

# ***Headquarters U.S. Air Force***

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*Integrity - Service - Excellence*

## **Air Force FY15 S&T Program**



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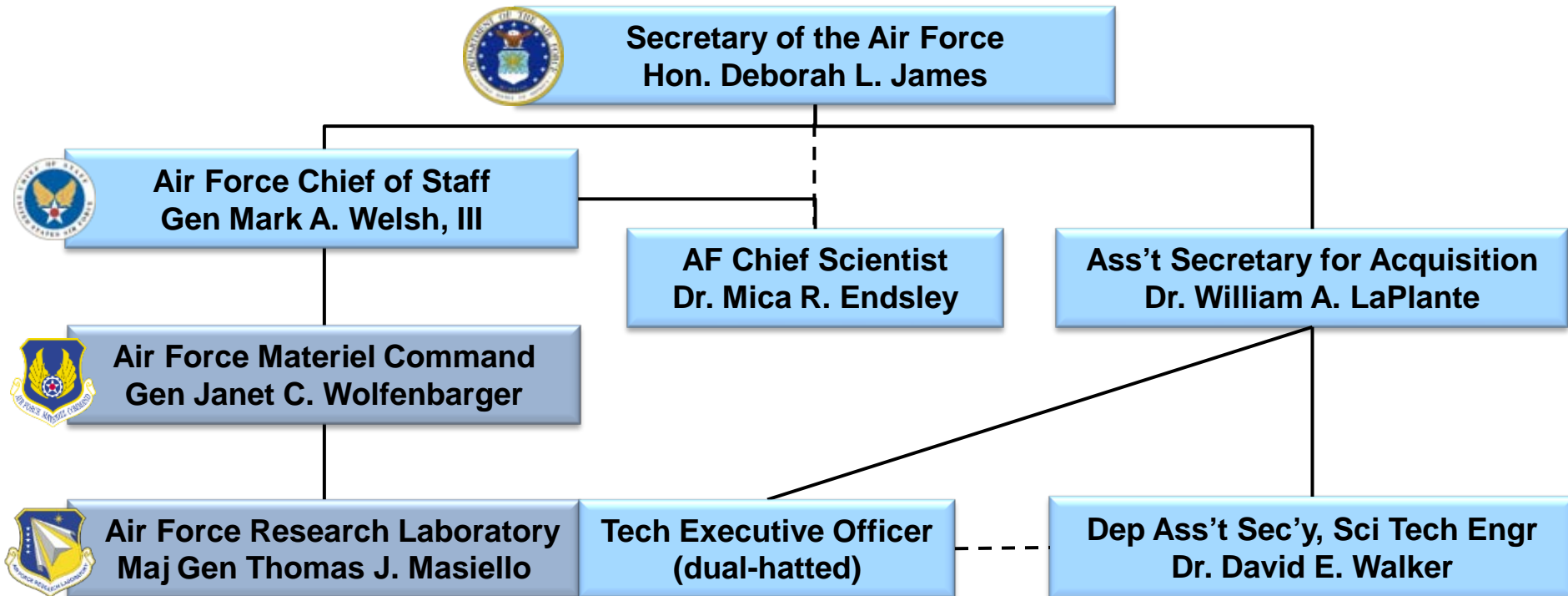
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**Colonel (s) Chuck Ormsby, PhD  
Military Deputy,  
Deputy Assistant Secretary  
Science, Technology and Engineering  
12 Mar 2014**



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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

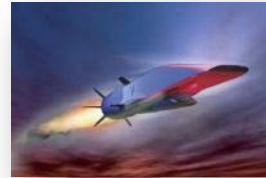
Vectored by Air Force Strategy + S&T Vision/Horizons + Product Center Needs + MAJCOM Needs



