



***Integrating Air & Space,
Command, Control, & Intelligence,
Surveillance & Reconnaissance***

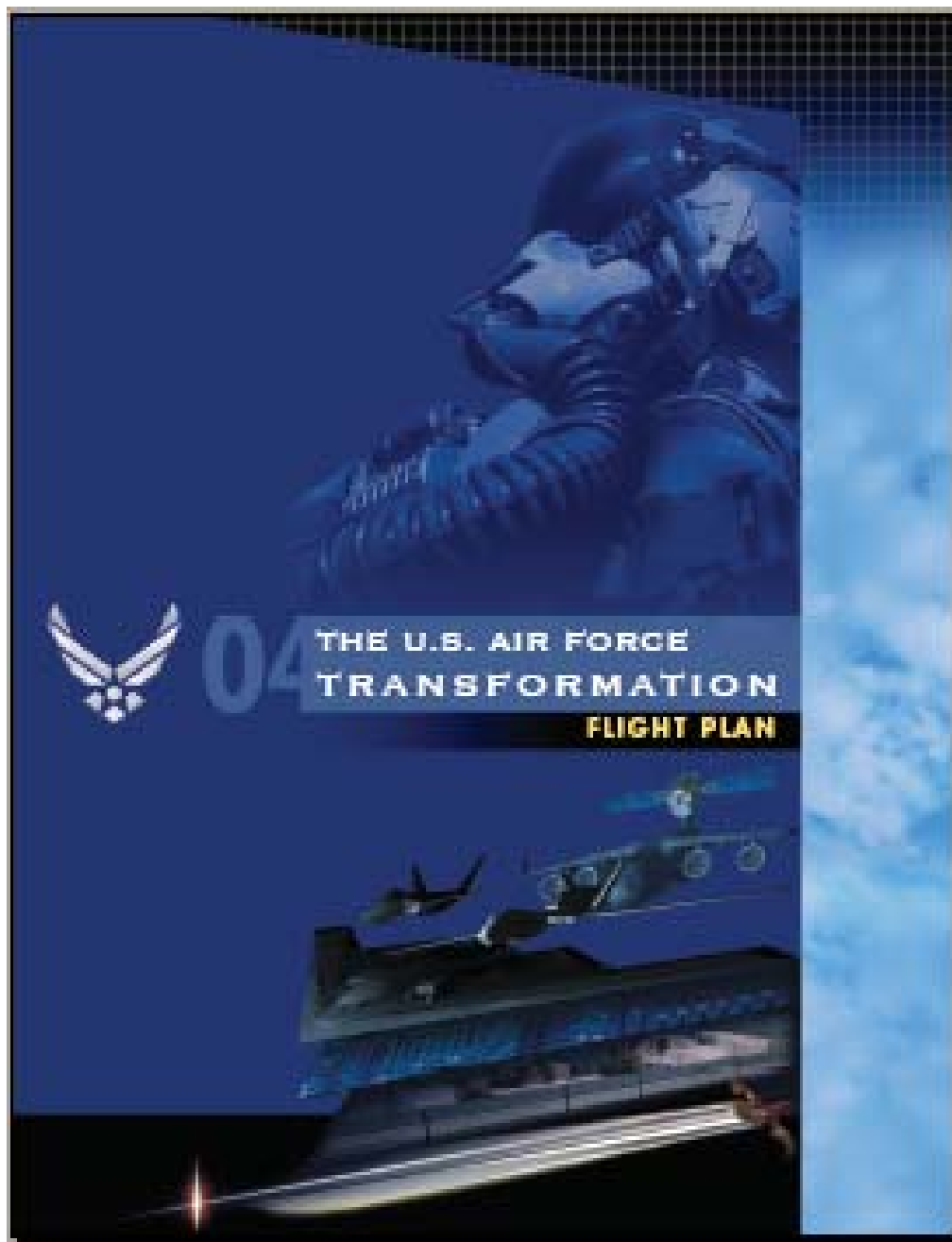
***Brig Gen Gary Connor
Commander, C2/ISR Systems Wing
20 September 2005***

***Ninth Annual High Performance Embedded Computing Workshop
Lincoln Laboratory
Massachusetts Institute of Technology***



Overview

- Vision & Concept of Operations
- USAF Transformation Flight Plan → S&T
- The High Performance Embedded Computing (HPEC) Challenge
- HPEC Initiatives
- Summary





