



Integrity ★ Service ★ Excellence

Air Force C4ISR S&T Vision

NDIA C4ISR Breakfast

1 December 2011

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Chief Technologist
Air Force Research Laboratory**



Did You Predict This?



Mobile Computing

~1990



2011





Entertaining Technology Predictions



The pessimistic

- *Most famous, Thomas Watson (President of IBM, 1943): “I think there is a world market for maybe five computers.”*
- *Second most famous, Ken Olsen (founder of Digital Equipment Corporation, in 1977): “There is no reason anyone would want a computer in their home.”*



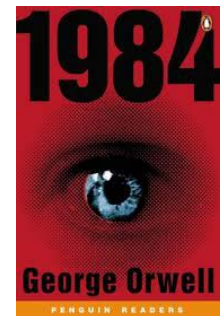
The optimistic:

- **“Nuclear-powered vacuum cleaners will probably be a reality within ten years.”—Alex Lewyt, President of Lewyt Vacuum Company, 1955**
- **“Two years from now, SPAM will be solved.”—Bill Gates, Microsoft founder, in 2004**



The frighteningly prescient

- **“Big Brother is watching you. George Orwell, “1984”—written in 1948**
- **“The improved “limitless-distance” telephone was presently introduced, and the daily doing of the globe made visible to everybody, and audibly discussable too, by witnesses separated by any number of leagues.”—Mark Twain, in the London times, 1898**





The Past The Future



Past

- One Strategic Threat: USSR
- Mutual Assured Destruction
- US Preeminence in Intel
- Traditional Open Sources
- Traditional Order of Battle
- Limited Comms for C&C
- Un-obscured Activities
- Conventional Weapons
- Open Source Operations



Present & Future

- Many State/Non State Actors
- Terrorism to Noncombatants
- Commercial/State Satellites
- World Wide Web & Google
- Unconventional Targets
- Internet Cafés, Chat Rooms
- Hidden in Jungles, Mountains & Cities
- IEDs, Cyber and Commercial Airplanes
- Underground Facilities
- The Unexpected Event
- “Black Swan” thinking

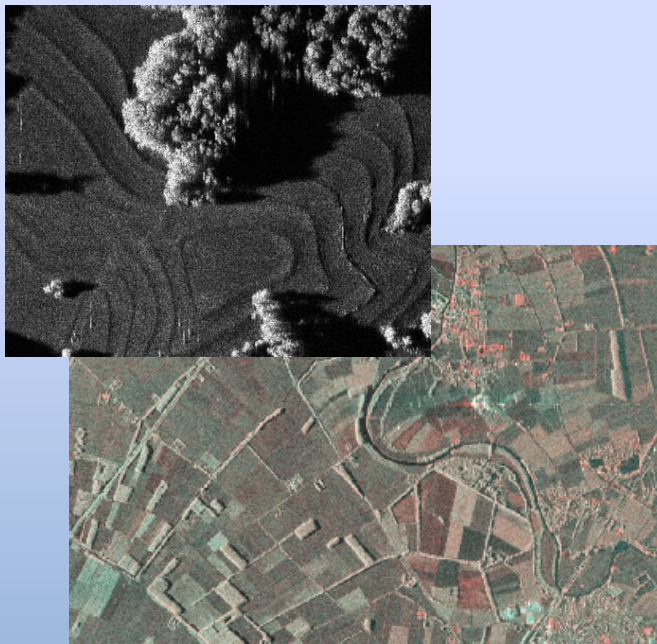


Where we were/Where we are



In the past

- There weren't very many sensors—exquisite pictures, but not many of them



Today

- We have too MUCH information from a variety of sources:
 - Video
 - Global Hawk
 - Cyber SIGINT—machines talking to other machines





The Globe is Increasingly ...