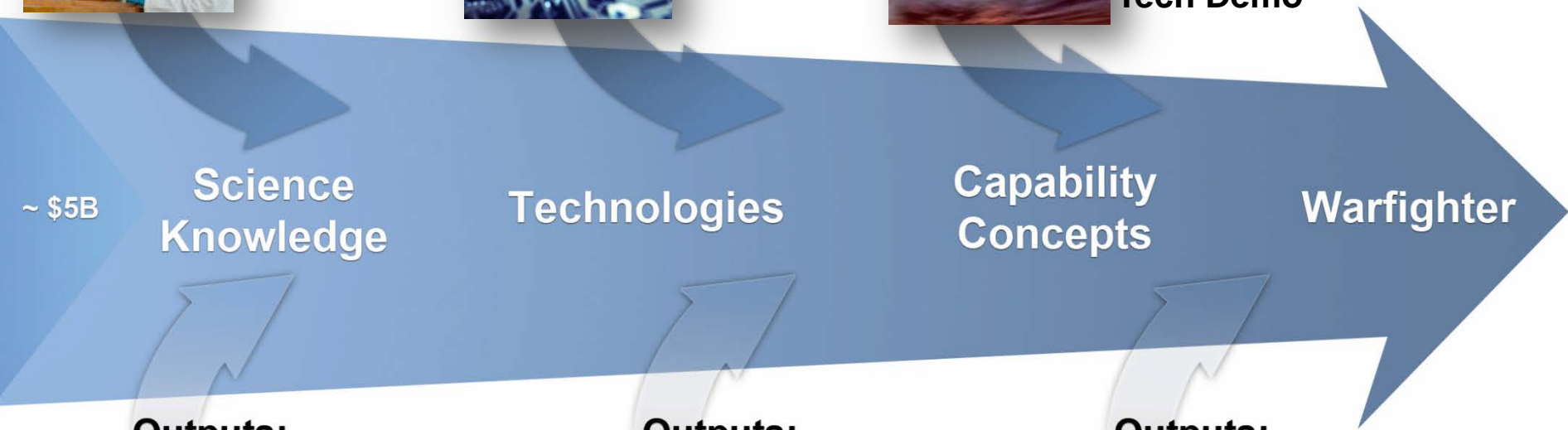
**6.1**  
**Basic**  
**Research**



**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*

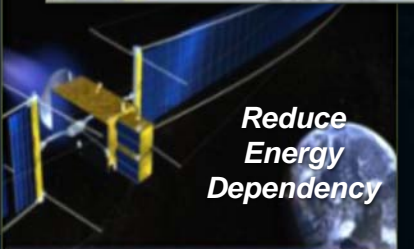
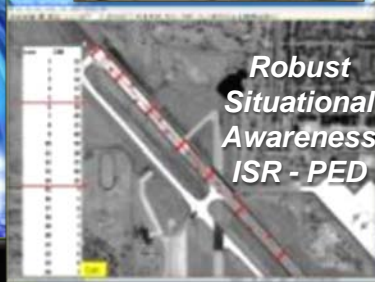
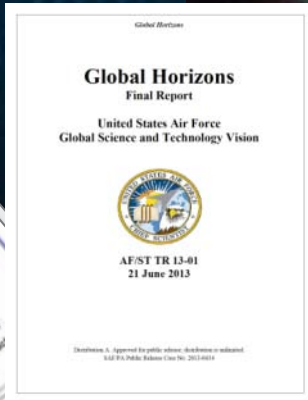
**Initial Operating Capability Timeline**





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# Revolutionary Innovation Technology Push



2014 UPDATE  
In Review

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# Next Gen Aerospace Systems

FY14-19 = \$3,396M

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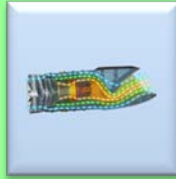
## Hypersonics

- 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)