Science & Technology Challenges

- Finding and Tracking
 - Control availability of latent sensory data/integrate with real time detection
 - Net large arrays of individual sensors
- Command and Control
 - Bio, nano, quantum computing
 - Intelligent dynamic software agents
 - High-level fusion tools and algorithms
 - Artificial intelligence, neural networks, fuzzy logic
- Controlled Effects
- Sanctuary
- Rapid Air and Space Responses
- Effective Air and Space Persistence

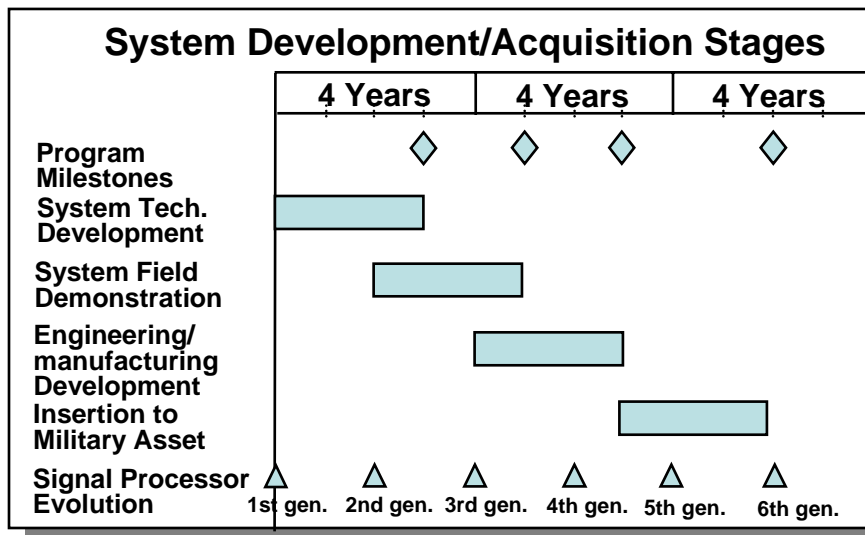


Issues with Current HPEC Development

Inadequacy of Software Practices & Standards



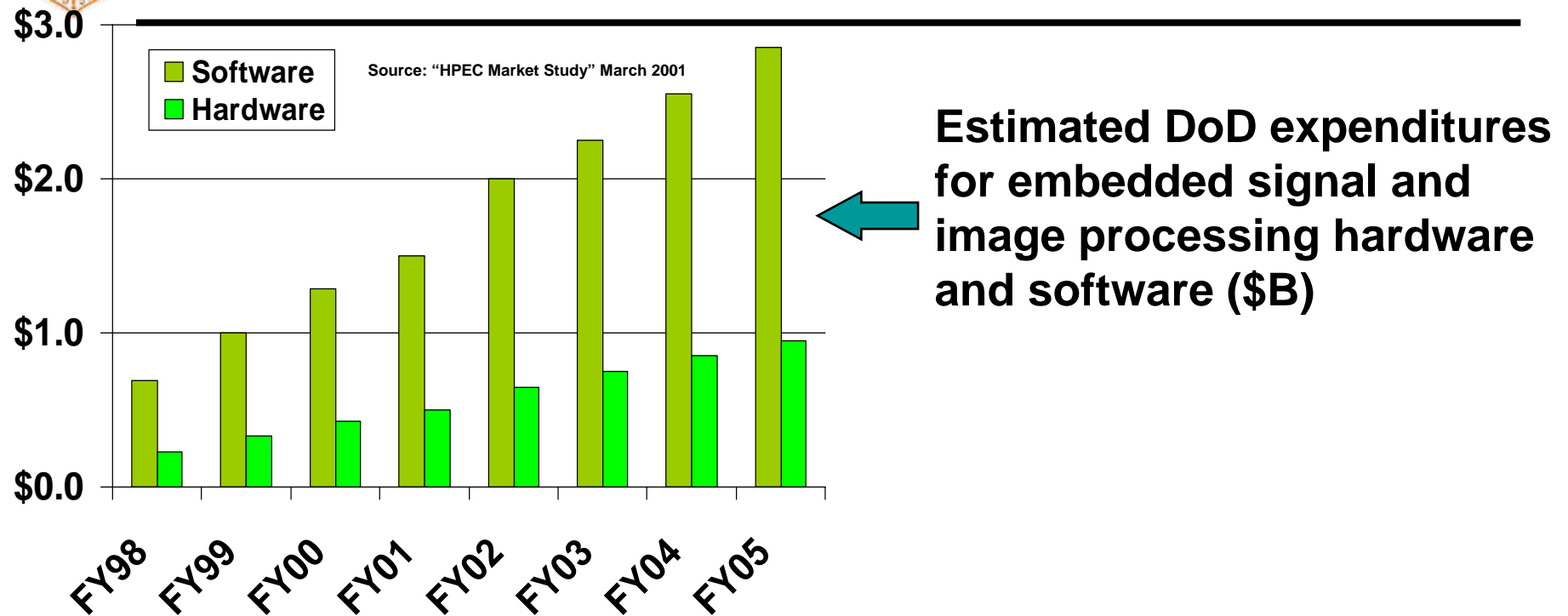
- **High Performance Embedded Computing pervasive through DoD applications**
 - **Airborne Radar Insertion program**
 - 85% software rewrite for each hardware platform
 - **Missile common processor**
 - Processor board costs < \$100k
 - Software development costs > \$100M
 - **Torpedo upgrade**
 - Two software re-writes required after changes in hardware design



