Headquarters U.S. Air Force

Integrity - Service - Excellence

FY19 Air Force President's Budget Request

Science and Technology Overview

Mr. Jeff H. Stanley
Deputy Assistant Secretary
Science, Technology and Engineering

U.S. AIR FORCE

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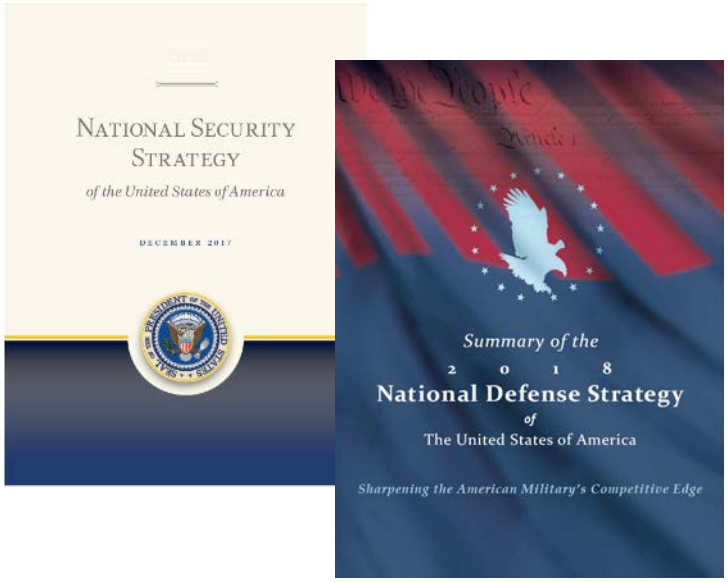
FY 19 President's Budget

- S&T invests in a broad portfolio aligned to National Security Strategy and Air Force Strategy
- Continues to emphasize technologies that are revolutionary, relevant and responsive
- Increases the use of experimentation and prototyping -- Leveraging partnerships with OSD and DARPA



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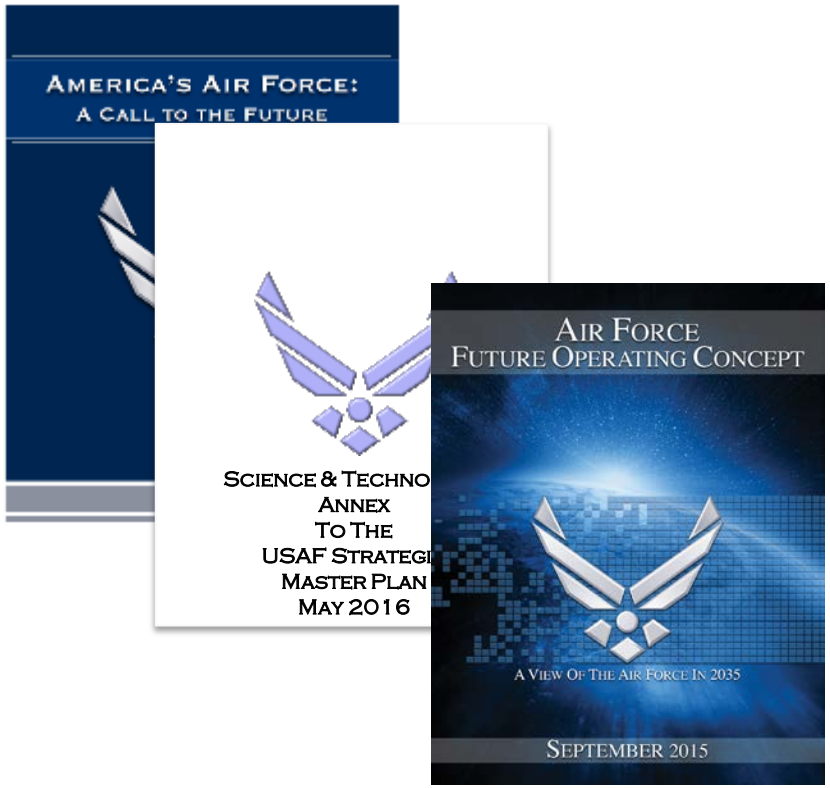
Air Force Strategy