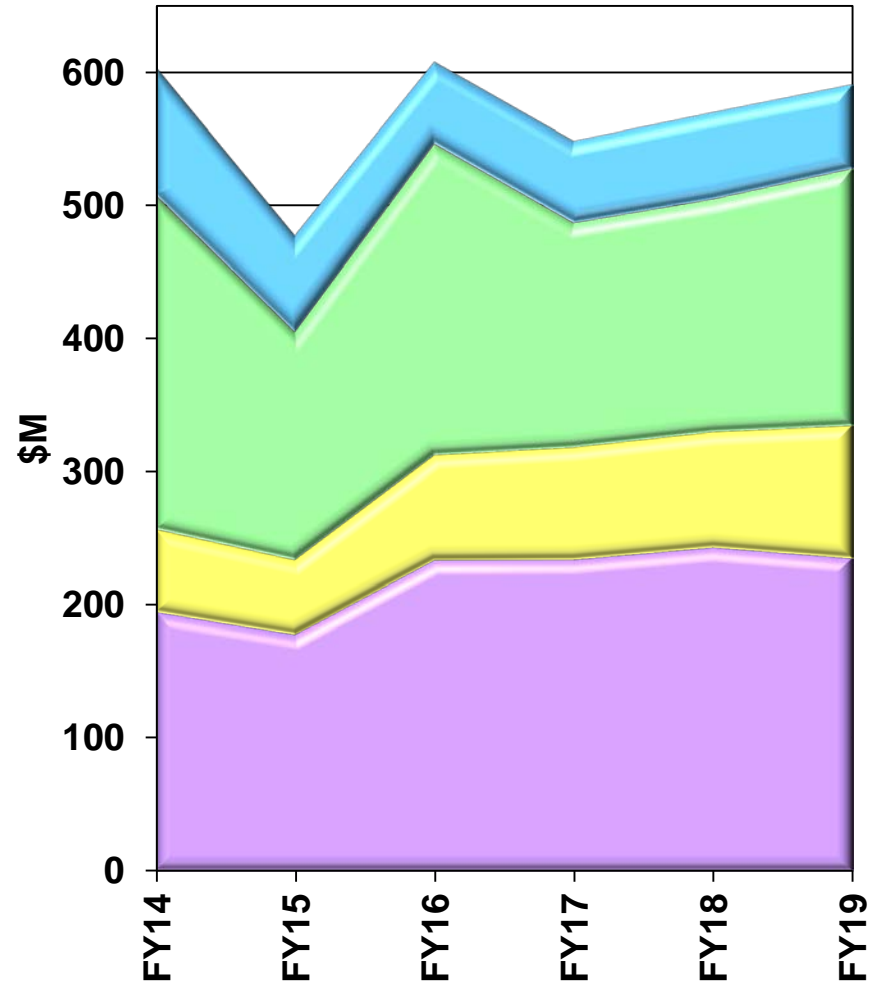
## UAS and Autonomy

- 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





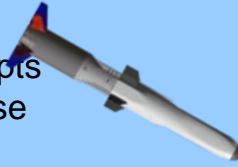
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# Weapons