Instrumented

We have the ability to measure, sense, and see the precise condition of just about everything

Interconnected



People, systems, and objects can communicate and interact with each other in entirely new and different ways

Intelligent

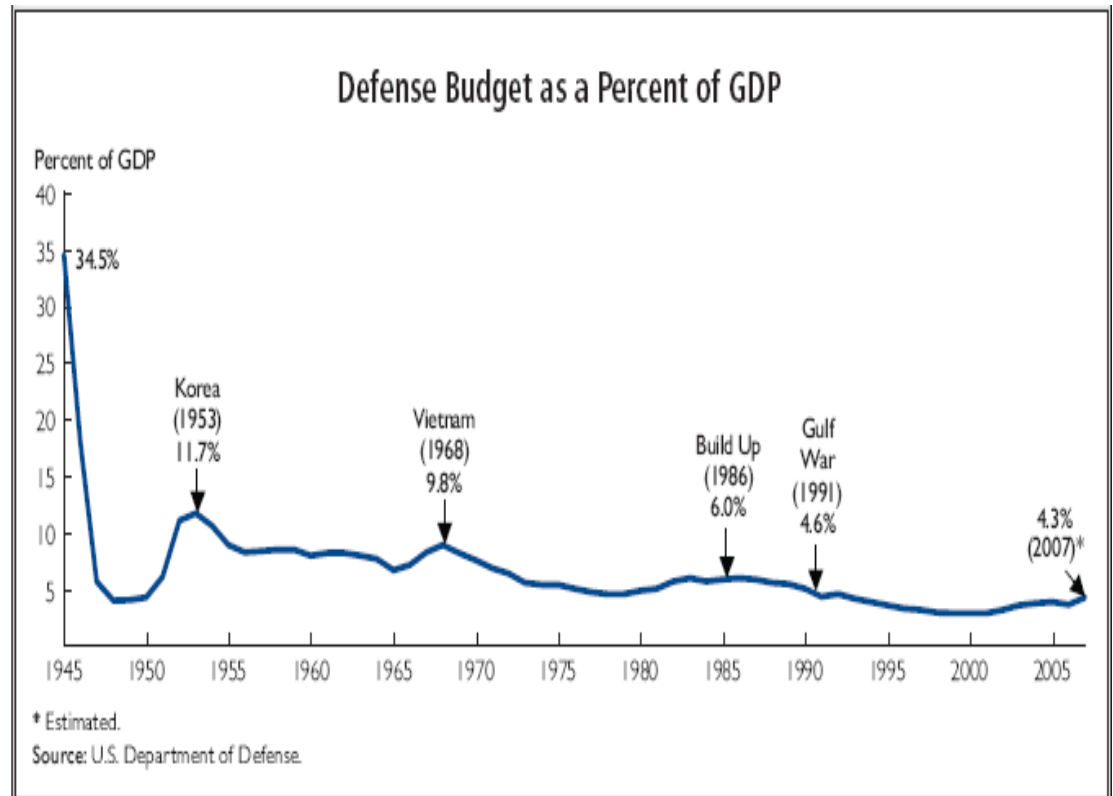
Things, processes and ways of working are becoming intelligent
- We can respond to changes quickly and accurately, and get better results by predicting an optimizing for future events



Emerging Landscape



- **Post War Demobilization**
- **This time it's different**
- **Not just Acquisition and O&M**
- **R&D taking cuts**



Source: <http://www.heritage.org/static/reportimages/55077CEFA5437851CDDF403A8DE280FB.gif>

Disclaimer: Views are entirely the authors and in absolutely no way do they reflect any Department policy or insights

