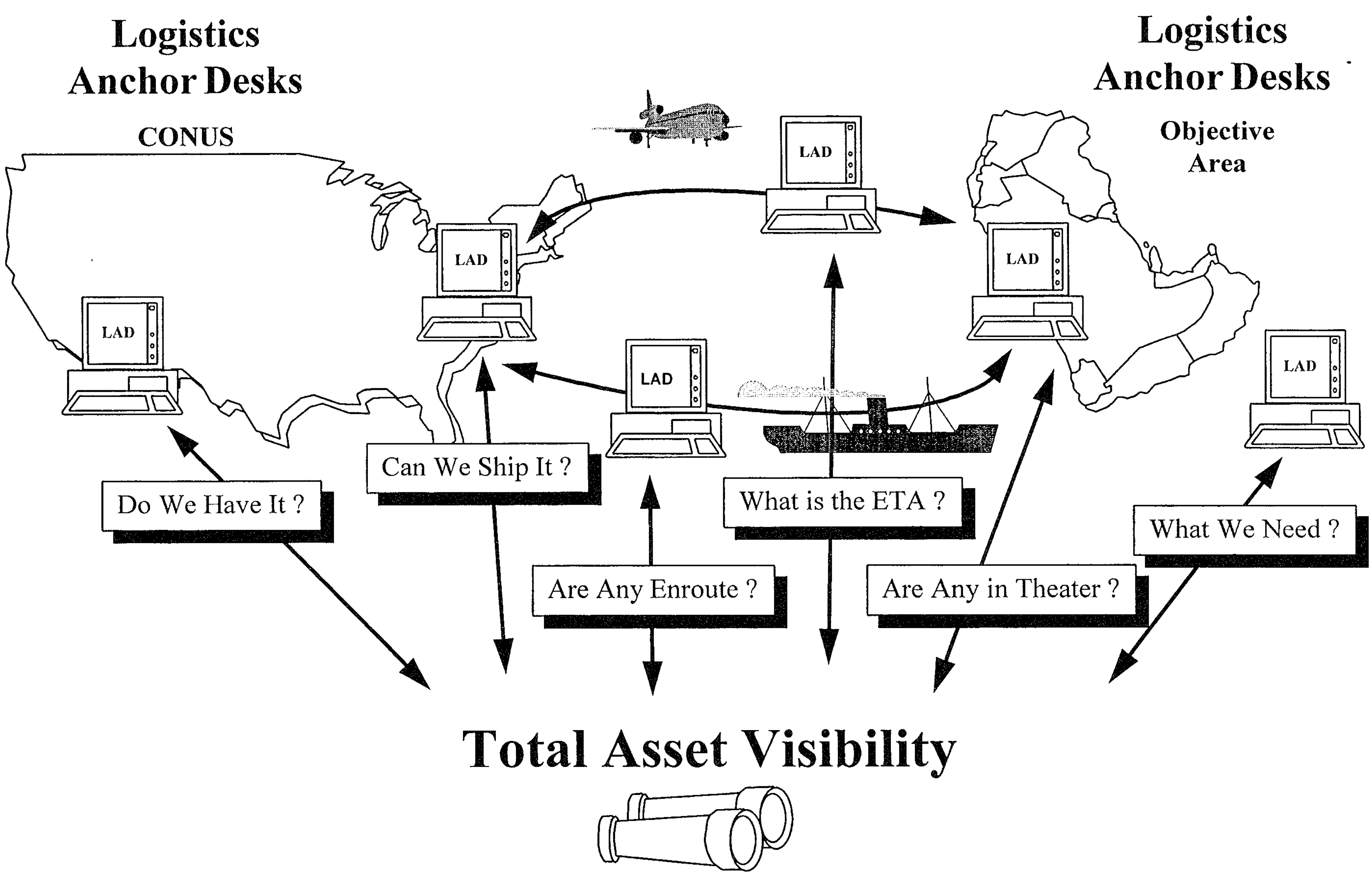
Lethality:

- *Ojective Individual Combat Weapon Multi-Purpose Individual Munition
- *Thermal Weapon Sight
- *Forward Observer/Forward Air Controller
- *Aiming Light (AN/PAQ 4B)
- *Small Arms Fire Control

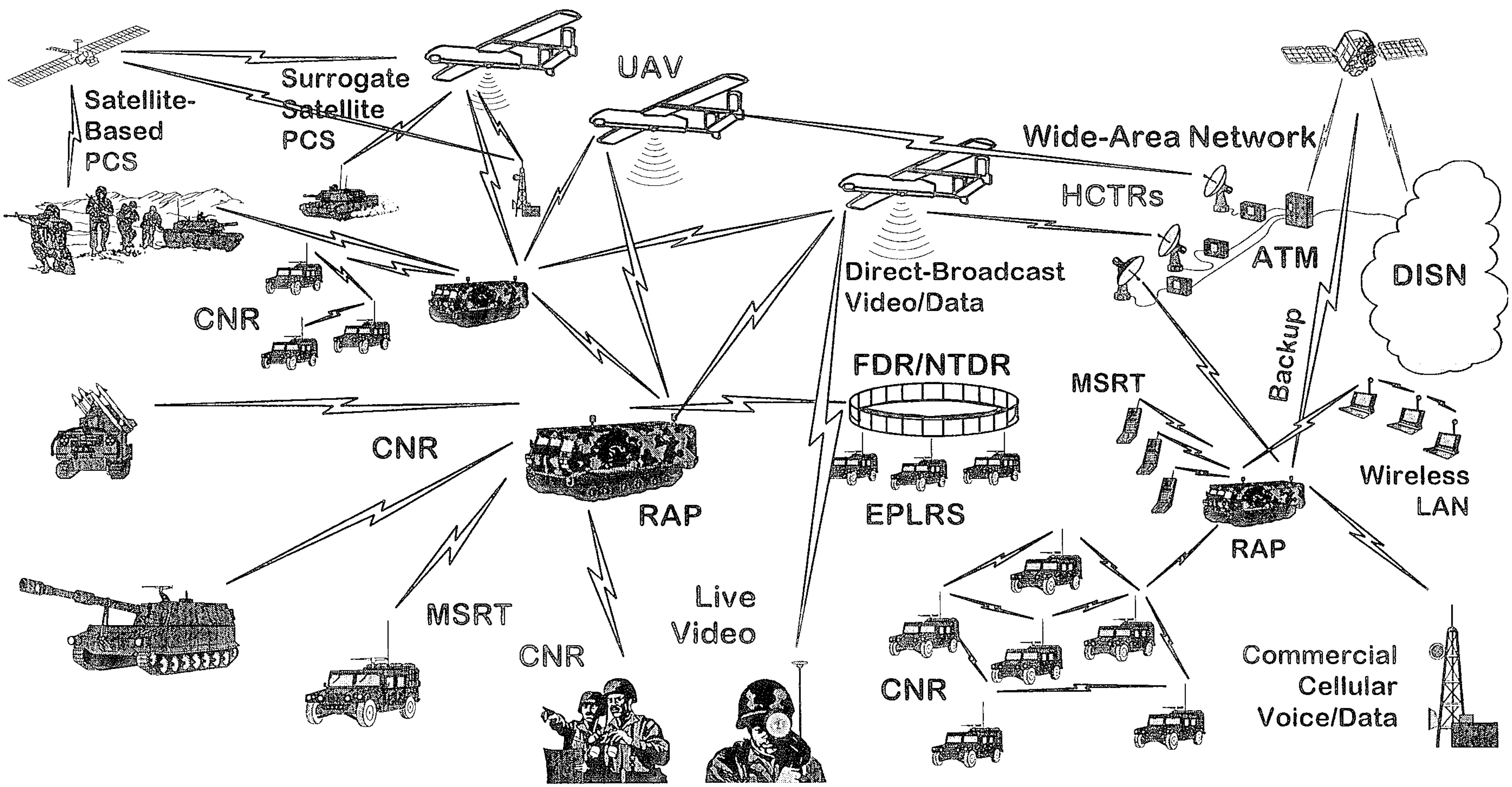
Data Network Provides Situation Awareness, C2, and Target Handover

Denotes CECOM Programs   * Integrated Into Data Network

Total Distribution - Technology Demonstrator



Digital Battlefield Communications Architectural Elements

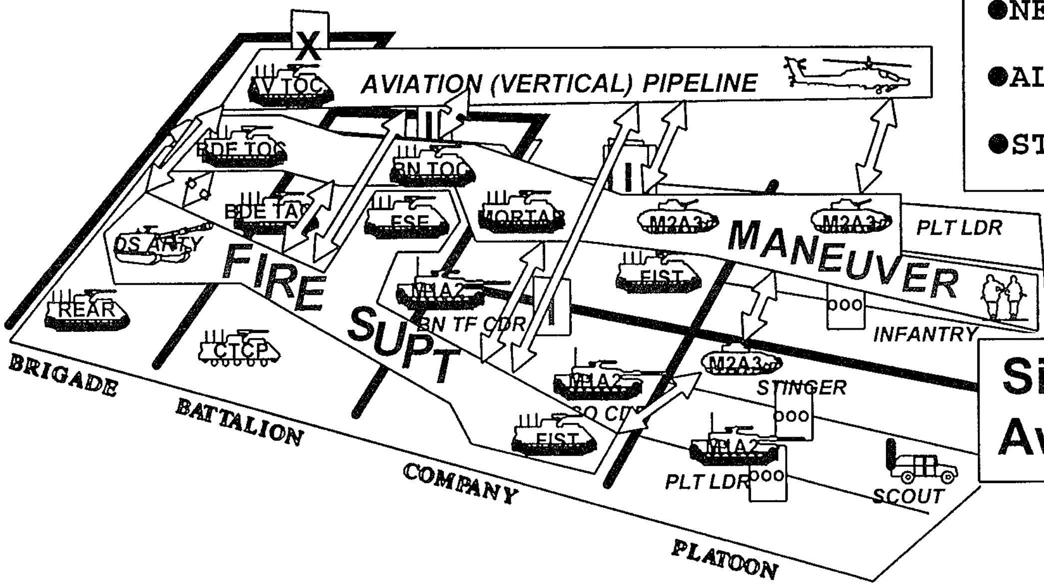


Out Think !

Digital Battlefield For Force XXI

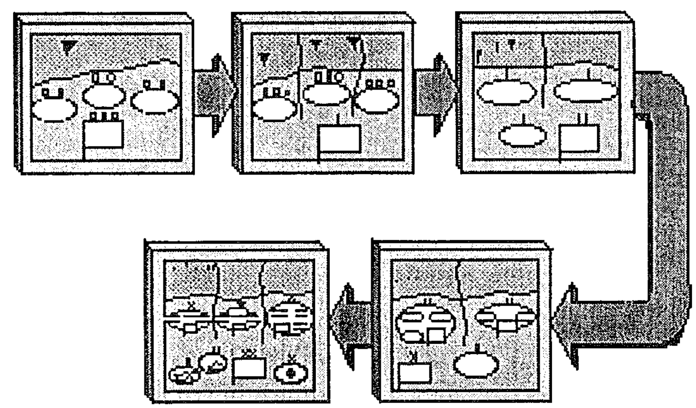
Battle Command
- *HORIZONTAL INTEG*
- *TARGET HAND OVER*

- SHARED MESSAGE SETS
- COMPATIBLE RADIOS/MODEMS
- NETS/ROUTING SOLUTIONS
- ALL LINKS ELEC DATA vs VOICE
- STANDARD PROTOCOLS



Situational Awareness

COMMON PICTURE
- DOES NOT MEAN: Common Display
- IT DOES MEAN: Common Data For The Same Area On All Displays



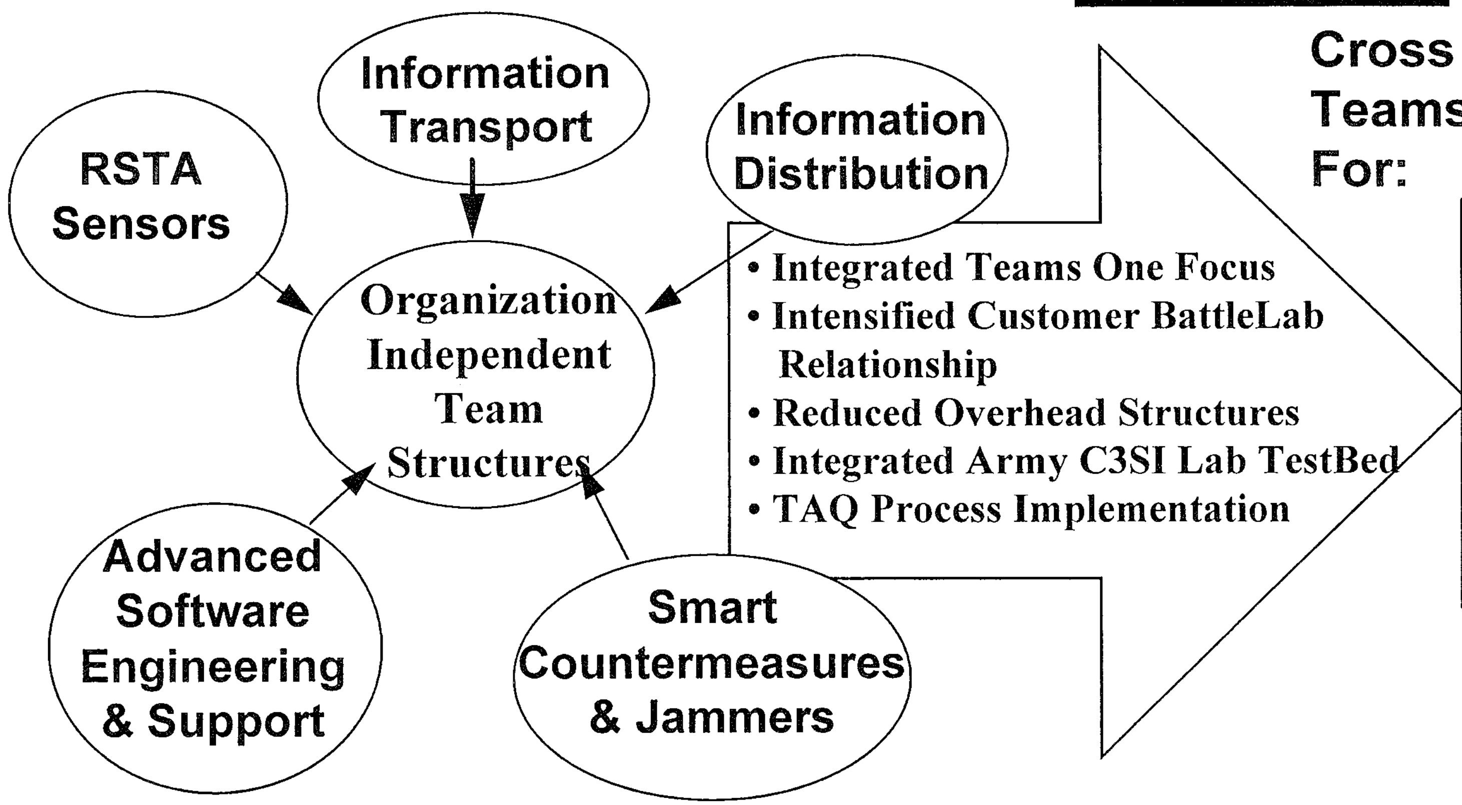
FOCUSED INITIATIVES

- Integrated Product Teams
- Customer Focus
- Modeling and Simulation
- Digital Integrated and Distributed Labs
- Battlelabs as a "Real Time" Team Member
- "Pull" Research into Technology Applications
- Buy Commercial
- Establish Technology Alliances
- Establish and Enforce Architecture
- Software Prototyping to Expedite Products
- ATDs : *Foundation for the Future*

Integrated Product Teams

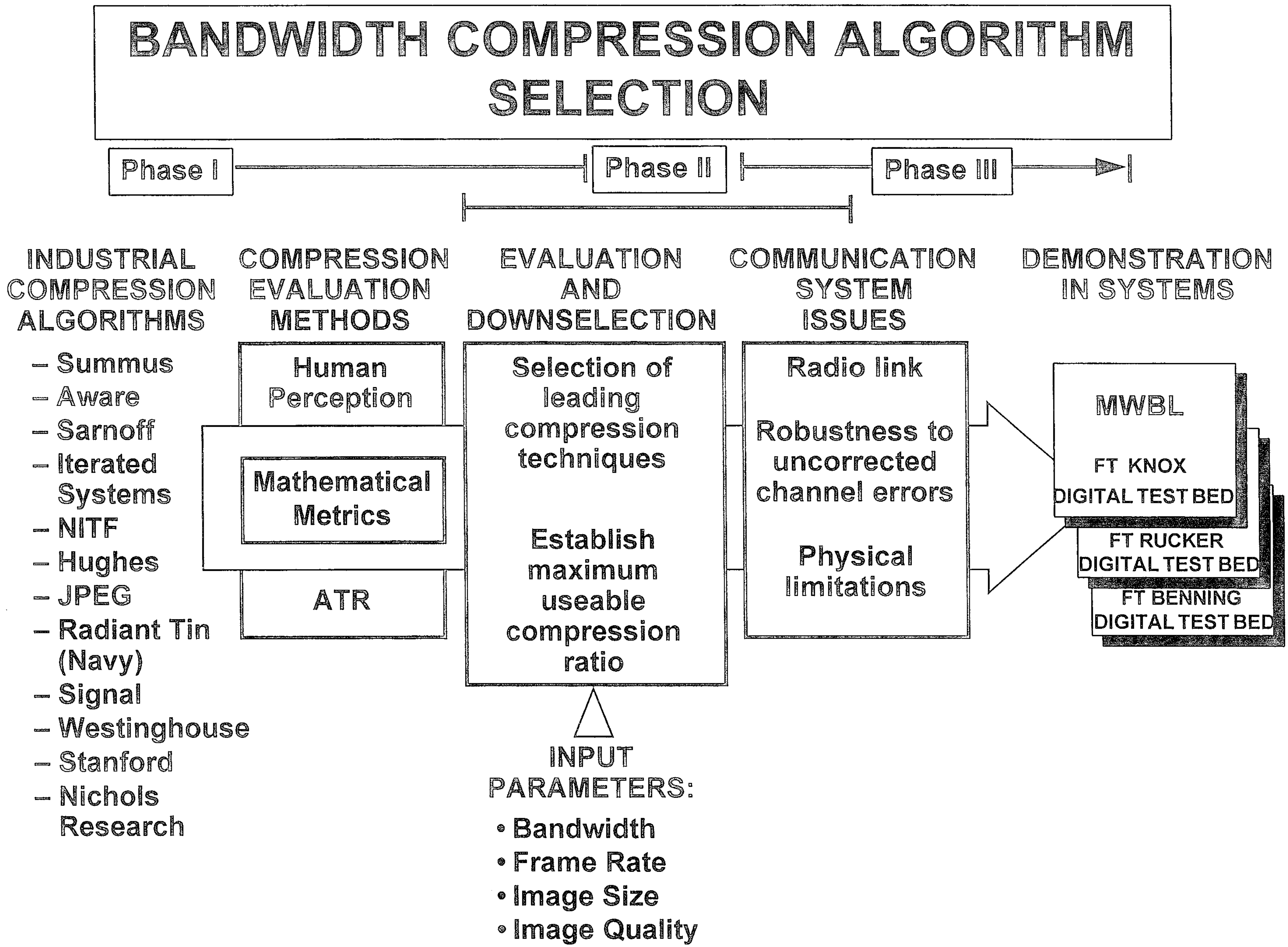
The New

The Result

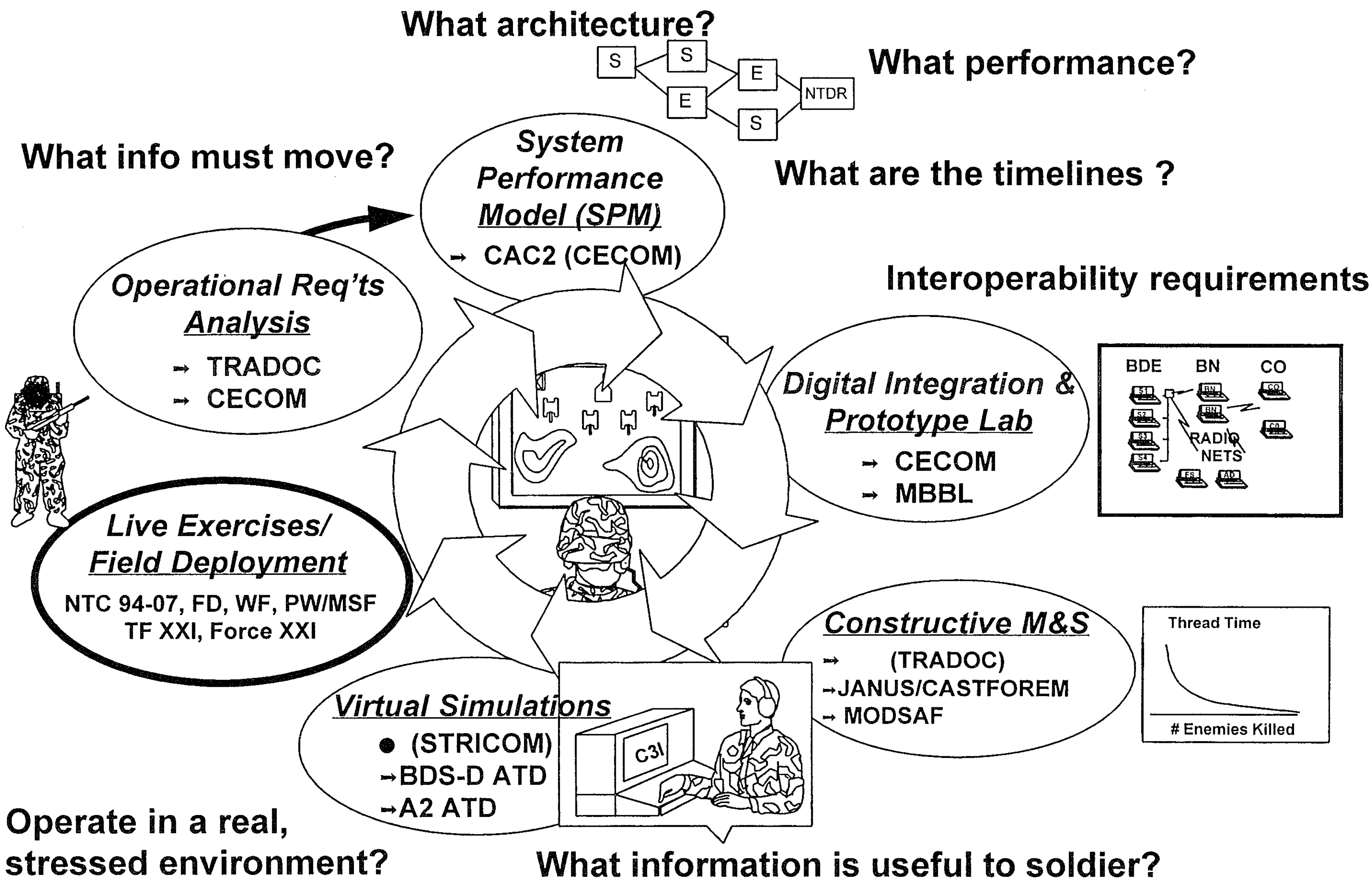


Cross Function Teams Established For:

- RFPI
- Image Compression
- CAC2
- TDATD
- Soldier System
- Digitization

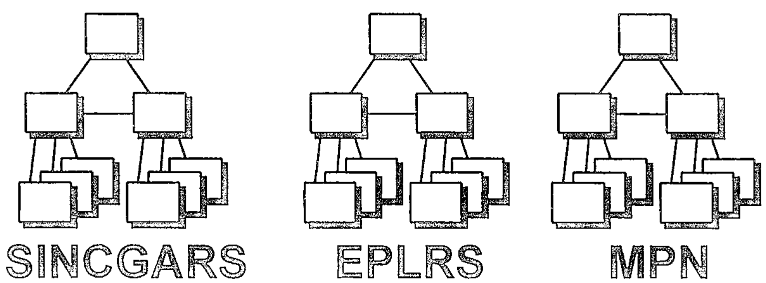

BANDWIDTH COMPRESSION ALGORITHM SELECTION
Phase I
Phase II
Phase III
INDUSTRIAL COMPRESSION ALGORITHMS
– Summus
– Aware
– Sarnoff
– Iterated Systems
– NITF
– Hughes
– JPEG
– Radiant Tin (Navy)
– Signal
– Westinghouse
– Stanford
– Nichols Research
COMPRESSION EVALUATION METHODS
Human Perception
Mathematical Metrics
ATR
EVALUATION AND DOWNSELECTION
Selection of leading compression techniques
Establish maximum useable compression ratio
INPUT PARAMETERS:
• Bandwidth
• Frame Rate
• Image Size
• Image Quality
COMMUNICATION SYSTEM ISSUES
Radio link
Robustness to uncorrected channel errors
Physical limitations
DEMONSTRATION IN SYSTEMS
MWBL
FT KNOX DIGITAL TEST BED
FT RUCKER DIGITAL TEST BED
FT BENNING DIGITAL TEST BED

Systems Modeling & Simulation Process

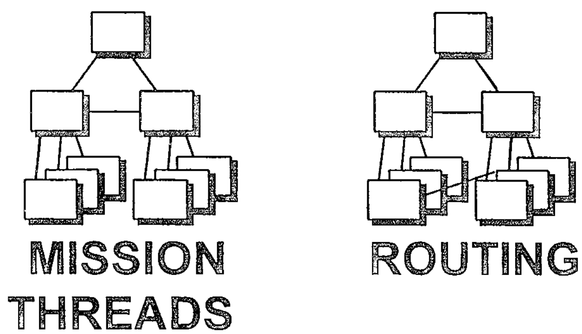


MODELING & SIMULATION OBJECTIVES

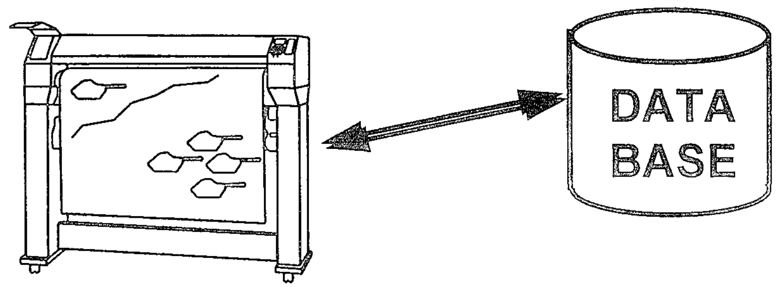
- NET STRUCTURE ANALYSIS



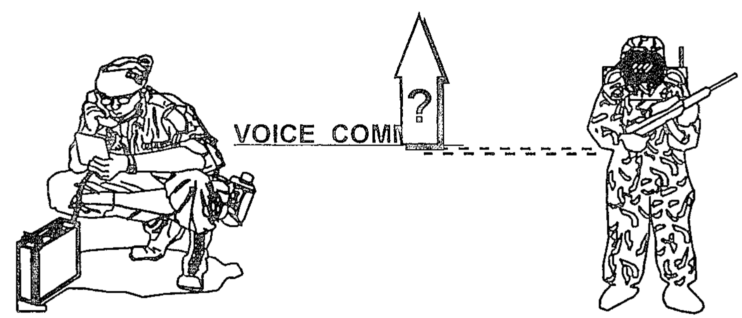
- INFORMATION FLOW ANALYSIS



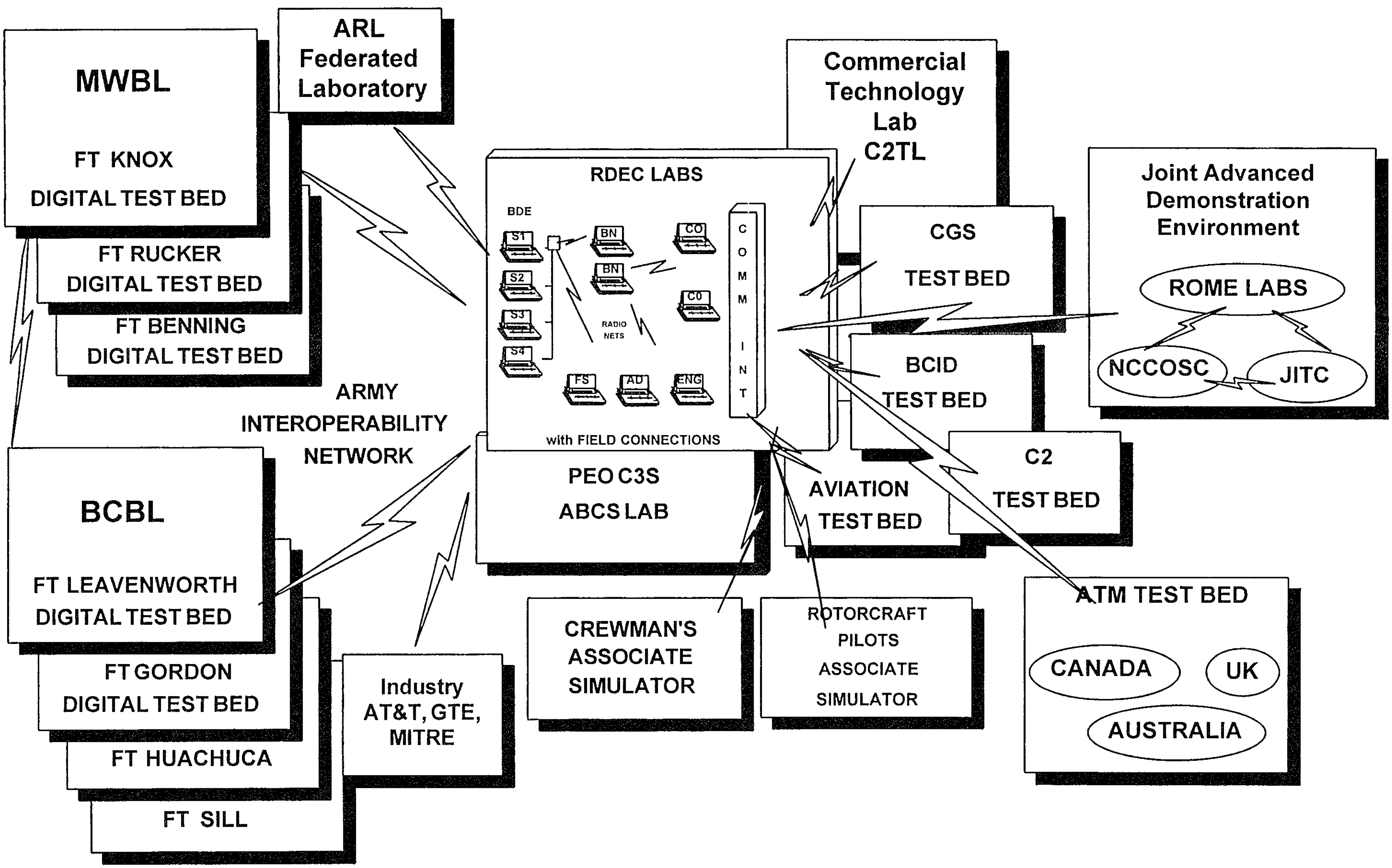
- SA & DB INFO DISTRIBUTION ANALYSIS



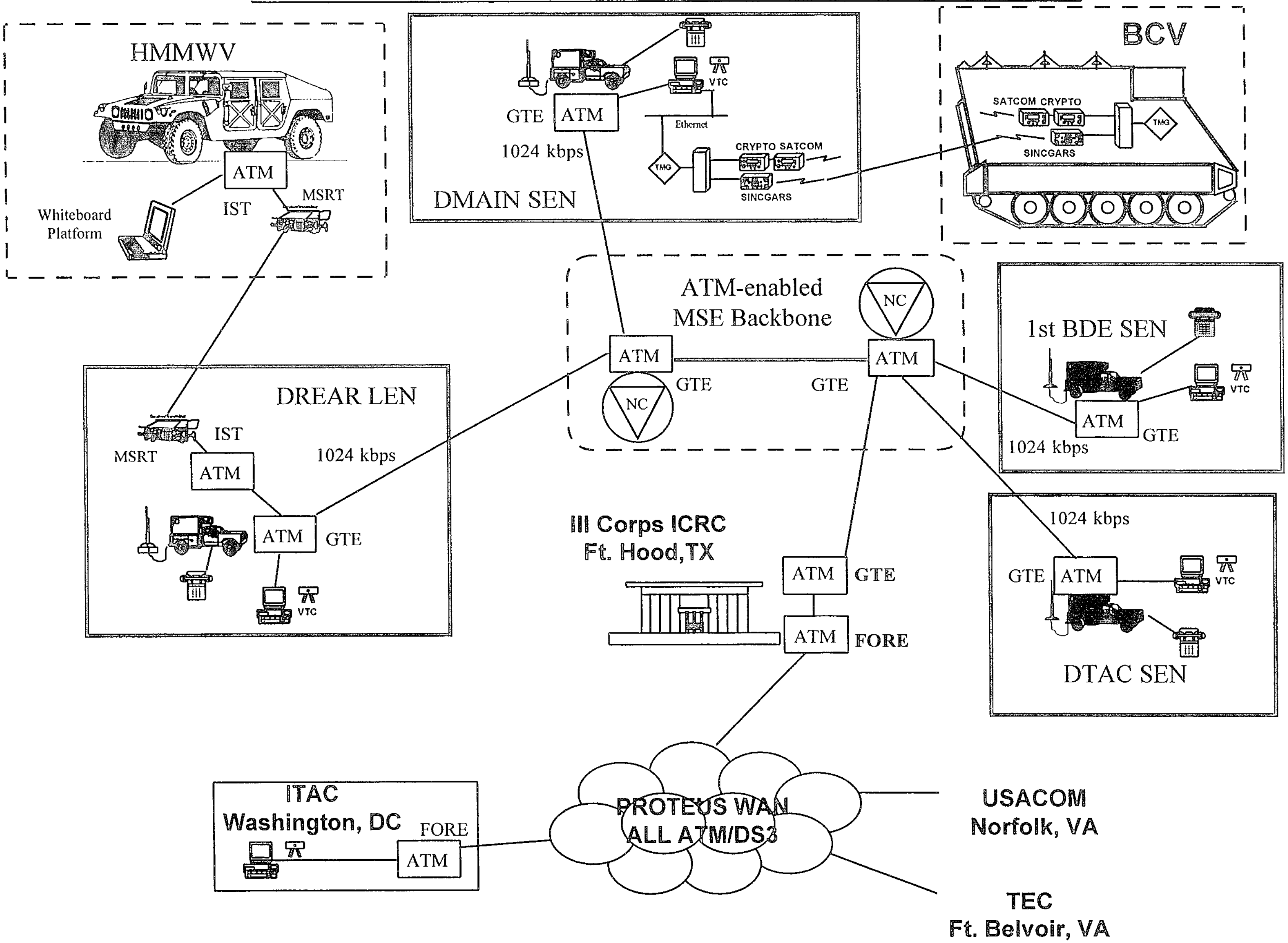
- VOICE/DATA CONTENTION



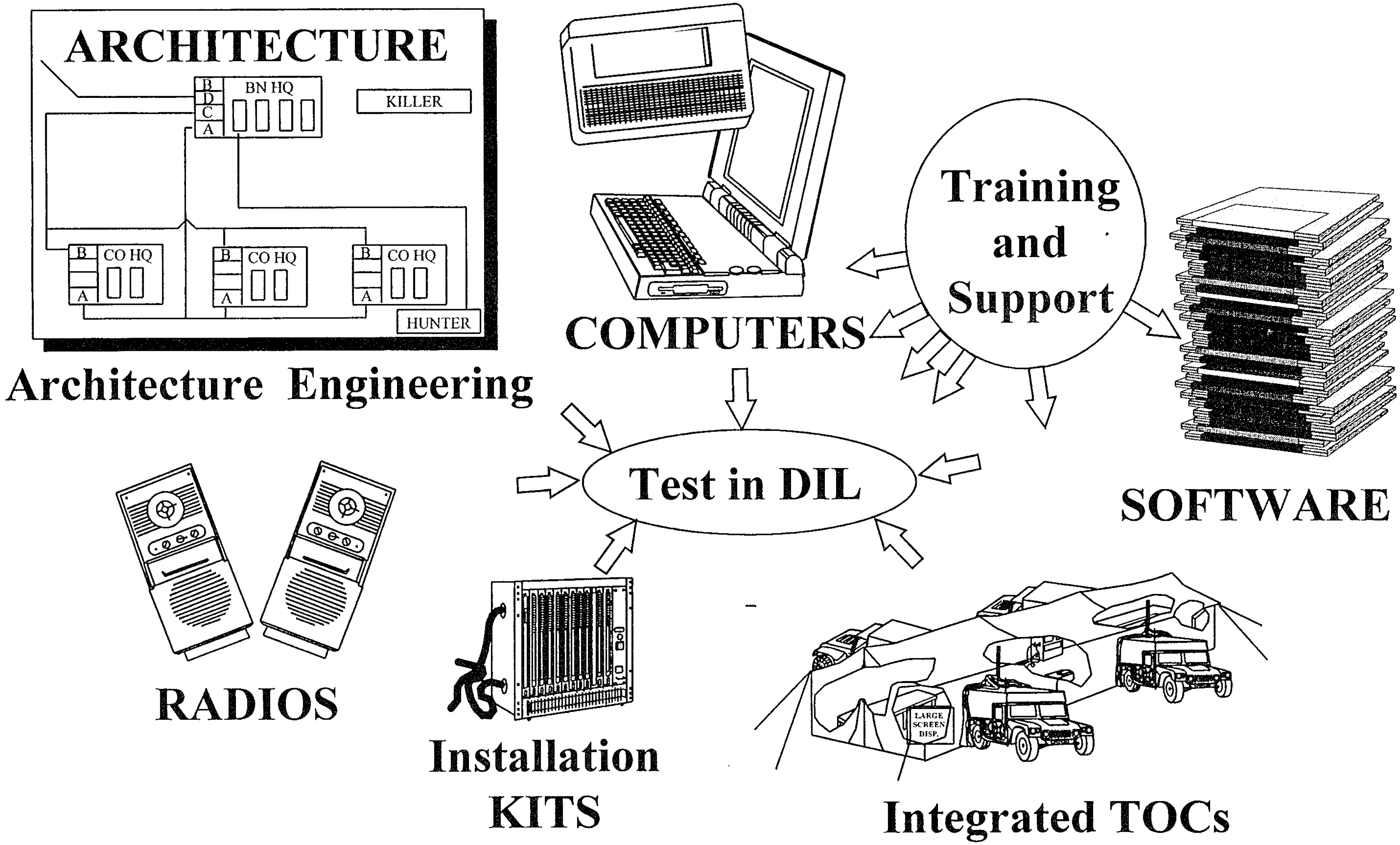
Digital Integrated Lab



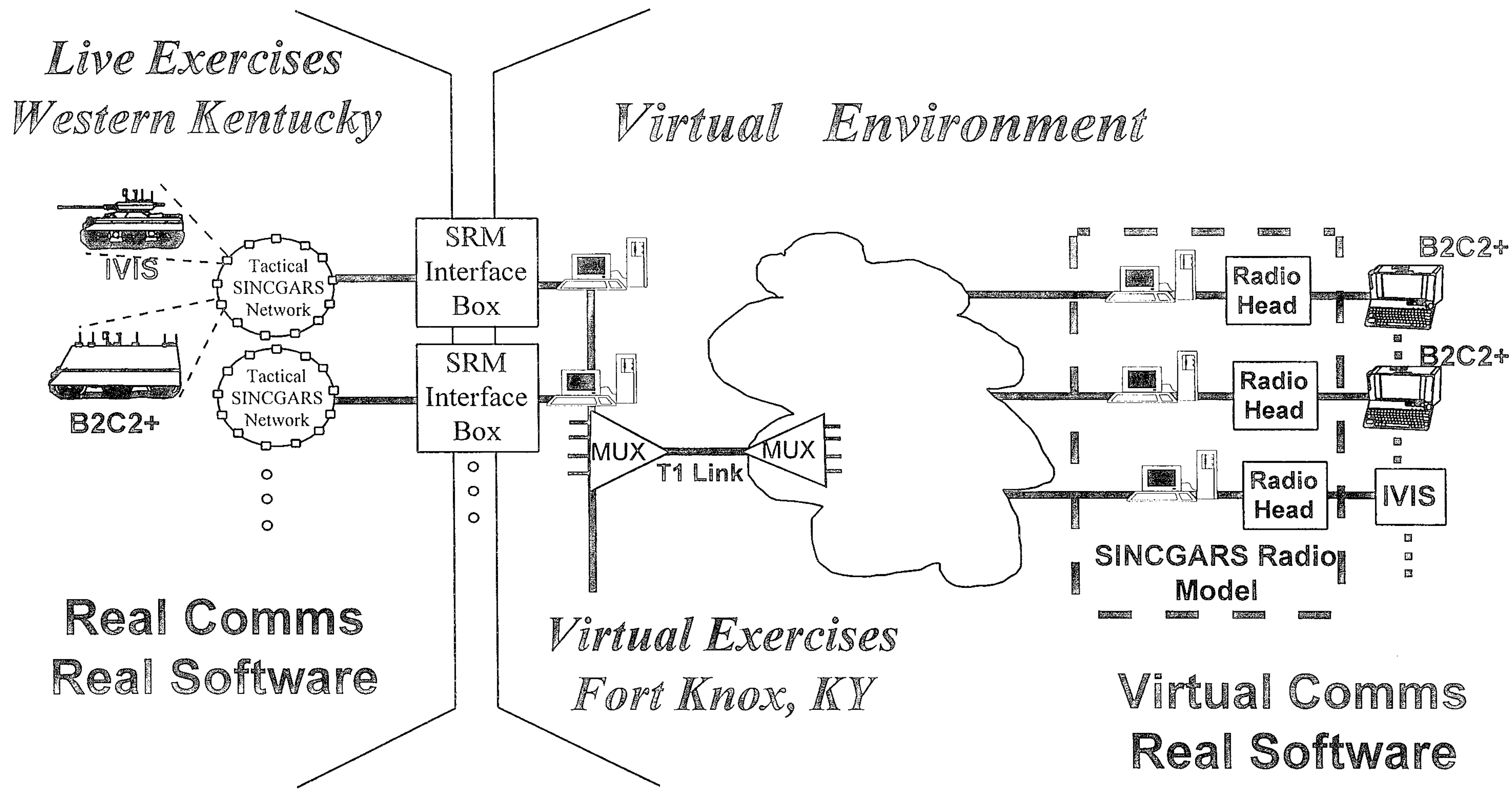
Proteus '95/Unified Endeavor



Team Monmouth Support to WARRIOR FOCUS



Team Monmouth Support to FOCUSED DISPATCH

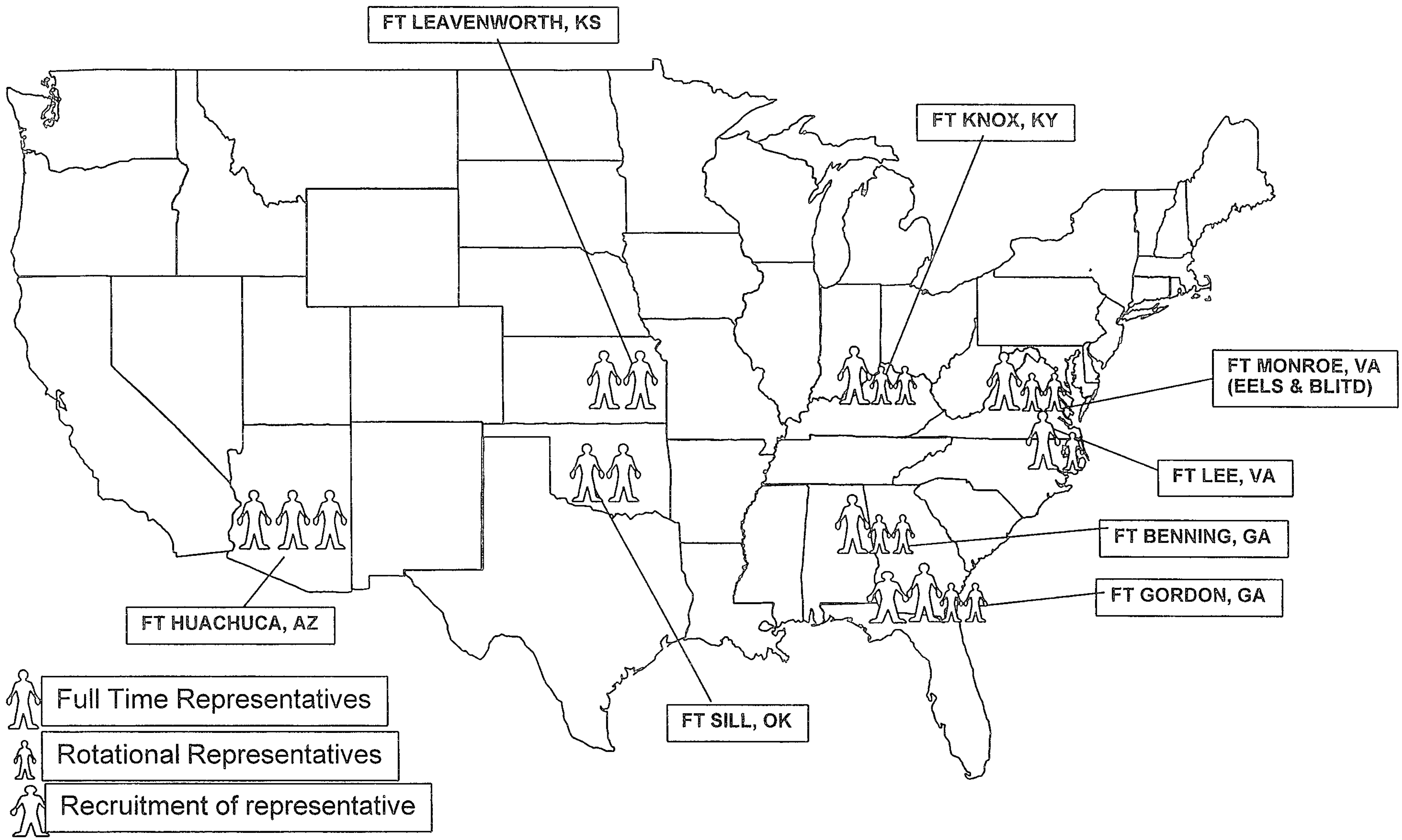


Battle Lab Plan

- Recognize Battle Lab As Major Customer
- Right Requirements the First Time
- Educate Workforce on New Way of Doing Business
- Establish <u>Technical</u> Presence; Work for Battle Lab
- Take Advantage of PEO/PM Foundations
- Exploit “Nuggets” in Existing Tech Base

Return On Investment
- Focused Programs
- Educated Workforce
- Satisfied Customer

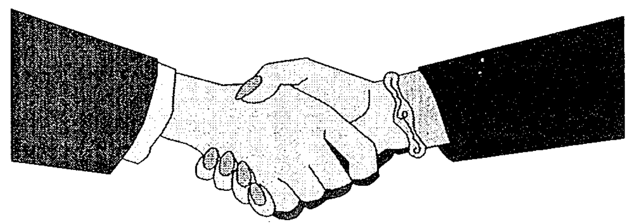
PRESENCE AT BATTLE LABS



ARMY RESEARCH LAB

APPROACH: Maximize leveraging of ARL technology

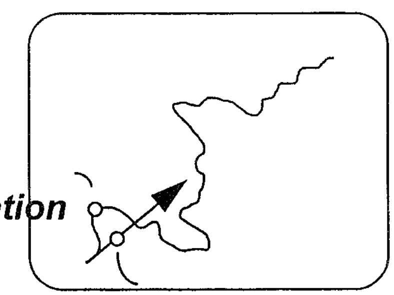
- Each TPA has defined exit criteria and products



Examples

- CECOM 3D Visualization Program using ARL Virtual Reality Technology
- CECOM CAC2 ATD incorporating the ARL GPS Track Reporting Algorithms and Filters

Commander's SA Display



Battlefield Visualization Foundation

B C 2

Manipulate and Display Information

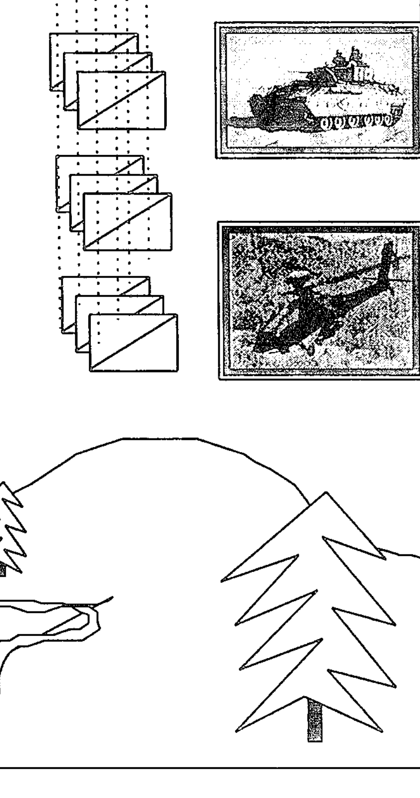
Disseminate & Integrate Digital Terrain, SA, Intel and other Data

R T V

Build Hi-Res Digital Terrain Representation

Without combatant, situational and environmental information, you only have part of the picture

If you can't get it there, even the best information is no good

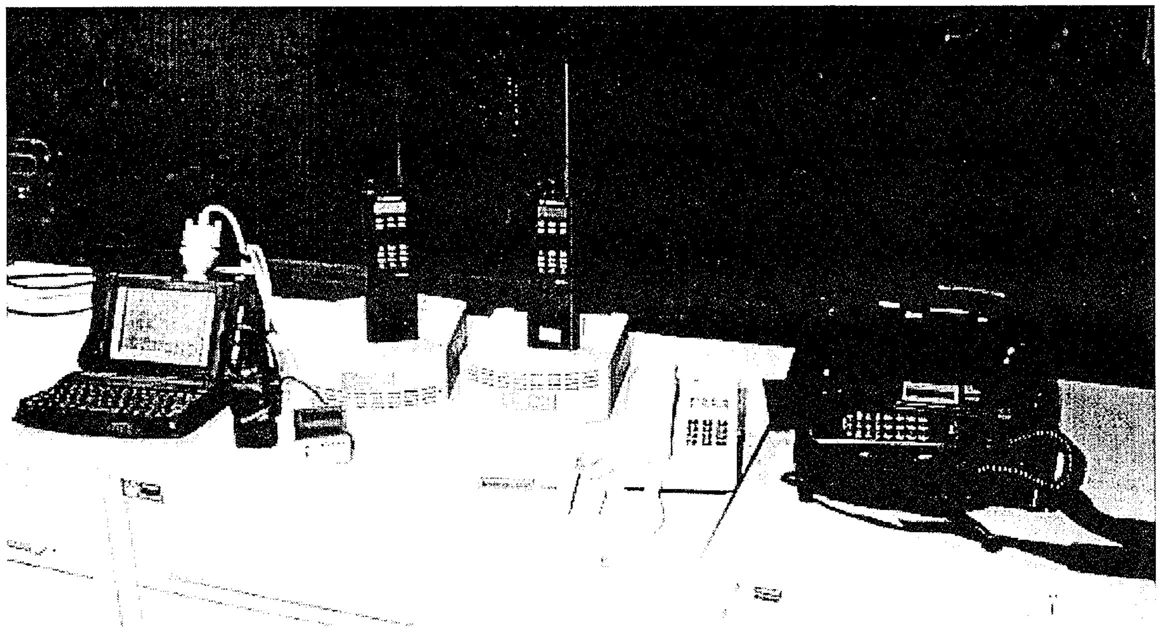


Without digital terrain data, friendly/enemy situation can not be placed in context

Commercial Communications Technology Laboratory

OBJECTIVE

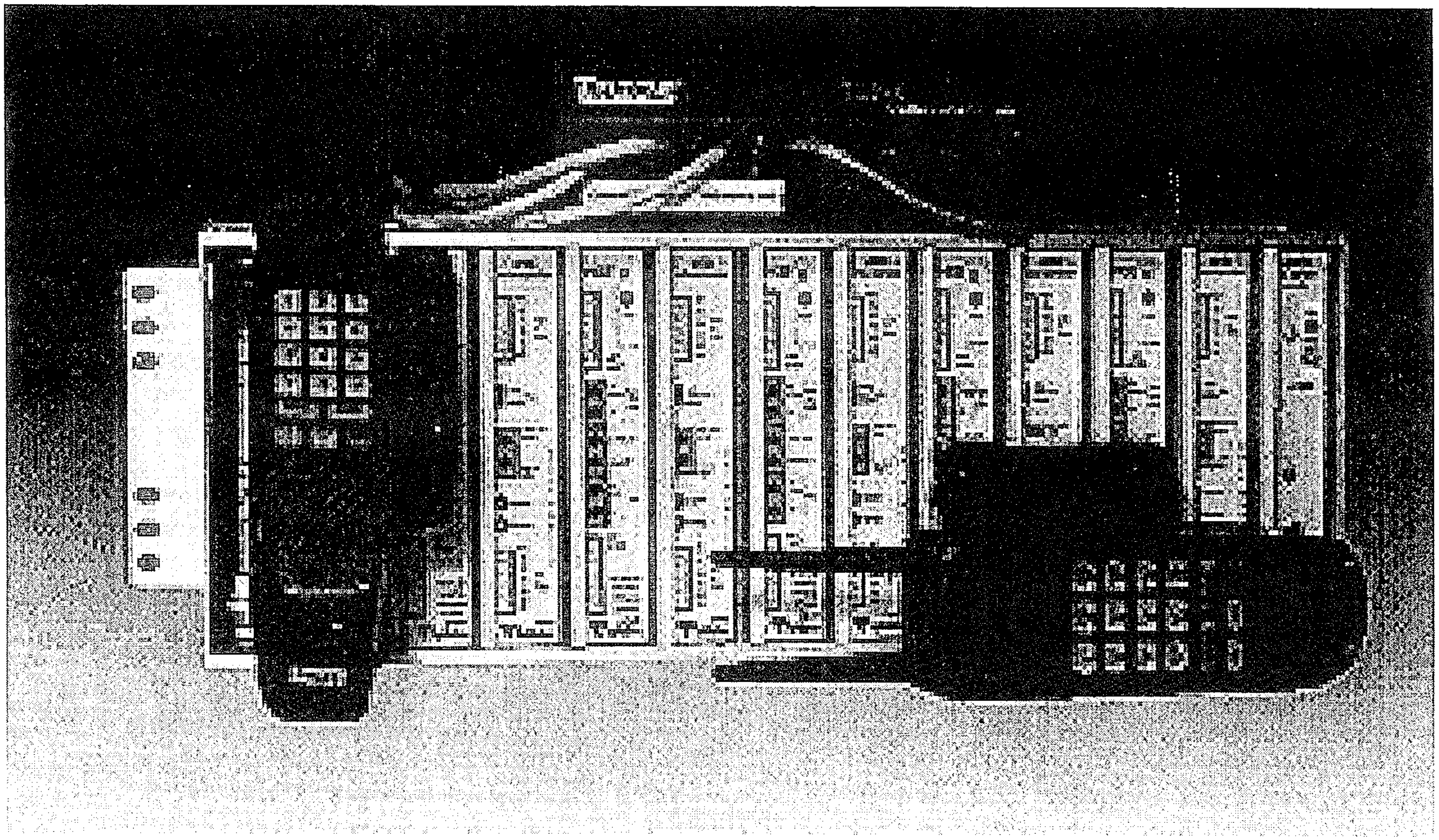
EVALUATE STATE-OF-THE ART COMMUNICATIONS EQUIPMENT AND EXPLOIT THIS TECHNOLOGY FOR MILITARY APPLICATIONS



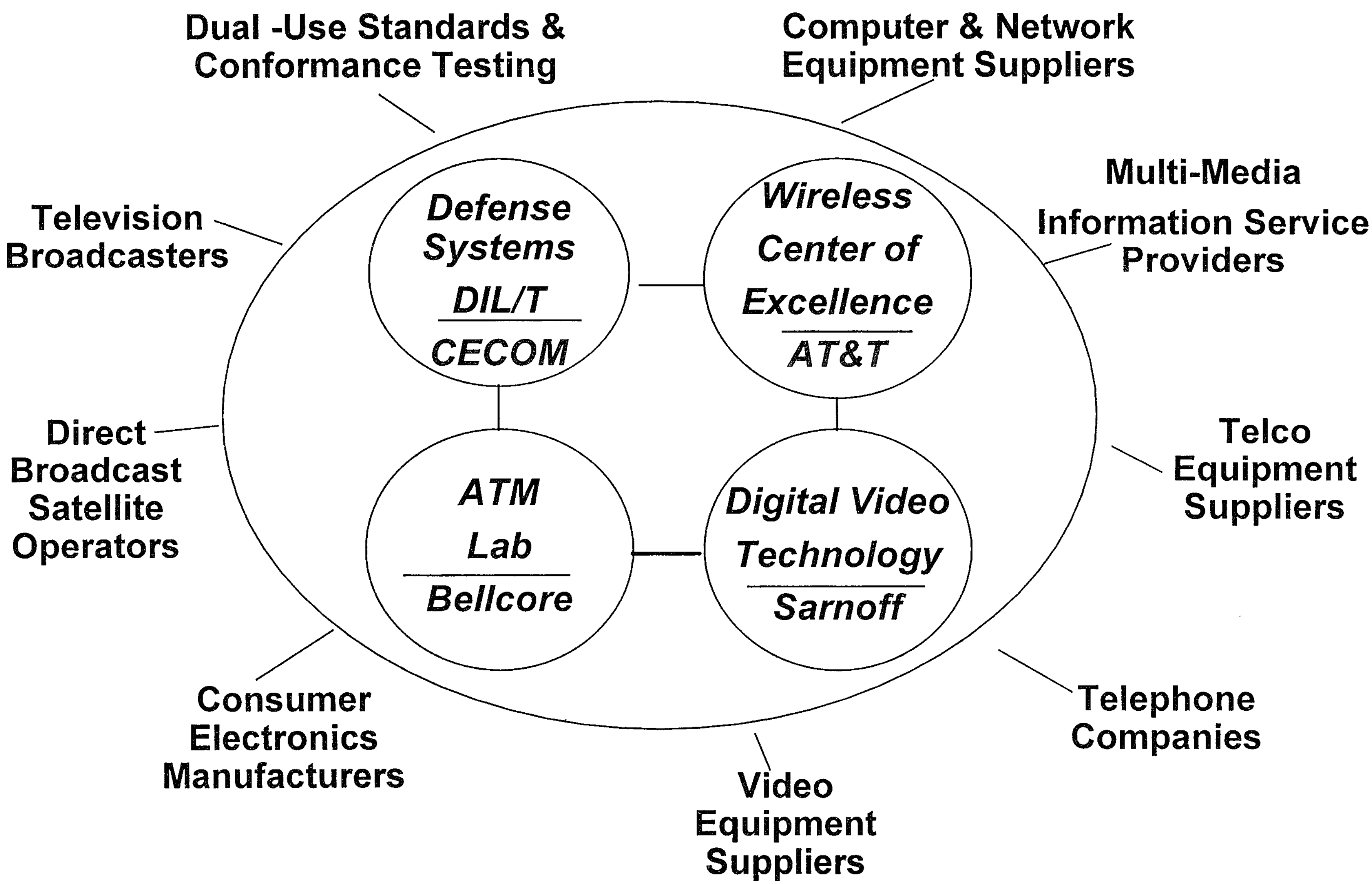
PRODUCTS DEMONSTRATED

- Cisco Routers
- CGS-100
- Motorola NES
- RTV-30

CODE DIVISION MULTIPLE ACCESS EQUIPMENT

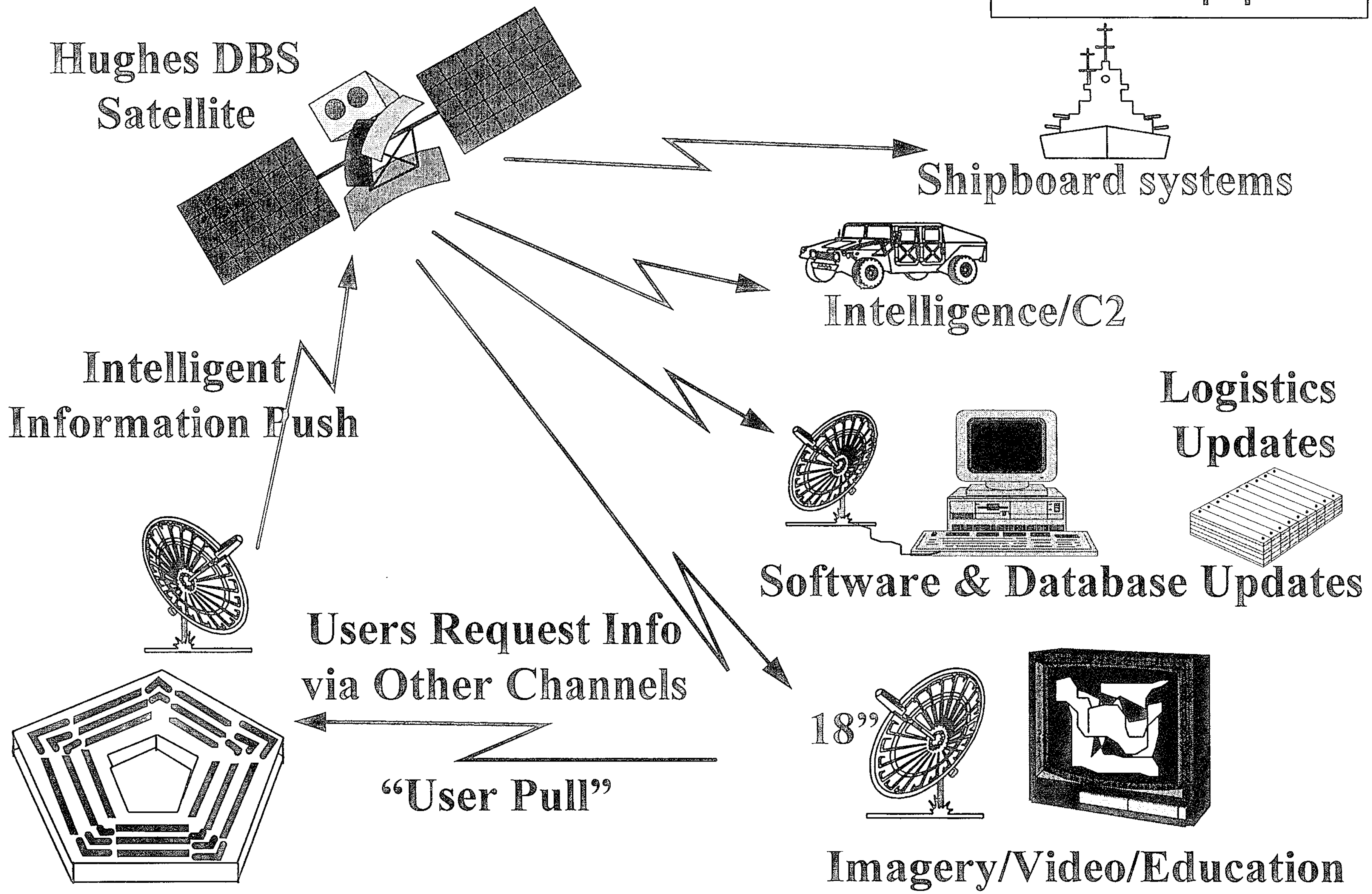


PROPOSED TRP TESTBED
NJ Regional Technology Consortium

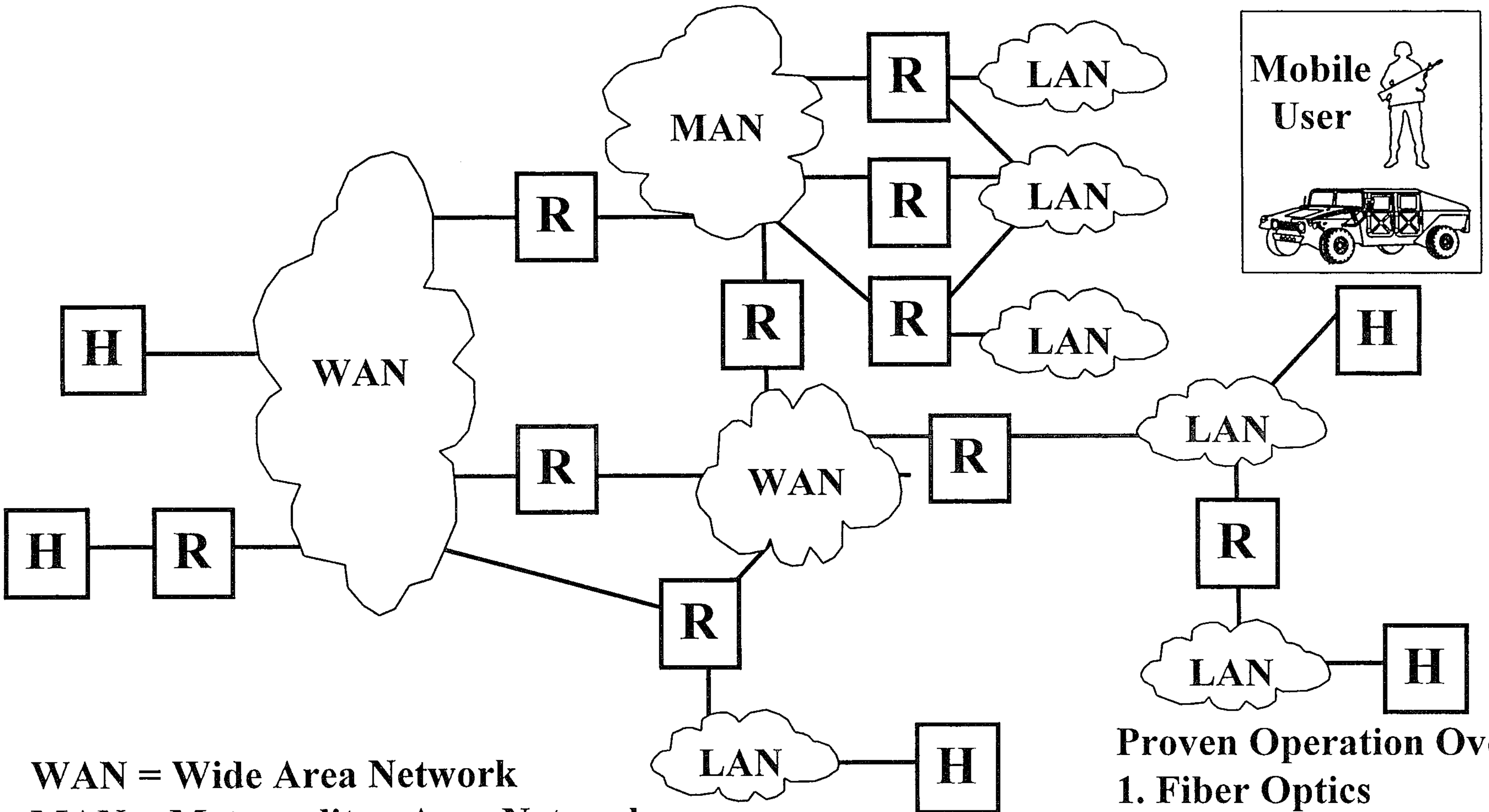


Direct Broadcast Satellite

Objective: To extend range and shrink SATCOM equipment



TECHNICAL ARCHITECTURE

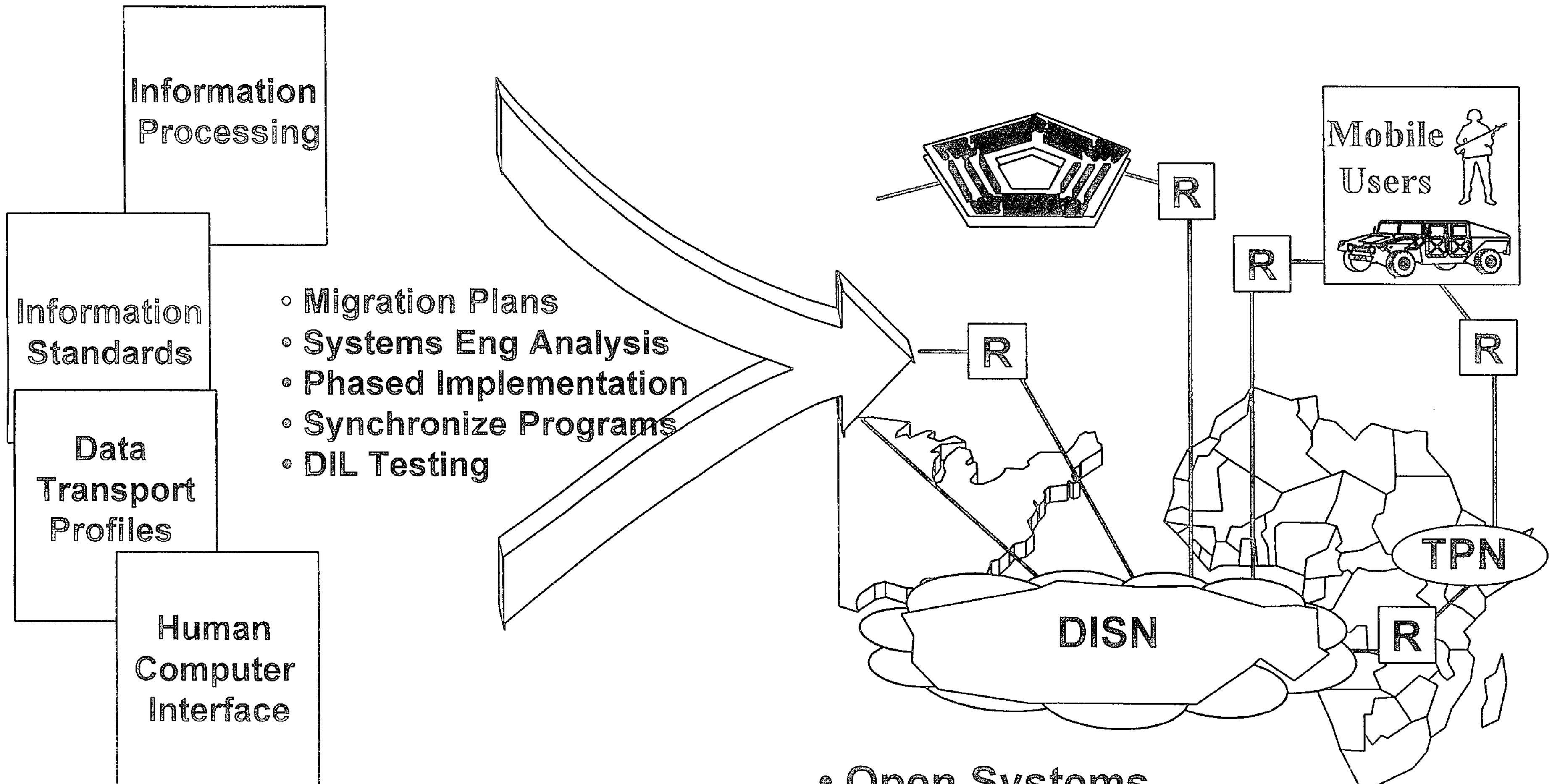


WAN = Wide Area Network
MAN = Metropolitan Area Network
LAN = Local Area Network
R = Router
H = Host (Workstation, Computer)

Proven Operation Over:
1. Fiber Optics
2. Coaxial Cable
3. Phone Lines
4. Radio Systems
5. Satellites

1994 Army Science Board Summer Study "Technical Architecture for Army C4I"

TECHNICAL ARCHITECTURE STRATEGY



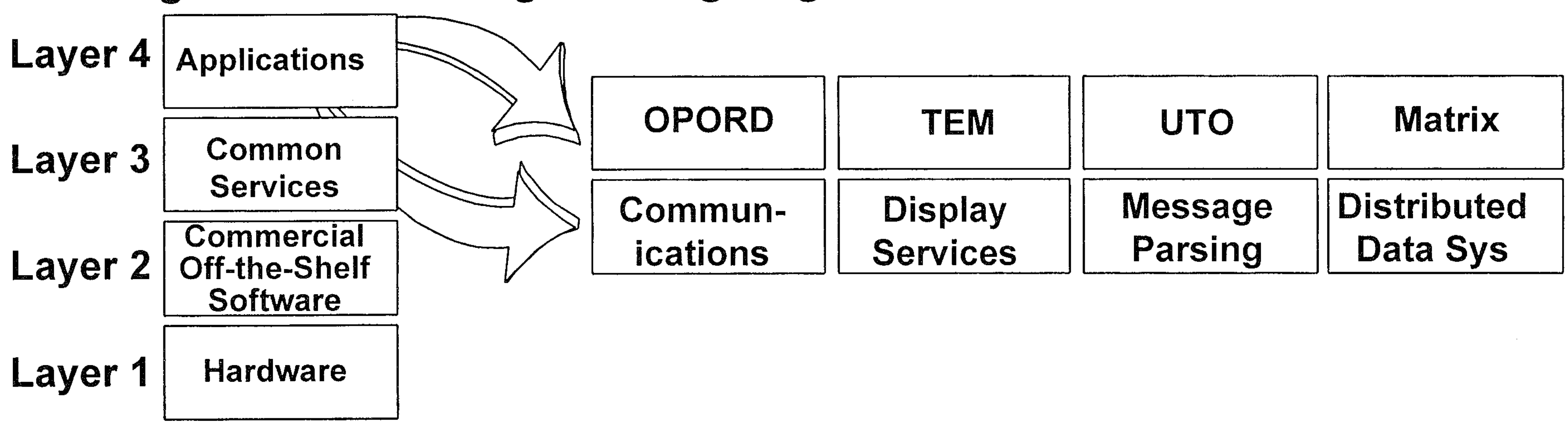
- Migration Plans
- Systems Eng Analysis
- Phased Implementation
- Synchronize Programs
- DIL Testing

- Open Systems
- Joint Applicability
- Seamless Connectivity
- Current Commercial Stds/SW