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



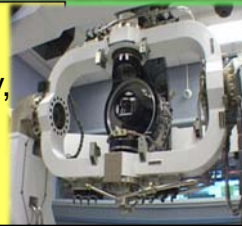
## KE Ordnance

- 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



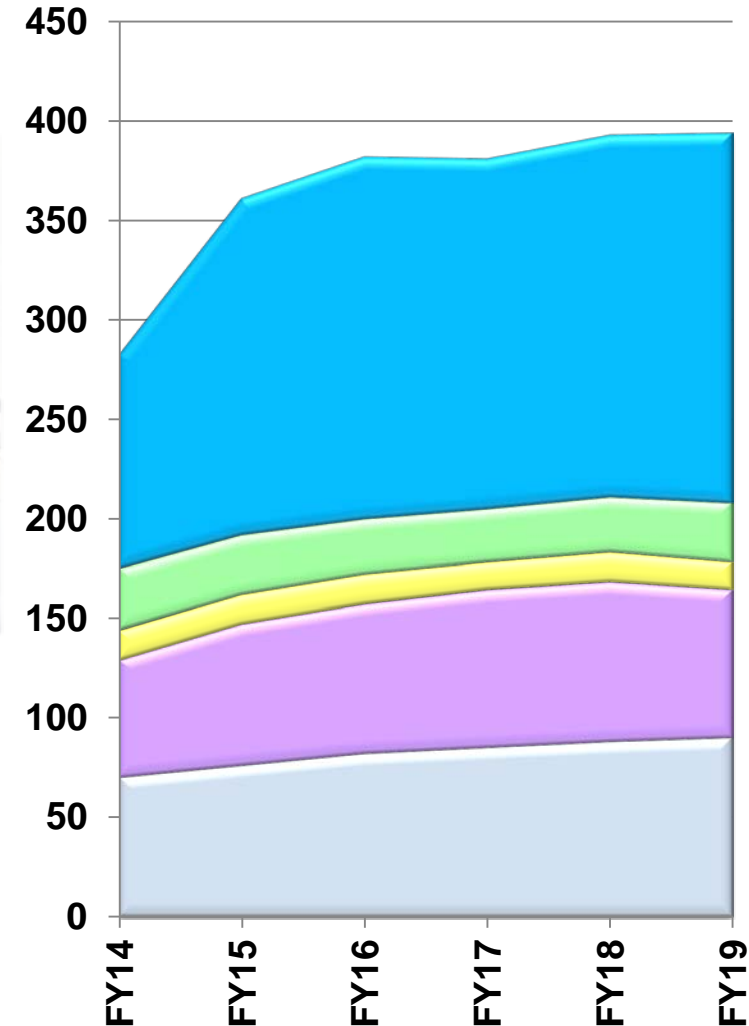
## Hi Pwr Electromagnetics (HPEM)