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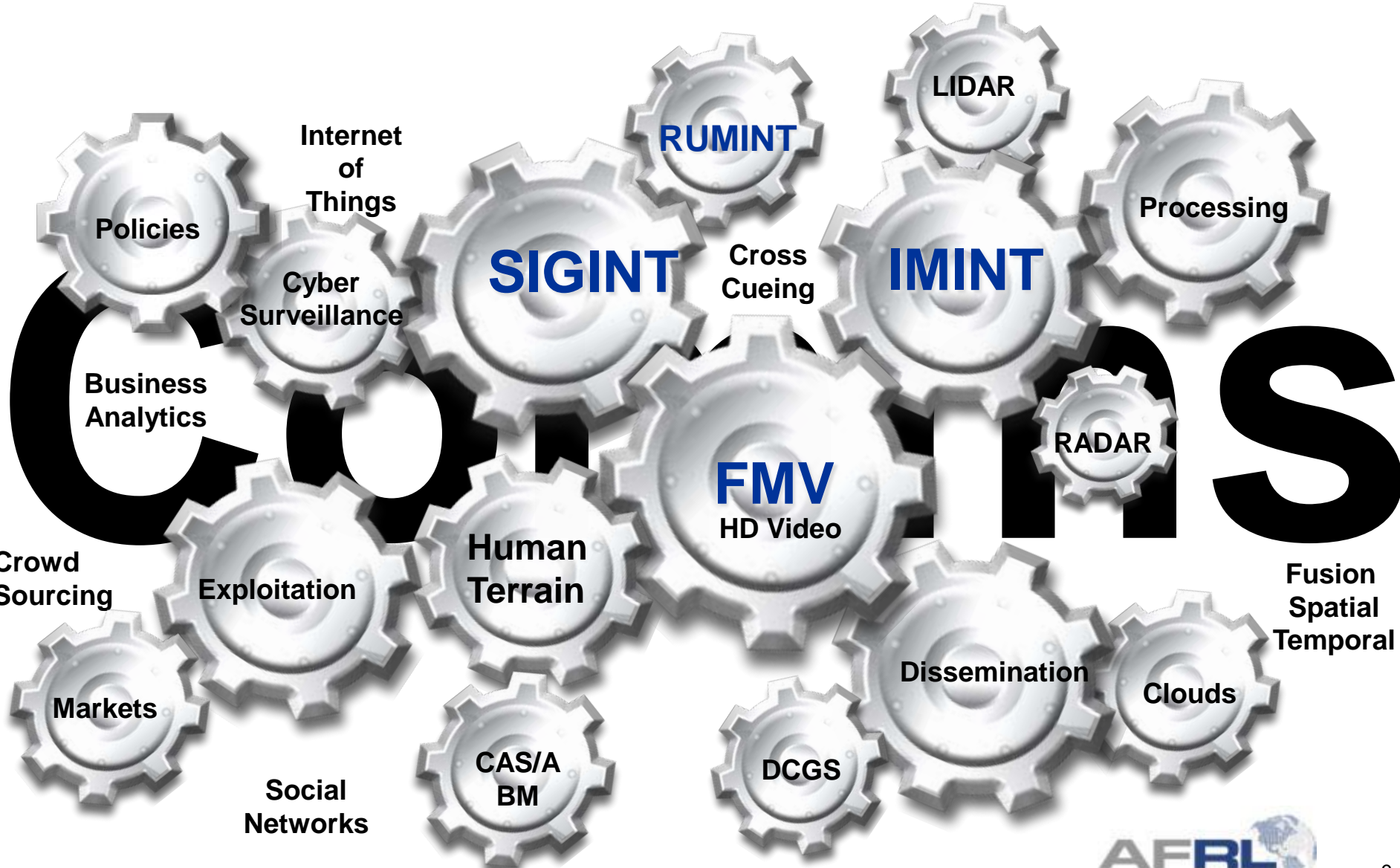


