Headquarters U.S. Air Force

Integrity - Service - Excellence

Air Force Science & Technology

Dr. Steven H. Walker
Deputy Assistant Secretary
Science, Technology, and Engineering

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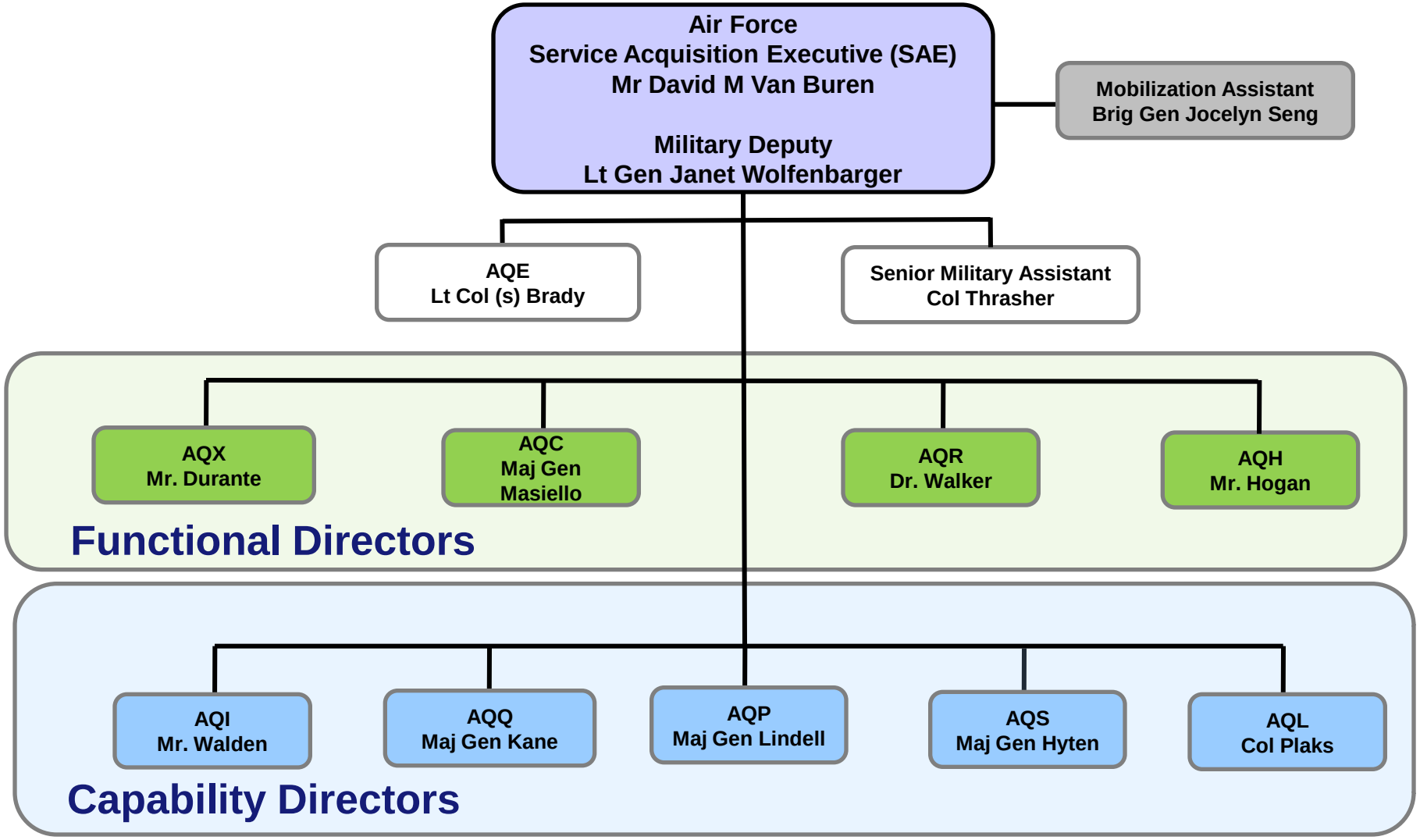
U.S. AIR FORCE

Outline

- AQ Organization
- AF S&T Vision
- AF S&T Strategy and Plan
- AF S&T Program Priorities
- Summary
- Contact Information

Assistant Secretary of the Air Force
SAF/AQ Directorate Structure



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AF S&T Vision

Create compelling air, space, and cyber capabilities for precise and reliable Global Vigilance, Reach and Power for our Nation

AF S&T Strategy to Task

Air Force Science & Technology Strategy

2010

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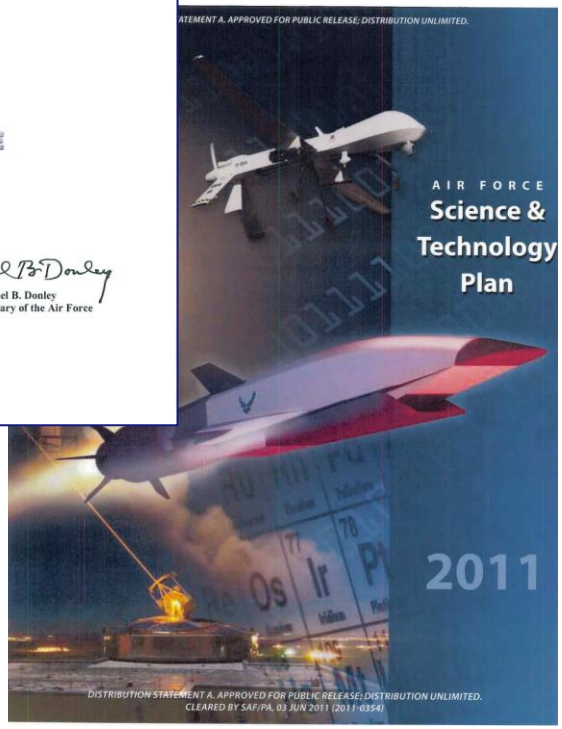
Norton A. Schwartz
General, USAF
Chief of Staff

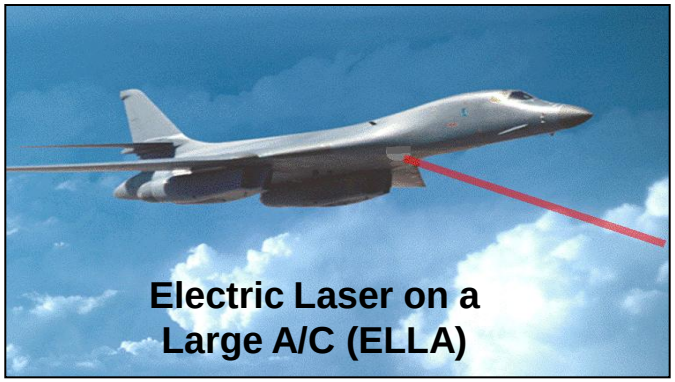
Michael B. Donley
Secretary of the Air Force



- **AF S&T Strategy**
  - **SECAF & CSAF Guidance**
  - **December 2010**
- **AF S&T Plan**
  - **Implementation of S&T Strategy**
  - **June 2011**

S&T Program Priorities

- <u>Priority 1</u>: Support current fight while advancing breakthrough S&T
  - Enable AF to operate effectively and achieve desired effects
  - Improve agility, mobility, affordability and survivability of AF assets



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S&T Program Priorities

- **<u>Priority 2</u>: Execute balanced, integrated S&T Program responsive to AF Service Core Functions**
  - **Improve sustainment, affordability & availability of legacy weapon systems**
  - **Reduce cyber vulnerabilities while emphasizing mission assurance**
  - **Support nuclear enterprise**
  - **Deliver autonomous systems & human performance augmentation technologies envisioned in *Technology Horizons***
  - **Provide robust situation awareness by improving ISR capabilities & data processing, exploitation and dissemination (PED)**
  - **Enable long-range precision strike**
  - **Reduce energy dependency**