The Future Is Software
Accomplishments

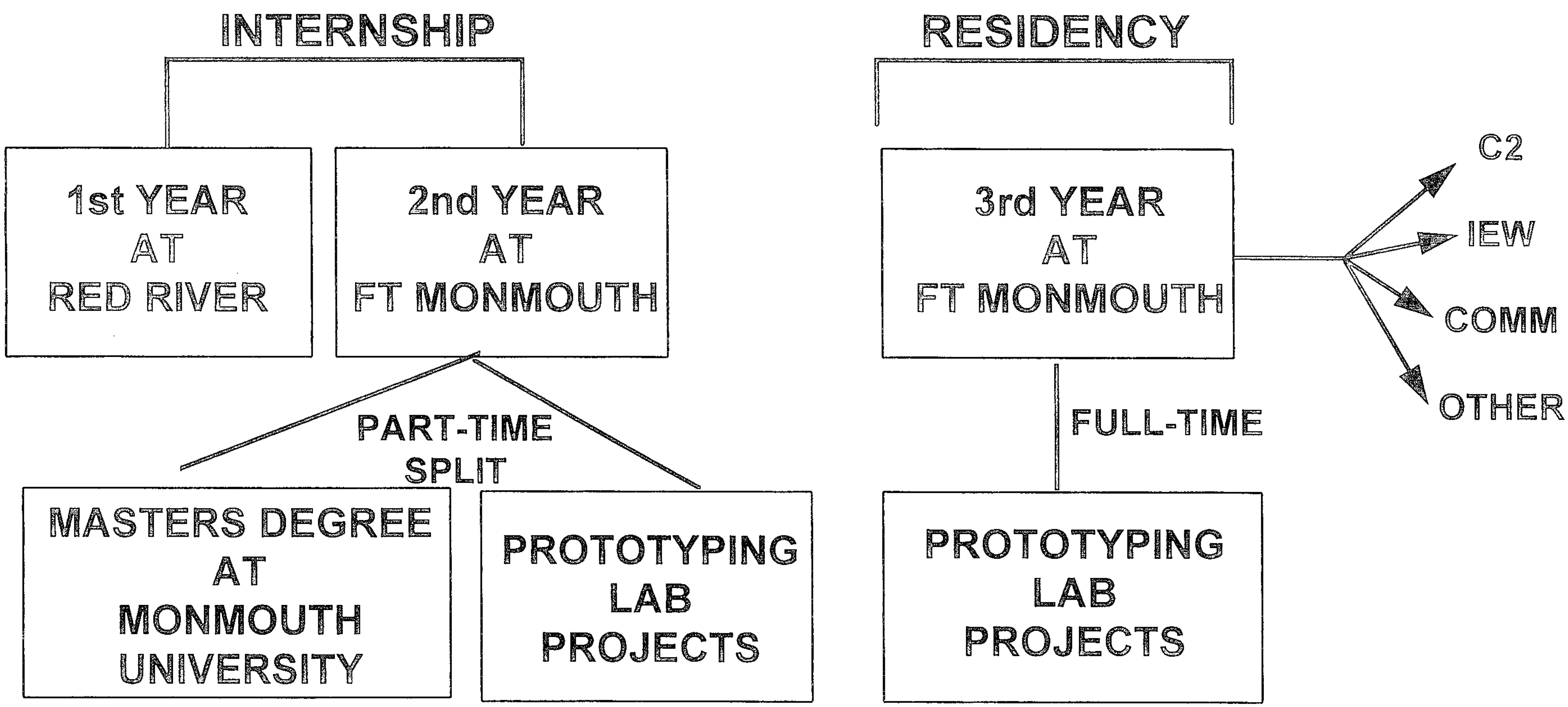
- ✦ Common Software Architecture
- ✦ ARPA Agent For Re-Use Program
- ✦ Common Applications Shared By Multiple Users
- ✦ Hardware Independence-Porting Facilitated
- ✦ SW Prototype Lab to Expedite Products

Building and Maintaining Leading Edge Software For The Battlefield



Software Common Architecture

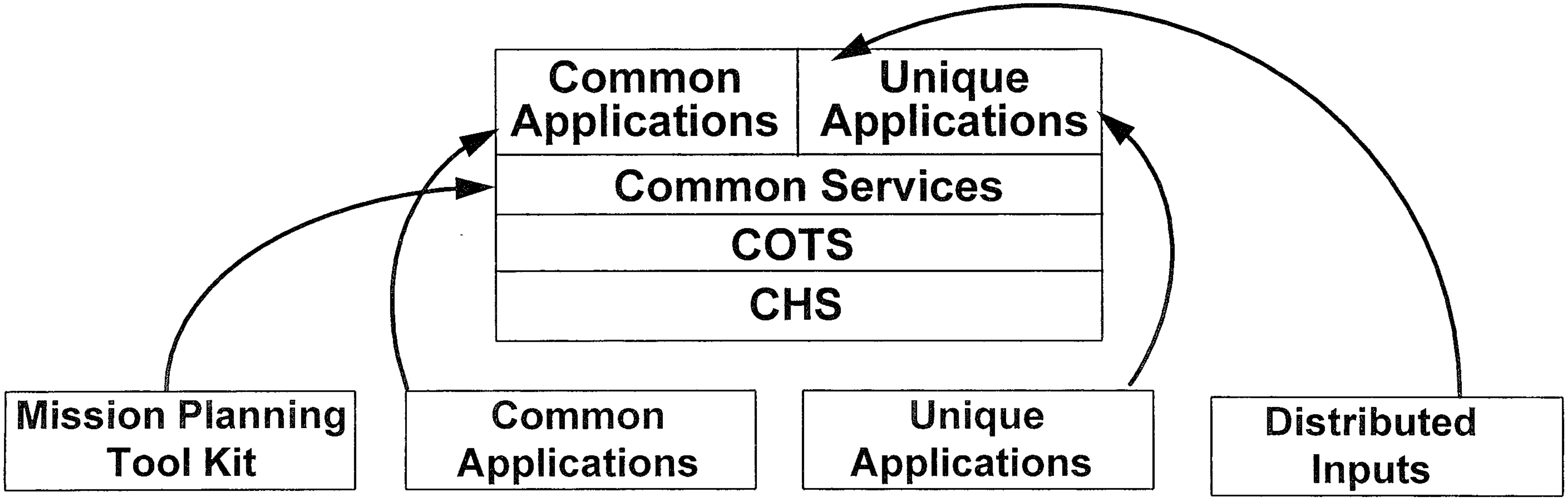
Software Prototyping and Integration Lab Coupling To Software Engineering Intern Program



Two Major Benefits in Establishing This Coupling:

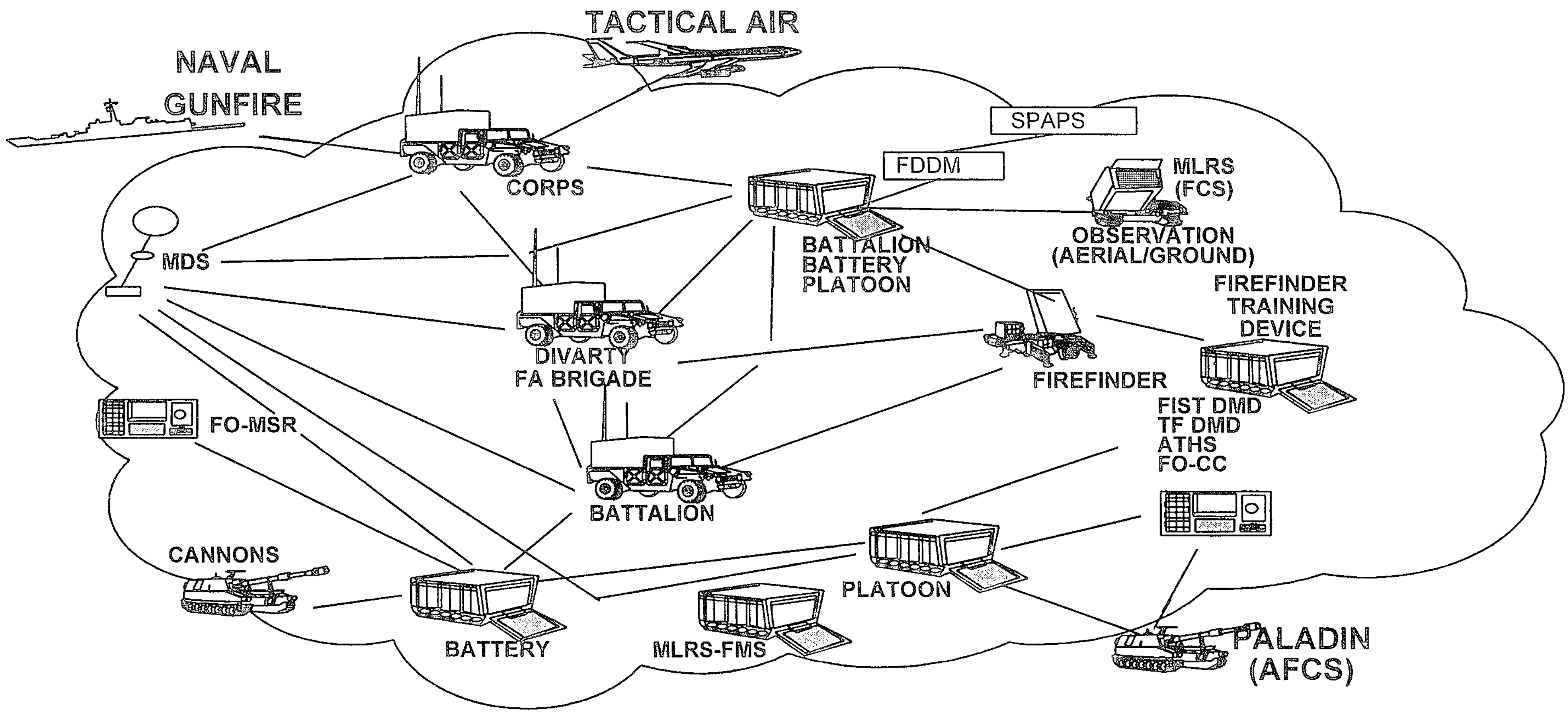
- **Intern Program Provides Talented People to Support Prototyping Activities**
- **Prototyping Activities Provide Functional Expert Interns In Anticipation of Their Permanent Assignments**

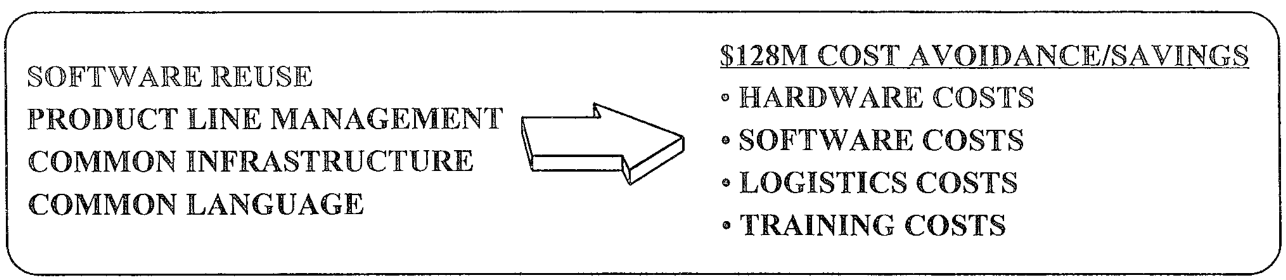
Force XXI Army Mission Planning
INTEGRATED MISSION PLANNING



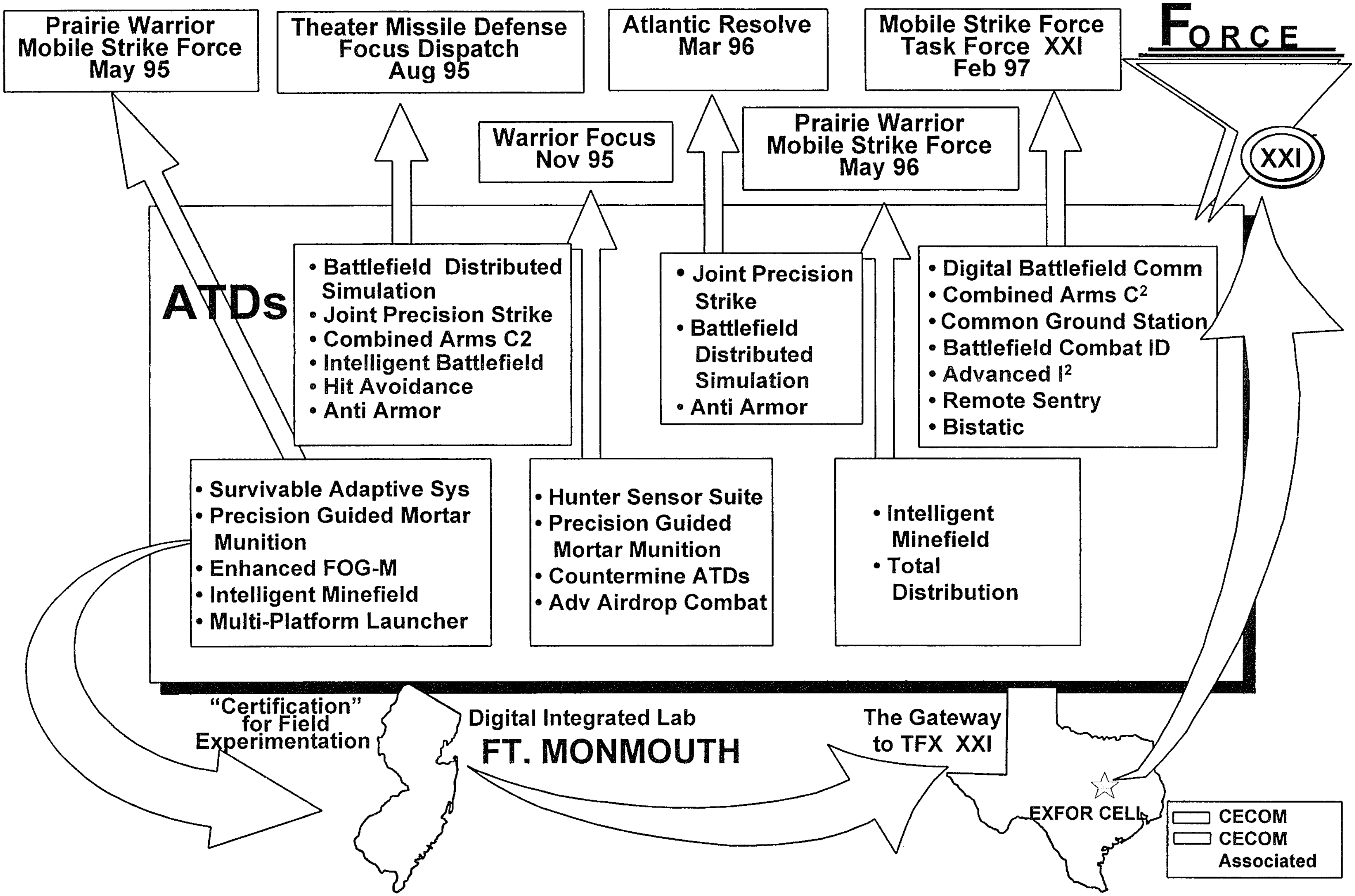
Mission Planning Tool Kit	Common Applications	Unique Applications	Distributed Inputs
• Retrieve Map • Display Control Map • Explore - Pan - Jump - Zoom • Measure • Overlays • Tactical Decision Aids (Analysis) • •	• Route Plan • Terrain Analysis • Navigation • Mobility - Corridors - Ave. of Approach - Ground Distance - Vehicle Type - Travel Restrict'ns • 2D/3D Visualization - 3D Fly Thru - Perspective View	• Platform • BOS Unique • Performance Planning • Data Transfer to Platform • • •	• Weather • Obstacles • Topography • Fire Support • Supply • Intell • Imagery • • •

FIRE SUPPORT SYSTEM OF SYSTEMS MANAGEMENT REUSE BENEFITS EXAMPLE

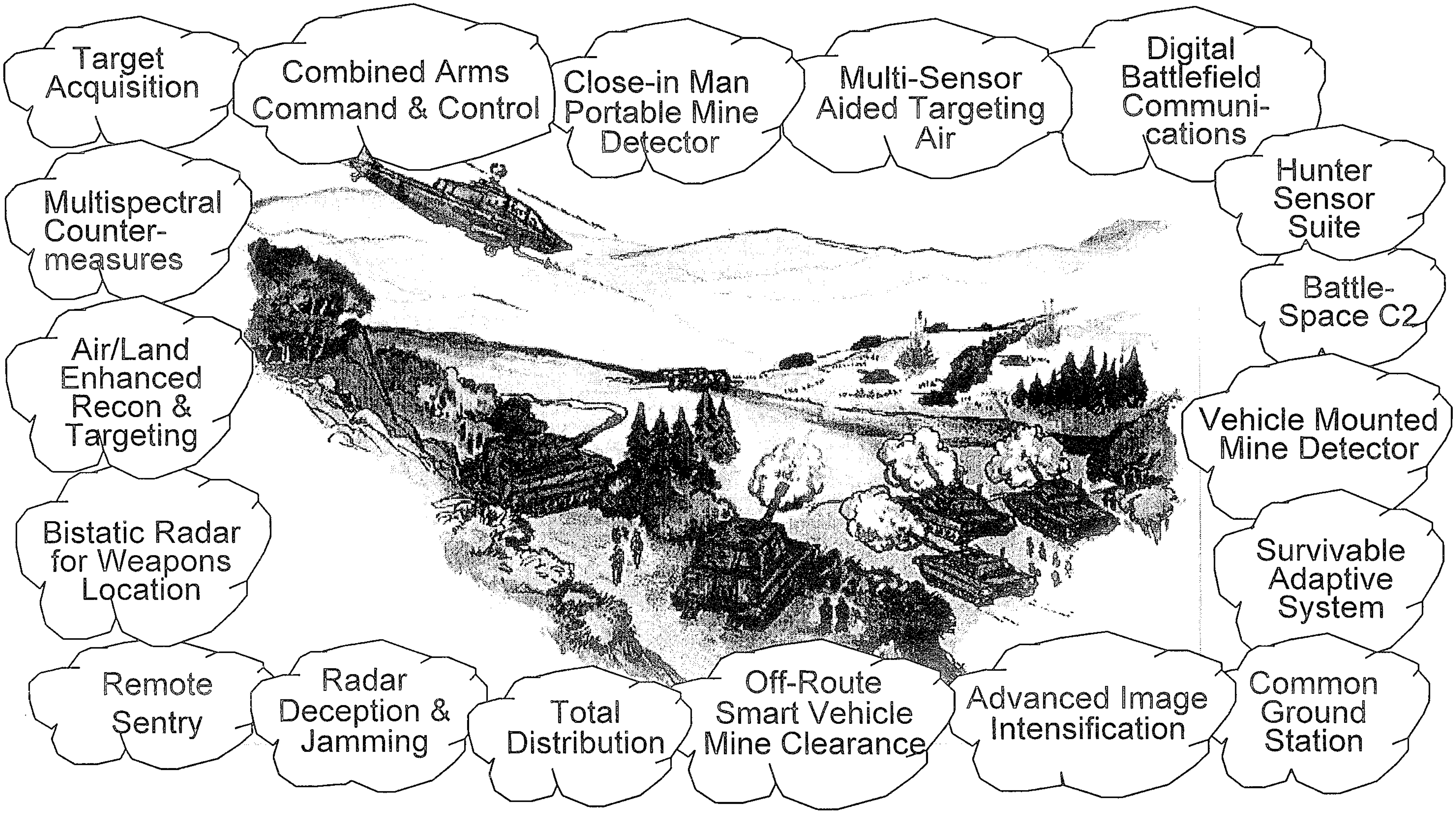




AMC... PROVIDING TECHNOLOGY FOR AWEs



CECOM ATDs : Foundation for the Future



Formula for Success

NEW WAYS OF DOING BUSINESS

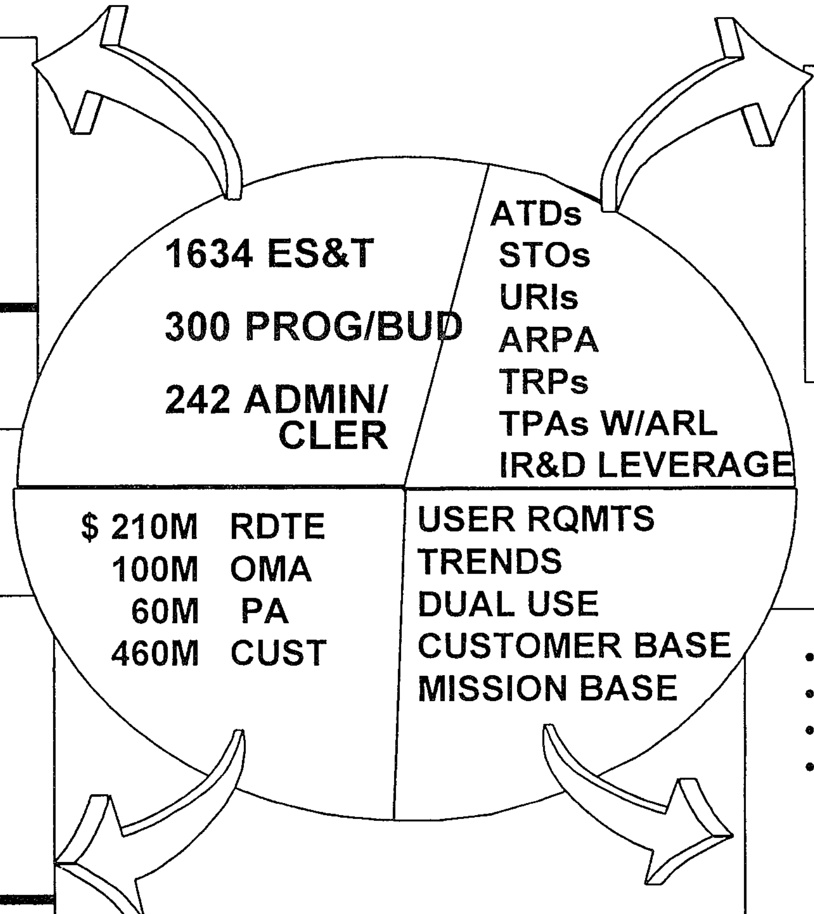
PEOPLE

- INTEGRATED TEAMS
- VISIONARIES
- PROFESSIONALS
- TECHNOLOGY LEADERS
- TECHNOLOGY MANAGERS

- 52% BS/22% TO MS
- 44% MS/3% TO PhD
- 3% PhD

TECHNOLOGY

- INFORMATION TRANSPORT
- INFORMATION DISTRIBUTION
- SENSORS/SENSOR SUITES
- SMART CM & PROTECTION
- SOFTWARE ENGRNG



DOLLARS

- 45% PEO/PM PROGRAM IMPLEMENTATION
- 25% REVOLUTIONARY DEMO'S
- 15% TECHNOLOGY ADVANCES
- 15% SUPPORT TO FIELD

- 30% IN HOUSE/ 70% OUT HOUSE

BUSINESS PLANNING

- CONTINUOUS UPDATE
- BUSINESS AREA FOCUS
- CUSTOMER ANALYSIS
- TIES RESOURCES TO VISION

Leverage of IR&D

- **Maximize Army Leverage of Industry IR&D Investments**

  -- *Host Technical Interchange Meetings with Industry*

  -- *Review Industry IR&D projects for one-on-one Interaction (Our Engineer/Your Engineer)*

- **Open Door Policy**

  -- *Host Demonstrations of IR&D programs relating to the RDEC mission thrust areas*

- **Utilize the Digital Integrated Labs - Commercial Technology Test Facility**

- **Cooperatively develop technology through using CRDA's**

Leverage of IR&D

- PROVIDE GUIDANCE TO INDUSTRY ON TECHNOLOGY AREAS OF INTEREST FOR IR&D
- CAPITALIZE ON INDUSTRY'S INVESTMENT IN IR&D TO FURTHER DEVELOP MILITARY SYSTEMS
- CONTINUE AND ENCOURAGE IR&D TECHNICAL INTERCHANGES
- USE COMMERCIAL PRODUCTS WHERE THERE IS A FIT
- MAXIMIZE THE USE OF THE DIGITAL INTEGRATED LABORATORY FOR EVALUATING POTENTIAL TECHNOLOGY INSERTIONS
- DEVELOP TECHNOLOGY THROUGH CRDA AGREEMENTS
- SUPPORT PARTNERSHIPS

SUMMARY

DIGITIZED BATTLEFIELD

HORIZONTAL TECHNOLOGY INTEGRATION 2nd GEN FLIR DIGITIZATION

INTEGRATED ATDs-HORIZONTAL INTEGRATION

CORPORATE STRATEGY & VISION

TECHNICAL ACCOMPLISHMENTS LEADING TO TASK FORCE XXI

INTEGRATED TEST BED

MODELING & SIMULATION

USE OF COMMERCIAL PRODUCTS

SOFTWARE ENGINEERING INTEGRATED SOFTWARE PROTOTYPE LABORATORY

LEVERAGING

CUSTOMER SATISFACTION

INTEGRATED RDEC TEAMS

SUPPORT TO THE SOLDIER

BATTLE LAB PARTNERSHIP

NOTES

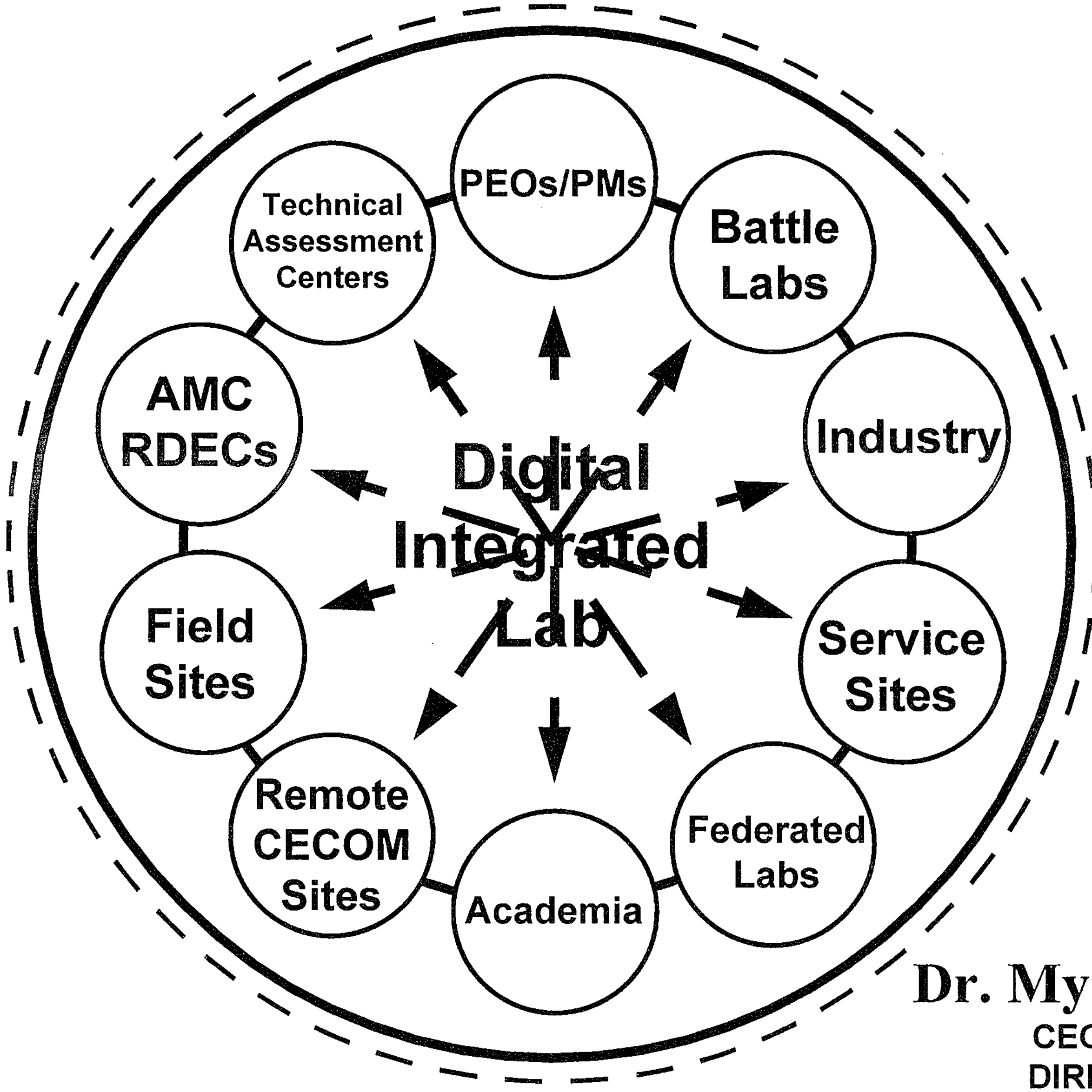
INTEGRATION OF DEFENSE AND COMMERCIAL INDUSTRIAL TECH BASES

DR. LANCE A . DAVIS

DEPUTY DIRECTOR
DEFENSE RESEARCH AND ENGINEERING
OFFICE OF THE SECRETARY OF DEFENSE

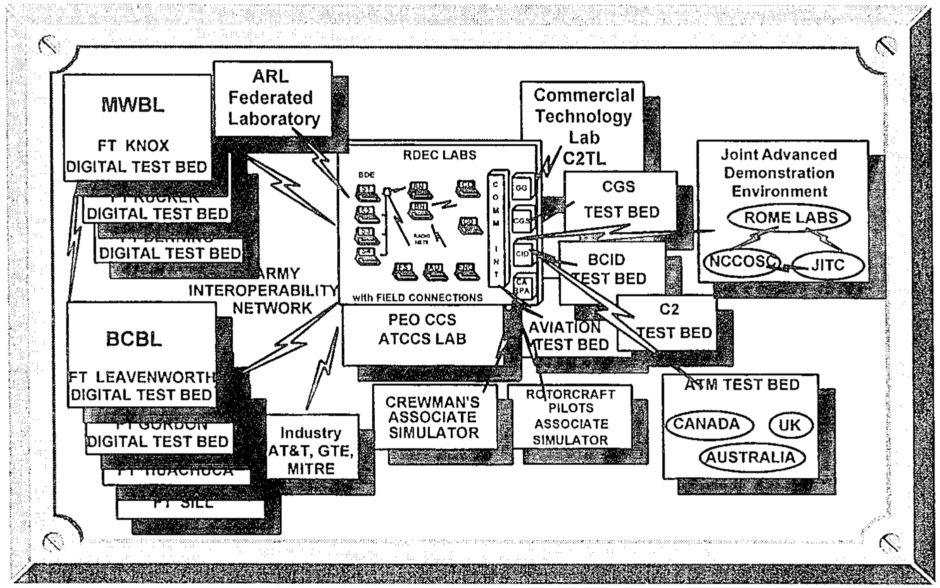
NOTES

Digital Integrated Lab as a Testbed



Dr. Myron Holinko
CECOM RDEC
DIRECTOR, DIL
DSN 987-3187 /COM 908-427-3187

The DIL is a C3I Development Tool

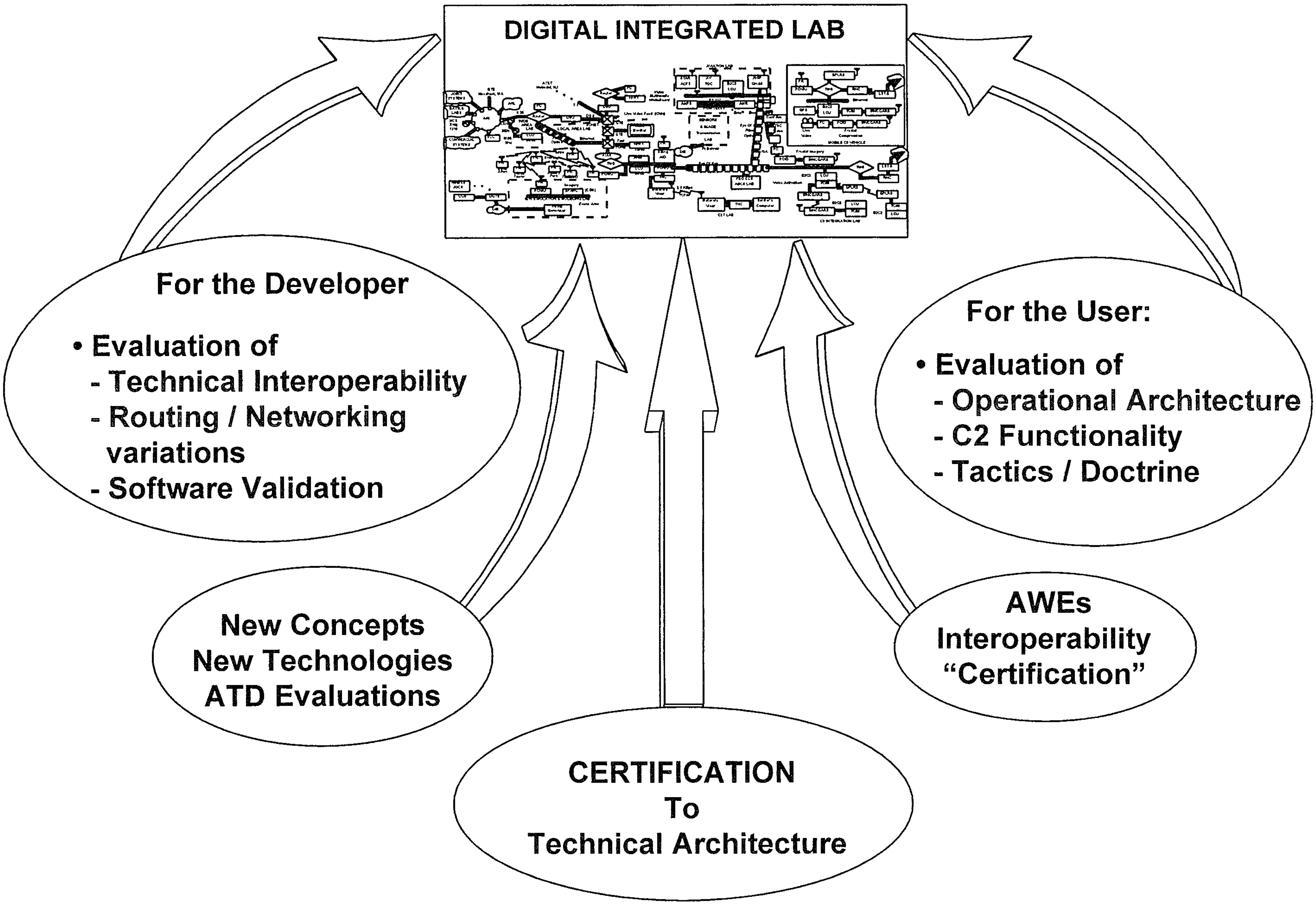


Which shrinks time and space by bringing:

- **The Laboratory into the Field**
  - **The Soldier into the Laboratory**
    - **The Developer and User virtually together**

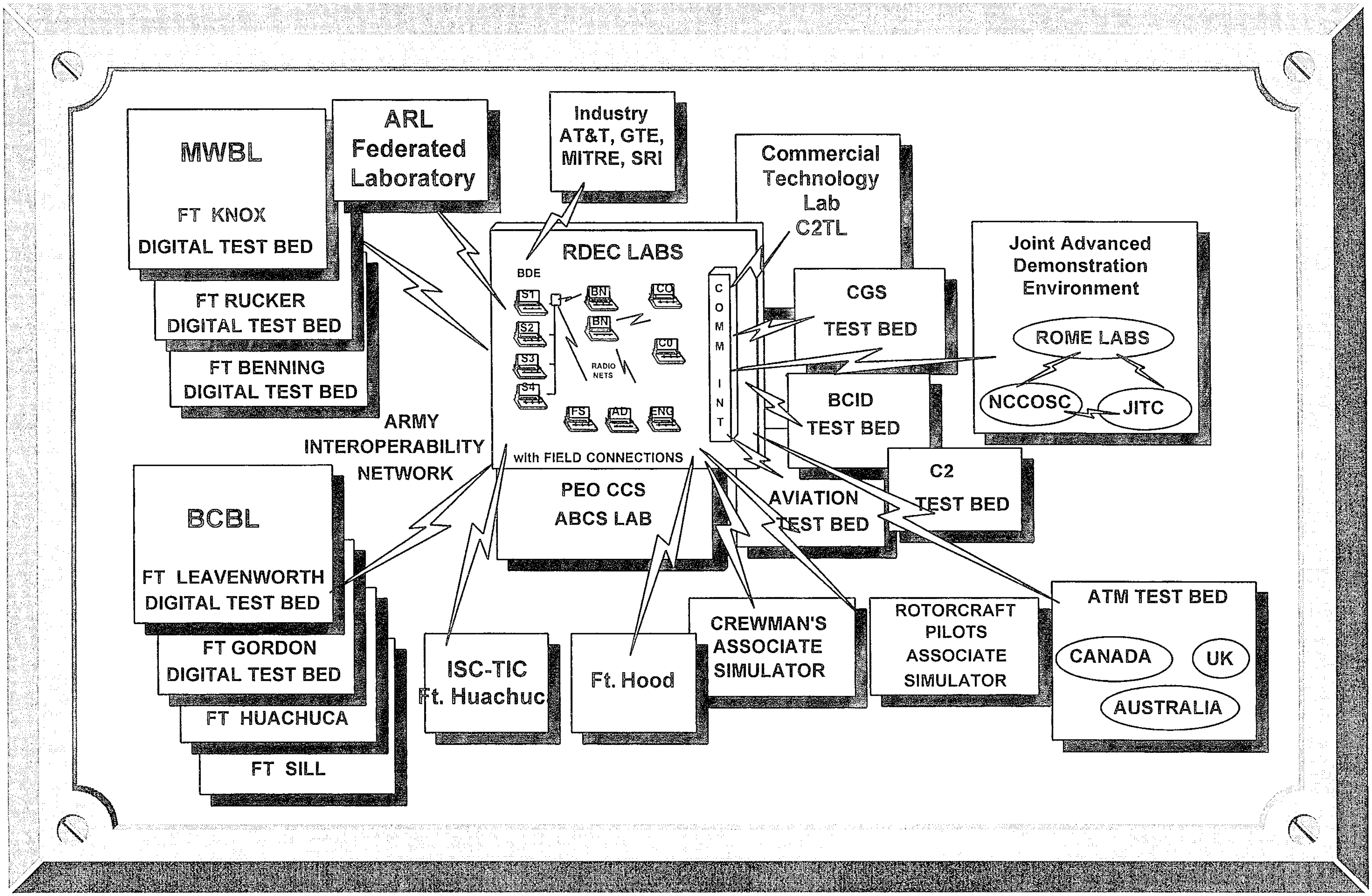
To Design - Develop - Integrate - Distribute - Verify

DIL

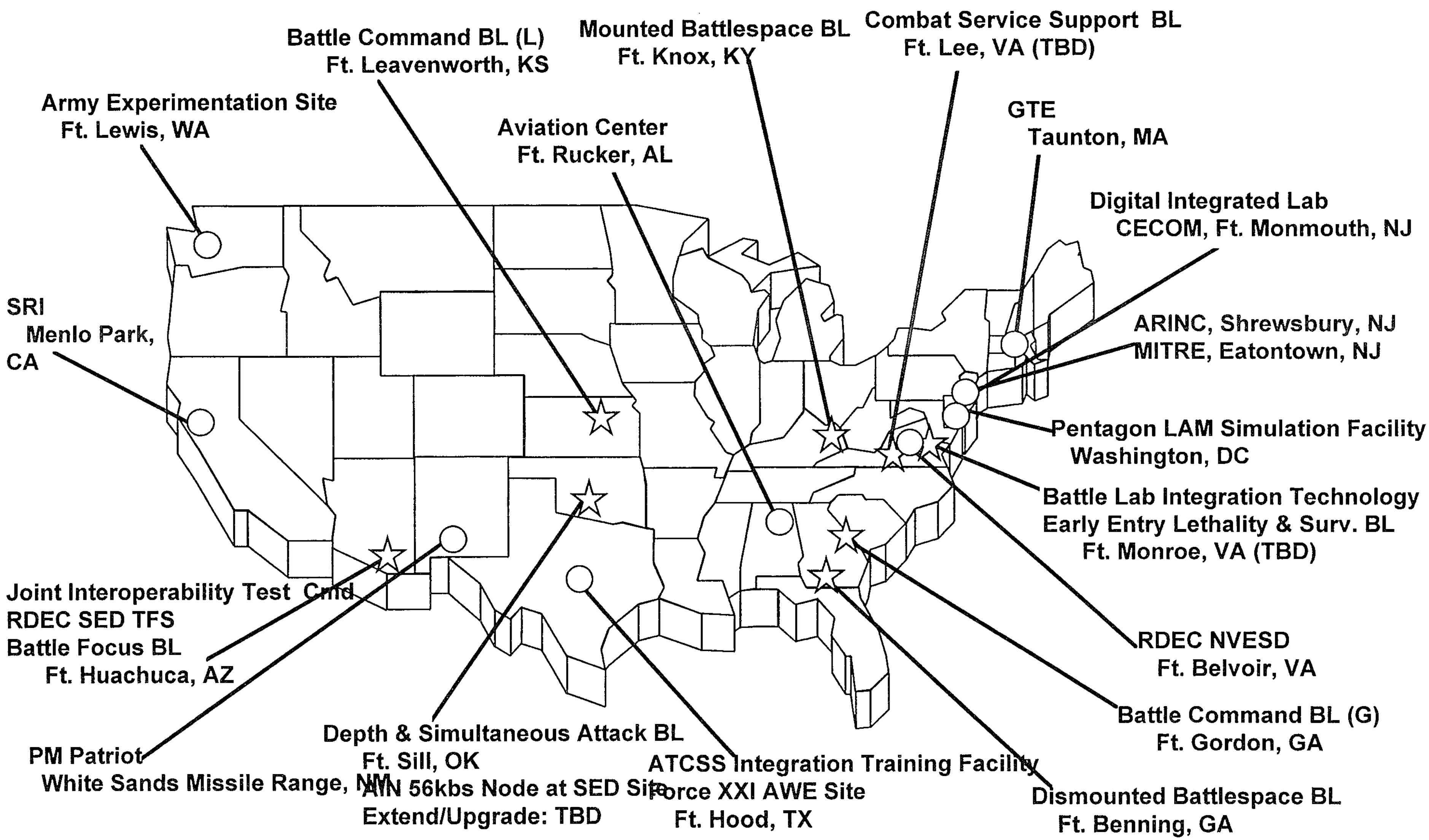


DIGITAL INTEGRATED LAB
For the Developer
• Evaluation of
- Technical Interoperability
- Routing / Networking variations
- Software Validation
For the User:
• Evaluation of
- Operational Architecture
- C2 Functionality
- Tactics / Doctrine
New Concepts
New Technologies
ATD Evaluations
AWEs
Interoperability
"Certification"
CERTIFICATION
To
Technical Architecture

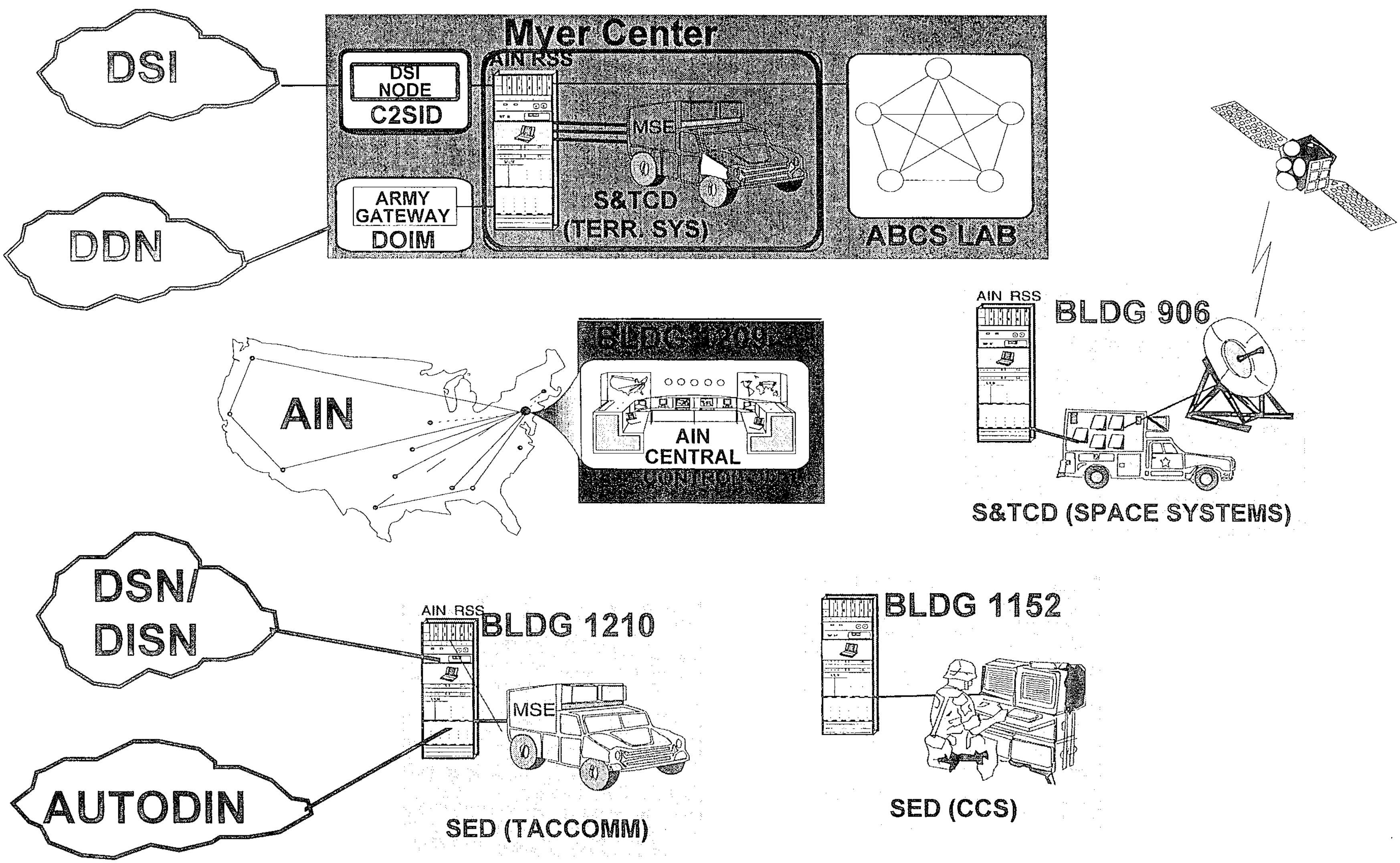
Digital Integrated Lab



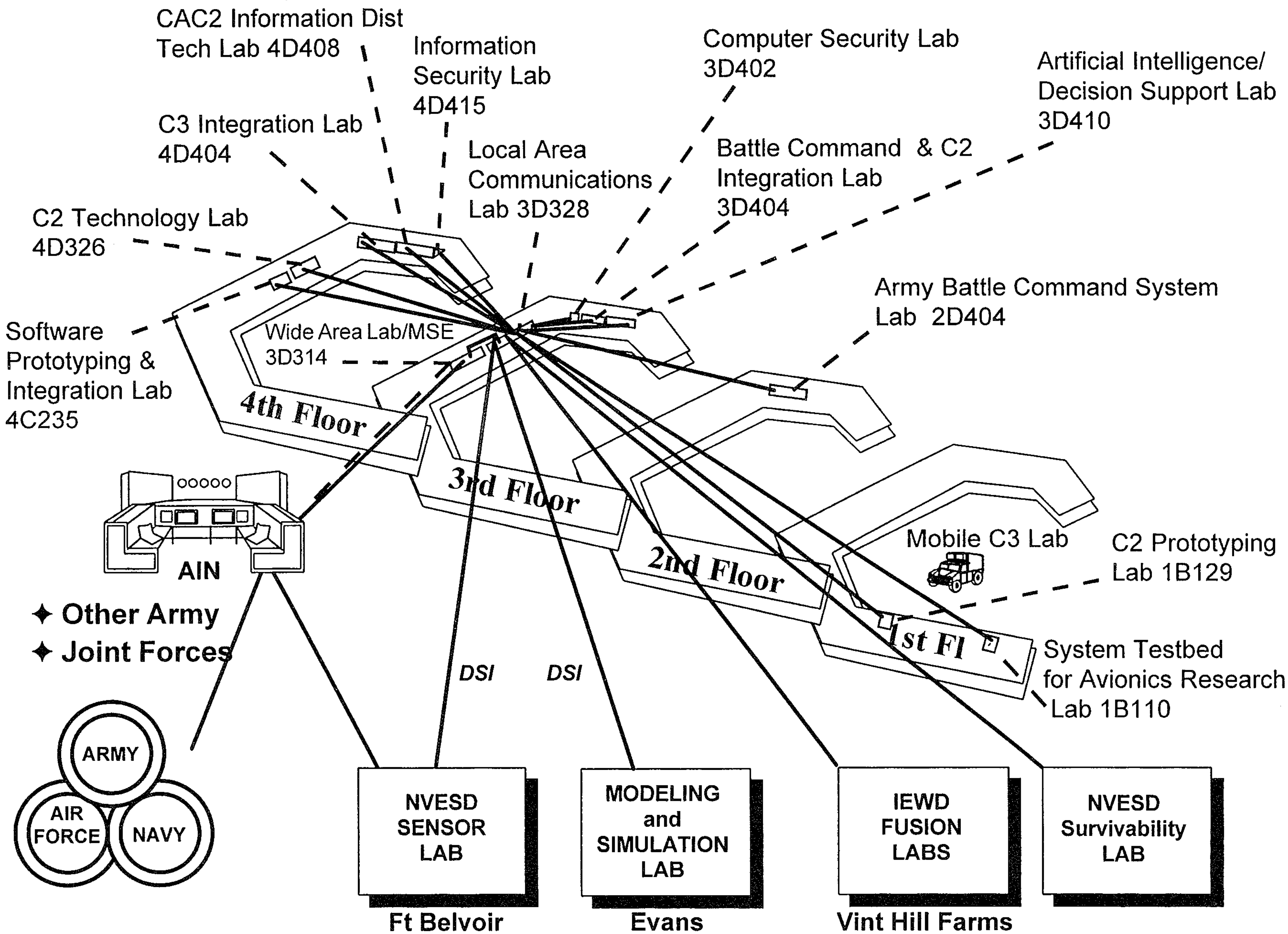
Digital Integrated Lab
Army Interoperability Network (AIN) Nodes



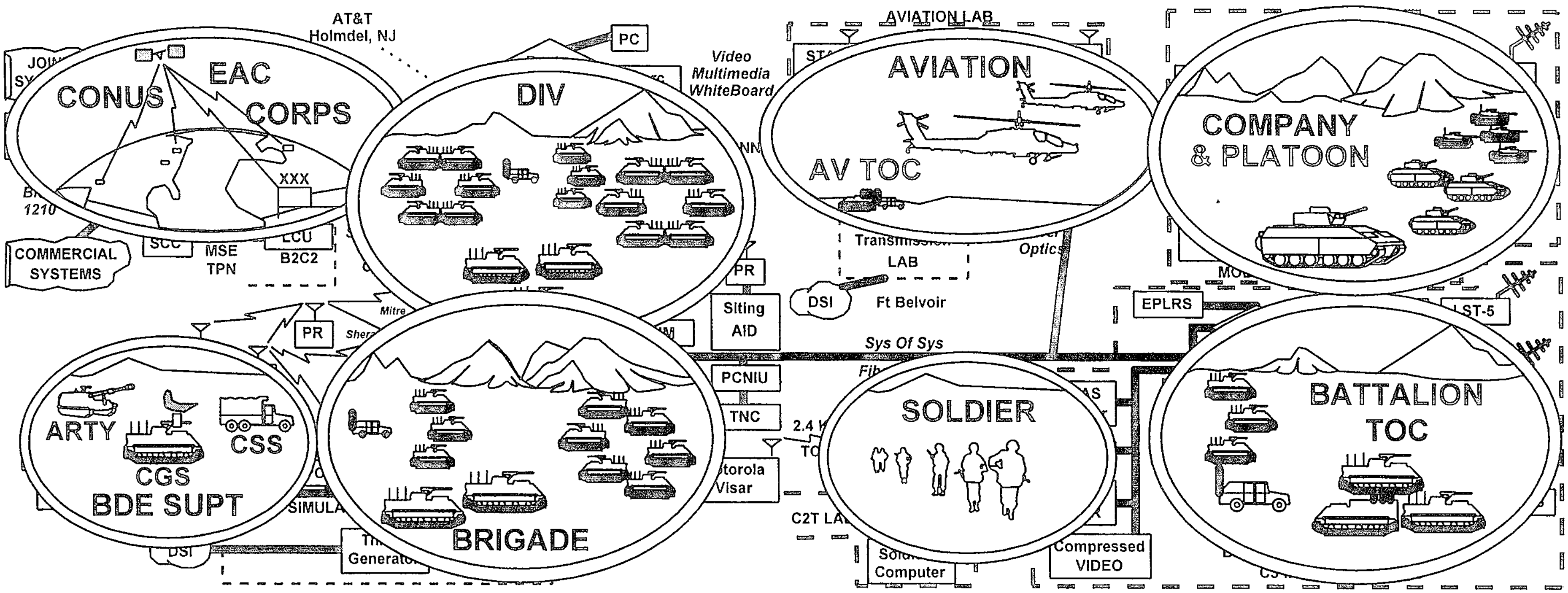
Connections At Ft. Monmouth



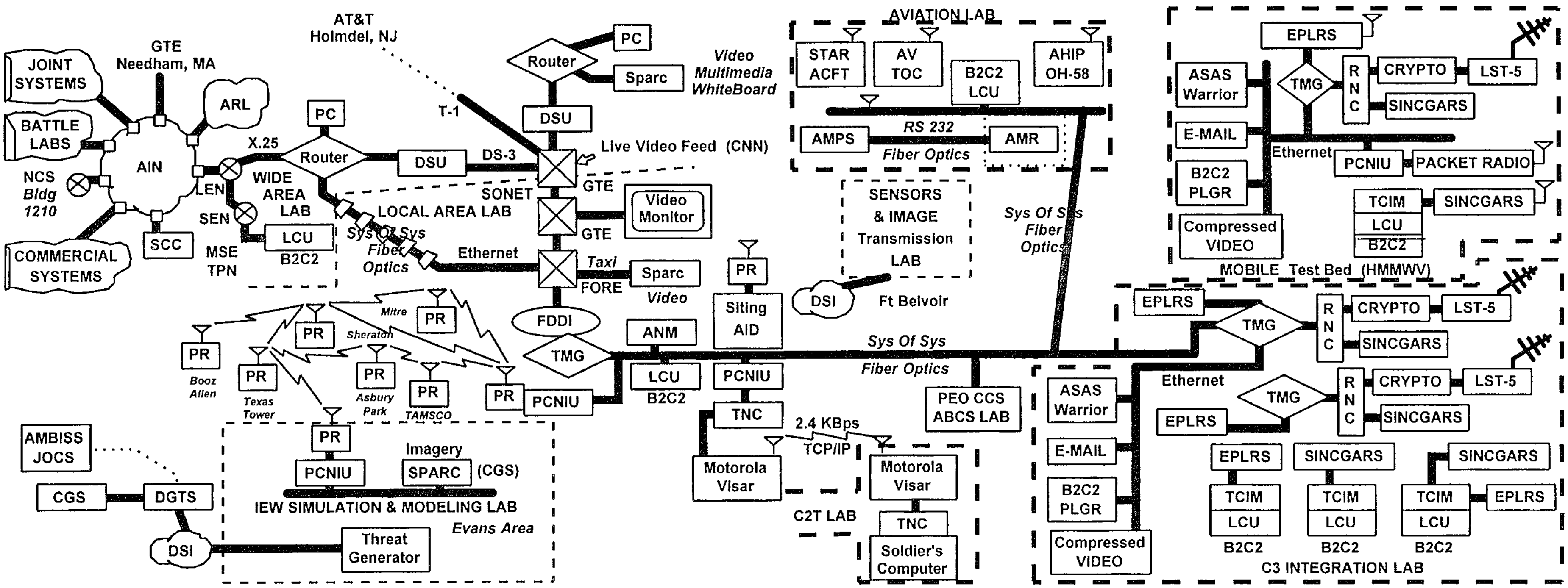
Myer Center System Connectivity



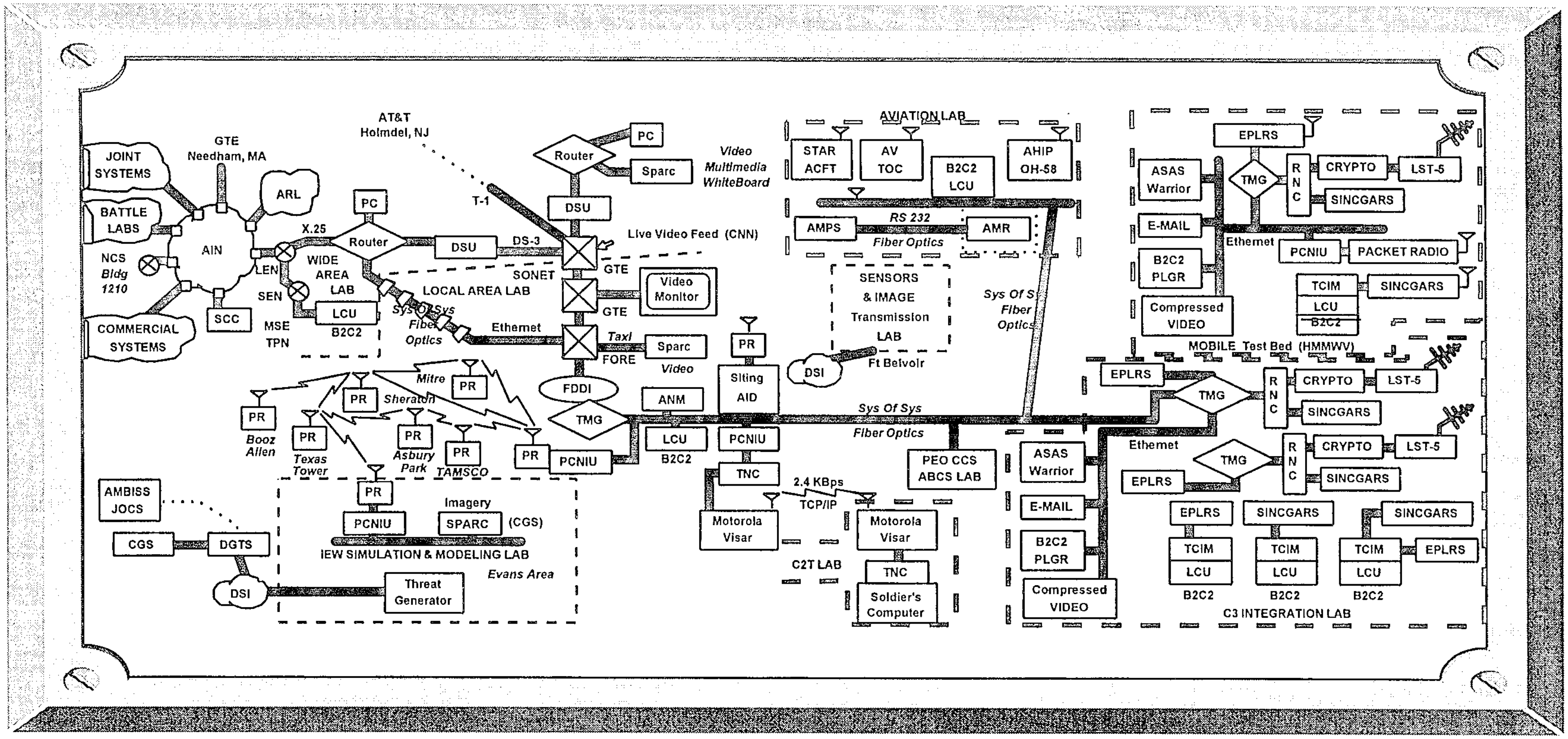
OPERATIONAL REPRESENTATIONS



DIGITAL INTEGRATED LAB



AWE Certification



DIGITAL INTEGRATED LAB

Policy for Use of Digital Integrated Lab (DIL)

21 Nov 94

" . . . the DIL will be used to develop, maintain, improve, and certify interoperability between and among C3I/EW hardware and software prior to participating in Task Force XXI (formerly Brigade 96) Advanced Warfighting Experiment, and the follow-on Division and Corps AWEs. In addition, I strongly encourage the maximum use of the Digital Integrated Lab/Testbed both within and between PEO/PM programs, systems already fielded, and Science and Technology programs."

Joe W. Rigby

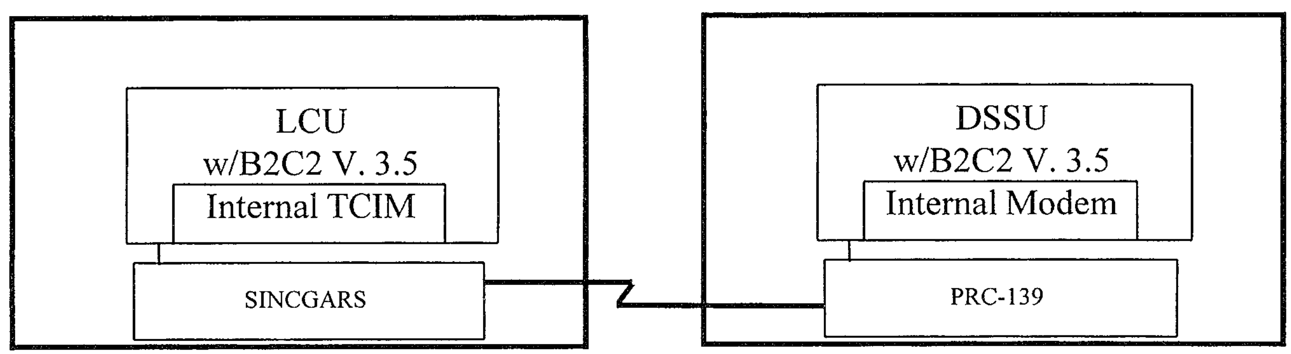
JOE W. RIGBY
Major General, GS
Director, Army Digitization Office

What is DIL Certification ?

For AWEs up to and including TF XXI, certification is the verification that one or more systems are interoperable, through identified hardware, software versions, protocols / associated parameters, message formats and communications media, as defined per the Systems Architecture and individual system specifications.

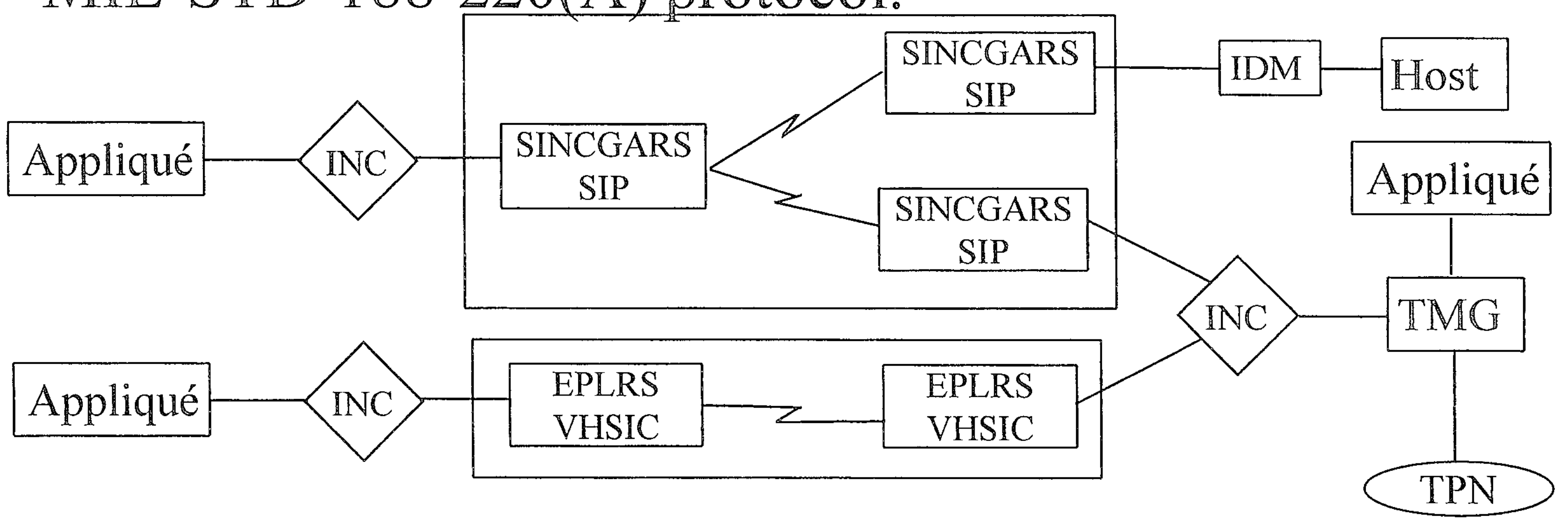
System Certification Example

B2C2 V3.5 hosted on an LCU with internal TCIM using NRPT with Error Correction correctly transmits the B2C2 message set over a SINCGARS to a PRC-139 connected to the internal modem of the DSSU which also hosts B2C2 V3.5 also using NRPT with Error Correction.



Radio Certification Example

The Appliqué addresses a message to several different nets using PPP-IP/UDP. The INC forwards the message to all addressees consisting of SINCGARS SIP nets, EPLRS nets, IDM, and TMGs using the MIL-STD-188-220(A) protocol.



Appliqué Certification Example

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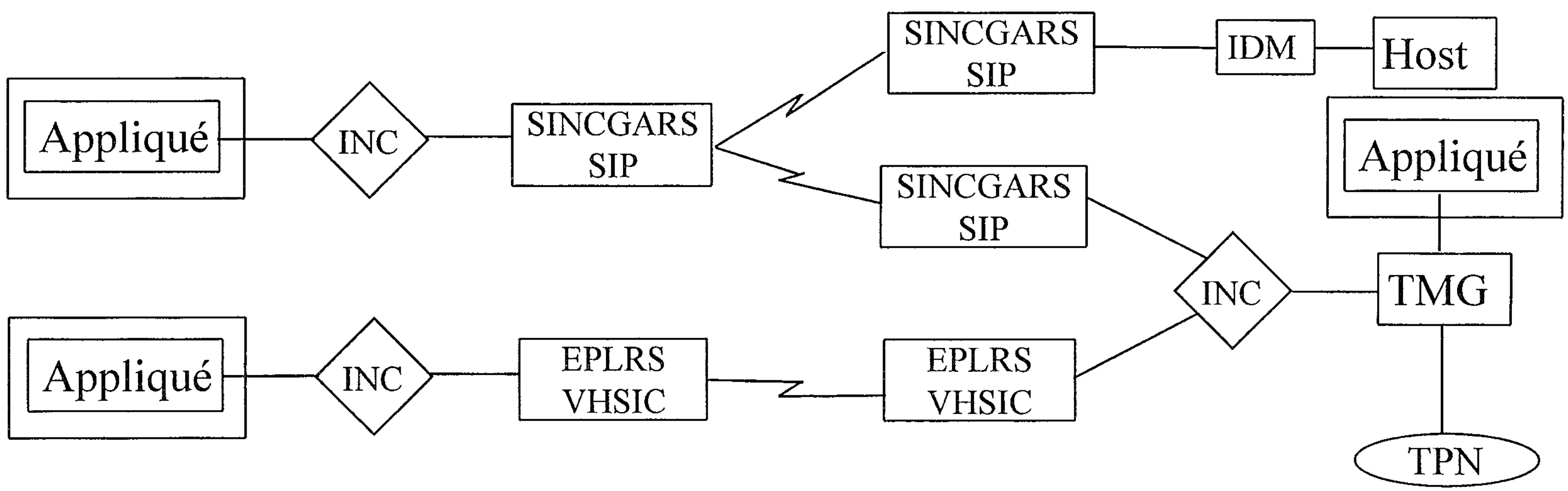


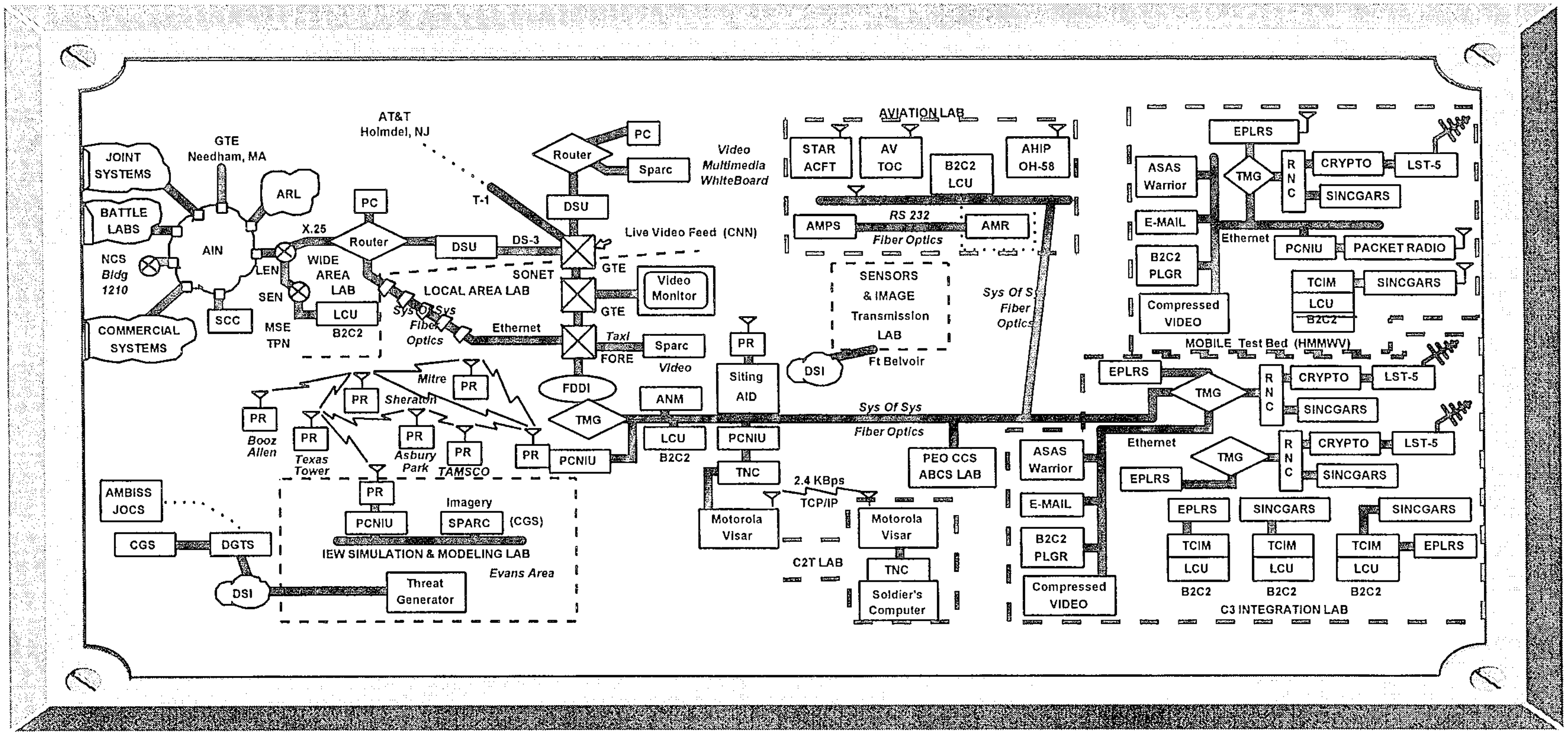
DIL Certification Process

- **Establish Certification Criteria**
  - Baseline Hardware, Software, and Communications
  - Define Interoperability Requirements
- **Develop Evaluation Procedures**
  - Data Collection Procedures, Test Plans, and Procedures
  - Evaluation Criteria
- **Coordinate Informal Experimentation Schedule**
- **Support/Conduct Informal Experimentation**
  - Media, e.g., SIP/INC
  - System, e.g., Appliqué
- **Coordinate Certification Test Schedule**
- **Conduct Certification Test**
- **Provide Certification Decision**

Pre-Certification Experiments

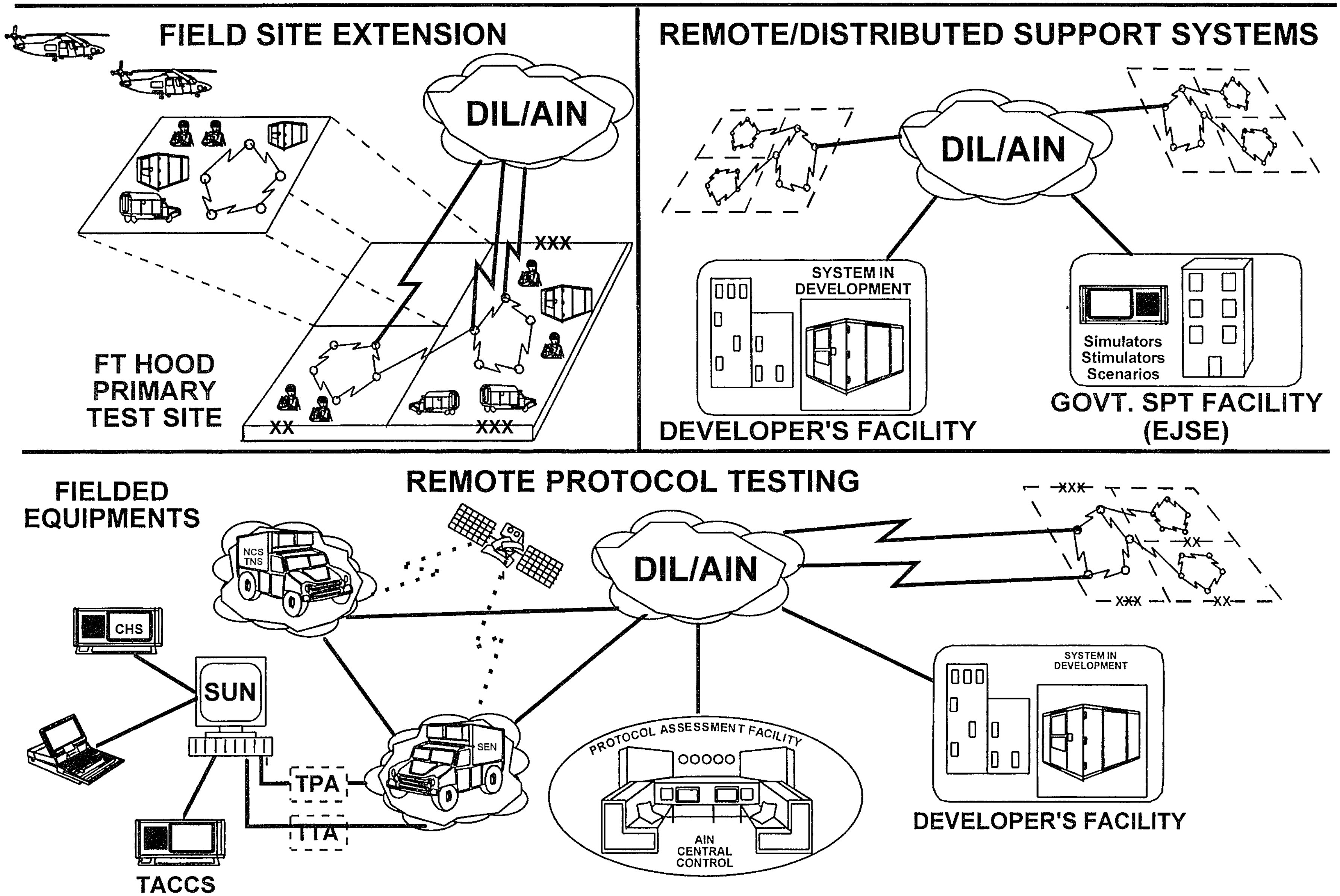
- In preparation for certification, resources and technical expertise are made available for experimentation by system developers without the rigors of the formal certification process.
- Advantages of Pre-Certification
  - Risk Reduction/Troubleshooting
  - Use of live systems vice interpretation of specs
  - Early access to new technology, e.g., SIP/INC
- As a result of pre-certification experiments, several systems have become significantly more mature.