ISR



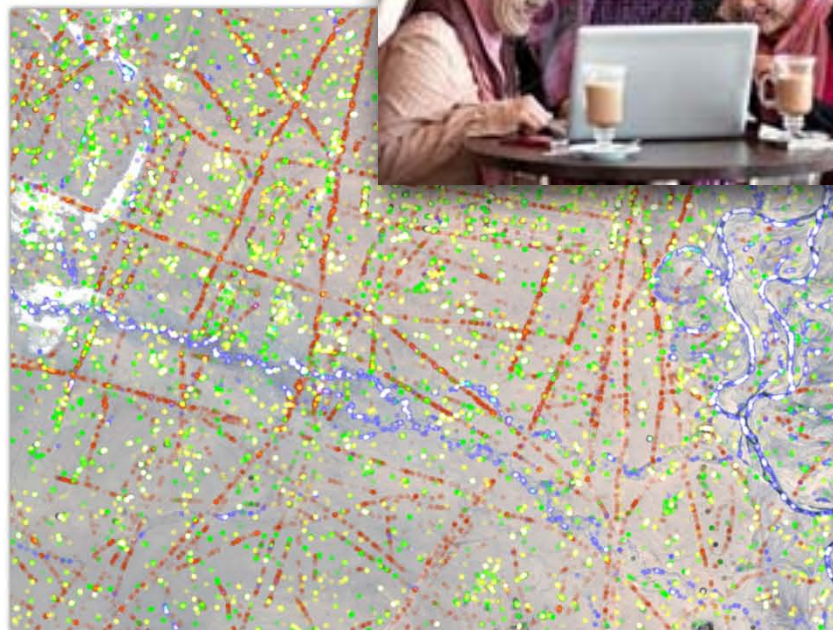


The C4ISR Machine





The State of ISR



\$150M Platform

3 Hactivists and a Laptop





Crowd Sourced Intelligence

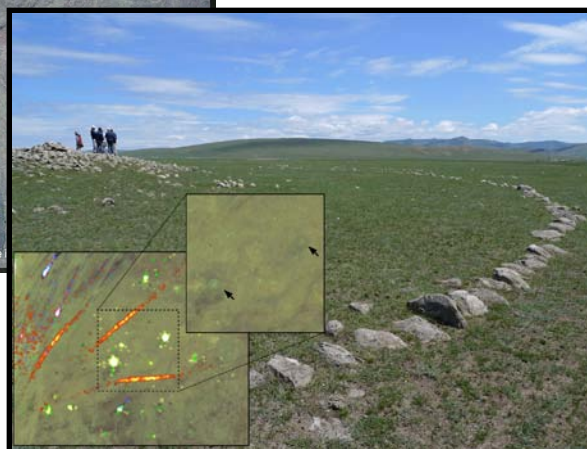
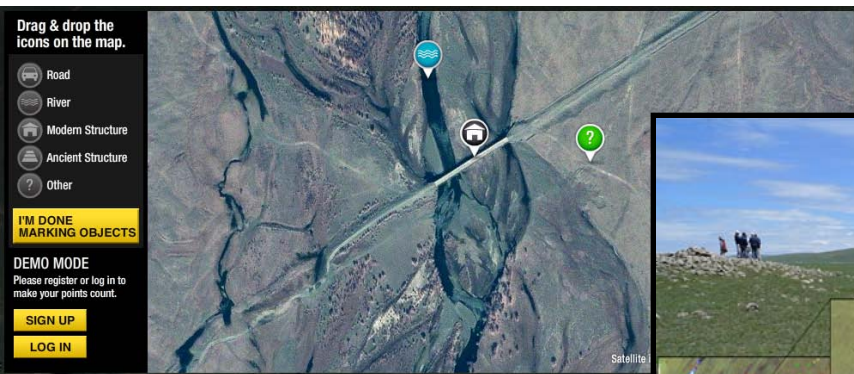
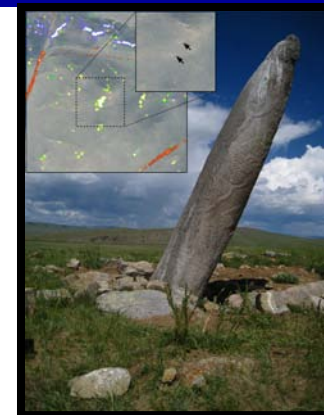


USER ENGAGEMENT

- 7,000 registered users
- Average user >10 mins on site

DATA RESULTS

- 1,500,000 unique tags
- Focused resources on high probability areas
- Discovery of >50 archaeological sites



Using the Crowd to assist in image analysis is estimated to have reduced the search time by more than 75 percent

