DCN 5256

AFRL Sensors Directorate

At

Rome Research Site, Rome, NY

Briefing to BRAC Commissioner Lloyd W. Newton

22 June 2005

Note: Includes additional information in response to a few of Commissioner Newton's key questions.

Mr. Joe Sciabica

Mr. Bill Baldygo

Mr. Rick Shaughnessy

Mr. Mike Sheehan

Mr. Ed Jones

Sensors Directorate

Air Force Research Laboratory

103-06A – DA14 – Community Input
Defense Agencies – Rome Laboratory – NY
BRAC COMMISSION – FY 2005
COFF:_____ DISPOSITION: Permanent

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July 5, 2005

Lester C. Farrington
Senior Analyst
2521 South Clark Street
Suite 600
Arlington, Va. 22202

RE: AFRL – Rome Research Site (Sensors Presentation to Commissioner Newton)

Dear Les:

Attached is a copy of the revised presentation that the Sensors Directorate provided to Commissioner Newton on June 22nd. This presentation was updated to address some of the questions raised by Commissioner Newton during the briefing. A copy of this presentation was given to the Commissioners at the Buffalo Regional Hearing but I wanted to make sure that you have a hard copy and electronic copy of the presentation just in case you did not receive a copy from the regional hearing.

Please do not hesitate to contact me if you have any further questions.

Sincerely,

Steven J. DiMeo
President
Mohawk Valley EDGE

Outline

- AFRL Sensors Directorate Overview
  - Mr. Joe Sciabica
- AFRL/SN Rome Research Site
  - Mission
  - People
  - Accomplishments
- Requirements/Considerations for SN RRS Relocation
  - BRAC Recommendations for SN RRS
  - Facilities
  - Sites
  - Classified Infrastructure
- Discussion and Q&A

DoD BRAC Recommendations

- Realign Rome Laboratory, NY, by relocating the Sensor Directorate to Wright Patterson Air Force Base, OH, and consolidating it with the Air Force Research Laboratory, Sensor Directorate at Wright Patterson Air Force Base, OH.
- Justification: This recommendation realigns and consolidates portions of the Air Force and Army Research Laboratories to provide greater synergy across technical disciplines and functions. It does this by consolidating geographically separate units of the Air Force and Army Research Laboratories.

Source: Department of Defense Base Closure and Realignment Report, Volume I, Part 2 of 2; Detailed Recommendations, Section 10 Recommendations-Technical Joint Cross-Service Group; May 2005, p. Tech-22.

"What did the DoD recommend and what are the implications?" Commissioner Newton

(This slide was added to address Commissioner Newton's Question)

"**Justification:** This recommendation realigns and consolidates portions of the Air Force and Army Research Laboratories to **provide greater synergy** across Technical disciplines and functions. It does this **by consolidating geographically separate units** of the Air Force and Army Research Laboratories."[1]

Implications:

- DoD's "Justification" **ignores their own Evaluation Criteria** and their own definition of ***Synergy***[1]
- DoD's "Justification" fails to consider mission degradation as a result of the loss of ***People*** (only about 9 out of 59 Engineers plan on moving to Dayton)
- DoD's "Justification" fails to include the ***Synergy*** successes of the past few years including the recent reorganization of AFRL
- Based upon the given DoD Evaluation Criteria, since ***People (30%)*** **and** ***Synergy (20%)*** together account for 50% of Military Value and the DoD "Justification" fails to include ***People*** **and** ***Synergy*** appropriately, the result is:
    - ***50% Military Value of AFRL Sensors-Rome adversely affected over the next 5-10 years of operation if moved to Dayton due to loss of People and Synergy***

[1]From "Technical Joint Cross Service Group Analyses and Recommendations," Volume XII, 19 May 2005

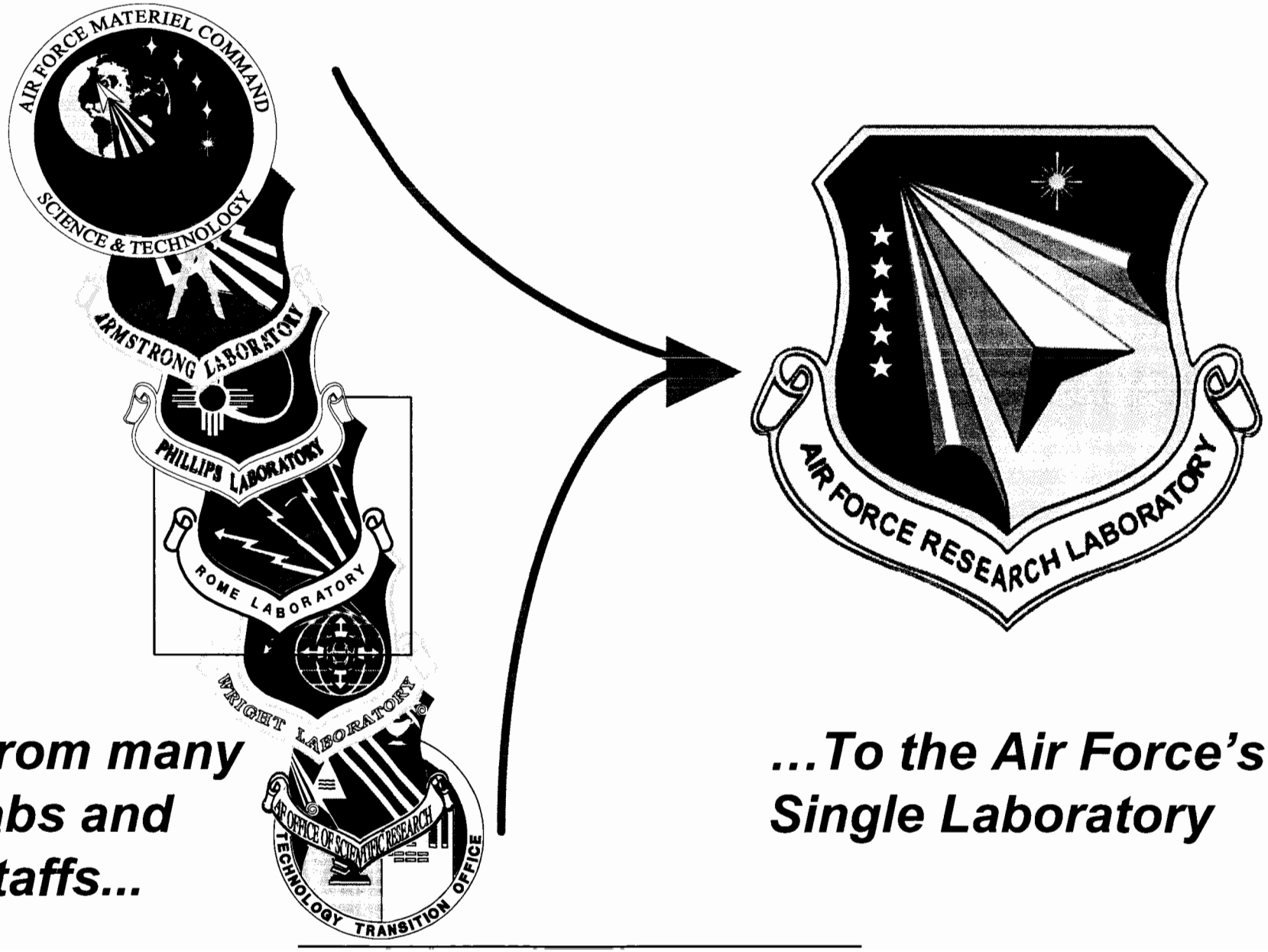
TJCSG Defined the Following Five *Attributes* to Evaluate Military Value[1]

(This slide was added to address Commissioner Newton's Question)

- "**People (30%)** – measures intellectual capital through education, experience, certifications, patents, publications and awards;
- Physical environment (7%) – measures special features of DoD technical facilities and encroachment;
- Physical structures and equipment (23%) – measures the presence of physical structures unique within DoD; and the value, condition, and use of physical structures;
- Operational impact (20%) – measures output of the RDAT&E functions through the number and funding of their projects; and size of their staff;
- **Synergy (20%)** – measures factors like working on multiple functions and multiple technical capability areas, proximity to customer, jointness, and dual-use."
  - Note: There is nothing in TJCSG's definition of *Synergy* that supports the statement in their Justification that, "…consolidating geographically separate units," increases Military Value!

[1]From "Technical Joint Cross Service Group Analyses and Recommendations," Volume XII, 19 May 2005, Appendix B.

Air Force Research Laboratory



From many labs and staffs...

...To the Air Force's Single Laboratory

AFRL Stand-Up 1997

- Consolidated All Sensors Work Performed at the Former Wright Laboratory and Rome Laboratory into the New Air Force Research Laboratory (AFRL) Sensors Directorate (SN) Headquartered at WPAFB

- Diverse Sensor Research Facilities, Capabilities, and Technical Disciplines at WPAFB, Hanscom AFB and Rome Site Were Combined to Provide a Completely Synergistic Sensor Research Capability