- **2014 AF Strategy -- Forge ahead on path of innovation to achieve Strategic Agility – break paradigms & leverage technology**
- **2016 AF S&T Annex -- Design agility and affordability into capability development, requires closer relationship between S&T, acquisition, requirements, and operators**
- ***New* SECAF directed AF S&T 2030 Strategy -- Harvest new technical approaches and R&D focus areas**
- ***New* Developing AF Warfighting Integration Capability**

"**Experimentation** is the engine of **development planning** to generate repeatable and defendable empirical data that explores and matures innovative capability concepts"--
2015 Air Force Capability Annex

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SECAF-Directed 2030 S&T Strategy

- ***Provide guidance for R&D over next decade that prepares AF for the national security challenges of 2030 and beyond and ensures our technological advantage***
- **<u>OUTCOMES / GOALS</u>**
  - **Draft a S&T Strategy for the AF that guides how we approach research and defines the areas of highest priority for the next decade and beyond**
  - **Evaluate innovative technical approaches and focus areas to advance the AF mission through R&D**
  - **Build and reinforce relationships between the AF scientific community and university, government, and industry partners**
  - **Make recommendations for improvements on the processes and the organizational structures by which the AF manages early stage research**

THE SCIENCE & TECHNOLOGY 2030 INITIATIVE

INVENT THE FUTURE TODAY

Engagement Schedule & Idea Submission:
www.afresearchlab.com

U.S. AIR FORCE

Revolutionary

Hypersonics

Directed Energy

Autonomy

Nano Technology

Unmanned Systems

Technology to make and keep the fight unfair - Game Changers

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Relevant


Agile Combat Support

Air Superiority

Space Superiority


Global Integrated ISR

Command and Control

Cyber Superiority

Rapid Global Mobility

Personnel Recovery


Nuclear Deterrence Operations

Global Precision Attack

Special Operations


Education and Training

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Prototyping and Experimentation

"Flavors of Experimentation"

- Light Attack Capabilities
- Multi-Domain Command and Control – Shadow Ops Ctr
- Spectral Halo (FY18 PDM)
- Air Superiority 2030 Enterprise Capability Collaboration Team (ECCT) recommended experimentation campaigns
  - Data-to-Decision (D2D) and Defeating Agile Intelligent Targets (DAIT)
- Adaptive Engine Transition Program
- Hypersonics (FY19 PDM)
- Directed Energy Weapons
- Resilient Space (FY17 RMD)
- Low Cost Attritable Aircraft Technology

Doctrine | Organization | Training | Materiel | Leadership & Education | Personnel | Facilities | Policy

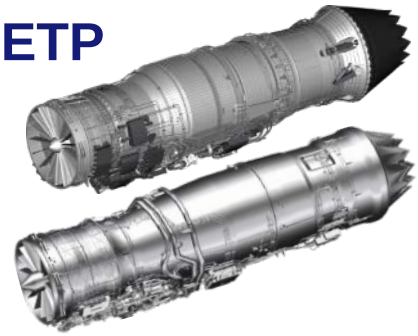
U.S. AIR FORCE

Adaptive Engine Follow-on EMD Opportunities

AETP technology is applicable to multiple combat aircraft

(2016 – 2021)

AETP



Flight Weight Adaptive Engine Prototypes (3 per contractor)

Validating technologies in a combat installation

Direct upgrade

Scaled Common Core

Scaled Core

(or Component applications)

Potential F-35 Upgrade **(2020-2025 EMD)**

- 30% increase CTOL/CV radius
- 18% decrease acceleration time
- 167% TMS increase (2.5x low-alt dash time)
- 3x more targets reached
- 45% reduced tanker sorties for CAP mission
- 17% more training flight hours

(2018+ TMRR/EMD)

AS2030+ Development

- 38% increase sub/super radius
- 23% increase subsonic radius
- 47% reduced tanker sorties for SEAD mission