- Today – Embedded Software Is:
- Not portable
- Not scalable
- Difficult to develop
- Expensive to maintain



Why Is DoD Concerned with Embedded Software?



- COTS acquisition practices have shifted the burden from “point design” hardware to “point design” software
- Software costs for embedded systems could be reduced by one-third with improved programming models, methodologies, and standards

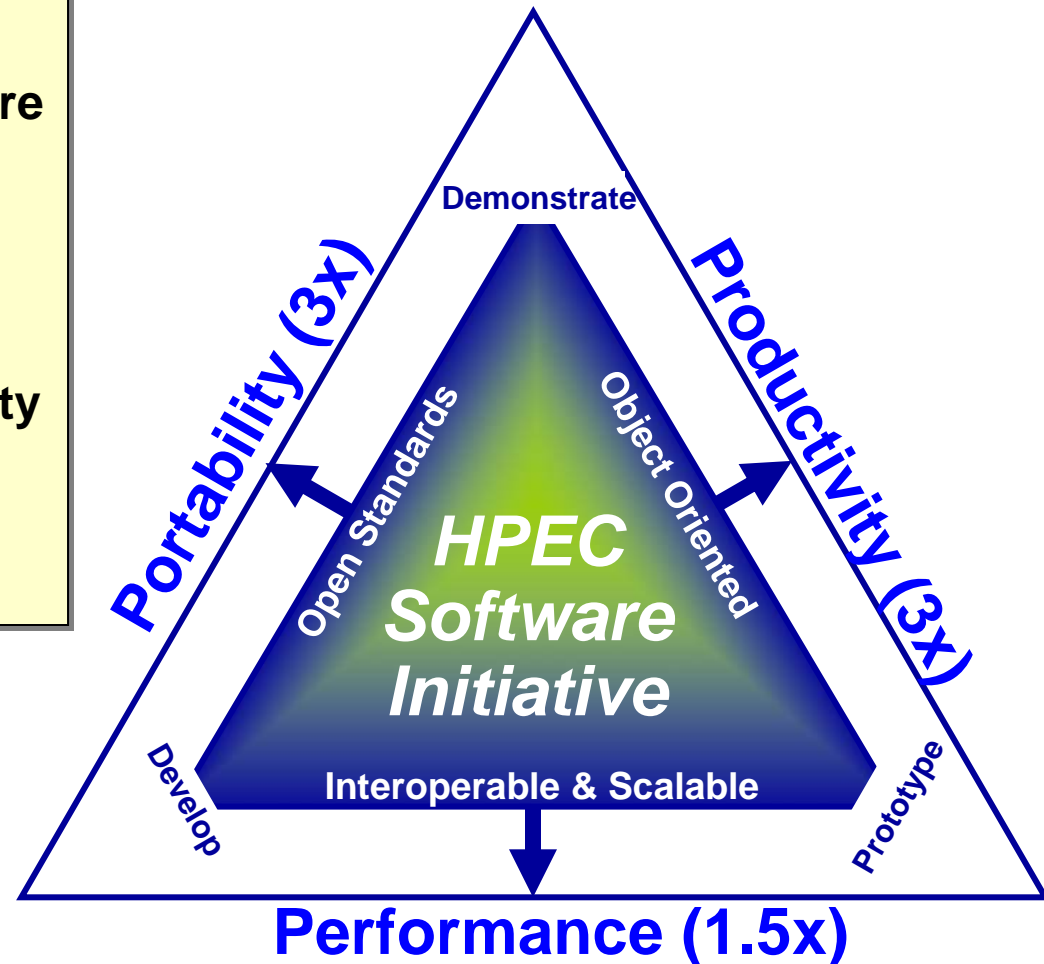


High Performance Embedded Computing - Software Initiative

Program Goals

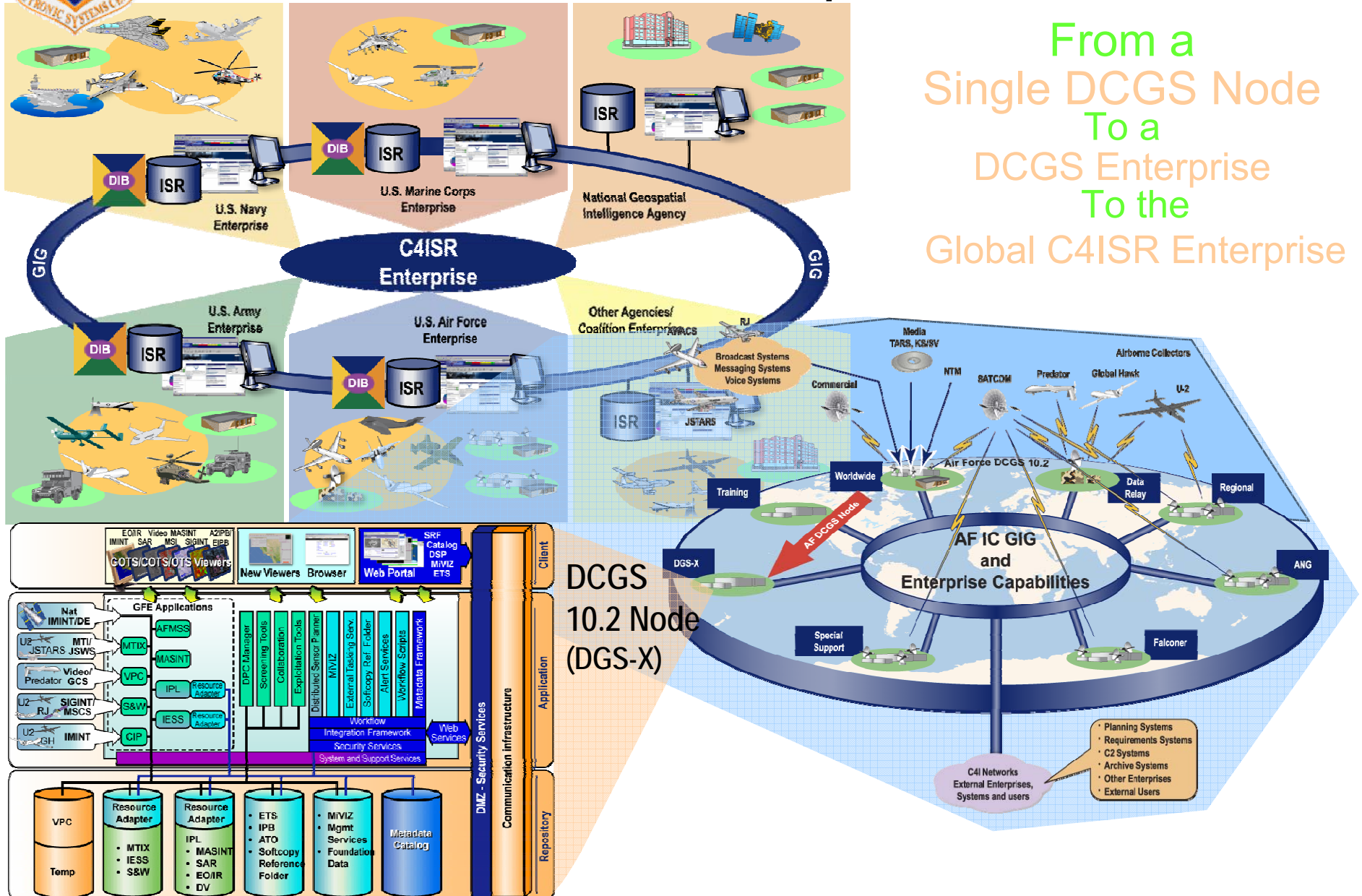
- Develop and integrate software technologies for embedded parallel systems to address portability, productivity, and performance
- Engage acquisition community to promote technology insertion
- **Deliver quantifiable benefits**