AFRL Stand-Up

Sensor Strategic Technical Differentiation

Wright Research Site – WPAFB, OH

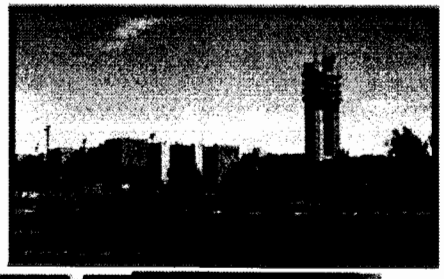
Electronic Warfare

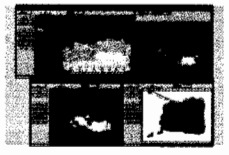
Electro Optical Sensors

Automatic Target Recognition

RF and EO Components

Sensor Fusion



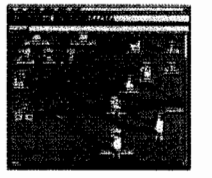


Rome Research Site – Rome, NY

Covert Radar Surveillance & Recon

Adaptive Radar Signal Processing

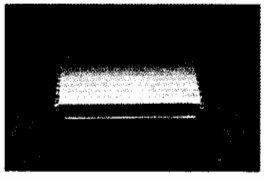
Photonic Components

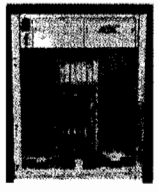


Hanscom Research Site – Hanscom AFB, MA

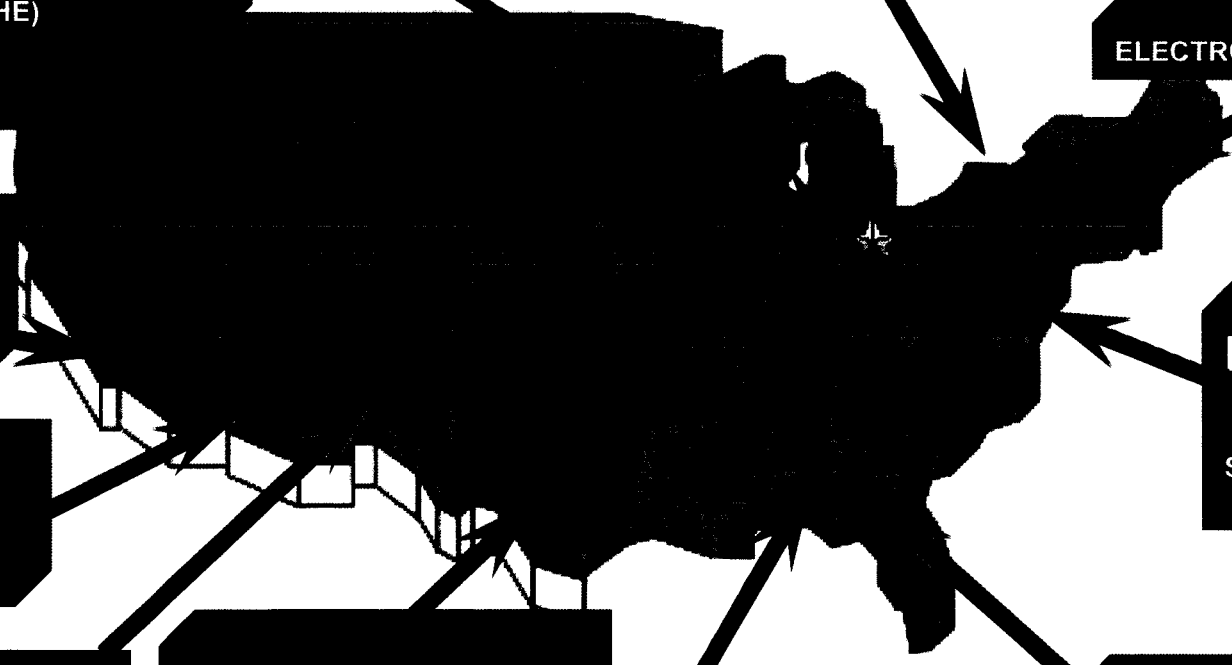
Antennas

Phenomenology





AFRL Major Sites



WRIGHT-PATTERSON
PROPULSION (PR)
AIR VEHICLES (VA)
SENSORS (SN)
MATERIALS AND MANUFACTURING (ML)
HUMAN EFFECTIVENESS (HE)
COLLABORATIVE C2 (IF)

HQ AFRL

ROME
INFORMATION (IF)
SURVEILLANCE (SN)

HANSCOM
BATTLE SPACE ENVIRONMENTS (VS)
ELECTROMAGNETICS (SN)

EDWARDS
ROCKET PROPULSION (PR)

BALLSTON
AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR)

MESA
WARFIGHTER TRAINING RESEARCH (HE)

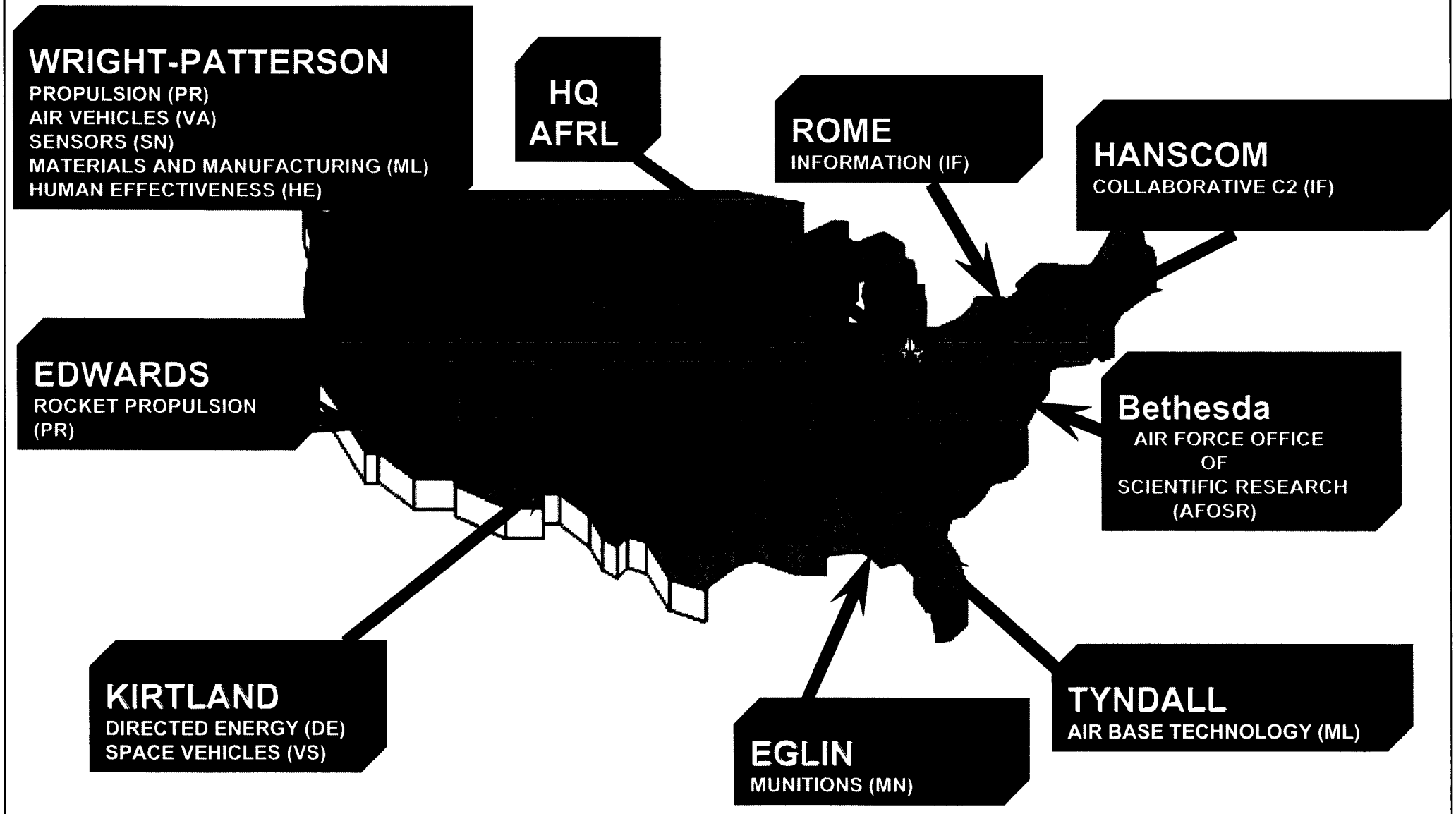
KIRTLAND
DIRECTED ENERGY (DE)
SPACE VEHICLES (VS)

BROOKS
BIOEFFECTS, AEROSPACE PHYSIOLOGY (HE)

EGLIN
MUNITIONS (MN)

TYNDALL
AIR BASE TECHNOLOGY (ML)

BRAC IMPACT


WRIGHT-PATTERSON
PROPULSION (PR)
AIR VEHICLES (VA)
SENSORS (SN)
MATERIALS AND MANUFACTURING (ML)
HUMAN EFFECTIVENESS (HE)
HQ AFRL
ROME
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HANSCOM
COLLABORATIVE C2 (IF)
EDWARDS
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Bethesda
AIR FORCE OFFICE OF SCIENTIFIC RESEARCH (AFOSR)
KIRTLAND
DIRECTED ENERGY (DE)
SPACE VEHICLES (VS)
EGLIN
MUNITIONS (MN)
TYNDALL
AIR BASE TECHNOLOGY (ML)

Sensors Directorate

Our Mission

To lead the discovery, development, and integration of affordable sensor and countermeasure technologies for our warfighters.