Sources: <http://exploration.nationalgeographic.com/>





Evolving Direction for C4ISR

A Systems Engineering Based Approach



- **Theater C4ISR is a system of systems challenge**
 - Begin with an understanding of end-users needs (requirements)
 - Avoid proliferation of competing, redundant DoD ISR capabilities
- **Develop/field capabilities that have:**
 - Open, non-proprietary data formats
 - Understood bandwidth requirements
 - Interoperability with common exploitation tools
- **Balance development of novel sensor modalities while providing capabilities that interoperate with a smaller PED* footprint**

* Processing, Exploitation, and Dissemination



Business Model Approach to PCPAD-X



- **App-based system**
 - Industry makes money by innovation, and by making the analysts happy
 - Analysts pick and choose what works for them
 - Configure their own workstation
- **AF S&T Creating Combined Planning Process between Information and Sensors**
 - Joint structure, joint planning process

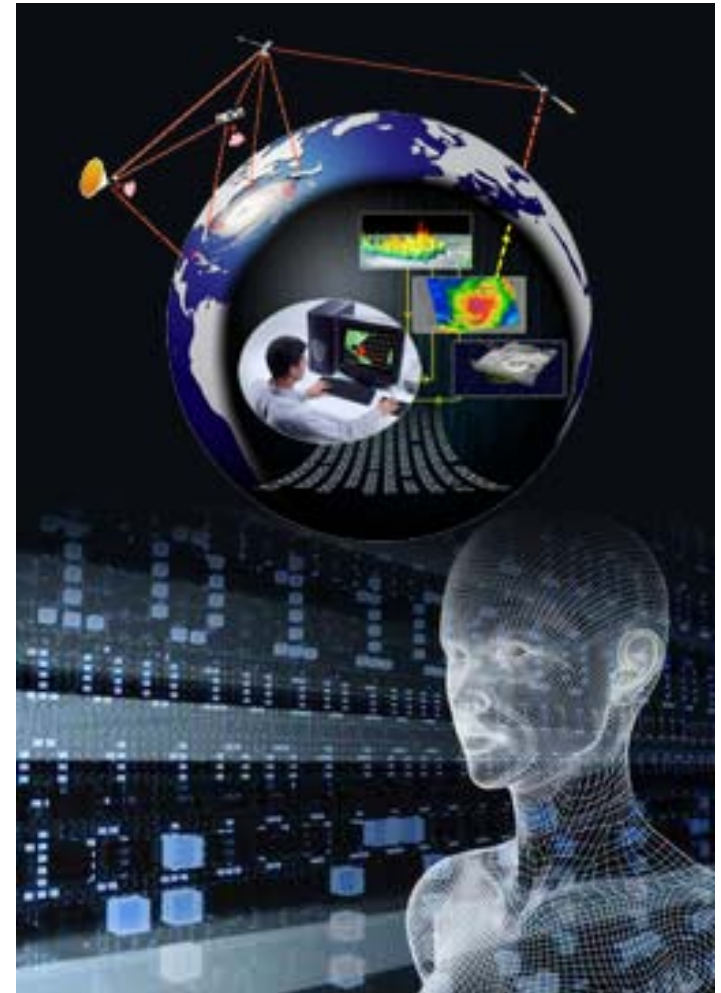




PED Process, Issues



- **Making sense of the information**
- **“Smart” sensing**
- **Need to keep updating**
- **Cost of updates, which move quickly**
- **Issues with the “long tail”**
- **Security, vulnerability, counterfeit**





AFRL Organization





"Layered C4ISR"