Improve Sustainment of Legacy Systems
The Graying USAF Fleet

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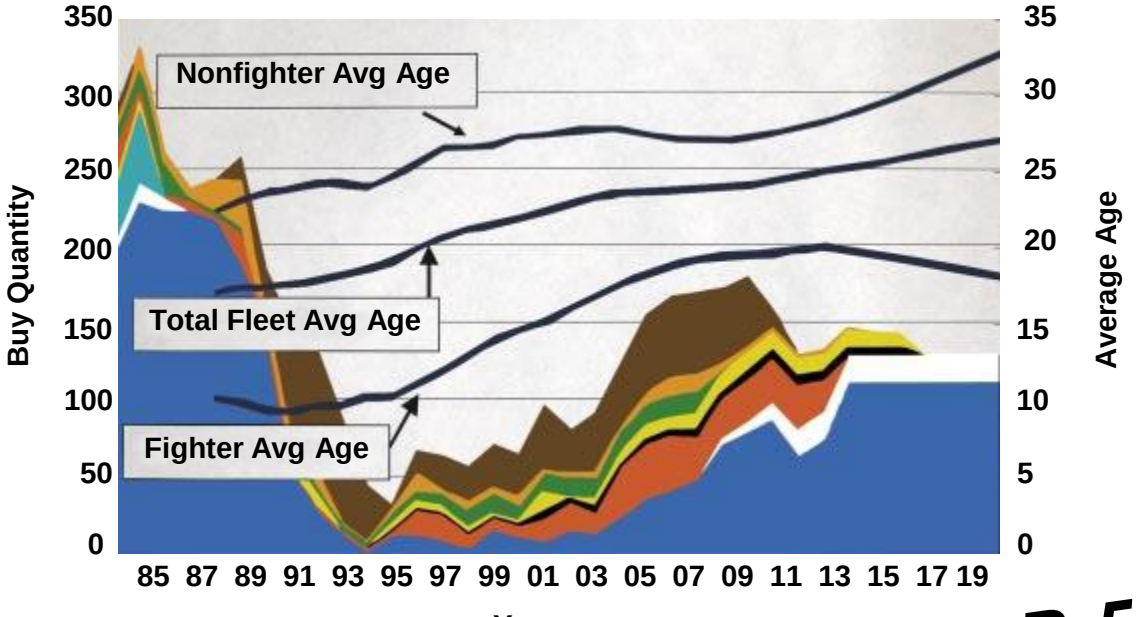

Average A/C Age: ~23 years

AIR FORCE Magazine / 2011 USAF Almanac

Aircraft

- Fighter/Attack
- C2ISR
- Intertheater
- Tanker
- Airlift-Special
- Other
- Bomber
- Intratheater
- Trainer

KC-135 & B-52:

Projected to be in operational use for 80+ years!

Must Maintain Viability of Legacy Aircraft Fleets

Improve Sustainment of Legacy Systems Condition-based Maintenance plus Structural Integrity (CBM+SI) Initiative

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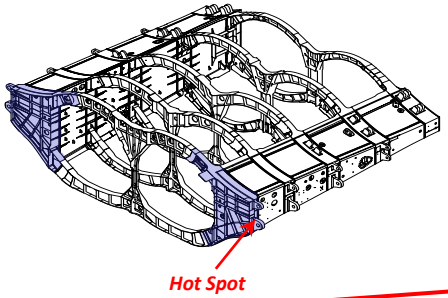
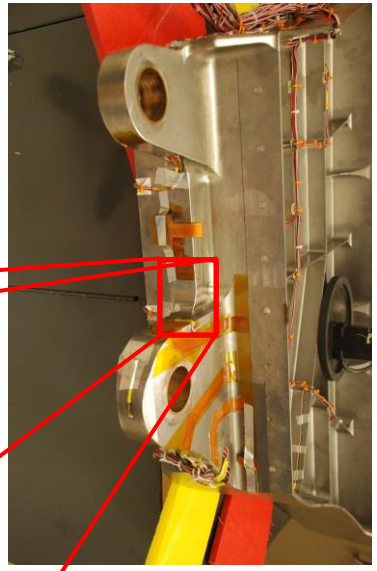
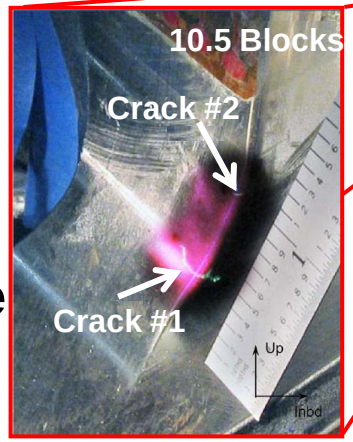
- **Cross-functional S&T Initiative targeting Airframe Sustainment – primary driver of depot maintenance man-hours**







Hot Spot Health Monitoring:

- **Damage detection algorithm developed**
- **Successful completion of F-22 full scale specimen tests**

Improve Sustainment of Legacy Systems Propulsion Safety and Affordable Readiness (P-SAR) Initiative

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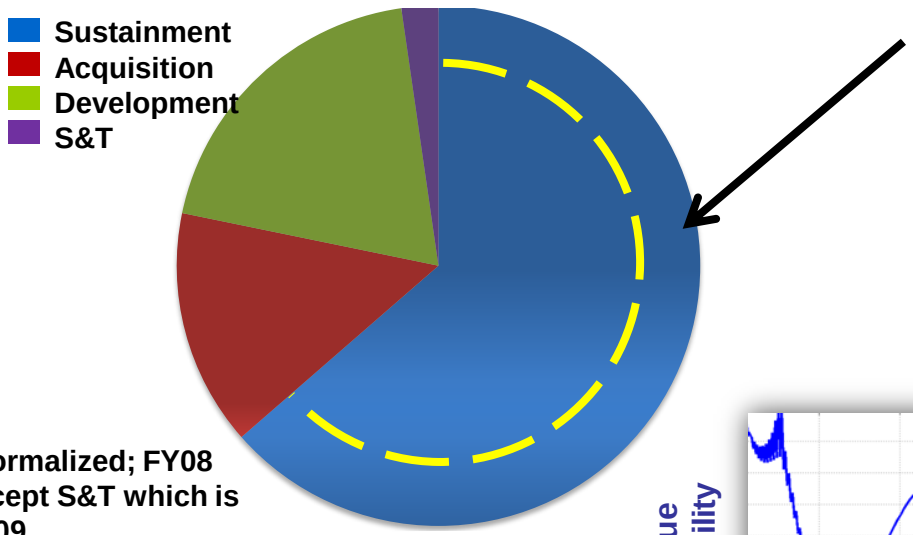
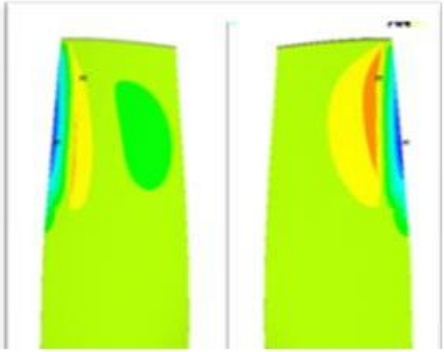
DoD's "Turbine Engine" Investments*