Testbed Initiatives/Support



DIGITAL INTEGRATED LAB

TESTBED DEVELOPMENT OPTIONS



PROTOCOL TESTING TOOLS

CONFORMANCE TESTING

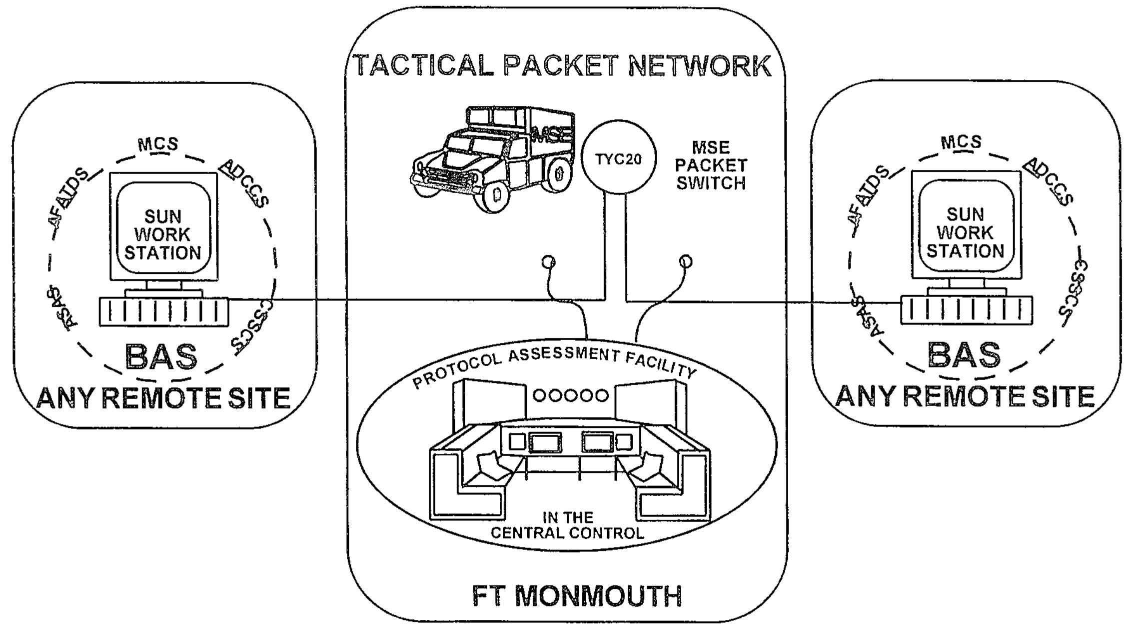
- ADDS/PJHI X.25
- DDN X.25
- MSE PACKET X.25 MIL-STD-188-220(A)

REFERENCE TESTING

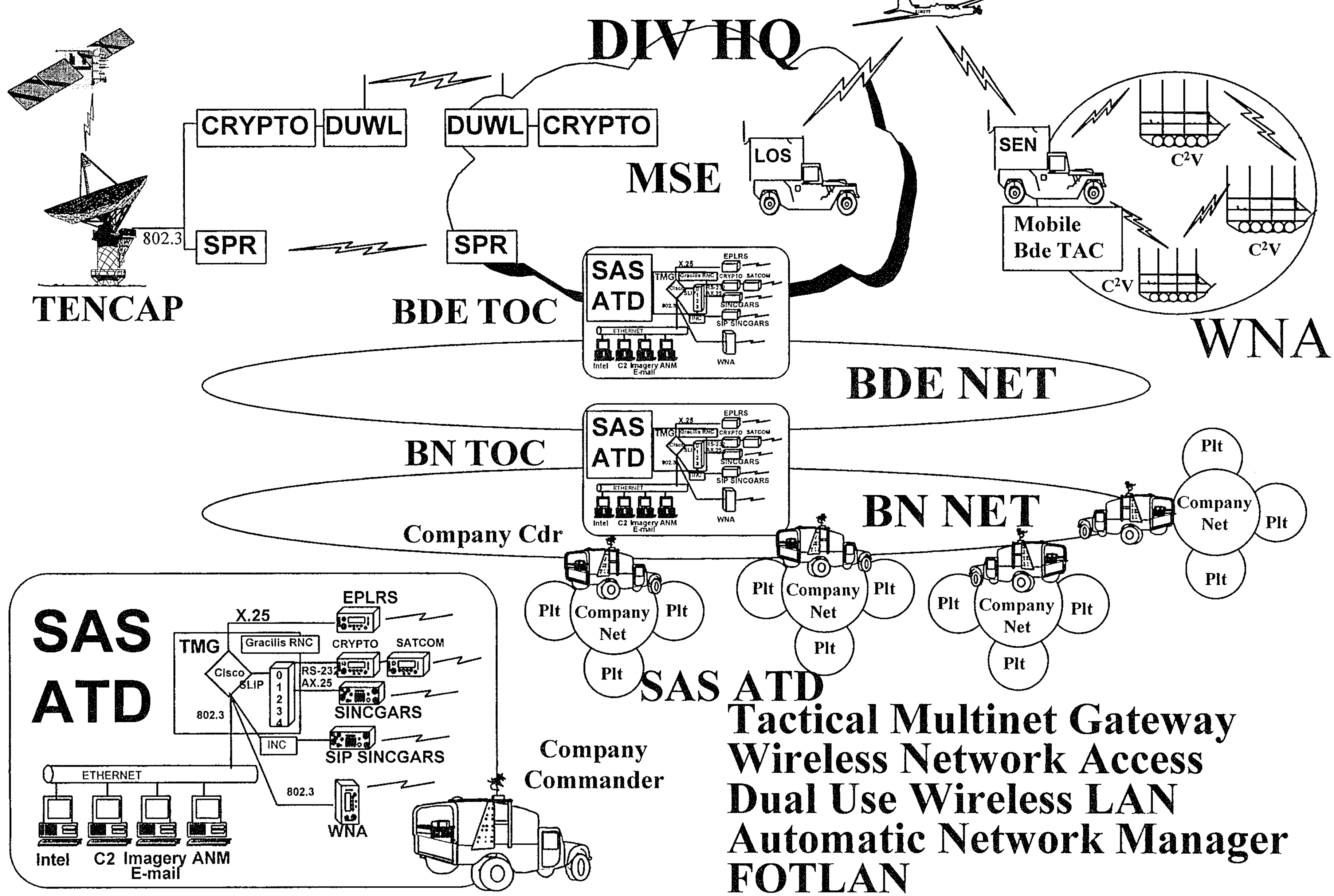
- MSE PACKET NETWORK
- DoD TCP/IP

MONITORING AND DECODE

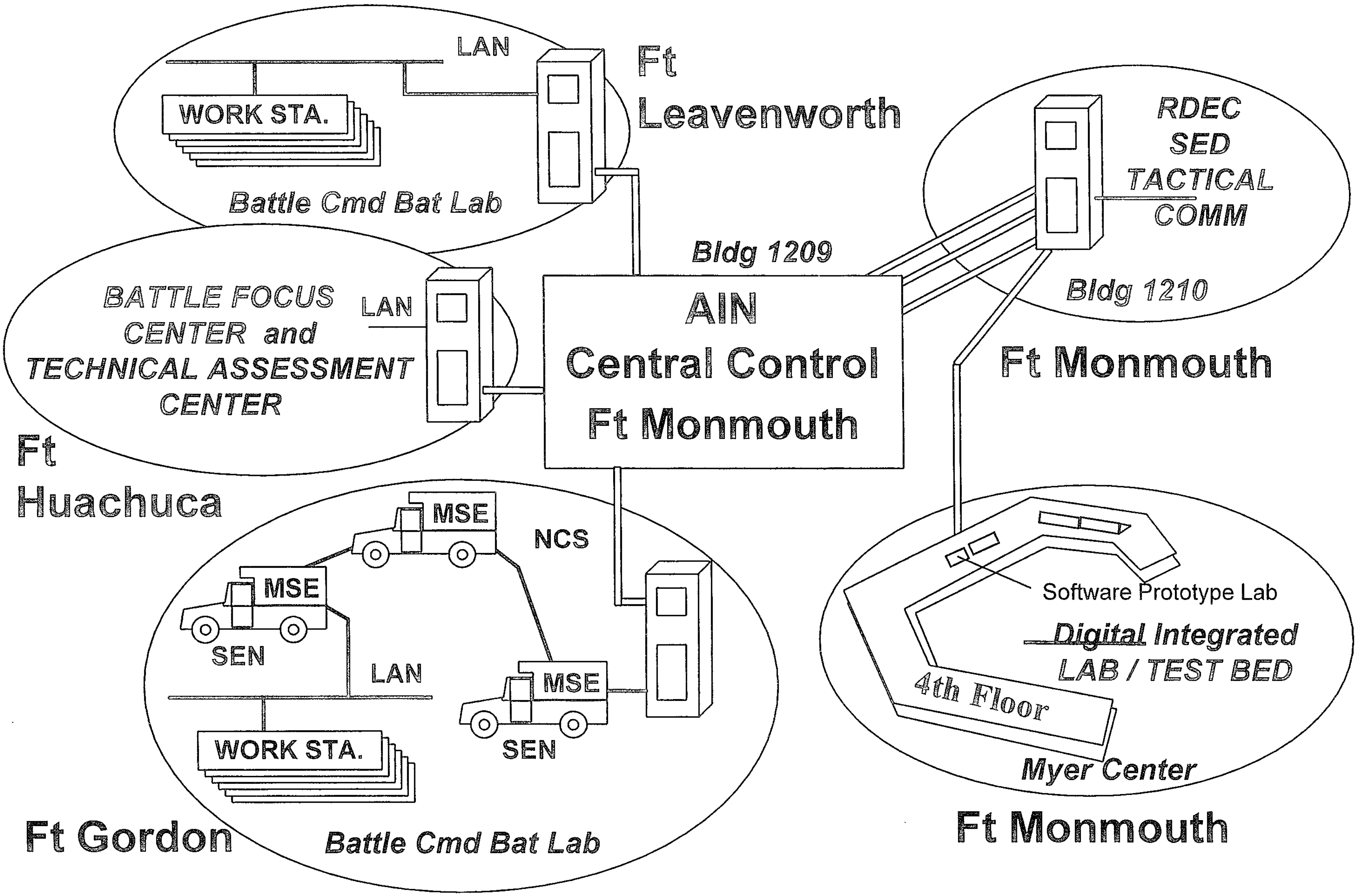
- ADDS/PJHI X.25
- DDN X.25
- MSE PACKET NETWORK X.25
- DoD TCP/IP



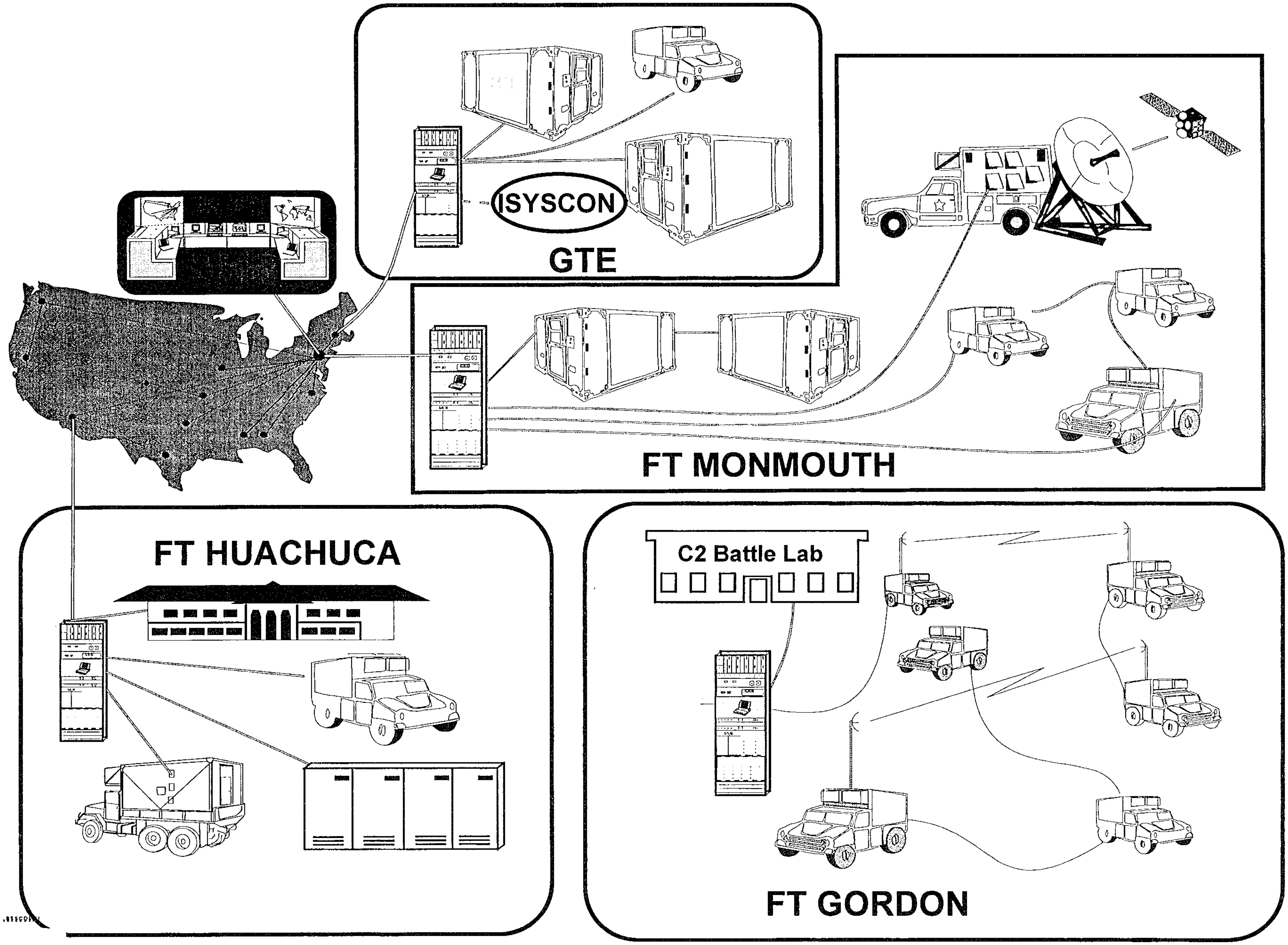
CECOM RDEC JWID 95



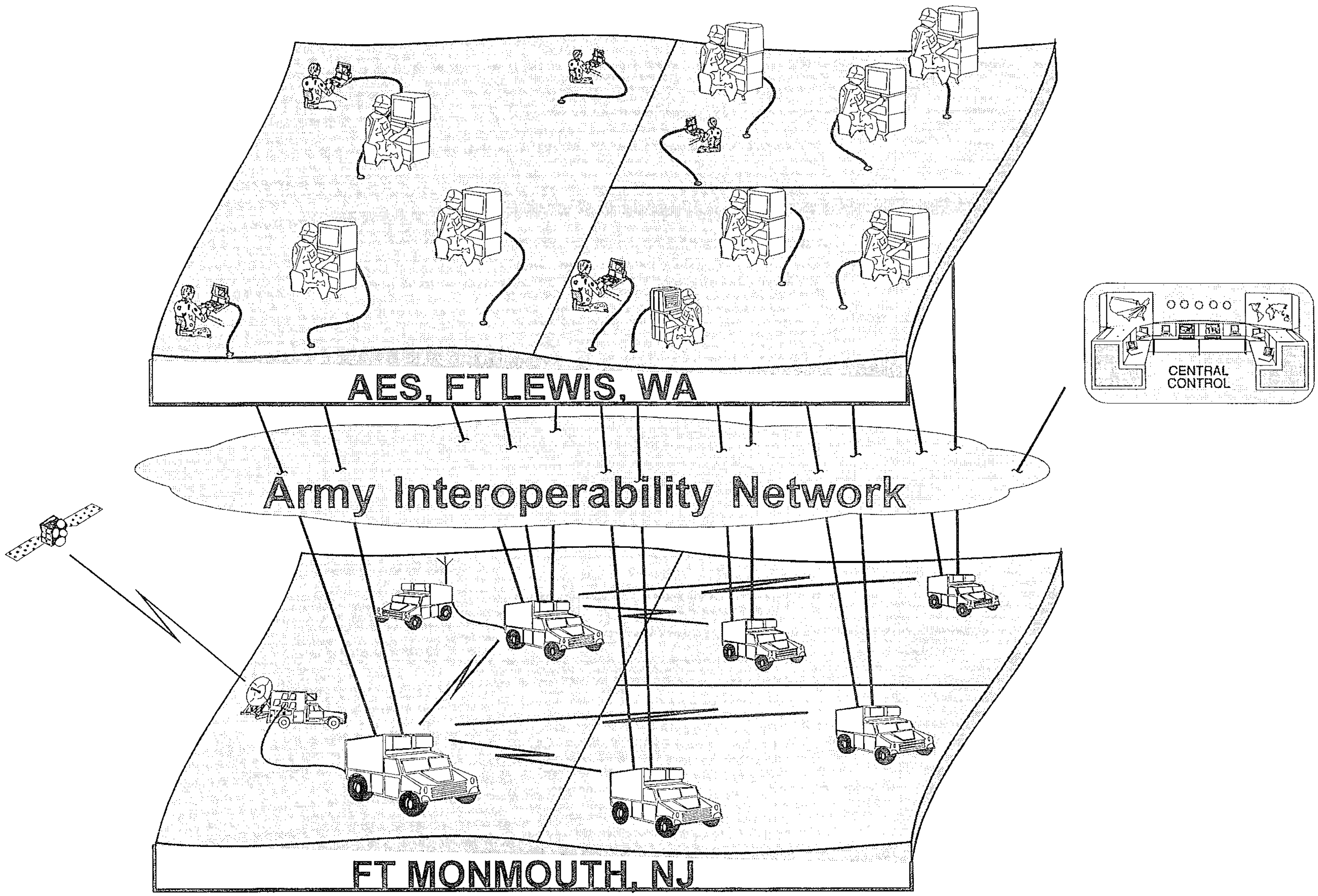
SUPPORT BATTLE LABS



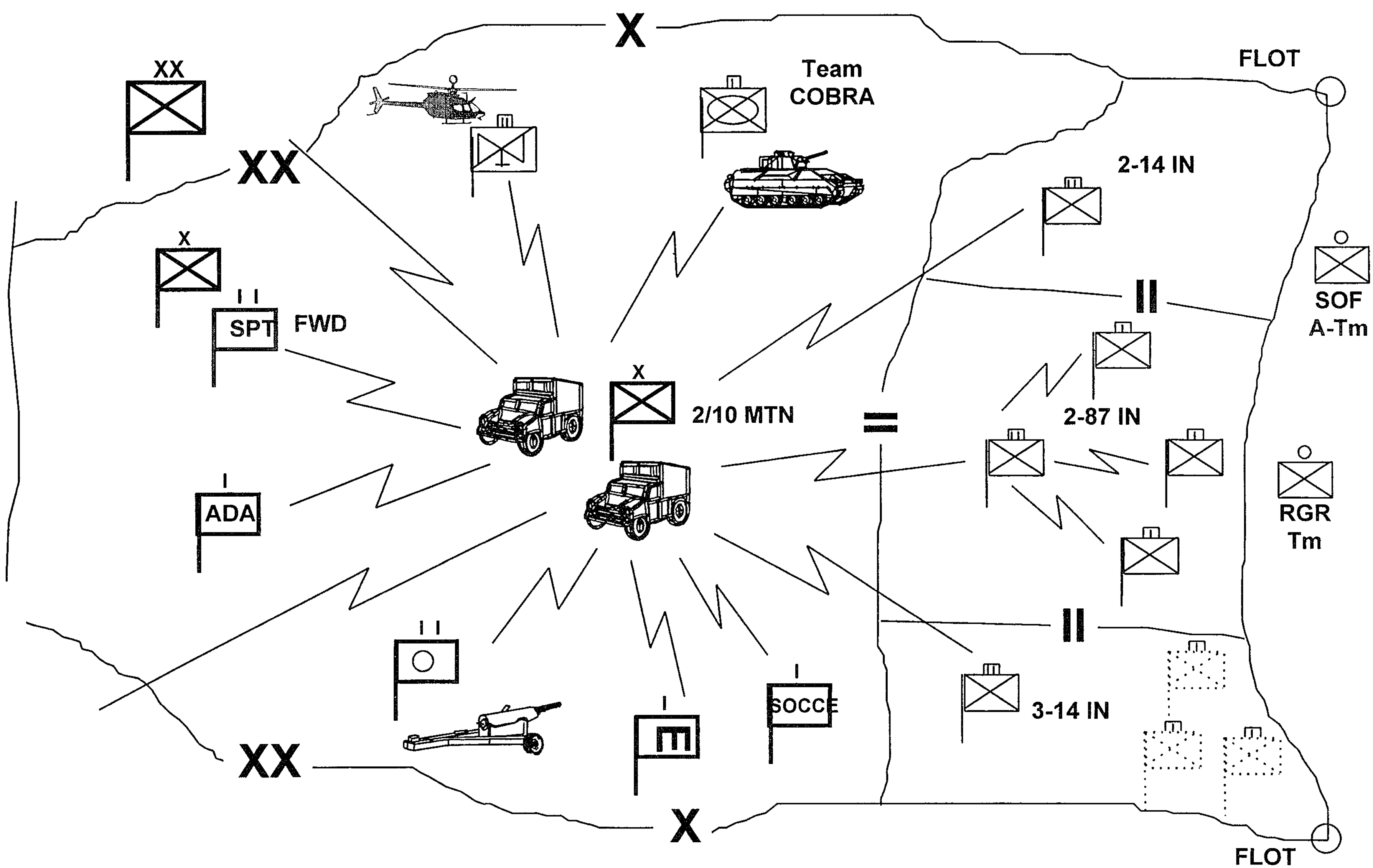
Support Networking of Systems



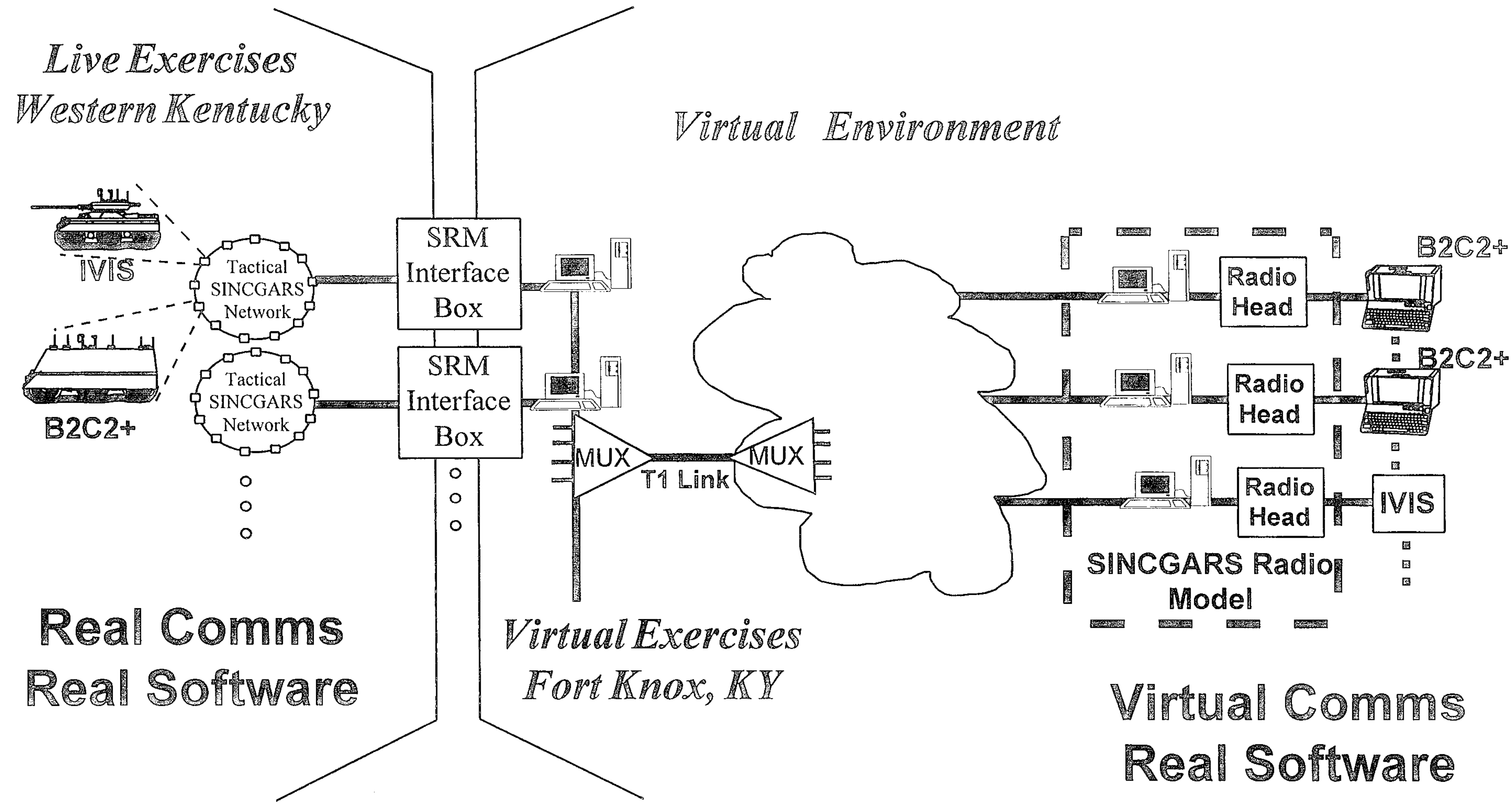
Support Field & Field Demos



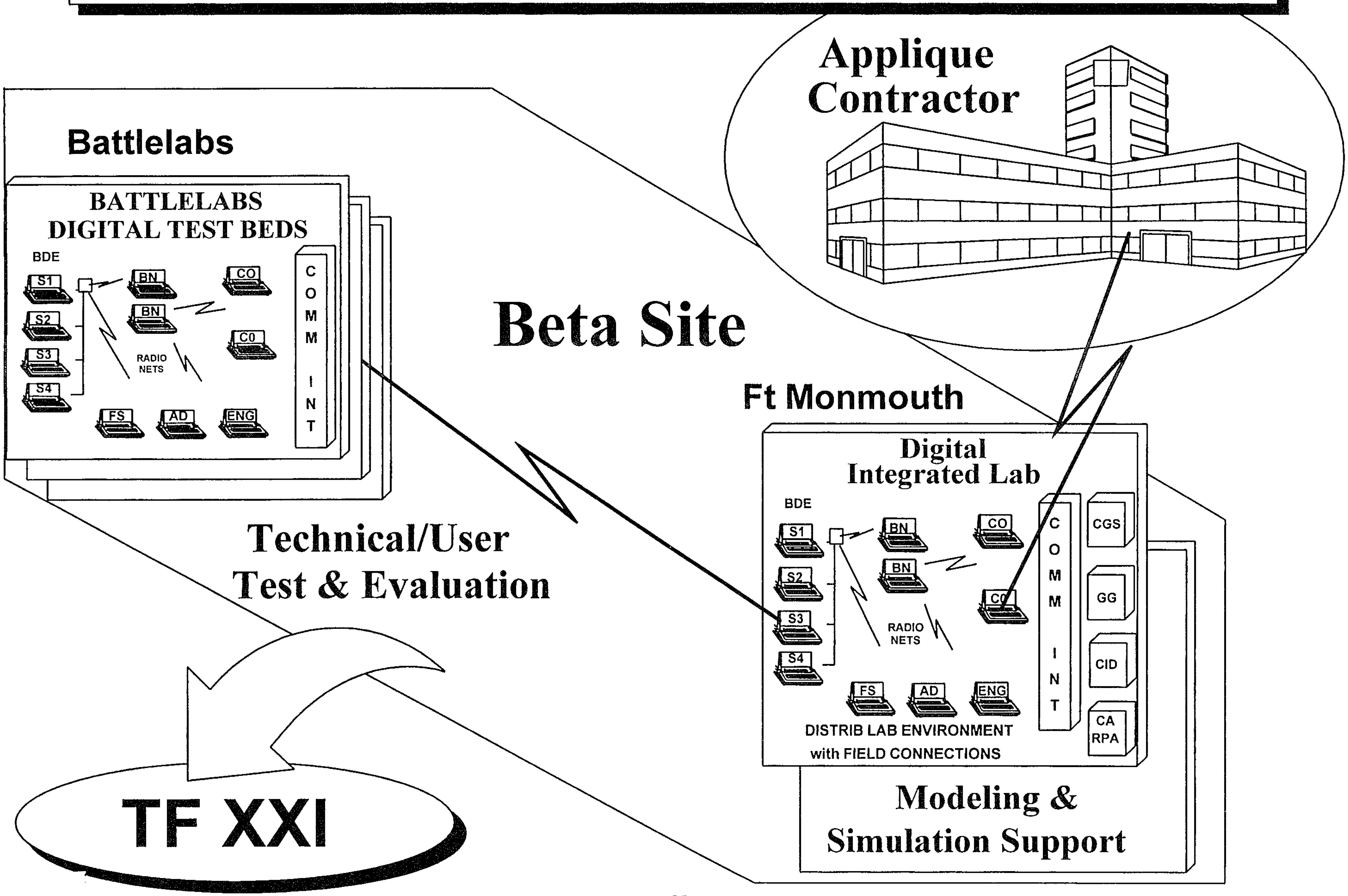
Support Warrior Focus



Team Monmouth Support to FOCUSED DISPATCH



Applique - Evaluation & Test



NOTES

SESSION I

SOFTWARE ENGINEERING

SOFTWARE TECHNOLOGY OVERVIEW

MYRON S. SAMUEL
ASSOCIATE DIRECTOR
SOFTWARE ENGINEERING DIRECTORATE

UNCLASSIFIED

SOFTWARE ENGINEERING DIRECTORATE

KEY MISSION AREAS

- **SOFTWARE ACQUISITION AND POST-FIELDING SUPPORT**
  - COMMUNICATIONS
  - COMMAND & CONTROL
  - SIMULATION-TRAINING-INSTRUMENTATION
  - INTELLIGENCE & ELECTRONIC WARFARE
  - FIRE SUPPORT
  - TACTICAL FUSION
  - AVIONICS

- **SOFTWARE PROTOTYPING LAB**
  - CAPTURE THE "GOLDEN NUGGETS"
  - FIELD AND SUSTAIN THE PROTOTYPES
  - IMPROVE THE PROTOTYPES

SOFTWARE ENGINEERING DIRECTORATE
KEY MISSION AREAS (Continued)

- **INTEROPERABILITY & STANDARDIZATION**
  - DEVELOP AND CERTIFY MESSAGE PROTOCOL STANDARDS
  - TEST COMBINED JOINT AND ARMY INTEROPERABILITY
  - DEVELOP AND OPERATE THE ARMY INTEROPERABILITY NETWORK
- **EXECUTIVE AGENT FOR TACTICAL COMM SWITCHES**
- **ARMY REPROGRAMMING AND ANALYSIS TEAM (ARAT)**
- **REPLICATION, DISTRIBUTION, INSTALLATION, AND TRAINING (RDIT)**
- **SOFTWARE TECHNOLOGY**

SOFTWARE ENGINEERING DIRECTORATE
TWO DIMENSIONS OF OUR BUSINESS

- SOFTWARE "PRODUCTS"
- SOFTWARE "PROCESS"

WE WOULD ENCOURAGE INDUSTRY TO CONSIDER IR&D INVESTMENTS IN "BOTH" AREAS

NOTES

TACTICAL SOFTWARE TECHNOLOGY

SOFTWARE REUSE

JOHN WILLISON
PROJECT LEADER
SOFTWARE ENGINEERING
DIRECTORATE

UNCLASSIFIED

AMSEL-RD-ST

POINT PAPER

SUBJECT: Software Reuse

OBJECTIVE: To provide increased productivity, reduced cost and risk, shorter development cycles, in the development of software for Army systems.

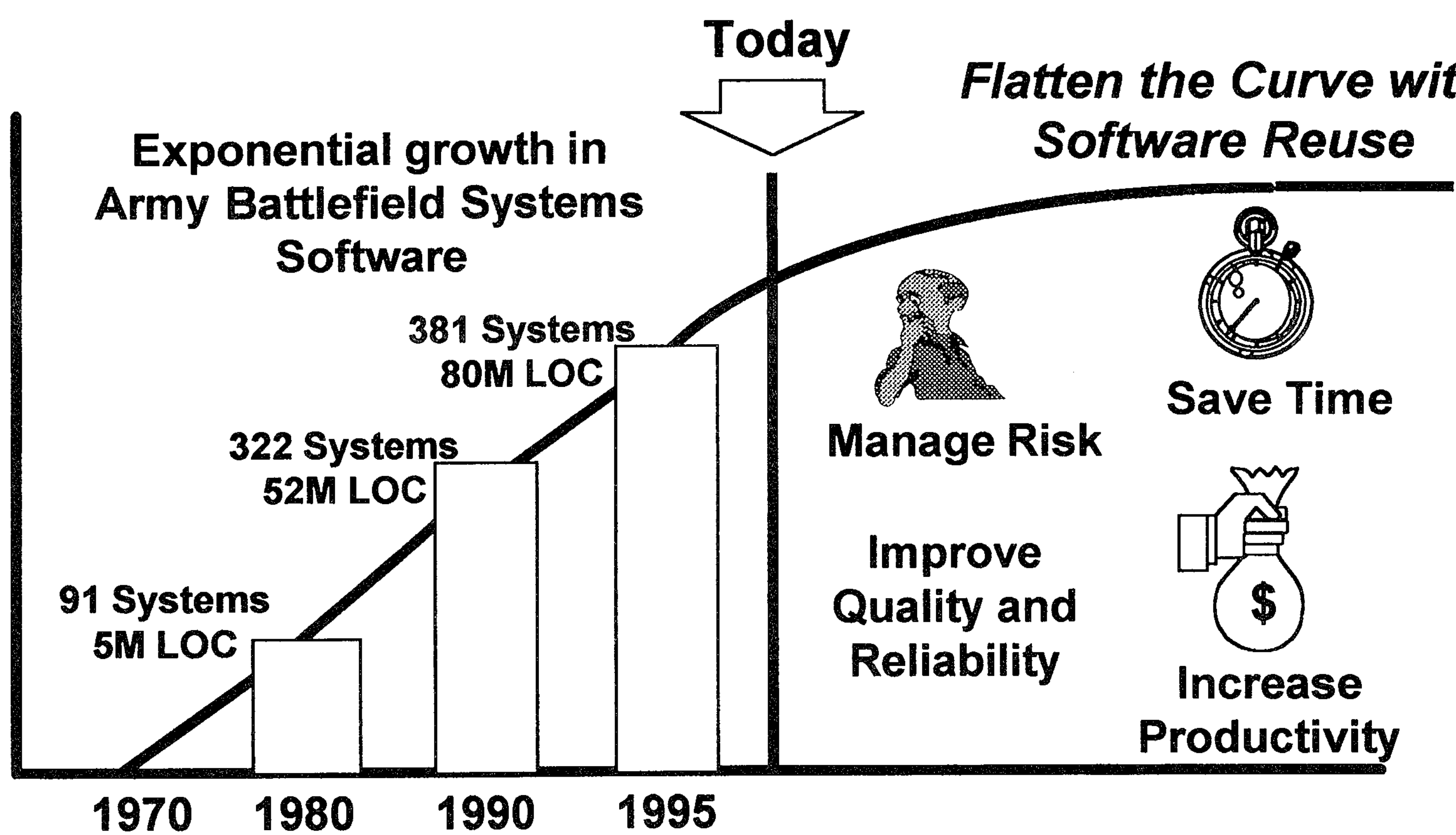
FACTS:

- The Software Engineering Directorate (SED) emphasizes a shift to product lines and architecture-centric development as the key element of our software reuse strategy.
- The technical challenges associated with architectures has been broken out into three parts (or conceptual layers): COTS, Military-Oriented Platform Extensions, and Applications.
- Each of these layers also has different management challenges associated with it.
- The emphasis must be on resolving management issues such as capital investment, ownership, contracting strategies, etc.

BRIEFER: John Willison, Project Leader, Software Engineering Directorate, AMSEL-RD-SE-PRO, (908) 532-2598.

RELEASED By:
Myron Samuel
Associate Director
Software Engineering Directorate

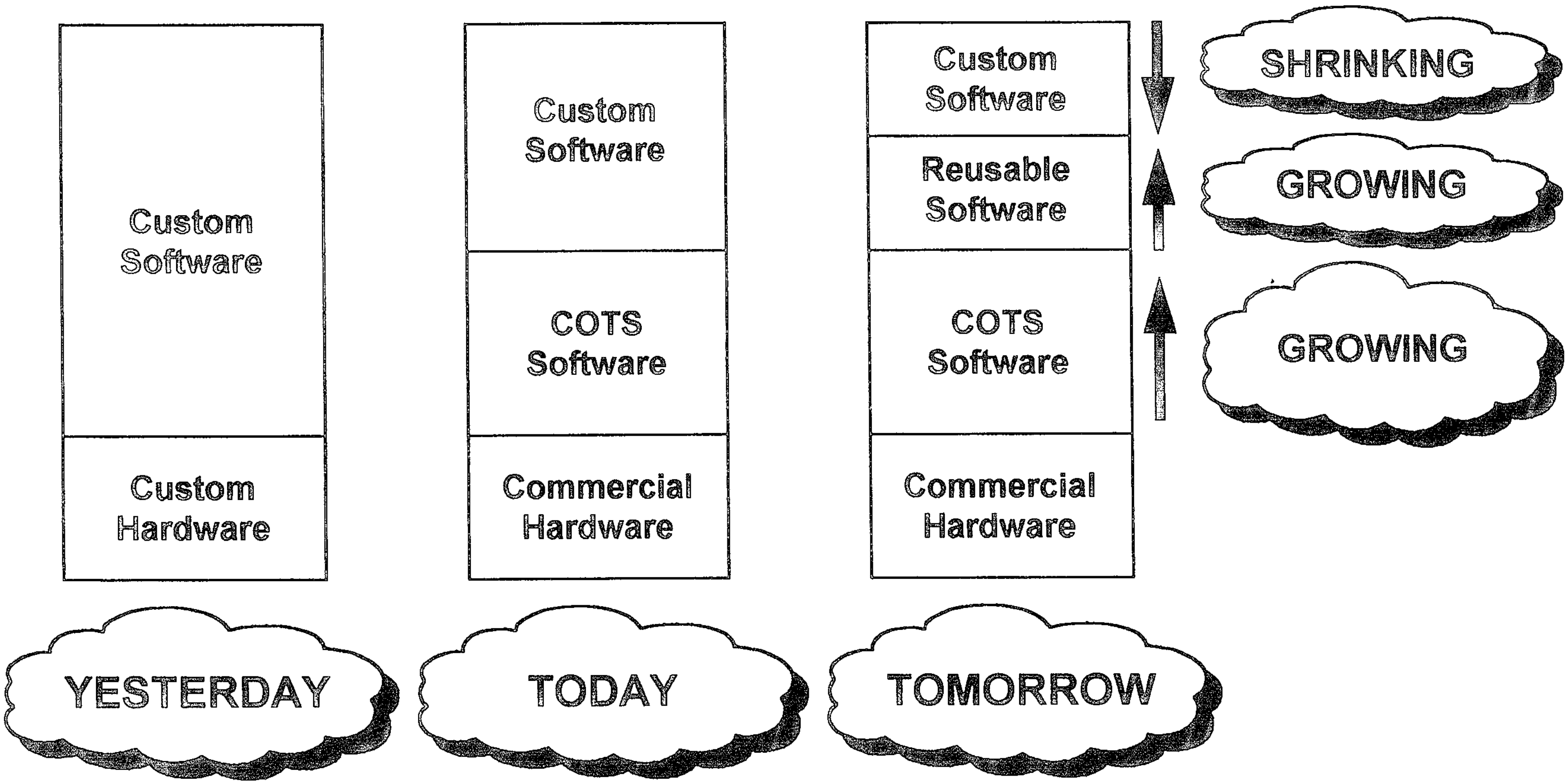
WHY SOFTWARE REUSE?
REDUCES COST & INCREASES PRODUCTIVITY



Widespread reuse will be "essential" if we are to live within our future budgets

SOFTWARE REUSE

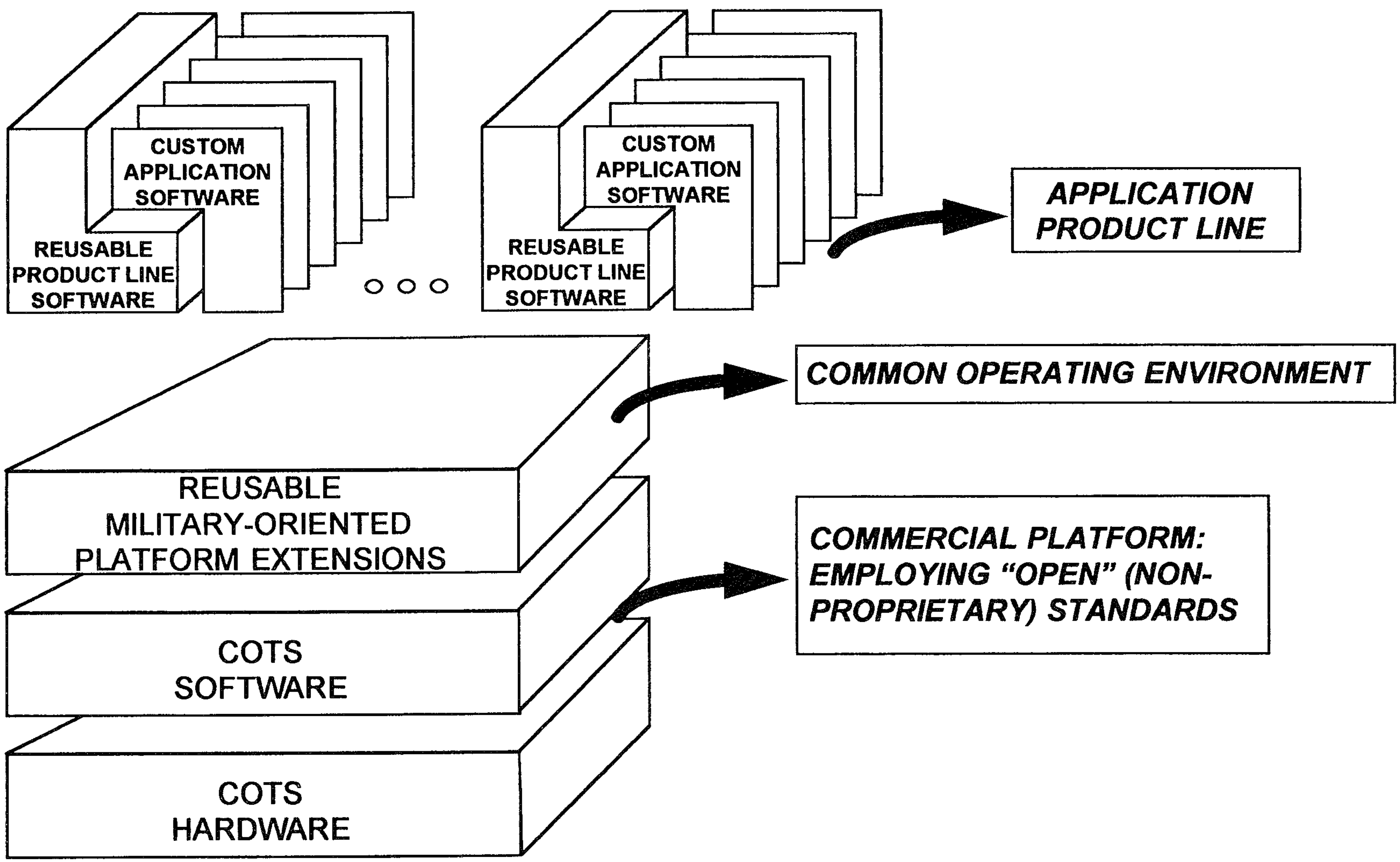
OUR ARMY SOFTWARE ACQUISITION APPROACH HAS BEEN CHANGING



We must "minimize" custom software!

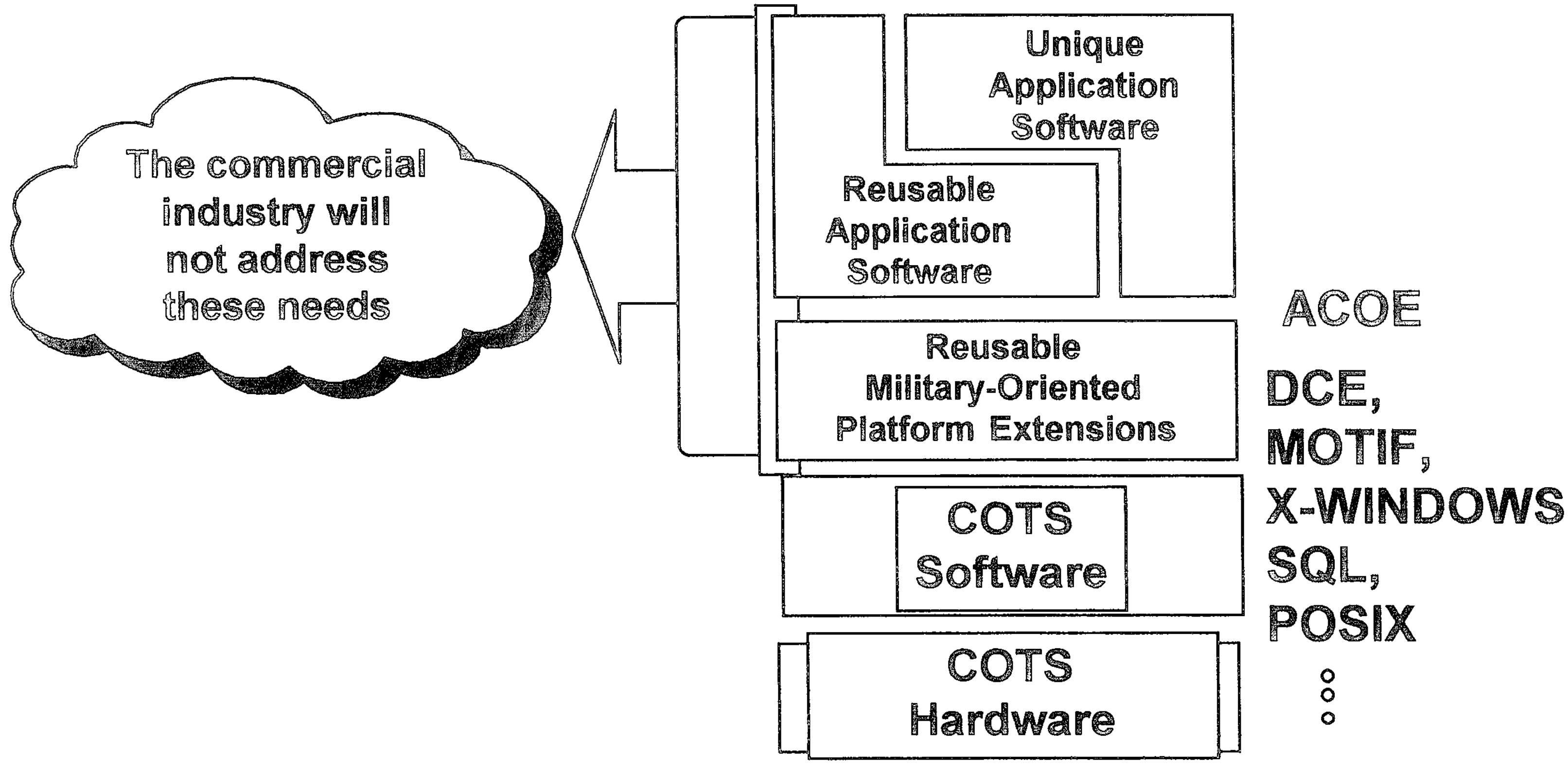
SOFTWARE REUSE

WHERE WE NEED TO GO



SOFTWARE REUSE

ARCHITECTURAL STANDARDS ARE THE KEY



Focus our investments on developing application architectural standards and leveraging established commercial architectural standards

SOFTWARE REUSE
REUSE CHALLENGES AT HAND

TECHNICAL

- Products:
  - Defining common software architecture
  - Developing conforming software
- Process

BUSINESS

- DoD Management
- Ownership
- Incentives
- Contracting Strategies
- Migration Strategies

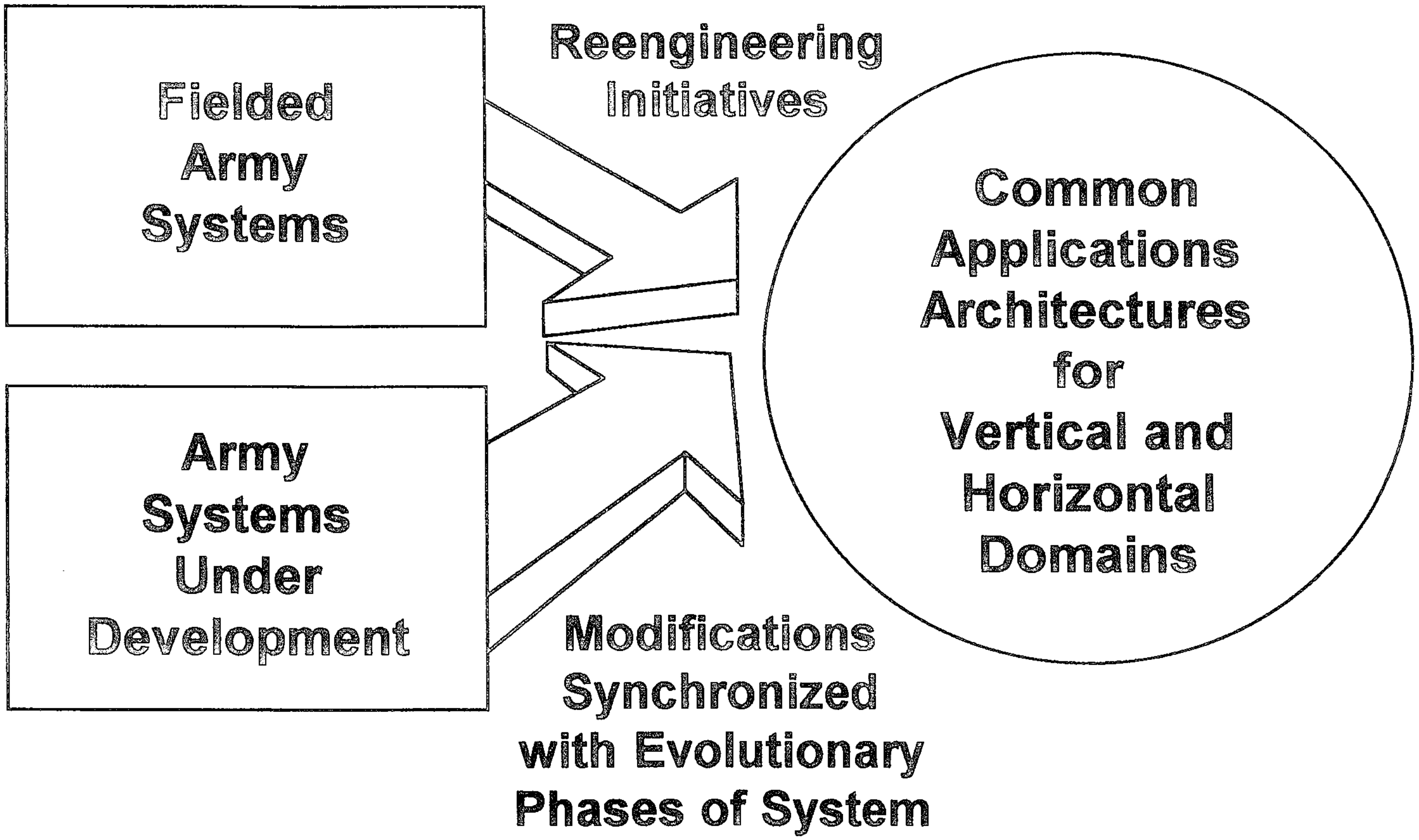
Need to shift to a product line management approach

Technical challenges exist but business challenges represent the more significant barrier

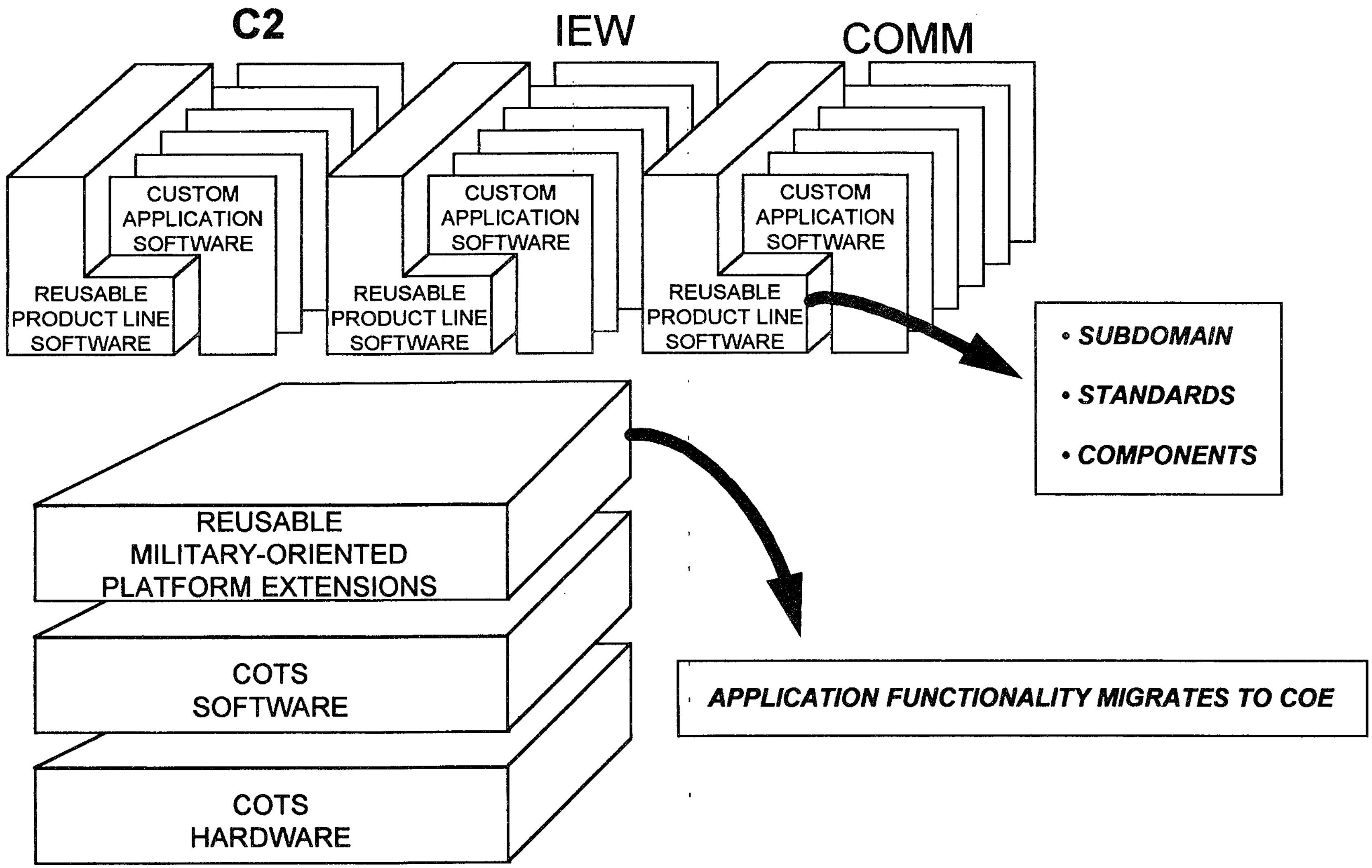
SOFTWARE REUSE

A PRACTICAL STRATEGY FOR INTEGRATING REUSABLE PRODUCTS

1. Invest in and establish architectural definitions/goals
2. "Evolve" toward those goals as opportunities present themselves



SOFTWARE REUSE
DEVELOPING REUSABLE PRODUCTS



SOFTWARE REUSE

PROCESS TECHNOLOGY NEEDS

- Architecture development process (domain & system)
- Architecture representation
  - Definition, specification, formal languages
  - Understanding and transition
- Architecture assessment methodologies
- System composition/code generation

SOFTWARE REUSE

CONCLUSIONS

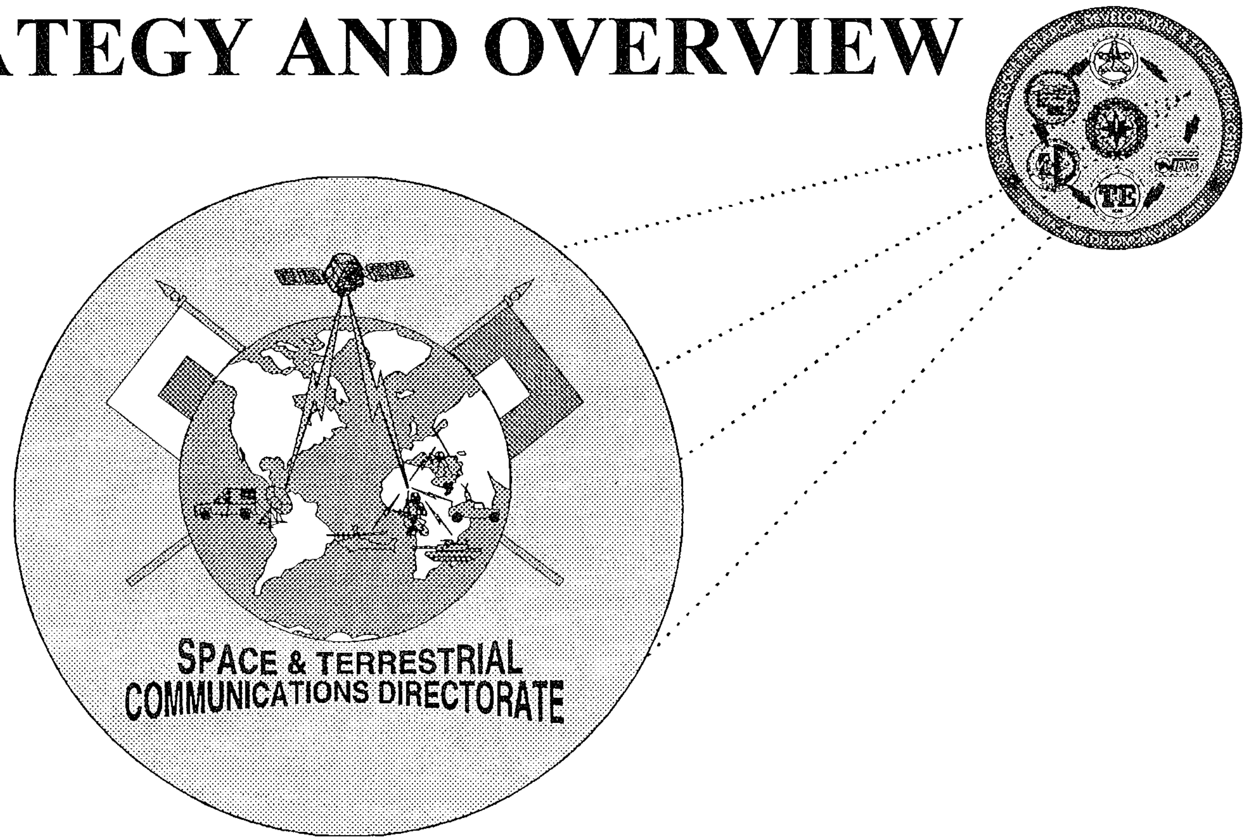
- Architecture, architecture, architecture
- Potential market for both processes and products

NOTES

SESSION II

SPACE & TERRESTRIAL (S&T) COMMUNICATIONS

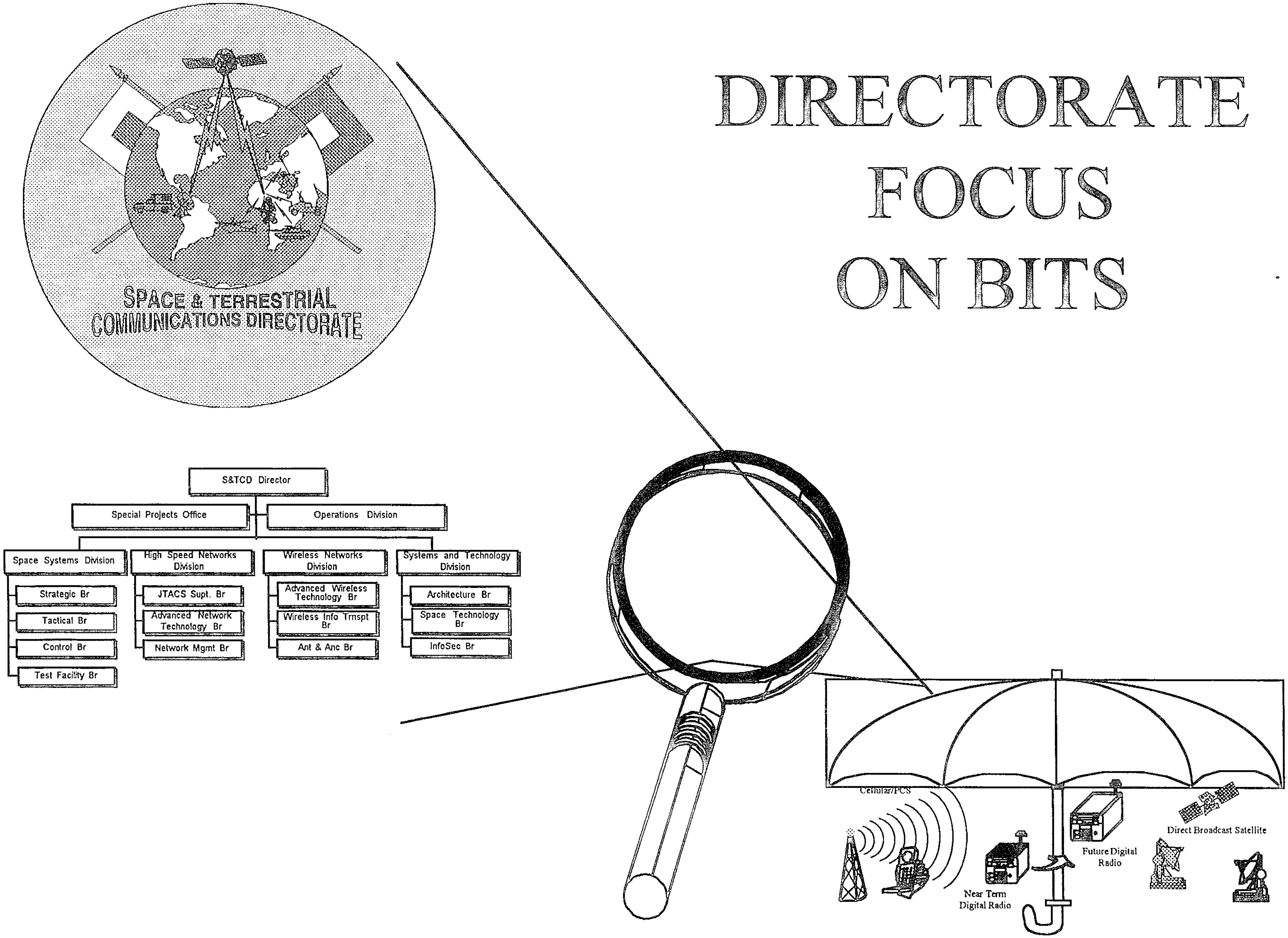
BITS STRATEGY AND OVERVIEW



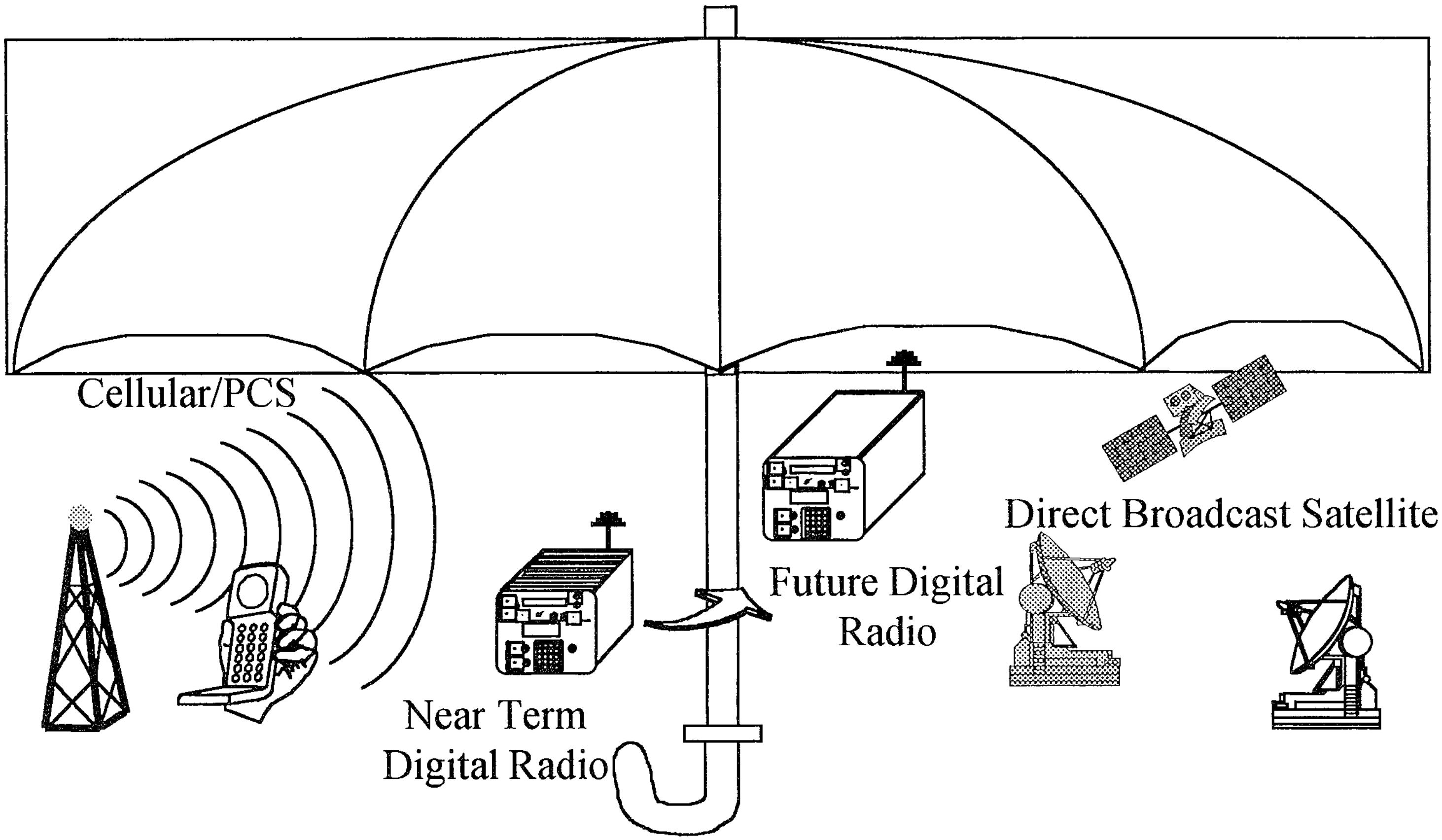
COL KENNETH A. THOMAS
ACTING DIRECTOR
SPACE & TERRESTRIAL COMMUNICATIONS DIRECTORATE

UNCLASSIFIED

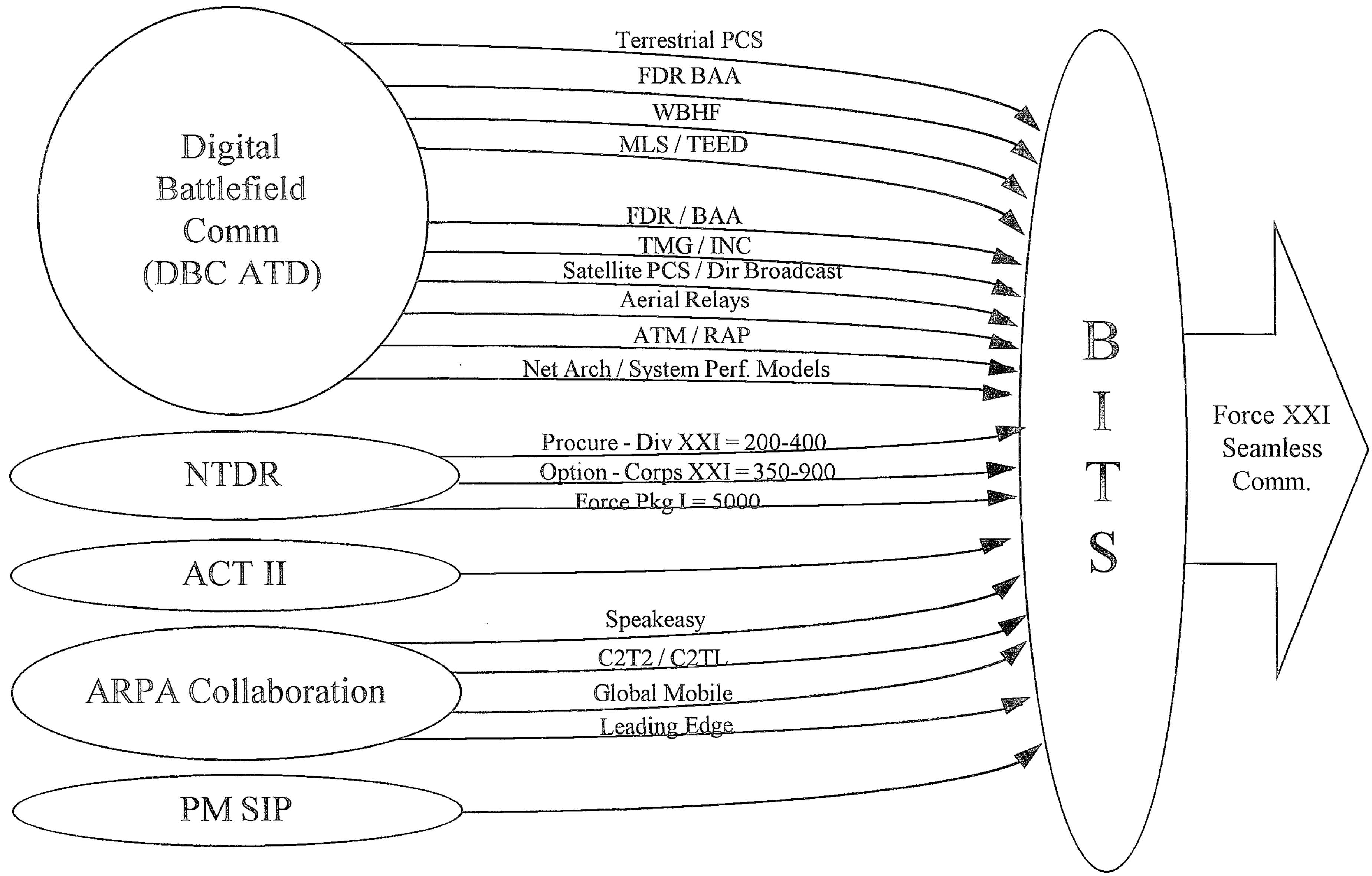
DIRECTORATE FOCUS ON BITS



Battlefield Information Transmission System (BITS) FAR TERM STRATEGY



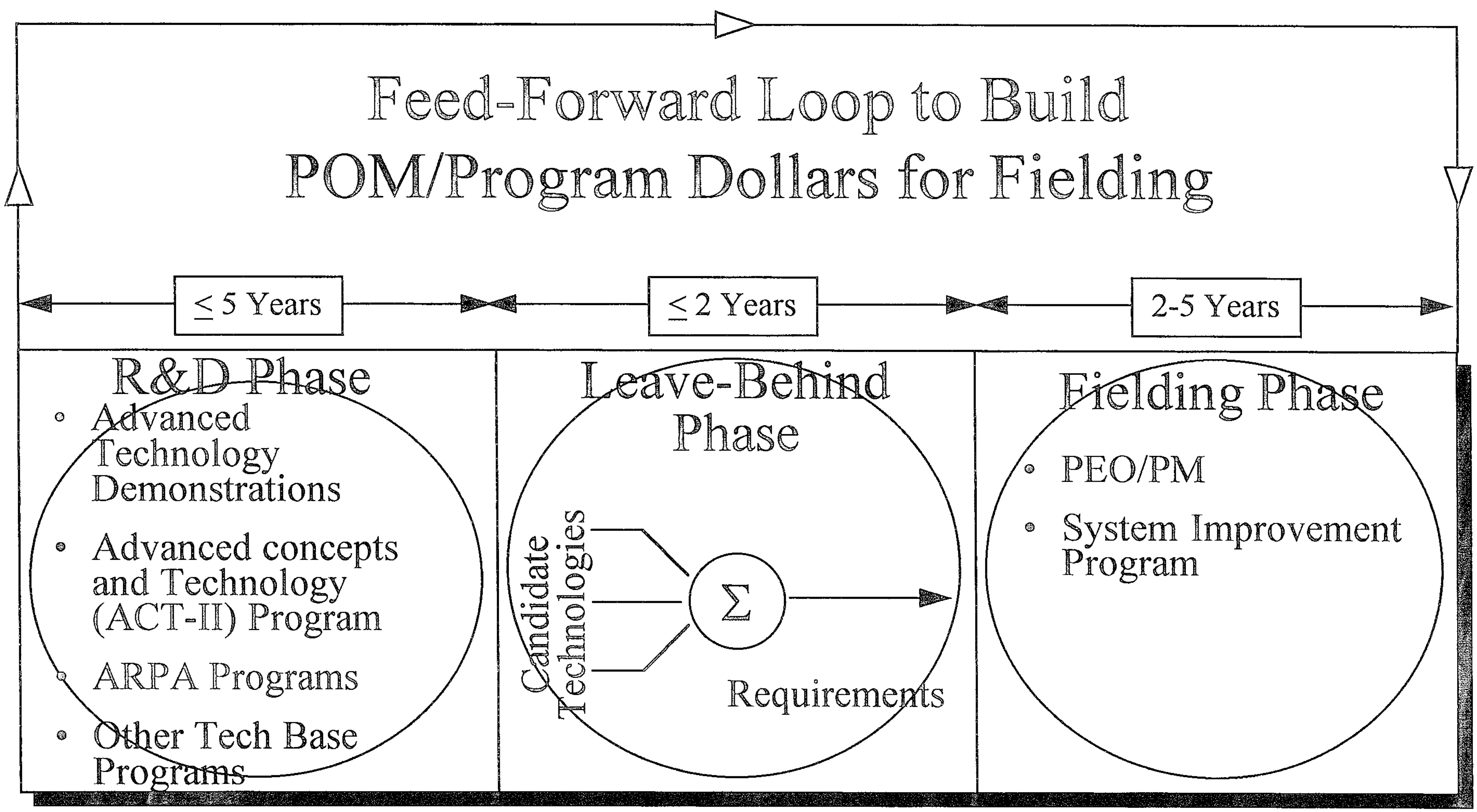
BITS Far Term Strategy



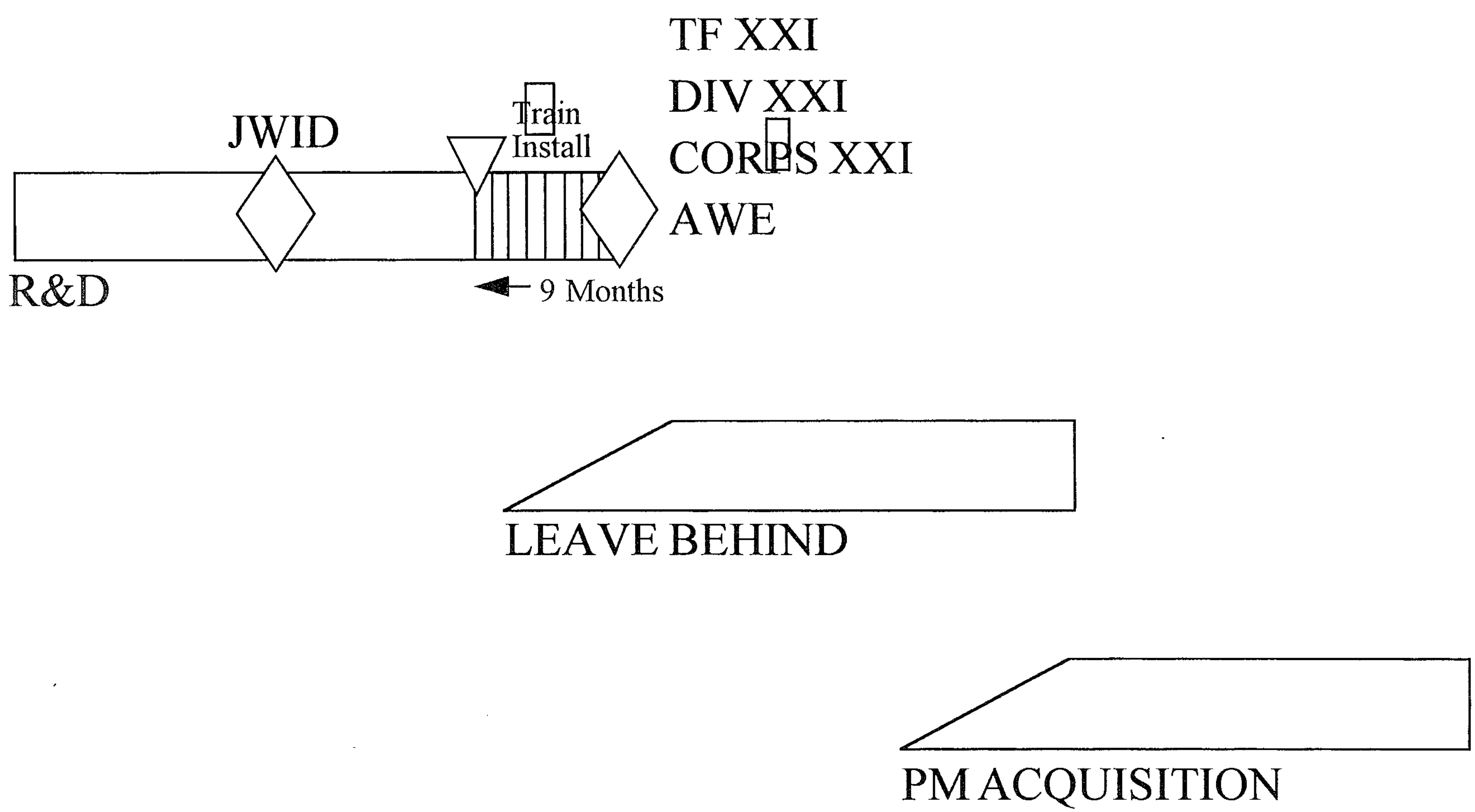
BITS Far Term Strategy

- Required by Jan 95 Army Digitization Master Plan
- Tasked to DISC4, to CECOM RDEC through ADO
- Focus for ARPA initiatives, ATD's, BLWEs
- Define experimentation and acquisition strategy
  - FY 95-99 RDTE (ATD)
  - FY 97 POM Plus-Up
  - Force XXI acquisitions funding FY99
- Define resource and funding shortfalls

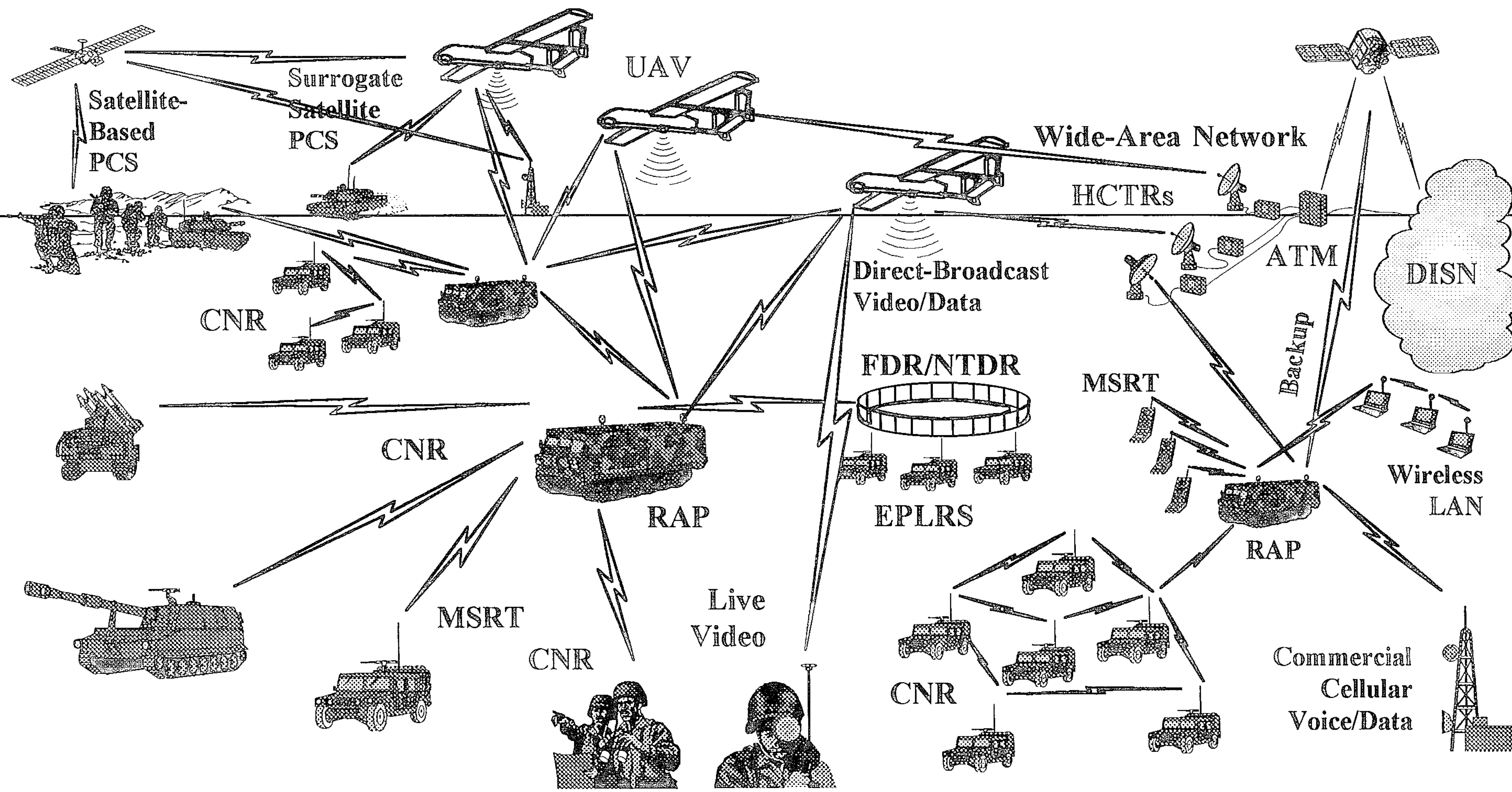
BITS Strategic Framework



BITS Development Strategy



Digital Battlefield Communications Architectural Elements



BITS AWE Product Insertions

PRODUCT	QUANTITY	TF XXI	DIV XXI	CORPS XXI	FY99
Tactical End to End Encryption Device (TEED)	30	X			
Wideband HF	5-7	X			
Terrestrial PCS	LMR 1B/50 HS	X			
	Hybrid CDMA 2B/50 HS		X		
	2 MSE Interfaces (each)	X	X		
Asynchronous Transfer Mode (ATM) Technology	3-5	X	X	X	
Direct Broadcast Service	1 U/L, 3 D/L	X			
	1 Program Center			(X)	
	1 UAV Package		X		
	1 OTM Antenna			(X)	
Near Term Digital Radio/Future Digital Radio	15 FDR	X			
	200 NTDR		X		
	400 NTDR			X	
On the move Antenna	1	(CGS)		X	
Airborne Relay	1		X		
High Capacity Trunk Radio (HCTR)	4 - 10 MB		X		
	4 Static 45 MBps			X	
	4 OTM				X
Satellite PCS	1 UAV, 25 HS		X		
	Univ HS				X
Radio Access Point	1 Static			X	
	1 OTM				X

( ) - Development complete; inadequate funding for AWE

Briefing Outline

- Directorate Focus (BITS) - Col Thomas
- Key Technologies for IR&D
  - Future Digital Radios - Mr. DiJulio
  - High Capacity Trunk Radio - Mr. Brockel
  - ATM Technology - Mr. Levine
  - Personal Communications System - Dr. Wichansky
  - Global Broadcast Service - Mr. Ozimek

NOTES

COMMUNICATIONS TECHNOLOGY

FUTURE DIGITAL RADIO

MICHAEL DIJULIO
CHIEF, WIRELESS NETWORKS DIVISION
SPACE & TERRESTRIAL
COMMUNICATIONS DIRECTORATE

UNCLASSIFIED

AMSEL-RD-ST

POINT PAPER

SUBJECT: Future Digital Radio

PURPOSE: To provide a small quantity of operational hardware to address functional areas of the FDR MNS during the TF XXI AWE.