- Portability:** reduction in lines-of-code to change port/scale to new system
- Productivity:** reduction in overall lines-of-code
- Performance:** computation and communication benchmarks





AF DCGS Interoperability Supports Global C4ISR Enterprise Vision





Common Imagery Processor - Demonstration Overview -

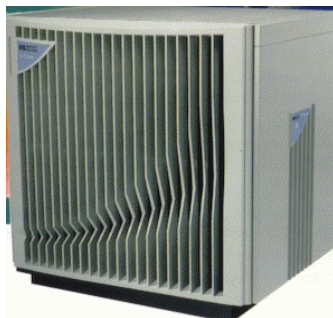


Common Imagery Processor

- Demonstrate standards-based platform-independent CIP processing (ASARS-2)
- Assess performance of current COTS portability standards (MPI, VSIPL)
- Validate SW development productivity of emerging Data Reorganization Interface
- MITRE and Northrop Grumman



Embedded Multicomputers



Shared-Memory Servers

Single code base
optimized for all high performance architectures
provides future *flexibility*



Commodity Clusters
Massively Parallel Processors



Swathbuckler: Wide-Swath High Resolution SAR Image Formation

Goal:

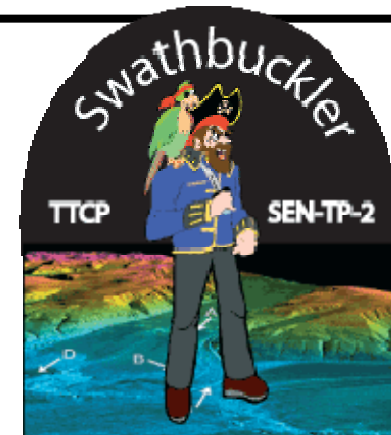
- Demonstrate affordable, continuous (22100 km²/hr) real-time, wide-swath (37 km), high-resolution (15 cm range pixels) SAR image formation, storage, and exploitation.

Approach:

- Canadian test aircraft with SAR radar and algorithms, frontend hardware, test flights
- US (AFRL) **HPC with parallel software, algorithm optimization, information management and dissemination**
- UK FPGA programming
- AUS conops and EO image enhancement

Military Impact:

