Headquarters U.S. Air Force

Integrity - Service - Excellence

Air Force FY15 S&T Program

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Military Deputy,
Deputy Assistant Secretary
Science, Technology and Engineering
12 Mar 2014

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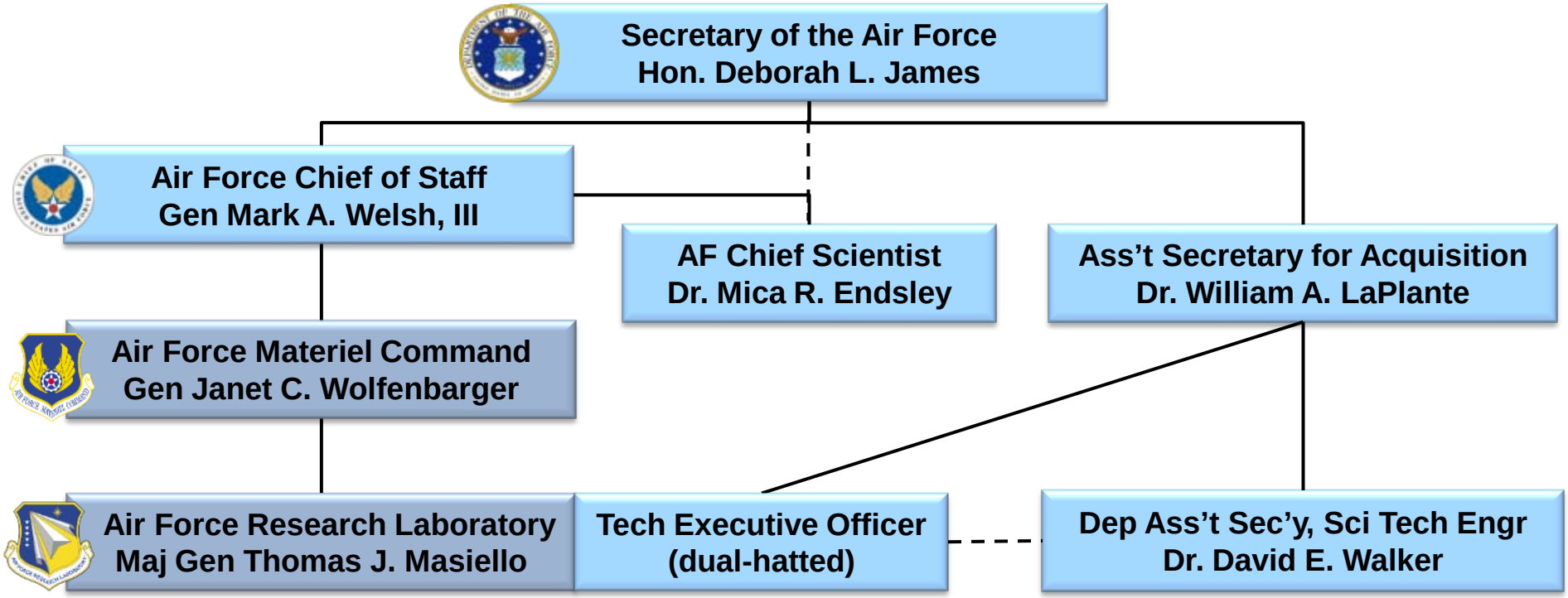
AF S&T Organization



- AFRL/CC under AFMC, dual-hatted as Technology Executive Officer to SAE
- SAF/AQR provides S&T guidance and oversight for SAE
- AF Chief Scientist under the CSAF advises SECAF and CSAF
- Scientific Advisory Board (SAB) reviews research quality and advises SECAF and CSAF on topics of interest

Turning Science Into Capability

Driven by Service Core Functions

Vectored by Air Force Strategy + S&T Vision/Horizons + Product Center Needs + MAJCOM Needs

6.1 Basic Research

6.2 Applied Research

6.3 Advanced Tech Demo

~ $5B

Science Knowledge → **Technologies** → **Capability Concepts** → **Warfighter**

Outputs:
New Technologies

Outputs:
Mature Technologies

Outputs:
Flagship Capability Concepts

25 Years | *10 Years* | *5 Years* | *1 Year*

Initial Operating Capability Timeline

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Revolutionary Innovation
Technology Push