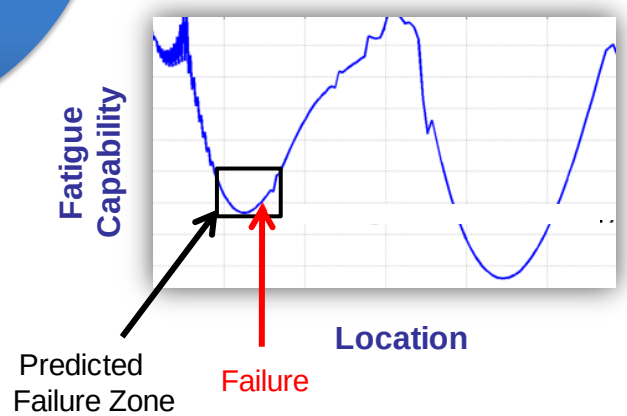


*Normalized; FY08 except S&T which is FY09

- **Tri-Service S&T initiative targeting Engine Sustainment**

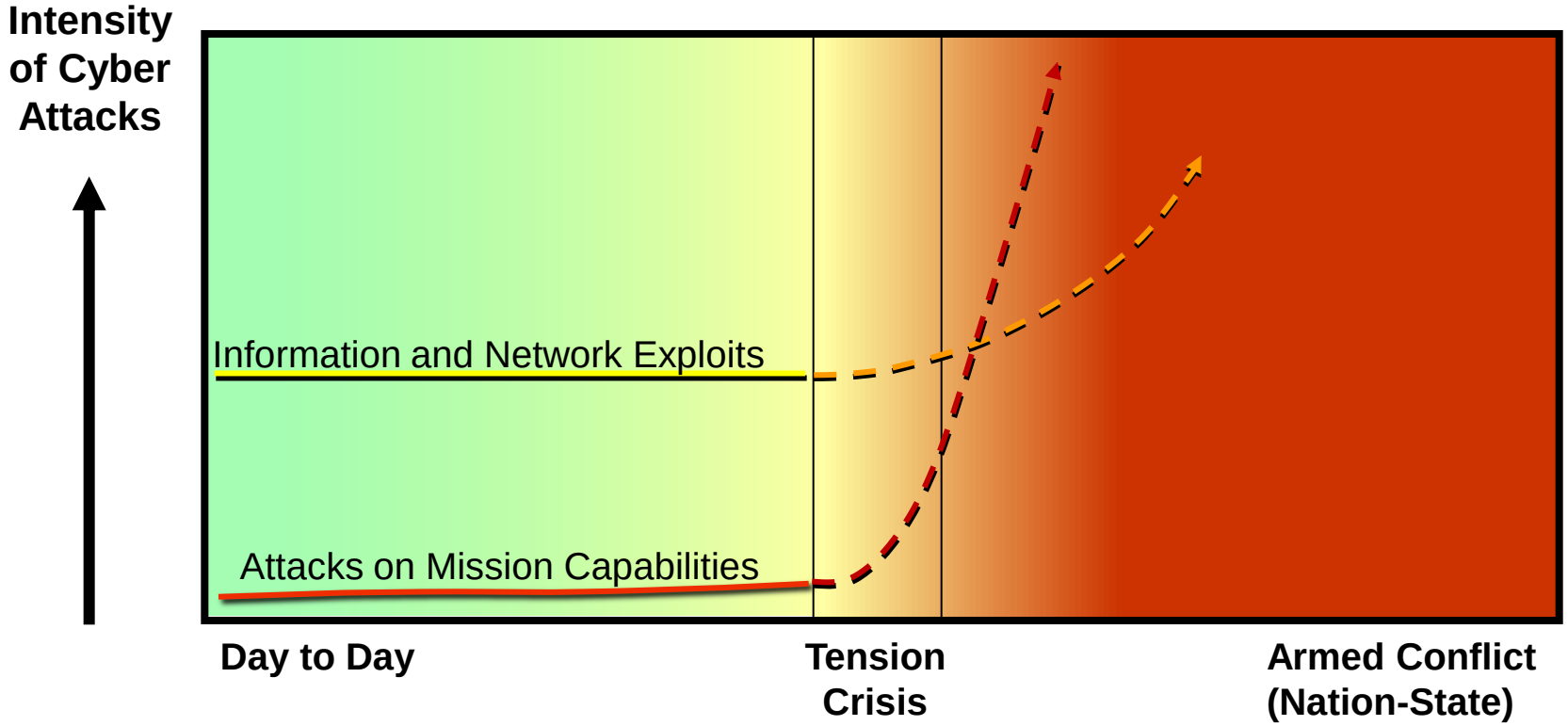


Predicted Residual Stress Distribution



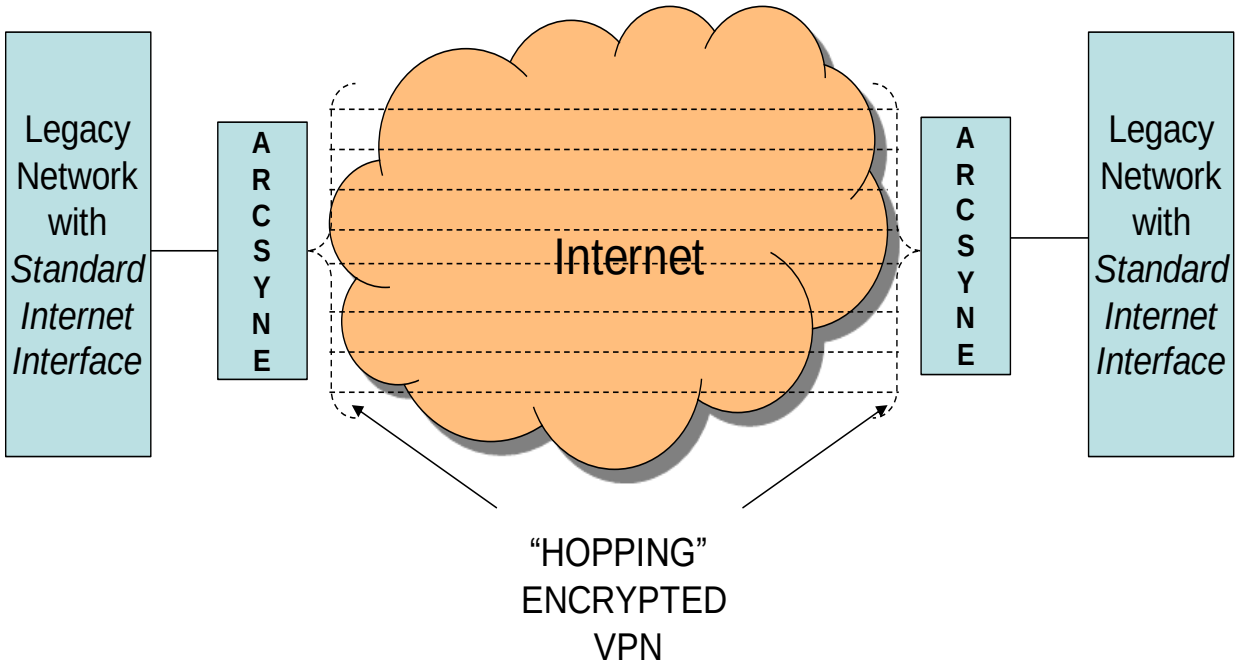
F100-PW-220 Airfoil Damage Tolerance Enhancement

Reduce Cyber Vulnerabilities
Contested Cyber Domain



- **Information system attacks will target Mission Capabilities**
  - **Simple, low-cost attacks result in tremendous costs to defender**
  - **Patch mentality & associated "patch lag" keeps defenders always at risk**