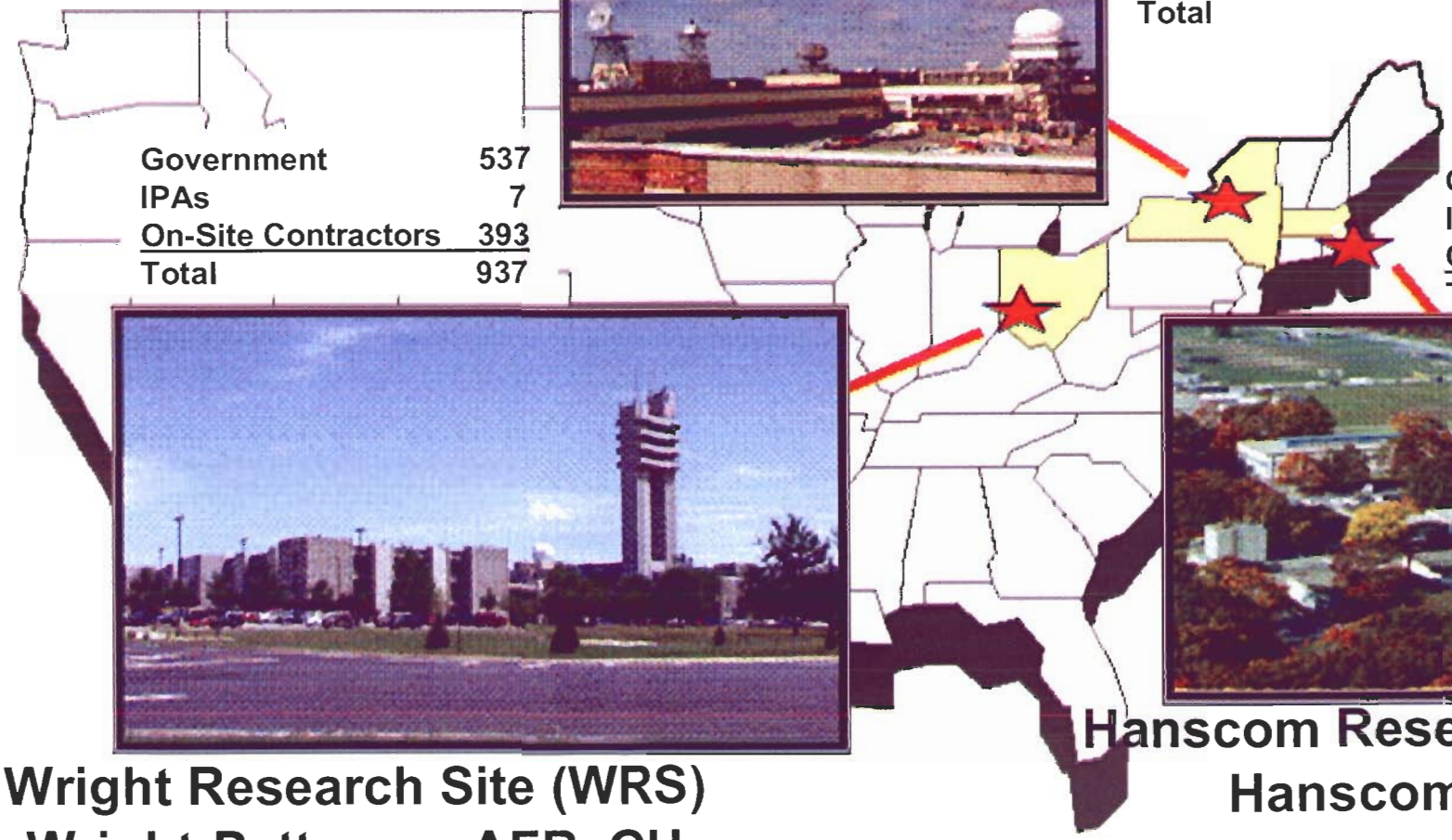
Our Vision

Sensor and countermeasure technology enabling complete freedom of air and space operations for our warfighters, no sanctuary for our adversaries, and homeland security.

Sensors Directorate Locations

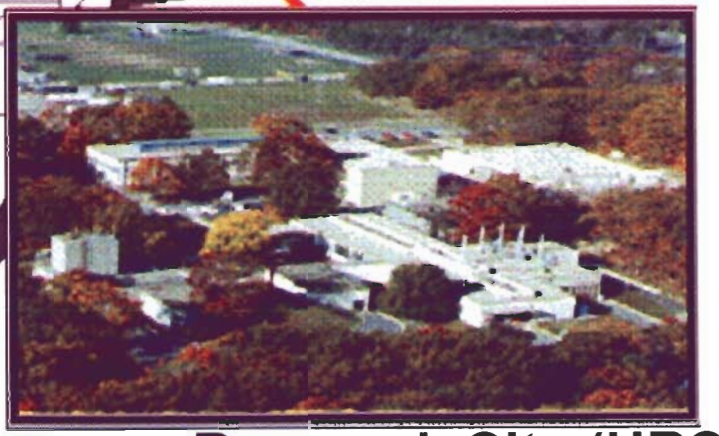
Rome Research Site (RRS)
Rome,NY

Government	82
IPAs	3
On-Site Contractors	25
Total	110



Government	537
IPAs	7
On-Site Contractors	393
Total	937

Government	110
IPAs	2
On-Site Contractors	73
Total	185



Hanscom Research Site (HRS)
Hanscom AFB, MA

Wright Research Site (WRS)
Wright-Patterson AFB, OH

Sensors Directorate

DIRECTOR
MR. J. SCIABICA

DEPUTY DIRECTOR
COL G. HOPPER

CHIEF SCIENTIST
DR. M. WICKS (Act'g)

CORP. INFORMATION
MR. R. KUTTER

ORG. DEVELOPMENT
DR. D. SASARAK

INTEGRATION & OPERATIONS
(SNO) MR. D. TOMLINSON

FINANCIAL MANAGEMENT
(SNF) MS. C. VAN VOORHIS

CONTRACTING
(SNK) MS. D. SUCHECKI

SECURITY
(SNY) MS. K. CATALANO

AEROSPACE COMPONENTS & SUBSYSTEMS TECHNOLOGY
(SND)
MR. T. KASTLE

ELECTROMAGNETIC TECHNOLOGY
(SNH)
DR. R. PAYNE

RF SENSOR TECHNOLOGY
(SNR)
MR. W. MOORE

EO SENSOR TECHNOLOGY
(SNJ)
COL R. GAUDETTE

SENSOR AUTOMATIC TARGET RECOGNITION (ATR) TECHNOLOGY
(SNA)
DR. M. BRYANT

SIGNATURE TECHNOLOGY OFFICE
(SNS)
MR. W. CUZICK

SENSOR APPLICATIONS & DEMONSTRATIONS
(SNZ)
MR. E. MARTINSEK

ANTI-TAMPER – SOFTWARE PROTECTION INITIATIVE OFFICE
(SNT)
MR. J. HUGHES

Sensors Collaboration with Other AFRL Directorates

INFORMATION
- Communications, Apertures & Components
- Spaced Based Radar
- ATR/Combat ID/Info Fusion/Exploitation
- Targets Under Trees
- Time Critical Targeting
- Collaborative Engineering Environment
- Laser Communication

SPACE VEHICLES
- Anti-Jam GPS
- Space Based Radar
- Rad Hard Electronics
- Hyperspectral Imaging
- Satellite Survivability
- Auto Target Recognition

AIR VEHICLES
- SensorCraft UAV
- Conformal Apertures
- Computational Electromagnetics
- Small / Micro UAVs
- UCAV

PROPULSION
- SensorCraft UAV

HUMAN EFFECTIVENESS
- SensorCraft UAV
- Time Critical Targeting
- Laser Warning & Protection
- Targets Under Trees

DIRECTED ENERGY
- Infrared Countermeasures
- PING
- MEDUSA
- Horizon-Limited Laser Radar
- RV Discrimination
- See Through Clouds
- Acquisition, Tracking & Pointing for Laser Weapons

MUNITIONS
- Anti-Jam GPS
- Small / Micro UAVs
- RF Components
- Focal Plane Arrays
- Auto Target Recognition
- Laser Radar
- Targets Under Trees

MATERIALS
- III-V Components
- RF Polymers
- SensorCraft UAV
- Laser Warning & Protection

AFOSR
- Waveform Diversity
- Electromagnetics
- Electronic Materials & Devices
- Auto Target Recognition

"Why move to Dayton?"
Commissioner Newton

(This slide was added to address Commissioner Newton's Question)

There is a great deal of Synergy between Sensors-Rome and Information-Rome, but minimal with Dayton!

***"…argues for status quo – don't move."* Newton**

INFORMATION-Rome
- Communications, Apertures & Components
- Spaced Based Radar
- Combat ID/Info Fusion/Exploitation
- Targets Under Trees
- Time Critical Targeting
- Collaborative Engineering Environment
- Sensor Fusion
- Intelligence Community Efforts

SPACE VEHICLES-Kirtland
- Space Based Radar

AIR VEHICLES-Dayton
- N/A*

PROPULSION-Dayton
- N/A*

HUMAN EFFECTIVENESS-Dayton
- N/A*

MUNITIONS-Eglin
- N/A*

AFOSR-Bethesda
- Waveform Diversity
- Electromagnetics

MATERIALS-Dayton
- N/A*

DIRECTED ENERGY-Kirtland
- N/A*

*Not Applicable – DoD's intent was to encourage more synergy between AFRL Directorates, but Sensors-Rome's technology does not directly lend itself to synergy in these Directorates

Collaborations

Sensors Directorate has >100 collaborations with external organizations

"Collaborators" provide:
- Technical skills
- Resources
- Warfighter needs

- AFRL (Other Directorates)
- Battle Labs
- DARPA
- DIA
- DOE Labs
- DTRA
- FFRDCs
- Foreign Countries
- Industry
- JPL
- MAJCOMs
- MDA
- NASIC
- NASA
- NGA
- NIST
- NRO
- NSA
- Other Services
- SPOs
- Universities

Local Collaborations

Academia

Binghamton Univ.
Univ. of Buffalo
Clarkson Univ.
Colgate Univ.
Cornell Univ.
Rensselaer Polytechnic Institute
Rochester Institute of Technology
SUNY Institute of Technology
Syracuse Univ.
Utica College

Local Contractors

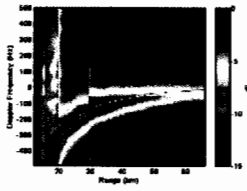
Automated Resource Management Associates
Black River Systems Company
Computer Sciences Corp.
ITT Industries
L-3 Communications
Capraro Technologies, Inc.
PAR Technology (Gov. Systems)
Research Associates for Defense Conversion
Syracuse Research Corporation
Northrop Grumman IT

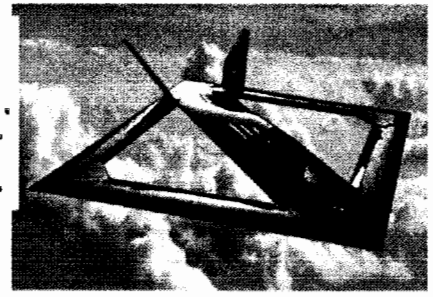
Outline

- AFRL Sensors Directorate Overview
  - Mr. Joe Sciabica
- AFRL/SN Rome Research Site
  - Mission
  - People
  - Accomplishments
- Requirements/Considerations for SN RRS Relocation
  - BRAC Recommendations for SN RRS
  - Facilities
  - Sites
  - Classified Infrastructure
- Discussion and Q&A
  - All