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Next Gen Aerospace Systems

FY14-19 = $3,396M

Hypersonics

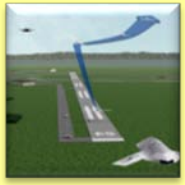
- X-51 Scramjet Demo
- High Speed Strike Weapon (HSSW)
- Reusable, Wide Operating Ranges

Turbines

- Efficient Engine for Fighter Aircraft (AETD)
- Efficient Engine for Mobility Aircraft (HEETE)
- Cruise Missile, RPA Propulsion (STELR)

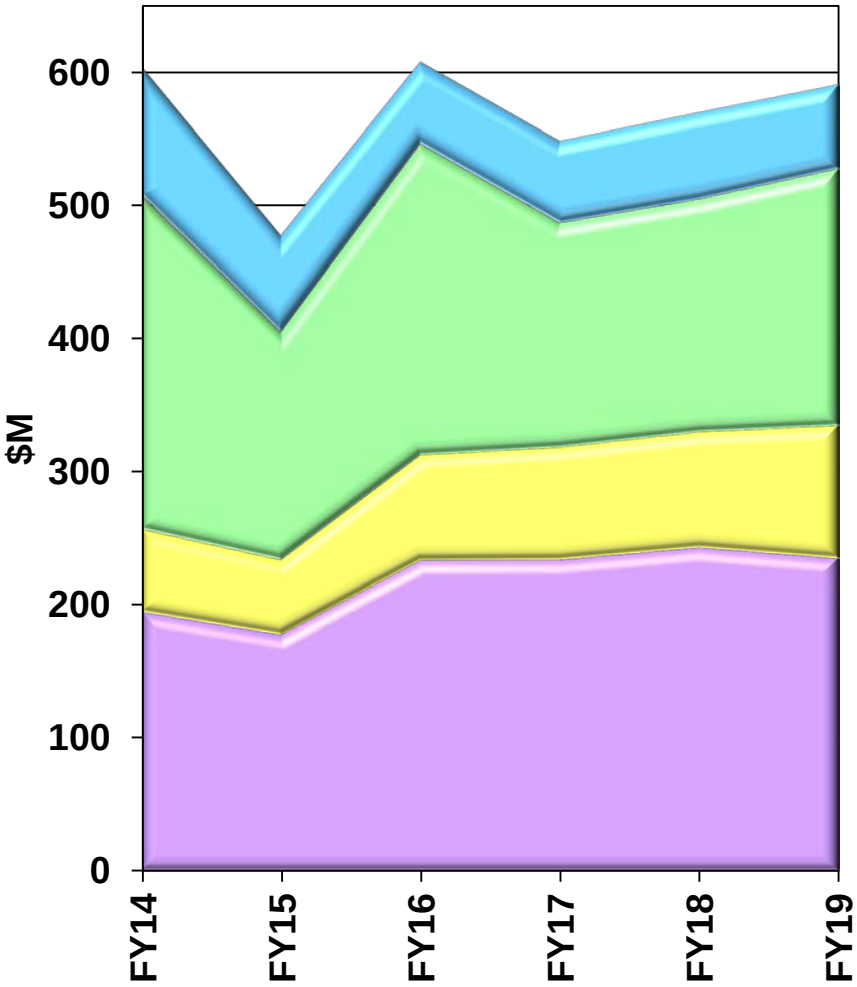
UAS and Autonomy

- UAS Airspace Integration, Sense and Avoid
- V&V of Adaptive and Autonomous Systems
- Ground Collision Avoidance



Energy & Airframes

- Energy Efficient Airframe Configurations
- Drag Reduction for Legacy MAF Fleet
- Energy Optimized Power and Thermal

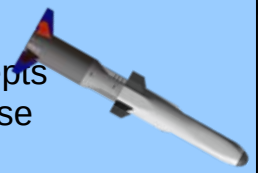


Weapons

FY14-19 = $2,196M

KE System Integration

- Demonstrate advanced conventional munitions concepts
- Integrate ordnance, guidance, and carriage and release technologies to demonstrate a warfighter capability



KE Ordnance

- Develop S&T that maximizes air-delivered weapon effectiveness
- Advance state of art in fuzes, energetic materials, and warheads technologies
- Assess target vulnerability