Reduce Cyber Vulnerabilities While Emphasizing Mission Assurance

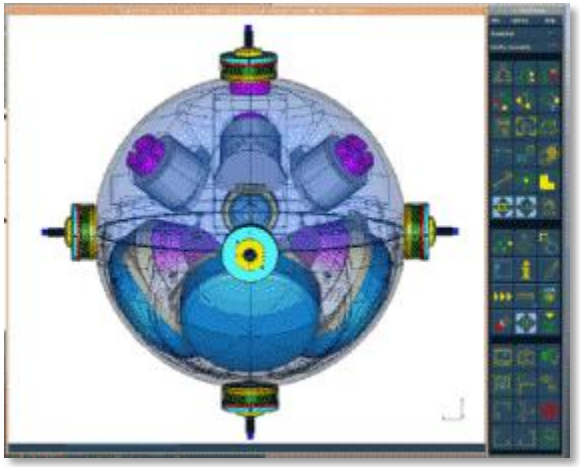


<u>Future Warfighting Capability</u>

Maintaining mission effectiveness in the presence of cyber threats, using technologies such as IP hopping, network polymorphism, massive virtualization and rapid network recomposition

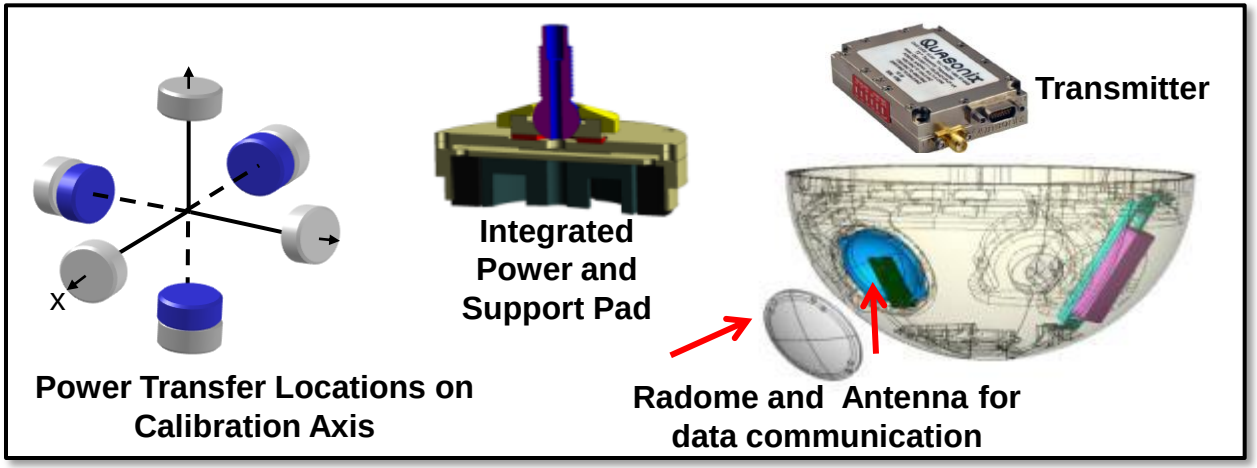
Support Nuclear Enterprise
#1 Air Force Priority

Support Nuclear Enterprise Strategic Grade Guidance



AIMU air-floated inertial reference sphere

Wireless Power Transfer & Data Communication



Combat Air Patrol Requirements: Five 24/7/365 MQ-1/9

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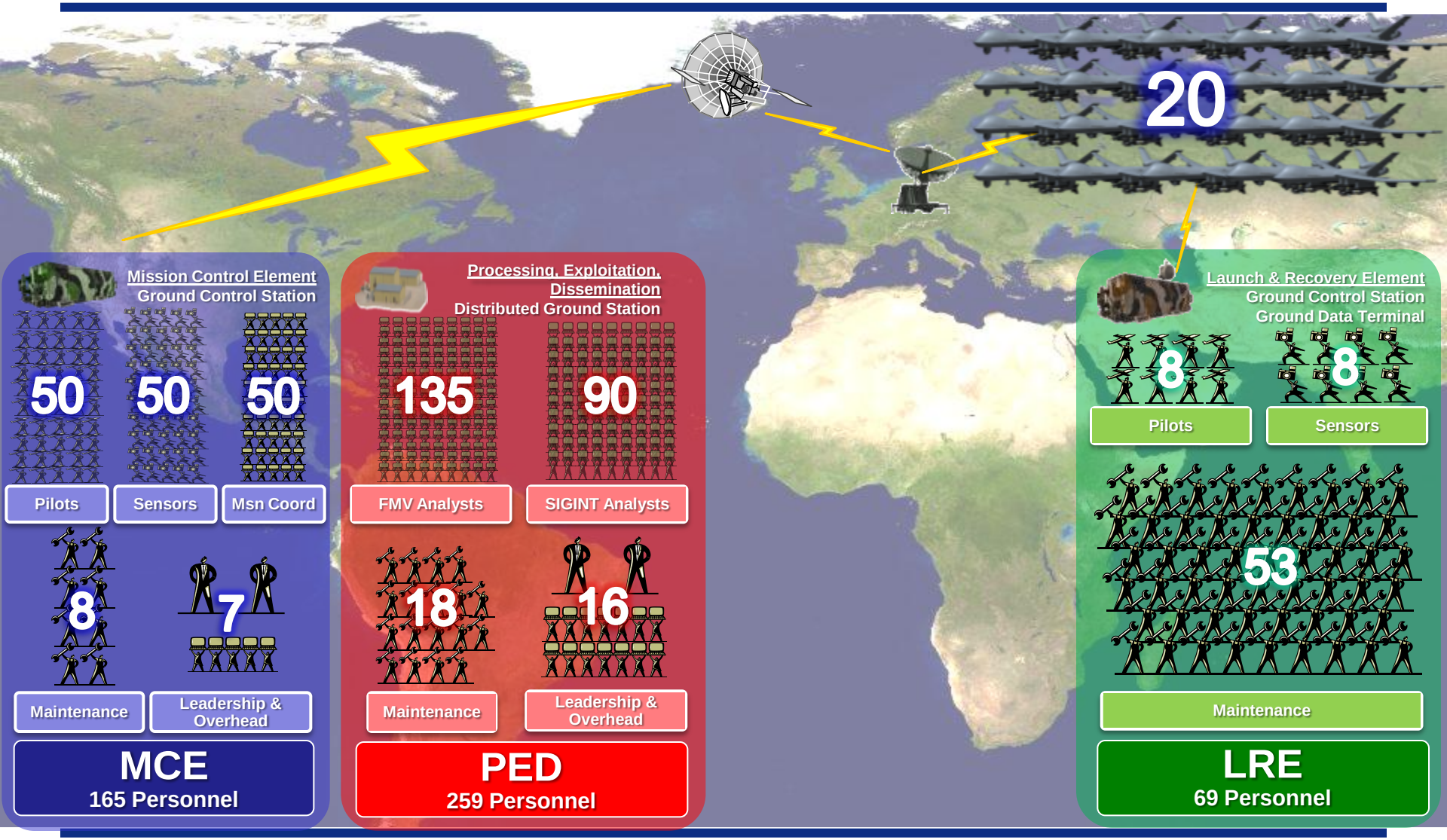

Deliver Autonomous Systems & Human Performance Augmentation Technologies

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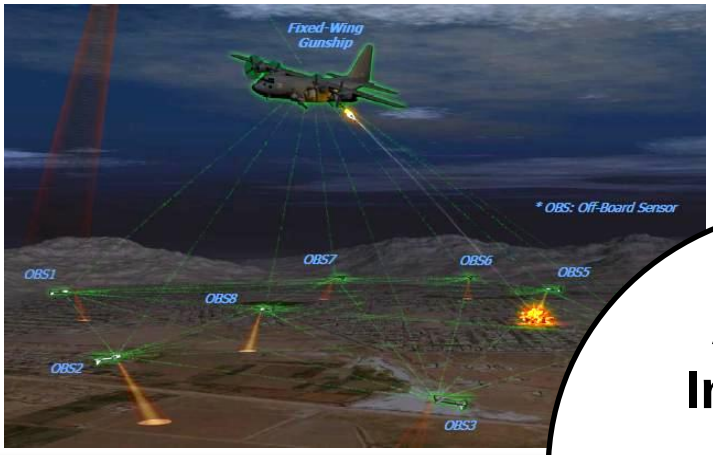
Enable Manned/Unmanned Teaming