Potential F-22 Development

- 18% range improvement
- $484M+ cost avoidance in fuel

Multiple Legacy Applications

F-15/F-16

- >20% range improvement
- >15% thrust improvement

Joint Simulation Environment

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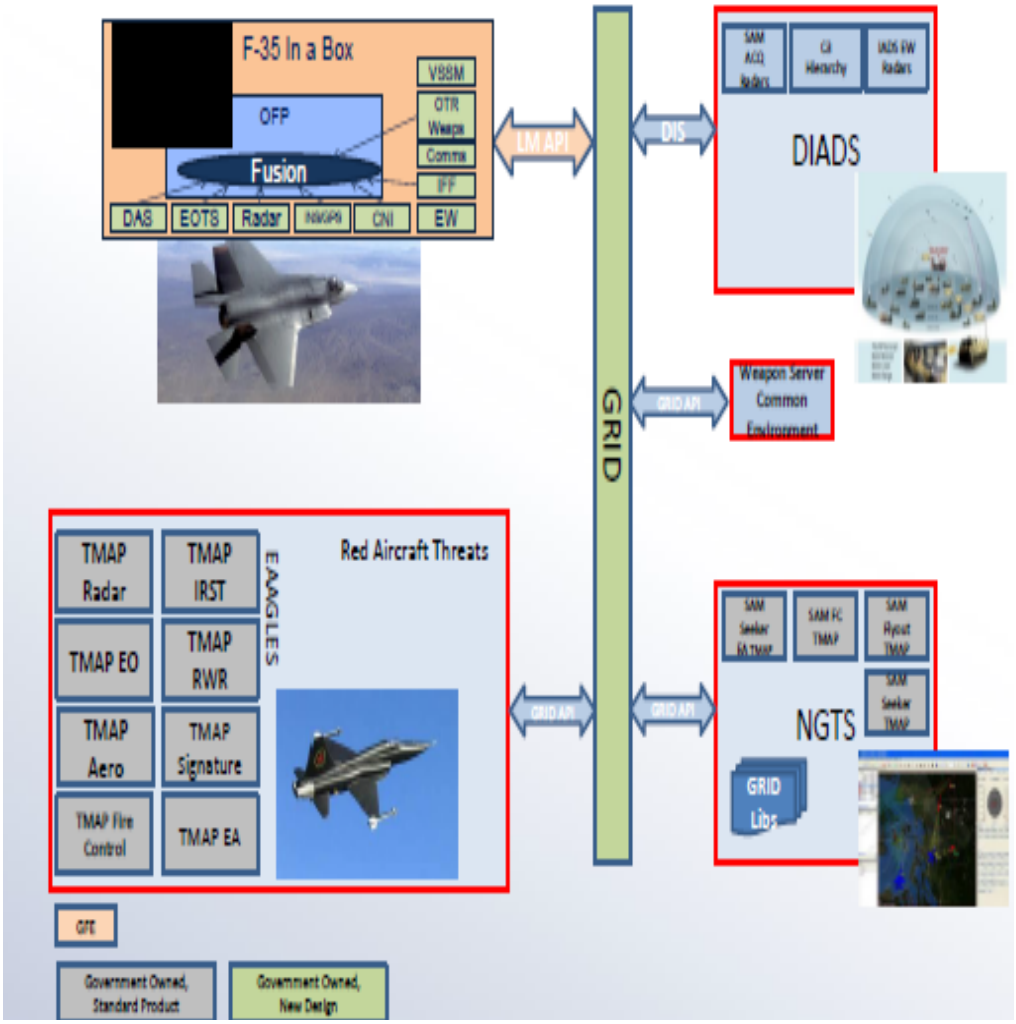
- **High fidelity simulation using aircraft OFP, accreditable for test as supplement to open air**
  - **Modular environment: operator in the loop; blue/red air, threat, terrain, weather - all standardized**
- **Enables high density, high end threat replication**
- **Allows for better test of 5th+Gen capabilities**
  - **Use of war reserve modes**
  - **Cross platform, family of sys**
  - **Multi-domain**
- **Replaces standalone, proprietary contractor solutions like F-22 ACS, F-35 VSIM**



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Low Cost Attritable Aircraft Technology

LCAAT will enable a family of limited function, rapidly produced, low cost, attritable UAVs to augment manned systems and force a <u>cost imposition</u> on near peer adversaries

Amplifies Enduring Attributes Of Airpower

- Mass
- Responsiveness
- Range
- Flexibility
- Asymmetric force
- Increased risk tolerance