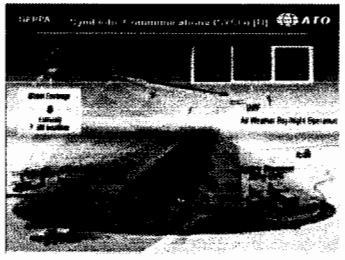
Sensors Directorate at RRS

Who We Are – What We Contribute

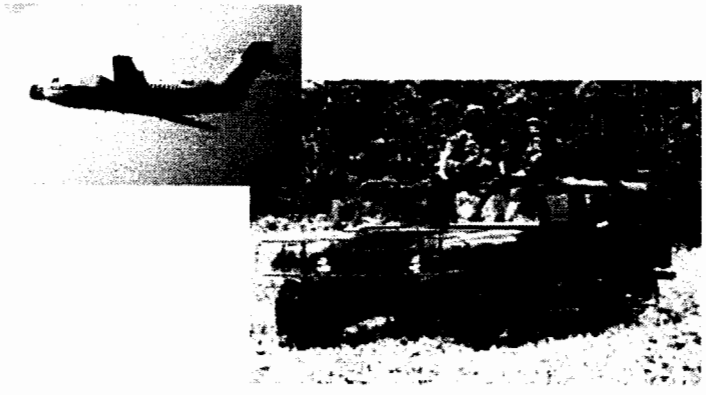




- Nationally Recognized Experts in:
  - Radar Technology and Applications
  - Advanced Waveforms and Signal Processing
  - Photonics Subsystems & Components
- Provide Key Sensors Technologies and Applications Enabling Superior Warfighting Capability:
  - Detecting & Tracking Difficult Threats in Difficult Environments
  - FOPEN, GPEN, BPEN
  - LO Targets, Dismounts, Slow Movers
  - Severe Clutter, Jamming & Interference



- Protect National Security by Ensuring U.S. Lead in Military Critical Technologies:
  - Bistatics/Multistatic Radar
  - Space Based Radar
  - Multi-Dimensional Adaptive Processing
- Key Users Come to Us!
  - AF SPOs, NSA, NRO, DHS, DARPA



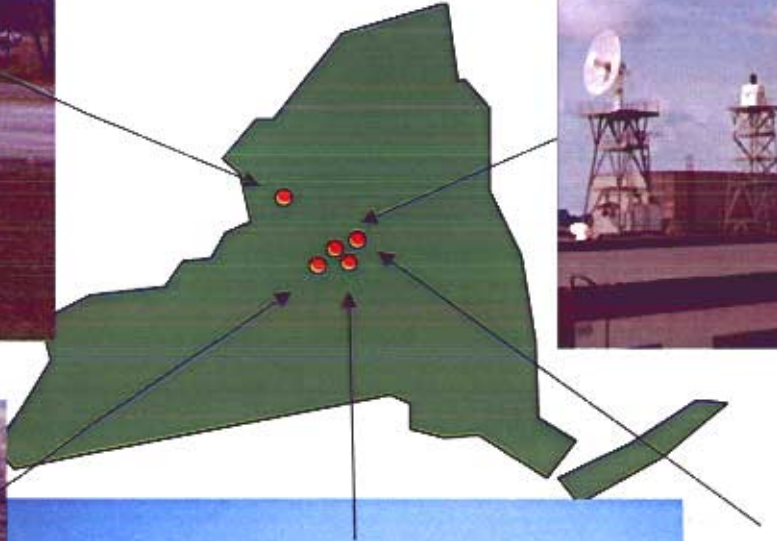
"What is unique about Rome's Facilities?"

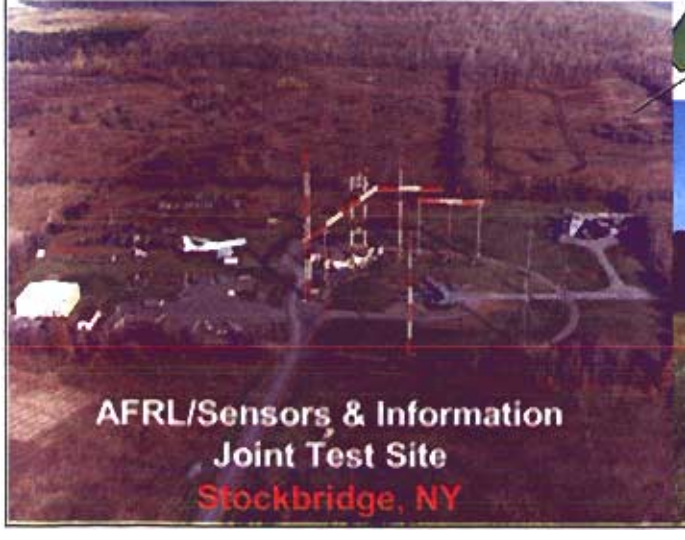
Commissioner Newton

(This slide was added to address Commissioner Newton's Questions)

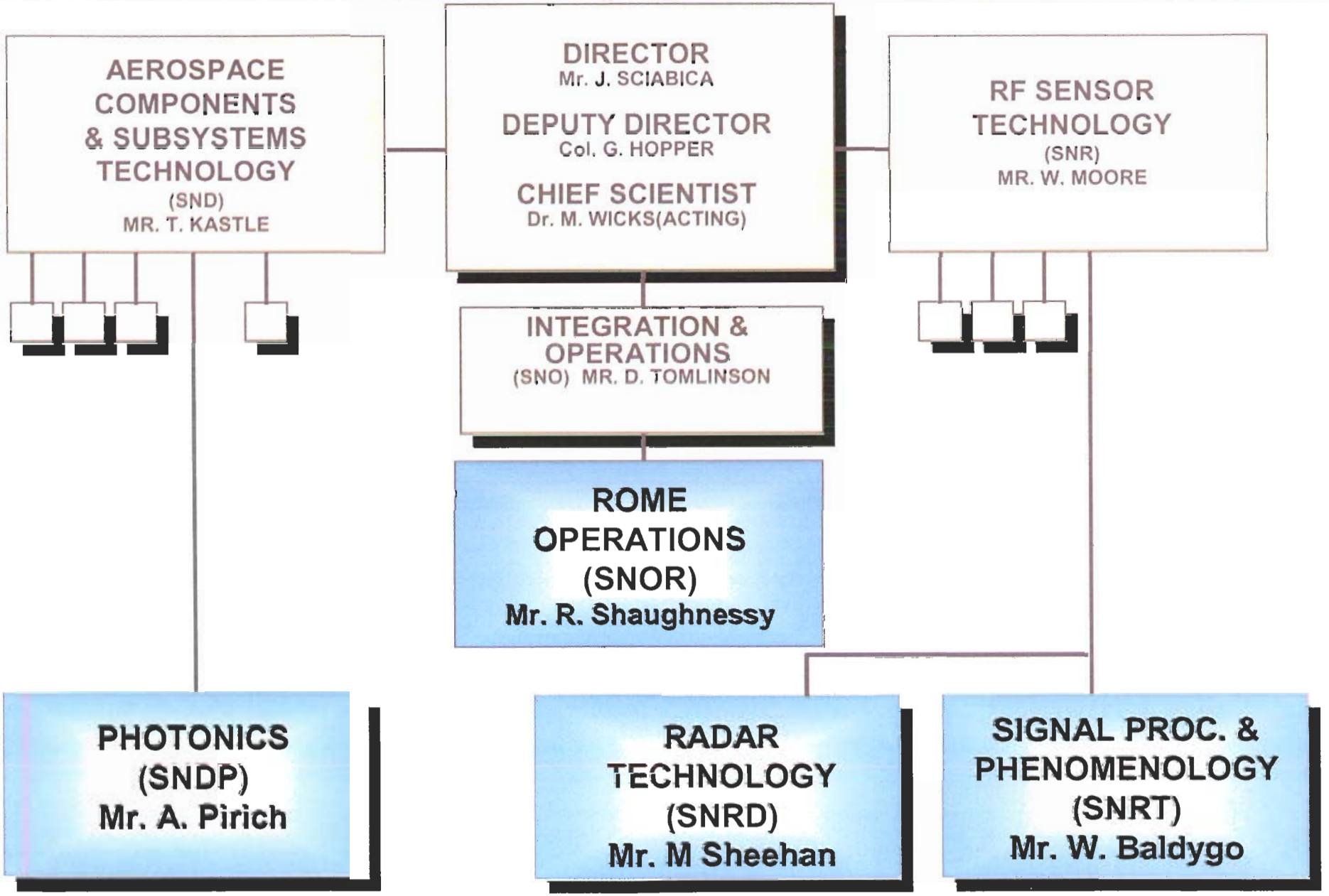
A Unique One of a Kind Joint AF-Army and Intelligence "Wide Band Radar National Asset"

(Due to In-place Agreements and Proximity to each other.)