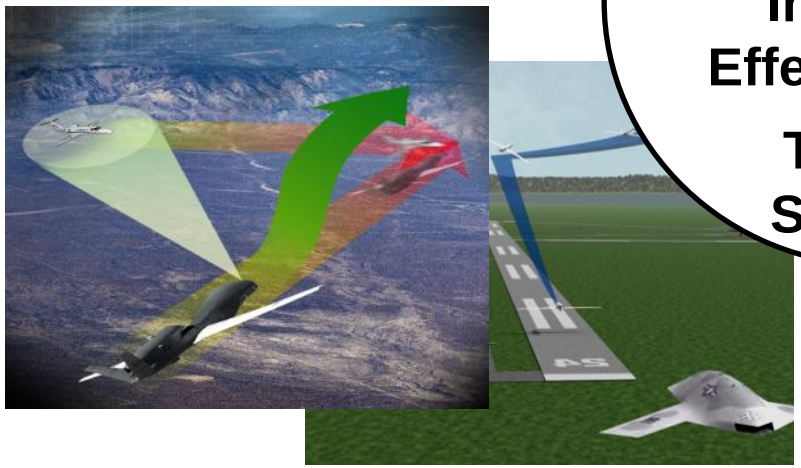


Enhanced UAS Effectiveness

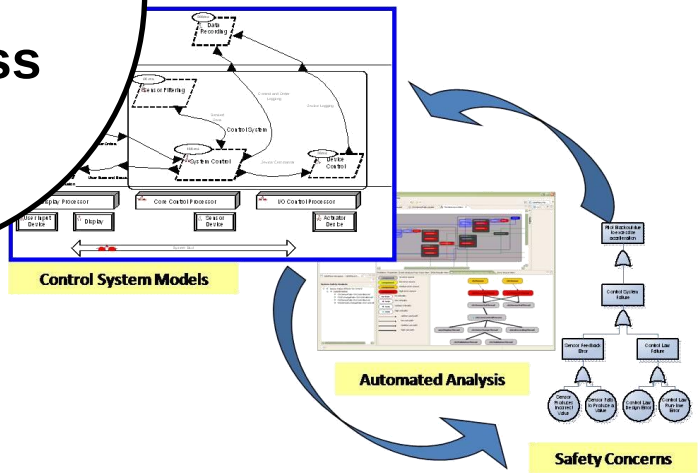
National Airspace Integration

Improved Effectiveness

Trusted Systems

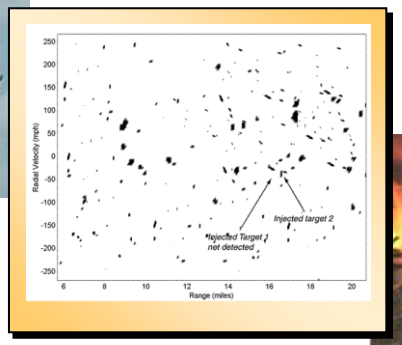


Sense and Avoid and Ground Operations



Gaining User Trust

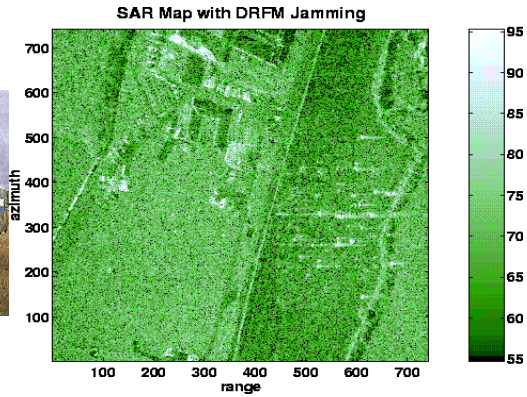
Provide Robust Situation Awareness Sensing Challenges



Small targets, Tracking, Dismounts

Electronic/Cyber Threats to Sensing

- **Contested Airspace**
- **Denied Spectrum**



Difficult Environments, All-Weather, Time-Sensitive

Provide Robust Situation Awareness
Blue Devil - View in the Ops Center

Annotation and layer tools

HD EO and IR Imagery in pop-up window (or on separate monitor)

Wide area EO/IR imagery

Other sensor tip-offs

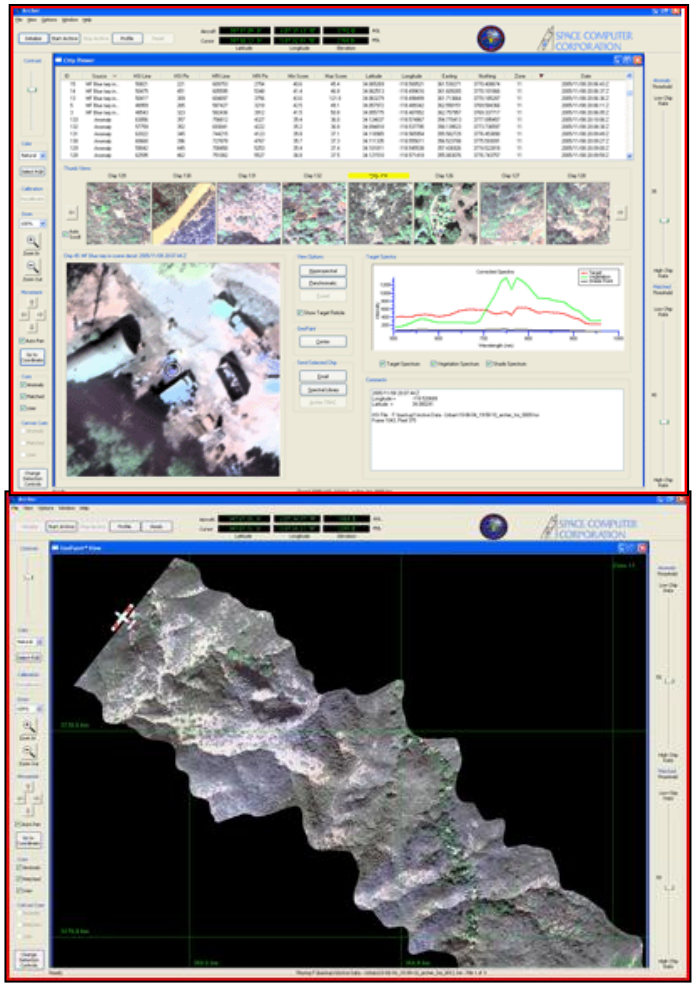
"3-D" controls

"TIVO-like" controls

Ellipse identifies location of HD EO and IR spot beam

Provide Robust Situation Awareness
Real-time HSI Sensor Processing

- **Real-time processing system for hyperspectral imaging (HSI) systems**
  - **Developed for Civil Air Patrol**
  - **Automated, on-board material detection and geo-location**
  - **Spinoffs transitioned to**
    - **Spectral Infrared Remote Transition Testbed (SPIRITT)**
    - **Advanced Responsive Tactically Effective Military Imaging Spectrometer (ARTEMIS)**
    - **Airborne Cueing and Exploitation System Hyperspectral (ACES HY)**
    - **Hyperspectral Collection and Analysis System (HyCAS)**
- **All current HSI systems use these algorithms**