KE Guidance

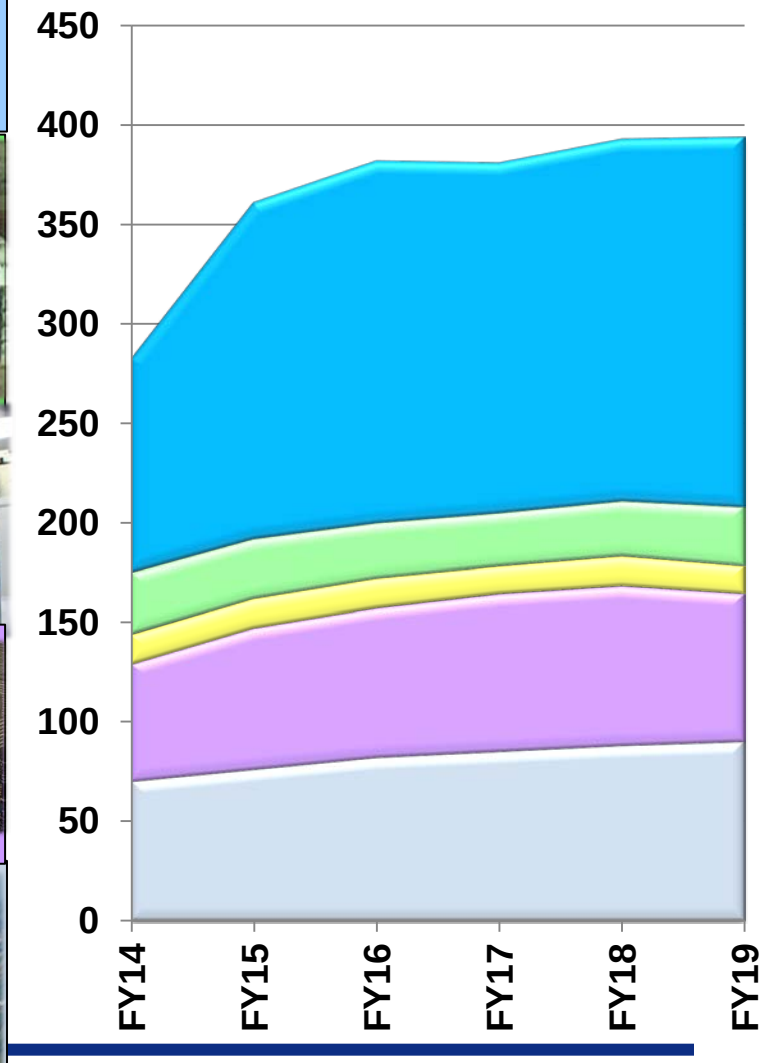
- Advance understanding of precision, autonomy, agility, control and maneuver for air launched weapons
- Define technologies effective in highly adversarial, confusing, & cluttered environments

Hi Pwr Electromagnetics (HPEM)

- End-to-end HPEM performance prediction
- Retire all subsystem risks to enable efficient HPEM weapons with emphasis on reduced SWaP and expanded trade space

Laser Weapon Systems (LWS)

- End to end laser system performance prediction
- Retire all subsystem risks to enable efficient HELs with required defensive and offensive weapons effects



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Intelligence, Surveillance, & Reconnaissance

FY14-19 = $1,669M

Human Centered ISR

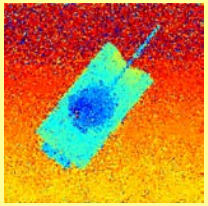
- Battlespace Visualization
- Analyst Augmentation
- Human Signatures, Trust, & Interaction

Processing & Exploitation

- Architectures for Massive Analytics
- Automated Exploitation
- Multi-Source Analysis