FACTS:

- The FDR (BAA), along with SPEAKEASY and the Near-Term Digital Radio (NTDR) are feeder programs needed to develop the digital and MBMMR technology to enable the Army to field the objective FDR.
- The requirement for the FDR is described in the FDR MNS, which was originally written as the supporting user documentation for the Joint SPEAKEASY program.
- The FDR BAA and NTDR efforts were planned and are being executed because, the SPEAKEASY program was not conceived or planned to provide operational hardware that will be available in time for the TF, Division, or Corps XXI AWEs.

BRIEFER: Mike DiJulio, Chief, Wireless Networks Division, Space & Terrestrial Communications Directorate, AMSEL-RD-ST-WL, (908) 532-0458.

RELEASED By: Barry S. Salis
Barry Salis
Deputy Director
Space & Terrestrial
Communications Directorate

ACTION OFFICER:
Mike DiJulio
Chief, Wireless Networks Div.
Space & Terrestrial
Communications Directorate

AMSEL-RD-ST

POINT PAPER

SUBJECT: Joint SPEAKEASY Multiband Multimode Radio (MBMMR)

PURPOSE: To develop the architecture and technology for the objective MBMMR, meeting the requirements of the Army Future Digital Radio (FRD) Mission Needs Statement (16 May 94) and the MBMMR requirements of the other services. The SPEAKEASY radio will also provide the capabilities required by the MBMMR (identified in the evolving digital battlefield architecture) for the mobile Radio Access Point (RAP). Advanced Development Models (ADMs) of the SPEAKEASY MBMMR will be produced and used for contractor development testing, Government/user demonstrations, and participation in the Digital Battlefield Communications (DBC) Advanced Technology Demonstration (ATD).

FACTS:

- The SPEAKEASY MBMMR program is a joint-service R&D program.
- The program is sponsored by the Advanced Research Projects Agency (ARPA) and managed by an Air Force Program Manager (Rome Labs, Executive Agent).
- The Army (CECOM), Navy (Naval Research and Development Center Space and Naval Warfare Systems), and National Security Agency (NSA) participation.

BRIEFER: Donald Upmal, Project Leader, Space & Terrestrial Communications Directorate, AMSEL-RD-ST-SP, (908) 532-0440

RELEASED By: Barry B. Salis
Barry Salis
Deputy Director
Space & Terrestrial
Communications Directorate

ACTION OFFICER
Donald Upmal
Project Leader
Space & Terrestrial
Communications Directorate

FUTURE DIGITAL RADIO
DEFINITIONS

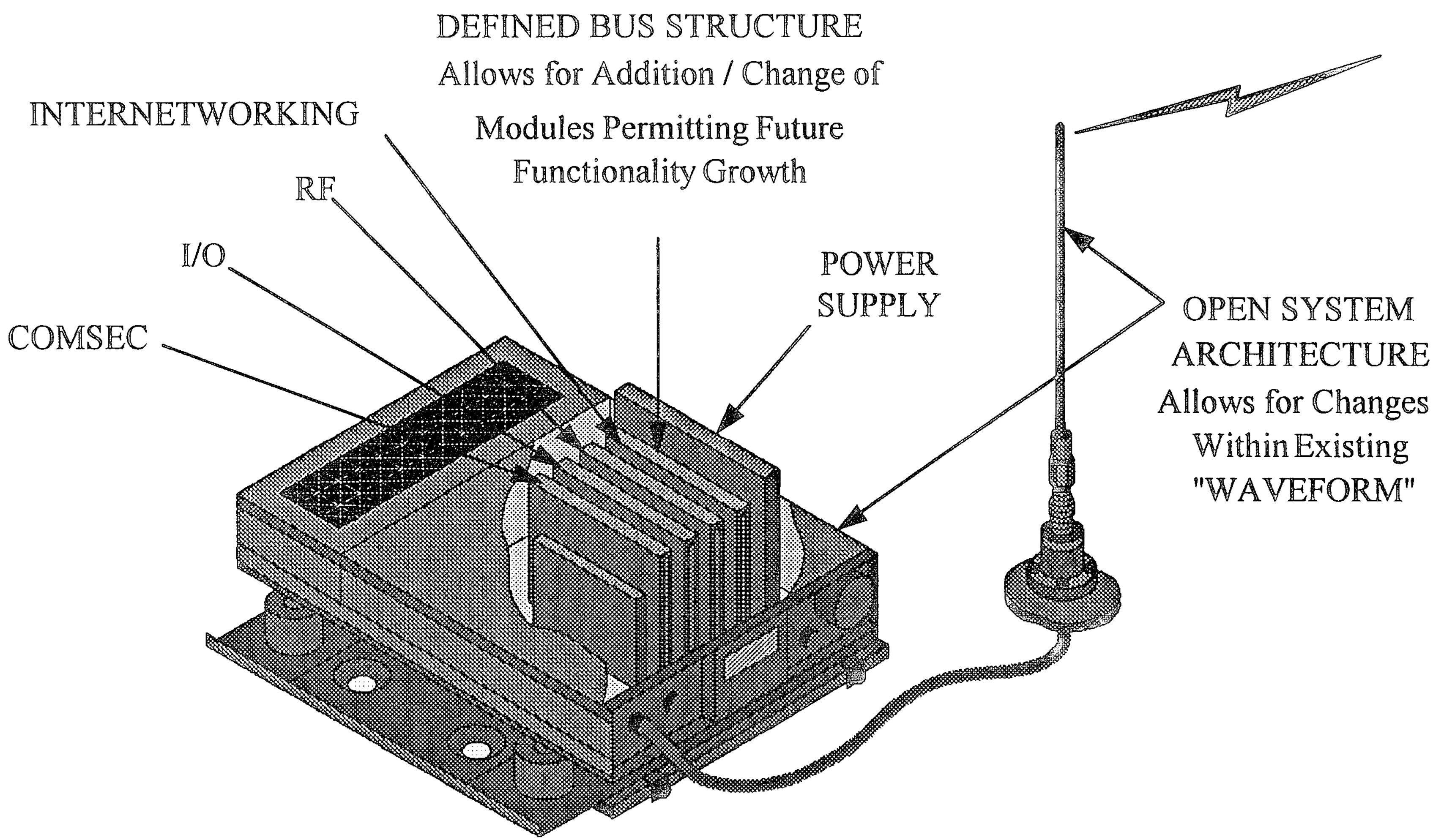
- FDR/BAA-AN EARLY VERSION OF THE FDR BOUGHT UNDER A BAA FOR TF XXI
- NTDR IS AN NDI EVOLUTIONARY GROWTH STEP IN THE TRANSITION FROM EPLRS TO THE FDR AIMED AT PROVIDING BDE/DIV QUANTITIES OF AN AVAILABLE DIGITAL RADIO-THE RADIO HAS GROWTH POTENTIAL
- FDR- A NETWORKED, MULTIBAND/MULTIMODE HIGH DATA CAPACITY RADIO FOR THE DIGITAL BATTLEFIELD OF THE YEAR 2000+.
- SPEAKEASY MBMMR - A JOINT SERVICE/ARPA R&D PROGRAM TO DEVELOP A PROGRAMMABLE, MULTIBAND, MULTIMODE RADIO (MBMMR), WITH AN OPEN SYSTEM ARCHITECTURE, MEETING THE REQUIREMENTS OF THE FDR MISSION NEEDS STATEMENT (MNS)

FUTURE DIGITAL RADIO

OBJECTIVES/VISION

- AS PER THE FDR MISSION NEEDS STATEMENT (MNS): FDR WILL PROVIDE THE FOLLOWING CAPABILITIES:
  - MULTI-BAND/MULTIMODE
  - ROBUST
  - LPI
  - MOBILE
  - FLEXIBLE
  - SIMULTANEOUS VOICE & DATA

FUTURE DIGITAL RADIO
OPEN ARCHITECTURE



FUTURE DIGITAL RADIO

APPROACH

- PROCURE AVAILABLE TECHNOLOGY FOR TF-XXI-(FDR/BAA)
- PROCURE MATURING TECHNOLOGY WITH GROWTH POTENTIAL FOR POST TF-XXI EXPERIMENTS AND EARLY FIELDING -(NTDR)
- DEVELOP A PROGRAMMABLE RADIO THAT CAN ACCOMMODATE LEGACY AND FUTURE WAVEFORMS-(SPEAKEASY)
- PROCURE QUANTITIES OF A PROGRAMMABLE RADIO BASED ON SPEAKEASY PROGRAMMED WITH LEGACY AND NTDR WAVEFORMS FOR SATISFYING OBJECTIVE SYSTEM CRITERIA-(TRI-SERVICE/FDR)

FUTURE DIGITAL RADIO

TECHNOLOGY
KEY CAPABILITIES

- MODULAR OPEN SYSTEM ARCHITECTURE BASED ON WIDELY ACCEPTED COMMERCIAL STANDARDS
- SOFTWARE RE-PROGRAMMABLE
- 2 MHz- 50 GHz OPERATION
- INTEROPERABLE WITH LEGACY RADIOS
- SIMULTANEOUS CHANNELS

FUTURE DIGITAL RADIO

TECHNOLOGY
KEY CAPABILITIES (CONT)

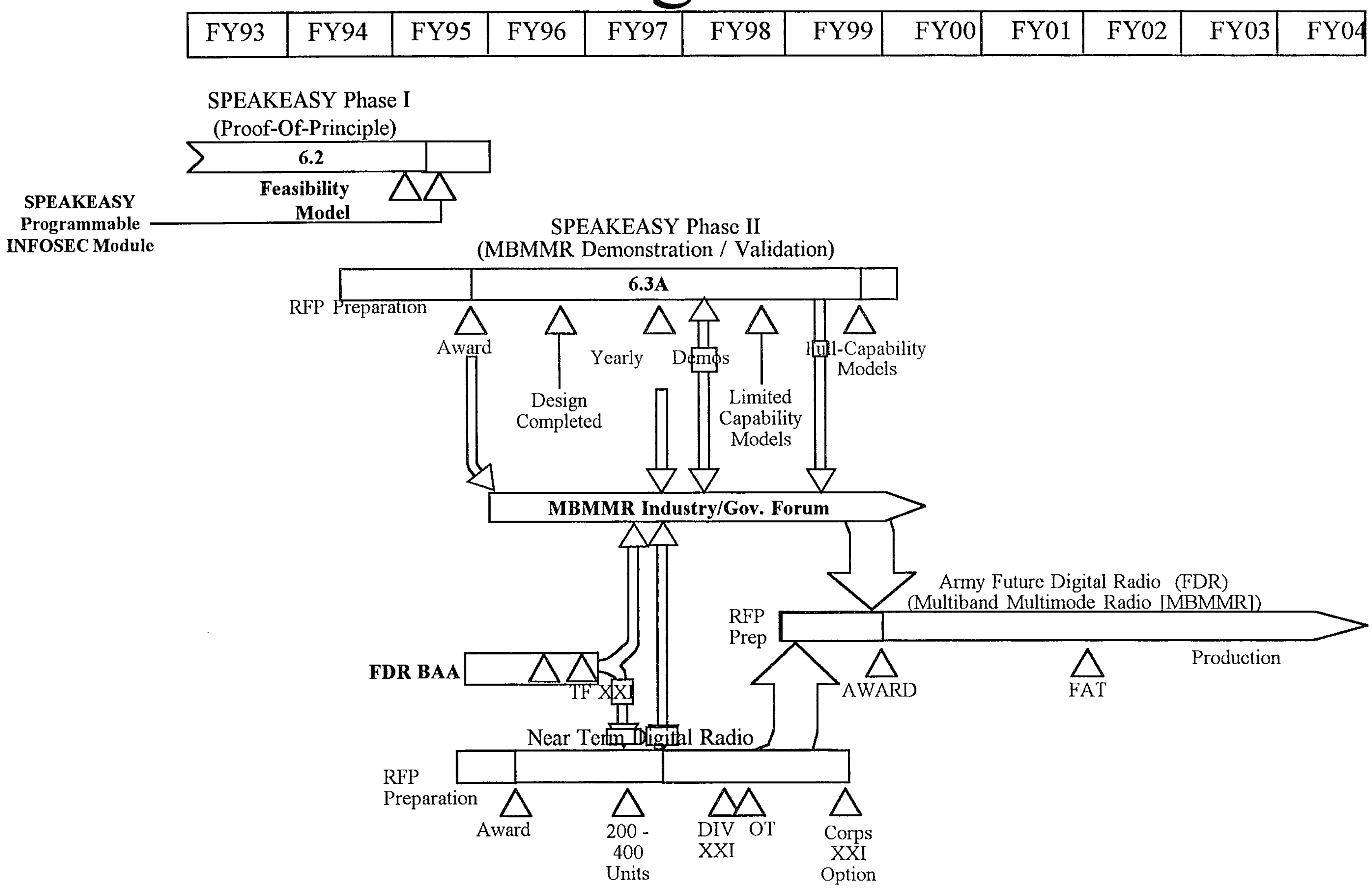
- HIGH CAPACITY THROUGHPUT WAVEFORMS
- EMBEDDED NETWORKING CAPABILITY
- LPI/D CAPABLE
- SECURE AND ANTI-JAM
- GPS AND CELLULAR EMBEDDED
- COMMERCIAL MARKET POTENTIAL

FUTURE DIGITAL RADIO

APPLICATION/TRANSITION

- FUNCTION: PROVIDE SEAMLESS COMMUNICATION FOR THE DIGITAL BATTLEFIELD
- APPLICATION: FUTURE OPPORTUNITIES WILL BE PROVIDING TECHNOLOGY INSERTION TO THE RADIOS (TRI-SERVICE RADIO, SPEAKEASY & NTDR) LEADING TO THE FDR
- RECEIVING ORGANIZATION: PM TRCS

Army Future Digital Radio Migration



FUTURE DIGITAL RADIO
TECHNOLOGY CHALLENGES

- LOW POWER / HIGH SPEED DEVICES & TECHNIQUES
- WIDEBAND & MULTIBAND ANTENNAS
- OPEN SYSTEM ARCHITECTURE: FORM-FACTOR & BUS INDEPENDENT
- WIDEBAND RF FRONT END: MULTI-CHANNEL, PROGRAMMABLE, TUNABLE & HOPPABLE
- PROGRAMMABLE INFOSEC: SOFTWARE REPROGRAMMABLE, EMBEDDED, MULTI-CHANNEL, LOW POWER, HIGH SPEED & NSA ENDORSEABLE
- COSITE INTERFERENCE REDUCTION
- MINIATURIZATION: MANPACK, HANDHELD & EMBEDABLE

FUTURE DIGITAL RADIO
IR&D TECHNOLOGY NEEDS

- LOW POWER / HIGH SPEED DEVICES & TECHNIQUES
  - 3.3V DSP'S, FFT'S, IC'S, ADC'S
  - HIGHLY EFFICIENT RF AMP'S, PA'S & COMPONENTS
  - GFLOPS DSP'S, CO-PROCESSORS, FFT'S
  - DC POWER MANAGEMENT
  - HIGH CAPACITY BATTERIES AND BATTERY LIFE EXTENSION
- WIDEBAND & MULTIBAND ANTENNAS
  - MINIMUM # OF ANTENNAS TO COVER 2MHZ TO 2GHZ
  - HIGH GAIN, WIDEBAND & OMNIDIRECTIONAL
  - MULTICHANNEL/MULTIBAND SIMULTANEOUS RX/TX
  - ON-THE-MOVE, MULTIPLE PLATFORMS, LOW PROFILE

FUTURE DIGITAL RADIO
IR&D TECHNOLOGY NEEDS (CONT)

- OPEN ARCHITECTURE
  - HAS INDUSTRY / MARKET ACCEPTANCE
  - STANDARDIZED & PUBLISHED NON-PROPRIETARY INTERFACES
  - BUS AND FORM-FACTOR INDEPENDENT FUNCTIONAL MODULES
  - BUS AND HARDWARE INDEPENDENT SOFTWARE
  - FUNCTIONAL ENHANCEMENT VIA SOFTWARE ONLY
  - TECHNOLOGY UPGRADE VIA MODULE REPLACEMENT

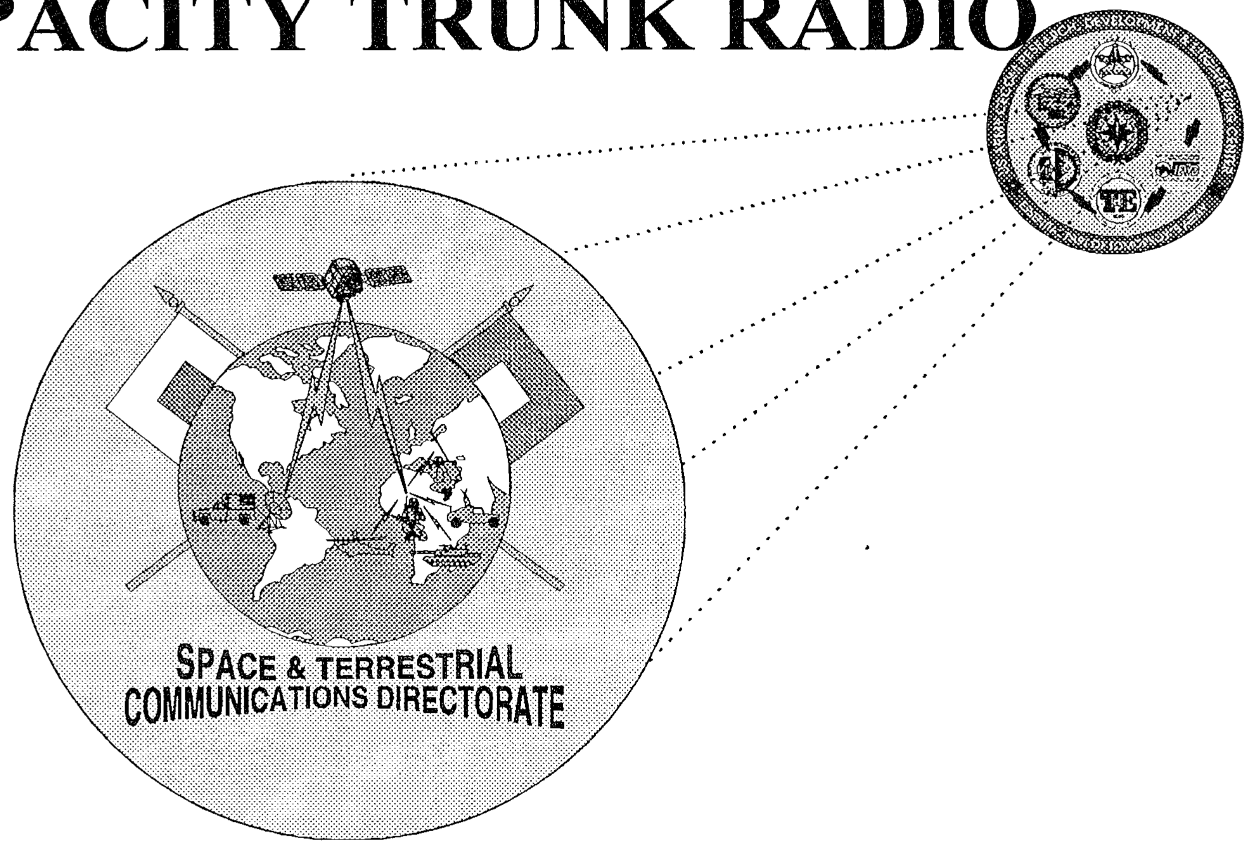
- WIDEBAND RF FRONT END
  - NEAR DIRECT "RF-TO-DIGITAL" CONVERSION
  - WAVEFORM PROGRAMMABLE/TUNABLE/HOPPABLE TRANSCEIVER FROM 2 TO 2000 MHZ

FUTURE DIGITAL RADIO
IR&D TECHNOLOGY NEEDS (CONT)

- PROGRAMMABLE INFOSEC
  - LOW POWER, HIGH SPEED, PROGRAMMABLE INFOSEC DSP'S
  - NSA ENDORSEABLE
  - KEY MGMT, OTAR & OTAD METHODS
- COSITE INTERFERENCE REDUCTION
  - INTERFERENCE CANCELLATION TECHNIQUES
  - SMALL, EFFICIENT & FAST TUNING COSITE FILTERS
  - SMART ANTENNA COUPLERS
  - ADVANCED MULTICHANNEL, MULTIPLEXING TECHNIQUES
- MINIATURIZATION
  - MULTI-CHIP MODULE (MCM) TECHNOLOGY & TECHNIQUES
  - LOW POWER .3 MICRON TECHNOLOGY
  - EFFICIENT THERMAL/HEAT DISSIPATION TECHNIQUES
  - RUGGEDIZED PACKAGING TECHNIQUES (FIELD ENVIRONMENT)

NOTES

HIGH CAPACITY TRUNK RADIO



KENNETH BROCKEL
PRODUCT DEVELOPMENT ENGINEER
SPACE & TERRESTRIAL
COMMUNICATIONS DIRECTORATE

UNCLASSIFIED

AMSEL-RD-ST

POINT PAPER

SUBJECT: High Capacity Trunk Radio (HCTR)

PURPOSE: To develop a radio capable of a minimum date rate of 45 Mbps to support asynchronous transfer mode (ATM) switching under dynamic battlefield conditions. The HCTR will serve as next generation wideband line-of-sight (LOS) radio for the Mobile Subscriber Equipment (MSE) wide-area network. HCTR is an integral part of the Radio Access Point (RAP) configuration envisioned to provide an on-the-move- high capacity data throughput for the Digital Battlefield Communications (DBC) Advanced Technology Demonstration (ATD).

FACTS:

- The HCTR program is a technology-based advanced-development initiative to explore and develop technologies to support the development of a wideband trunk radio with the capability of operating on-the-move (OTM).
- The HCTR will be a part of the wide-area backbone and mobile subsystems, such as the RAP, and be compatible with local-area hubs and ATM switching.

BRIEFER: Frank Loso, Project Engineer, Space & Terrestrial Communications Directorate, AMSEL-RD-ST-WL-AW, (908) 427-4025

RELEASED By: Barry B. Salis
Barry Salis
Deputy Director
Space & Terrestrial
Communications Directorate

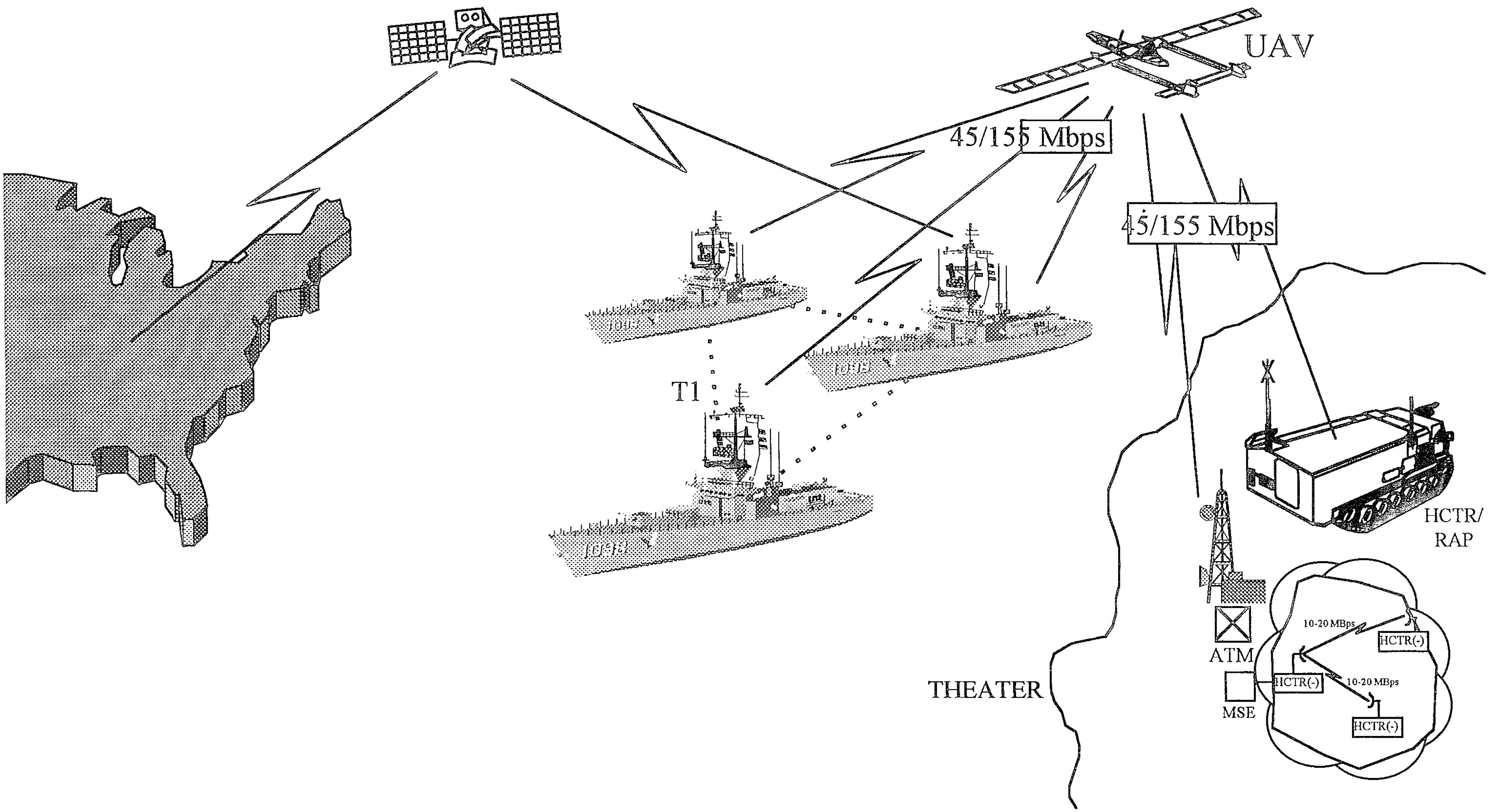
ACTION OFFICER
Frank Loso
Project Engineer
Space & Terrestrial
Communications Directorate

High Capacity Trunk Radio (HCTR)

Objectives

- Multimedia LOS transmission capability over Services wideband backbones at trunking rates of 1.544 to 155.52 Mb/s
- Wide bandwidth Asyncronous Transfer Mode (ATM)-to-ATM switch interconnections of up to 40 km link lengths (22 miles)
- On-the-move operation over land and sea
- Provide high reliability, low delay times for efficient transmission of ATM cells
- Seamless, multimedia comm between broadband Integrated Services Digital Network (ISDN) networks & narrowband systems

High Capacity Trunk Radio (HCTR)



High Capacity Trunk Radio (HCTR)

Approach

- HCTR is a technology based advanced development initiative in 3 Phases
  - Phase I
    - Purchased COTS SONET radio
    - Propagation measurements
    - ATM interfacing
    - Evaluate COTS features which may be incorporated into HCTR
    - Modeling and Simulation

High Capacity Trunk Radio (HCTR)

Approach (cont.)

- Phase II
  - Purchase HCTR (-)
  - A Near Term ATM Upgrade for MSE
  - Demonstrate in Division XXI
- Phase III
  - Develop prototypes for evaluation in Corps XXI
  - Competitive procurement 1Q97

High Capacity Trunk Radio (HCTR)

Application/Transition

FUNCTION: Will Provide a Trunk Radio capable of:

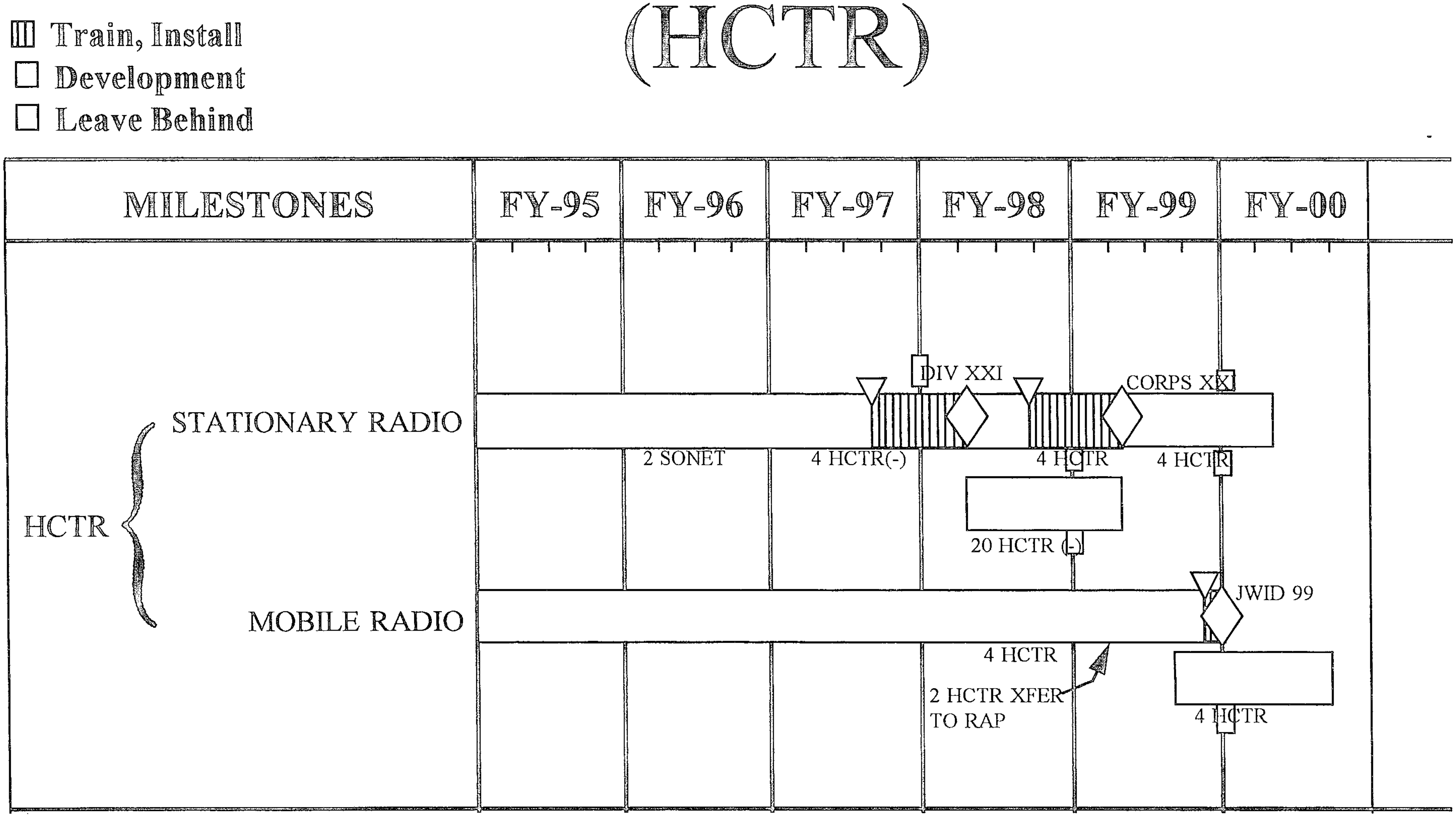
- 45 Mbps data on the move for RAP/Airborne relay
- ATM to ATM switch interconnection of up to 40 Km (Stationary) (155 MBps)
- ATM to Mobile RAP interconnection of up to 20 Km
- 10 MBps upgradeto MSE LOS Interswitch Trunks (HCTR(-))

APPLICATION: HCTR would serve as Next Generation Wideband Line-of-Sight Radio for the MSE Wide Area Network

RECEIVING ORG: PM JTACS

TRANSITION: FY2000

High Capacity Trunk Radio (HCTR)



High Capacity Trunk Radio (HCTR)

Technology Challenges

- Expected to operate 155.52 Mbps when stationary and 44.736 Mbps with one end on-the-move
- High reliability low BER ($<10^{-8}$) transmissions in a tactical environment
- Efficient utilization of spectrum
- Minimization of multipath effects

High Capacity Trunk Radio (HCTR)

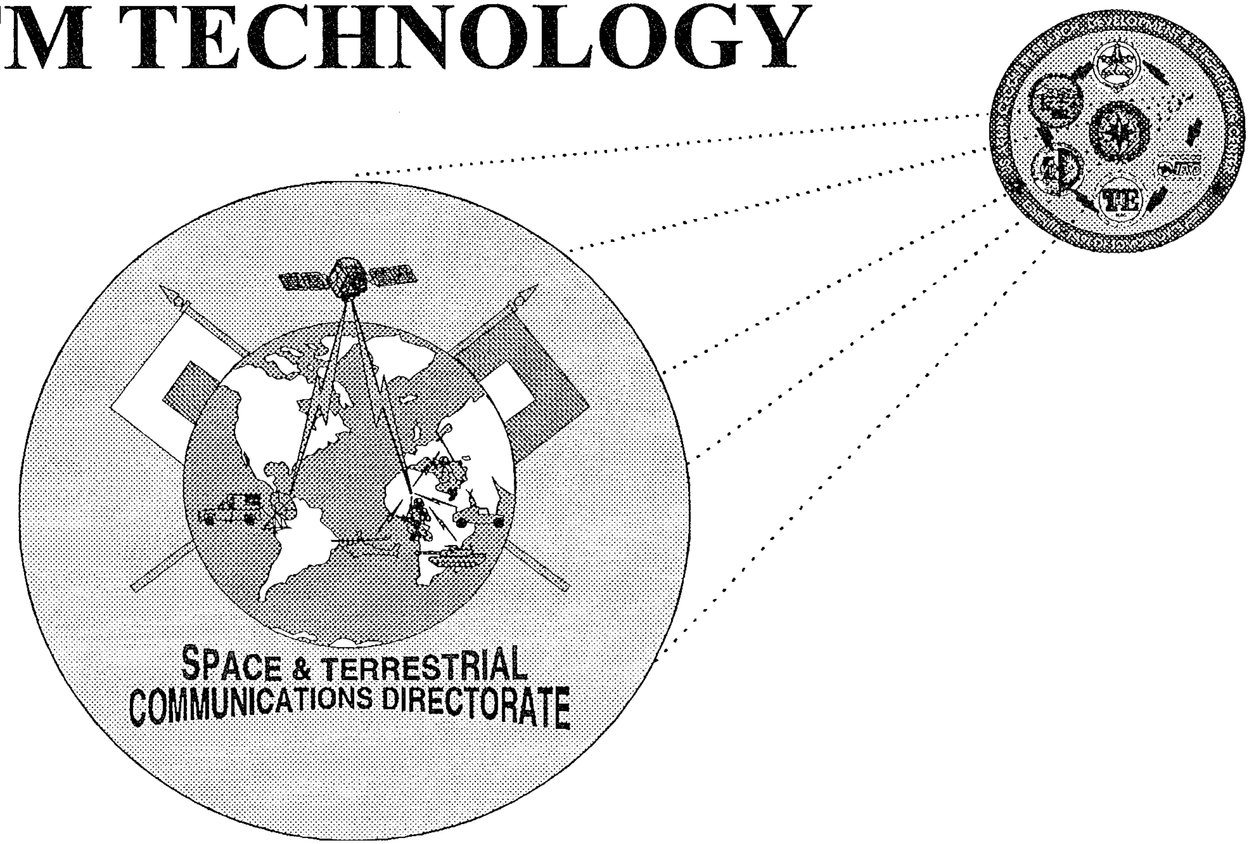
IR&D Technology Needs

- Require countermeasure techniques for fade compensation
- ATM mobile infrastructure capable of moving with the forward echelons
- Resolve cosite interference problems inherent in the RAP platform
- Stable/economical antenna configuration to support HCTR OTM operation

NOTES

TACTICAL C3 TECHNOLOGY INTEGRATION

ATM TECHNOLOGY



LARRY LEVINE

CHIEF, HIGH SPEED NETWORKS DIVISION
SPACE & TERRESTRIAL COMMUNICATONS DIRECTORATE

UNCLASSIFIED

AMSEL-RD-ST

POINT PAPER

PURPOSE: DBC Asynchronous Transfer Mode (ATM) Technology Integration Program

OBJECTIVE: To support the insertion of ATM technology into the Army's tactical wide-area communications system through a series of planned product improvements (ultimately replacing MSE with the next-generation switching system).

FACTS:

- ATM experiments conducted during Unified Endeavor in April 1995 serves as the baseline for this program. During Unified Endeavor, seven ATM switches were installed in MSE shelters, enabling MSE voice traffic to be combined with additional data traffic over the existing MSE backbone network. The additional data traffic was used to support collaborative planning and desktop video conferencing at four deployed sites.
- Emerging services and applications, including video, worldwide web servers, and collaborative planning, are beginning to be used on the battlefield. These types of services and applications are not supported by the existing MSE system.
- ATM technology has the potential to support these and other wideband services desired by the warfighter. ATM technology, however, was designed for use in low-bit-error-rate fiber optic based static networks. Effective use of ATM technology in a tactical environment will therefore require that a number of key areas be addressed. These include forward error collection (FEC), low-rate survivable protocols, bandwidth allocation, signaling, and wireless ATM.

BRIEFER: Larry Levine, Chief, High Speed Networks Division, Space & Terrestrial Communications Directorate, AMSEL-RD-ST-HS, (908) 427-4506.

RELEASED By: Barry S. Salis
Barry Salis
Deputy Director
Space & Terrestrial
Communications Directorate

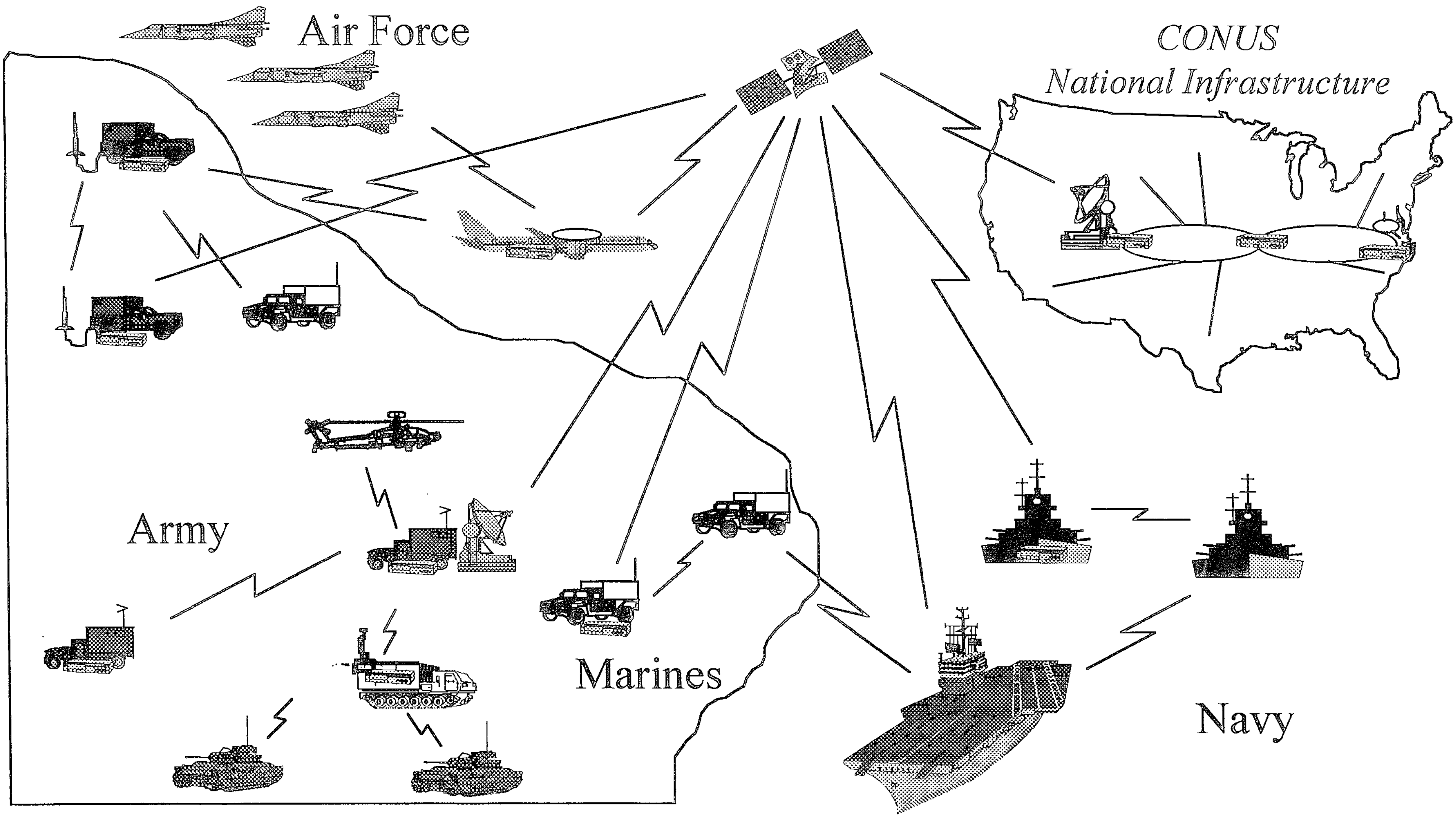
ACTION OFFICER:
Larry Levine
Chief, High Speed Networks Div.
Space & Terrestrial
Communications Directorate

ATM TECHNOLOGY

Objectives

- Leverage commercial technology wherever feasible
- Address tactical communications not addressed by commercial industry objectives
  - ➢ Forward Error Correction
  - ➢ Network Management
  - ➢ Survivable Protocols
- Develop enhancements to commercial products for integration/operation in a tactical environment
- Coordinate and synchronize research being done in each service to address the common areas jointly

Joint ATM Architecture



ATM TECHNOLOGY

Approach

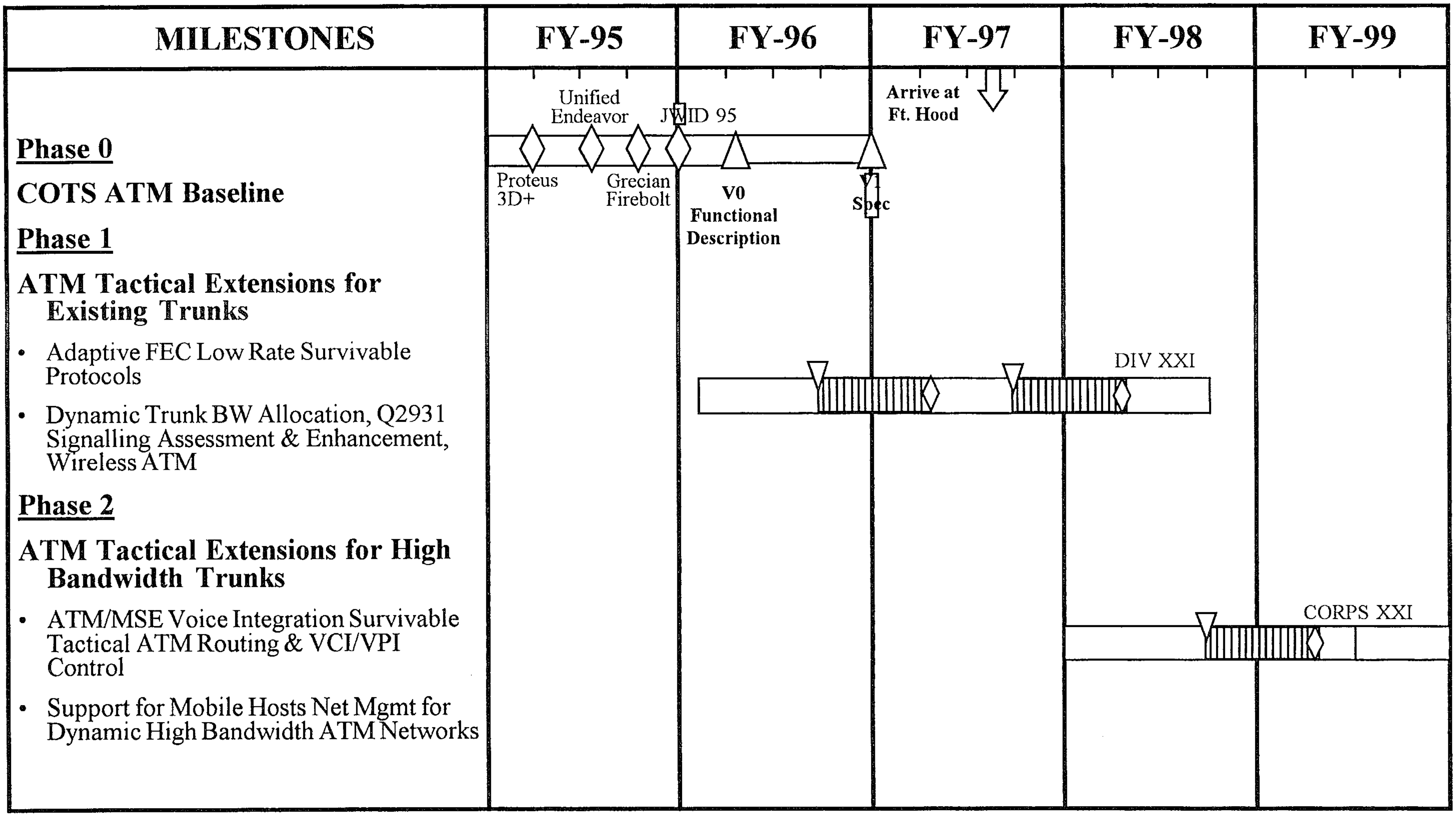
- Address the issues of using ATM in a tactical environment that are common to all of the services
- Ensure that service-unique communications platforms interoperate in Joint global communications architecture
- Leverage commercial products to minimize development time of tactical systems
- Perform Joint ATM testing over JADE/DISN LES networks

ATM TECHNOLOGY
Application/Transition

FUNCTION:	Provide capability for additional services over MSE such as video teleconferencing by providing better utilization of existing bandwidth
APPLICATION:	The Army ATM program will feed into the development of the next generation Army Common User System (ACUS)
RECEIVING ORG:	PM JTACS
TRANSITION:	Baseline - FY96 Enhanced - FY98 Final Spec - FY99

ATM Technology Integration Program

- Train, Install
- Development
- Leave Behind



ATM TECHNOLOGY

Technology Challenges

- Tactical environment subject to lower bandwidth, lower quality (10-5 BER), and higher latency links than commercial environment
- Tactical interfaces not currently compatible with network interfaces being developed by ATM standards bodies
- Commercial ATM does not provide military precedence/priority, accountability, or security features
- Tactical networks are more dynamic than commercial networks due to mobility requirements

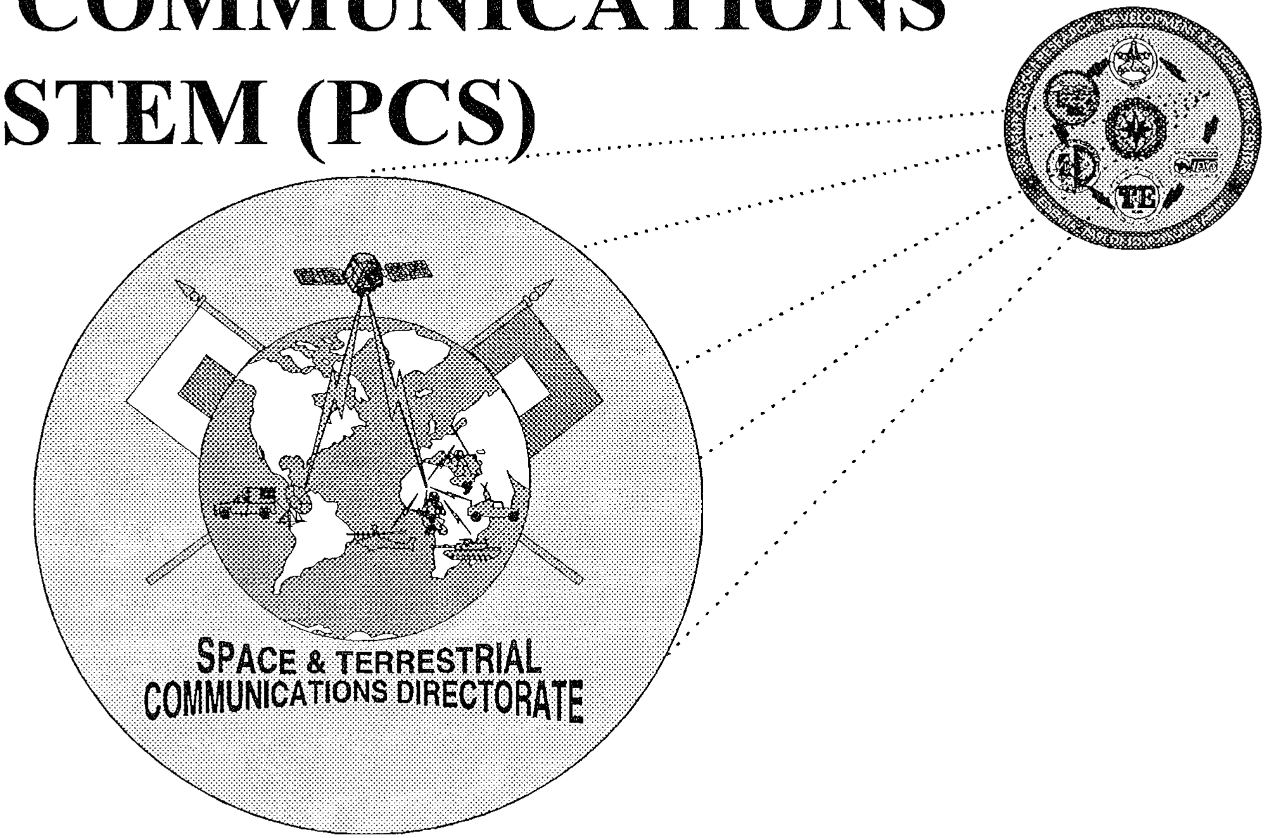
ATM TECHNOLOGY

IR&D Technology Needs

- Adaptive FEC and low rate survivable protocols
- Dynamic bandwidth allocation of tactical communications
- Wireless ATM to support mobile hosts
- ATM Voice Integration to tactical environment
- ATM Network Management
- ATM Networking Protocols

NOTES

PERSONAL COMMUNICATIONS SYSTEM (PCS)



DR. HOWARD WICHANSKY
CHIEF, ADVANCED WIRELESS TECHNOLOGY BRANCH
SPACE & TERRESTRIAL COMMUNICATIONS DIRECTORATE

UNCLASSIFIED

AMSEL-RD-ST

POINT PAPER

SUBJECT: Terrestrial Personal Communications Systems (PCS)

PURPOSE: To define the feasibility and benefits of emerging communications technologies for Army applications with specific emphasis on personal communications systems (PCS). Demonstrate capability with legacy systems, Mobile Subscriber Equipment, for Task Force XXI (TFXXI) and Corps XXI.

FACTS:

- The Advanced Research Projects Agency (ARPA)) funded Commercial Communications Technology Testbed (C2T2) program performed a market survey in FY93 to identify available PCS technology for dismounted infantry.
- The Ericsson trunked Land Mobile Radio (LMR) system was identified and selected as the first system to be evaluated.
- The second will be Hybrid PCS.

BRIEFER: Joseph A. Staba, Project Leader, Space & Terrestrial Communications Directorate, AMSEL-RD-ST-WL-EW, (908) 427-3988.

RELEASED By: Barry S. Salis
Barry Salis
Deputy Director
Space & Terrestrial
Communications Directorate

ACTION OFFICER
Joseph A. Staba
Project Leader
Space & Terrestrial
Communications Directorate

AMSEL-RD-ST

POINT PAPER

SUBJECT: Satellite Personal Communications Systems

PURPOSE: To leverage and exploit emerging commercial satellite-based personal communications systems (PCS). Demonstrate these capabilities via both the eventual satellite system and airborne relay packages prior to the availability of the commercial satellite. The full satellite PCS capability will be integrated with the Radio Access Point (RAP) as part of the Digital Battlefield Communications (DBC) Advanced Technology Demonstration (ATD) program.

FACTS:

- The commercial communications industry is developing several candidate solutions for providing global PCS capability.
- These candidate systems typically employ a relatively large number of low-earth-orbiting (LEO) or medium-earth-orbiting (MEO) satellites. These systems will provide the user with a worldwide cellular telephone service.
- The system design allows small handheld portable phones to place calls worldwide despite the location of the user.

BRIEFER: Dennis Peras, Project Leader, Space & Terrestrial Communications Directorate, AMSEL-RD-ST-SY-TE, (908) 532-6191.

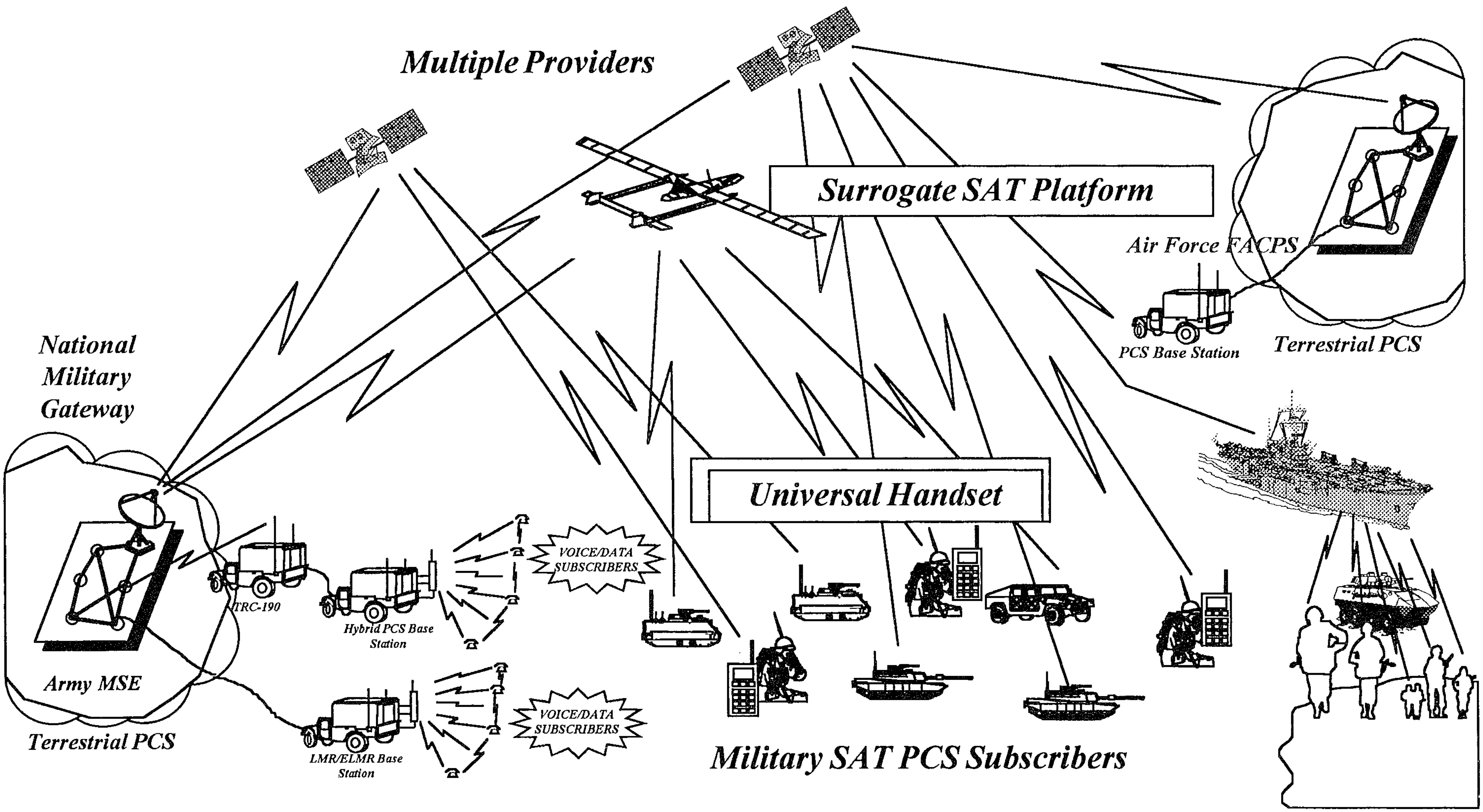
RELEASED By: Barry S. Salis
Barry Salis
Deputy Director
Space & Terrestrial
Communications Directorate

ACTION OFFICER
Dennis Peras
Project Leader
Space & Terrestrial
Communications Directorate

PERSONAL COMMUNICATIONS SYSTEM
Objectives

- Develop PCS technology, building on commercial advances, to provide mobile users with data capability ranging from 75bps to 125kbps over terrestrial link ranges up to 18 km (cell radius)
- Increase user population density through use of PCS waveforms (i.e., CDMA/TDMA)
- Investigate ultra-wide spreading techniques to achieve high degree of LPI/AJ
- Develop Universal Handset to utilize in a terrestrial and satellite infrastructure capable of interfacing to multiple service providers
- Integrate Type I encryption into PCS
- Develop Military Gateway to establish required paths to link multiple providers

PERSONAL COMMUNICATIONS SYSTEM (PCS)



PERSONAL COMMUNICATIONS SYSTEM

Approach

TERRESTRIAL:

- Trade off studies have been awarded (FY-95)
- Land Mobile Radio (LMR) Testing Warrior Focus 1Q96
- LMR Surrogates to be integrated/tested in TF XXI 3Q96
- MSE Interface DIL Testing 2Q96
- PCS integration/testing 1Q97 prior to DIV XXI insertion.

PERSONAL COMMUNICATIONS SYSTEM
Approach

SATELLITE:

- Leverage developing satellite systems.
- Develop concept for use of Satellite PCS on Battlefield.
- Demonstrate technology and utility on the battlefield.
- Develop universal handset for use with multiple systems.

PERSONAL COMMUNICATIONS SYSTEM

Application/Transition

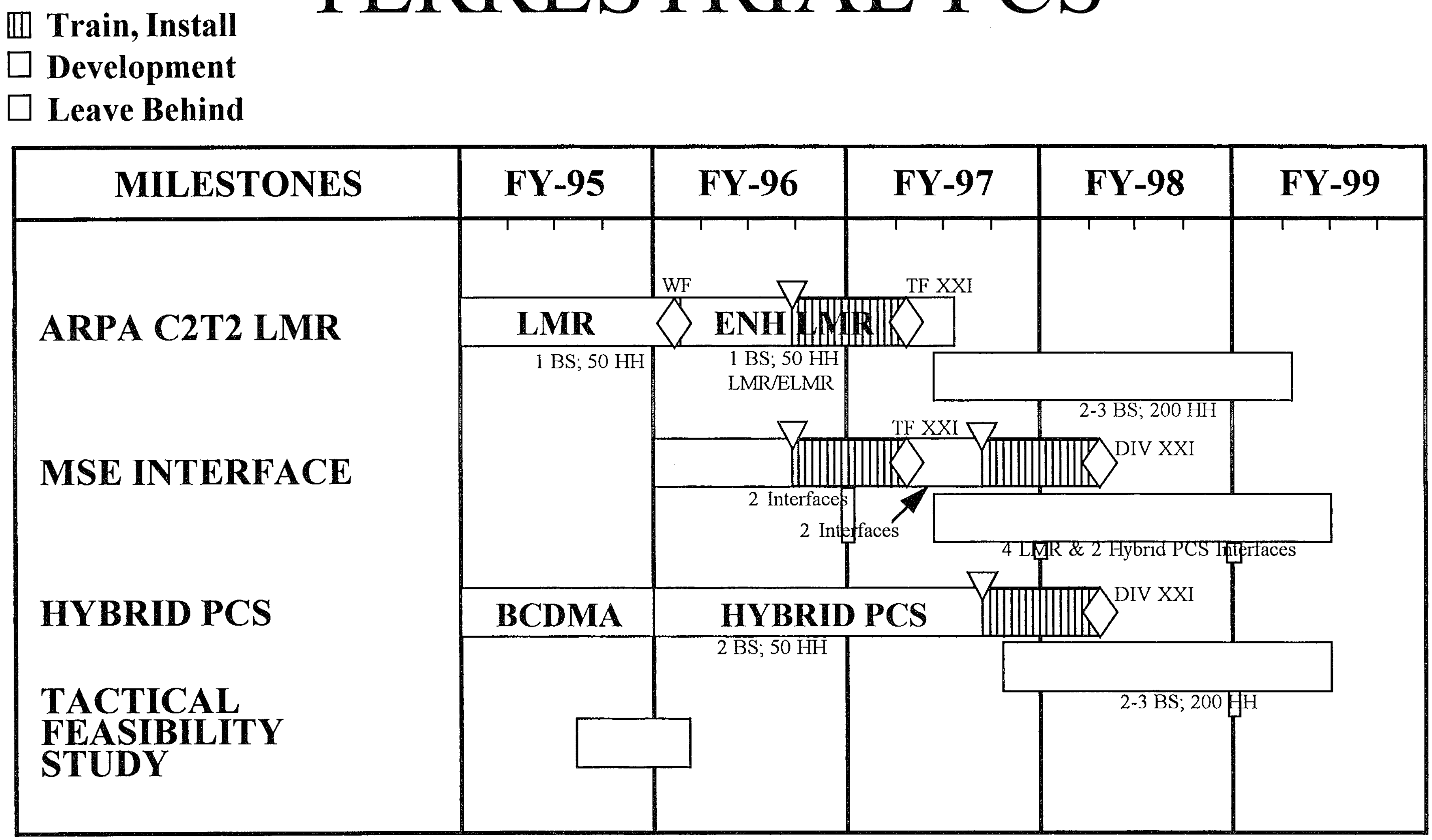
FUNCTION: (1) Wireless PBX to provide Local Loop Connection to MSE Telephone Subscribers
(2) Increase the survivability of Cellular Communications Architecture via Distributed Cellular Control
(3) Utilize commercial PC's to supplement/replace MSE RAU

APPLICATION: Elimination of Wired Connections and use of commercial
Satellite PCS is part of the new MILSATCOM architecture
RAU replacement using PCS Technology

RECEIVING ORG: PM JTACS for Terrestrial PCS
PM SATCOM for Satellite PCS

TRANSITION: Terrestrial: FY2000
Satellite: TBD (COTS Dependent)

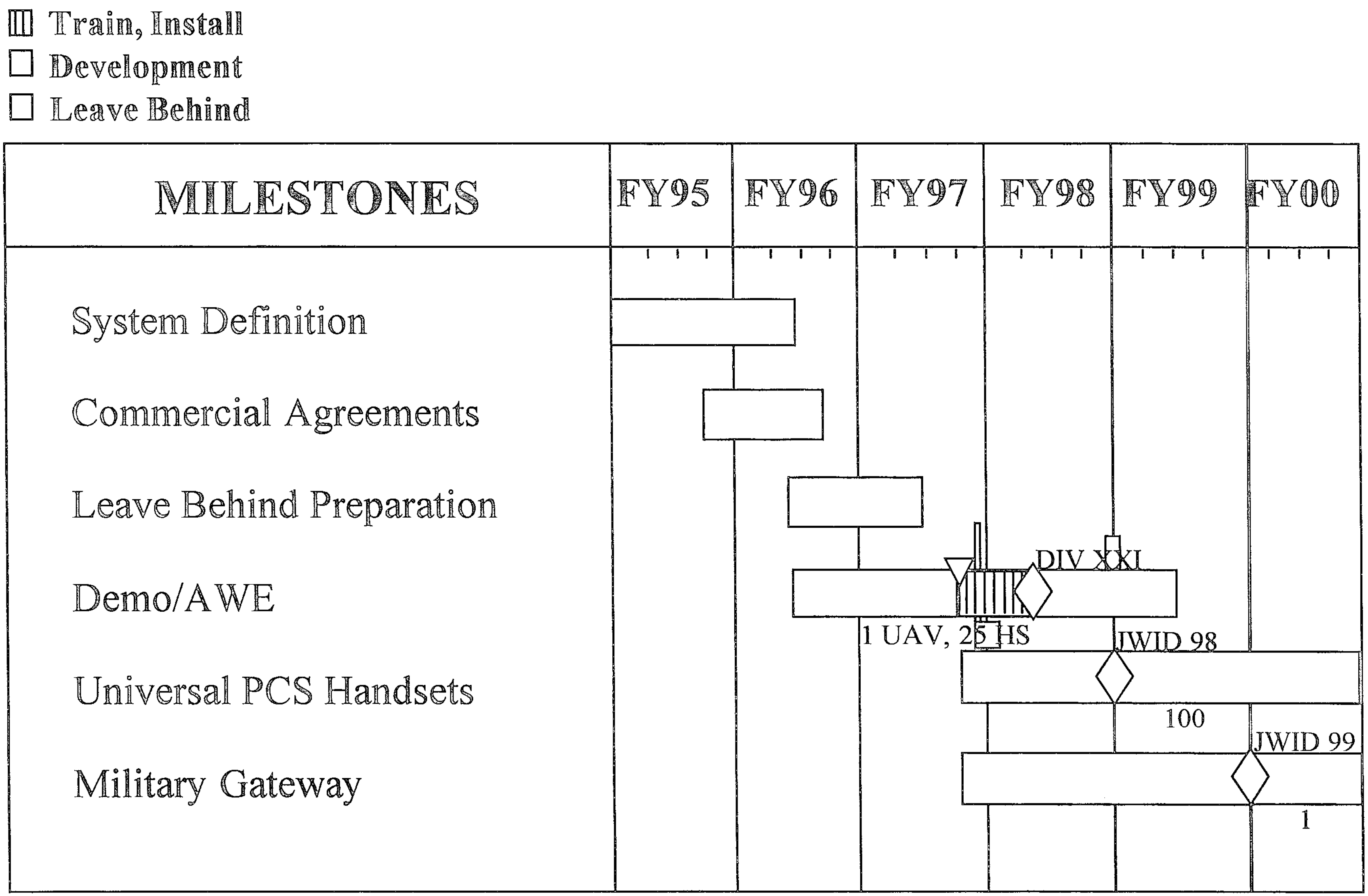
TERRESTRIAL PCS



ELMR = Enhanced LMR
HH = Hand Held

BCDMA = Broadband CDMA
BS = Base Station

SATELLITE PCS



PERSONAL COMMUNICATIONS SYSTEM
Technology Challenges

- Devise required technology to expand commercial PCS which is based on fixed infrastructure to support mobile PCS with dynamic protocols and down sized base station
- Develop interfaces to yield seamless connectivity between commercial and Legacy system
- Overcome vulnerabilities of commercial waveforms to achieve LPI/AJ and robust access schemes

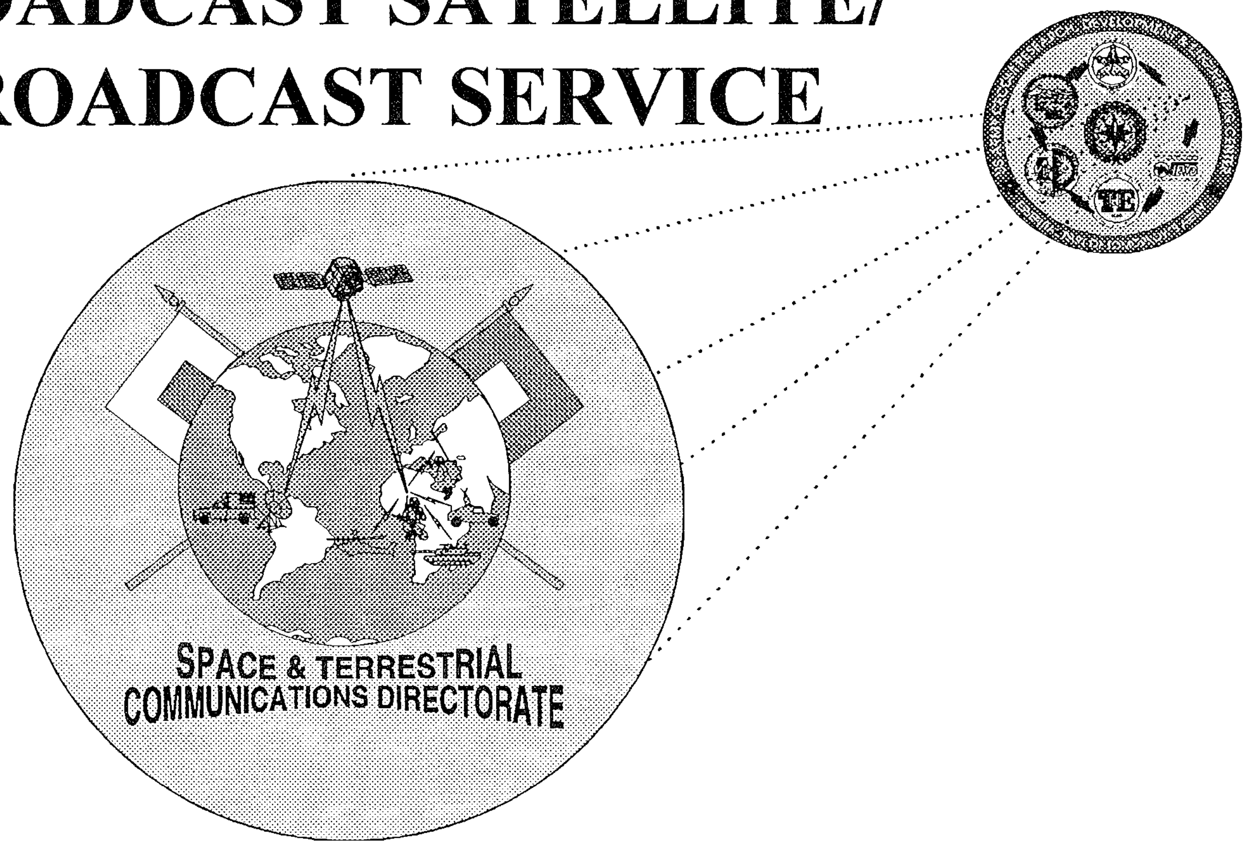
PERSONAL COMMUNICATIONS SYSTEM
IR&D Technology Needs

- Assure compatibility of Type I INFOSEC techniques in response to inadequate security of commercial based PCS systems
- Satisfy technical demands for a Universal Handset:
  - Merge various LEOS receive systems
  - Extend battery life
  - RF front-end for multimode operation
- Development for UAV platforms
  - Antennas
  - Transponder
  - Switch
- Develop compatible switching and protocol concepts for military gateway

NOTES

SATELLITE COMMUNICATIONS (SATCOM)

DIGITAL BROADCAST SATELLITE/ GLOBAL BROADCAST SERVICE



JEFFREY OZIMEK

CHIEF, SYSTEMS & TECHNOLOGY DIVISION

SPACE & TERRESTRIAL COMMUNICATIONS DIRECTORATE

UNCLASSIFIED

AMSEL-RD-ST

POINT PAPER

SUBJECT: Direct Broadcast Satellite (DBS)

PURPOSE: To develop and demonstrate a high-data-rate broadcast capability to small, inexpensive satellite receivers.