Enable Long-Range Precision Strike

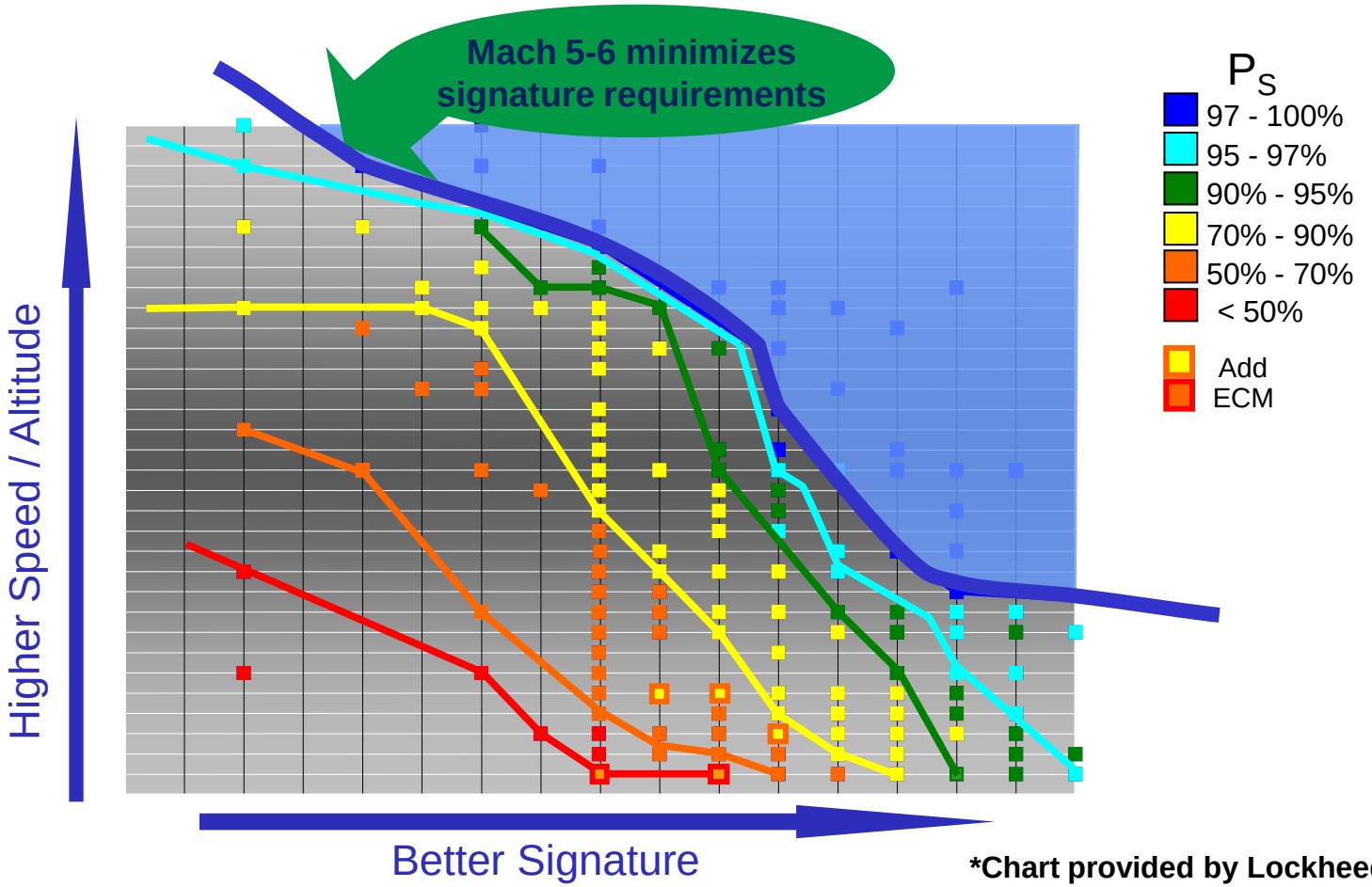


*Chart provided by Lockheed Martin

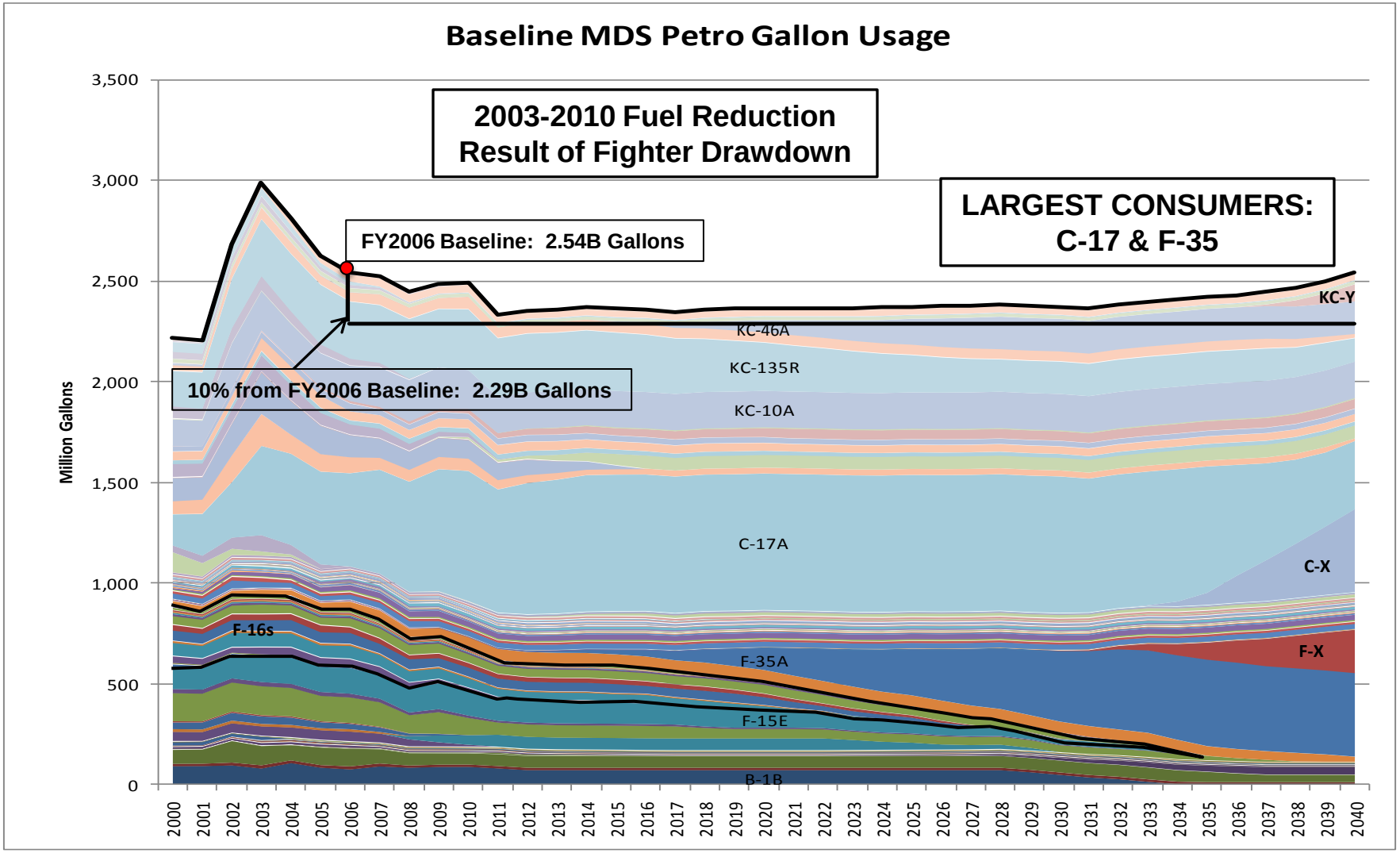
Survivability can be achieved with higher speed or better signature