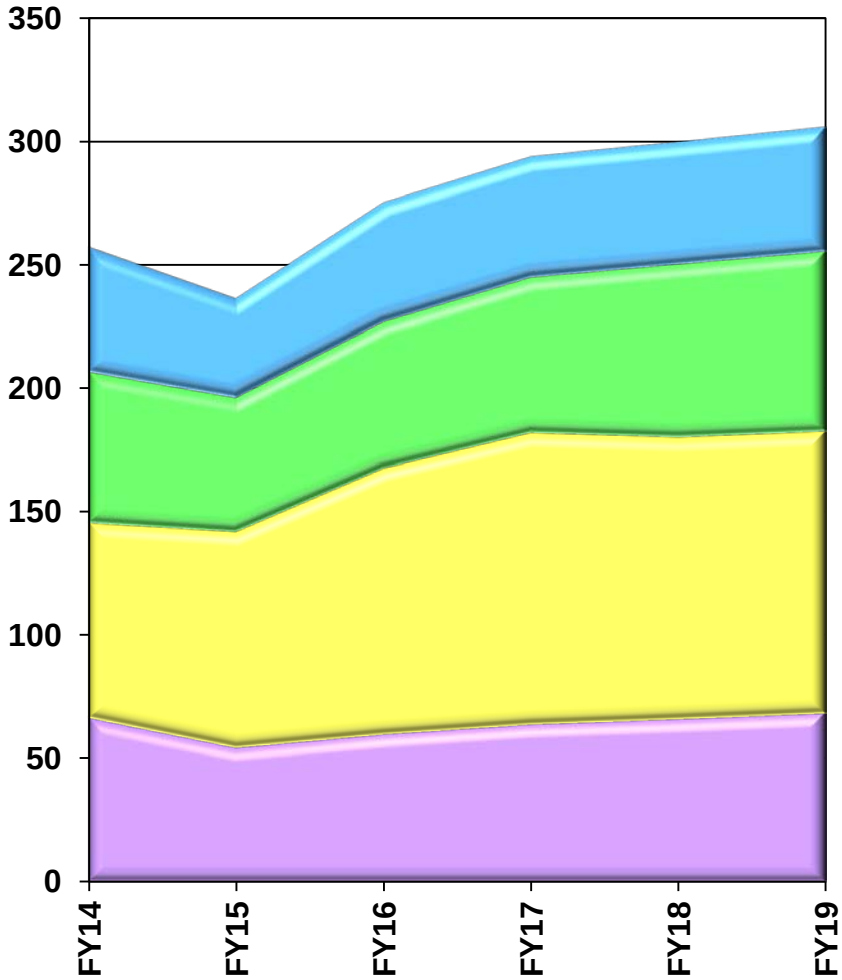
Multispectral Sensing

- EO, IR, RF, and Layered Sensing
- All Weather, Passive Sensing
- Wideband, Multimode Sensing



Basic Research, Materials & Devices

- Optoelectronic and Photonic Materials
- Innovative and Affordable Devices
- Physics, Electronics, and Mathematics Research



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Command, Control, Communications, & Cyber

FY14-19 = $1,464M

Trusted & Assured Systems

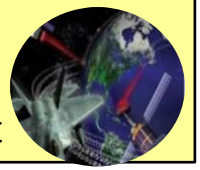
- Scientific Foundations of Mission Assurance
- Scientific Foundations of Trust
- Supply Chain Trust

Connectivity & Dissemination

- Advanced Networks and Data Links
- Mission-Responsive Enterprise Management
- Secure Multi-level Data Sharing