FACTS:

- The DBS program shares a high-degree of synergism with other CECOM programs.
- The DBS will be integrated with Common Ground Station demonstrations.
- DBS is a key element of the Digital Battlefield Communications (DBC) Advanced Technology Demonstration (ATD) program, and is a capability offered by the Battlefield Information Transmission System (BITS).
- The DBS airborne relay will be derived from the CECOM airborne relay project.
- The CECOM phased-array antenna program will be a source of enabling technology of the DBS OTM demonstrations.
- The Army's activities are intended to aid in identifying user needs and will be done in close coordination with the joint DBS working group now being formed.

BRIEFER: Gary Blohm, Project Leader, Space & Terrestrial Communications Directorate, AMSEL-RD-ST-SI, (908) 532-6272.

RELEASED By: Barry S. Salis
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Space & Terrestrial
Communications Directorate

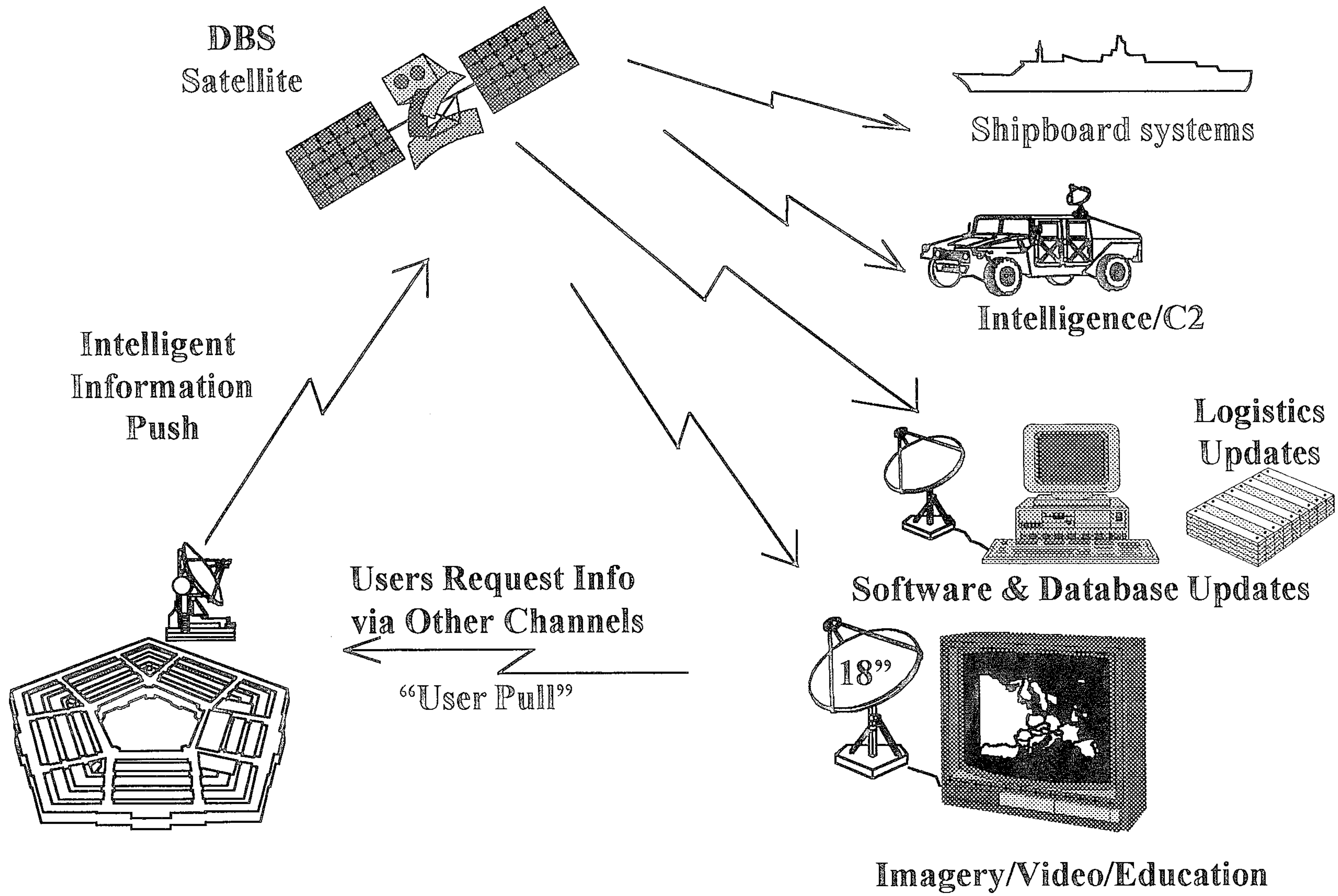
ACTION OFFICER:
Gary Blohm
Project Leader
Space & Terrestrial
Communications Directorate

Direct Broadcast Satellite (DBS)/ Global Broadcast Service (GBS)

Objectives

- To provide a means of high speed data dissemination to the global warrior
- To develop applications and concepts that enable the services to influence future joint GBS system design
- To evaluate the application of low cost commercial technology to military GBS needs

Direct Broadcast Satellite



Direct Broadcast Satellite

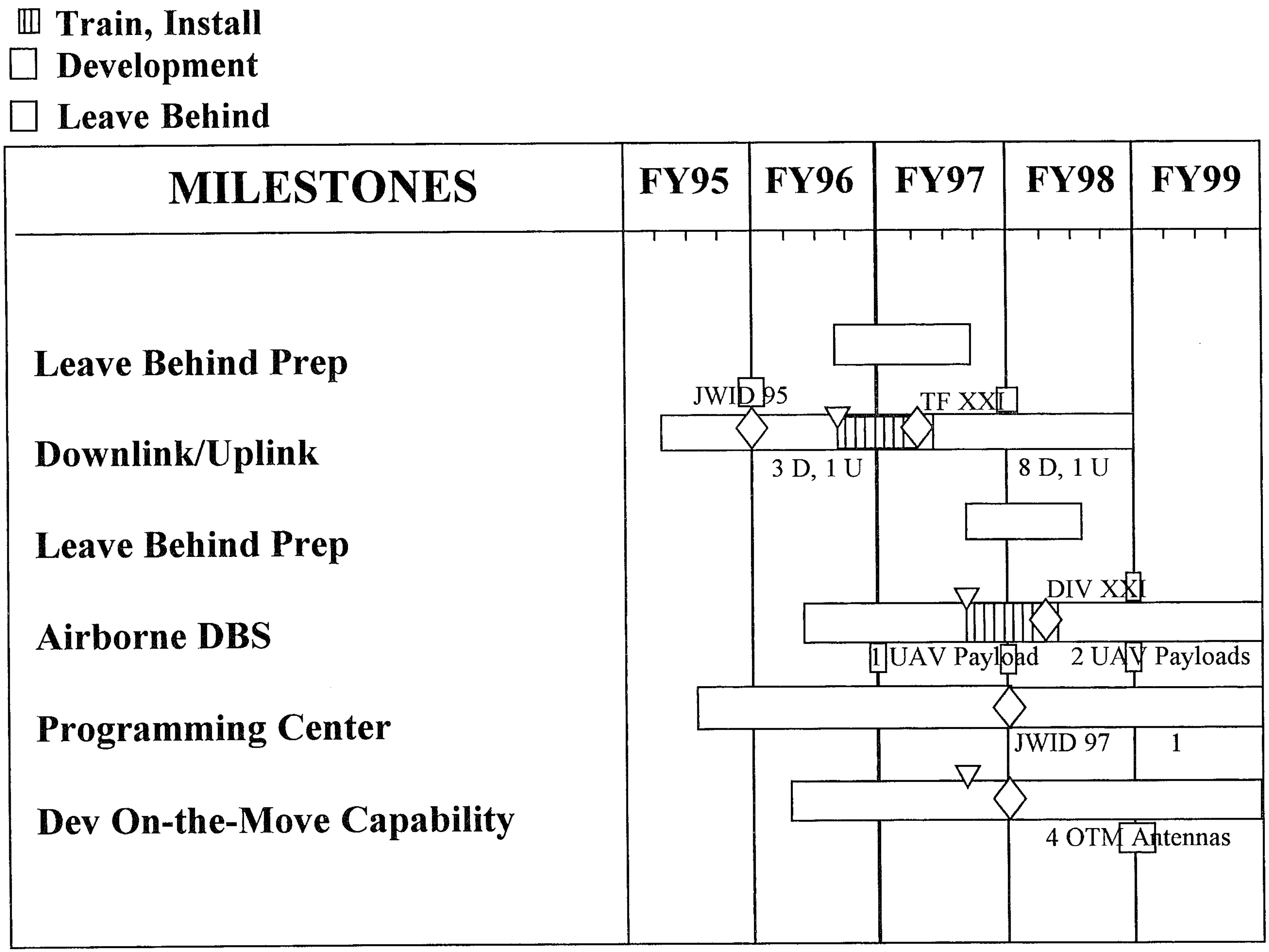
Approach

- Utilize DBS technology in TFXXI AWE to demonstrate/experiment with capability in field environment.
- Identify Army sources of broadcast information and integrate with other systems on Digitized Battlefield.
- Start investigation of an on-the-move receive capability.

Direct Broadcast Satellite
Application/Transition

- FUNCTION: Provide a wideband broadcast capability to the tactical commander. Broadcast data to include Intelligence, Imagery, Logistics, Training, etc.
- APPLICATION: The Army DBS program will feed into the development of the DoD Global Broadcast Service (GBS) program.
- RECEIVING ORGANIZATION: GBS will be a new start, joint program.
- TIME FRAME: Joint RFP development to start as soon as Oct 96. Awaiting OSD approval.

Army Direct Broadcast Satellite (DBS)



Global Broadcast Service
Technology Challenges

- To address worldwide coverage deficiencies
  - ➢ Airborne broadcast payloads
- Small low cost receivers
  - ➢ Frequency band of operation
  - ➢ Antenna technology
  - ➢ Commercial technology application

Global Broadcast Service

Technology Challenges (Cont.)

- Information management
  - ➢ Data base location and distribution
  - ➢ Data interchange protocols and processes
  - ➢ Intelligent push and user pull
  - ➢ Data authentication
  - ➢ Programming center for bandwidth and time management
- Security and encryption
  - ➢ Key distribution
  - ➢ Synchronization techniques
  - ➢ Hostile access denial

Global Broadcast Service

IR&D Technology Needs

- Airborne Payloads
  - Integrated airborne "Bent-Pipe" transponder (approx. 36 Mhz bandwidth)
  - Airborne uplink high gain receive antenna
  - Airborne downlink hemispherical transmit antenna
- Low cost, low noise amplifiers with block downconverter at X-band and KA band
- Antennas for ground mobile vehicles
  - Pointing system for 2ft dia. dish
  - Low cost flat panels
- Antenna for airborne platform reception from satellite
  - Low cost flat panels
  - "Hatch mount"

Global Broadcast Service

IR&D Technology Needs (Cont.)

- Information management techniques
  - Intelligent agents
  - Protocols for data requests
  - Protocols for data dissemination
- Automated programming center (Anchor desk)
- Methods to determine if the receiver is in friendly or hostile hands
- Crypto sync process for broadcast
  - Account for planned/unplanned net entry
  - Recovery from equipment failures

NOTES

SESSION III

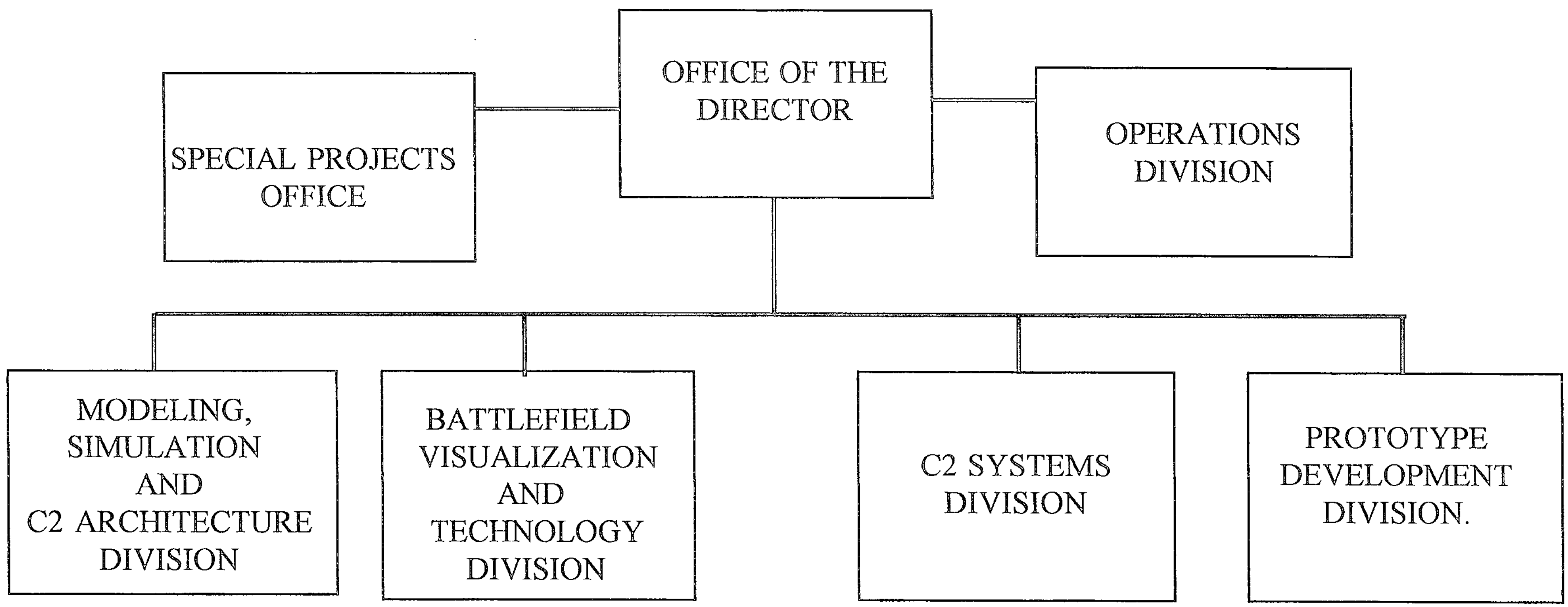
COMMAND, CONTROL (C2) AND SYSTEMS INTEGRATION TECHNICAL PROGRAMS

STRATEGY AND OVERVIEW

GEORGE OLIVA
ACTING DIRECTOR
COMMAND, CONTROL & SYSTEMS
INTEGRATION DIRECTORATE

UNCLASSIFIED

COMMAND / CONTROL AND SYSTEMS INTEGRATION DIRECTORATE



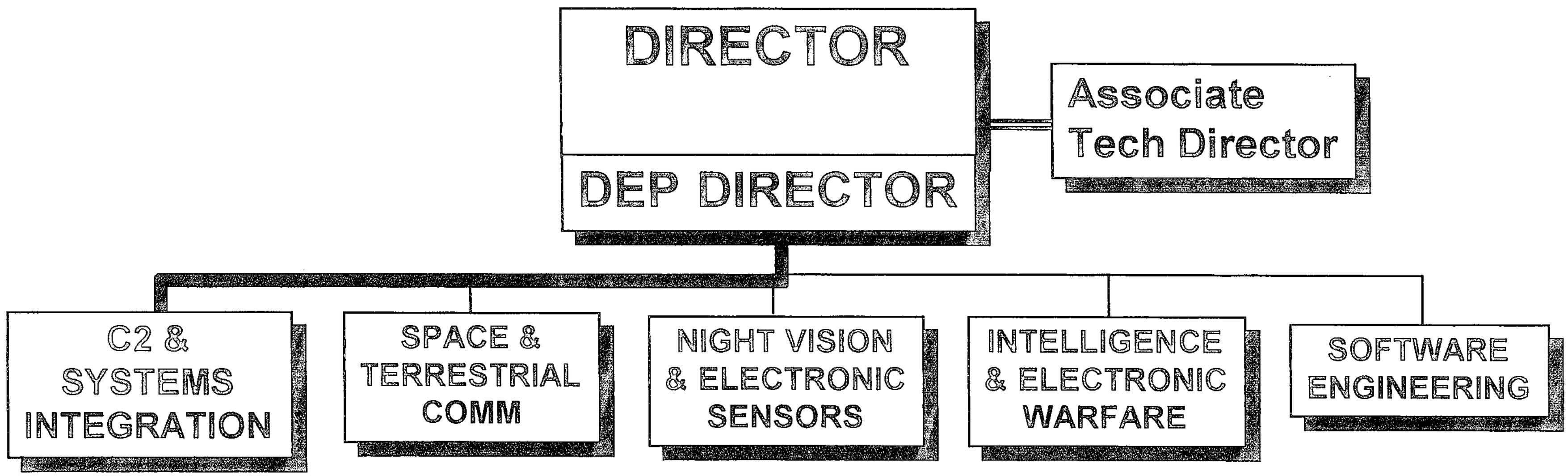
TOTAL PERSONNEL
411

COMMAND / CONTROL AND SYSTEMS INTEGRATION DIRECTORATE

Major Missions

- BATTLEFIELD VISUALIZTION/MISSION PLANNING
- COMBINED ARMS COMMAND & CONTROL/BATTLESPACE COMMAND & CONTROL
- MODELING AND SIMULATION
- TOTAL DISTRIBUTION/JOINT LOGISTICS ACTD
- BATTLEFIELD AWARNESS & DATA DISEMINATION
- SOLDIER COMMAND & CONTROL
- PRECISION NAVIGATION/GPS
- VOICE TECHNOLOGY
- PLATFORM SYSTEM INTEGRATION TO INCLUDE: AIRCRAFT, SHELTERS, VEHICLES, AND THE SOLDIER
- TACTICAL POWER GENERATION AND ENVIRONMENTAL CONTROL

Research, Development & Engineering Center

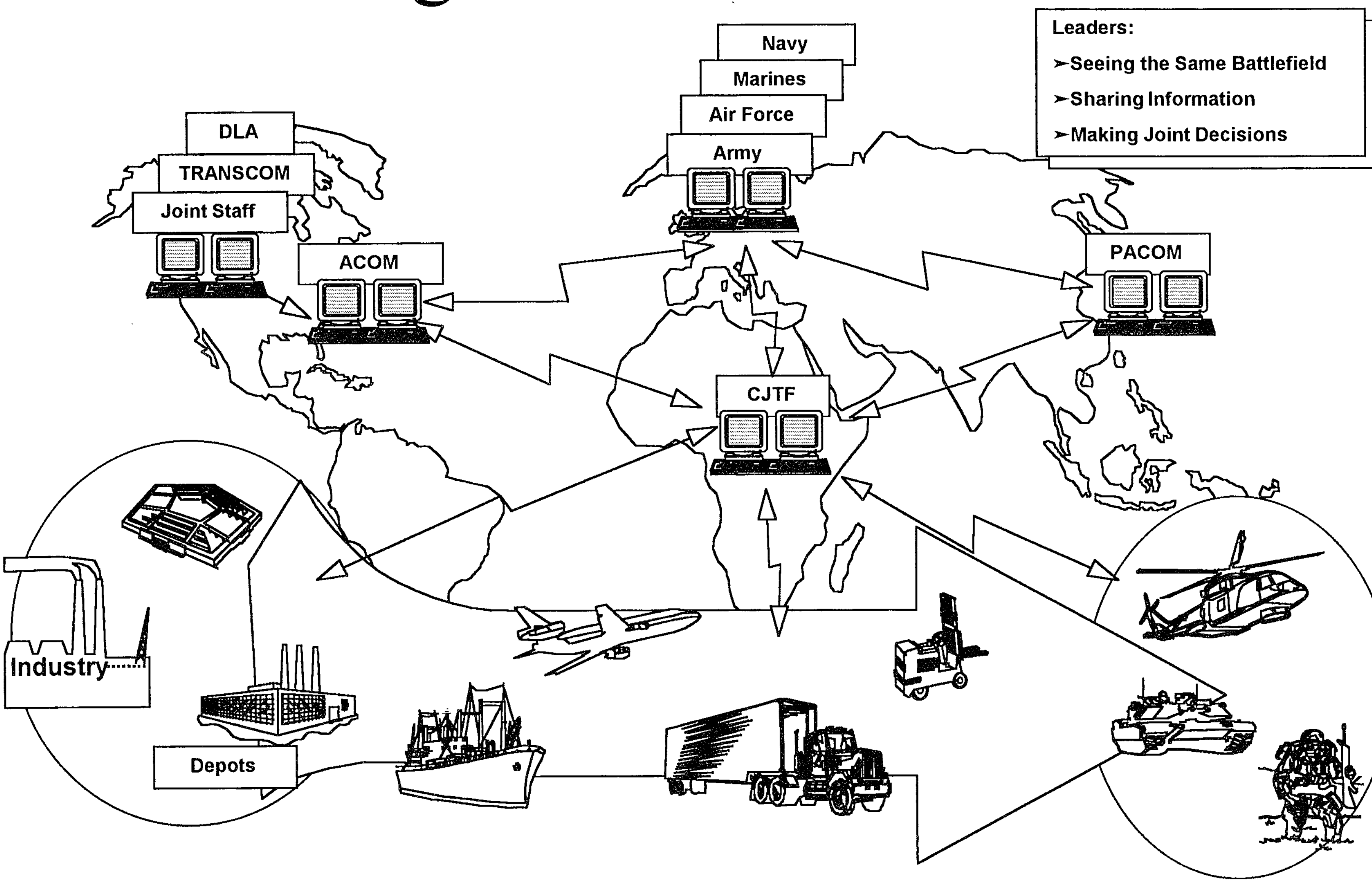


Size of Organization	411
Value of Operating Budget	$74M Annually *
Number & Value of Contracts	61 ; $57.0M

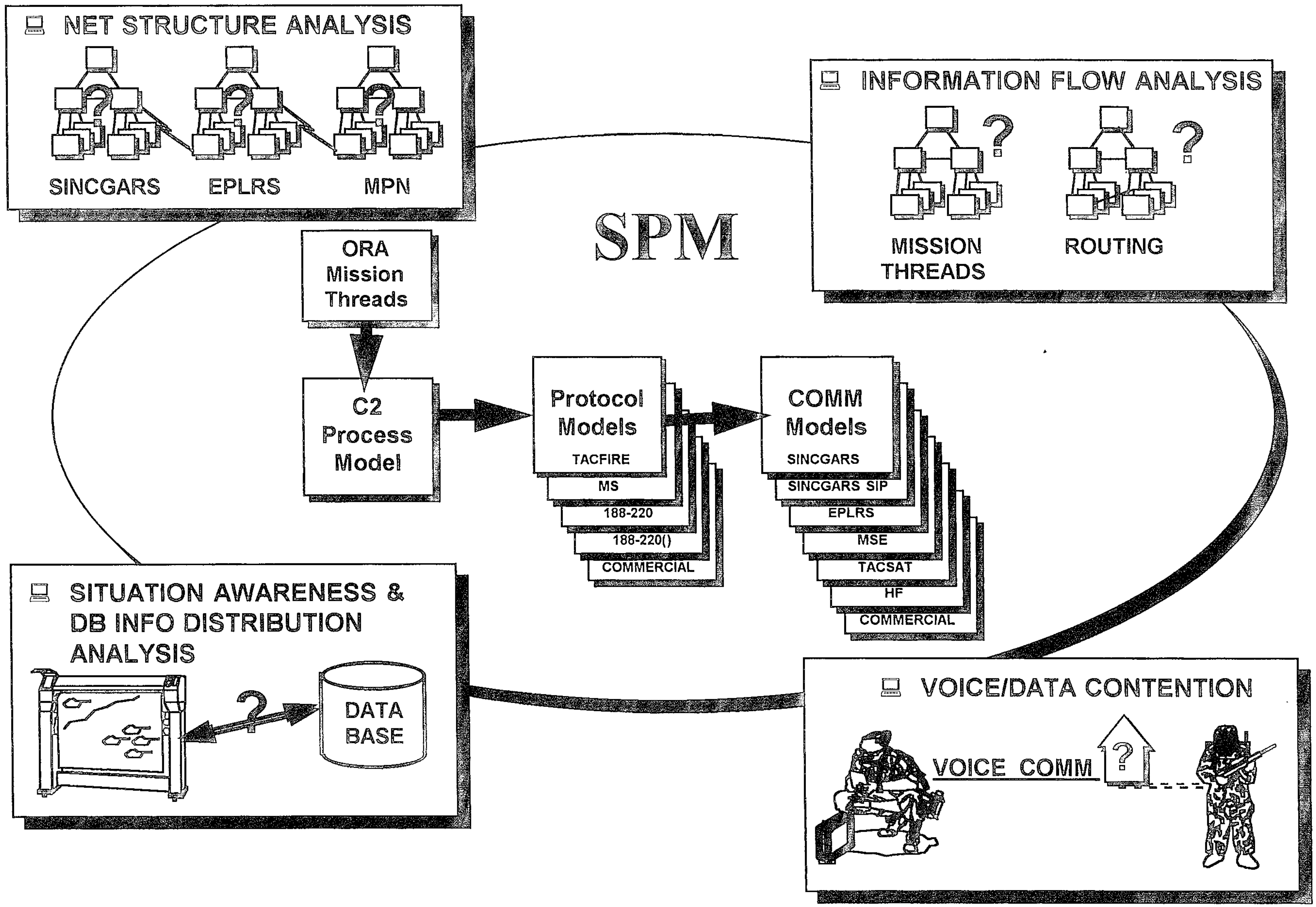
* Includes R&D Mission, SOF, OMA, ARPA and Reimb.

Note: ***Value will extend to Billions when taken into Production Deployment phase by PEOs.***

Joint Logistics ACTD Schematic



Systems Performance Modeling



COMMAND AND CONTROL SYSTEMS INTEGRATION BRIEFINGS TODAY

PROGRAM BRIEFS:

TACTICAL AUTOMATION
- BATTLE PLANNING
- LOGISTICS COMMAND AND CONTROL

AVIATION INTEGRATION TECHNOLOGY
- NAVIGATION TECHNOLOGY
- MISSION REHEARSAL
- INTERACTIVE SPEECH RECOGNITION

TACTICAL POWER
- FUEL CELLS

NOTES

TACTICAL AUTOMATION

BATTLE PLANNING

HAL GORMAN
PROJECT ENGINEER
COMMAND, CONTROL SYSTEMS INTEGRATION DIRECTORATE

UNCLASSIFIED

AMSEL-RD-AS-TD

POINT PAPER

SUBJECT: Battle Planning and Visualization

OBJECTIVE: The Battle Planning effort will develop, integrate and demonstrate emerging technologies to significantly enhance battlespace visualization and enable collaborative planning, rehearsal, execution and monitoring (including real-time intelligence/operations) on the digital battlefield. The focus is on the commander's interface to the battlespace and the embedded software "tools" which will allow the commander and his staff to collaborate electronically in a rapid and effective manner.

FACTS:

- The capabilities will enable the commander to quickly grasp the situation and react to the dynamically changing battlespace.
- By FY99 demonstrate a fully integrated capability to allow the commander and staff to perform end-to-end collaboration to include: split based operations, course of action evaluation aids, hands-off user interface using "natural language" speech input and real-time 3D depiction of the battlefield.

CECOM-Team Fort Monmouth established as lead for the development of all (mission planning) systems to ensure these systems are compatible with the digitized battlefield technical and operational architecture.

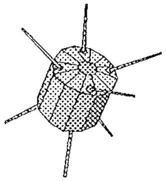
BRIEFER: Harold Gorman, Project Manager, Command, Control Systems and Integration Directorate, AMSEL-RD-C2-PA, (908) 427-4603

BATTLE PLANNING

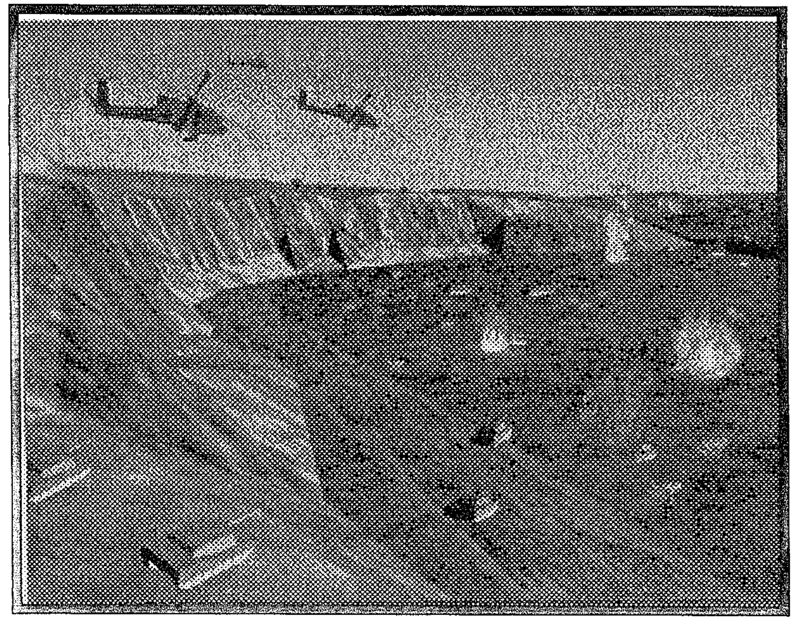
Objective

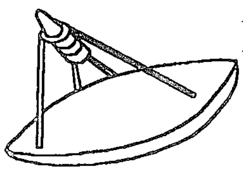
- Electronically visualize the battlespace
- Collaboratively plan, rehearse, execute and monitor the battle

BATTLE PLANNING

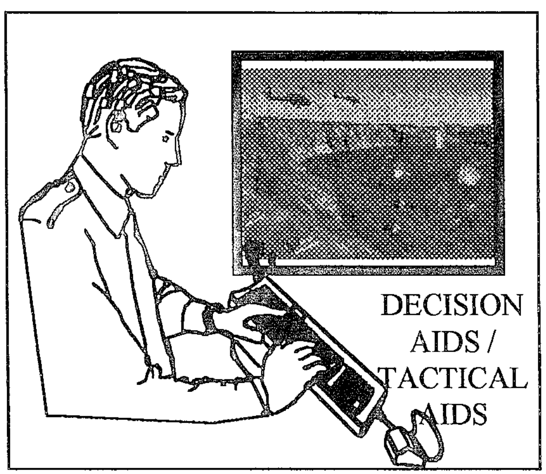


DIRECT BROADCAST
SATELLITE

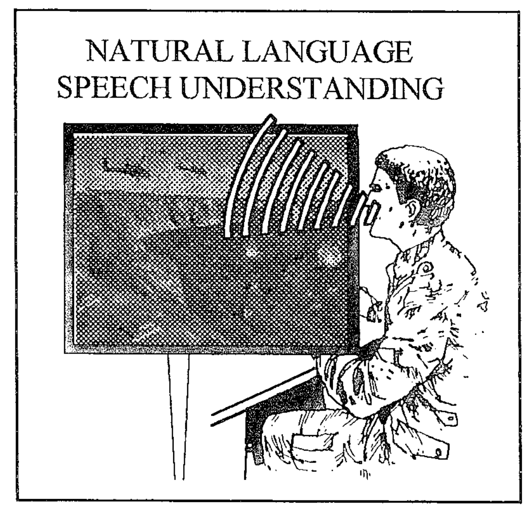




RELEVANT COMMON BATTLESPACE VISUALIZATION/
SITUATION AWARENESS, 3D PERSPECTIVE VIEWS



Focus: ***Commander / Work-station interfaces and the HW & SW tools necessary to achieve objective.***



ELECTRONIC / COLLABORATIVE
BATTLE PLANNING,
REHEARSAL, EXECUTION & MONITORING

BATTLE PLANNING

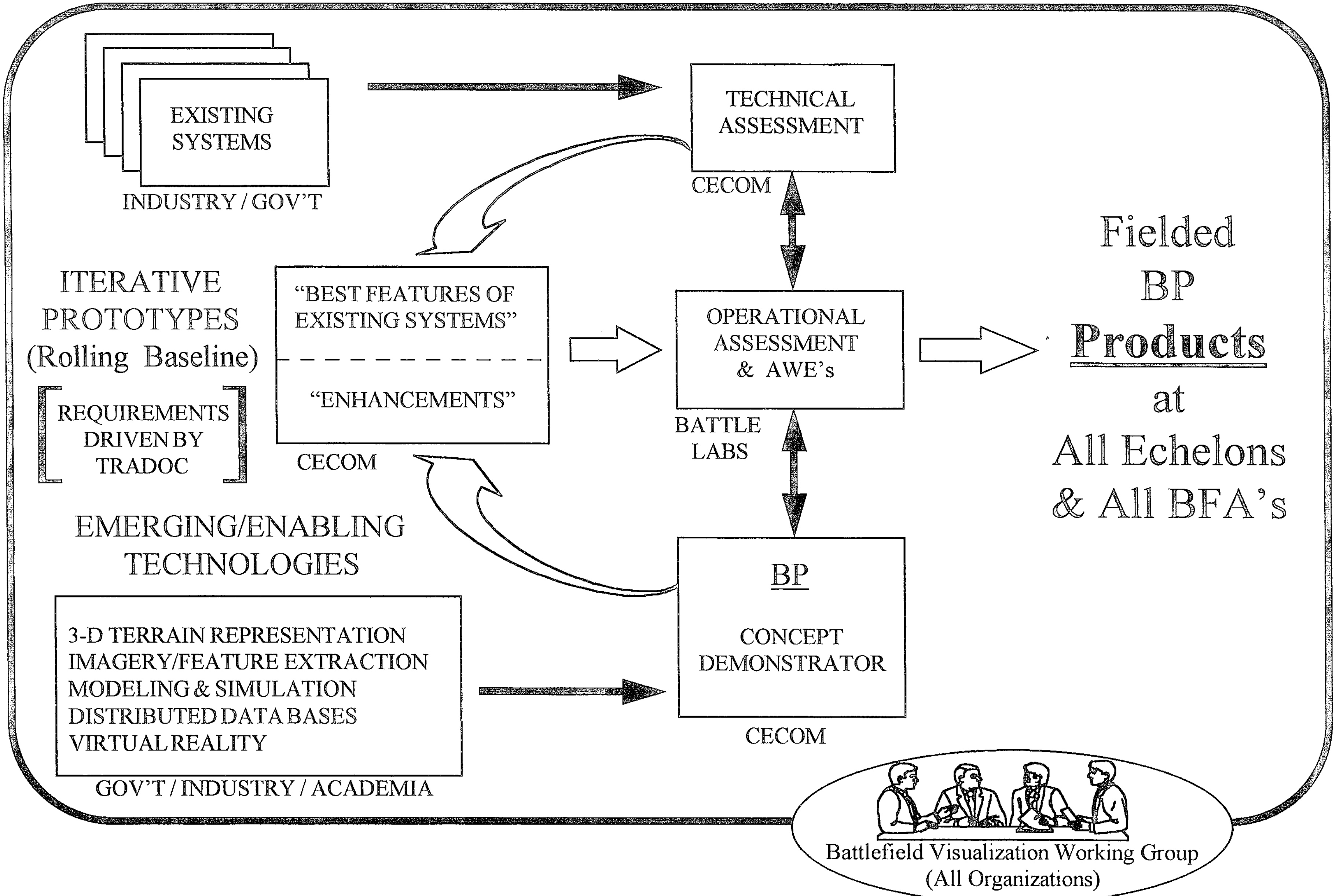
APPROACH

- Demonstrate real-time collaborative planning between the commander and his intelligence and operations staff elements.

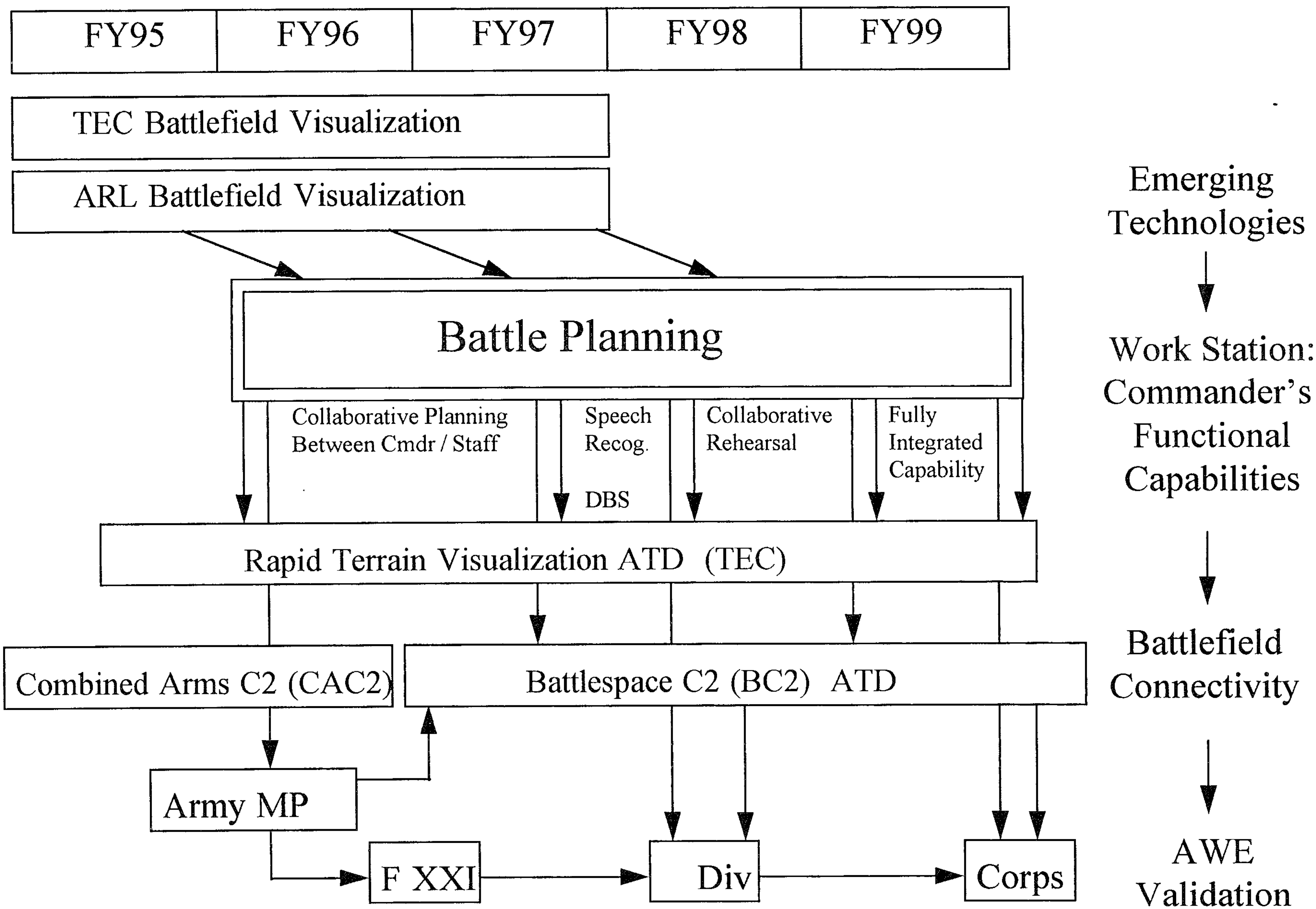
- Demonstrate capability to perform planning and near real time rehearsal, demonstrate speaker independent, continuous speech recognition and exploit direct broadcast satellite (DBS) imagery distribution.

- Demonstrate a fully integrated capability to allow the commander and staff to perform "end-to-end" collaboration to include: split based operations, course of action evaluation aids, "hands-off" user interface using "natural language" speech input, real-time 3D depiction of the battlefield and "virtual conferencing".

BATTLE PLANNING
PRODUCT DEVELOPMENT PROCESS



BATTLE PLANNING ROADMAP

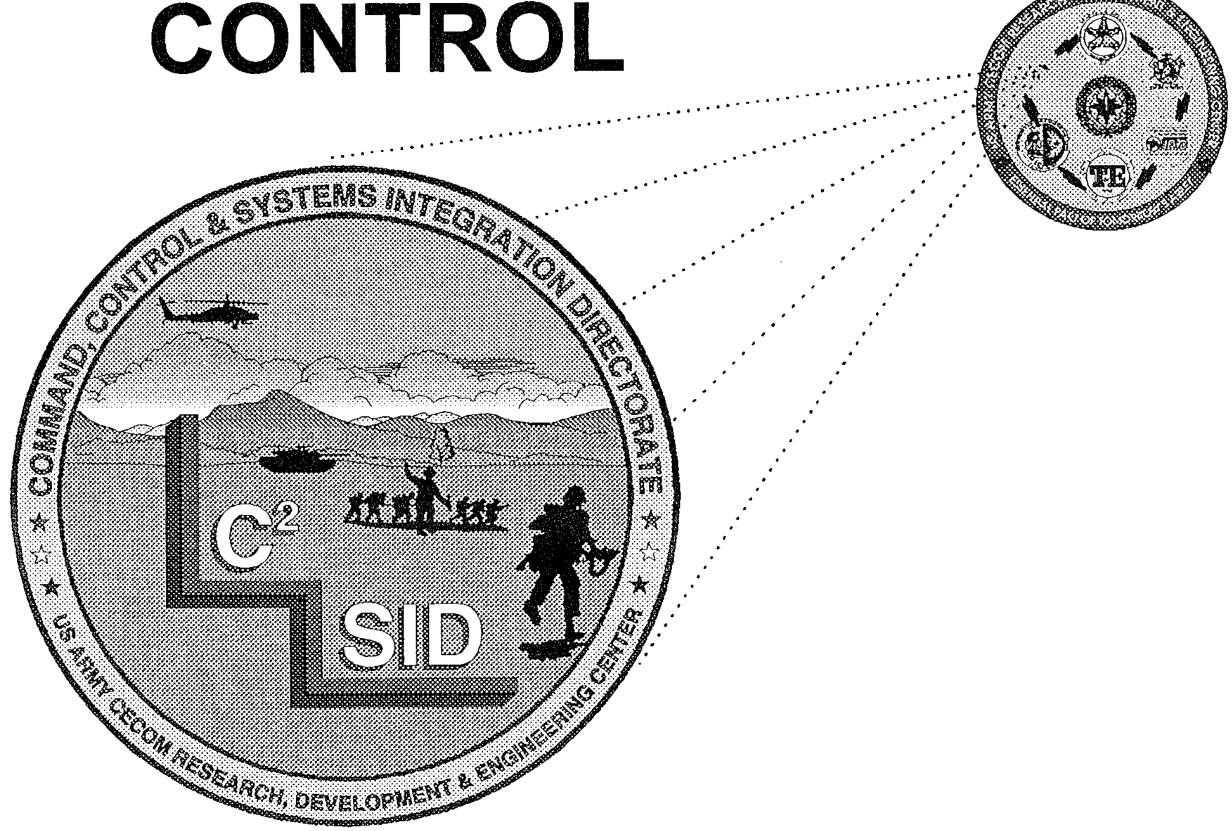


BATTLE PLANNING
TECHNOLOGY NEEDS

- Desktop Visualization capability.
- Rapid Collection of HI-Resolution Terrain and Feature Data.
- Rapid Construction of 3-D Databases / Automatic Generation of Features and Urban Areas.
- Weather Effects (Rain, Snow, Wind, Fog, Etc.).
- FLIR, I2 and Other Sensor Perspective Views.
- Distributed "push-pull" Databases to support Client/Server Architecture on the Digital Battlefield.
- Tactical Decision Aids.
- Operations on-the-move.

NOTES

LOGISTICS COMMAND & CONTROL



LTC TONY MANGANIELLO
TOTAL DISTRIBUTION ATD MANAGER
COMMAND, CONTROL SYSTEMS INTEGRATION DIRECTORATE

UNCLASSIFIED

AMSEL-RD-AS-TD

POINT PAPER

SUBJECT: Logistics Command and Control

OBJECTIVE: To provide the CINCs and Joint Task Forces with the capability to plan and execute more responsive and efficient logistics support through the networking of workstations connecting operational planners and logisticians across Services and echelons. Provide for advanced data distribution and visualization techniques to provide a common, relevant picture. Integrate existing logistics models with knowledge based tools to provide decision support.

FACTS:

- A tool for Total Asset Visibility Management, Logistics planning decision support and Monitoring and rapid replanning.
- Provides Enhanced connectivity among Services, TRANSCOM, and DLA
- Reduces logistics timeline and support costs

BRIEFER: LTC Anthony J. Manganiello, Chief, Special Projects Office, Command, Control Systems and Integration Directorate, AMSEL-RD-C2-SPO, (908) 532-0014

LOGISTICS COMMAND & CONTROL (C2)

Objective

- To provide commanders with the capability to plan and execute more responsive and efficient logistics support.
- Enhance capabilities to plan, analyze, mobilize, deploy, sustain and reconstitute materiel, personnel and forces in combat or crisis response situations.
- Reduce logistics timeline & support costs.

Logistics C2 Overview

JTF CMDR Logistics Capability

- Trans
- Asset VIS
- Decision Support

Joint

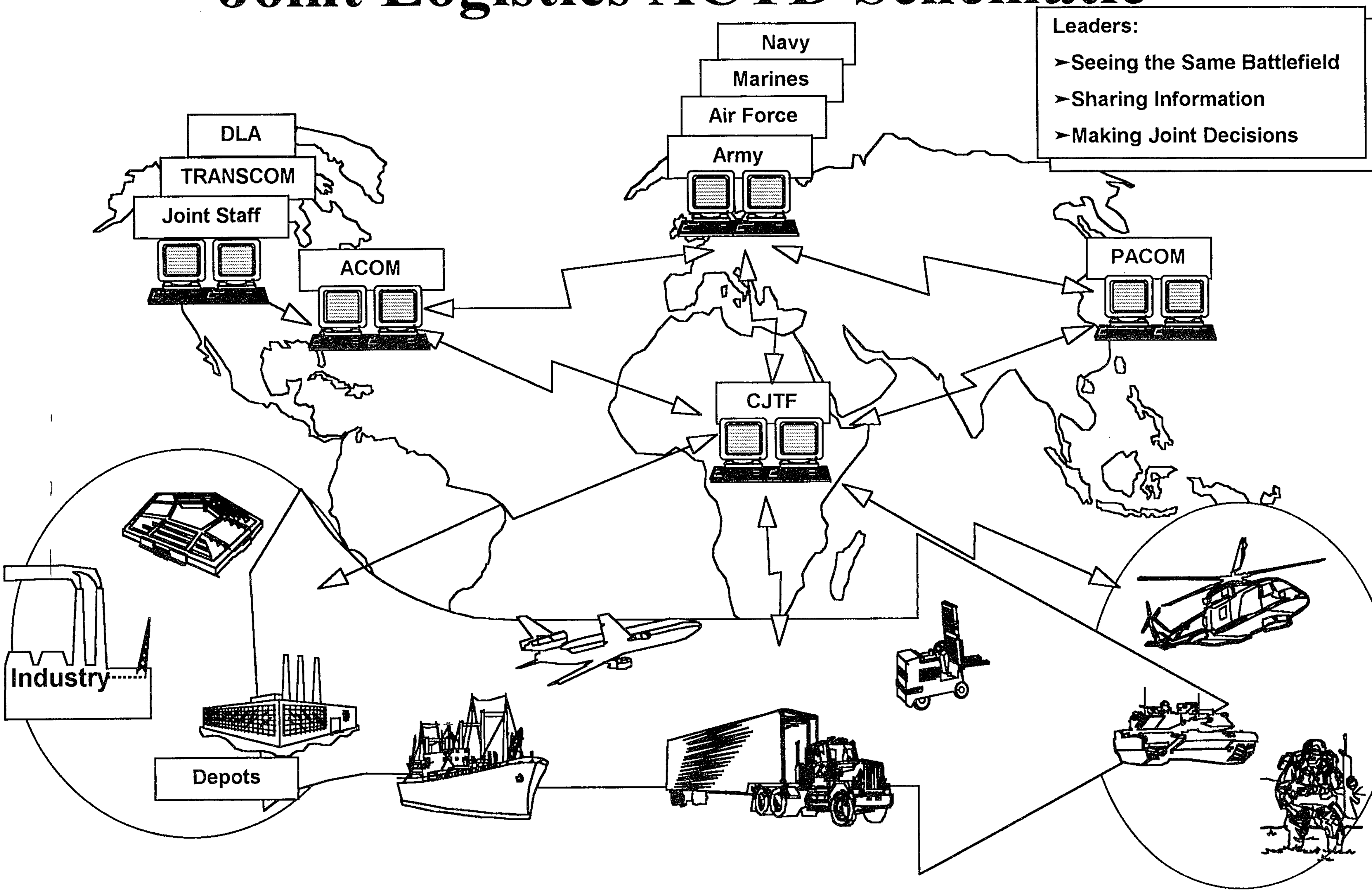
DEF Log Functions

- Readiness
- Planning
- Mobilization
- Deployment
- Sustainment
- Redeployment
- De-Mobilization

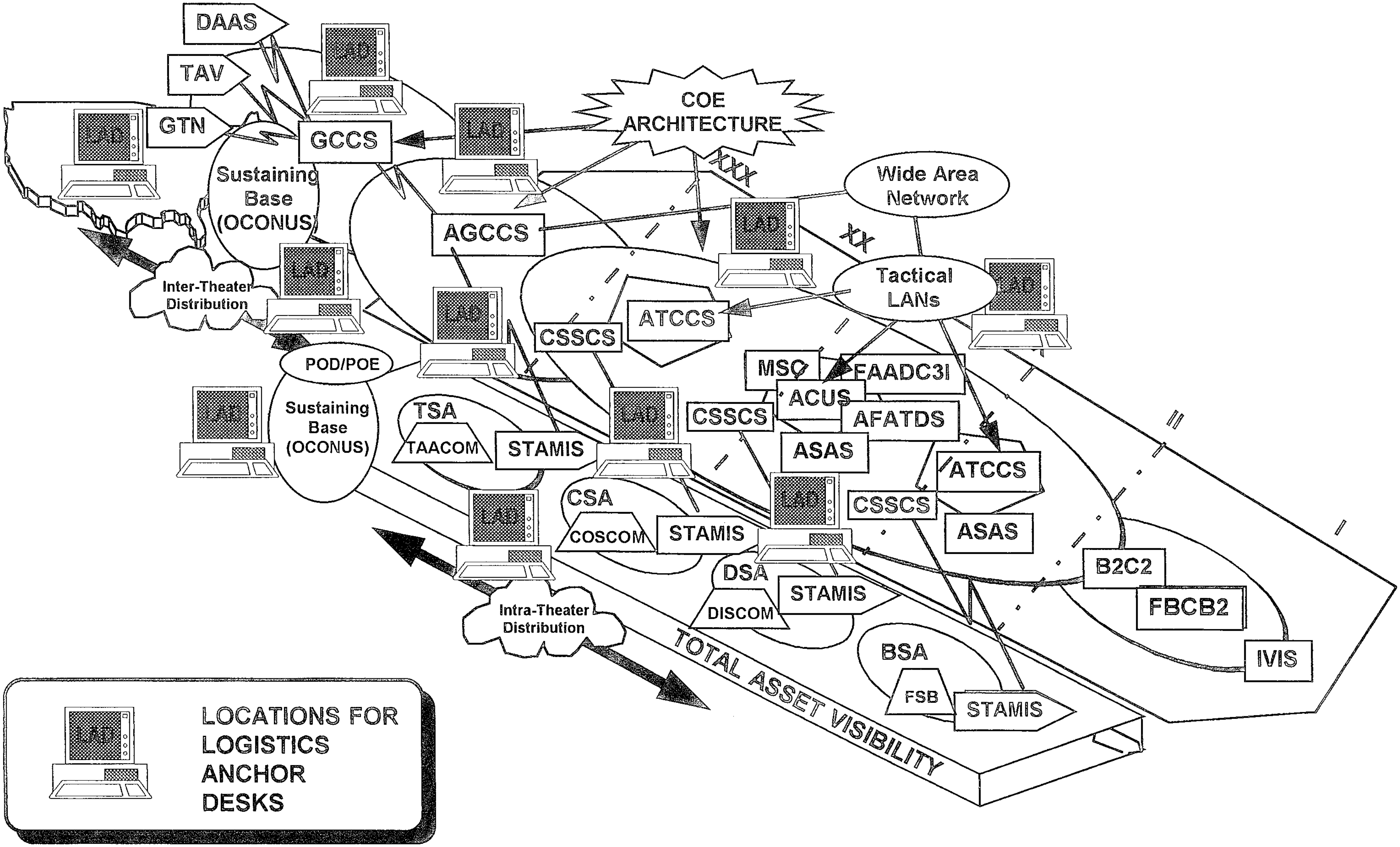
Services

Joint Planning / Execution (Joint Log ACTD)				
Army (TDATD)	Navy	MarineCorps	Air Force	
Defense Total Asset Visibility (including ITV)				
Army	Navy	Marine Corps	Air Force	DLA
LIF Terms RF Tech SARSS-O SPBRS DAAS TC AIMS	Salts VICP CAIMS/ OMMS ATAC VMISR SNAP DAAS TC AIMS	MAGTF-II MUMMS SASSY DSSC AMMOLOGS TMS DAAS TC AIMS ATLAS	AFEMS CAS-A SCS SBSS MASS REMIS AFLIF CMOS DAAS TC AIMS	LIPS LINK SAMMS DEPRA DSS DAAS TC AIMS

LOGISTICS C2
Joint Logistics ACTD Schematic

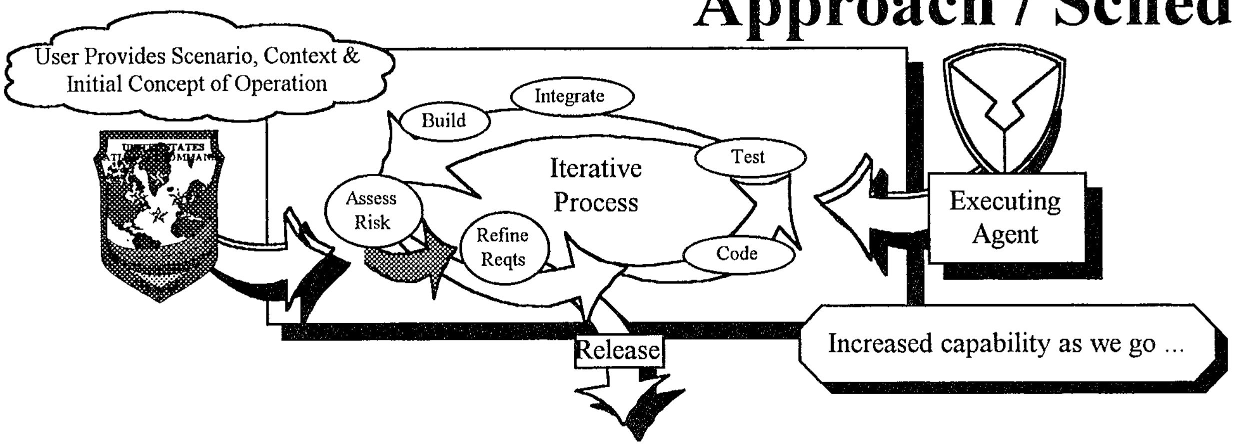


LOGISTICS C2
Total Distribution ATD Schematic



LOGISITCS C2

Approach / Schedule



- Spiral Development Process
- Learn by doing - User Feedback
- Tune in Exercises
  - JL ACTD utilizes Unified Endeavor Exercise
  - TD ATD utilizes Prairie Warrior Exercises
- ACTD provides leave behind with operational forces
- ATD provides an "interim fix" while helping to identify requirements and solutions

LOGISTICS C2
IR&D TECHNOLOGY NEEDS

- DATA
  - Real time data updates
  - Data reconciliation
  - Data Adjudication
- TOOLS
  - Data visualization
  - Machine learning
  - 3-D visualization for logistics
- CONNECTIVITY
  - Multi-level security
  - Transportation of large data sets
  - Integration of disparate models
- INTEGRATION
  - Interactive ability to use selected data, tools & communications
  - Integrated applications for plans, simulations, training & execution

NOTES

AVIATION INTEGRATION TECHNOLOGY

NAVIGATION TECHNOLOGY

DR. JOHN NIEMELA
CHIEF, ELECTRONIC SYSTEMS DIVISION
COMMAND, CONTROL SYSTEMS
INTEGRATION DIRECTORATE
UNCLASSIFIED

AMSEL-RD-AS-TD

POINT PAPER

SUBJECT: Navigation Technology

OBJECTIVE: Apply, advanced sensor, digital terrain model (DTM) and integration technologies to improve navigation system accuracy and robustness. Robust and accurate navigation required for semi-automated guidance and precision target/emitter location. This project supports the Science and Technology Objective (STO) "Aviation Integration into the Digitized Battlefield", which has the goal to demonstrate one-meter positioning, registered in a digital terrain model (DTM) by FY 98.

FACTS:

- C2SID is conducting efforts in the areas of DTM suitability, Enhanced GPS, GPS Satellite selection Algorithms and Integration technology. The four areas will be brought together to support the FY 98 demonstration.
- It is projected that navigation technology will progress into the areas of multi-sensor, imagery, and multi-source map correlation/fusion to support position location, targeting and guidance. Such a technology is Visual Flow Field Navigation. In addition, concepts for extremely high integrity navigation data will be required for guidance and control of next generation platforms.

BRIEFER: John Niemela, Chief, Electronic Systems Division, Command, Control Systems and Integration Directorate, AMSEL-RD-C2-ES, (908) 427-4635

NAVIGATION TECHNOLOGY

Objective

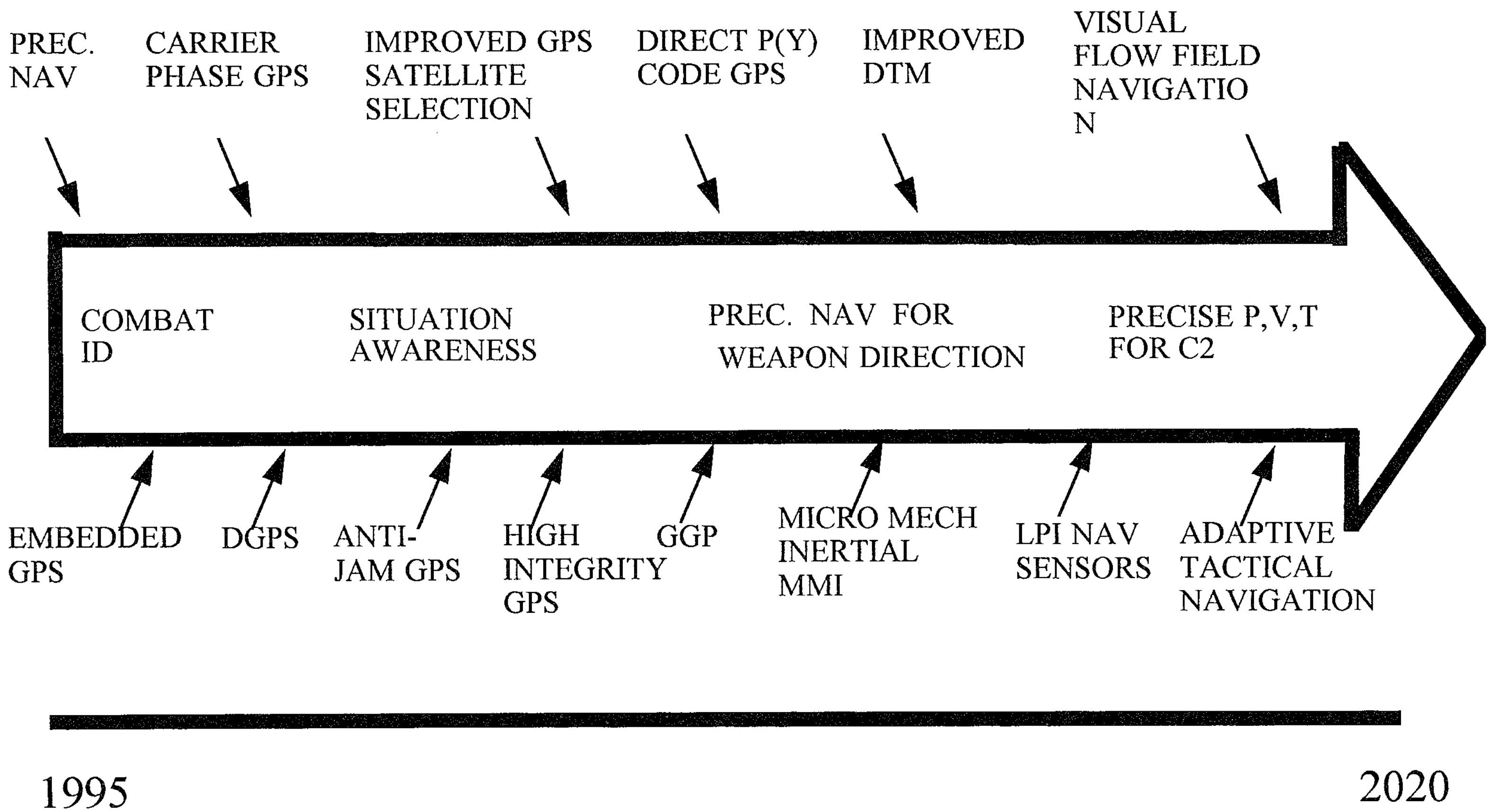
- Improve navigation accuracy by an order of magnitude while operating in a hostile environment

NAVIGATION TECHNOLOGY
TECHBASE STRATEGIC PLAN

CURRENT CAPABILITIES
- EXTERNAL REF NAV
  - GPS, TACAN, VOR, DME
- SELF CONTAINED NAV
  - INS (.2-1.0 NM/hr)
  - AHRS (0.1 deg)
  - DOPPLER RADAR (0.5% DT)
- INTEGRATED NAVIGATION
  - ECM SUSCEPTIBLE
  - PERF SCENARIO DEPENDENT
  - NAV SENSORS EMANATE
  - DATA BASE CHAOS
- FUNCTIONALITY SEPARATE

OBJECTIVE CAPABILITIES
- ROBUST NAV
  - WORLD WIDE
  - ECM RESILIENT
  - FAULT TOLERANT
  - ADAPTIVE
- PRECISION NAV
  - P: 2-4 m
  - V: 10-20 mm/s
  - T: 10-50 ns
- INTEGRATED NAVIGATION IN
  - HIGH INTEGRITY DATABASE
- INTEGRATED FUNCTIONALITY
- IMPROVED REL & Affordability

NAVIGATION TECHNOLOGY
TECHBASE ROAD MAP



NAVIGATION TECHNOLOGY

Approach

- Digital Terrain Database (DTD) Suitability Study
  - Exploit DTD technology to support advanced integration concepts (NOE, TF/TA, TRN and Passive Ranging)
- GPS Satellite Selection Algorithm Study
  - Simulation and vehicle/flight test of alternative GPS satellite selection algorithms for NOE and ground applications

NAVIGATION TECHNOLOGY

Approach (Cont'd)

- PN Data Acquisition System (PNDAS) Development
  - o Development of a data acquisition and truth reference system to host advanced integrated navigation systems
- Enhanced GPS for ECM Environments
  - o Investigation, simulation and flight test evaluation of emerging GPS technologies

NAVIGATION TECHNOLOGY

IR&D Technology Needs

- GPS vulnerability reduction
- System concepts for Tactical/Civil Airspace
- Size/Cost reduction systems for soldier applications
  - o GPS - PCMCIA Format
  - o Inertial - Micro-Mechanical Inertials (MMI)
- Carrier Phase Differential GPS (DGPS)
- Adaptive Tactical Navigation (ATN)
- Low Probability of Intercept (LPI) DNS and RAD ALT
- Storage, compression and utilization of dense DTMs

NAVIGATION TECHNOLOGY

IR&D Technology Needs (Cont'd)

- Visionionics technology application to navigation
  - o Correlation of digital imagery and live video for positioning, guidance and targeting
- Neural Network application to navigation
  - o Correlation of multi-sensor input for position, guidance and targeting

NOTES

MISSION REHEARSAL

PETER CSIKY

PROJECT ENGINEER

COMMAND, CONTROL & SYSTEMS INTEGRATION DIRECTORATE

UNCLASSIFIED

AMSEL-RD-AS-TD

POINT PAPER

SUBJECT: Mission Rehearsal

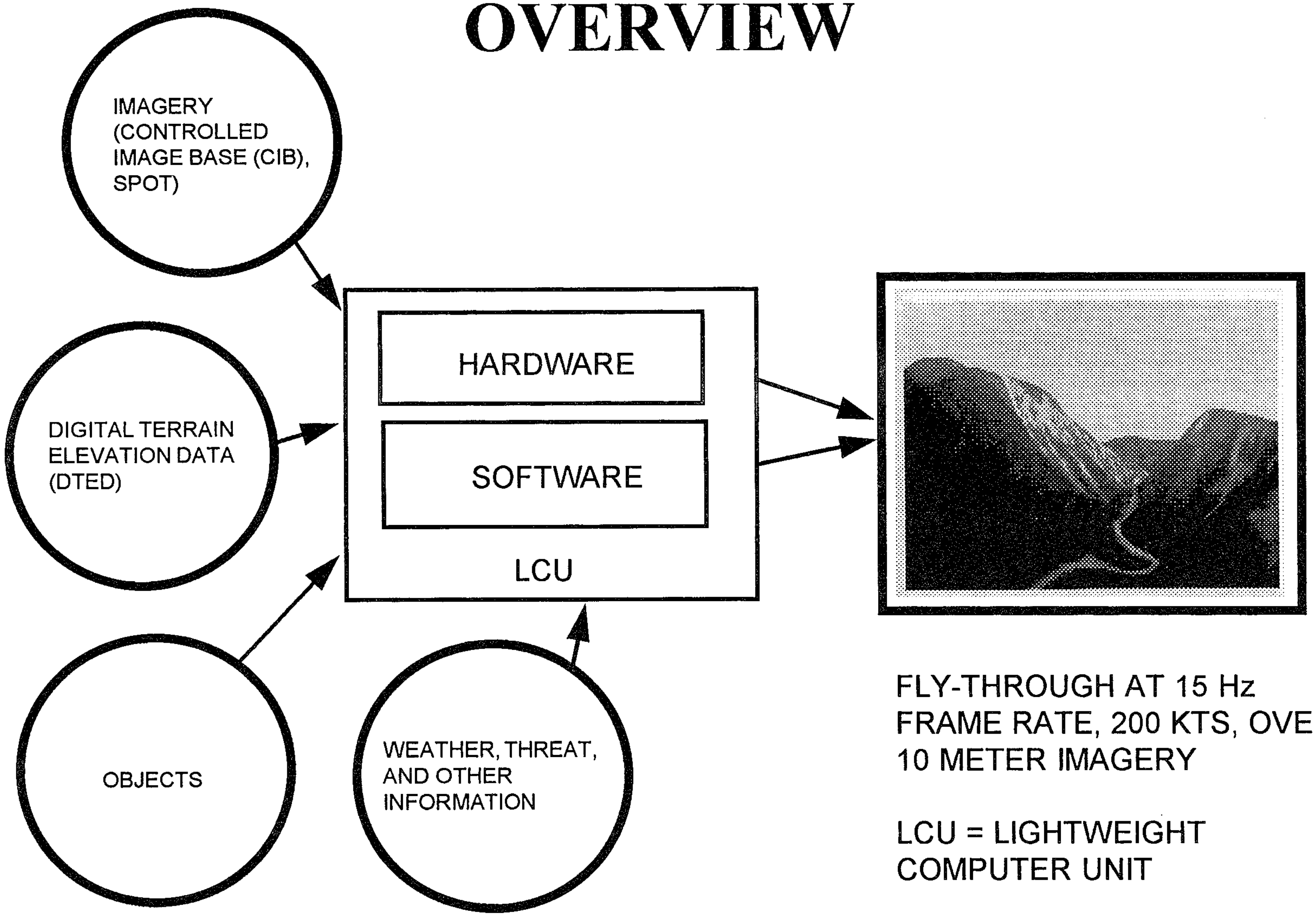
OBJECTIVE: To develop a real-time mission rehearsal capability on an Intel based PC Platform. The system increases the pilot's situational awareness by providing rehearsal capability over the terrain and tactical conditions anticipated during the time of the battle. Another significant use is as a Command and Control planning tool. Here, an operator can use the mission rehearsal tool to view the terrain for any line of sight application.

FACTS:

- The Mission Rehearsal allows for a preview of a position as a possible battle position for use by tanks or emplacement of air defense artillery or ground surveillance radar. Leaders' recons could be performed using this tool and eliminate the time required to go to the actual terrain.
- The RDEC has developed a real-time 3 - dimensional perspective view of the terrain called the Portable Mission Preview Device (PMPD).
- The current project is to transition from a preview device to a rehearsal device. The difference between the two will be an increase in situational awareness to allow a rehearsal to be conducted in the terrain and the conditions expected at mission time.

BRIEFER: Peter Csiky, Project Engineer, Command, Control Systems and Integration Directorate, AMSEL-RD-C2-PM-AV, (908) 427-4698

MISSION REHEARSAL
OVERVIEW



FLY-THROUGH AT 15 Hz FRAME RATE, 200 KTS, OVER 10 METER IMAGERY

LCU = LIGHTWEIGHT COMPUTER UNIT

MISSION REHEARSAL OBJECTIVE

Objective

- Situational awareness
- Route rehearsal capability over the unfamiliar terrain.

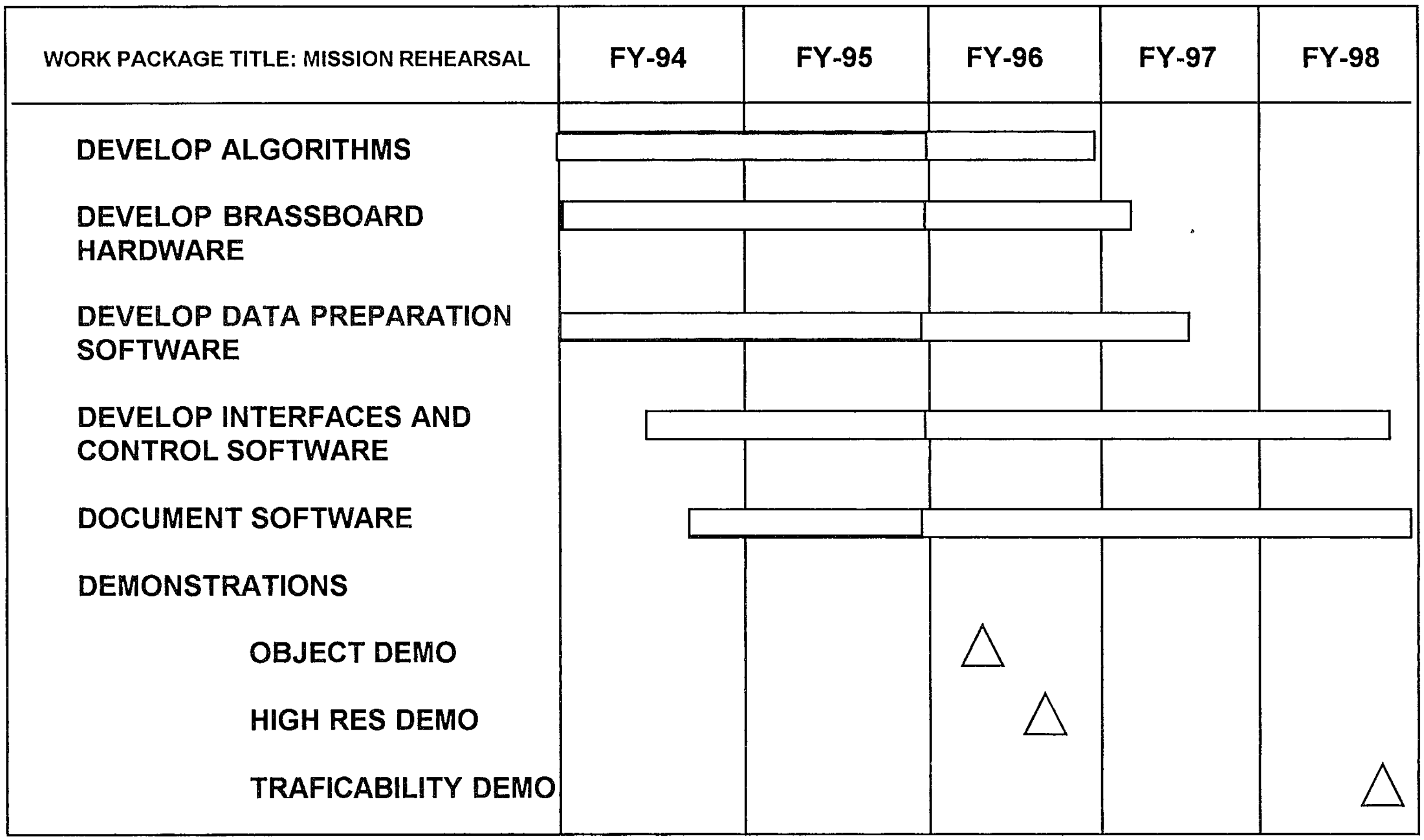
MISSION REHEARSAL APPROACH

- Register Controlled Image Base (CIB), SPOT or LANDSAT imagery with Digital Terrain Elevation Data (DTED).
- Provide a mission preview and rehearsal capability consisting of a real time, flicker free, 3-D perspective view of the terrain.
- Generate and display overlays such as buildings, powerlines, targets, threats, threat envelopes, GPS satellite availability, communications connectivity

MISSION REHEARSAL APPROACH (CONT.)