Enable Long-Range Precision Strike

5th Gen Weapons for 5th Gen Platforms

Engage high-value, time-critical targets in anti-access/area-denial environments

Reduce Energy Dependency
AF Fuel Consumption Projection



Reduce Energy Dependency

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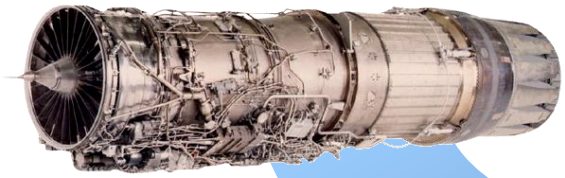
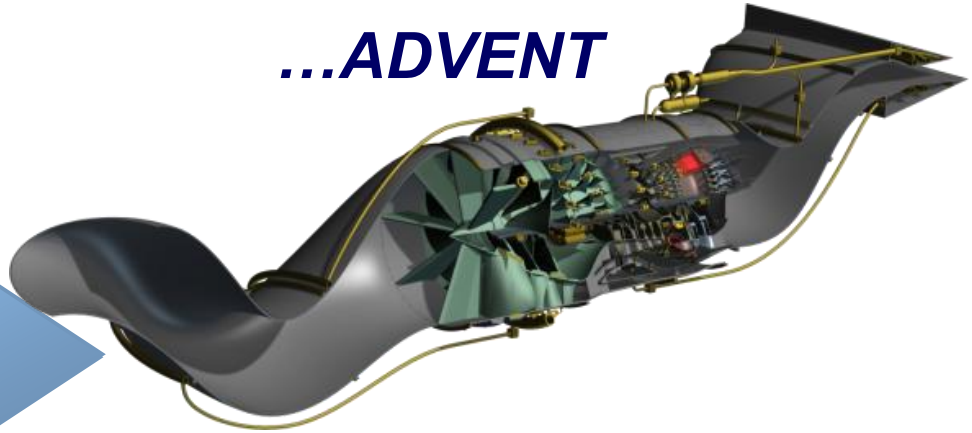
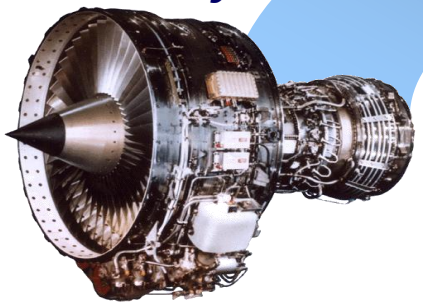
High Performance...

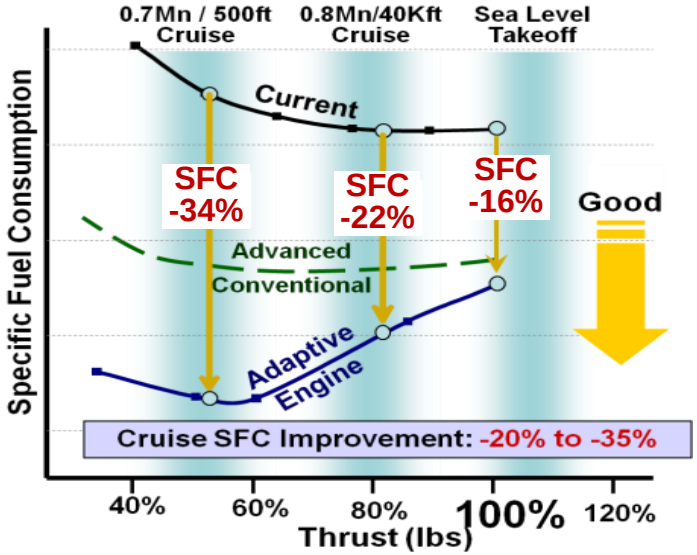


...ADVENT



Fuel Efficiency...





<u>Future Warfighting Capability</u>

Reduced fuel costs and increased range and endurance and providing both propulsive and electrical power and thermal management for advanced air platforms

S&T Program Priorities

- **<u>Priority 3</u>: Retain & shape critical competencies to address full range of S&T capabilities**
  - **Increase in-house basic research**
  - **Enhance critical competencies of organic cyber workforce**
  - **Support AF Science, Technology, Engineering, and Mathematics (STEM) initiatives**

The Global STEM Challenge

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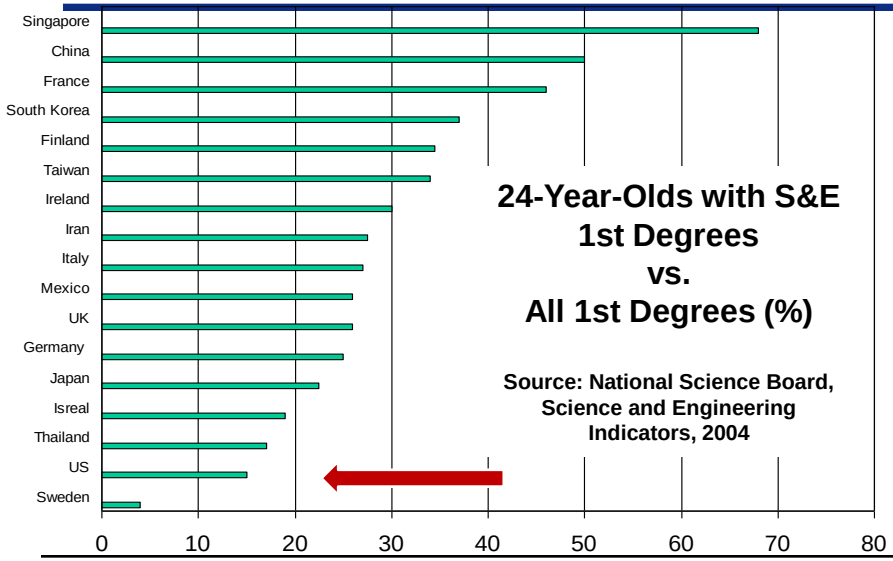
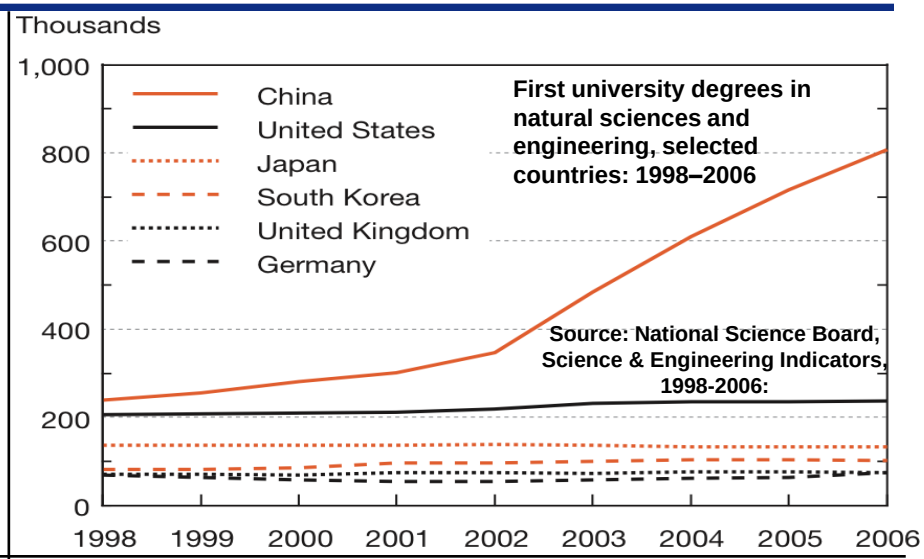
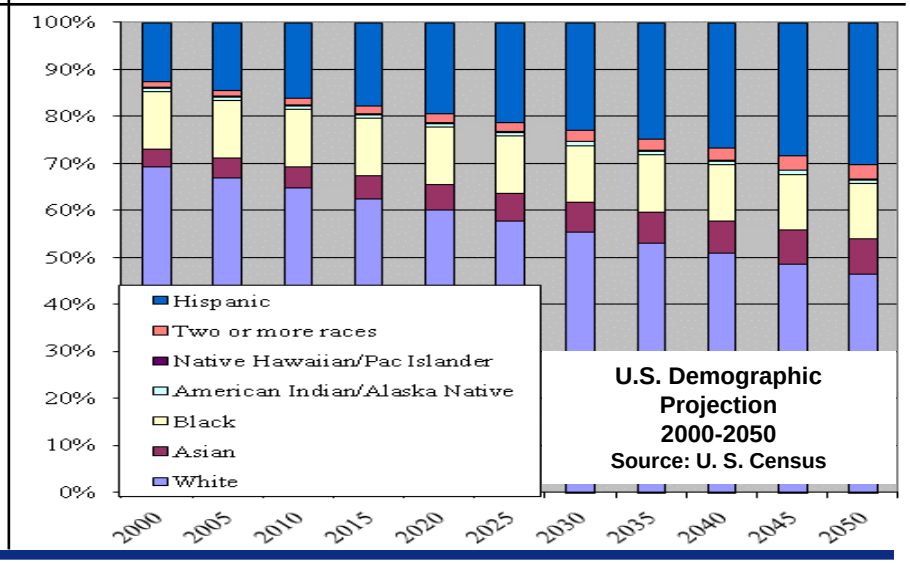