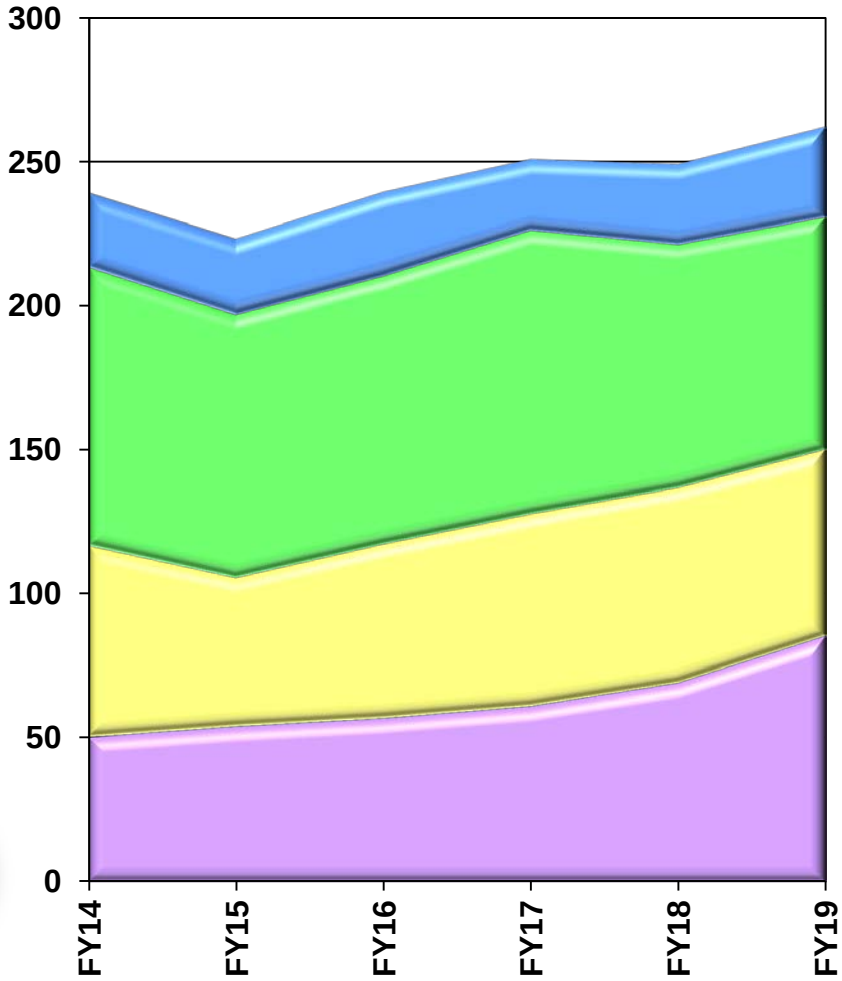
C2, Autonomy, & Human Optimization

- Mission Awareness and Visualization
- Integrated Full Spectrum Operations
- Command, Control (C2) and Decision Support



Network Attack, Defense, & Resilience

- Cyber Maneuver and Response
- Resilient Architectures
- Military-Grade Hardware and Software



Electronic Protection/Electronic Warfare

FY14-19 = $831M

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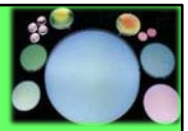
Multispectral Electronic Attack/Support

- Cognitive / adaptive / distributed EW effects
- EO/IR threat assessment / countermeasures
- Integration of EW and cyber effects

Electronic Protection (EP)

- Proactive techniques & sensor protection tech
- Identify / mitigate avionics cyber vulnerabilities
- Development of anti-tamper technologies

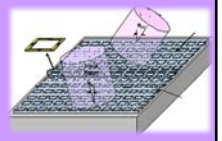


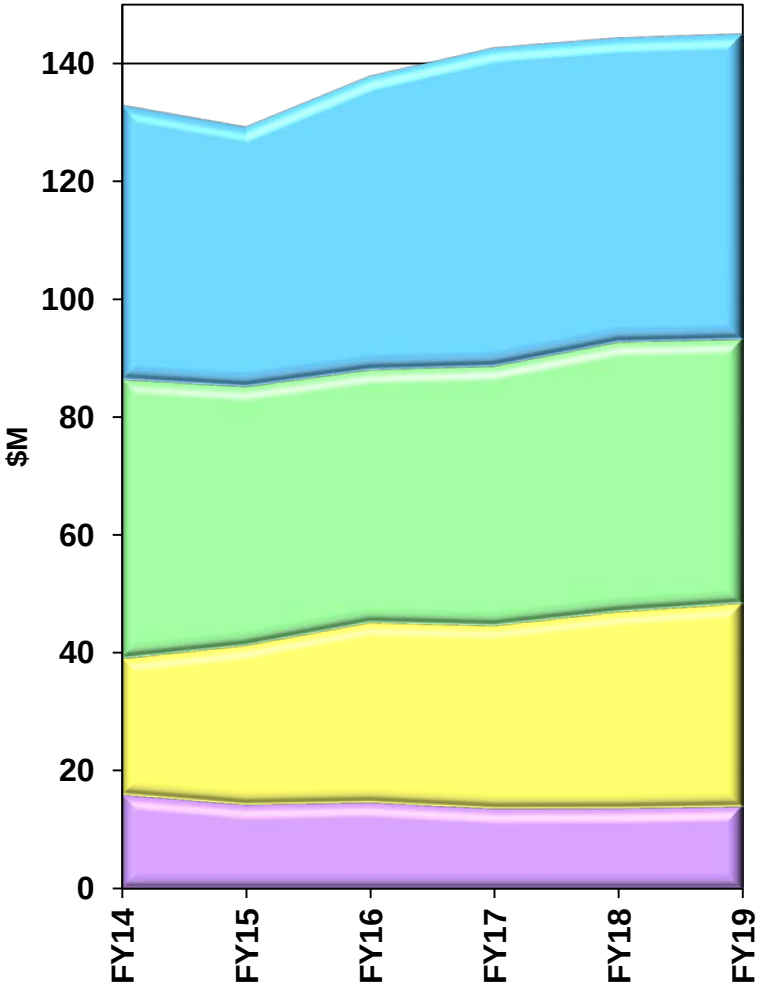
Alternative Navigation (PNT)

- Provide GPS accuracy to warfighter in A2AD
- High precision timing and transfer
- Sensor aided inertial; reduced C-SWAP