- Integrate Terrain Evaluation Module (TEM) and Interim Terrain Data (ITD)/Tactical Terrain Data (TTD).
- Add rendering of meteorological conditions (i.e., Fog, weather ceiling, sun/moon position and illumination).
- Add FLIR and NVG rendering.
- Identify solution in CHS-2 environment.
- Port Mission Rehearsal to ground mission planning systems.

MISSION REHEARSAL
PROGRAM SCHEDULE



MISSION REHEARSAL
IR & D TECHNOLOGY NEEDS

- Develop a hardware/software solution for the CHS-2 (Sun Sparc-20) version.

- Reduce components count, power consumption and heat generation of graphics accelerator in LCU version.

- Develop software for interface with meteorological and intel systems to provide realistic NVG, FLIR or other sensor views based on predicted conditions at actual mission time.

- Develop software to provide full mission rehearsal to include communications connectivity, GPS satellite visibility, employment of ASE and fuel management.

NOTES

INTERACTIVE SPEECH TECHNOLOGY

LOCKWOOD REED
PROJECT ENGINEER
COMMAND, CONTROL SYSTEMS INTEGRATION DIRECTORATE

UNCLASSIFIED

AMSEL-RD-AS-TD

POINT PAPER

SUBJECT: Interactive Speech Technology

OBJECTIVE: Automate Command-on-the-Move access to C2 application software and information retrieval utilizing state-of-the-art Speech Recognition technology with the ultimate goal of applying AI techniques to achieve Intent Understanding.

FACTS:

- Developed Voice Control B2C2 Interface
- Extended voice Controlled B2C2 Interface
- Developed Voice Controlled BCDSS Interface
- Developed Networked Speech Recognition
- Developed Virtual Speech Recognition
- Developed PCMCIA format Speech Recognizer
- Developed Baseline Next Generation Speech Recognition Algorithm.

BRIEFER: Lockwood Reed, Project Engineer, Command, Control Systems and Integration Directorate, AMSEL-RD-C2-ES-I, (908) 427-2559

INTERACTIVE SPEECH RECOGNITION

OBJECTIVE:

- Provide C2 On-the-Move Improved Soldier/Machine Interface
  - o Hands Free Operation
  - o Reduce Data Entry Time
  - o Provide Natural Speech Capability
- Develop a Next Generation Speech Recognition Capability
  - o Natural Speech/Speaker Independent
  - o Incorporates Natural Language Processing
  - o Incorporates "Intent Understanding"
  - o Useable in High Ambient Noise Environments

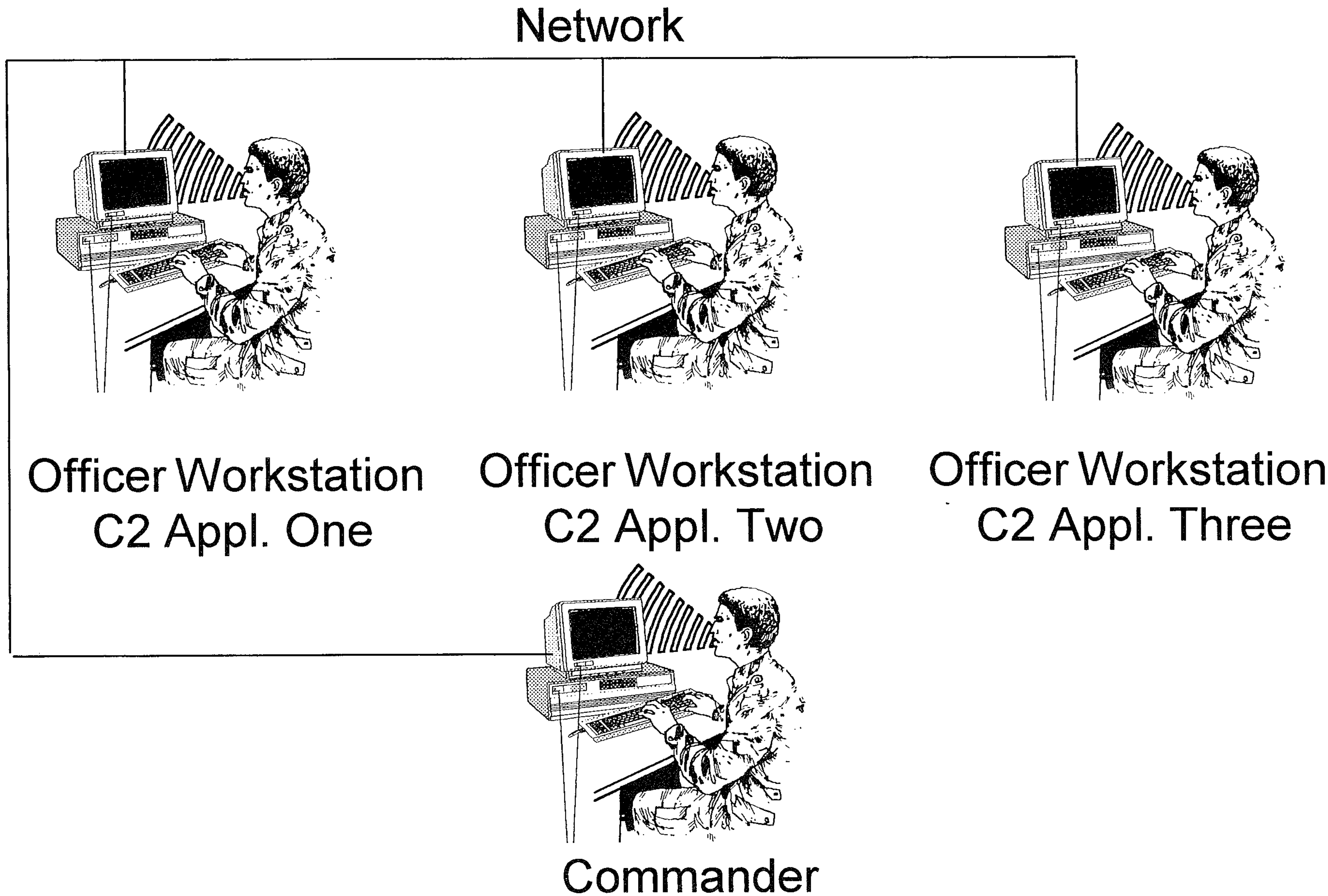
INTERACTIVE SPEECH RECOGNITION

APPROACH:

- "Turn Key" Speech Recognition Technology for Common Hardware Software Suite
  - Universal Software Interface(Completed)
  - Natural Speech Recognition(Completed)
  - Applications Demonstrations(Completed)
  - Network Speech Recognition(Completed)
  - Virtual Speech Recognition(Completed)
  - Diverse Form Factors(Partial)
  - User Friendly Developers Toolkit

- Next Generation Speech Recognition Technology
  - Baseline Natural Speech/Speaker Independent Technology(Completed)
  - Noise Robustness
  - Natural Language
  - Intent Understanding

Networked Virtual Speech Recognition



INTERACTIVE SPEECH RECOGNITION

IR&D TECHNOLOGY NEEDS:

- Develop Next Generation PCMCIA Speech Processor Card
- Baseline Plus Noise Robustness
- Baseline Plus Natural Language
- Baseline Plus Intent Understanding

NOTES

TACTICAL POWER

FUEL CELLS

RICHARD JACOBS
PROJECT ENGINEER
COMMAND, CONTROL SYSTEMS INTEGRATION DIRECTORATE

UNCLASSIFIED

AMSEL-RD-AS-TD

POINT PAPER

SUBJECT: Fuel Cells

OBJECTIVE: The Fuel Cells program is aimed at meeting the goals of the Soldier Individual Power. It is a four year effort with demonstrations in FY96 and FY98. The CECOM RDEC has been working agreements with other organizations at many levels and are influencing development programs at the Army Research Laboratory and the Advanced Research Projects Agency.

FACTS:

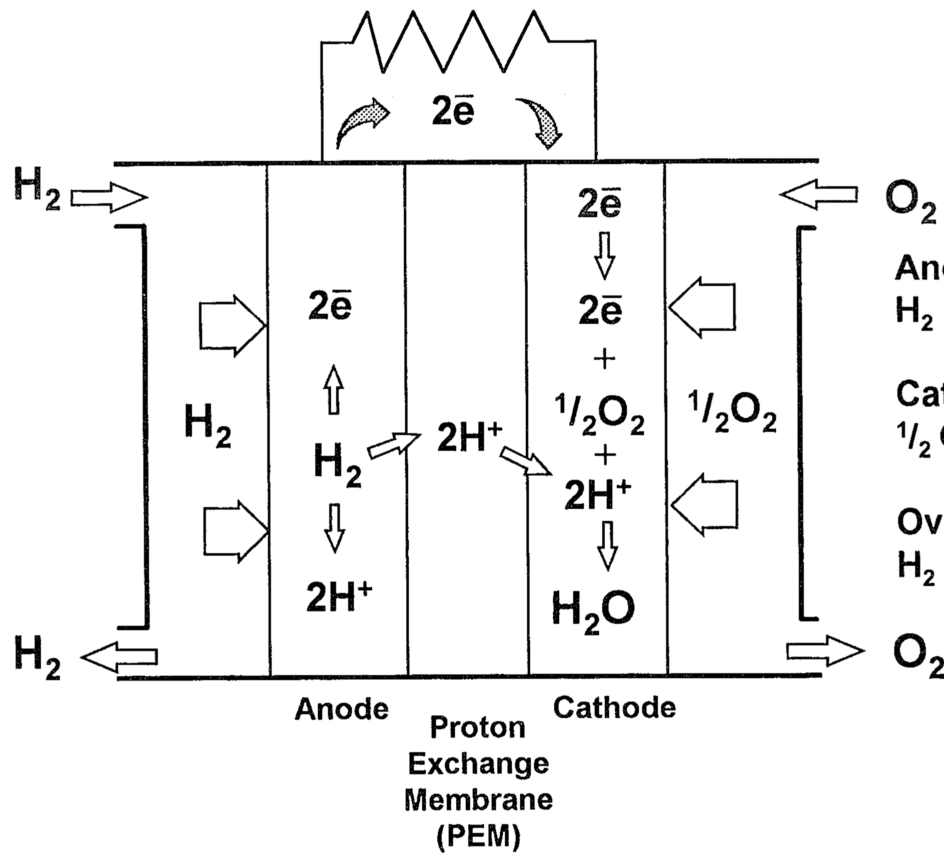
- The Fuel Cell Power Sources are much like batteries that consume external fuel. The fuel cells being developed at C2SID consume Hydrogen and Oxygen (air) and produce water, heat and electric power.
- The proton Exchange Membrane (PEM) Fuel Cell has been selected for the small power source applications since it has the lowest signature and is one of the least complicated types of fuel cell.
- Applications for this technology include Soldier Individual Power, remote sensors, Unmanned Aerial Vehicles, Unmanned Underwater Vehicles, battery charging, microclimate cooling, lightweight TOC's and other systems where energy requirements are significant and engine generator sets are not acceptable.
- A good goal for industry would be a system that is simple, rechargeable, and that contains greater than 10% hydrogen by weight. In addition techniques for producing and using hydrogen on the battlefield with minimal logistic impact.

BRIEFER: Richard Jacobs, Project Engineer, Command, Control Systems and Integration Directorate, South, AMSEL-RD-C2-PD-E, (703) 704-2637

FUEL CELL SCHEMATIC

Fuel Cell

- A Device Which Produces Electricity Cleanly, Silently, And Efficiently
- Works by Electrochemically Reaction in Which the Energy of a Fuel And an Oxidant Are Transformed Into DC Current.
- Reactant Chemicals Are Supplied From an External Source, Not Stored Within



Anode Reaction
$H_2 \Rightarrow 2H^+ + 2E$

Cathode Reaction
$^1/_2\, O_2 + 2H^+ + 2E \Rightarrow H_2O$

Overall
$H_2 + {}^1/_2\, O_2 \Rightarrow H_2O$

FUEL CELLS

OBJECTIVE

SOLDIER INDIVIDUAL POWER

FY96- USING BEST AVAILABLE HYDROGEN/AIR PROTON EXCHANGE MEMBRANE (PEM) FUEL CELL TECHNOLOGY:

- DEMONSTRATE FUEL CELL POWERED BATTERY CHARGER (1200 WATT- HRS CHARGE PER Kg FUEL)

- EVALUATE PRESSURIZED HYDROGEN/OXYGEN PEM FUEL CELL AND COMPARE TO EXISTING HYDROGEN/AIR SYSTEMS TO DETERMINE IF FURTHER DEVELOPMENT IS WARRANTED

- DEMONSTRATE 50WATT/200WATT-HR FUEL CELL (2 Kg) AND CHARACTERIZE A 500 WATT-HR UNIT

FUEL CELLS

OBJECTIVE CONTINUED

FY 98- USING BEST AVAILABLE PEM FUEL CELL TECHNOLOGY HYDROGEN/AIR, HYDROGEN/OXYGEN, OR LIQUID FUEL

- **DEMONSTRATE 50WATT/200 WATT-HR UNIT WEIGHING LESS THAN 1.0 Kg**
- **DEMONSTRATE 150 WATT/600 WATT-HR UNIT WEIGHING LESS THAN 2.5Kg**

FUEL CELLS APPROACH

COMBINED DEVELOPMENT EFFORTS WITH THE ARMY RESEARCH OFFICE, ARMY RESEARCH LAB, ADVANCED RESEARCH PROJECTS AGENCY AND INDUSTRY THAT WILL PROVIDE DEMONSTRATIONS IN FY 96 AND FY98 OF SMALL FUEL CELL POWER SOURCES

REQUIRED DEVELOPMENTS

REDUCTION IN STACK WEIGHT	WATER MANAGEMENT
IMPROVED HYDROGEN SOURCES	DIRECT METHANOL FUEL
THERMAL MANAGEMENT	CYCLE LIFE DETERMINATION
MILITARY REQUIREMENTS	SYSTEM INTEGRATION

FUEL CELLS

APPLICATIONS

SMALL FUEL CELL POWER SOURCES

FUEL CELLS OFFER THE SILENCE, SIMPLICITY AND RELIABILITY OF BATTERIES, WITH THE ABILITY TO REFUEL LIKE AN ENGINE

SOLDIER INDIVIDUAL POWER

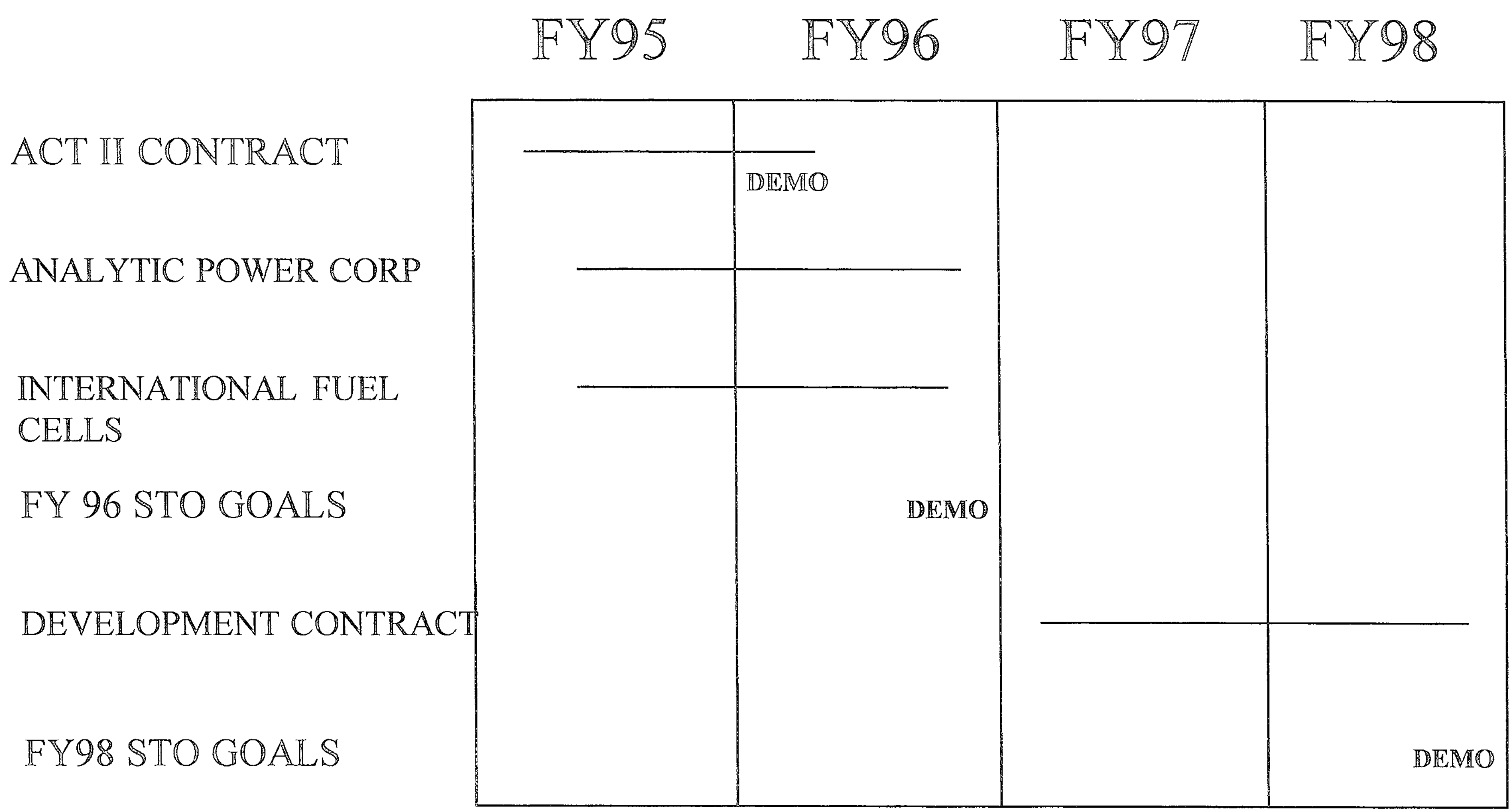
REMOTE SENSOR/SENSOR SUITES

BATTERY CHARGING

MICROCLIMATE COOLING

LIGHTWEIGHT TACTICAL OPERATIONS CENTER

FUEL CELLS SCHEDULE



FUTURE TECHNOLOGY NEEDS

• Hydrogen Sources	10% Weight Hydrogen
• Cycle Life	500 Cycles
• Cost Reduction	$1000/kw
• System Integration	Functional Power Sources

NOTES

SESSION IV

INTELLIGENCE AND ELECTRONIC WARFARE (IEW)

STRATEGY & OVERVIEW

US ARMY CECOM RESEARCH, DEVELOPMENT & ENGINEERING CENTER
ESSENTIAL PART OF TOMORROW'S ARMY

Intelligence and Electronic
Warfare Directorate

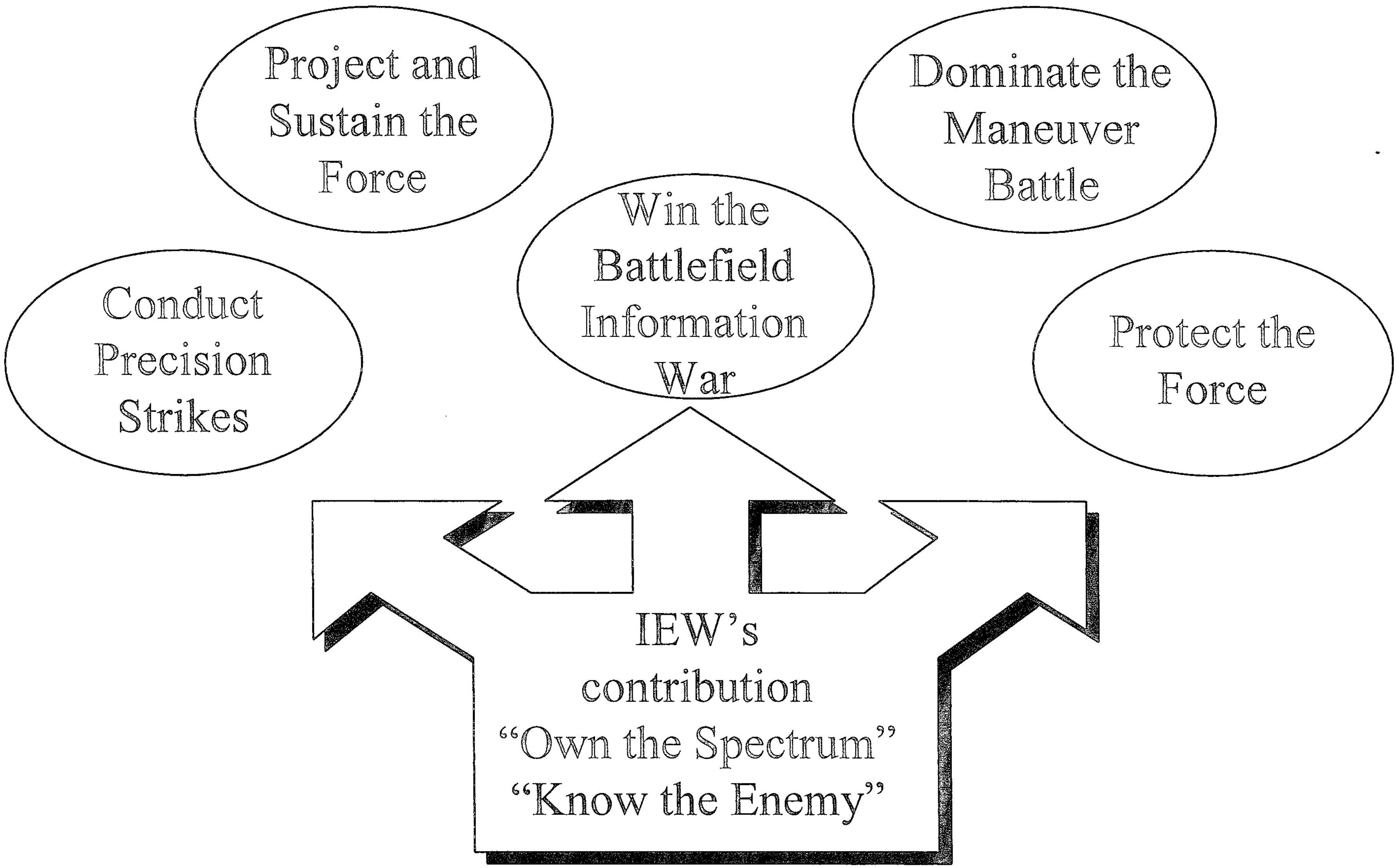
IEWD

LISTEN • DISRUPT • INFORM

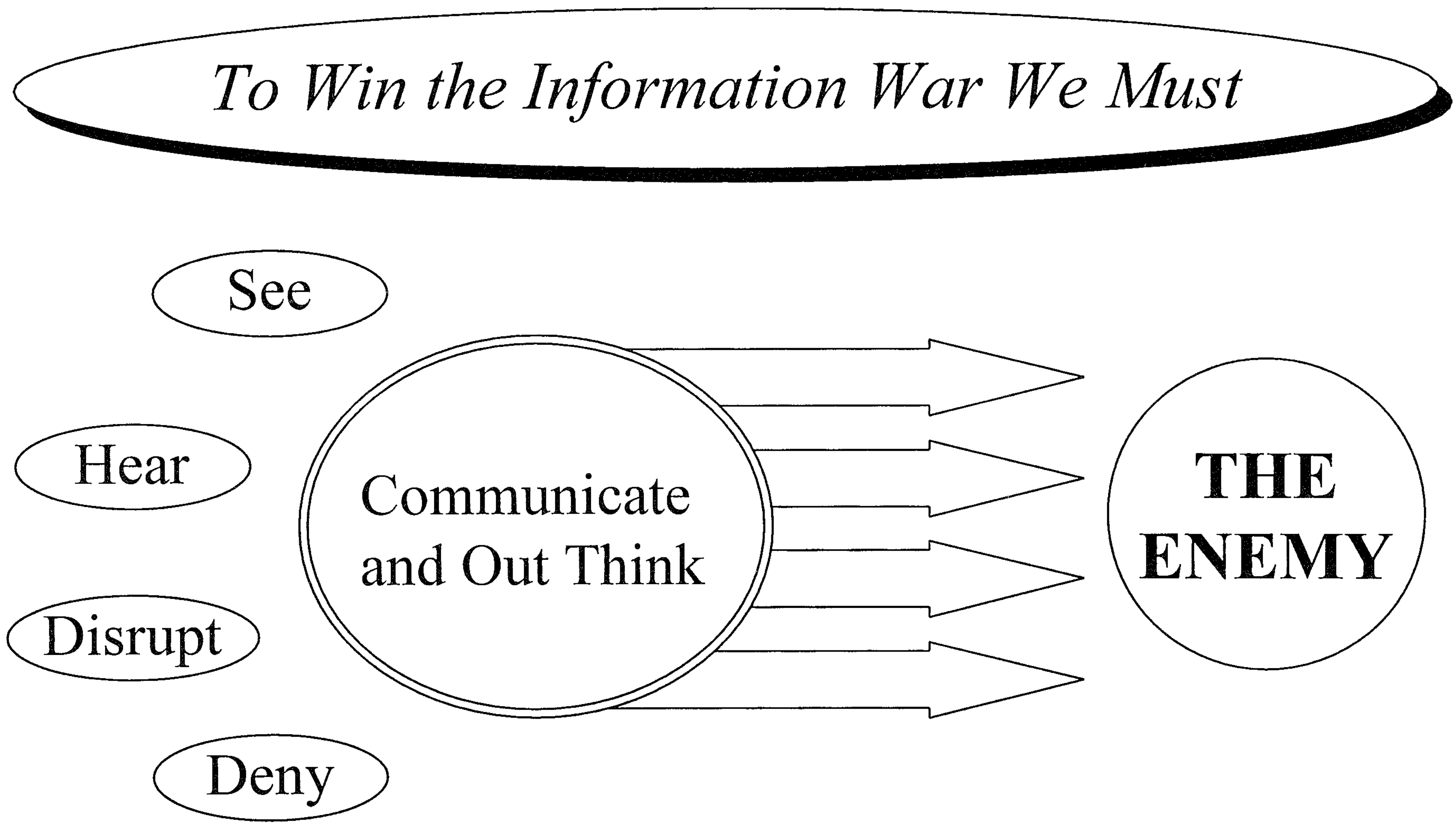
DR. FRANCIS WILLIAMS
ASSOCIATE DIRECTOR FOR SYSTEMS
INTELLIGENCE AND ELECTRONIC
WARFARE DIRECTORATE

UNCLASSIFIED

Army Modernization Objectives



Win the Battlefield Information War



Mission

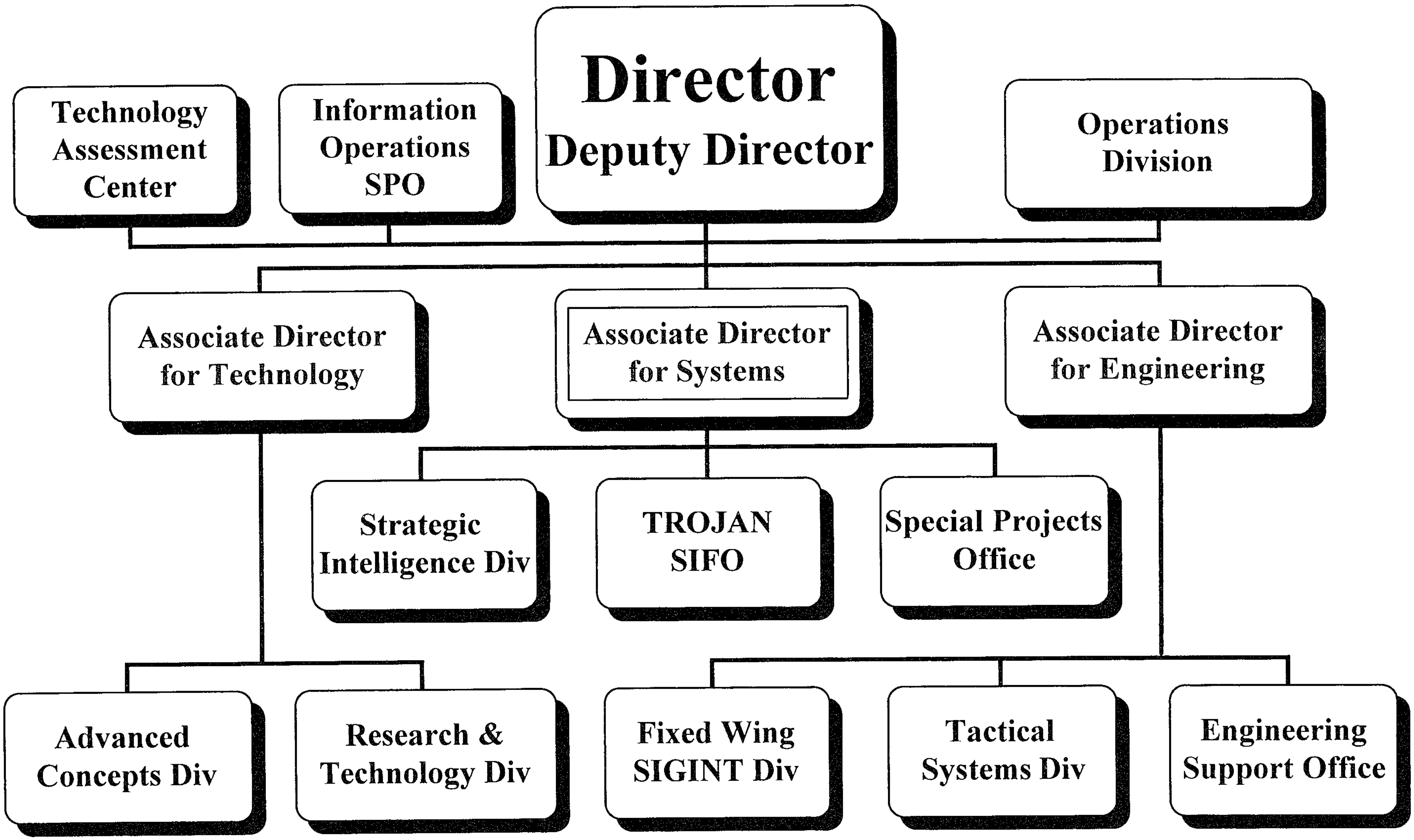
Provide the U.S. Army effective Command and Control and Information Warfare:

- Signals Intelligence
- **Electronic Support/Attack**
- Measurement and Signature Intelligence
- **Meteorological Sensing**
- **Intelligence Data Fusion and Dissemination**

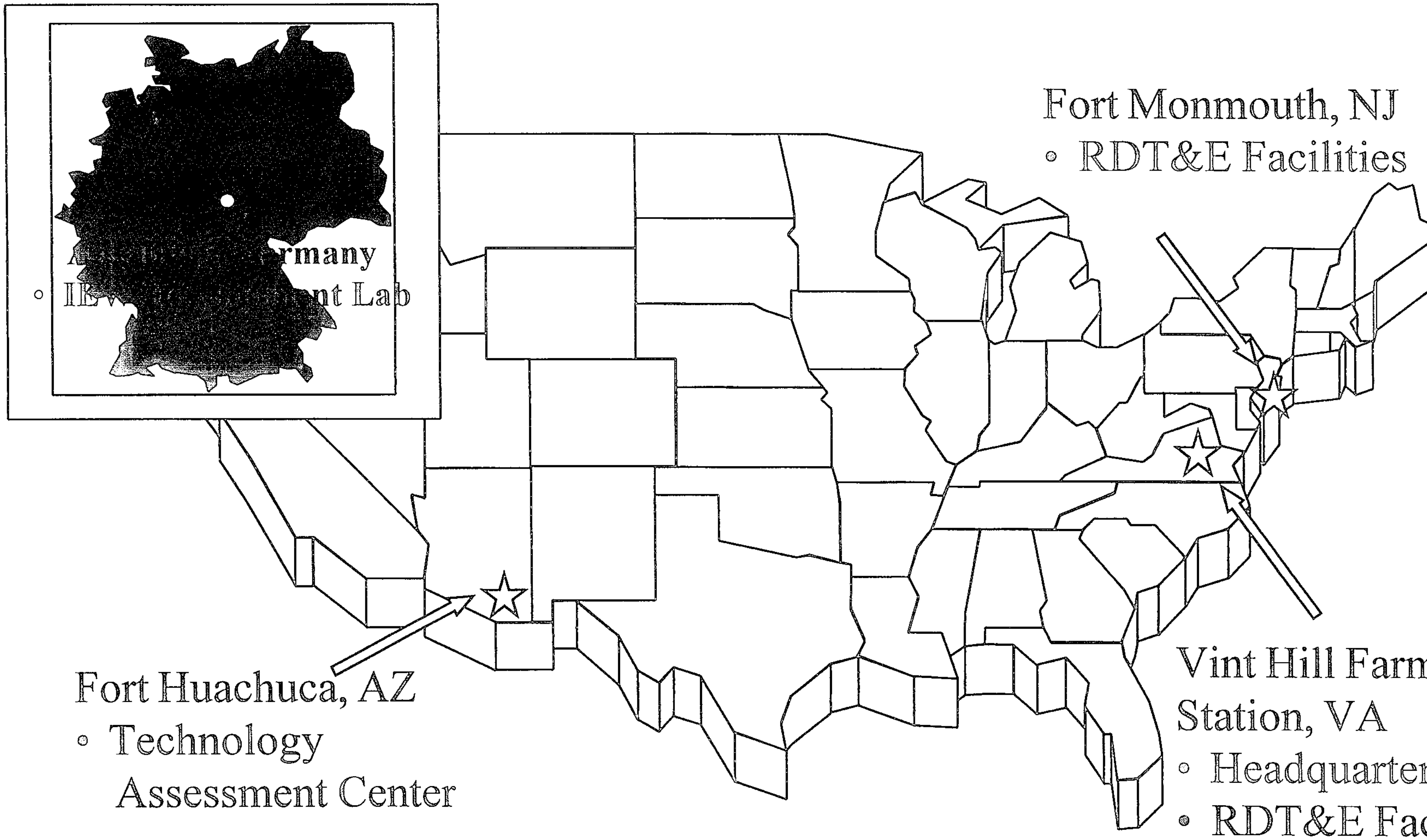
Functions:

- Define, develop and acquire superior technologies
- Prototype and evaluate advanced system concepts
- Develop and Acquire non-major systems and equipment
- Provide development and acquisition support to Program Executive
- Officers and Project Managers (PEO/PM)

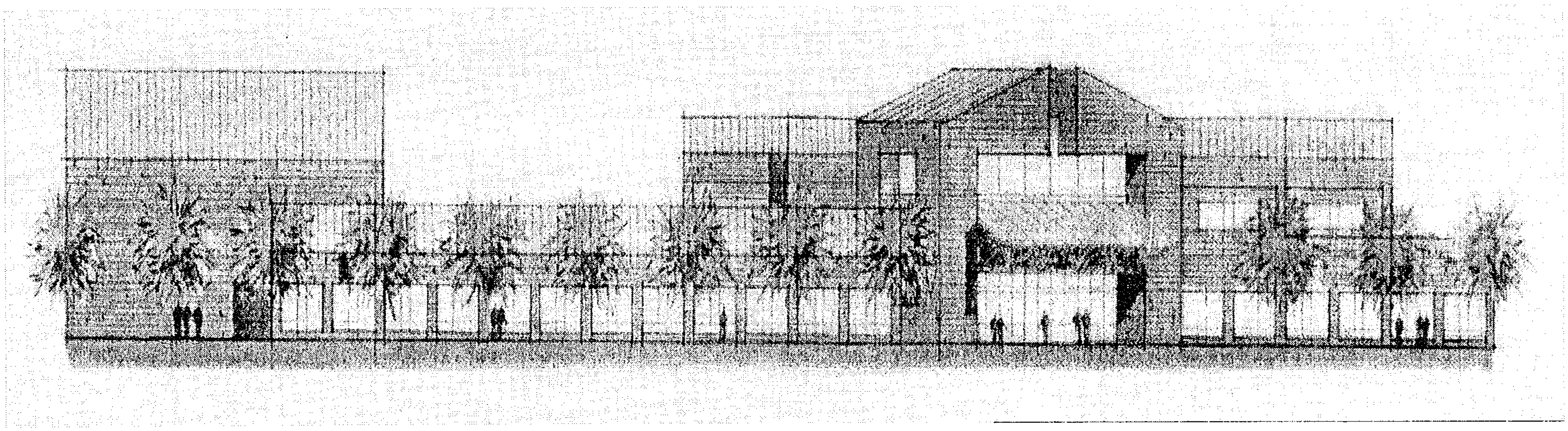
Intelligence and Electronic Warfare Directorate



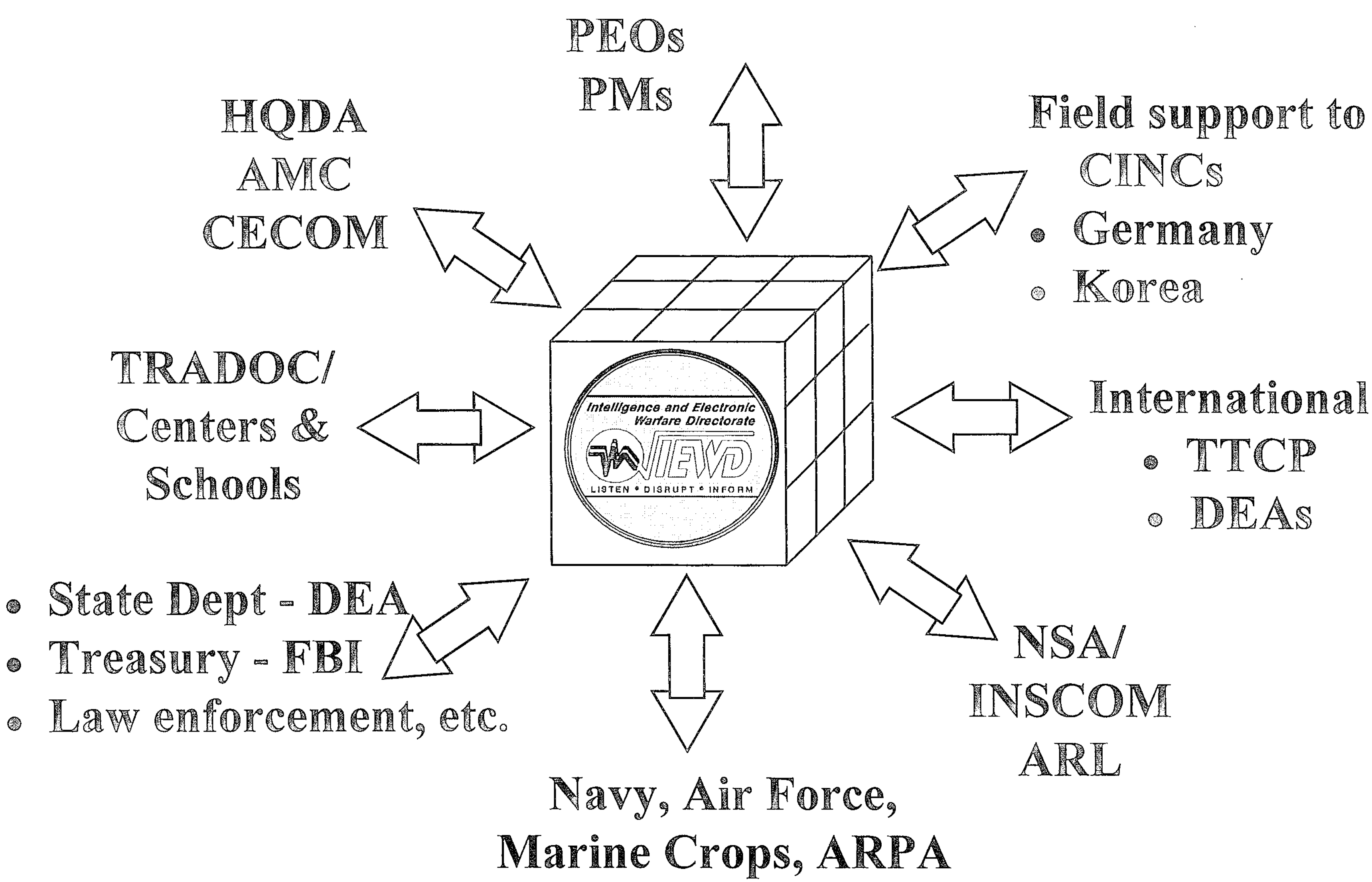
Intelligence and Electronic Warfare Directorate

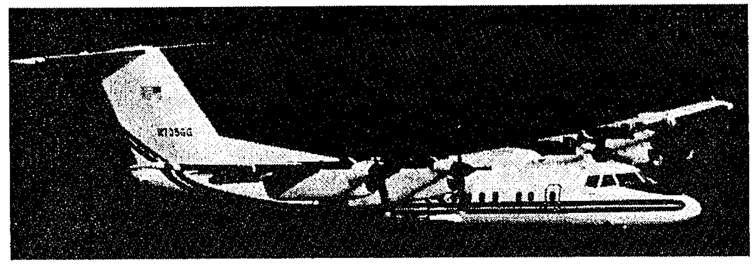


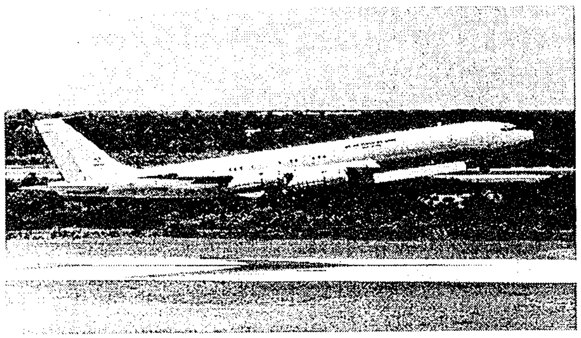
Artist Concept IEWD Building
Ft. Monmouth, N.J.



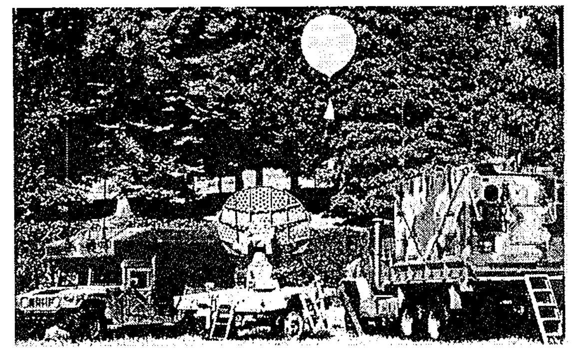
IEWD Customers

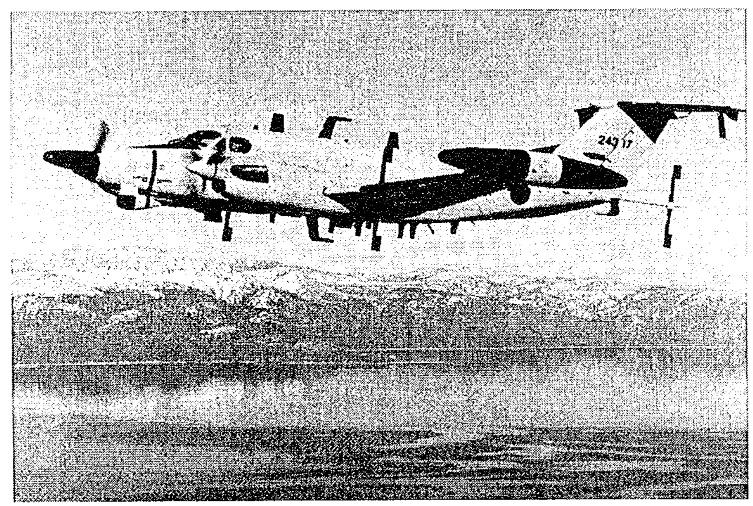


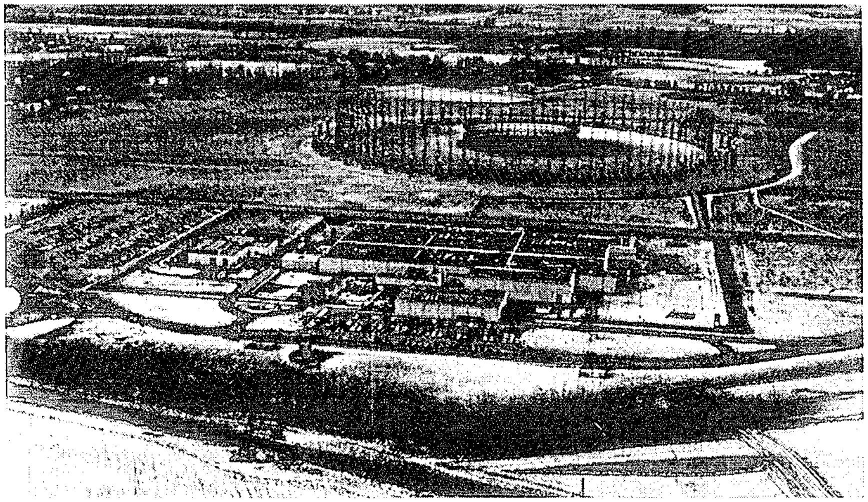


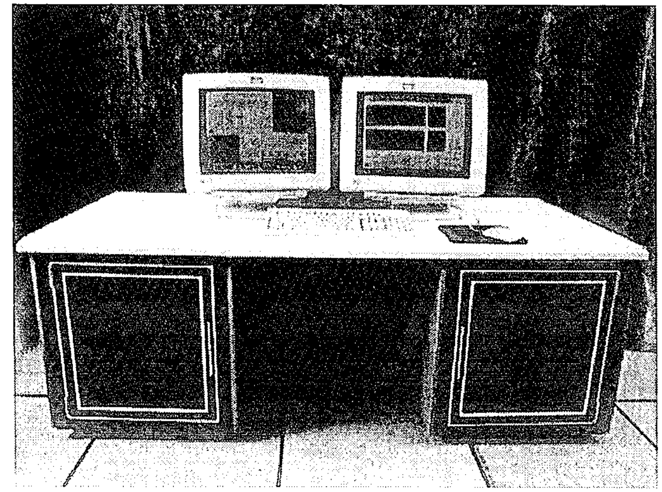


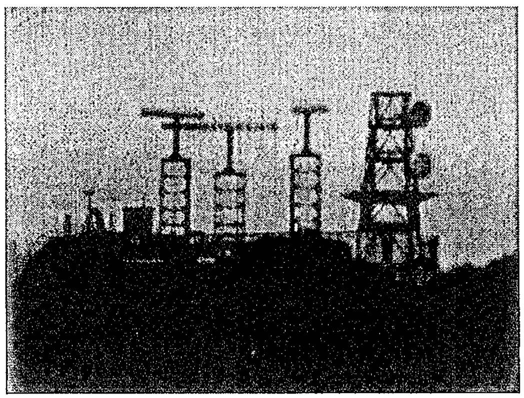
SUPPORT TO PEOs & PMs



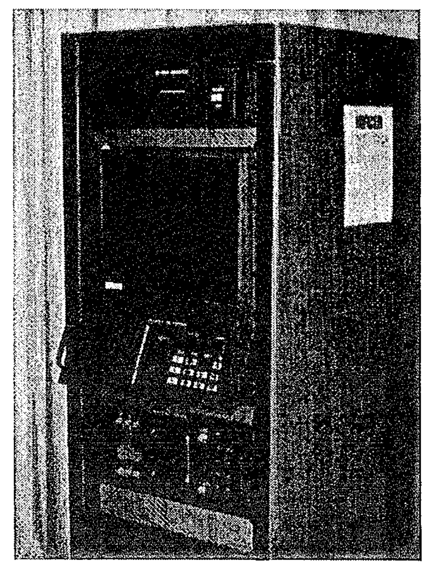


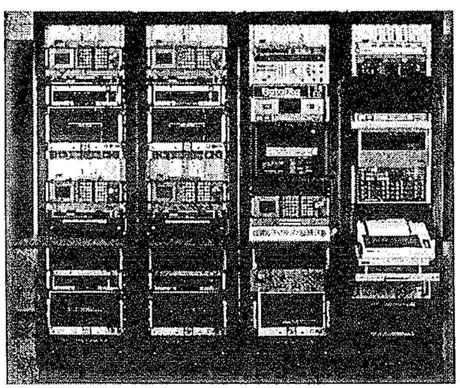


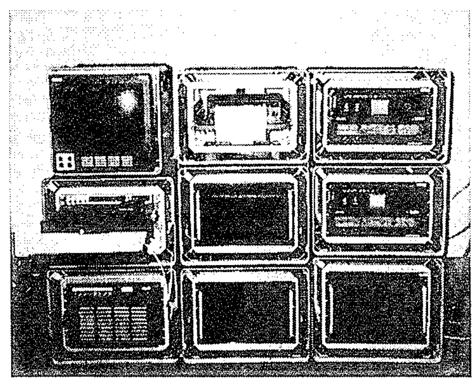




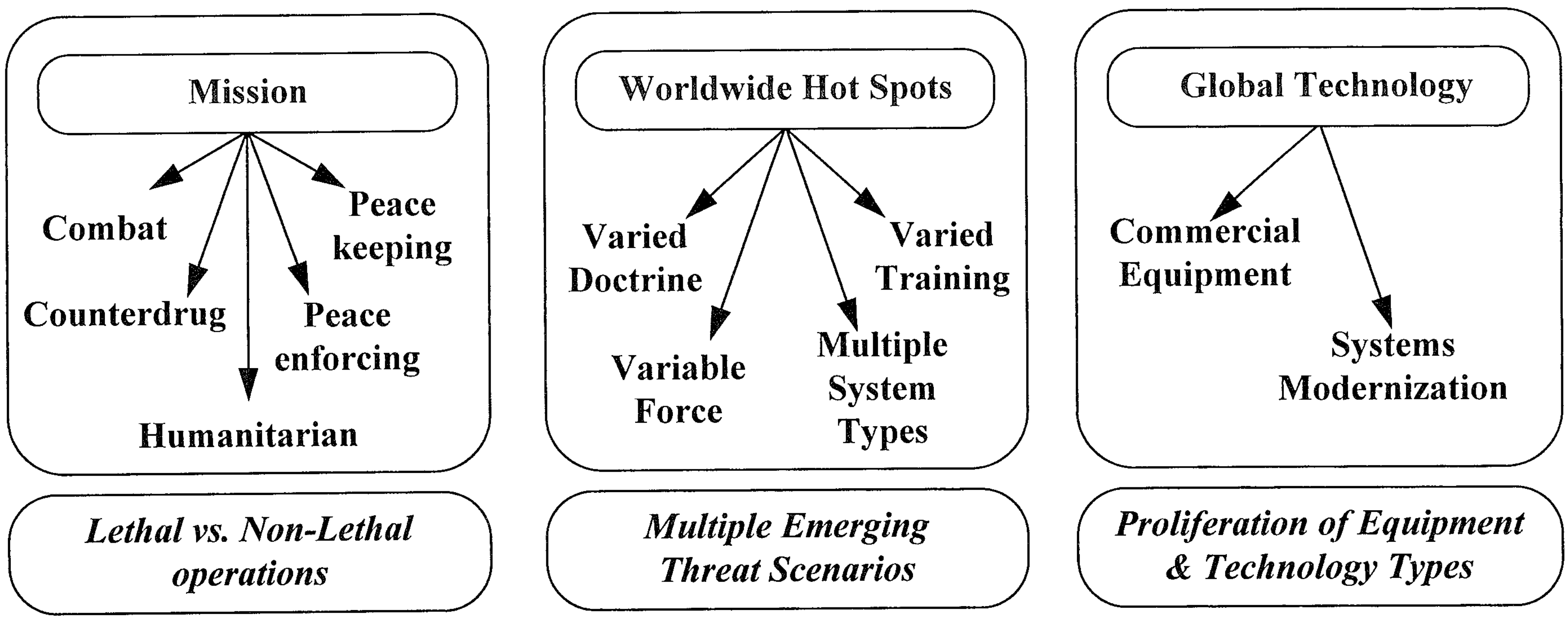
Strategic SIGINT

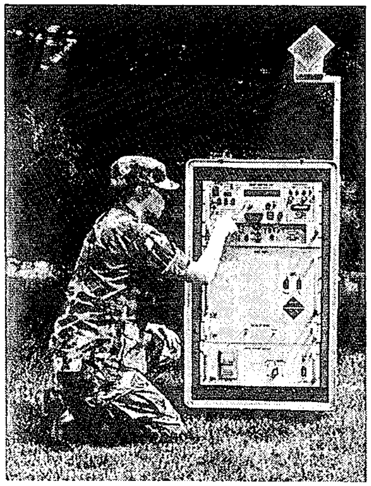


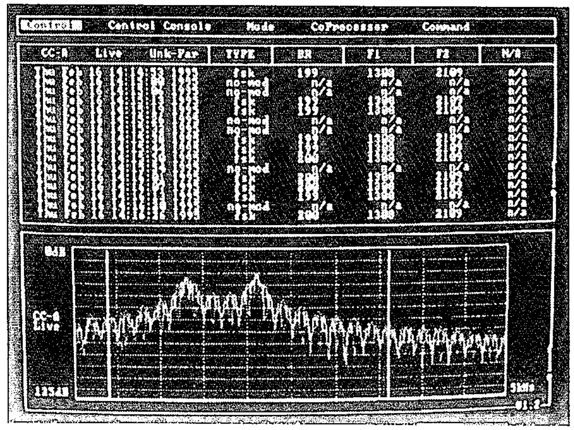




New Situation



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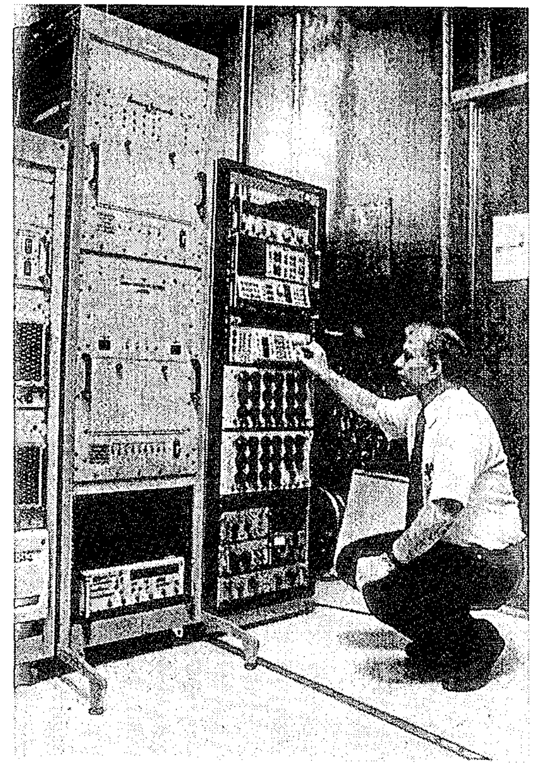
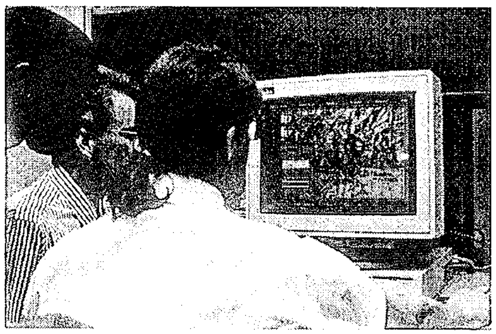
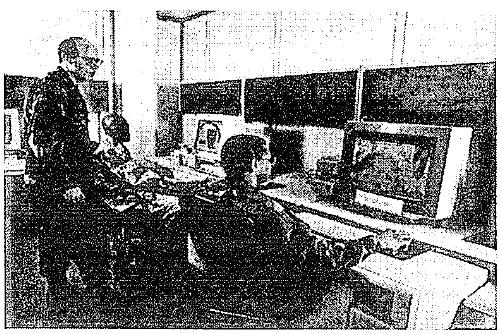
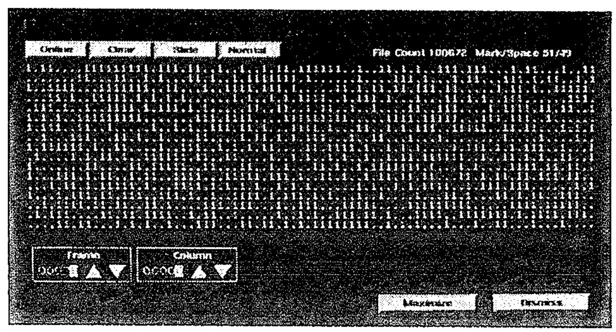




Technology

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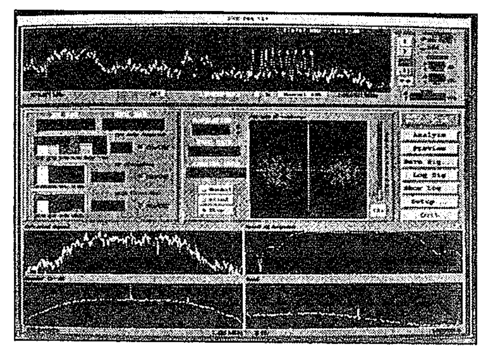
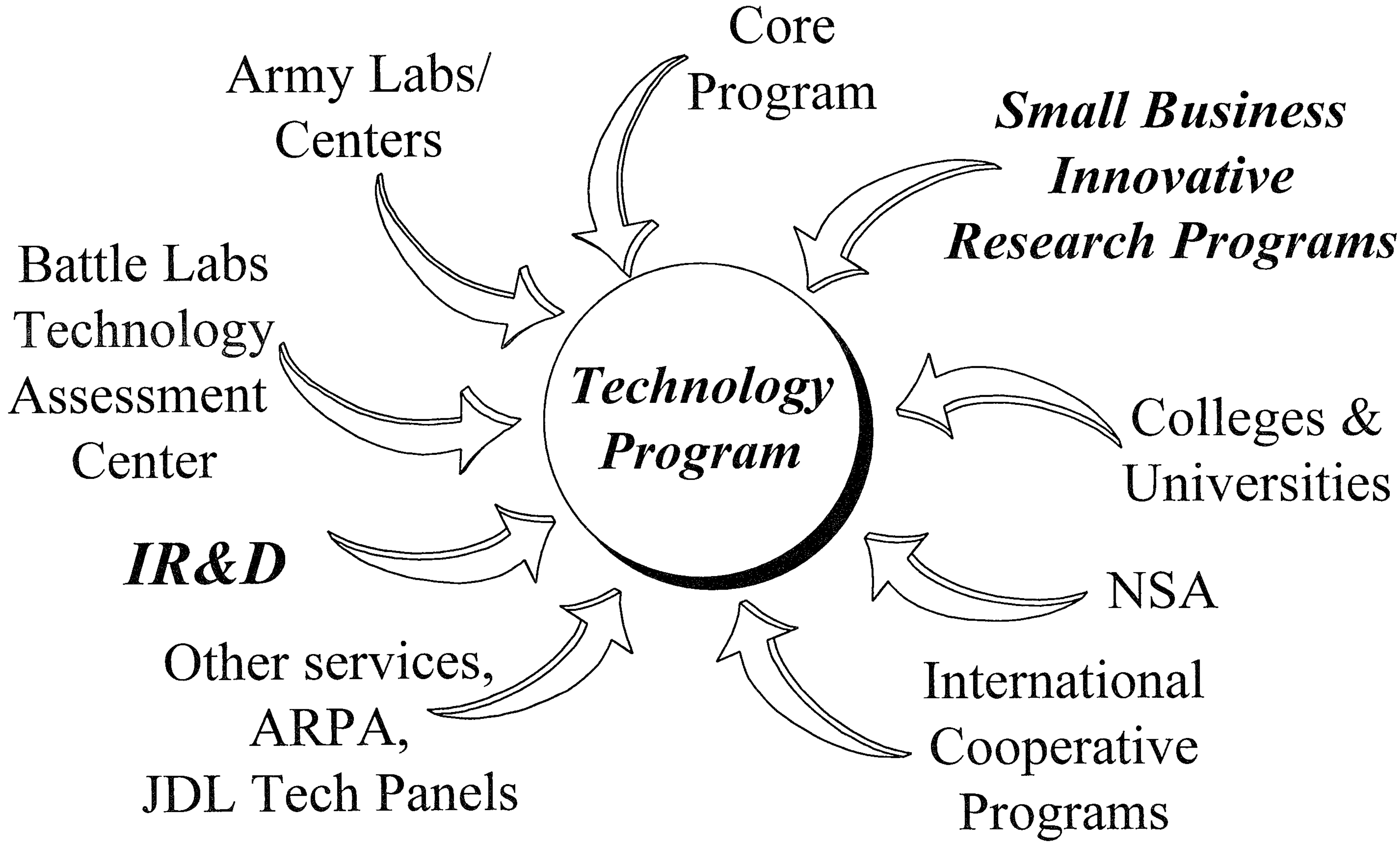


Technology Sources



Technology Goals

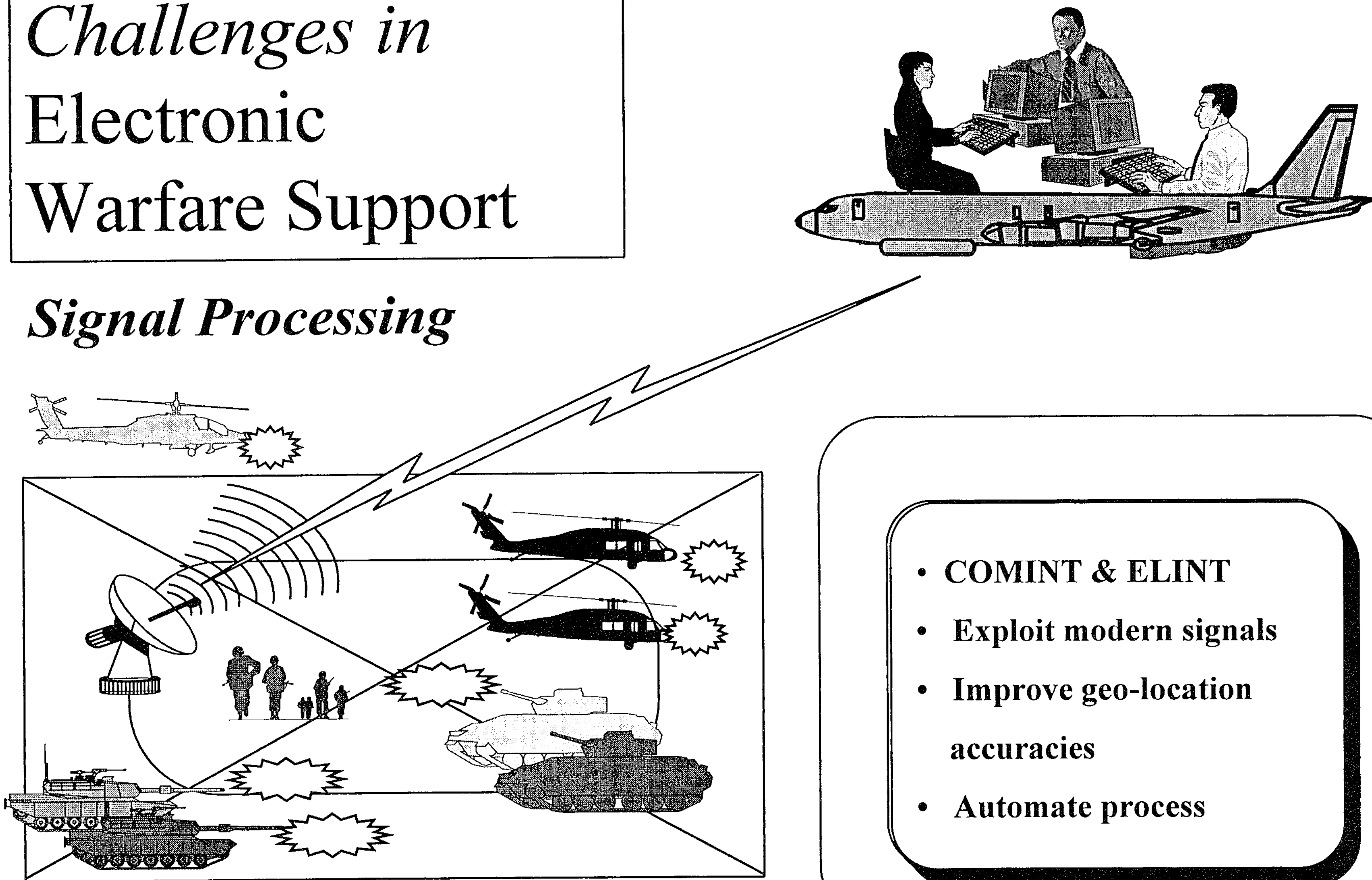
Provide technology to:

- Locate and exploit hostile command, control, and communications (C3) systems and other battlefield emitters and sensors
- Deny hostile forces use of their C3 and sensor assets
- Process, analyze, correlate and disseminate battlefield intelligence and combat information

Thereby "Knowing the Enemy and "Owning the Spectrum"

Technology Challenges in Electronic Warfare Support

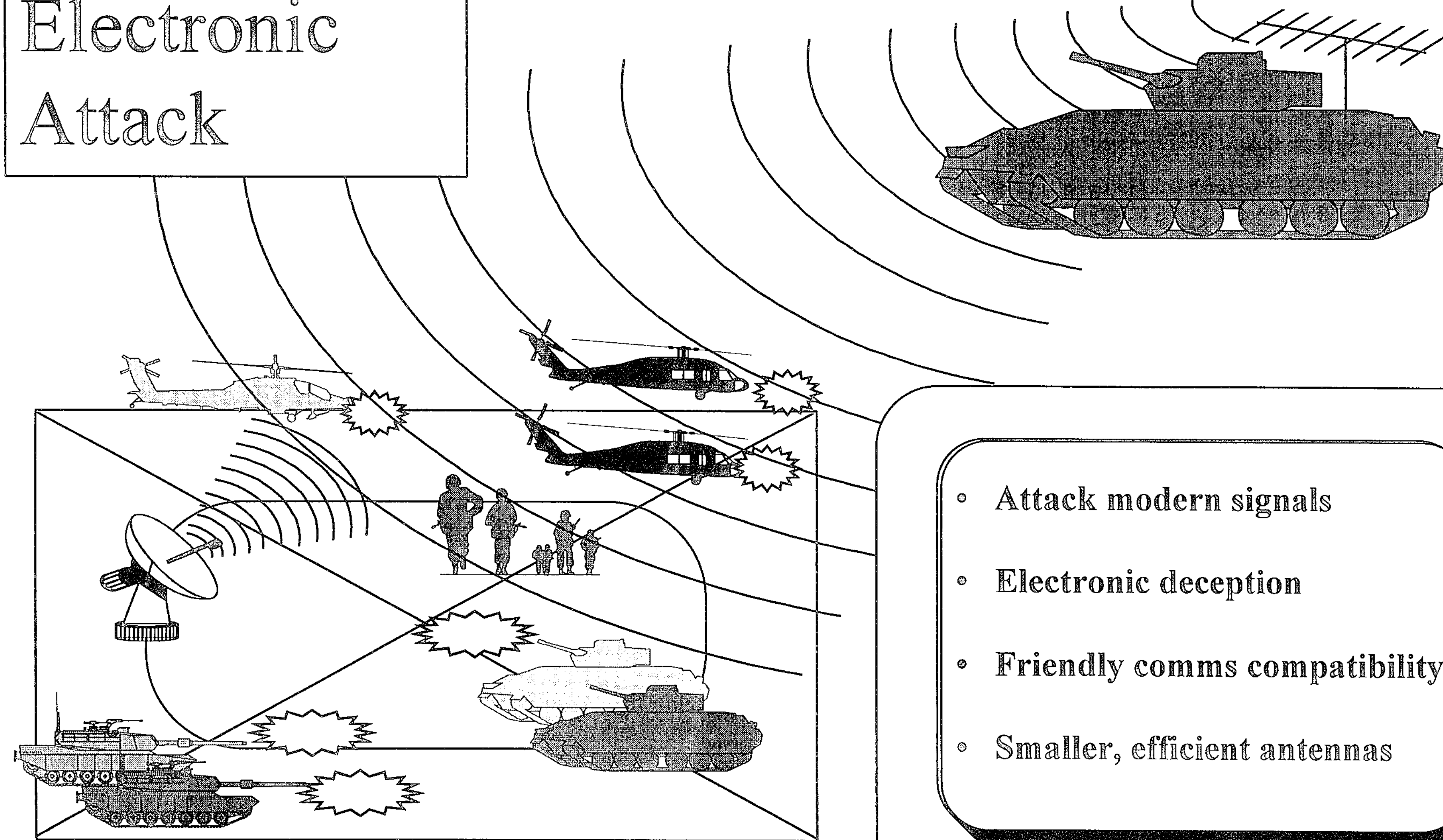
Signal Processing



- COMINT & ELINT
- Exploit modern signals
- Improve geo-location accuracies
- Automate process

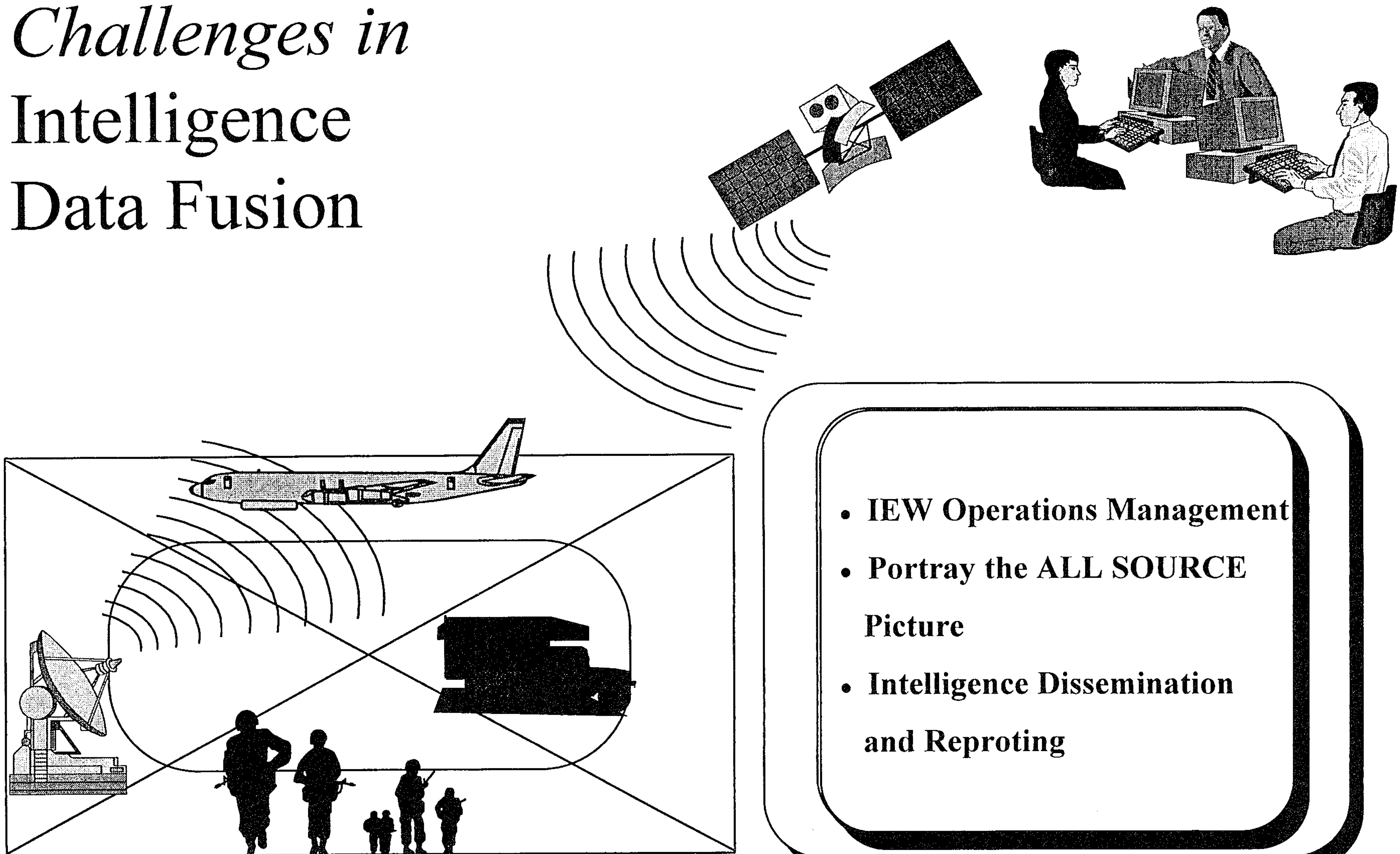
Technology Challenges in Electronic Attack

Communications and Non-Communications Antennas and Receivers



- Attack modern signals
- Electronic deception
- Friendly comms compatibility
- Smaller, efficient antennas

Technology Challenges in Intelligence Data Fusion



- IEW Operations Management
- Portray the ALL SOURCE Picture
- Intelligence Dissemination and Reproting

Conclusion

- **Worldwide battlefield dependence on information**
- **Technology goals meet emerging threats, IEW concepts and product improvements**
- ***Solicit active industry participation to meet technology challenges***

"Owning the spectrum to Win the Information War"

IEWD IR&D CONFERENCE

Westfields Conference Center

Chantilly, VA

19 October 1995

TOPICS:

Antenna/Direction Finding

Advanced Receivers & Digital Processors

Signal Detection/Classification

Intelligence Data Fusion

POC: Ms. Linda Monroe (540) 349-7370

IEWD IR&D Conference

Intelligence and Electronic Warfare Directorate

- Advanced Non-Communications Electronic Warfare
  - ➢ Signal Processing - *Dr. Frank Elmer*

- **Advanced Communications/ Non-Communications Electronic Countermeasures**
  - ➢ **Non-Communications EW Receivers** - ***Dr. Frank Elmer***
  - ➢ **Advanced IEW Antenna Technology** - ***J. Thomas Dizer***

- Electronic Warfare Processing Techniques
  - ➢ **Tactical Intelligence Data Fusion** - ***Richard Anthony***

NOTES

ADVANCED NON-COMMUNICATIONS ELECTRONIC WARFARE

SIGNAL PROCESSING

DR. FRANK J. ELMER
SENIOR TECHNICAL ADVISOR
INTELLIGENCE AND ELECTRONIC WARFARE DIRECTORATE

UNCLASSIFIED

POINT PAPER

SUBJECT: Signal Processing

OBJECTIVE: To inform industry of IEWD Plans to migrate digital signal processors into the open architecture compliant with the Joint Airborne SIGINT Architecture (JASA).