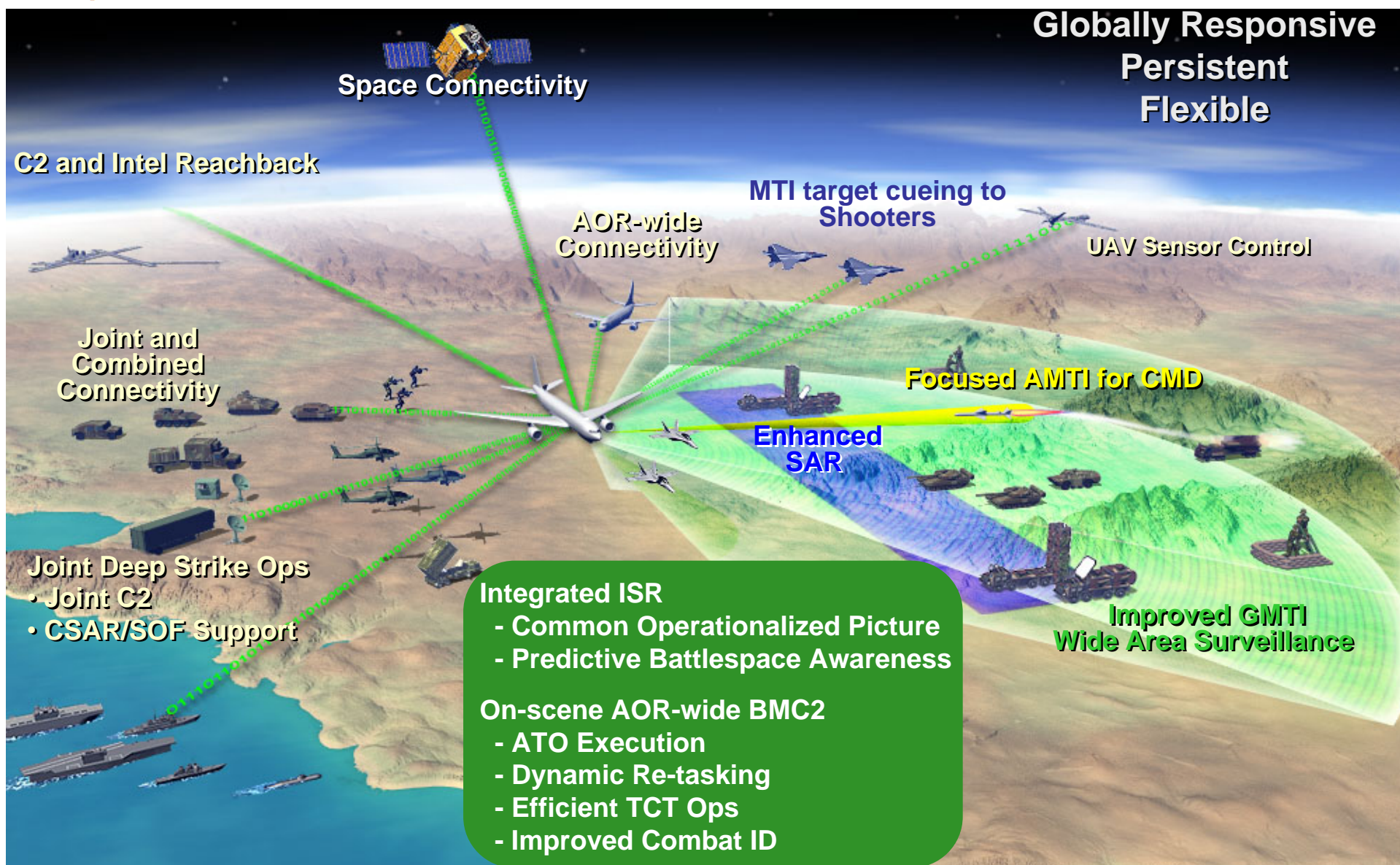
- Affordable, High-resolution SAR area coverage
 - 3.5x Global Hawk coverage: 477K km²/day vs 138K km²/day
 - 18x Global Hawk pixels: 0.37x0.15 m² vs 1m²
- >10 TB data collected for ATR algorithm development