- 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



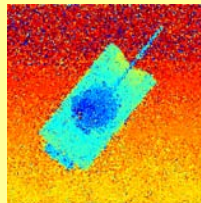
## Processing & Exploitation

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



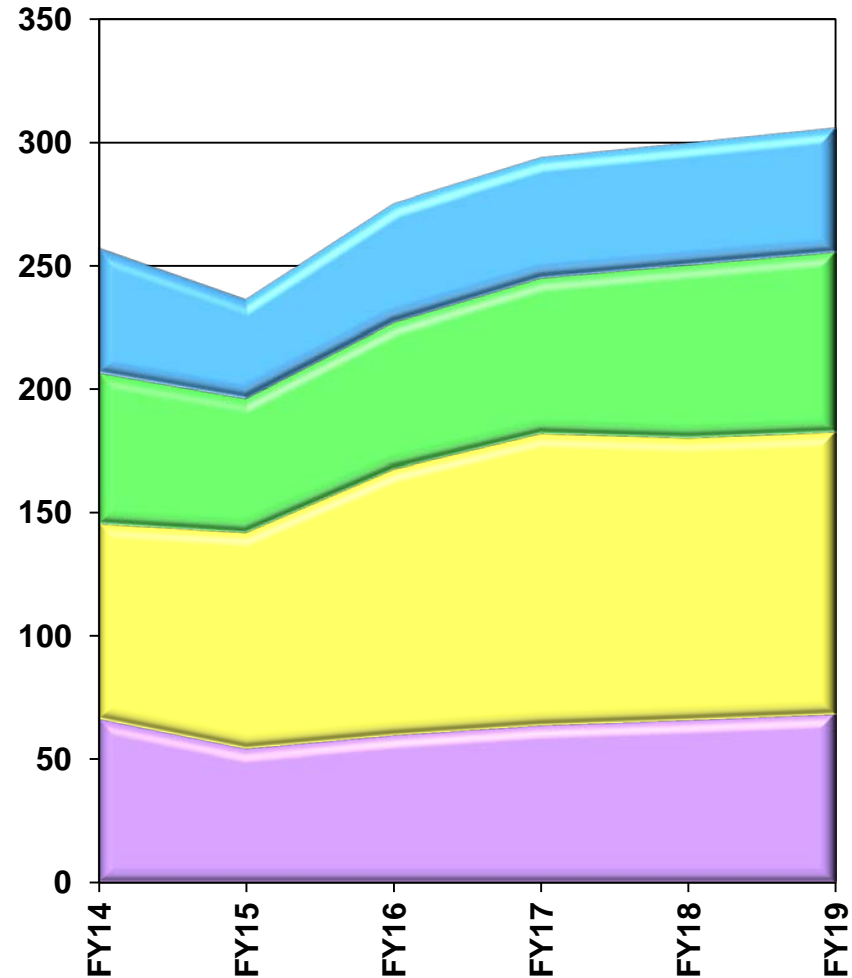
## Multispectral Sensing

- 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



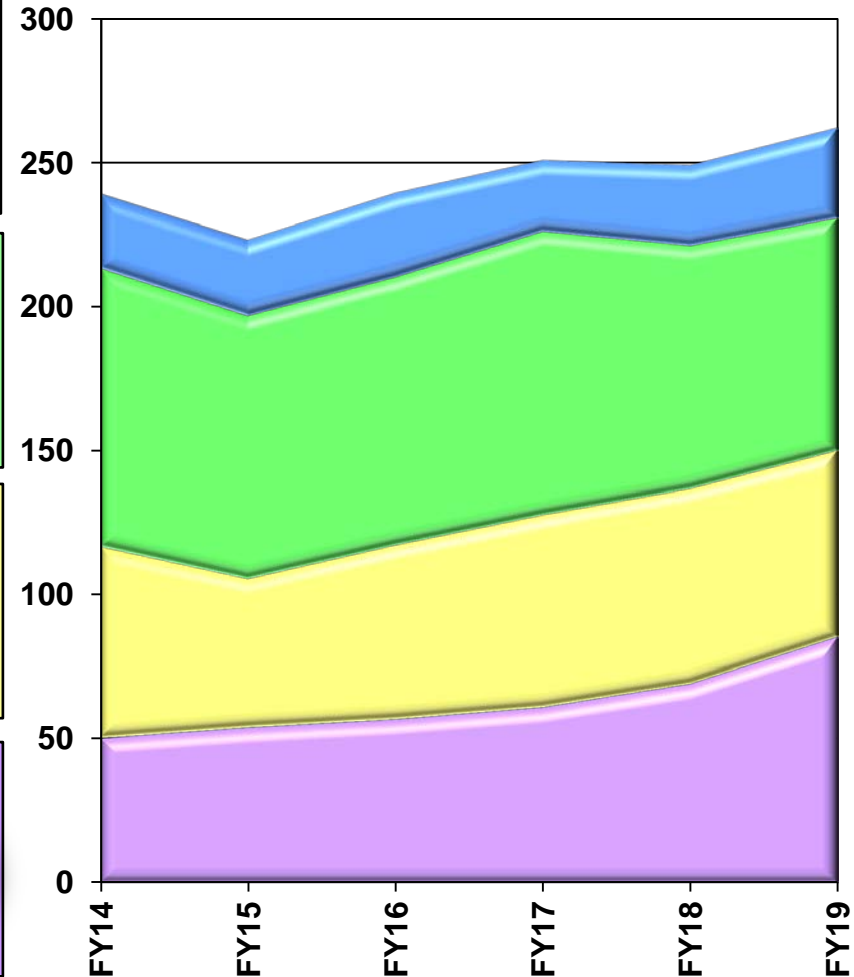
## C2, Autonomy, & Human Optimization

- 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

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FY14-19 = \$831M

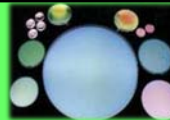
## Multispectral Electronic Attack/Support