FACTS:

- IEWD has a joint program with the Air Force to cast the best of the available algorithms into Computer Aided Software Engineering/Computer Assisted Engineering (CASE/CAE) objects using a subset of the Rapid Prototyping for Application Specific Signal Processors (RASSP) toolset developed by the Advanced Research Projects Agency (ARPA).
- These RASSP tools will permit development/demonstration of a virtual prototype with data from a variety of SIGINT receivers. These tools will also permit optimization and a hardware/software tradeoff to be performed. The output will be VHSIC High Level Design Language (VHDL) for the processes to be rendered in hardware and C++ or Ada for the processes to be rendered in software. This process will allow the SIGINT processor to be implemented using the latest open architecture compatible technology.
- The RASSP tools are available to industry and will be the wave of the future for hardware/software development. RASSP info is available by calling (803)-760-3376, E-mail: info@rassp.scra.org, World Wide Web: http://rassp.scra.org
- IEWD invites industry to participate through casting their algorithms into the appropriate RASSP objects, demonstrating them using the IEWD virtual prototype, and proposing them for inclusion into JASA.

BRIEFER: Dr. Frank J. Elmer, Senior Technical Advisor, Advanced Concepts Division, Intelligence and Electronic Warfare Directorate, ATTN: AMSEL-RD-IEW-TAE-M, (908)-427-5956

SIGNAL PROCESSING
Objective

- Provide the user with Digital Signal Processors that utilize state-of-the-art technology and the capability to process current threat signals in a Battlefield environment.
- Migrate Digital Signal Processors into an open architecture compliant with Joint Airborne SIGINT Architecture (JASA) standards to handle future threats in support of joint airborne and ground based applications.
- Provide upgrades to PEO IEW/PM-SW platforms (e.g., GBCC, AQF, ARL, and GRCS) as required.

SIGNAL PROCESSING
Challenges

- Technology independent processor architectures that:
  - Permit implementation in the latest hardware/ software
  - Permit combining the "best" parts of previously developed algorithms
  - Permit combining the data from and orchestrating a set of special purpose subreceivers required to cover the modern non-comm signals

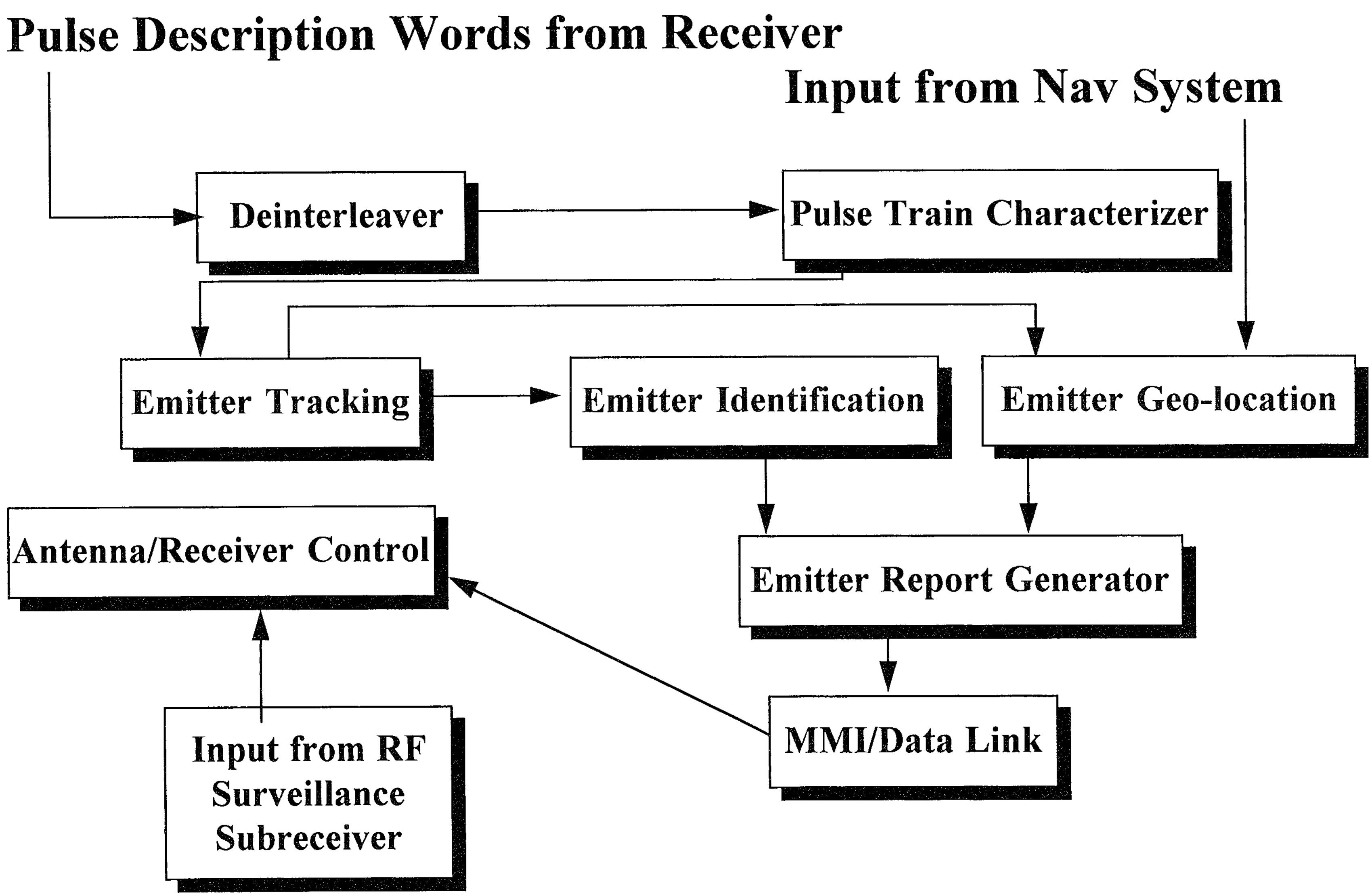
SIGNAL PROCESSING
Challenges

- **Accepting very large pulse descriptor words at a very fast rate for a prolonged period**
- **Extracting information content from the very high speed flow of pulse descriptor word data**
- **Interoperability at the parameteric level with other sensors to combine their information**
- **Recognizing the difference between comm and non-comm emitters with similar waveforms**
- **Recognizing when a signal reported by a subreceiver does not fit in the class of signals for which the subreceiver was designed**

Drivers for Electronic Support (ES)

Radar Improvement	Radar Technology	ES Challenge	Required ES Technology
Smaller Size Better Resolution	Higher Frequency • MMW	VHF - MMW Coverage	Wideband Antennas Freq. Surveillance for ES Receiver Cueing 360 Degree Coverage
Less Clutter Multi-Target Search/Track	Phased Arrays • Low Sidelobes • Electronic Scan	Lower Probability of Intercept	
Smaller Target Detection	MIMIC • Smaller Size/Power • Improved Sensitivity	Lower Effective Radiated Power	More Sensitivity
Clutter rejection Improved Target Acq & Tracking	Analog/Digital Processing • Complex Waveforms • Improved Sensitivity • Adaptive Scan/Waveform	Complex Waveform Detection/ Measurement/DF Difficult Deinterleaving Emitter ID/Geo-location	Waveform Detection Cued Demodulators Better Deinterleaving, AOA, TOA
Avoid Addl Xmtr	Embedded IFF/MG Signals	Simultaneous Comm Waveform Signals	ELINT/COMINT Fusion
Shorter On-Time Improved Target Recog/Tracking	Communications • Other Sensor Hand-off		
	Databases	Short Response Time Req.	Faster ID/ Geo-location
	Displays		

Architecture



SIGNAL PROCESSING
Approach

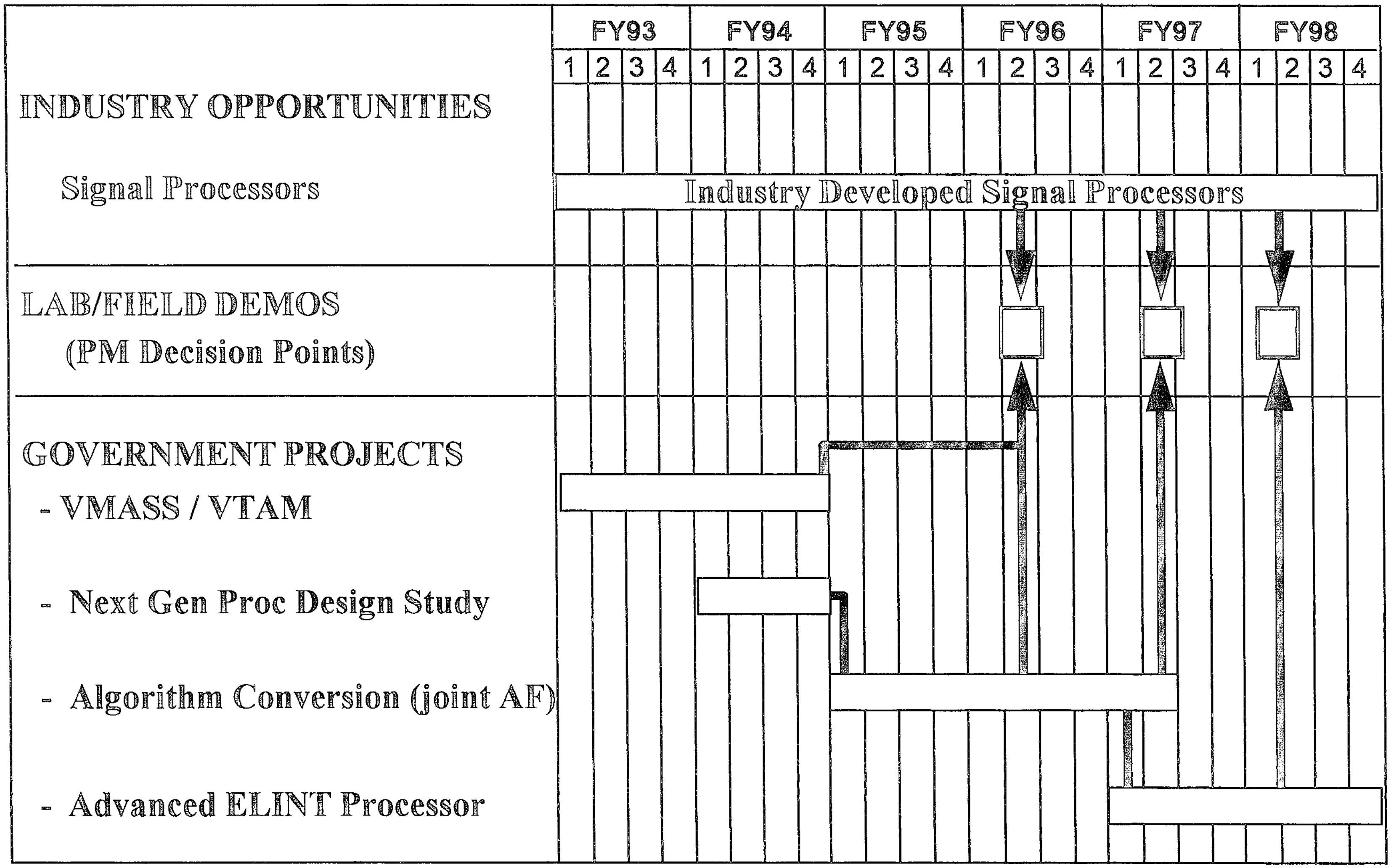
- Joint Airborne SIGINT Architecture
  - Distributed computing
  - High Speed Data Networks/Busses
  - C++, Ada
  - COTS where mature and supportable

- Processing power available makes it possible to do all processing in the ES sensor

SIGNAL PROCESSING
Approach

- **New way of developing/documenting/optimizing system software**
  - **Rapid Prototyping for Application Specific Signal Processors (RASSP)**
    - **$150M ARPA effort to develop tool set**
    - **Commercially available**
    - **Provides means to virtual prototype/optimize/document design and spit out High Level Language/VHDL**

Schedule



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INDUSTRY OPPORTUNITIES
Signal Processors
Industry Developed Signal Processors
LAB/FIELD DEMOS
(PM Decision Points)
GOVERNMENT PROJECTS
- VMASS / VTAM
- Next Gen Proc Design Study
- Algorithm Conversion (joint AF)
- Advanced ELINT Processor

SIGNAL PROCESSING
Applications

- **Downsizing, limited funding, deliberate decision to skip a generation of systems all limit and force changes to the normal way of doing business**

- **DARO Initiatives**
  - **Joint Airborne SIGINT System (JASS)**
  - **Unmanned Aerial Vehicles (UAVs)**

SIGNAL PROCESSING
Applications

- Only current active program is "Algorithm Conversion" which is joint Army/Air Force project to develop the next generation of ES processors for fielded systems
  - Uses algorithms from previous programs
  - Uses subset of RASSP tools
  - Virtual Prototype generates HOL/VHDL Specifications
    - Customizable to any ES receiver

SIGNAL PROCESSING
Transitions

- PEO IEW, PM-SW platforms
  - Ground Based Common Sensor (GBCS)
  - Advanced Quickfix (AQF)
  - Airborne Reconnaissance Low (ARL)
  - Guardrail Common Sensor (GRCS)
- Join IEWD in Cooperative R&D
  - No cost, win-win effort to leverage IEWD resources and your IR&D resources
  - Opportunity to demonstrate your IR&D products to potential customers on a tri-service basis

SIGNAL PROCESSING
Future Technology Needs

- Techniques to fuse the data from a set of special purpose subreceivers
- Techniques to orchestrate the set of special purpose subreceivers
- Improved deinterleaving algorithms to handle modern highly agile emitters
- Improved pulse train descriptors for the agile emitters
- Modular pulse parameter descriptor words
- Technology and Techniques for accepting and processing 256 bit pulse descriptor words at a rate of 15 million per second

NOTES

ADVANCED COMMUNICATIONS ELECTRONIC COUNTERMEASURES DEMOS

NON-COMM EW RECEIVERS

Intelligence and Electronic
Warfare Directorate

IEWD

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DR. FRANK J. ELMER
SENIOR TECHNICAL ADVISOR
INTELLIGENCE AND ELECTRONIC WARFARE DIRECTORATE

UNCLASSIFIED

POINT PAPER

SUBJECT: Non-Comm EW Receivers

OBJECTIVE: To inform industry of IEWD Technologies/Plans in migrating to future efforts

FACTS:

- IEWD has projects, both in-house research and contractual efforts, in developing and transitioning technologies.
- The vision of these projects is to be consistent/compliant with the Joint Airborne SIGINT Architecture (JASA) standards which will be finalized June 1996, and with other critical Army ongoing systems. Prevailing against future threats within the evolving array of combat scenarios, is important, and thus should present to industry an almost vast panoply of technological opportunities. These opportunities will be guided by the need for lower weight, size and cost, coupled with the cost-effective advantages of electronic steerability/adaptability over wide-bands and new materials.
- IEWD invites industry to participate through free-market engineering data exchanges between government and industry, and gear up for inclusion of future/present technologies into JASA.

BRIEFER: Mr. Mark Coy, Project Leader, Advanced Concepts Division, Intelligence and Electronic Warfare Directorate, ATTN:AMSEL-RD-IEW-TAE-M, (908)-427-5746.

NON-COMM EW RECEIVERS

Objective

- Provide the EW user with receivers that employ state-of-the-art technology and the capability to intercept, ID, and locate current/future threat signals in a Safe-Haven/Early Entry/Battlefield environment.

NON-COMM EW RECEIVERS
Vision

- Migrate EW receiver technologies into an open architecture, compliant with Joint Airborne SIGINT Architecture (JASA) standard and other standards (e.g. ground based, sea borne, etc.); in order to prevail against future threats within the evolving array of combat scenarios.

NON-COMM EW RECEIVERS
Challenges

- Detection, angle-of-arrival determination, and accurate parameteric description of each non-comm pulse in a dense , wideband environment
- Use the appropriate combination of each technology (e.g., compressive, IFM, acousto-optic, etc.) to do the signal processing that it does best
- Coordination of the specifications and capabilities of the various subreceivers to form a comprehensive set, to handle the required signals

NON-COMM EW RECEIVERS
Challenges

- Extracting the information contained in the data measured by the subreceiver to reduce the input rate to the processor
- Control of the subreceivers to act as a team
- Covering the .4 to 40 GHz frequency range with a high probability of intercept
- Devising a flexible pulse descriptor word structure which can support the varying capabilities of the subreceivers
- Recognizing when a signal reported by a subreceiver does not fit in the class of signals for which the subreceiver was designed

Drivers for Electronic Support (ES)

Radar Improvement	Radar Technology	ES Challenge	Required ES Technology
Smaller Size Better Resolution	Higher Frequency • MMW	VHF - MMW Coverage	Wideband Antennas Freq. Surveillance for ES Receiver Cueing 360 Degree Coverage
Less Clutter Multi-Target Search/Track	Phased Arrays • Low Sidelobes • Electronic Scan	Lower Probability of Intercept	
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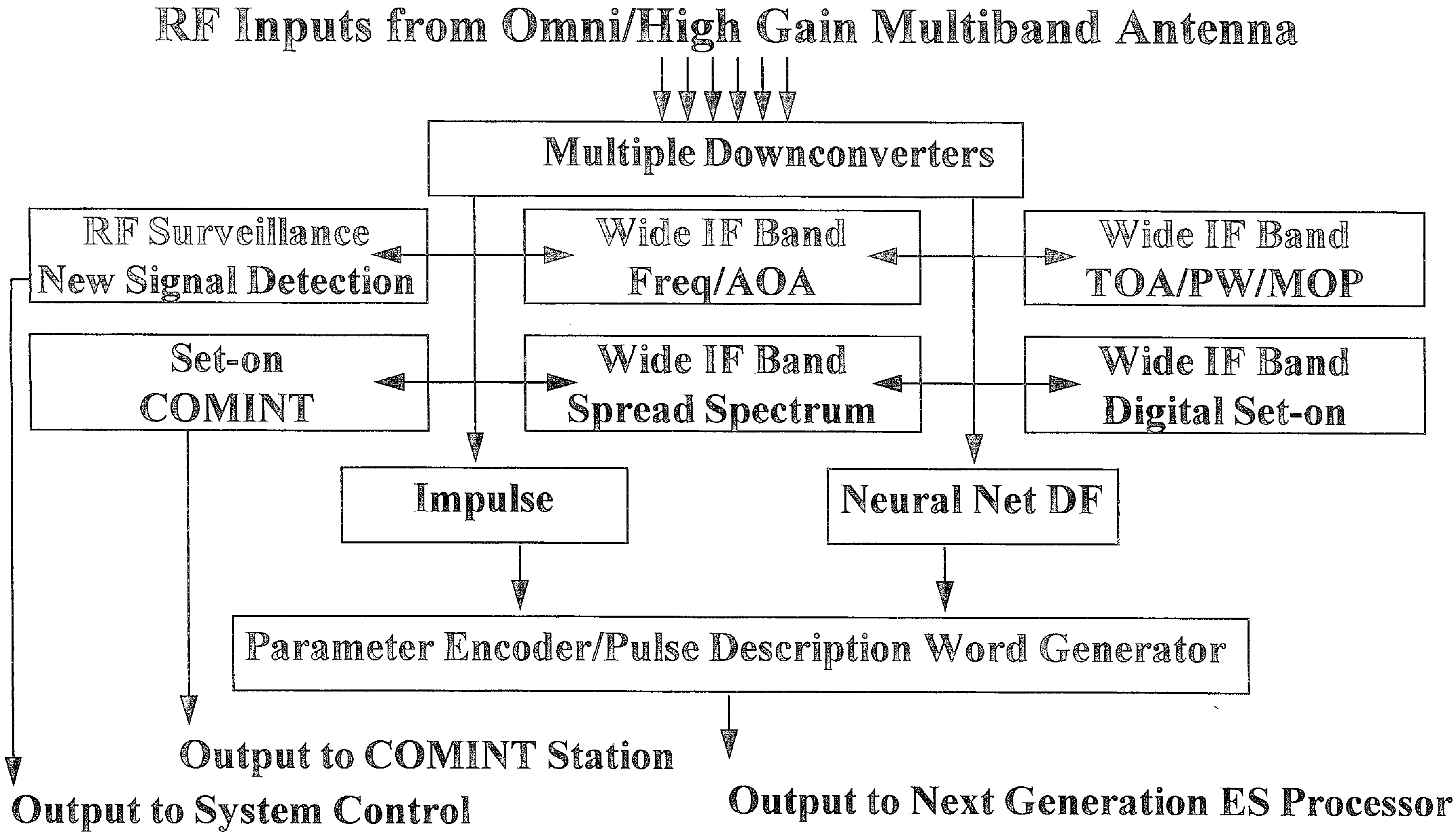
Shorter On-Time Improved Target Recog/Tracking	Communications • Other Sensor Hand-off		
	Databases	Short Response Time Req.	Faster ID/ Geo-location
	Displays		

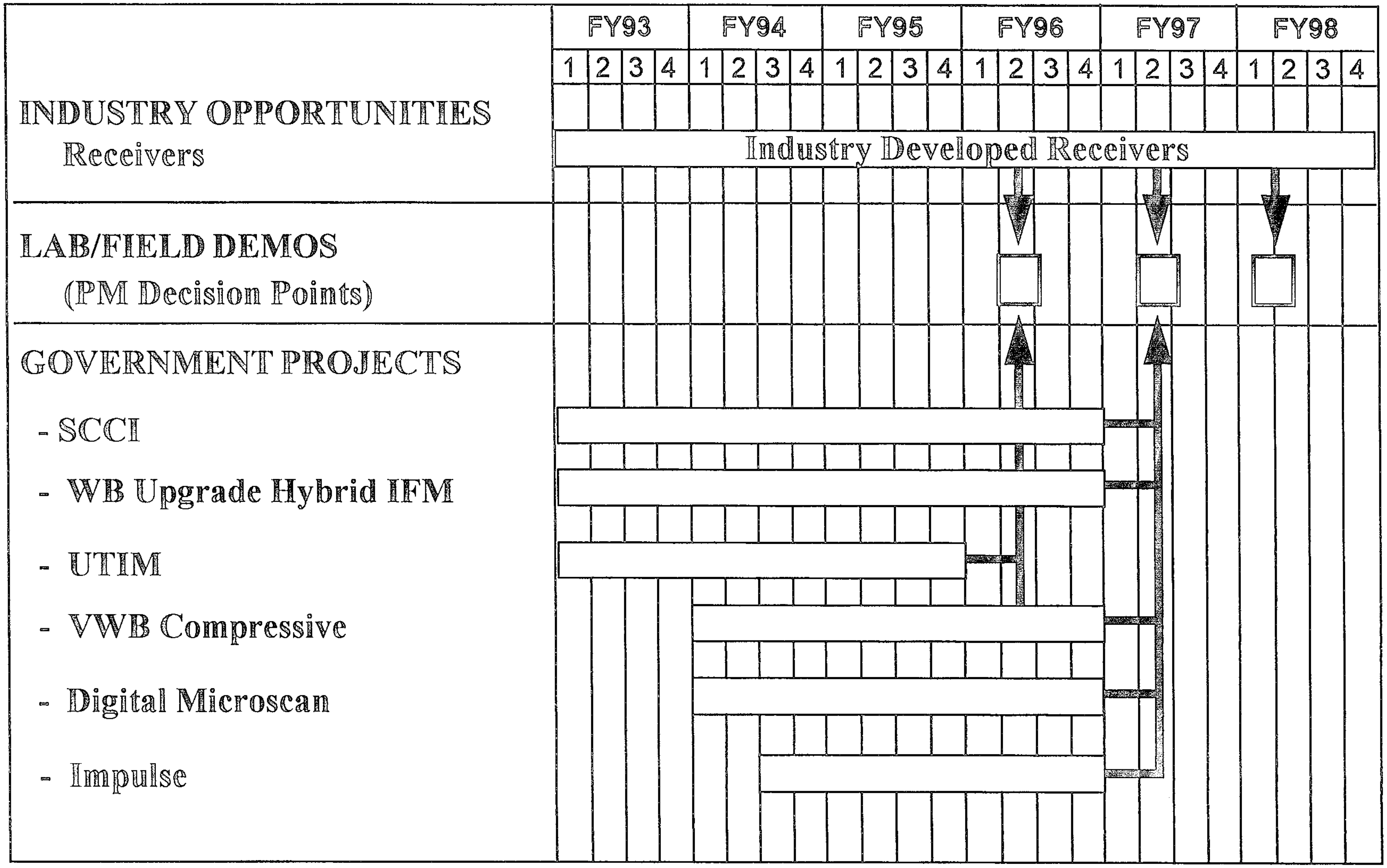
Schematic Representation of Classes of EW Receivers



NON-COMM EW RECEIVERS
Approach

- Modularity
- Interchangability/Multi-Function
- Broadband, Hi Sensitivity, Lower Cost, & Weight
- Faster/Higher data rate receiving, resolution, less noise, wider bandwidth A/Ds
- Extended signal set intercept capabilities

Schedule



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INDUSTRY OPPORTUNITIES
Receivers
Industry Developed Receivers
LAB/FIELD DEMOS
(PM Decision Points)
GOVERNMENT PROJECTS
- SCCI
- WB Upgrade Hybrid IFM
- UTIM
- VWB Compressive
- Digital Microscan
- Impulse

NON-COMM EW RECEIVERS
Applications

- Retrofit (PIP) to existing systems
- Incorporation into JASA standards
- Application to other platforms (e. g., UAVs)
- Commonality between Airborne and Ground based platforms
- Dual use Technology

NON-COMM EW RECEIVERS
Transition

- PEO IEW, PM-SW platforms
  - Common Module ELINT System (CMES)
- Air Force programs
  - Rivet Joint
- Join IEW in cooperative R&D
  - Opportunity to demonstrate your IR&D products to potential customers on a Tri-Service basis

NON-COMM EW RECEIVERS
Future Technology Needs

- Rapid tuning downconverters to convert .4 to 40 GHz to IF Bandwidths of 2, 10, 50, 500, 1000, 2000 MHz with low phase noise and amplitude/phase matching between multiple channels
- Subreceivers specifically configured to handle the following signal set:
  - Unmodulated simple pulse
  - Frequency Modulated pulse (linear, non-linear, FSK)
  - Phased Modulated pulse (MPSK, M=2,4,8)
  - Impulse
  - Pulse widths: .1 nsec - 680 microseconds

NON-COMM EW RECEIVERS
Future Technology Needs

- Capability to monitor the .4 to 40 GHz band for rapid detection of new signals
- Capability to accurately measure pulse
  - Time-of-Arrival <5 nsec
  - Angle-of-Arrival <1 degree
  - Amplitude < 2 dB
  - Modulation
- Modular, 6UVME footprint, Joint Airborne SIGINT Architecture compliant
- Rugged, small size, weight, power

NOTES

ADVANCED IEW ANTENNA TECHNOLOGY

Intelligence and Electronic Warfare Directorate

IEWD

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JOHN T. DIZER

CHIEF, INFORMATION WARFARE TECHNOLOGY BRANCH

INTELLIGENCE AND ELECTRONIC WARFARE DIRECTORATE

UNCLASSIFIED

POINT PAPER

SUBJECT: Advanced IEW Antenna Technology

OBJECTIVE: To inform industry of IEWD program to develop a family of modern antennas incorporating interdisciplinary state-of-the-art technology. These antennas shall provide both intercept and jamming capability to accomplish on-the-move operations with enhanced electronic parameters while significantly reducing size and weight.

FACTS:

- IEWD is conducting a program to modernize the electronic warfare capability of the U.S. Army forces. Concepts of heavy jammers with limited mobility, frequencies, critical net coverage and signal propagation are being replaced by flexible systems that support high mobility and deep attack forces; multiple frequencies, modes and nets; minimal manning and training and automated IEW mission and management functions.
- A critical RF subsystem that needs special attention is the front end equipment, that must be capable of radiating and receiving the sophisticated signals and information of modern day warfare. At this time, the weakest link of modern EW-communication systems are both transmitting and receiving antennas of diverse applications.
- The antenna modernization program at IEWD includes, for example: A ceramic-dielectric antenna, capable to steer its main beam by means of an applied DC voltage. This inexpensive and lightweight antenna can be used as the basis of an array antenna. At the present, R&D efforts are still in a developmental stage and need refining. Another concept is the use of modern superconductors of high critical temperature (HTS). An HF antenna can effectively utilize HTS technology by incorporating in its network, HTS elements that will greatly enhance its radiation parameters. At the present, a prototype HTS impedance matching network with very fast frequency tuning has been fabricated. It needs further developing to be rendered size and weight compatible as well as cost effective. Also an HF antenna using an HTS delay line has been built and tested. It needs to be optimized in terms of its internal circuit's impedance matching, dielectric loading, etc., in order to be rendered effective and efficient. Other antennas in developmental stages include a wideband patch antenna, a circular antennas array, a Butler matrix and also a superconductive, low band spiral antenna.
- IEWD invites industry to participate through proposing, designing and manufacturing antennas with advanced technology aimed to the special applications of ESM and ECM, demonstrating them in realistic environments and presenting them for possible insertion into the Army inventory.

BRIEFER: Mr. Thomas N. Tuma, Senior Engineer/Physicist, Research and Technology Division, Intelligence and Electronic Warfare Directorate,
ATTN: AMSEL-RD-IEW-TRS, (703) 349-7460.

ADVANCED IEW ANTENNA TECHNOLOGY

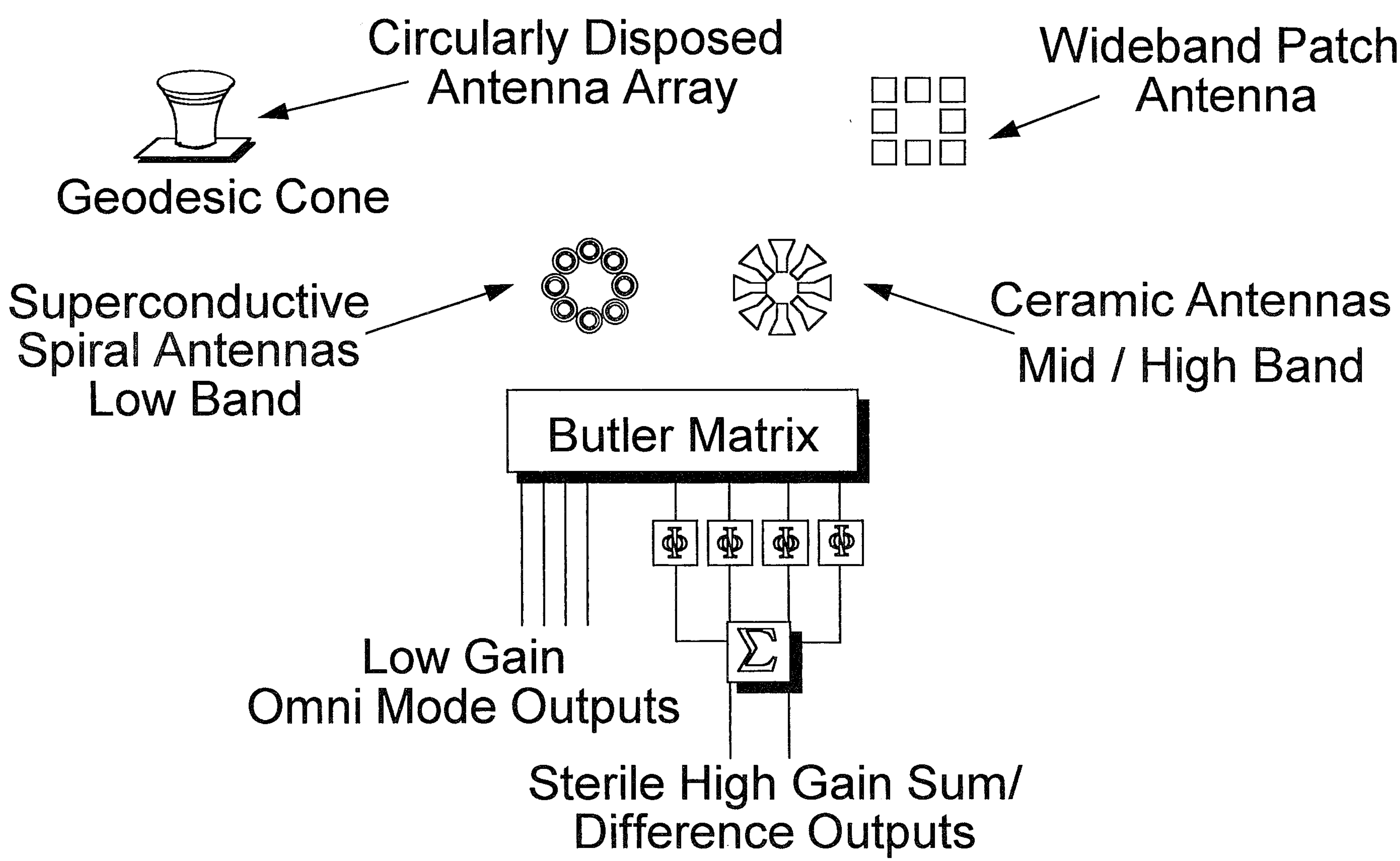
Objective/Vision

Provide both intercept and jamming antennas that support on-the-move operations with better gain and efficiency, while significantly reducing size; thereby contributing to the goal of owning the spectrum.

ADVANCED IEW ANTENNA TECHNOLOGY
Challenges

- Small, on the move antennas for HF and VHF
- Greater gain
- Greater directivity
- Optimize Power Output
- Greater DF accuracy
- Need to co-exist with other interfering subsystems

Schematic Representation of Classes of EW Antennas



High Temperature Superconductive (HTS) Electronic Attack Antennas

Approach

- Use both bulk and thin film materials
- Use the newest material: flexible HTS thick film
- Develop superconductive components; inductors, delay lines, filters, splitters/combiners, etc.
- Realize antenna design previously impossible with non-superconductor materials
- Use Fast Tuning if necessary

High Temperature Superconductive (HTS) Electronic Support Antenna

Approach

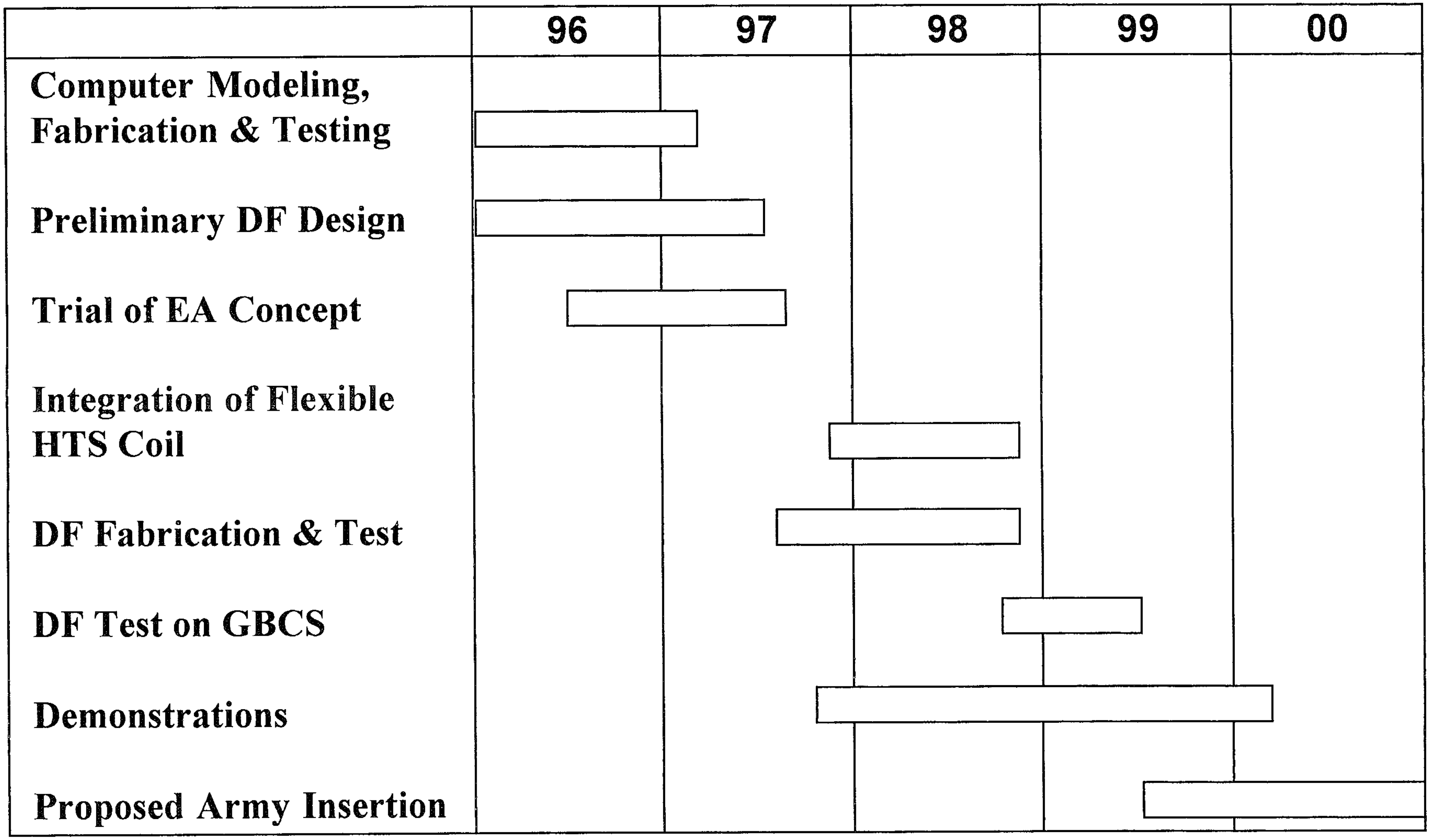
- Utilize superconductive matching circuit and butler matrix
- Cryogenic cooling of solid state devices for noise reduction

High Temperature Superconductive (HTS) Antennas and Materials

Objective / Vision:

- Develop small electronic support and electronic attack antennas and/or antenna couplers utilizing high temperature superconductive (HTSC) materials and technologies; deployable on tactical ground and air platforms

Schedule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97
98
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Computer Modeling, Fabrication & Testing
Preliminary DF Design
Trial of EA Concept
Integration of Flexible HTS Coil
DF Fabrication & Test
DF Test on GBCS
Demonstrations
Proposed Army Insertion

ADVANCED IEW ANTENNA TECHNOLOGY

Transitions:

- AN/TLQ-17A jammer
- Ground platforms for IEW Ground Based Common Sensor (IEWCS)
- Advanced Quick Fix (AQF)

Potential critical customer:

- PM-SW
- CMES (Common Module ELINT System)
- ARL (Airborne Reconnaissance Low)
- Other Tri-Service & Agency interest

ADVANCED IEW ANTENNA TECHNOLOGY

Future Technology Needs

- Improved antenna couplers
- Improved high power, high temperature superconductive (HTS) materials
- Flexible HTS materials for front end structures
- Smart antenna / coupler control mechanisms
- Ruggedization for EW on-the-move application
- Conformal antennas
- Lower Weight, Size and Cost
- Higher sensitivity

NOTES

WARFARE PROCESSING TECHNIQUES

TACTICAL INTELLIGENCE DATA FUSION

RICHARD ANTONY

COMPUTER SCIENTIST

INTELLIGENCE AND ELECTRONIC WARFARE DIRECTORATE

UNCLASSIFIED

POINT PAPER

SUBJECT: Tactical Intelligence Data Fusion

OBJECTIVE: To provide information on the CECOM Intelligence and Electronic Warfare Director's (IEWD's) interest and cooperative development opportunities with industry in the area of tactical intelligence data fusion.

FACTS:

- IEWD is developing technologies that support enhanced information dissemination and exchange, collection management, multi-sensor fusion, terrain reasoning and battlefield damage assessment.
- This briefing described IEWD's principal in-house programs that address these technologies.

BRIEFER: Mr. Richard Antony, Computer Scientist, Data Fusion Branch, Research and Technology Division, Intelligence and Electronic Warfare Directorate, AMSEL-RD-IEW-TRF, (703) 540-7313.

TACTICAL INTELLIGENCE DATA FUSION

Objective

Provide the technology products to PM Information Fusion, PM Signals Warfare and the Battle Labs that enable, enhance, and protect the Commander's decision and execution cycle while influencing an opponent's decision and execution cycle.

TACTICAL INTELLIGENCE DATA FUSION

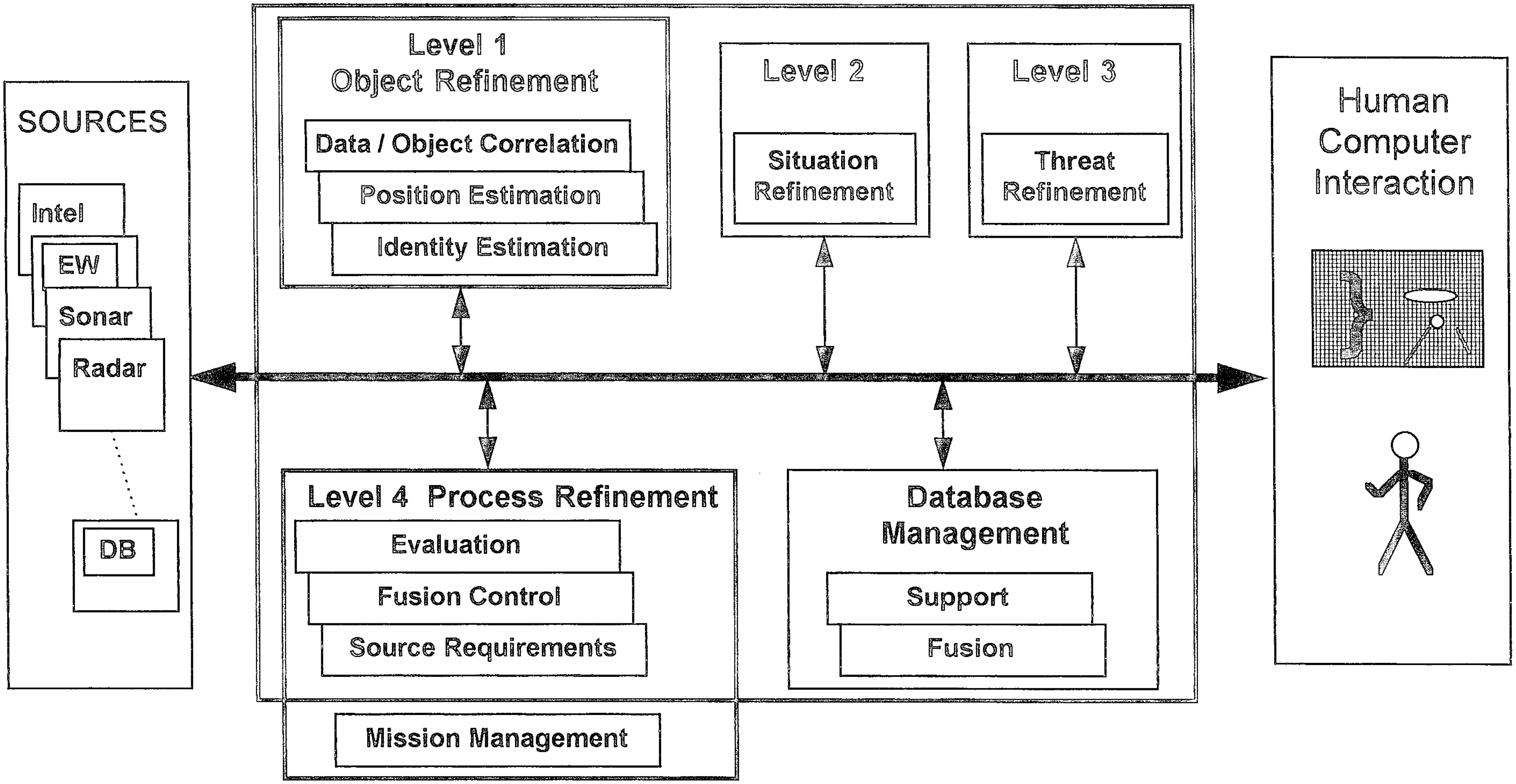
Vision

Achieve the effective fusion of data from multiple intelligence sources to provide the Commander with a concise and comprehensive understanding of the current enemy situation and intention.

TACTICAL INTELLIGENCE DATA FUSION
Challenges

- **Interfacing heterogeneous systems**
- **Asset management**
- **Fusion process automation**
- **Spatial reasoning**
- **Battlefield damage assessment**

The Data Fusion Model

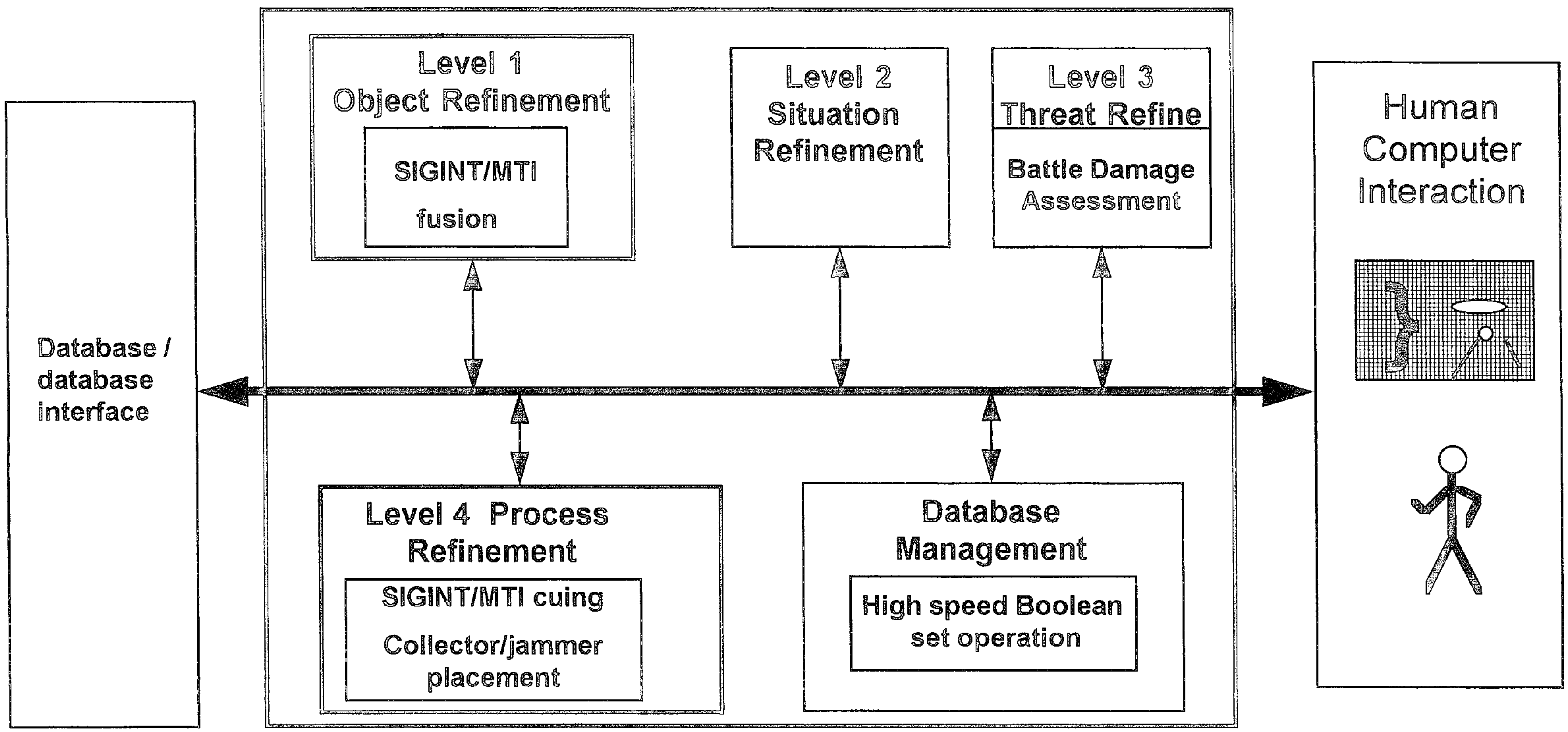


TACTICAL INTELLIGENCE DATA FUSION

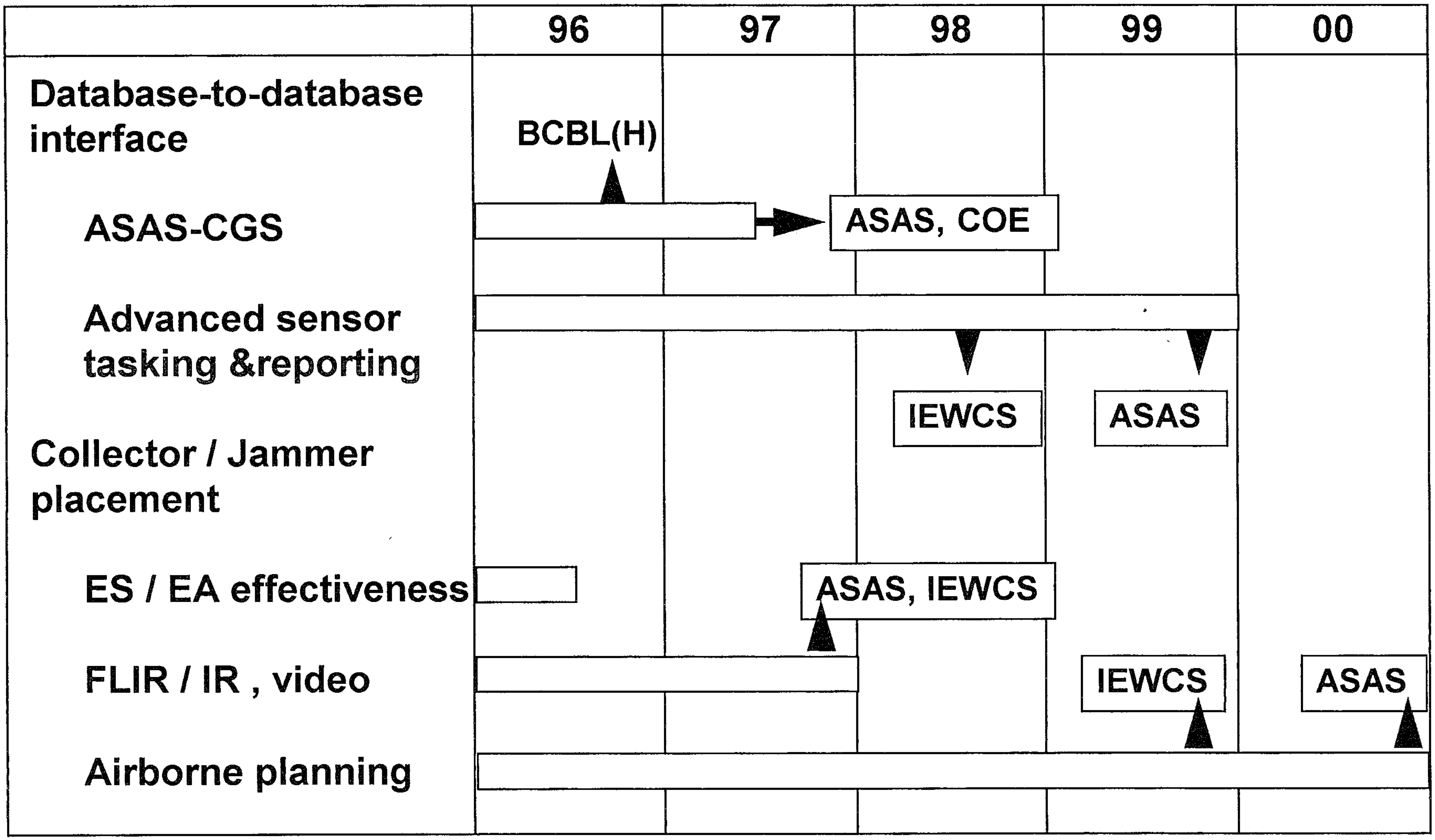
Approach

- **Develop and transition the following technologies:**
  - **Database level interface paradigm for linking the All Source Analysis System (ASAS) and the Common Ground Station (CGS) Advanced Technology Demonstration**
  - **Collector/jammer placement tool**
  - **Signals Intelligence (SIGINT) / Moving Target Indicator (MTI) Radar cross-cuing and fusion**
  - **Set operation generation to support spatial reasoning**
  - **Tools and techniques to support all-source Battlefield Damage Assessment (BDA)**

The Data Fusion Architecture:
Project Mapping



Schedule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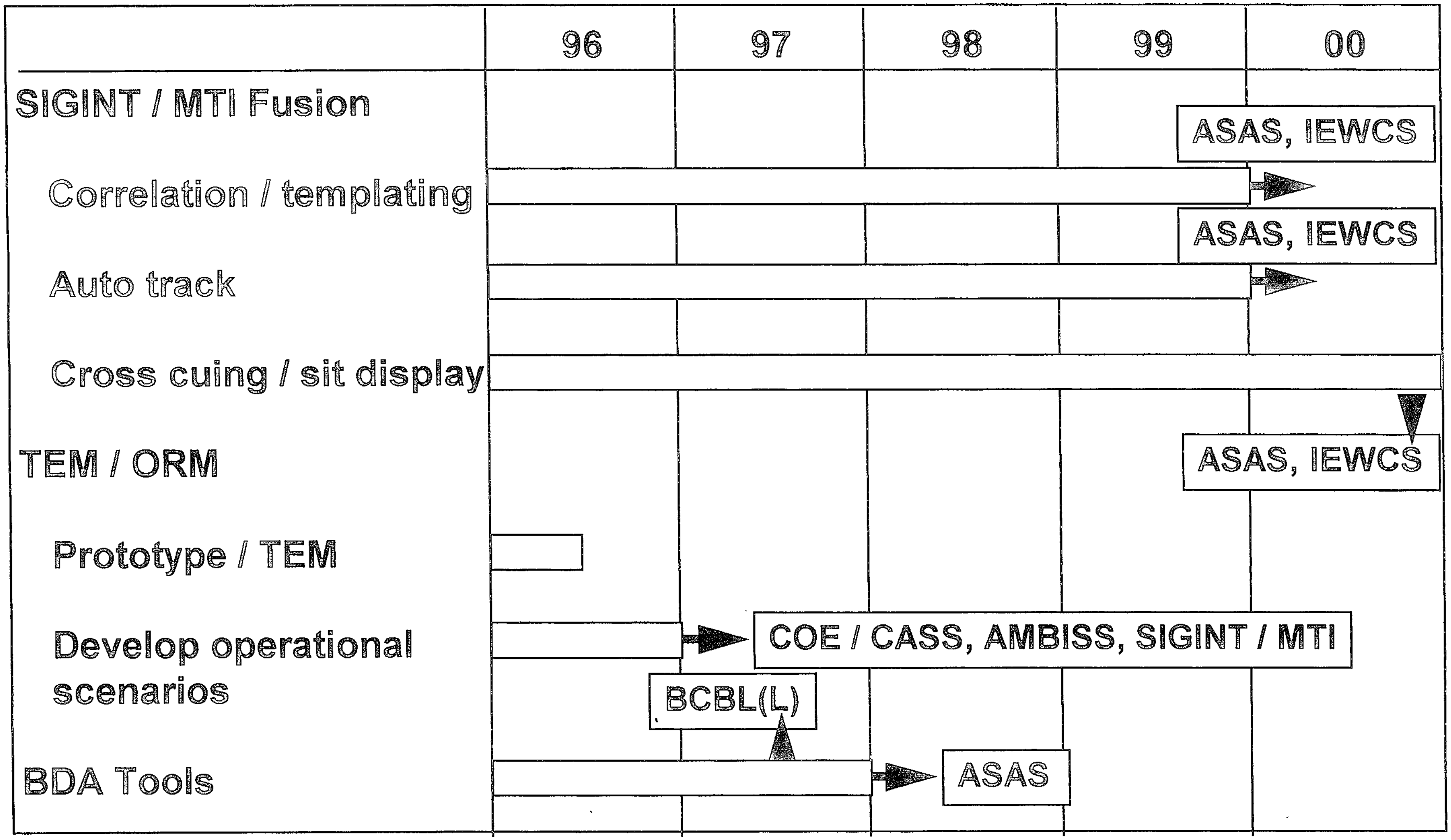
Database-to-database interface
BCBL(H)
ASAS-CGS
ASAS, COE
Advanced sensor tasking &reporting
IEWCS
ASAS
Collector / Jammer placement
ES / EA effectiveness
ASAS, IEWCS
FLIR / IR , video
IEWCS
ASAS
Airborne planning

Schedule



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SIGINT / MTI Fusion
Correlation / templating
Auto track
Cross cuing / sit display
TEM / ORM
Prototype / TEM
Develop operational scenarios
BDA Tools
ASAS, IEWCS
ASAS, IEWCS
ASAS, IEWCS
COE / CASS, AMBISS, SIGINT / MTI
BCBL(L)
ASAS

TACTICAL INTELLIGENCE DATA FUSION
Applications

- Advanced asset management and placement capabilities
- Multi-sensor fusion and sensor cross-cuing
- Advanced spatial reasoning tools and capabilities Advanced Battlefield Damage assessment tools and techniques
- Commercial applications
  - Cellular communications planning
  - Medical diagnosis
  - Multi-media heterogeneous database networking

TACTICAL INTELLIGENCE DATA FUSION

Transitions

- PM Signals Warfare:
  - Sensor placement tool
  - Database to database interface
  - SIGINT / MTI fusion algorithms and templating tool
- Battle Command Battle Lab (Huachuca):
  - Database to database interface
- Battle Command Battle Lab (Leavenworth):
  - Battlefield Damage Assessment tool

TACTICAL INTELLIGENCE DATA FUSION

Transitions

- PM Information Fusion:
  - Sensor placement tool
  - Database to database interface
  - SIGINT / MTI fusion algorithms
  - Battlefield Damage Assessment

TACTICAL INTELLIGENCE DATA FUSION
Future Technology Needs

- Commercial database products for interfacing legacy systems
- Airborne asset planning
- All source fusion techniques and tools
- Increased use of non-sensor derived domain knowledge in automated algorithms
- Advanced database management systems
- Improved human-computer interfaces
- Formalization of an underlying theory of data fusion

NOTES

SESSION V

NIGHT VISION ELECTRONIC SENSORS

STRATEGY & OVERVIEW

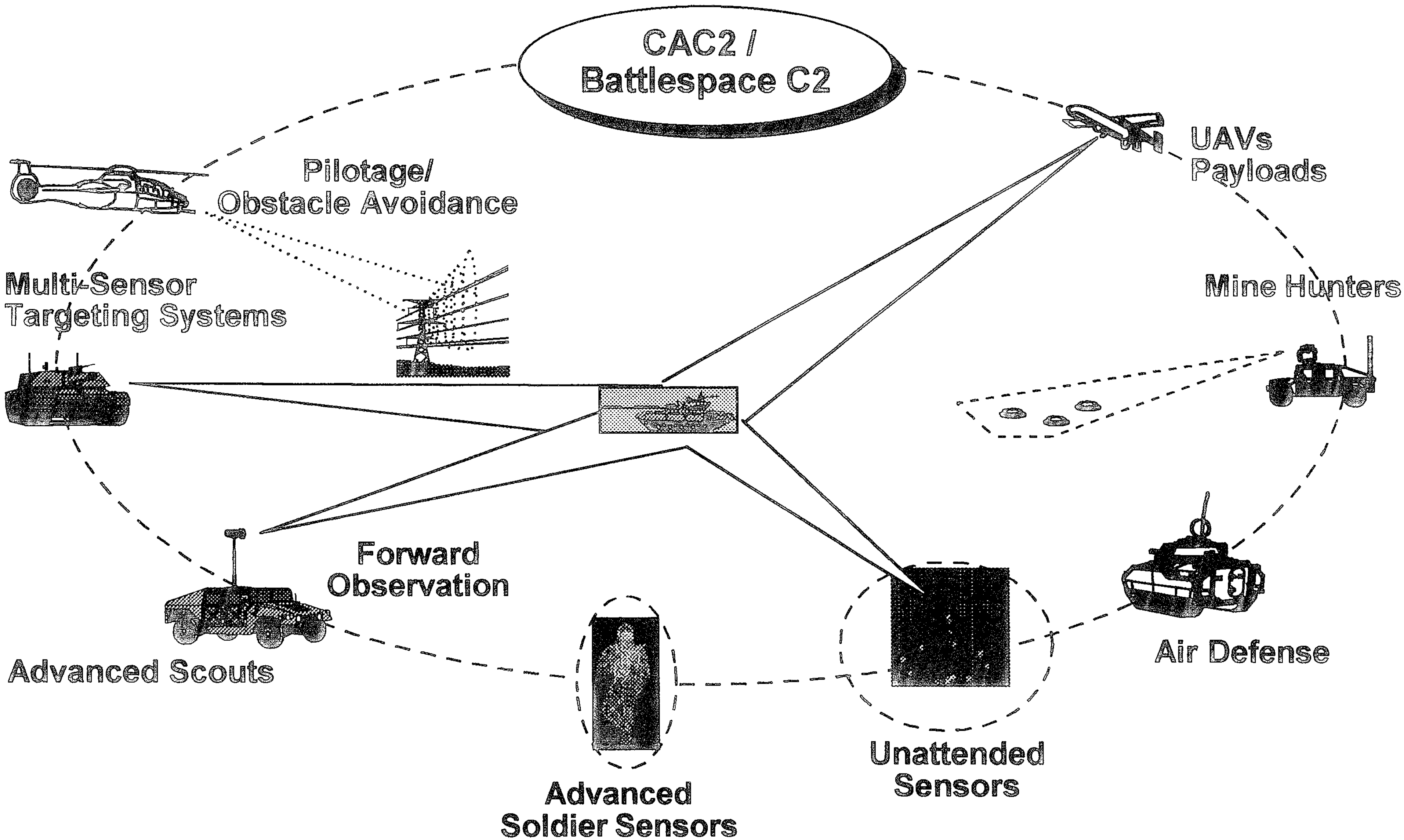
Mr. Larry L. Fillian

Director, Technical Support and Operations

NIGHT VISION & ELECTRONIC SENSORS DIRECTORATE

UNCLASSIFIED

NVESD - Sensors for the Battlefield

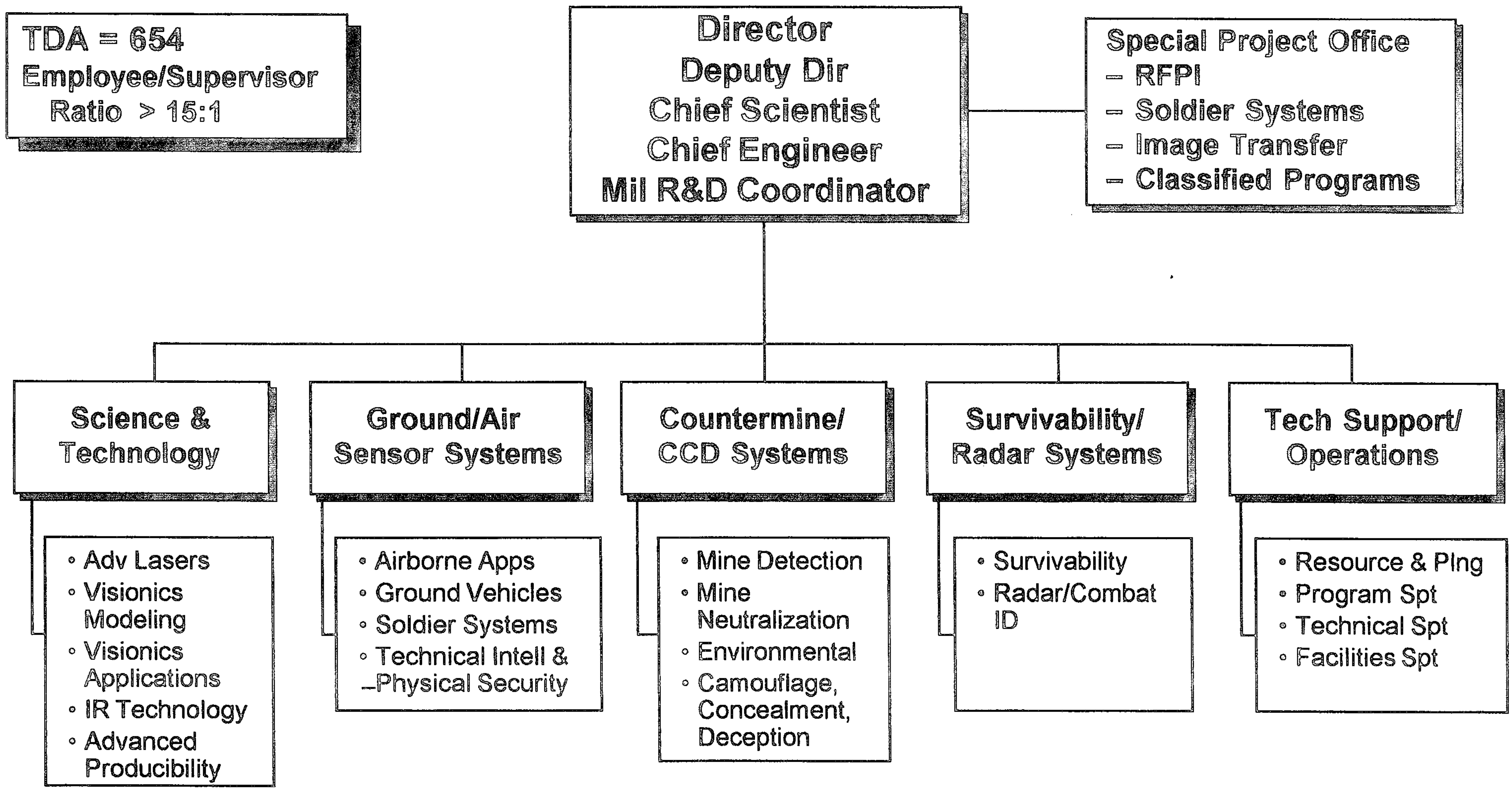


Mission Focus

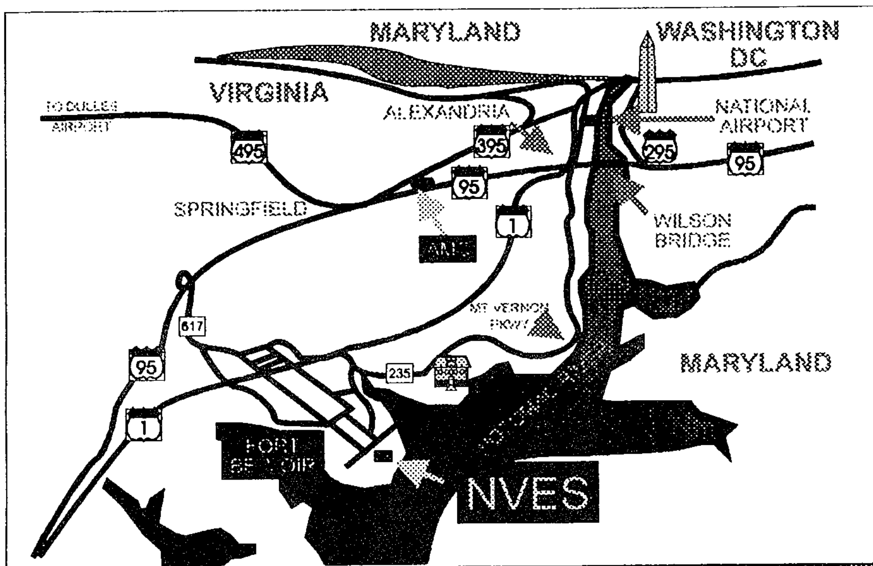
- Conduct Research and Development to Provide US Forces with Advanced Sensors and Sensor Suites to Dominate the 21st Century Digital Battlefield
  - Acquire/Engage Enemy Forces Day or Night and Under Adverse Battlefield Environments
  - Deny the Enemy the Same Capabilities Through Electronic/ Electro-Optic Means and/or Camouflage, Concealment, Deception
  - Detect and Neutralize Mines and Minefields
  - Protect U.S. Forces From Friendly Fire
  - Protect Fixed Installations and Rear Echelons from Enemy Intrusion

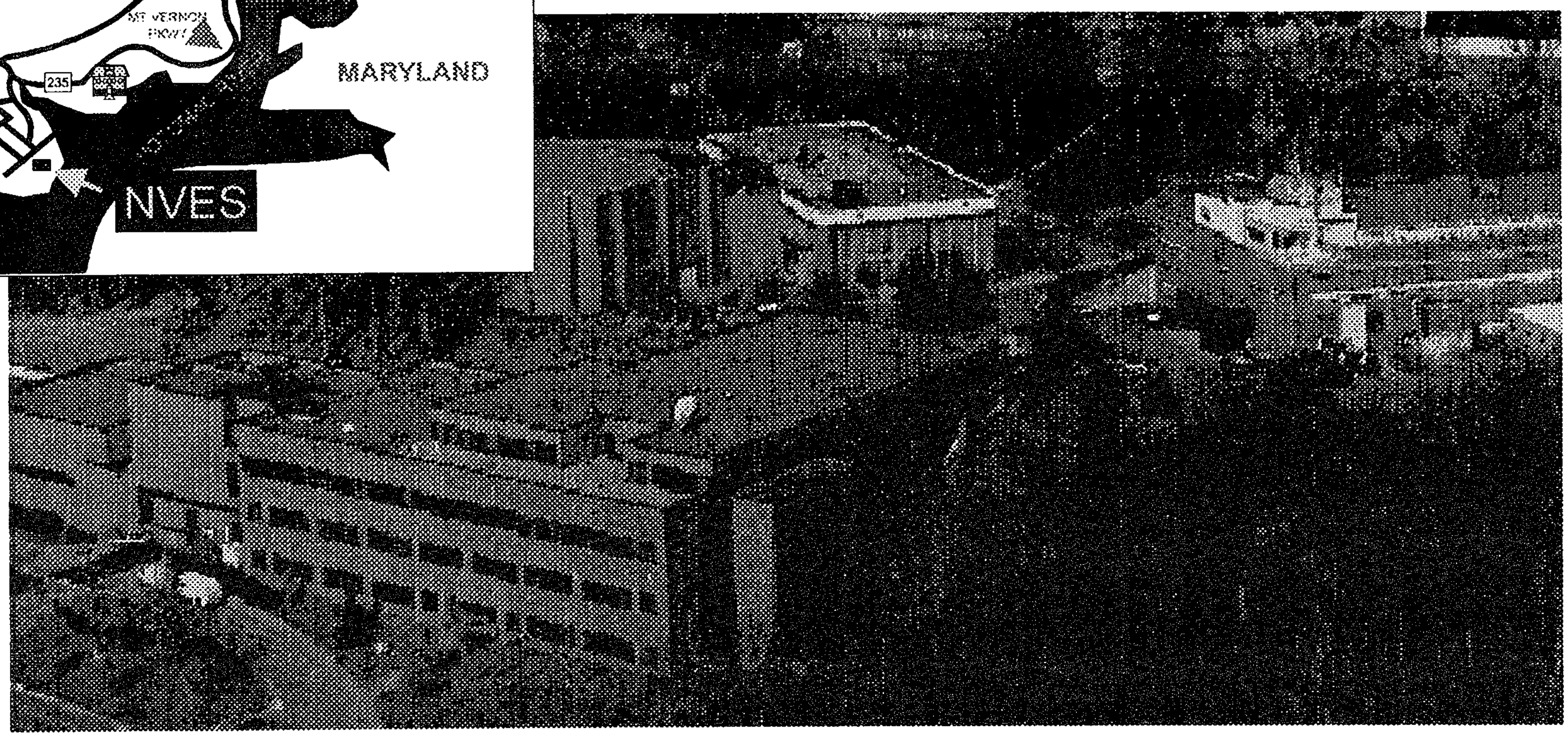
See and Control the Battlefield
Around the Clock in All Battlefield Conditions

Organization

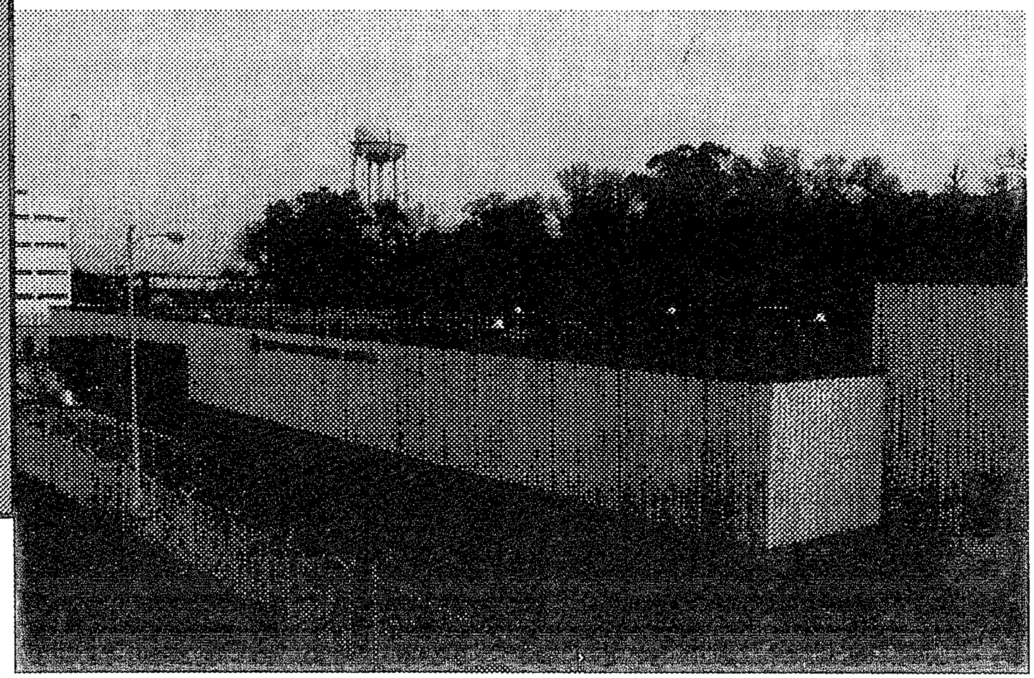


Night Vision and Electronic Sensors
Ft. Belvoir, VA





Night Vision and Electronic Sensors
Ft. Monmouth, NJ



Core Technologies

TECHNOLOGY

- Thermal Imaging
  - Forward Looking Infrared (FLIR)
  - Infrared Search & Track (IRST)
- Image Intensification (I^2)
- Charge Couple Devices (CCD)
- Radar
- Sensor Fusion
- Advanced Optics
- Focal PLane Array Standardization
- High Density Processors
- Aided Target Recognition (ATR)
- Specialized Software
- Lasers / Laser Radar (LADAR)
- Sensor CAD / CAM
- Hyperspectrals
- Modeling & Simulation
- Camouflage

FUNCTIONS

- Surveillance & Target Acquisition for Soldier, Ground/Air PLatforms, Missiles
- Silent Watch / Scouts
- Pilotage / Obstacle Avoidance
- Protection Suites
- Identify Friend or Foe (IFF)
- Mine Detection
- Countermine / Intrusion Protection
- Camouflage / Deception
- Air Defense
- Special Activities
- Modeling & Simulation (Constructive / Interactive)
- Training
- Dual Use

Technology Leadership and Focus

- Army/DoD Lead for:
  - Night Vision and Electronic Sensors
  - Tactical Laser Technology
  - Aided Target Recognition/Sensor Fusion
  - Counter Mine Technology
  - Tactical Electronic Warfare Technology
- National Focal Point for Target Acquisition Modeling
- Development and Configuration Manager for 1st/2nd Generation FLIR Standardization
- Key Technical Leaders on Army Research Office (ARO) University Research Initiatives (URI)

Technology Investment Strategy

Core Technologies

- Thermal Imaging
- Image Intensification (I^2)
- Charge Couple Devices (CCD)
- Radar
- Sensor Fusion
- Advanced Optics
- Focal PLane Array Standardization
- High Density Processors
- Aided Target Recognition (ATR)
- Specialized Software
- Lasers / Laser Radar (LADAR)
- Sensor CAD / CAM
- Hyperspectrals
- Modeling & Simulation
- Camouflage

Producibility Techniques

- Manufacturing Science
- IPPD

Technology Demonstrators

Aviation

- Obstacle Avoidance System
- Radar Deception & Jamming
- Multi Sensor Aided Targeting
- Advanced Image Intensification
- Advanced Helicopter Pilotage
- Multispectral Countermeasures
- Air/Land Enhanced Recon & Targeting

Adv Land Combat

- Integrated Sight Modules
- 2nd Gen Tank Sight
- Remote Sentry
- Hunter Sensor Suite
- Target Acquisition Sensor Suite
- Enhanced Survivability Sensor Suite
- Aerial Scout Sensors Integration
- Combat ID
- Advanced Camouflage

Air Defense

- Electronic Integrated Sensor Suite
- Masked Target Kill

Engineer & Mine Warfare

- Close-In Manportable Mine Detector
- Off-Route Smart Mine Clearance
- Vehicle Mounted Mine Detector
- Demining & OOTW

Fire Support

- Bistatic Radar
- Multimission UAV Payload

Technology Demonstration Involvement

PROGRAM	LEAD	USER
RFPI ACTD	MICOM	DBBL
HUNTER SENSOR SUITE ATD	NVESD	DBBL
REMOTE SENTRY ATD	NVESD	DBBL
AERIAL SCOUT SENSOR INTEGRATION TD	NVESD	DBBL
RFPI C2 TD	C2SID	DBBL
INTELLIGENT MINEFIELD ATD	ARDEC	DBBL
ADVANCED IMAGE INTENSIFICATION (AI2) ATD	NVESD	DBBL
GEN II SOLDIER ATD	NATICK	DBBL
OBJECTIVE INDIVIDUAL COMBAT WEAPON ATD	ARDEC	DBBL
OBJECTIVE CREW SERVED WEAPON	ARDEC	DBBL
INTEGRATED SIGHT MODULE TD	NVESD	DBBL
HIGH RESOLUTION DISPLAYS TD	NVESD	DBBL
CLOSE IN MAN PORTABLE MINE DETECTOR ATD	NVESD	DBBL
JOINT COUNTERMINE ACTD	NVESD	MWBL
ADVANCED CAMOUFLAGE EXPERIMENT ATD	NVESD	MWBL
VEHICLE MOUNTED MINE DETECTOR ATD	NVESD	MWBL
OFF ROUTE SMART MINE CLEARANCE ATD	NVESD	MWBL

Technology Demonstration Involvement

PROGRAM	LEAD	USER
• TARGET ACQUISITION ATD	NVESD	MWBL
• MULTIFUNCTION LASER TD	NVESD	MWBL
• ADVANCED TANK TECHNOLOGIES TD	TARDEC	MWBL
• CREWMAN'S ASSOCIATE ATD	TARDEC	MWBL
• CAC2 ATD	C2SID	MWBL
• ANTI-ARMOR ATD	AMSAA	MWBL
• HIT AVOIDANCE ATD	TARDEC	MWBL
• COMBAT ID ATD/ACTD	PM-CID	MWBL
• DIRECT FIRE LETHALITY ATD	ARDEC	MWBL
• ROTORCRAFT PILOTS ASSOCIATE ATD	ATCOM	MWBL/AVN
• OBSTACLE AVOIDANCE SYSTEM (OASYS) TD	NVESD	MWBL/AVN
• M-SAT AIR ATD	NVESD	MWBL/AVN
• RADAR DETECTION AND JAMMING ATD	NVESD	MWBL/AVN
• MULTISPECTRAL COUNTERMEASURES ATD	NVESD	MWBL/AVN
• AIR/LAND ENHANCED RECON & TARGETING ATD	NVESD	D&SA
• BISTATIC RADAR FOR WEAPONS LOCATION ATD	NVESD	D&SA
• RAPID COUNTER 240 MRL ACTD	JPSD	D&SA
• SURVIVABLE ARMED RECONNAISSANCE ACTD	JPSD	D&SA

Customers

Army

PM's

NVEO
Firefinder
Combat ID
JSTARS
TOW/ITAS
Javelin
LOSAT
Soldier
JPSD

Abrams
Bradley
Armor Gun Sys
Survivability
M-60
Avenger
Stinger
FAAD
TESAR

Comanche
AAH
Cobra
AHIP
AEC
Longbow
Mine/Countermine
Physical Security

MSC's

SOCOM
MICOM
TACOM
AVSCOM
AMCCOM
ARL

MACOM's

AMC FAST
INSCOM

BATTLE LAB's

Dismounted
Mounted
Combat Service Support
Early Entry
Depth & Simultaneous Attack
Battle Command

DoD

ARPA
Navy
Air Force
JSOC
JPO-UGV

Marines
DSMO
BMDO
JPO-UAV

Other Gov't

DEA
FBI
State
INS
NSA

Transportation
NASA
DOE
DNA

Sensor Development Challenges

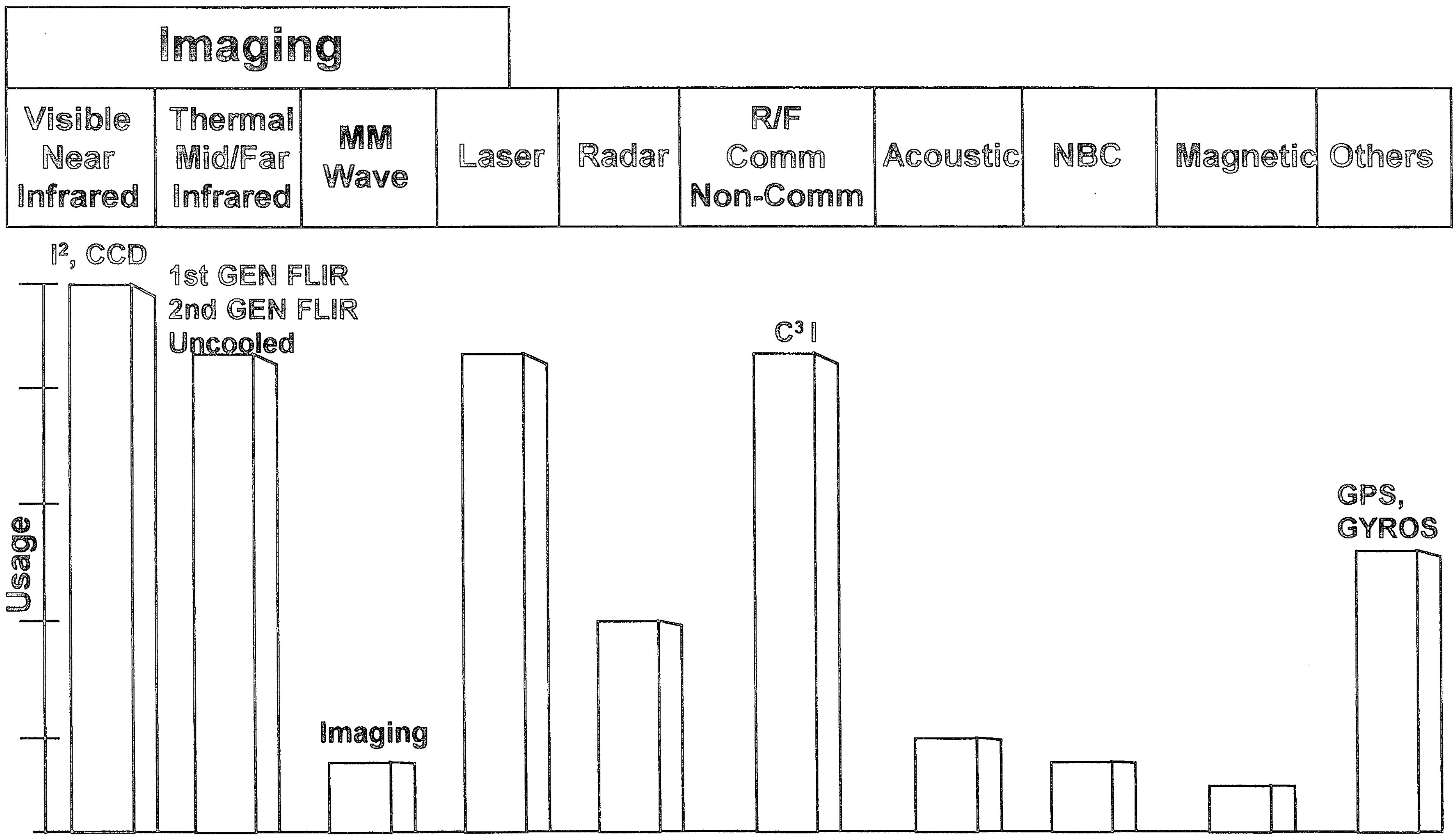
State of Detection / Sensing Technology

- Detector/Detection Systems for Many Sensor Sensing Devices are Reaching the Fundamental Limits of Physics

Where Do We Go From Here?