Embedded HPC
Challenge Problem
exceeding 200
GFLOPS



E-10A Key Capabilities





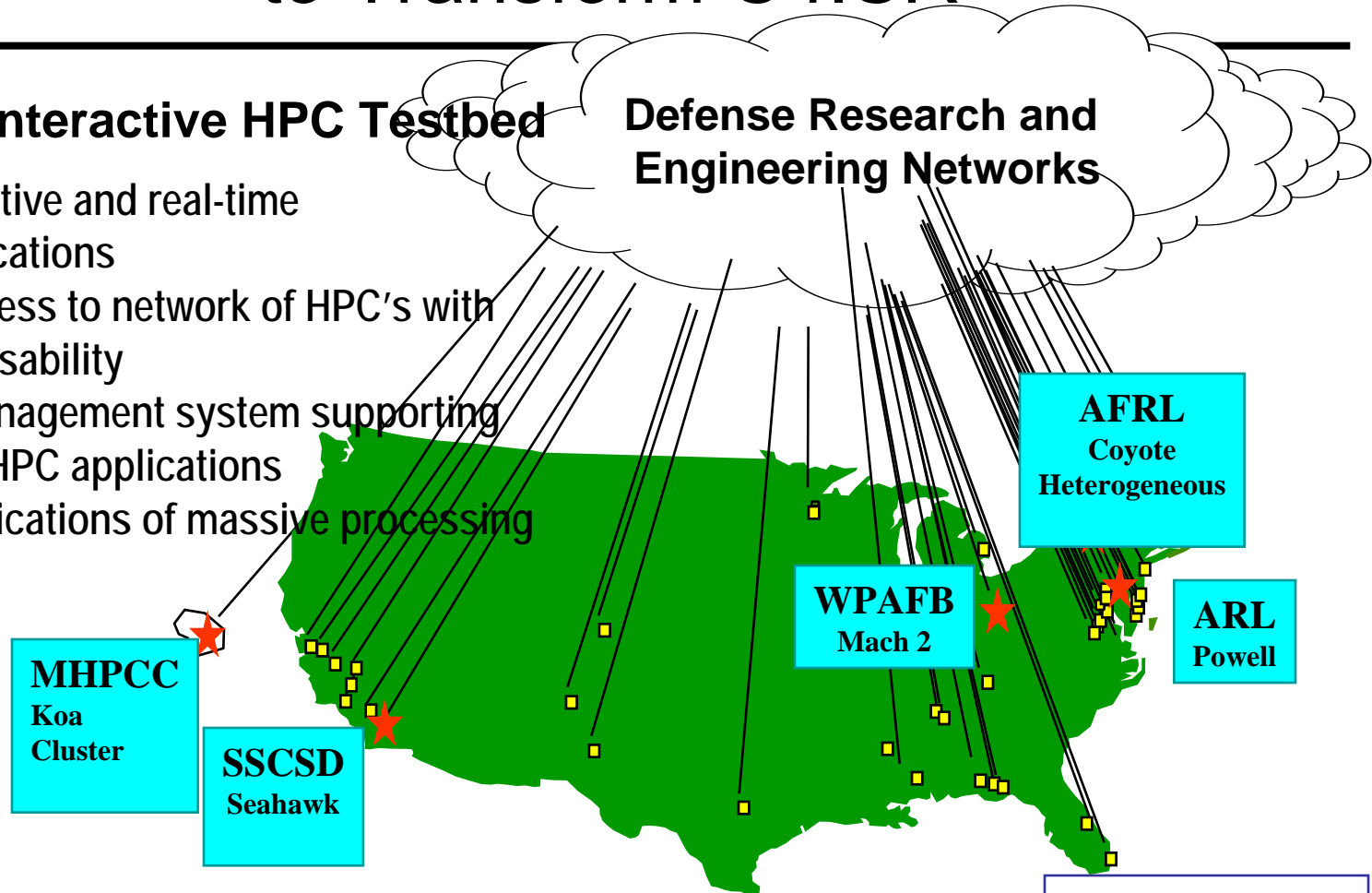
High Performance Computing to Transform C4ISR



Distributed Interactive HPC Testbed

- Support interactive and real-time C4ISR applications
- Web-based access to network of HPC's with enhanced usability
- Information management system supporting distributed HPC applications
- Horizontal applications of massive processing power

Defense Research and Engineering Networks



- ✓ Distributed HPC's
- ✓ Accessed by authorized users anywhere on the DREN and Internet
- ✓ Interactive and time critical problems