- 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



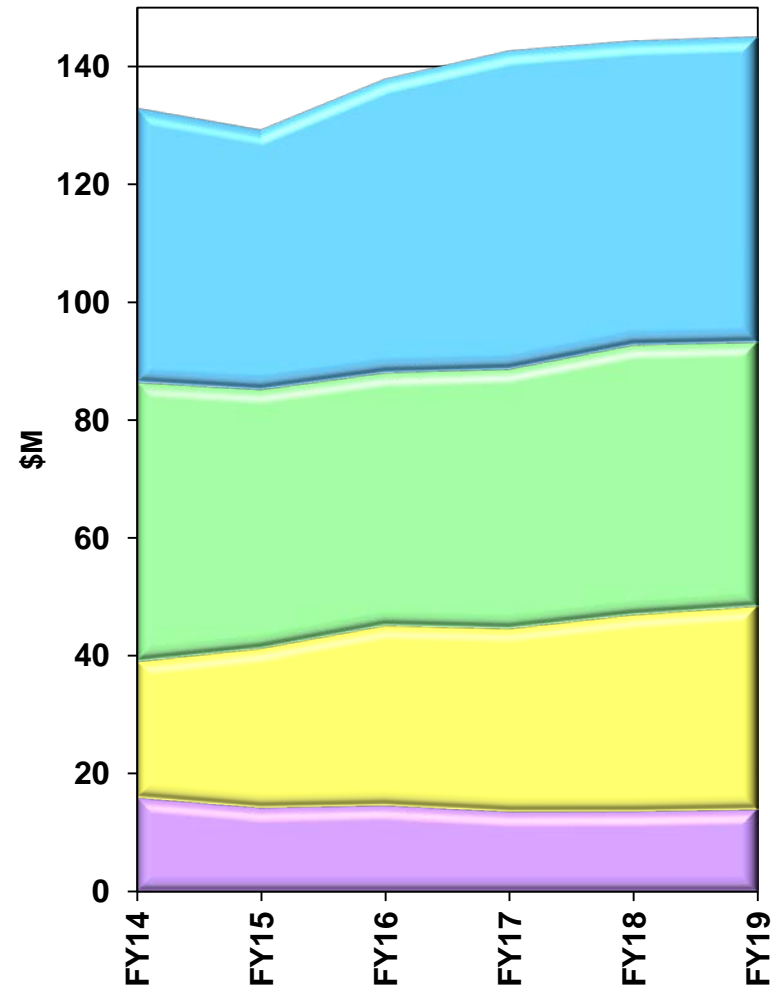
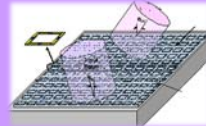
## Alternative Navigation (PNT)