- Significant Performance Improvements Only Possible by:
  - Integration, Miniaturization, and Digitization
  - Multiple Sensor Fusion and Data Fusion
  - Information Processing Advances (Software/Hardware) in Connection with Quality Data Bases / Collection
  - Advanced Design Techniques

Projected Field Usage Of Battlefield Sensors



Dual Use / Civilian Markets

- Transportation Safety
  - Commercial Driving Aids
  - Integrated Airport Landing System
  - Traffic Surveillance
  - Railroad Obstacle Sensing
- Geological Research
- Undersea Research
- Industrial/Commercial Security Systems
- Recreation - Ultra-Low-Cost Family of Night Vision Products
- Medical Applications
  - Laser Surgery
  - Night Blindness
  - Imaging
- Wildlife Research

Conclusions

- Advanced Sensor Development - an Explosive Technology Area
  - Modern Life Cannot Exist Without Sophisticated Sensing/Processing Devices
  - Modern Warfare Cannot Be Conducted and Military Tasks Cannot Be Performed Without Appropriate Sensing and Processing
- Sensing Information Transport Crucial
  - Sensor Information Needs to Be Fused, Digested and Transported Rapidly
  - Integrated Architectural Structures With Flexibility and Growth Potential Are Fundamental

Night Vision Electronic Sensors Briefings Today

<u>NV Electro-Optics Technology</u>
- Adv Optics and Display Applications
- Smart Focal Plane Arrays

<u>NV Advanced Technology</u>
- Open Architecture ATR Processing
- Air/Land Enhanced Reconnaissance and Targeting

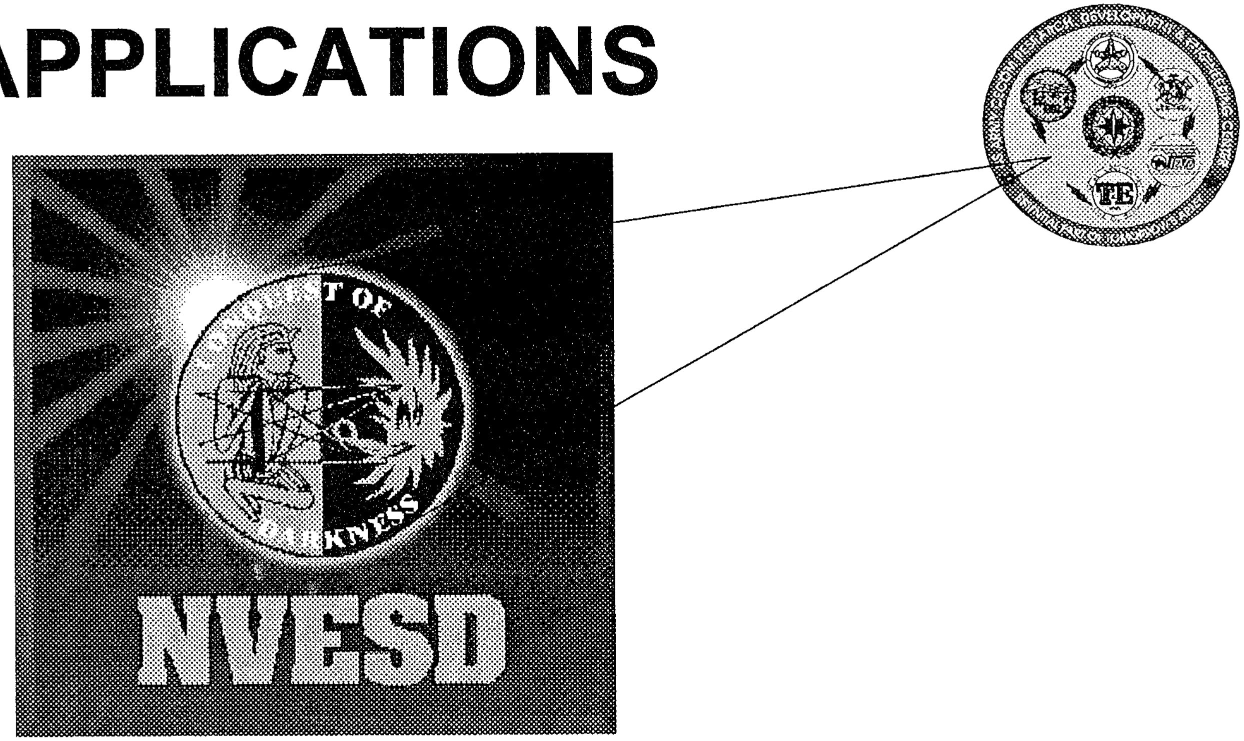
<u>Mobility Equipment Technology</u>
- Mine Detection and Neutralization

<u>Tactical Electronic Warfare Technology</u>
- Adv Countermeasure Techniques

NOTES

NIGHT VISION ELECTRO-OPTICS TECHNOLOGY

ADVANCED OPTICS AND DISPLAY APPLICATIONS



William P. Markey
Chief, Advanced Optics
NIGHT VISION & ELECTRONIC SENSORS DIRECTORATE

UNCLASSIFIED

POINT PAPER

SUBJECT: *ADVANCED OPTICS & DISPLAY APPLICATIONS*

OBJECTIVE: Advanced Optics Applications will develop and demonstrate a family of core optics and sensor technologies for future head-mounted vision systems. Key technologies/demonstrations include:

- Evaluations of state-of-the-art optics technologies - binary, defractive, holographic, etc. - for horizontal technology integration across all head-mounted vision systems
- Investigate cost and weight reductions for all potential optical system upgrades using binary optics hybrids.
- Advanced designs for objective and ocular optics
- Critical core display electronics and sensor technologies for helmet-mounted vision system
- Fabrication of advanced optics components for demonstration in head-mounted vision systems
- Exploit ARPA/ARL high resolution displays

POTENTIAL APPLICATIONS:

- Cargo/Utility/SOF Rotorcraft Pilot's Night Vision Goggles
- CS/CSS Tactical Vehicles
- Soldier's Night Vision Goggles

TECHNOLOGY CHALLENGES

- Video Rate High Resolution Sensors And Displays For The Military Environment
- Order Of Magnitude Power Reduction
- Lightweight, Fast F# (<1.5), Wide Field Of View (60^{o}) Optics
- Multispectral, Common Aperture Optics For Targeting And Navigation

DESIRED IR&D FOCUS

- Display Brightness, Gray Scale Improvements
- Ultra Low Noise CCD Sensors
- Economic Mass Production Of Aspheric And Diffractive Optics
- Economic Production Of Off-Axis Reflective Optical Systems

BRIEFER: William Markey, Project Engineer, AMSEL-RD-NV-SS-AA, NVESD, 703-704-1306

Advanced Optics And Display Applications

Objective

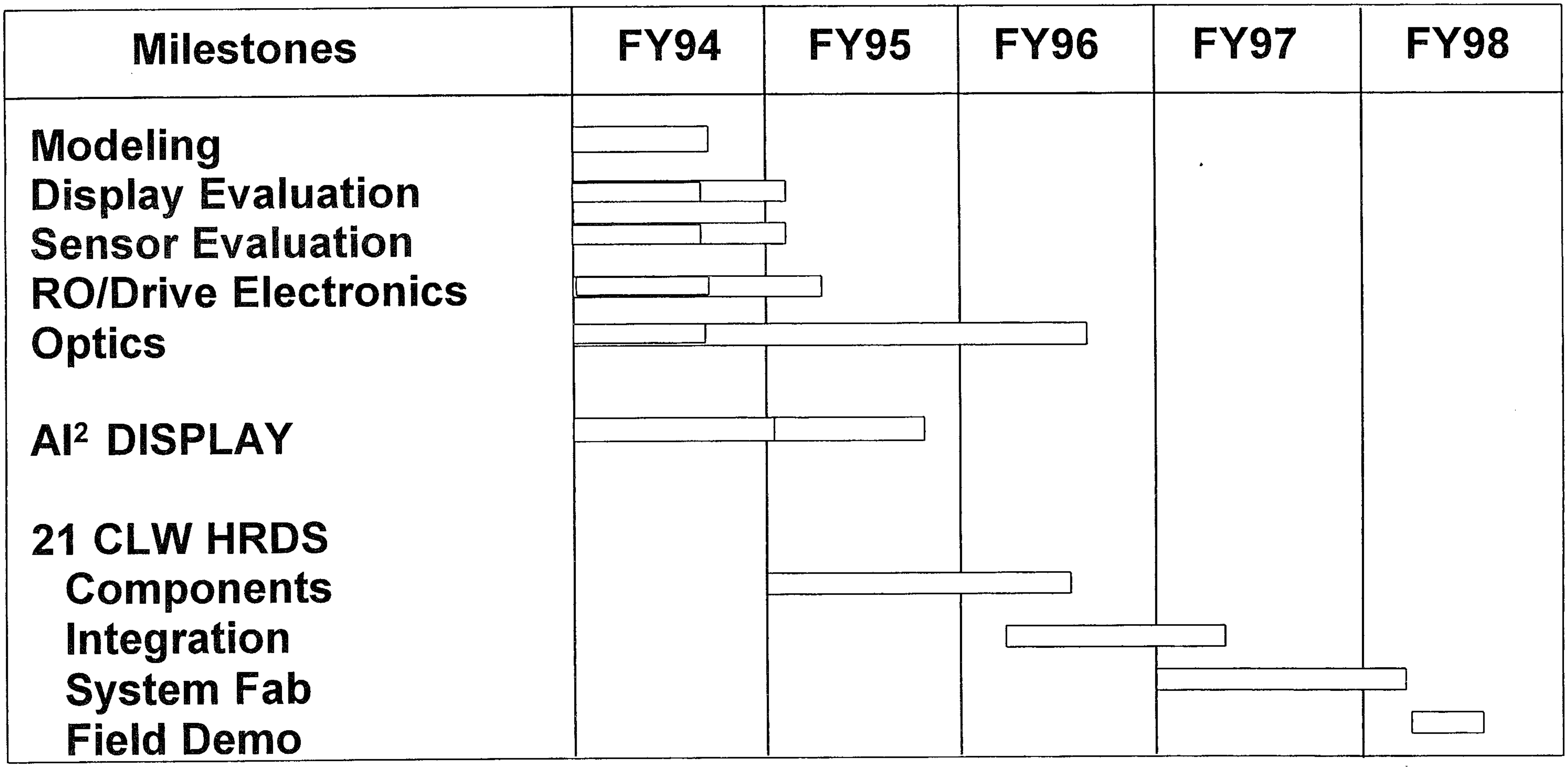
- Development Of Common Module Electronics, Optics, And Displays For Helmet Mounted Vision Systems Applicable To Infantry, Armor, And Aviation
- Applications
- Land Warrior
- Mounted Warrior
- Air Warrior
- Comanche AHP

Advanced Optics And Display Applications

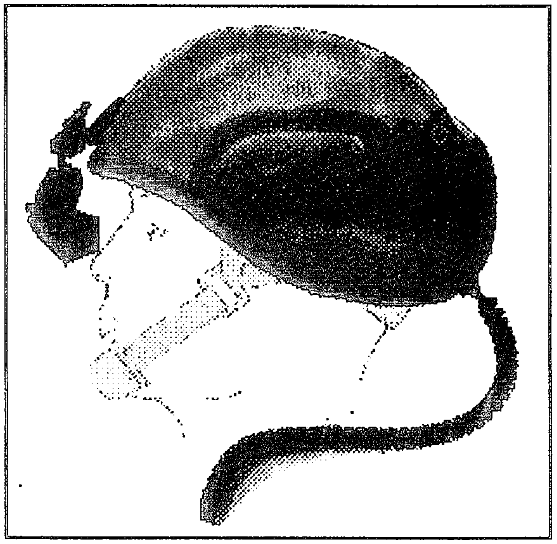
Approach

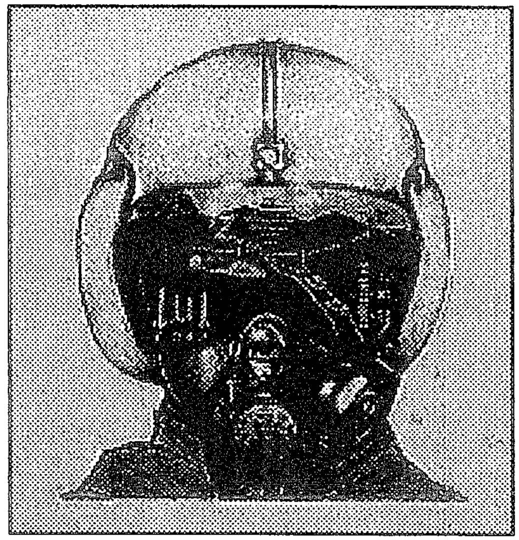
- Target / Scene Modeling
- Sensor Design
- Image Generator Design
- Read-Out / Driver Electronics Design
- Video / Data Interface Architecture Design
- Objective / Ocular Optics Design
- Design / Producibility Studies

Advanced Optics And Display Applications



Advanced Optics And Display Applications





Advanced Optics And Display Applications

<u>Technology Challenges</u>

- Video Rate High Resolution Sensors And Displays For The Military Environment
- Order Of Magnitude Power Reduction
- Lightweight, Fast F# (<1.5), Wide Field Of View (60^{o}) Optics
- Multispectral, Common Aperture Optics For Targeting And Navigation

Advanced Optics And Display Applications

IR&D Technology Needs

- Display Brightness, Gray Scale Improvements
- Ultra Low Noise Visible And Near IR CCD Sensors
- Economic Mass Production Of Aspheric And Diffractive Optics
- Economic Production Of Off-Axis Reflective Optical Systems

NOTES

SMART FOCAL PLANE ARRAYS

David J. Bohan

Chief, Advanced Infrared Technology

NIGHT VISION & ELECTRONIC SENSORS DIRECTORATE

UNCLASSIFIED

POINT PAPER

SUBJECT: *SMART FOCAL PLANE ARRAYS*

OBJECTIVE: Smart FPA's STO will demonstrate the feasibility of "smart" staring infrared FPA's. Smart refers to FPA's with image processing at or near the FPA and/or multiband (optical through millimeter wave) real-time imaging capability. Key developments include:

- Alternative concepts for the development of 3rd Generation FPA detectors utilizing NVESD microfactory (MOMBE) technology and NVESD readout circuitry design
- Early version preprocessing and detector architectures and their implementation
- A/D on chip architectures for digital outputs and reduced noise
- Incorporation of advanced algorithms in hardware on the focal plane for recognition tasks

POTENTIAL APPLICATIONS:

- 2+ and 3rd Gen IR/Multiband sensors
- Autonomous recognition systems

TECHNOLOGY CHALLENGES

- Smart On-Chip Readout Circuits
- Large Staring Focal Plane Arrays
- Multi-Color Architectures

DESIRED IR&D FOCUS

- A/D On-Chip With Very Low Power Dissipation
- High Definition TV Compatible Detectors (At Least 1000 x 2000 Elements)

BRIEFER: Stuart Horn, Project Leader, AMSEL-RD-NV-ST-IRT, NVESD, 703-704-2025

Smart Focal Plane Arrays

Objective

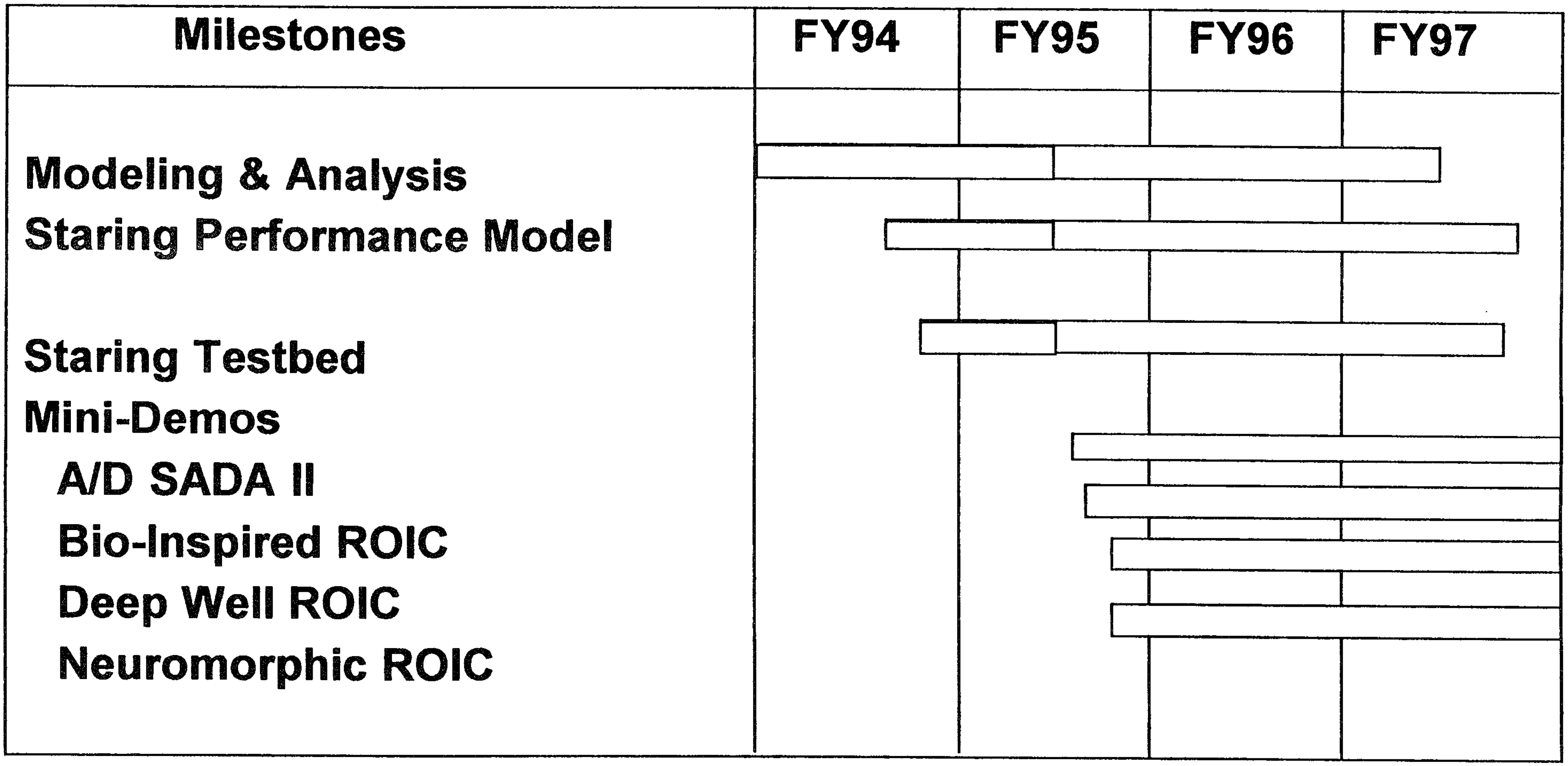
- Develop Critical On Focal Plane Read-Out Integrated Circuits that Optimize Processing And Spectral Response To Improve Range Performance, Human / ATR Interfaces, Minimize Performance Degradation From Weather or CM of Next Generation Smart Sensors
- Applications
- Future Armor And Aviation Systems And Upgrades
- Smart / Brilliant Munitions

Smart Focal Plane Arrays

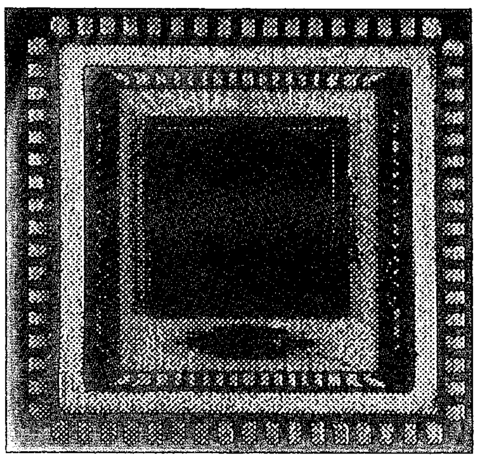
Approach

- Develop Critical On Focal Plane Read-Out Integrated Circuits (ROICs) For 3rd Generation Focal Plane Arrays
  - SADA II A/D Circuit To Increase S/N And Dynamic Range
  - Bio-Inspired ROIC To Perform On FPA Processing That Mimics Human Retinal Moving Target Detection
  - Neuromorphic ROIC That Provides Pixel Based Non-Uniformity Correction, Contrast / Edge Enhancement, Dynamic Range Control
  - Deep Well ROIC That Increases Sensitivity And Dynamic Range To Enhance Poor Weather Range Performance And ATR Capability

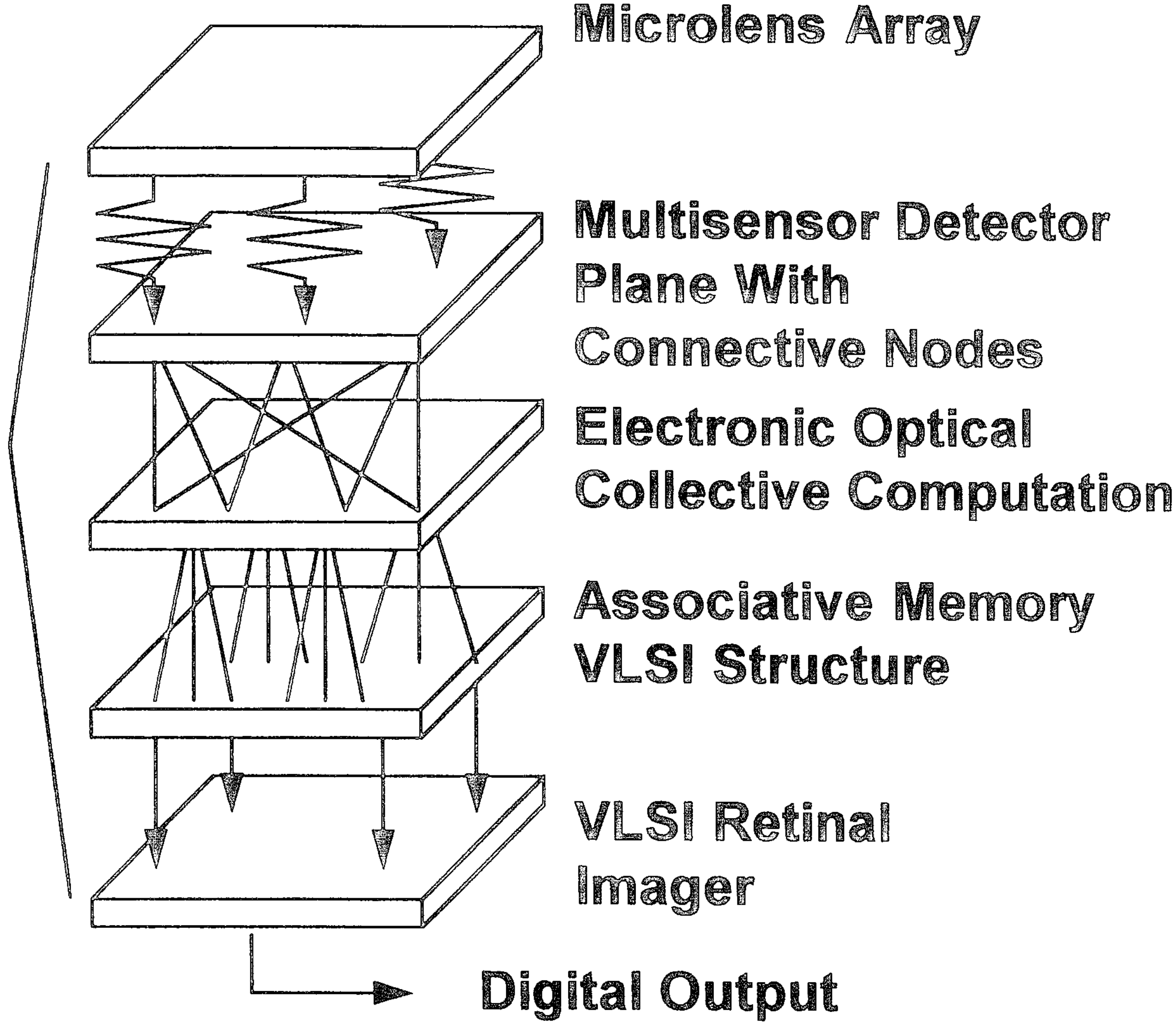
Smart Focal Plane Arrays



Smart Focal Plane Arrays



128 X 128
Silicon
FPA



Smart Focal Plane Arrays

Technology Challenges

- Smart On-Chip Readout Circuits
- Large Staring Focal Plane Arrays
- Multi-Color Architectures

IR&D Technology Needs

- A/D On-Chip With Very Low Power Dissipation
- High Definition TV Compatible Detectors (At Least 1000 x 2000 Elements)

NOTES

NIGHT VISION ADVANCED TECHNOLOGY

OPEN ARCHITECTURE ATR PROCESSING

David J. Bohan

Chief, Advanced Infrared Technology

NIGHT VISION & ELECTRONICS SENSORS DIRECTORATE

UNCLASSIFIED

POINT PAPER

SUBJECT: *OPEN ARCHITECTURE ATR PROCESSING*

OBJECTIVE: Modular High Density, High Performance Processor Technology will leverage Aladdin-like, multi-chip module (MCM) technology to develop a family of common, open architecture high performance image and digital signal processor modules for advanced weapons applications. Key developments include:

- Computer-aided design techniques and commercial/ARPA developed rapid prototyping tool sets will be utilized to develop a modular processor architecture
- Identify and utilize commercial techniques, practices, modules, and boards for cost effectiveness and upgradability
- Common ATR Processor Modules and Algorithm Software Packages for both ground VME and airborne SEM hardware architecures.

POTENTIAL APPLICATIONS

- Multiple Tri-service ATR applications
- FMBT / FIFV / FSV / Comanche Upgrades / FAAV / Future Smart munitions

TECHNOLOGY CHALLENGES

- Leverage The Commercial World In Both Hardware And Software Technology To Provide Cost Affordable Solutions While Still Meeting The Stringent Demands For Battlefield Operational Missions And Scenarios
- Develop A New Discipline For Providing Computing Resources For Military Applications.

DESIRED IR&D FOCUS

- Focus On A Systematic Approach To Developing A Cohesive And Comprehensive Simulation And Modeling Capability That Provides The Means For Developing Virtual Prototypes Of The Processor System Prior To System Development
- Address Open System Architecture Methodology For Providing Scalable, Upgradable And Cost Affordable Processing Solutions

BRIEFER: Lynda Graceffo, Project Engineer, AMSEL-RD-NV-ST-IRT, NVESD, 703-704-1745

Open Architecture ATR Processing

Objective

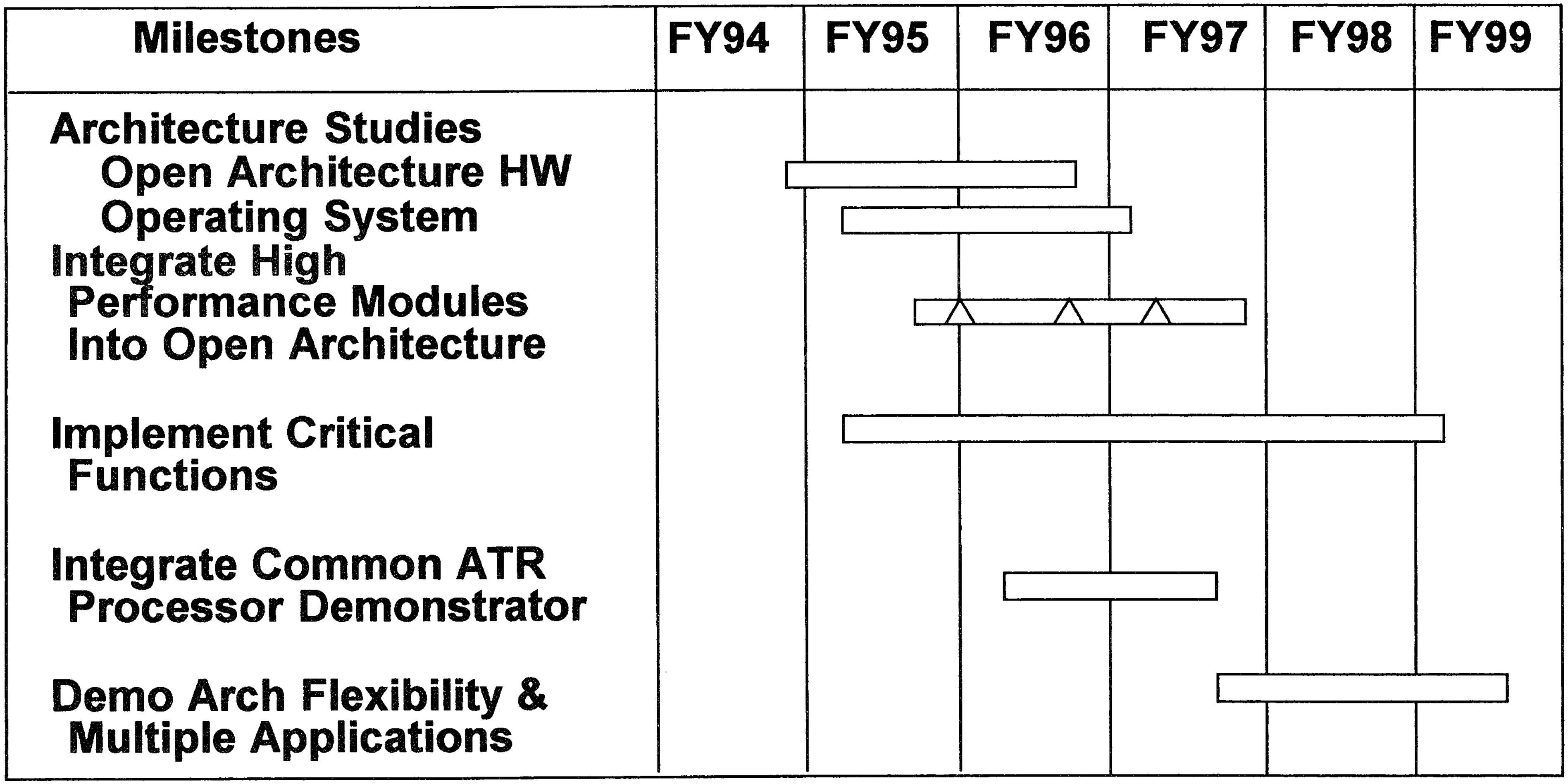
- Develop An Affordable, Open Architecture For High Performance Image / Signal Processing And Automatic Target Recognition Applications
- Applications
- Future Armor And Aviation Systems And Upgrades
- Smart / Brilliant Munitions

Open Architecture ATR Processing

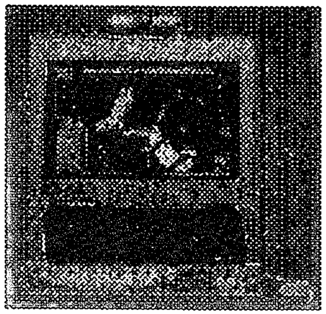
Approach

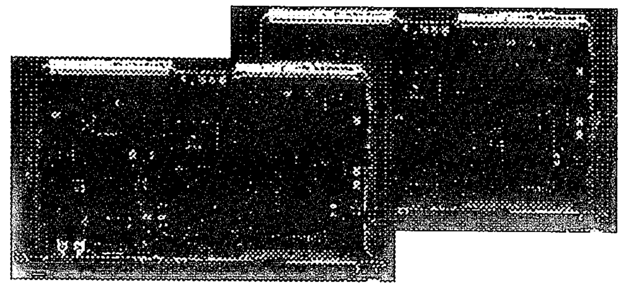
- Identify And Utilize ***COMMERCIAL*** Techniques, Practices, Modules, And Boards To Demonstrate Cost Effective Processing Solutions For Military Applications
  - Leverage Aladdin-Like, Multi-Chip Module (MCM) Technology
  - Exploit Computer-Aided Design Techniques And Commercial / ARPA Developed Rapid Prototyping Tool Sets To Develop An Open, Modular Processor Architecture
  - Establish Rapid Prototyping, Development, And Integration Facility

Open Architecture ATR Processing

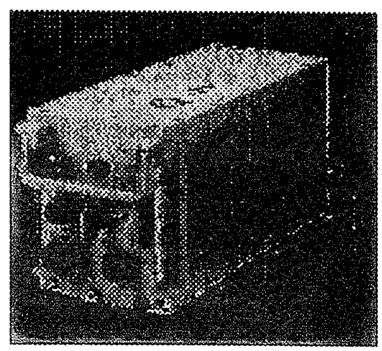


Open Architecture ATR Processing





- Open Architecture ATR Operating System
- Commercial HW Modules



Open Architecture ATR Processing

Technology Challenges

- Leverage The Commercial World In Both Hardware And Software Technology To Provide Cost Affordable Solutions While Still Meeting The Stringent Demands For Battlefield Operational Missions And Scenarios
- Develop A New Discipline For Providing Computing Resources For Military Applications

Open Architecture ATR Processing

IR&D Technology Needs

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- Address Open System Architecture Methodology For Providing Scaleable, Upgradable And Cost Affordable Processing Solutions

NOTES

AIR/LAND ENHANCED RECONNAISSANCE AND TARGETING

Dr. Donald A. Reago
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NIGHT VISION & ELECTRONIC SENSORS DIRECTORATE

UNCLASSIFIED

POINT PAPER

SUBJECT: *AIR/LAND ENHANCED RECONNAISSANCE AND TARGETING (ALERT)*

OBJECTIVE: The Multi-Sensor Aided Targeting-Air (MSAT-Air) ATD demonstrated real-time aided target detection and recognition using fused data from millimeter wave (MMW) and second generation Forward Looking Infrared (FLIR) sensors. Though highly successful, the MSAT-Air approach to aided targeting works only in a static (pop-up) search scenario and can not be used by two-thirds of the Apache and Comanche fleets, Kiawa Warriors, and ground combat vehicles that will not have MMW radar as part of their mission equipment package. This ATD will demonstrate on-the-move automated surveillance and targeting applicable to those platforms that do not have a MMW radar sensor. 2nd Gen FLIR and multi-function laser data will be combined to allow large search areas to be covered with high targeting accuracy while at low depression angles and high platform motion. Range profiling of the highest priority targets will provide target identification. Key technologies/demonstrations include:

- Aided target detection and recognition capabilities for static and on-the-move searches approaching the results of FLIR/MMW sensor fusion
- Combine 2nd GEN FLIR and multi-function laser for directing fire to targets, providing battle damage assessment, and providing the information in a timely and efficient manner
- Application to all platforms using a 2nd GEN FLIR and laser rangefinder/designator

POTENTIAL APPLICATIONS:

- All platforms within the tri-services that incorporate a 2nd GEN FLIR and laser rangefinder/designator

TECHNOLOGY CHALLENGES

- High Repetition Rate Multi-Function Laser
- Real-Time Processing For Target Detection And Identification
- Sensor Data Correlation / Fusion While On-The-Move

DESIRED IR&D FOCUS

- Multi-Function Laser For Target Range, Profiles, And Designation
  High Speed CPU And Bus For Image Processing And Data Correlation
  (Commonality And Expandability For Potential Applications)

BRIEFER: Richard Wright, Project Engineer, AMSEL-RD-NV-SS-AA, NVESD, 703-704-1329

Air/Land Enhanced Reconnaissance and Targeting ATD

Objective

- Demonstrate On-The-Move Performance Of Multiple Sensor Identification In An Airborne, Automatic Target Acquisition Suite to Improve Ability To Rapidly Acquire Targets With Low False Alarm Rates At Extended Ranges In Day, Night And Adverse Weather

Air/Land Enhanced Reconnaissance and Targeting ATD

Applications

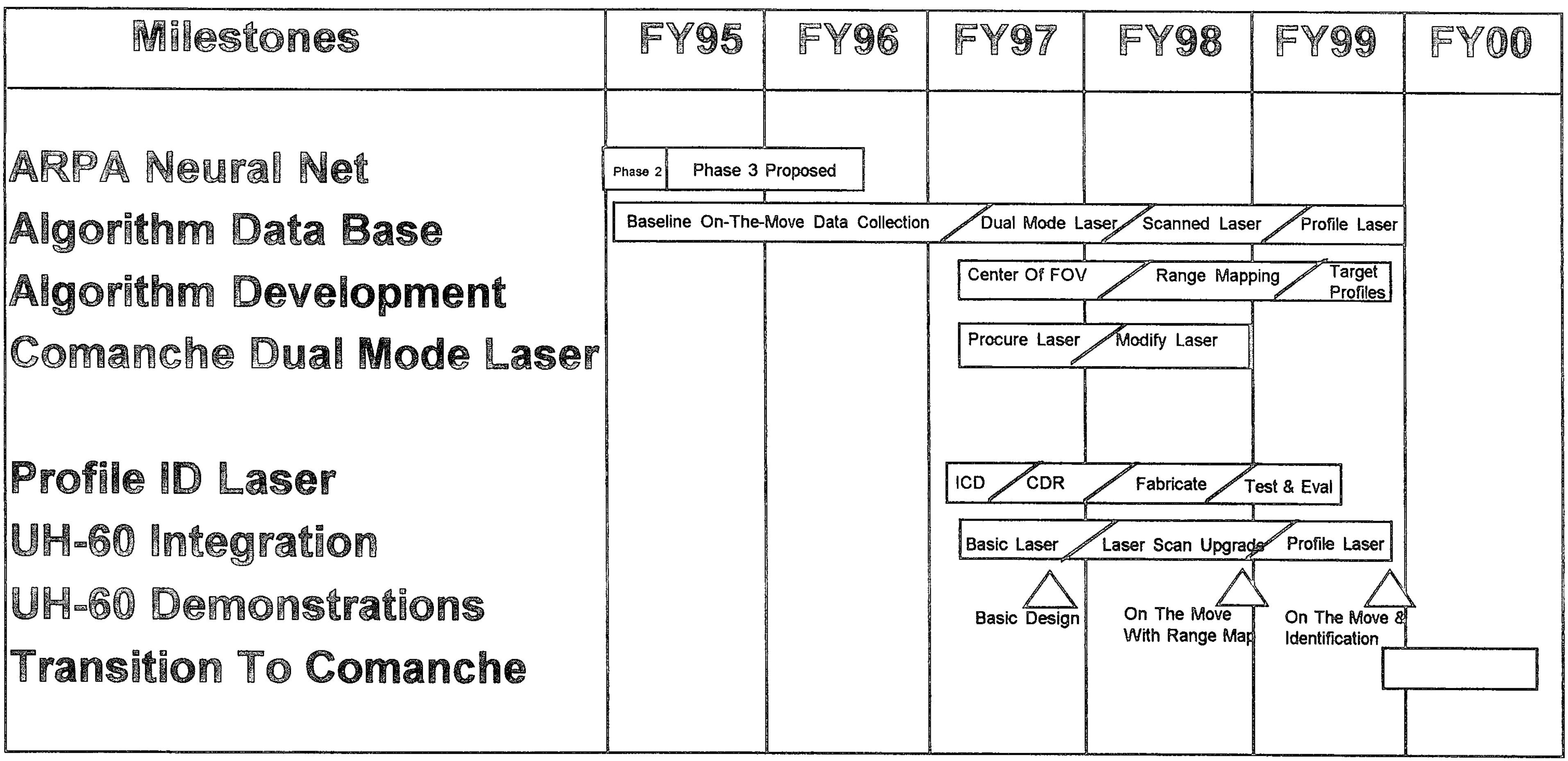
- RAH-66 Comanche
- AH-64C Apache
- OH-58D Kiowa Warrior
- Precision Strike
- Advanced Land Combat

Air/Land Enhanced Reconnaissance and Targeting ATD

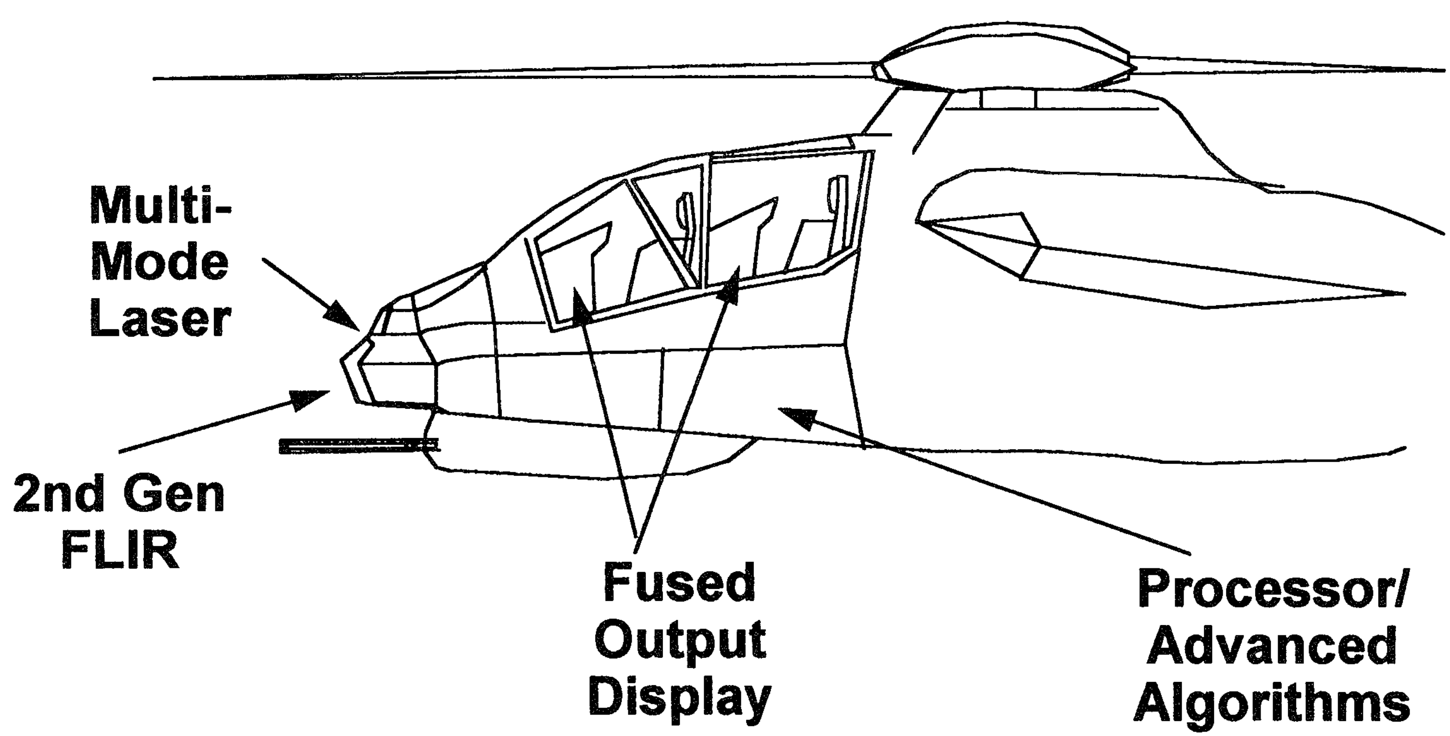
Approach

- Demonstrate ON-THE-MOVE Wide Area Search Through Advanced FLIR / Laser
  - Install Multi-Function Laser Range Finder / Designator
  - Incorporate EO MTI / USAF Fractil Algorithm Upgrades
  - Incorporate Neural Net Into Algorithms
  - Complete The Target Acquisition Process By Adding Moving Target Indication, Target Priority, Tracking And Hand-off, And BCIS
  - Provide Data Compression And Transmission Of Targeting Reports And Imagery

Air/Land Enhanced Reconnaissance and Targeting ATD



Air/Land Enhanced Reconnaissance and Targeting ATD



Air/Land Enhanced Reconnaissance and Targeting ATD

Technology Challenges

- High Repetition Rate Multi-Function Laser
- Real-Time Processing For Target Detection And Identification
- Sensor Data Correlation / Fusion While On-The-Move
- Algorithm Development
- Laser Diodes

Air/Land Enhanced Reconnaissance and Targeting ATD

IR&D Technology Needs

- Multi-Function Laser For Target Range, Profiles, And Designation
- High Speed CPU And Bus For Image Processing And Data Correlation (Commonality And Expandability For Potential Applications)

NOTES

MOBILITY EQUIPMENT TECHNOLOGY

MINE DETECTION AND NEUTRALIZATION

Robert L. Barnard

Chief, Mine Detection

NIGHT VISION & ELECTRONIC SENSORS DIRECTORATE

UNCLASSIFIED

POINT PAPER

SUBJECT: *MINE DETECTION AND NEUTRALIZATION*

OBJECTIVE: This effort will develop mine detection technology for the detection of buried metallic and non-metallic anti-tank mines across the full vehicle width at a rate commensurate with mounted mobility on the battlefield to enhance the mounted force operational capability and survivability. This program will also integrate multiple detection/ sensing and neutralization technologies into a single system to provide the ability to both detect and kill mines and unexploded ordnance at a standoff range. Key technologies/demonstrations include:

- Infra-red detection scheme on a combat vehicle.
- Forward looking microwave detection device.
- Breadboard/explosive neutralizer mounted in a combat vehicle.
- Technology alternatives to support automated targeting capability and standoff detection.

POTENTIAL APPLICATIONS:

- Minefield breaching
- Route clearing
- Vehicle mounted mine detection
- Range clean-up
- Demining in operations other than war

TECHNOLOGY CHALLENGES

- Automatic Target Recognition
- False Alarm Rate
- Deep Magazine
- Detection Of Non-Metallic Mines
- Forward Looking Mine Detection
- Mine Detection In High Clutter Environments
- Mine Detection In Diverse Environments

DESIRED IR&D FOCUS

- Forward Looking Mine Sensors
- Low Cost Neutralization Techniques
- Multi-Sensor Data Fusion
- Automatic Target Recognition
- Stand-Off Detection

BRIEFER: Richard Weaver, Project Leader, AMSEL-RD-NV-CD-MN, NVESD, 703-704-1090

Mine Detection And Neutralization

Objective

- Demonstrate The Maturity Of A Vehicular Mounted Mine Detector That Detects Metallic And Non-Metallic Mines At Tactical Speeds
- Develop An Integrated System Concept For Autonomous Detection And Destruction Of Mines At Maneuver Speeds

Mine Detection And Neutralization

Applications

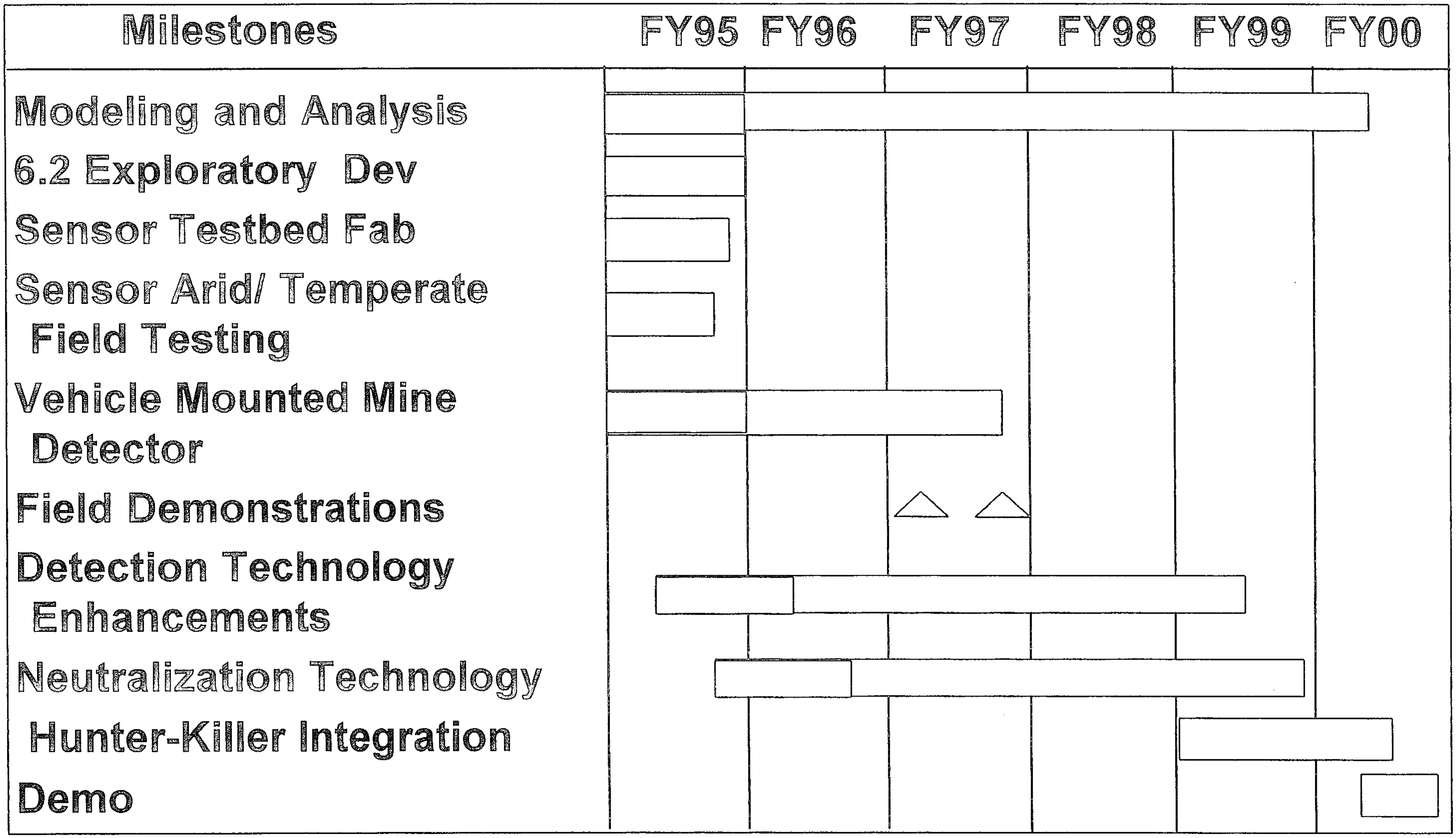
- Joint Countermine Advanced Concept Technology Demonstration (JCACTD)
- Transition to PEO ASM
- Minefield Breaching
- Mine And Route Clearing
- Demining

Mine Detection And Neutralization

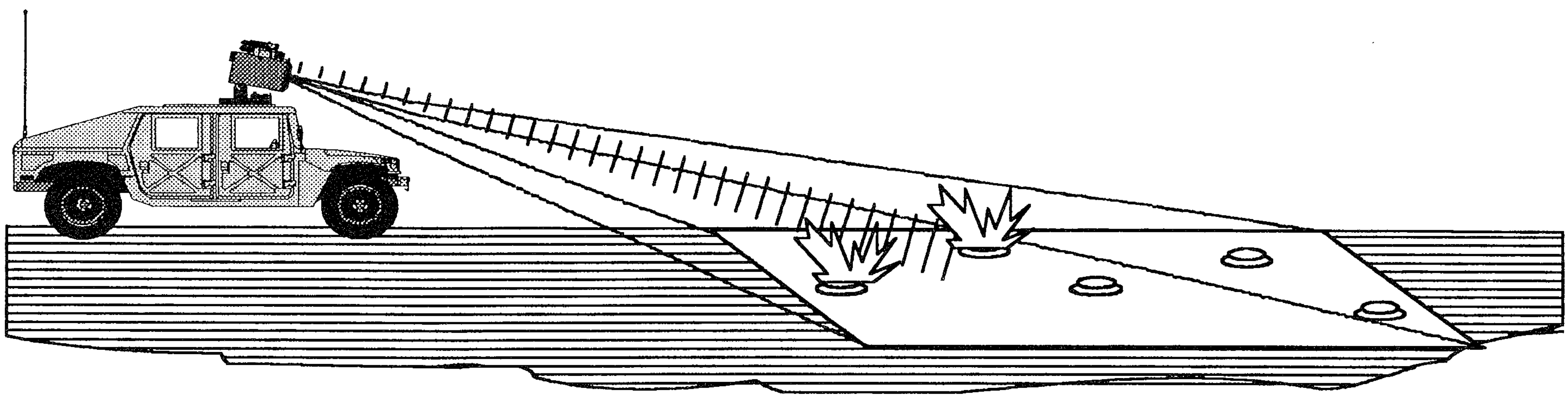
Approach

- Combine Mine Detection And Neutralization Technologies Into An Integrated Autonomous System Capable Of Detecting, Locating, And Destroying Mine Targets
- Demonstrator Development
  - Develop Two Multi-Sensor Suite Approaches
  - Electromagnetic Induction
  - Down And Forward Looking Ground Penetrating Radars
  - Forward Looking IR
  - Sensor Fusion / ATR

Mine Detection And Neutralization



Mine Detection And Neutralization



Mine Detection And Neutralization

Technology Challenges

- Detection Of Non-Metallic Mines
- Forward Looking Mine Detection
- Mine Detection In High Clutter Environments
- Mine Detection In Diverse Environments
- Automatic Target Recognition
- False Alarm Rate
- Deep Magazine

Mine Detection And Neutralization

IR&D Technology Needs

- Multi-Sensor Data Fusion
- Automatic Target Recognition
- Stand-Off Detection
- Forward Looking Mine Sensors
- Low Cost Neutralization Techniques

NOTES

TACTICAL ELECTRONIC WARFARE TECHNOLOGY

ADVANCED COUNTERMEASURE TECHNIQUES

Joseph C. O'Connell
Chief, EO/IR Countermeasures
NIGHT VISION & ELECTRONIC SENSORS DIRECTORATE

UNCLASSIFIED

POINT PAPER

SUBJECT: *ADVANCED COUNTERMEASURE TECHNIQUES*

OBJECTIVE: Develop Multi-Functional Survivability Equipment To Perform The Roles Of Warning, Situational Awareness, Countermeasures, Targeting And Combat Assist For Aircraft, Ground Vehicles, High Value Targets, And Dismounted Soldiers. Also, demonstrate Multi-Source Countermeasures That Will Be Capable Of Countering Both Present And Future Multi-Color Imaging Focal Plane Array And Non-Imaging Missile Seekers.

POTENTIAL APPLICATIONS:

- ATIRCM And ATIRCM P3I
- Integrated Suite Of ASE
- Tri-Service Common Missile Warning System
- Future Aircraft / Ground Vehicle Survivability Equipment
-

TECHNOLOGY CHALLENGES

- Lightweight, Low Cost, Variable Bandwidth And Sensitivity Digital Receivers
- Fiber Optically Remoted Antennas For Warning And Countermeasures Over The Band Of .1 To 40 Ghz
- Jamming Technique To Protect Rotary Wing Aircraft From Phased Array Tracking And Homing Radars Capable Of Polarization And Space Diversity Operation
- Developing A Lightweight Multiline Laser For IRCM
- Providing Low Cost Missile Warning
- Providing Low Loss Transmission Of Laser Energy
- Detect And Counter Laser Beam Rider Missiles
- Provide Protection To Army Platforms Against Advanced Imaging IR Missiles

DESIRED IR&D FOCUS

- Fiber Optic Capability To Remote Antennas
- Direct Emitting Laser Diodes That Produce .5 To 2 Watts In The 4 To 5 Micron Region At 30 To 50% Duty Cycle And Pulse Widths Of Over 100 msec
- Receiver Antennas Covering .1 To 40 Ghz That Phase And Amplitude Track With A Precision Sufficient To Provide .5 Degrees Or Better Of Angle Of Arrival Accuracy
- Generic IRCM Techniques For Laser Jammers
- Low Cost, High Sensitivity Laser Detectors Coupled To Onboard/Off-board Jammers
- Efficient Solid State IRCM Sources
- Uncooled FPAs For Missile Warning
- Further Develop Fiber Optics For Laser Energy Transmission

BRIEFER: KEITH DUGAS, AMSEL-RD-NV-RMS, NVESD, 908-427-0012

Advanced Countermeasure Techniques

Objective

- Develop Multi-Functional Survivability Equipment To Perform The Roles Of Warning, Situational Awareness, Countermeasures, Targeting And Combat Assist For Aircraft, Ground Vehicles, High Value Targets, And Dismounted Soldiers
- Demonstrate Multi-Source Countermeasures That Will Be Capable Of Countering Both Present And Future Multi-Color Imaging Focal Plane Array And Non-Imaging Missile Seekers

Advanced Countermeasure Techniques

Applications

- ATIRCM And ATIRCM P3I
- Integrated Suite Of ASE
- Tri-Service Common Missile Warning System
- Future Aircraft / Ground Vehicle Survivability Equipment

Advanced Countermeasure Techniques

Approach

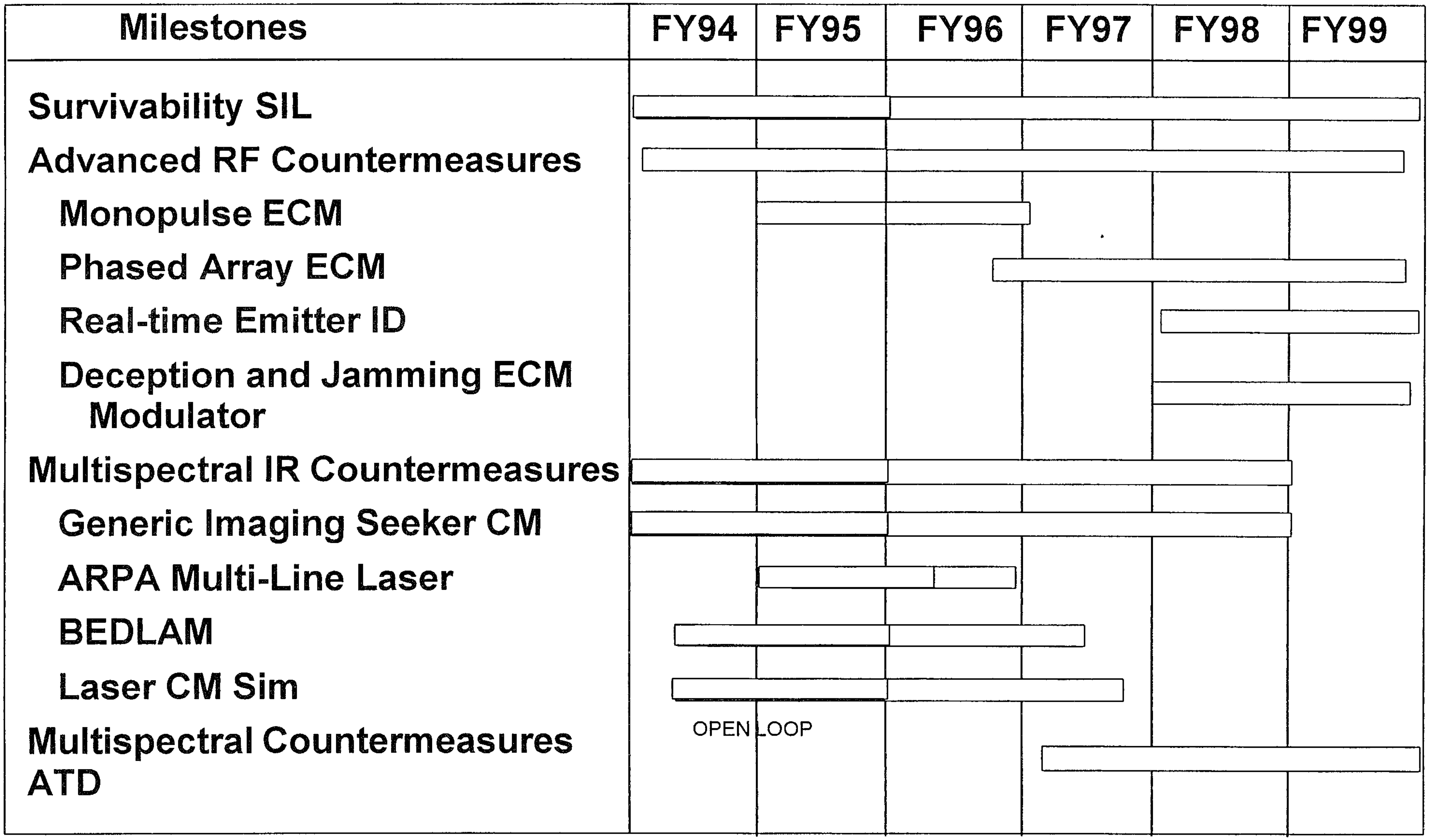
- **Advanced Component Developments Supported By Integrated Survivability SIL**
  - Monopulse, Phased Array, LPI Radar Bi-Static CM
  - Precision Low Cost Geolocation of Emitters
  - Aircraft Protection/Ground Vehicle Protection DIS
  - RF Fuze/Top Attack Munition ECM
  - Solid State Laser Using Optical Parametric Oscillators (OPOs)

Advanced Countermeasure Techniques

Approach (cont'd)

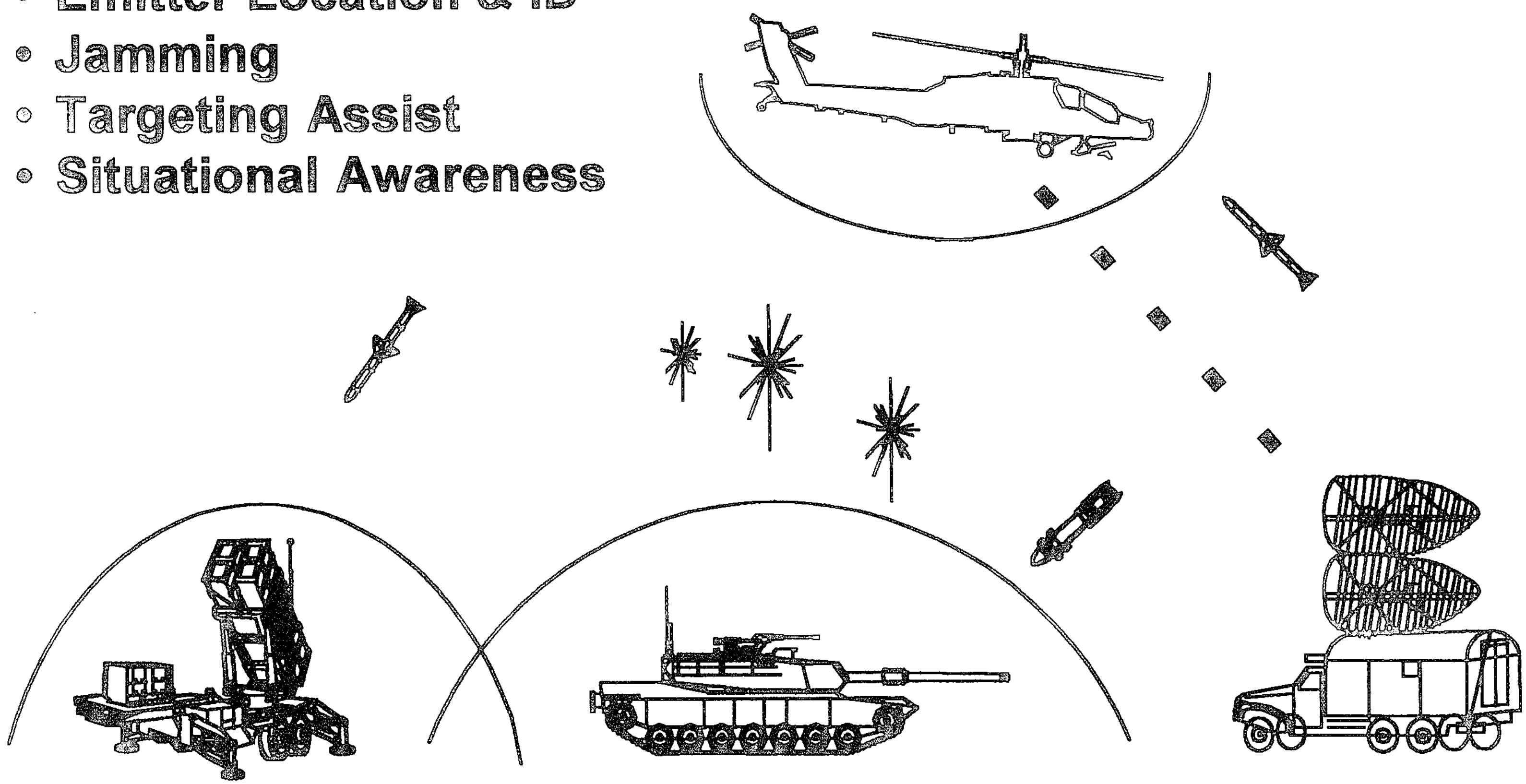
- Multi-Line Laser to Defeat Imaging IR Threats
- Optical Coupler To ATIRCM Jam Head Using Hollow Wave Guide
- Low Loss Fiber Optic Cable With Terminations
- Assess ARPA Active Tracker For ATIRCM
- Design And Field Test Barrage Emission Decoy Of Laser Aided Munition (BEDLAM)
- Demonstrate Technology Enhancements to ATIRCM / Tri-Service Common Missile Warning System (CMWS) Core Hardware in the Multispectral Countermeasures ATD

Advanced Countermeasure Techniques



Advanced Countermeasure Techniques

- Warning
- Emitter Location & ID
- Jamming
- Targeting Assist
- Situational Awareness



Advanced Countermeasure Techniques

Technology Challenges

- Lightweight, Low Cost, Variable Bandwidth And Sensitivity Digital Receivers
- Fiber Optically Remoted Antennas For Warning And Countermeasures Over The Band Of .1 To 40 Ghz
- Jamming Technique To Protect Rotary Wing Aircraft From Phased Array Tracking And Homing Radars Capable Of Polarization And Space Diversity Operation

Advanced Countermeasure Techniques

Technology Challenges (cont'd)

- Developing A Lightweight Multiline Laser For IRCM
- Providing Low Cost Missile Warning
- Providing Low Loss Transmission Of Laser Energy
- Detect And Counter Laser Beam Rider Missiles
- Provide Protection To Army Platforms Against Advanced Imaging IR Missiles

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IR&D TECHNOLOGY NEEDS

- Fiber Optic Capability To Remote Antennas
- Direct Emitting Laser Diodes That Produce .5 To 2 Watts In The 4 To 5 Micron Region At 30 To 50% Duty Cycle And Pulse Widths Of Over 100 μsec
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Advanced Countermeasure Techniques

IR&D TECHNOLOGY NEEDS CONT'D

- Generic IRCM Techniques For Laser Jammers
- Low Cost, High Sensitivity Laser Detectors Coupled To Onboard/Off-board Jammers
- Efficient Solid State IRCM Sources
- Uncooled FPAs For Missile Warning
- Further Develop Fiber Optics For Laser Energy Transmission

NOTES

CLOSING REMARKS

NOTES

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