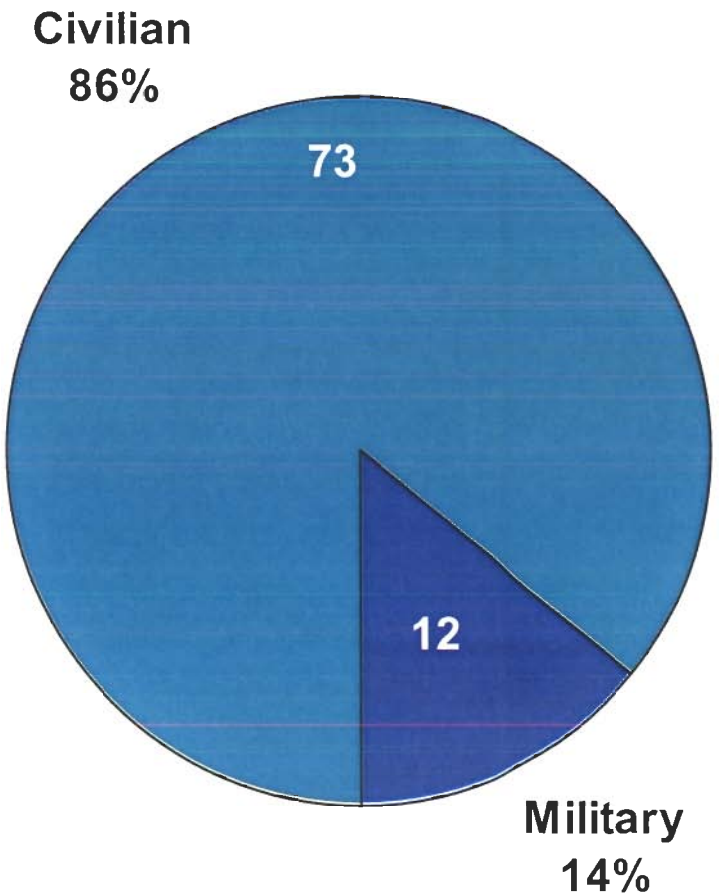
Sensors Directorate @ Rome



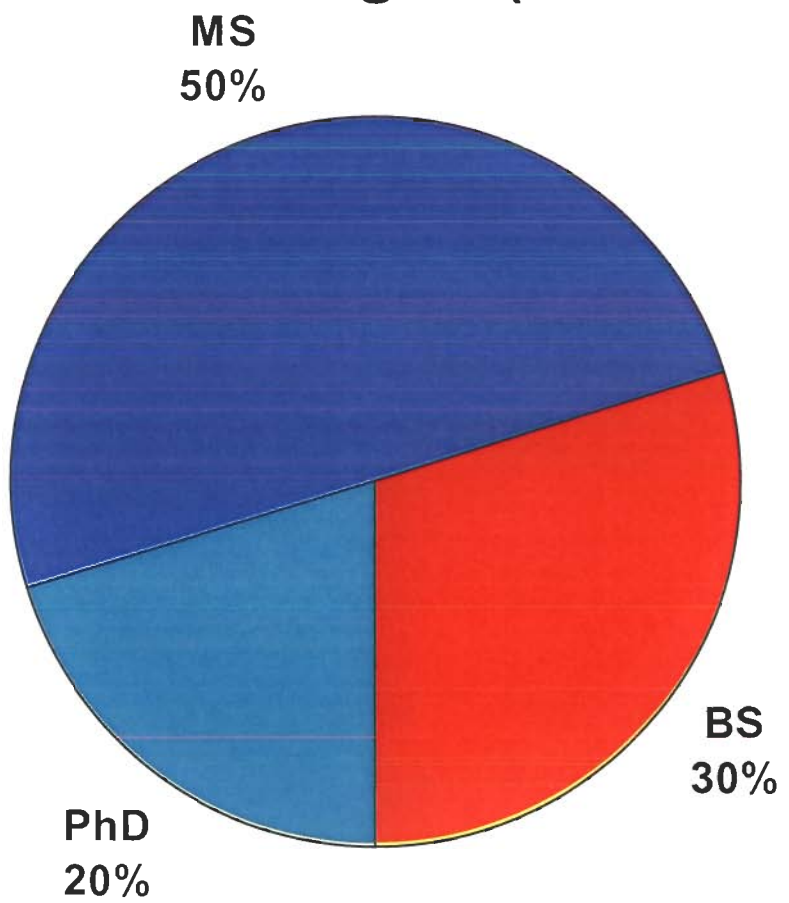
Personnel - Rome Site

GOVERNMENT	85
ONSITE CONTRACTORS	25
Total	110

SN/RRS (85)



Academic Degree(S&E Only)



People - Our Most Valuable Resource

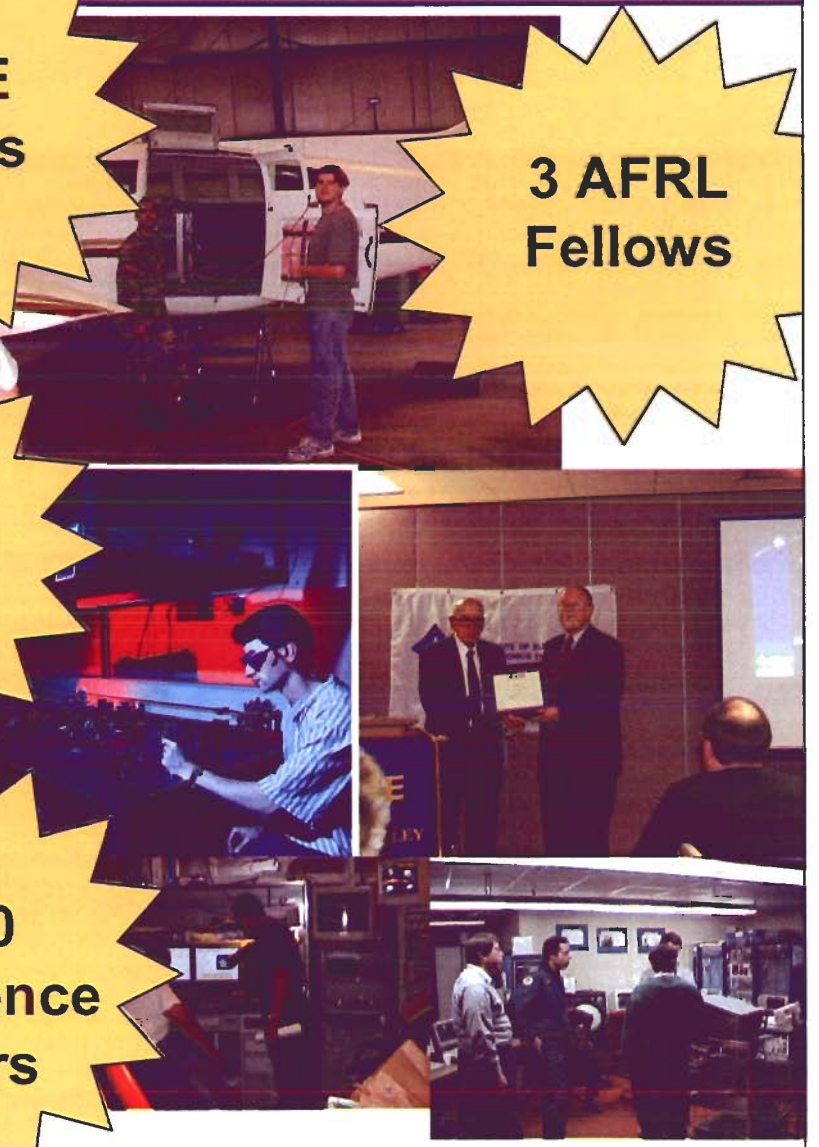
- Acting Chief Scientist, AFRL/SN
- Three AFRL Fellows
- Five IEEE Fellows; Three Section Chairs Including Current Chair
- One SPIE Fellow
- Three Sensor Directorate Level Award Winners Including Last Two "Veiled Award" Winners
- IEEE National Radar Conference Host 1997 & 2006
- Annual Tri-Service Radar Symposium Air Force Co-chair
- Association Of Old Crows Section Conference Chair
- TTRDP Experiments Chair
- TTCP SEN-TP-3 Lead
- AFRL/DARPA KASSPER Workshop Chair
- NATO SET-071 Panel Member
- Annual Tri-Service Waveform Diversity Workshop
- Annual AFRL STAR Workshop

5 IEEE Fellows

3 AFRL Fellows

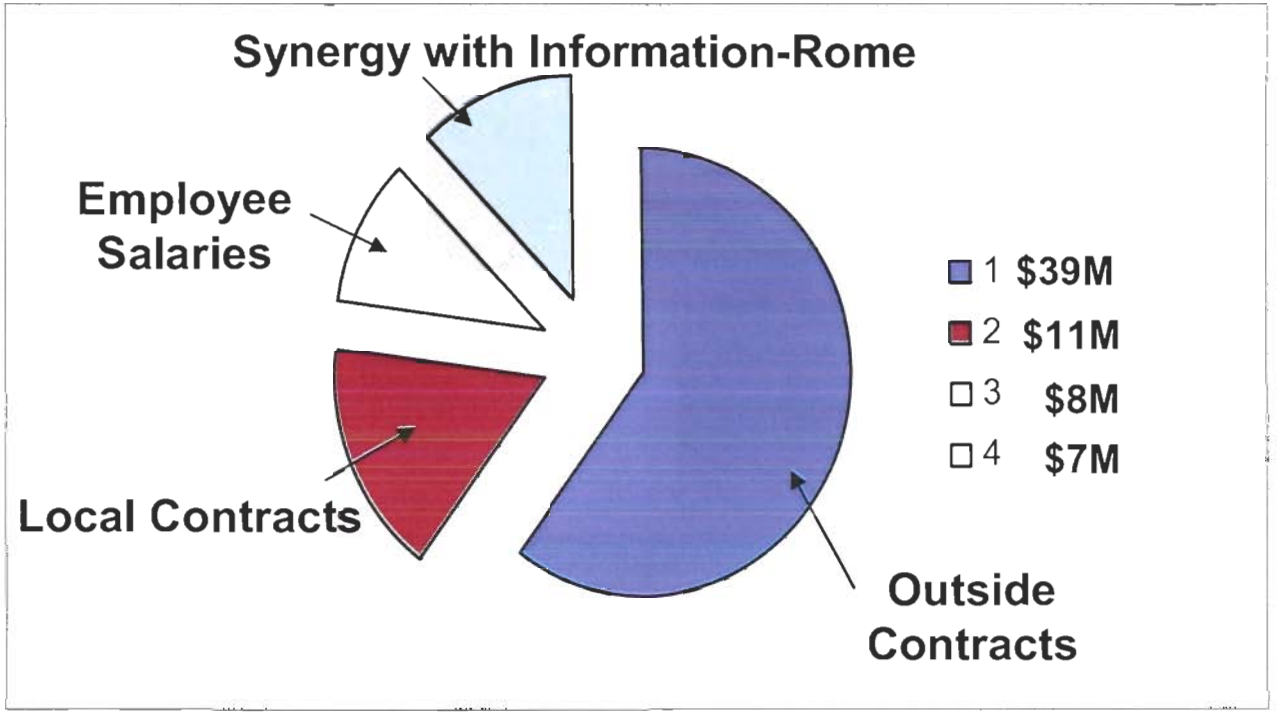
1 SPIE Fellow

> 200 Conference Papers



NATIONAL TECHNICAL RECOGNITION

Sensors-Rome
Local Area Synergy & Financial Impact



Sensors-Rome Income

AF	$ 30.5 M
Customer	$ 34.5 M
Sensors Total	$ 65.0 M

Sensors-Rome OUTGO

Sensors-Rome Contracts Outside Local Area	$ 39M
Sensors-Rome Contracts Inside Local Area	$ 11M
Sensors-Rome SENT To Information-Rome (Synergy)	$ 7M
Employee Salaries	$ 8M