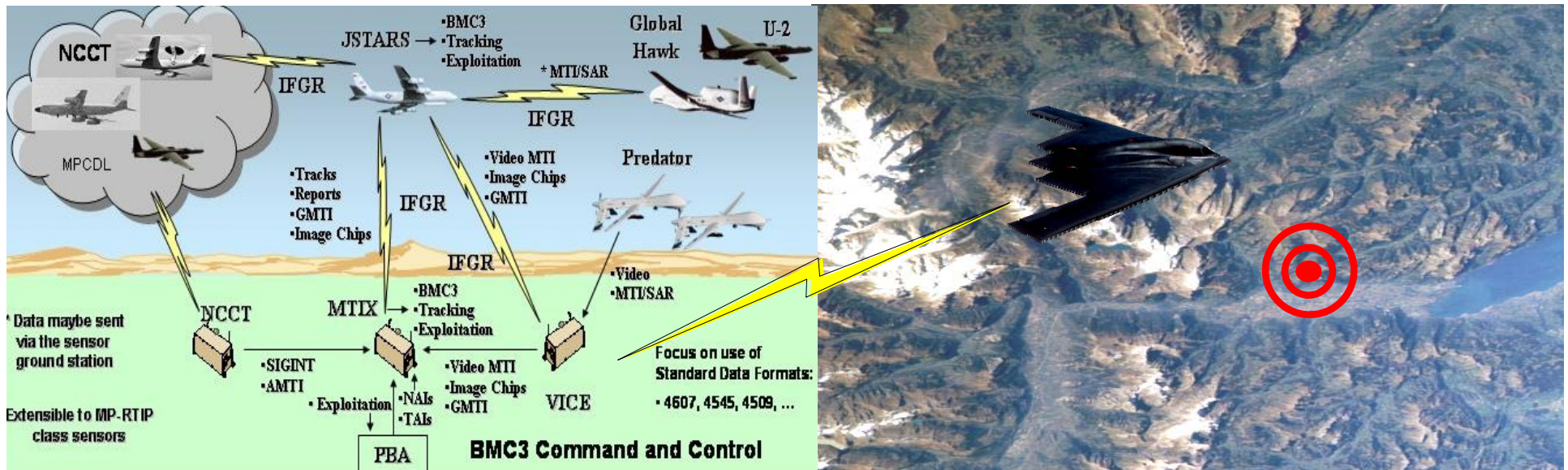
Legend

- Remote Users
- ★ Networked HPC's



Network Centric Connectivity

- Machine to Machine
- Machine to Decision Makers
- Decision Makers to Weapon Systems
 - Provide flexible, rapidly configurable systems and operations
 - Create capability on demand
 - Facilitate distributed operations
 - Provide customized applications allowing for dynamic flexibility



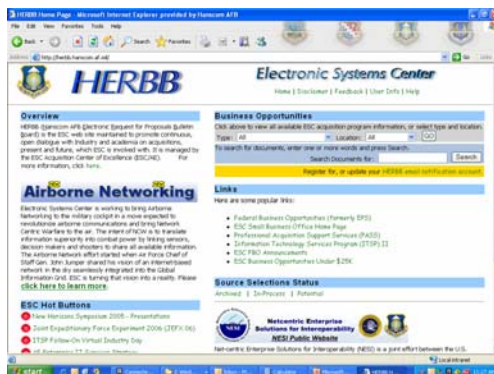


C2ISR and CS Capability Integration Points of Contact

- Capabilities Integration Directors
 - C2/ISR Systems – Ray Modeen, 781-266-9627
 - Battle Management – Marie Francesca, 781-377-9007
 - Network Centric – Col David Madden, 781-377-2389
 - Ops Support – E. Steve Wright, 334-416-5860

- HERB Site Address →

<http://herbb.hanscom.af.mil/>





HERBB Website

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Overview

HERBB (Hanscom AFB Electronic Request for Proposals Bulletin Board) is the ESC web site maintained to promote continuous, open dialogue with Industry and academia on acquisitions, present and future, which ESC is involved with. It is managed by the ESC Acquisition Center of Excellence (ESC/AE). For more information, click [here](#).

Airborne Networking

Electronic Systems Center is working to bring Airborne Networking to the military cockpit in a move expected to revolutionize airborne communications and bring Network Centric Warfare to the air. The intent of NCW is to translate information superiority into combat power by linking sensors, decision makers and shooters to share all available information. The Airborne Network effort started when Air Force Chief of Staff Gen. John Jumper shared his vision of an internet-based network in the sky seamlessly integrated into the Global Information Grid. ESC is turning that vision into a reality. Please [click here to learn more](#).

ESC Hot Buttons

- New Horizons Symposium 2005 - Presentations
- Joint Expeditionary Force Experiment 2006 (JEFX 06)
- ITSP Follow-On Virtual Industry Day
- AF Enterprise IT Services Strategy

Business Opportunities

Click above to view all available ESC acquisition program information, or select type and location.

Type: All Location: All GO

To search for documents, enter one or more words and press Search.

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Links

Here are some popular links:

- Federal Business Opportunities (formerly EPS)
- ESC Small Business Office Home Page
- Professional Acquisition Support Services (PASS)
- Information Technology Services Program (ITSP) II
- ESC FBO Announcements
- ESC Business Opportunities Under \$25K

Source Selections Status

Archived | In-Process | Potential

Netcentric Enterprise Solutions for Interoperability (NESI) Public Website

Net-centric Enterprise Solutions for Interoperability (NESI) is a joint effort between the U.S.

HERBB Web Address – <http://herbb.hanscom.af.mil/>



Where You Can Help

- Capabilities – Focused Tech Investment
- Openness → Technologies & Business Strategies
- Tech Transition to the Field...