Cyber Science & Technology



Autonomy, C2, & Decision Support



Processing & Exploitation



Network-Enabled Spectrum Warfare



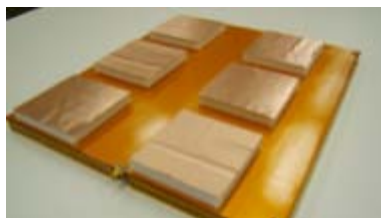
Layered Sensing Exploitation



Radio Frequency Sensing



Connectivity & Dissemination



Devices and Components

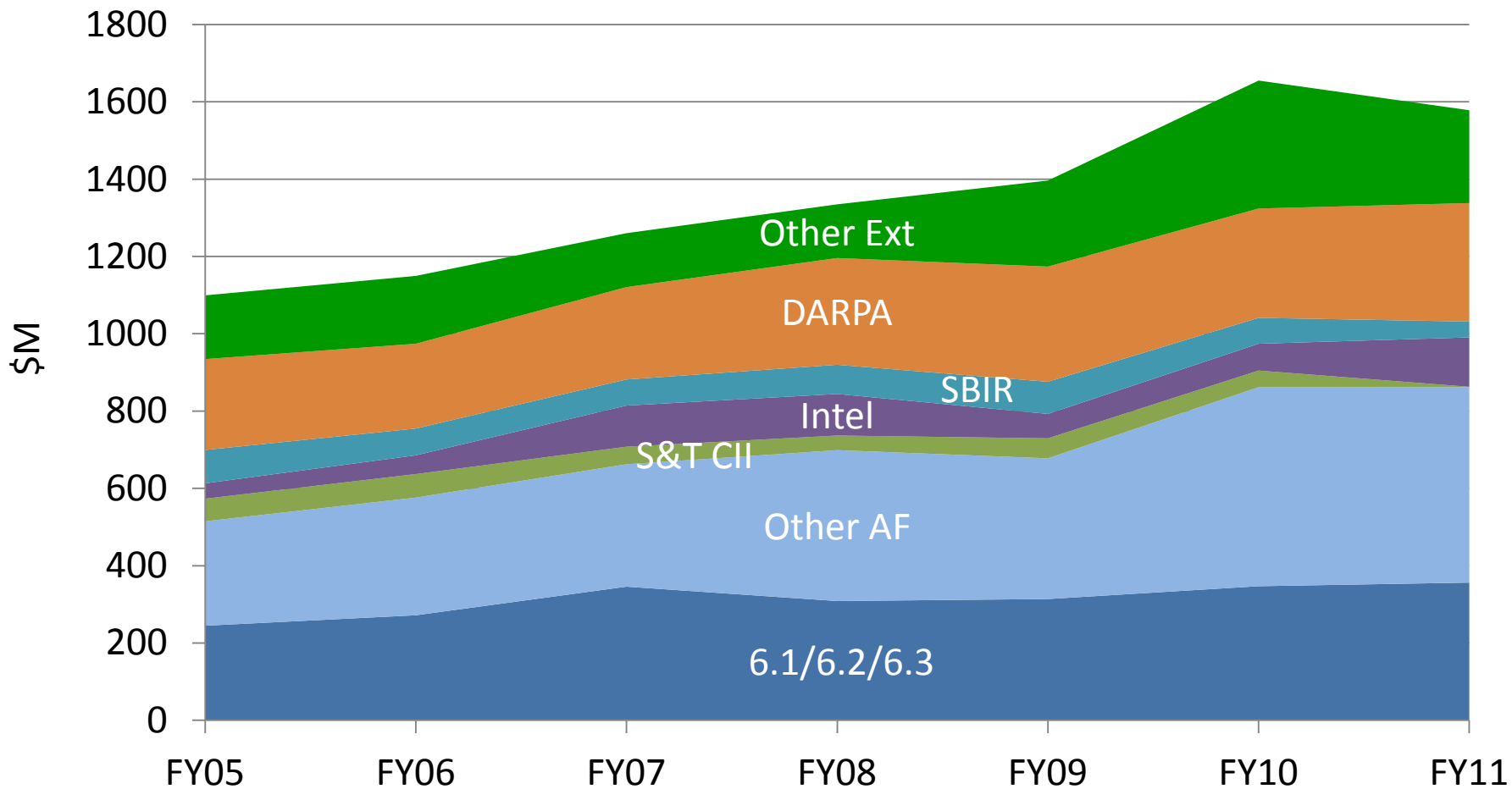


Electro-Optical Sensing





C4ISR S&T Funding Trend (\$M)