20% of Customer-received Funds for Cross-Directorate Synergy with Information-Rome

SN RRS Military Value

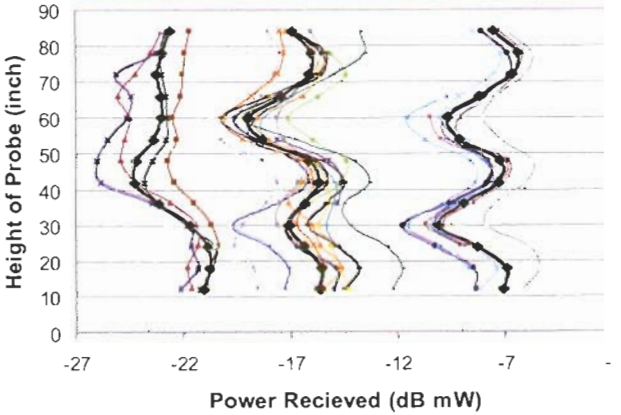
- **FOREST**—Detect Small Vehicles/Dismounted Troops
- **FOPEN**—Foliage Penetration (Aspect Sensitive RCS of Mil/Civ Vehicles)
- **STRUCTURALLY-INTEGRATED CONFORMAL ARRAY**—End-Fire Array Technology
- **BAO**—Battle Field Air Operations
- **TTRDP-RADARSAT**—Bistatic GMTI from Space Illuminator
- **ISBR**—Integrated Space Based Radar
- **SYCO**—Symbiotic Communications System
- **INTELLIGENCE COMMUNITY SUPPORT**
- **KNOWLEDGE AIDED SIGNAL PROCESSING**
- **OPTICAL SIGNAL PROCESSING**

FOREST Data Collection (Stockbridge)

Objective: Analyze the Backscattering Behavior of a Moving Target in a Forest Environment

The GUI presents radar data analysis in a user friendly environment.

Choreographed Paths thru woods



Attenuation and Fading Statistics of Propagation within a Forest Environment

Knowledge of these scattering and fading statistics will lead to the development of more accurate target models and, in turn, for improved radar detection and signal processing techniques

Elevation probing used to analyze attenuation and multipath statistics

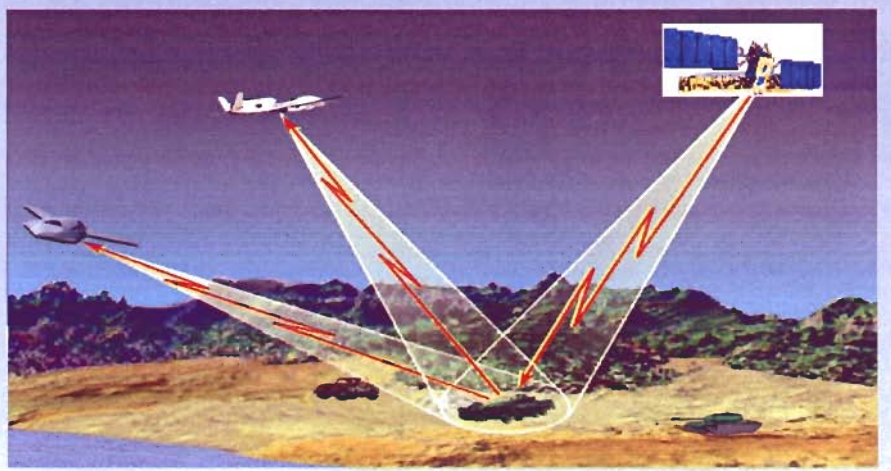
Troops Disbanding from Vehicles

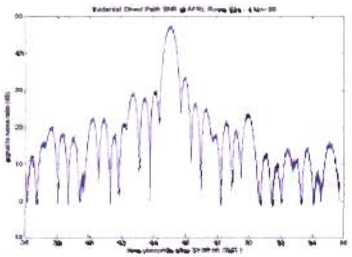
Provides Measurements and Ground Truth for Evaluation of Theoretical Models and Simulation.

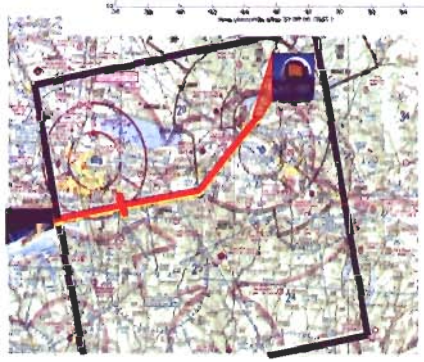
RadarSat I/II Experimentation

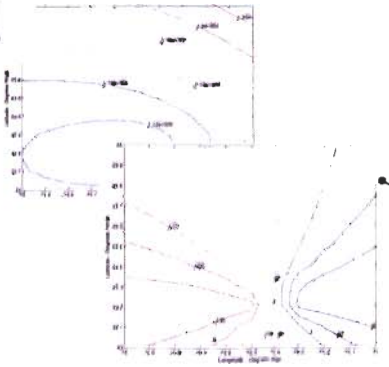
Accomplishments:

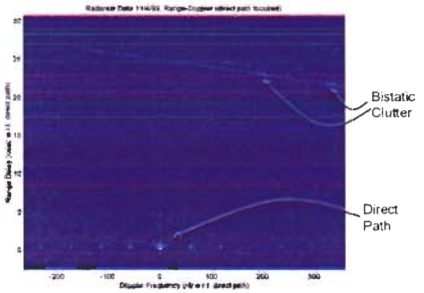
- Collected Multichannel Airborne Radar Data to Evaluate SBR GMTI Concepts
- Passive/Covert Radar Function
- Conducted Airborne GMTI Experiment
  - 5 Nov 2000 at CFB Petawawa
  - Fall 2004 at Ft. Drum
- Planning For Transportable Receiver Experiments
  - Clutter Phenomenology
  - Waveform Diversity

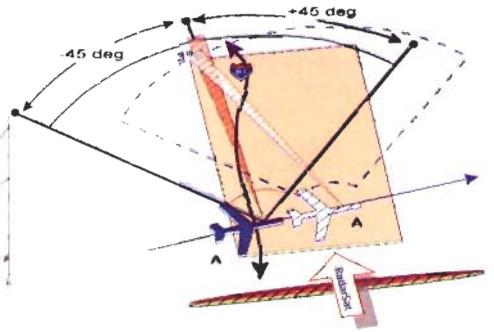




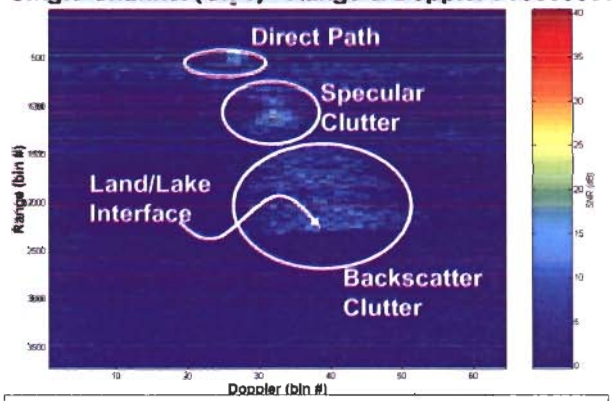








• Single Channel (Ch 1) - Range & Doppler Processed



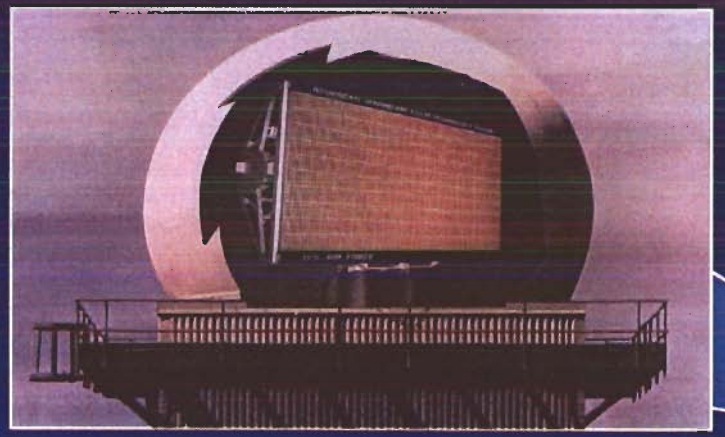
Clutter Range/Doppler Distribution is Reasonable