PISA	Reading	Math	Science
Avg.	493	496	501
High	549	600	575
US	500	487	502
US Rank	15th (t)	30th (t)	23rd

- 65 countries scored
- Shanghai – China highest score in each category
- Source: PISA 2009 Results



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Bright Horizons

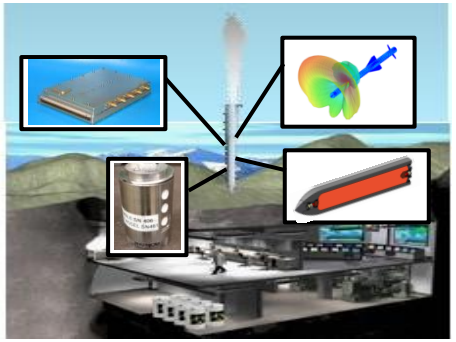
- **Air Force STEM Workforce Strategic Plan**
- **STEM Advisory Council – quarterly, expanding membership**
- **Six Goal Areas – 31 initiatives, covers military & civilians**
- **Linked to AF Strategic Plan, S&T Strategy, & *Technology Horizons***
- **Signed by SecAF and CSAF**
- **Established AF STEM Outreach Office**

S&T Program Priorities

- **<u>Priority 4</u>: Ensure AF S&T program addresses highest priority AF capability needs**
  - **Be a trusted partner of the acquisition/sustainment community**
  - **Leverage research & development efforts within industry**
  - **Develop & demonstrate technology solutions that decrease manufacturing risks**

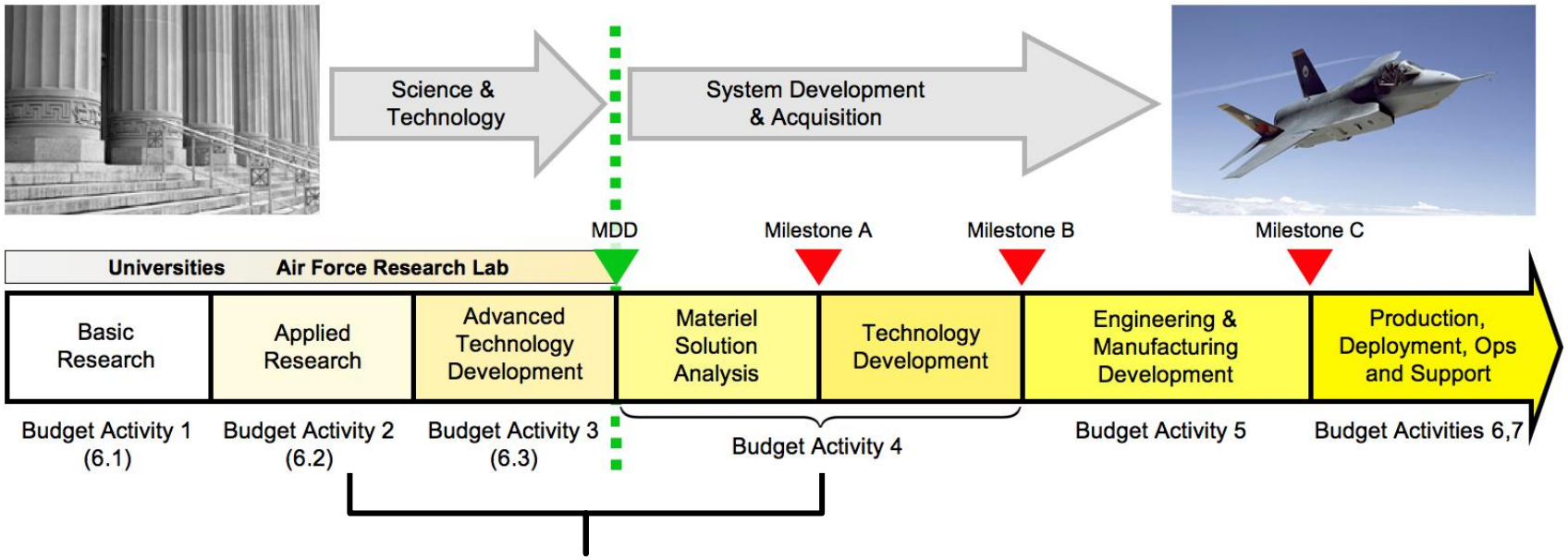
Flagship Capability Concepts

- AF-level S&T Programs addressing high priority warfighter needs with a focus on transitioning capabilities
  - High Velocity Penetrating Weapon (HVPW)
  - Responsive Reusable Booster for Space Access (RBS)
  - Selective Cyber Operations Tech Integration (SCOTI)



VCSAF approved Nov 2010

Development Planning
Transitioning Technology to Capability



Development Planning

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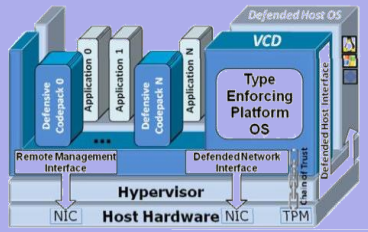
Addressing AF Needs

Nuclear Deterrence Operations

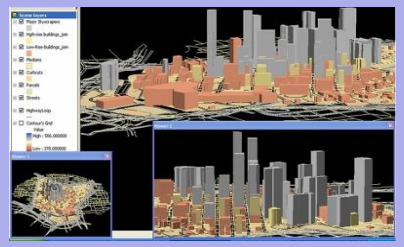
Air Superiority

Space Superiority

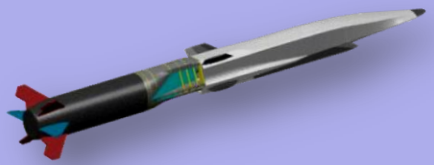


Cyberspace Superiority

Command and Control



Global Integrated ISR



Global Precision Attack

Special Operations

Rapid Global Mobility

Personnel Recovery

Agile Combat Support

Building Partnerships

S&T Delivering Future Capabilities for Each Service Core Function

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Contact Information

For additional information, please contact:

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