Devices / Phenomenology

- Reconfigurable RF devices/electronics
- Integrated photonic circuits for EW systems
- Wideband apertures / EM phenomenology





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Human Performance

FY14-19 = $485M

Training

- Live-Virtual-Constructive Warfighter Training
- Cognitive Modeling
- Continuous Learning

Decision Making

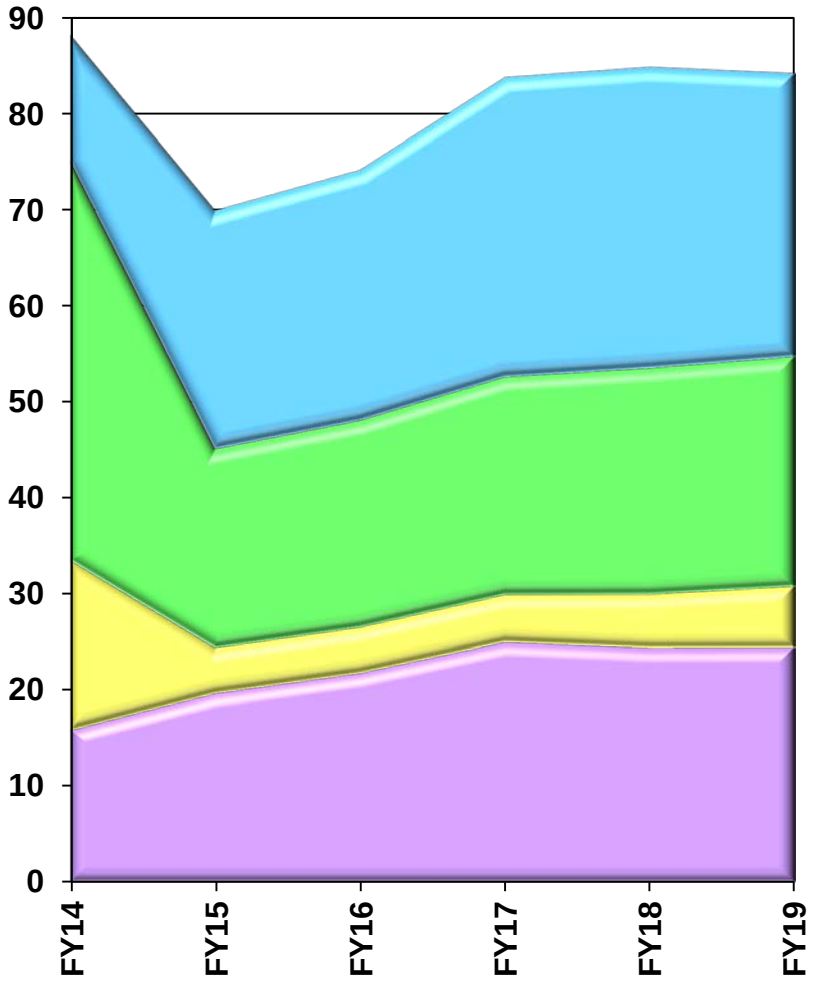
- Supervisory Control Interfaces
- Battlespace Visualization
- Wearable Interfaces for Battlefield Airmen

Bioeffects

- Laser and RF Bioeffects
- Tactical Decision Support Tools
- Biological Interaction of Nanomaterials

Aerospace Physiology

- Aircrew Performance in Extreme Environs
- Next Generation Oxygen Systems
- Toxicology



Space and Nuclear

FY14-19: $1,889M

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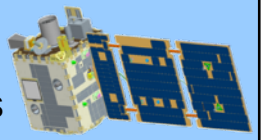
Space Situational Awareness

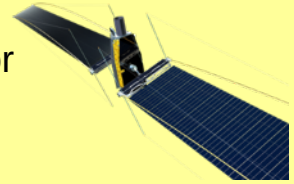


- Optimize existing ground architecture
- Advance exploitation of existing data sources
- Low-cost small satellites for exquisite GEO surveillance

Space Access

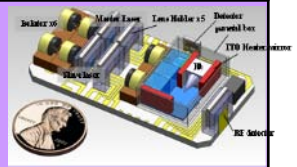
- Reduce risk & cost of EELV modernization
- Increase EELV capacity by dual-launch spacecraft
- Small satellites/spacecraft miniaturization S&T