Optical Signal Processing

RADAR TEST BED FOR ANTI-JAMMING OPTICAL BEAMFORMING (AJOB) SIGNAL PROCESSOR TEST

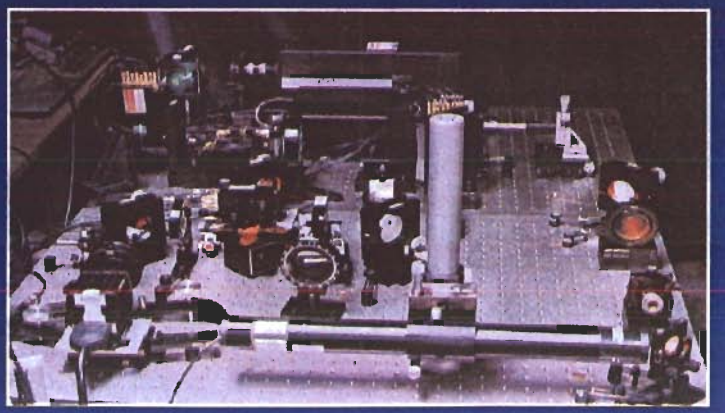
(1) STAND-OFF JAMMERS

- ONE FILLS RECEIVERS WITH BARRAGE NOISE
- OTHER ANTENNA TRANSMITS A SIMULATED TARGET



(2) ECCM RADAR

RECEIVES SIGNAL(S) FOR OPTICAL PROCESSING

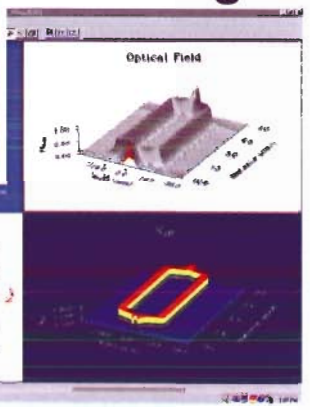


(3) OPTICAL SIGNAL PROCESSOR

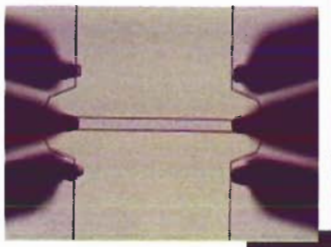
PERFORMS JAMMER CANCELLATION & PULLS THE TARGET OUT OF THE NOISE

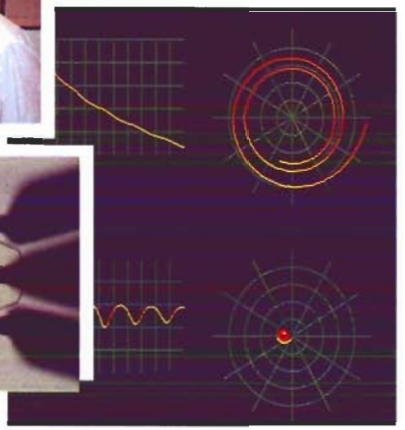
AFRL/SNDP In-House Capabilities

Optical Modeling

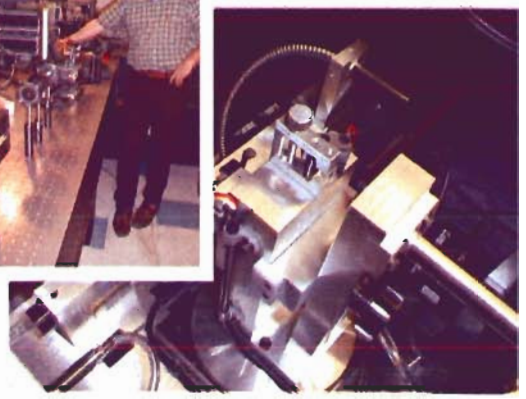


Electrical Modeling

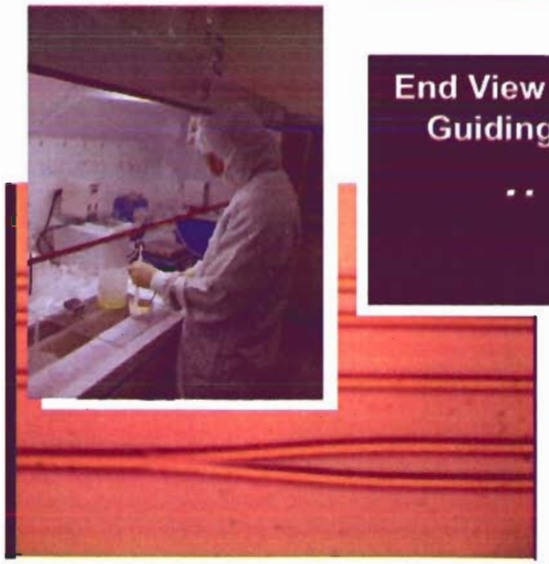




Materials for Processing

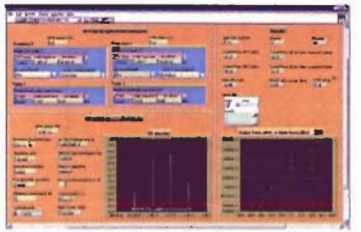


Electro-Optical Material Characterization



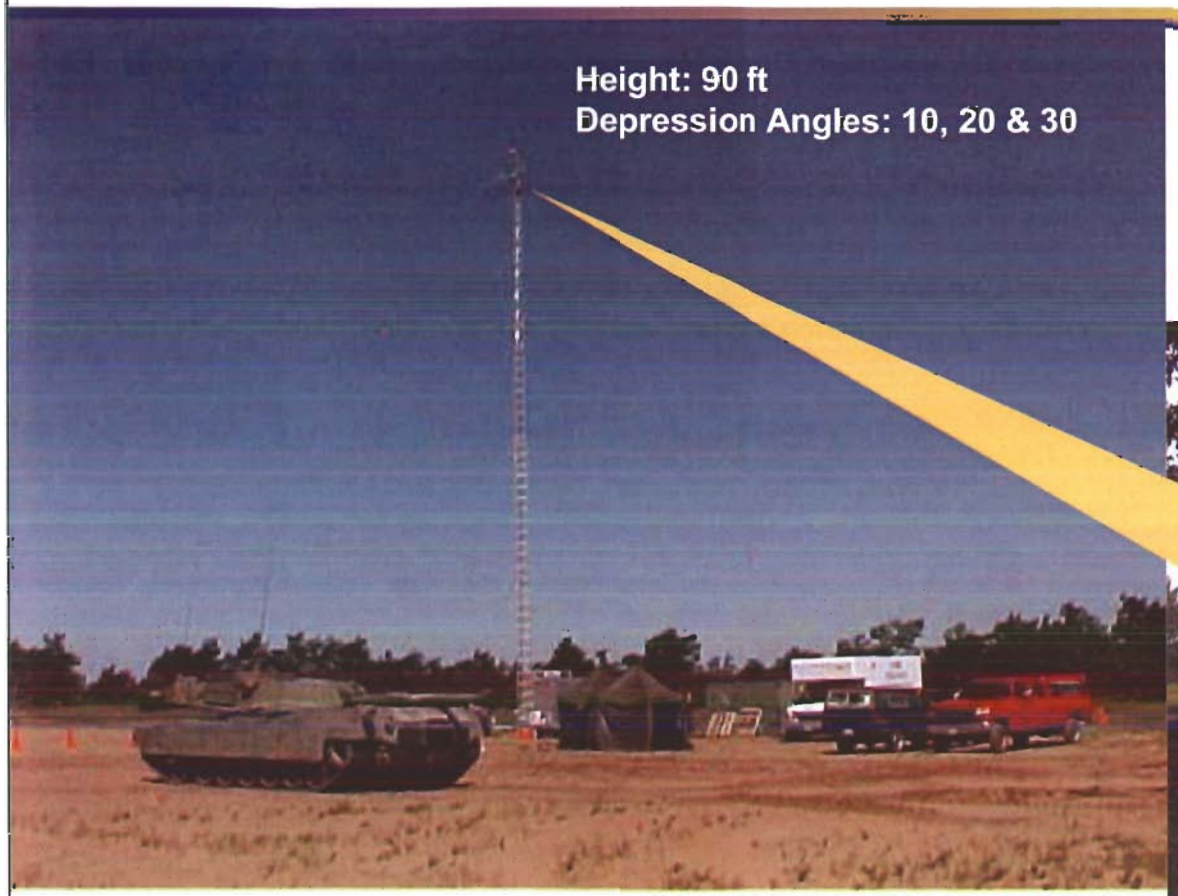
End View Optical Guiding Split

Electro-Optical Device Fabrication



RF Link Demonstration And Component Evaluation

Sensors-Rome Engineers Support to Joint Warfighter Community at Ft Drum



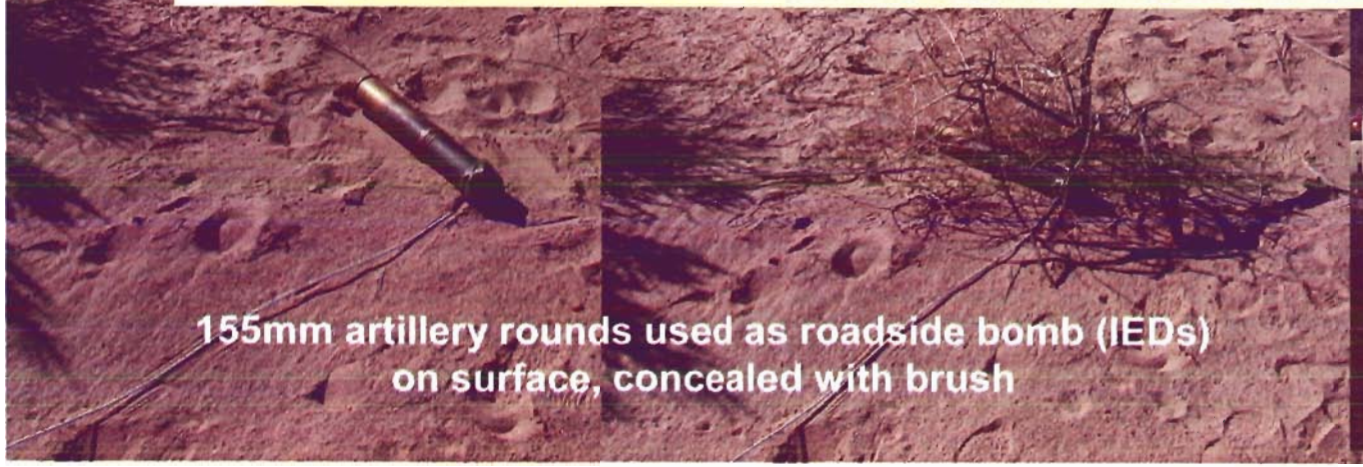
- Baseline FOPEN Test System
- Improve Target & Clutter Models
- Detect & Track Slow Moving Targets
- Wheeled & Tracked, In & Out of Trees

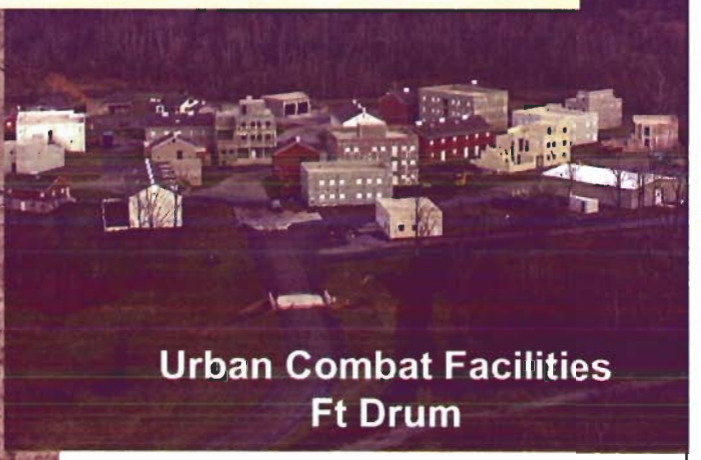
- **Collect Doppler Signature Data on Slow-Moving Ground Targets, Extract RCS**
  - **Develop First-Order Statistics; i.e., Mean Value & Variation About the Mean**
  - **Function of: Aspect Angle, Polarization, Frequency, Target Type & Depression Angle**
  - **Examine Time Correlation Properties; Collect Environment Clutter Data**