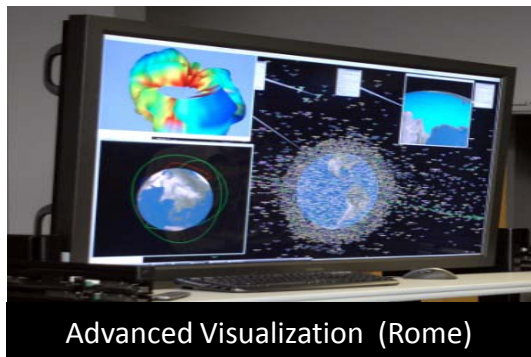


CII – Congressional Interest Item





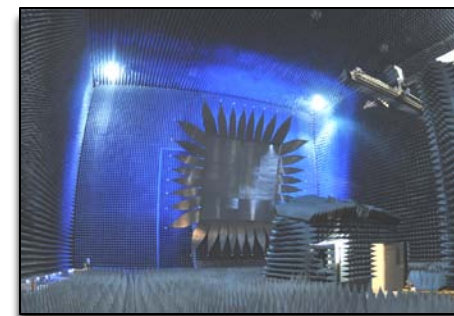
C4ISR Facilities



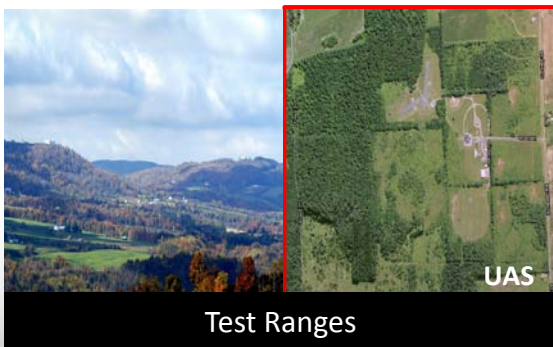
Advanced Visualization (Rome)



Outdoor Sensing Range (WPAFB)



Indoor RF Range (WPAFB)



Test Ranges

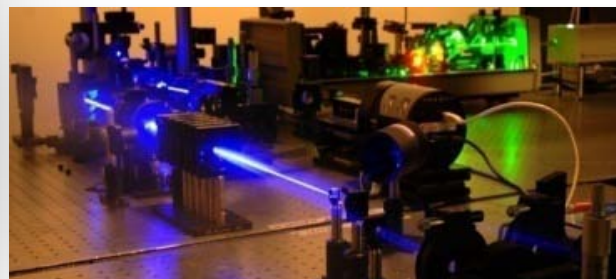
Corporate Facilities
Total Space: 1,576k sq ft



NAVWAR Laboratory (WPAFB)



High Performance Comp (WPAFB)



Quantum Computing Facility (Rome)



LADAR Laboratory (WPAFB)





AFRL Cyber S&T Vision for 2020



Assured, effective mission capabilities...

- Commanders maintain awareness and control while disrupting adversaries
- Elude adversaries by reshaping our network and nodes several times per second
- Missions are difficult to disrupt despite successful attacks on our infrastructure

...built upon trusted, resilient, affordable...

- Hardware and software have architectural provisions to withstand attack
- COTS and GOTS are intelligently mixed for an affordable but trusted enterprise

...cyberspace foundations across the air, space and cyberspace domain...

- Strengthened mathematical foundations provide provable assurance
- Cyber warriors are educated, trained, selected, and enhanced with augmentation



Summary



- **AFRL S&T vision and strategy for C4ISR fully supports Air Force operations in the air, space, and cyberspace**
- **C4ISR S&T is a multi-disciplined approach to solving technology challenges in Cyber, PED, C2, and EW**
- **AFRL is partnering with acquisition and operational communities to speed delivery of capabilities**



Legacy of War-Winning Technology Development



Early Flight

Space Age

Modern Flight

Cyber Domain

Future