- 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

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## Training

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



## Decision Making

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



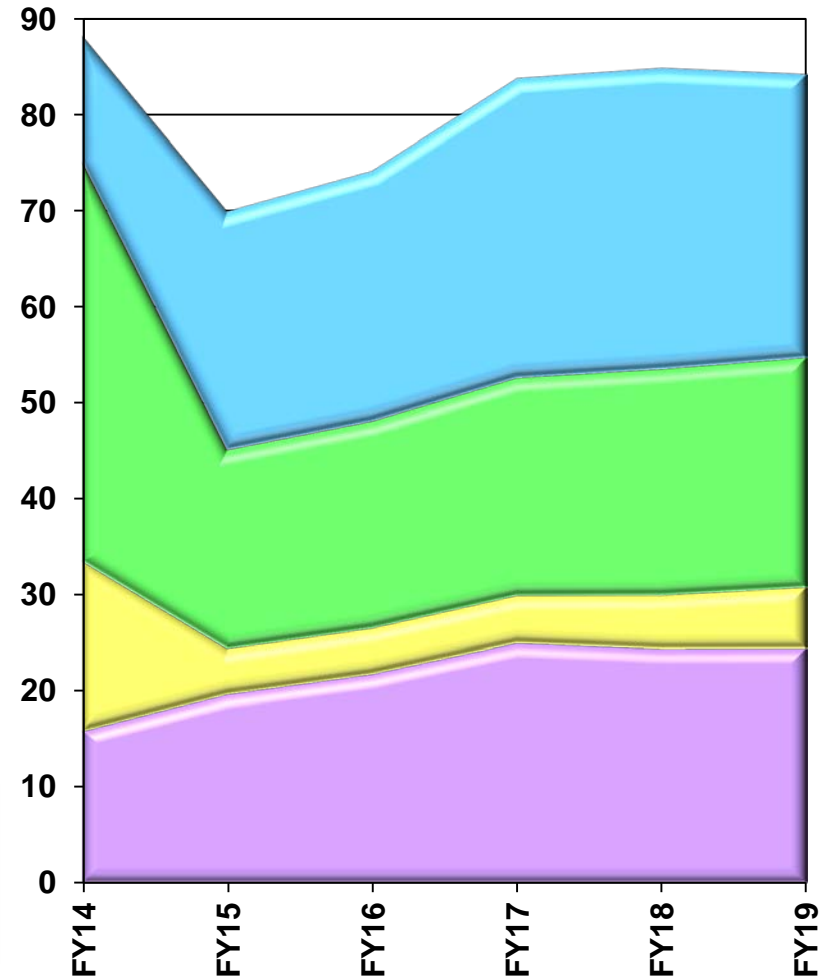
## Bioeffects

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



## Aerospace Physiology

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





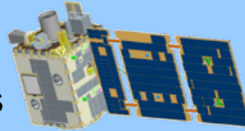
# Space and Nuclear

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



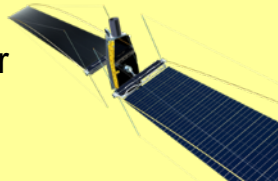
## Space Access

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



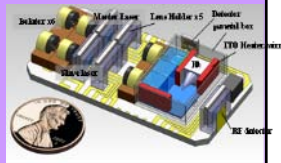
## Space Platforms

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



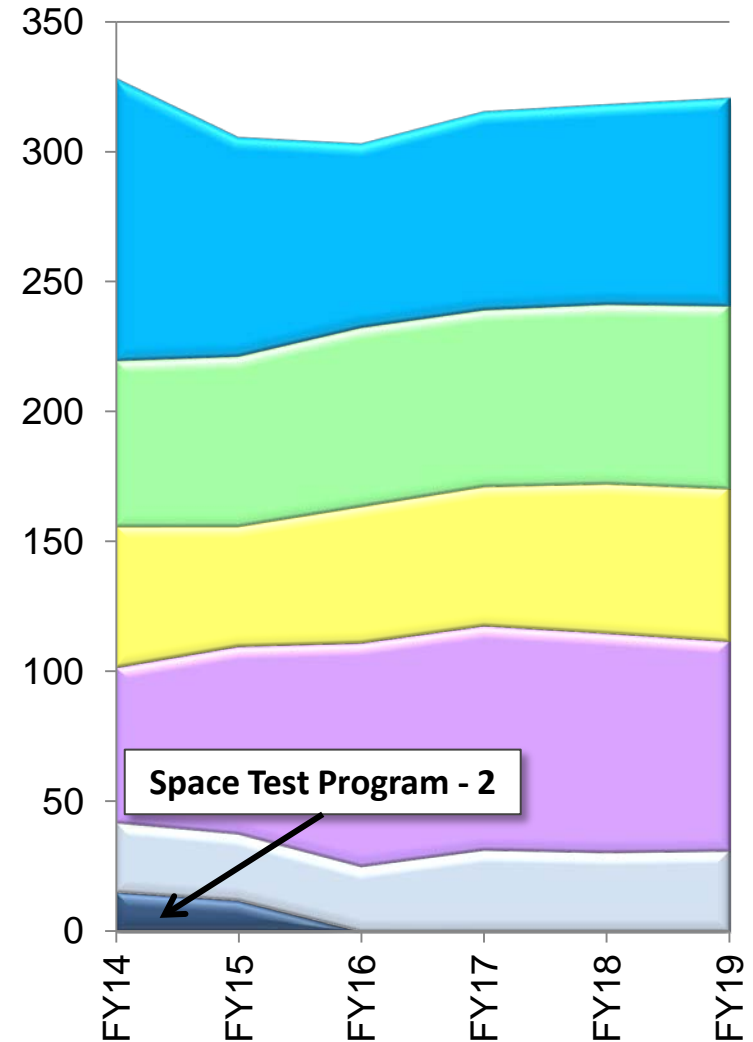
## Space Payloads

- 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





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# 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