Intelligence Community Efforts at Ft Drum, NY in Support of the *War on Terror* and Reconnaissance of N. Korea

(Due to Agreements In-place and Proximity to Sensors-Rome)

Developing New Methods to Locate Terrorist Bombs in Urban Settings





Developing New Methods to Perform Reconnaissance on N. Korean Troops

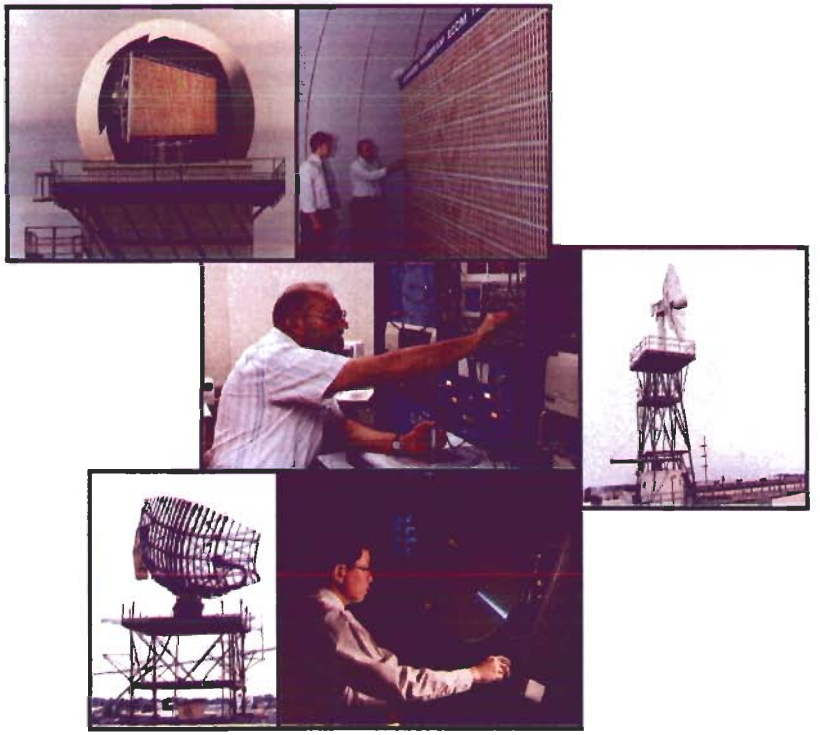
Outline

- AFRL Sensors Directorate Overview
  - Mr. Joe Sciabica
- AFRL/SN Rome Research Site
  - Mission
  - People
  - Accomplishments
- Requirements/Considerations for SN RRS Relocation
  - BRAC Recommendations for SN RRS
  - Facilities
  - Sites
  - Classified Infrastructure
- Discussion and Q&A
  - All

Relocation Requirements

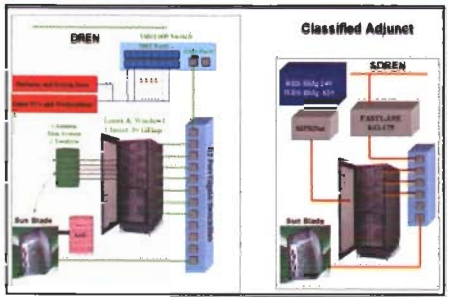
Surveillance Facility

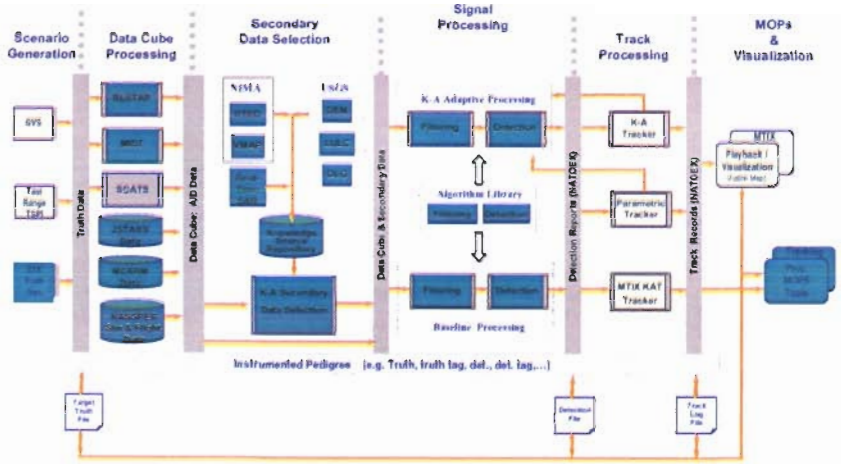
- 4 Sensor Systems; 3 active and 1 passive
- High-Fidelity Data Acquisition
- Complex, experimental radar testbeds
- Re-configurable nature makes them world-unique
- Towers, antennas, transmitters, instrumentation, frequency allocation/authorization

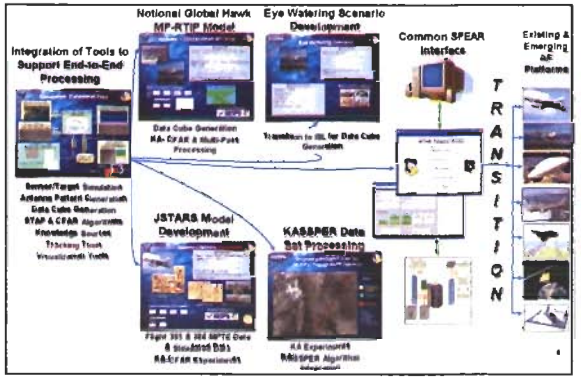


Relocation Requirements

SPEAR Facility





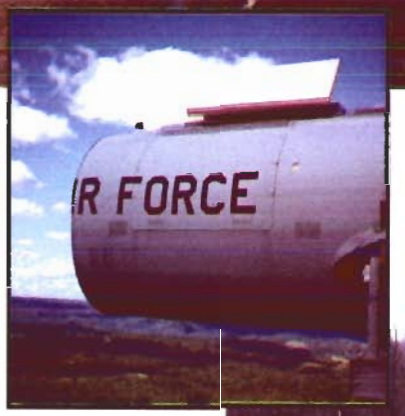


- Unique Testbed for developing, evaluating and demonstrating advanced sensor concepts and signal processing algorithms to <u>Accelerate Transition to the Warfighter.</u>
- Multi-level Secure Environment
  - Open Storage
- SIPRNET and SDREN connectivity to other DoD, AF, and FFRDC Organizations
- 1600 ft^2 Classified Processing

Remote Site Synergy

Remote Site Capabilities - Newport, Stockbridge & Ft. Drum

- Quiet RF Environment for Antenna Testing, RCS Measurements
  - FOPEN Radar Meas.
  - FOREST Demo
  - Conformal Array Testing
- At Ft. Drum developed, tested and demonstrated core technology for BAO Kit
- Diverse Joint Service Target Sets - Tanks, Trucks, Tracked Wheel Vehicles and F-16s



Relocation Requirements

Vaults – SCI and SAP

- 2 SAP Facilities & 1 SCI Facility
  - Storage Containers
  - Computers, Telephones and VTC
  - Workspace and Conference Area
  - SPEAR Testbed Replicated in SCI area
  - GWAN (SCI Computer Network)

BRAC COBRA Run Accuracy

- Technical Joint Cross-Service Group (TJCSG) Directed Use of Field Certified Data from AF Concerning Contractors Cost – 3 May 2005

- COBRA Data Standard for Contractor Reductions
  - Apply 15% Reduction Against All Contractor Personnel
  - Show $200K Miscellaneous Recurring Savings for Each Contractor Eliminated
  - Certified Data FY03: 82 Gov't Employees; 31 Contractors (32_tech_04277_ftes_funding_fo.xls) = Total 113 FTEs

- COBRA Run 5 May 2005 Assumed Reduction of 64 Contractors from Rome and Miscellaneous Recurring Savings of $200K per reduced contractor equaling $12.8M Savings/year
  - Data Standard Should Have Used 4 Contractors vs. 64
  - Results in $36M Total Savings Discrepancy FY2009-2011

- Will AF/DoD Realize Consolidation Savings?
  - COBRA for SN RRS Needs to be re run Using Correct # Contractors and 15% Reduction

Summary

- World-Class Expertise in Surveillance Radar Technology & Radar Signal Processing Technology
  - Personnel Depth (Ph.D.'s, Fellows)
  - Refereed Publications
  - Patent Applications & Awards
- Numerous Accomplishments Supporting Customers & Partners:
  - Technical Staff Name-Requested by High-Profile Customers/Partners
- Extensive Relationships to Leverage R&D Investment
- Synergy between SNDP/SNRT/SNRD
- Importance of Facilities/Capabilities to Sensors Directorate Mission
- Important to Recreate these Capabilities at WPAFB to Support Recommended Move

Outline

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  - Classified Infrastructure
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  - All

"What will be the net result if you move?"

Commissioner Newton

(This slide was added to address Commissioner Newton's Question)

- *"The DoD will spend about $35M to move about 9 mid-level engineers and their unique radar equipment from Rome to Dayton.*
- *The Air Force will lose all of their Nationally Recognized Technical Experts in the field of Covert Radar Surveillance & Reconnaissance, and Adaptive Radar Signal Processing because they will not move.*
- *Overall Military Value of the "function" will significantly decrease over the next 5-10 years due to loss of technical expertise and the fact that the unique radar system will not be able to operate at full potential in the Dayton area (lack of FCC license).*
- *Our enemy counter-parts will be given time to catch up and/or pass us in the critical fields of Covert Radar Surveillance & Reconnaissance, and Adaptive Radar Signal Processing."*[1]

[1]As discussed within the Group with Commissioner Newton