Space Platforms



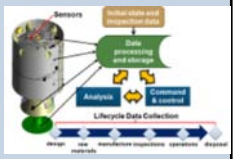
- Increase power generation & packing factor
- Increase dynamic range of thermal mgmt
- Leverage commercial rad-hard market

Space Payloads

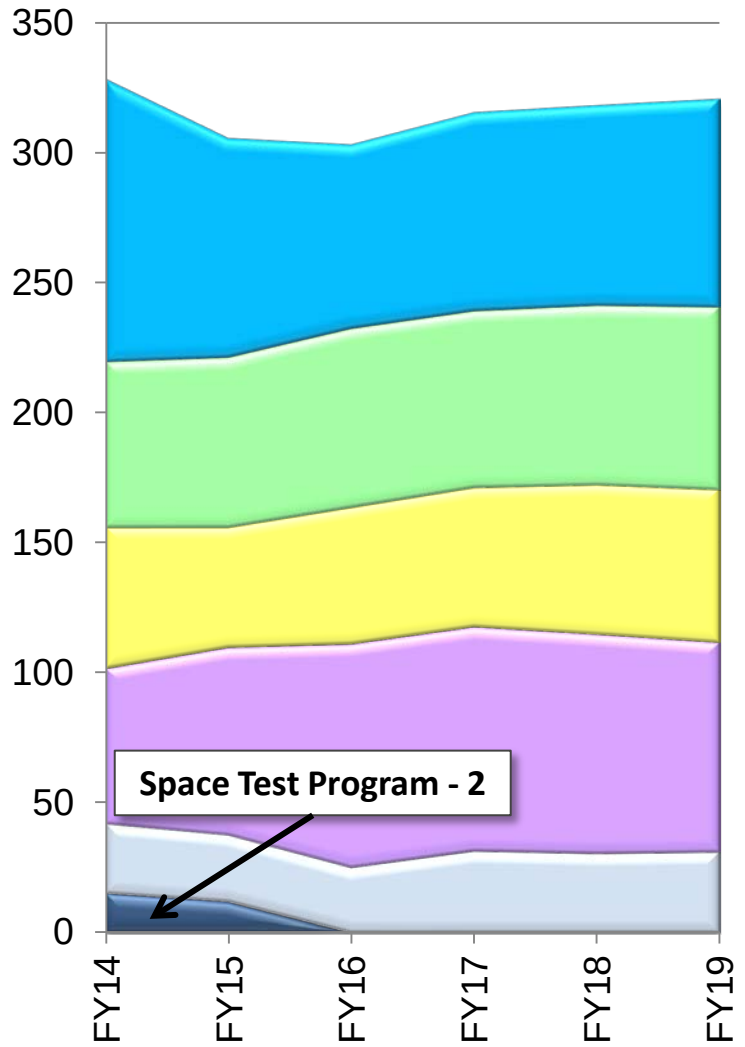


- V/W & Laser communication S&T
- Missile Warning launch detection S&T
- GPS: dual manifest options, flexible payloads, low cost IMU

Nuclear Enterprise



- Sustainment/Maintenance alternatives S&T
- S&T to avoid costly sys mods for aging fleet
- Adv sensor & algorithms development



Affordability & Sustainment

FY14-19: $977M

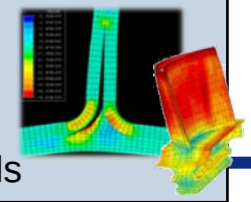
Improve Manufacturing of AF Systems
- Active Electronically Scanned Radar Antenna
- Turbine Engine Propulsion System Man
- Munitions Component Manufacturing