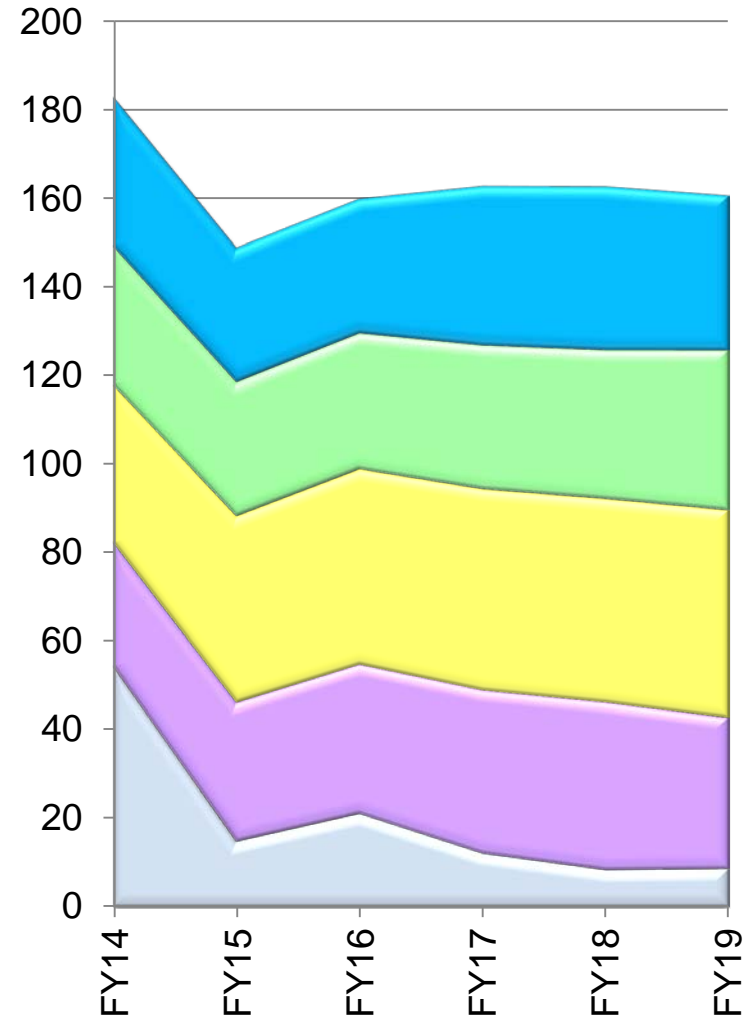
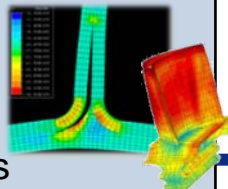
## Improve Fleet Health Management

- 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



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# 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



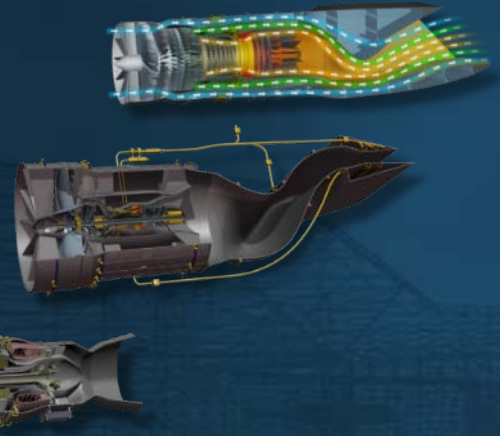
## Autonomy

- 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





# Summary

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- 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



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