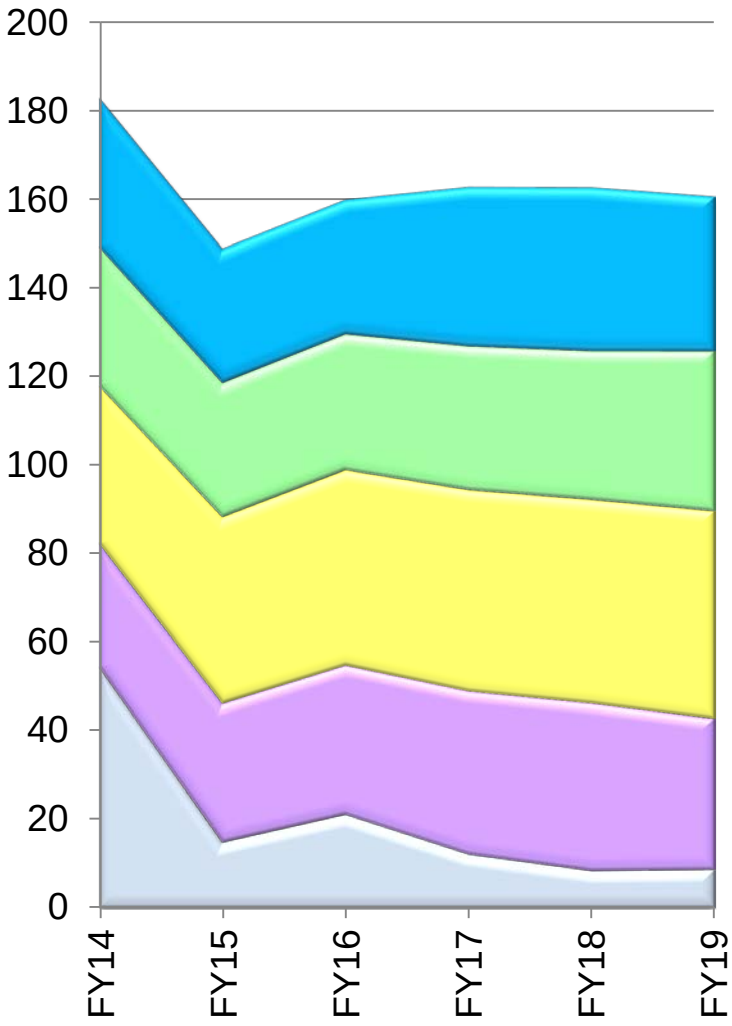
Longer Life, Lower Life-Cycle Cost Systems
- Advanced Manufacturing Enterprise
- Adv Man Concepts, A/C Struct, Mun & C2ISR
- Integrated M&S for Discovery, Design & Man

Support Sust of AF Fleet (Field & Depot)
- LO Maintainability
- NDI/Virtual Re-inspection Methods
- Maintenance Technologies

Improve Fleet Health Management
- Risk Based Life Mgmt for Turbine Engines
- Condition-based Maint + Structural Integrity
- Damage Characterization, Modeling & Testing

Enable Robust Design of New Sys
- Propulsion System Design Methods
- Propulsion Sust; Advanced Tech Demo
- Residual Stress Design/Struct Life Predict Tools





Game Changers

Hypersonics

- Survivable, fast-flying
- Lightweight, high-temp structures

Directed Energy

- High Power Microwave tech
- Lasers with air & ground selectable effects & reduced collateral damage

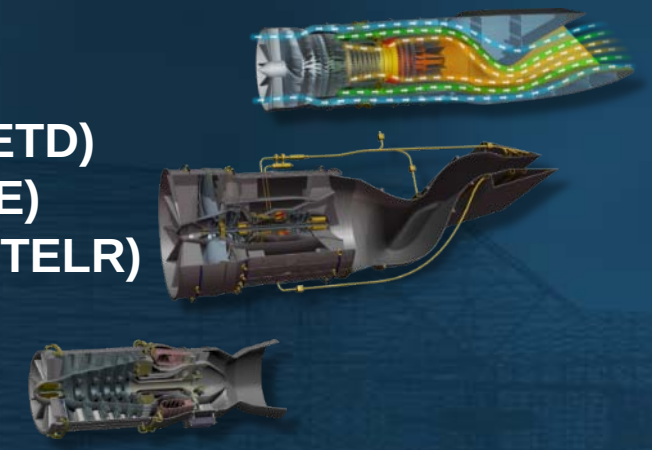
Autonomy

- UAS teams, single operator
- Self awareness & troubleshooting intelligence to aid mission performance

Other High Value Areas in the Near & Mid Term

Enhanced Range & Persistence

- Adaptive Engine Technology Development (AETD)
- Highly Energy Efficient Turbine Engine (HEETE)
- Supersonic Turbine Engine for Long Range (STELR)
- Aerodynamic efficiencies / drag reduction



Alternative Navigation

- Robust GPS resistant to jamming
- Alternate methods (i.e. terrestrial tracking, star tracking)
- Exploiting signals of opportunity

Big Data

- Pattern-of-life recognition for better threat analysis
- Multi-source analysis of imagery, signals, audio, text, media

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Summary

- **AF S&T is in direct support of prioritized AF & COCOM capability needs captured in AF Core Function Master Plans**
- **AF S&T is balanced between meeting warfighter current needs and discovering/developing new game-changing technologies**


QUESTIONS?