AFRL Weapons Truck LCAA Variant Concept

Challenge/Problem Space

- Rising costs of exquisite Air Force aircraft
  "In the year 2054, the entire defense budget will purchase just one aircraft." – Norman Augustine
- Permissive A2/AD environments

Foundational Knowledge and Planning

- Conduct ops analysis, vehicle design, lifecycle cost, industry engagement, manufacturing studies, and define technology needs
- Develop plan: reduce risks of LCAA objective systems

Technology, Capability Experimentation

- Conduct a campaign of experiments to explore LCAAT, innovations and capabilities
- Validate cost and performance of key technologies
- Demo LCAAT in a capability context to the Warfighter

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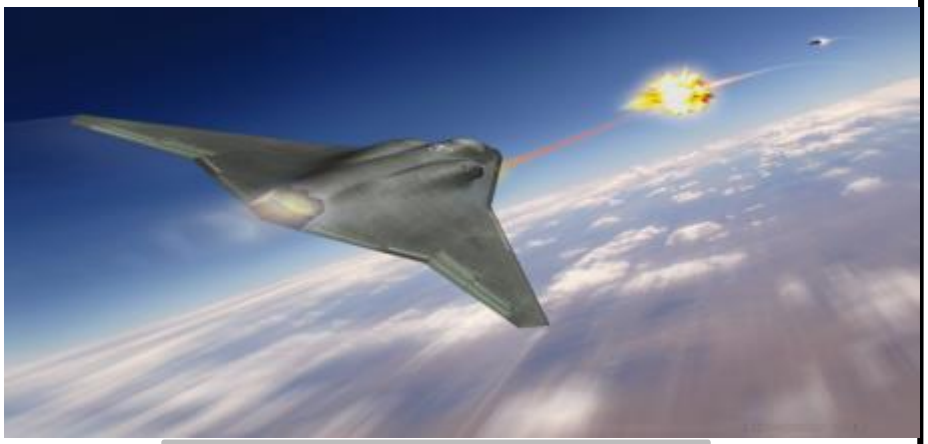
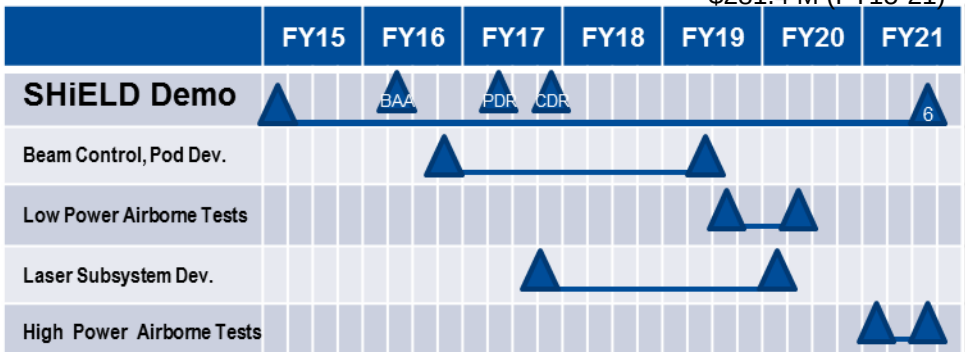
Self-Protect High Energy Laser Demonstrator (SHiELD)



$281.4 M (FY15-21)



Description

- Integrate Laser Weapon System (LWS) into fighter fuel tank pod
- Airborne flight test of a beam control in a transonic/ supersonic airspeeds & High-G flight
- Demos 50 kW-class power LWS in relevant flight environments for defeat of EO/IR based threats

Technology

- Packaged/ruggedized LWS within fighter size, weight and power (SWaP) constraints
- Aero optics mitigation at subsonic - supersonic airspeeds
- Agile, compact, large aperture flight qualified beam director
- Acquisition, Tracking, Pointing to defeat dynamic missile targets

Delivering

- Integrated LWS on legacy fighter to show self-protect from EO/IR air-air and ground-air threats
  - Demonstrate laser effectiveness in transonic environment
  - Characterize supersonic environment to strategize beam control advances
  - Flight qualified weapon system to explore next steps (component advancements, CONOPS, alternate platforms)
- Laser subsystems (Beam Control, power, cooling) scalable to higher power to increase range, number, target types engaged
- Multi-capable system for both defensive & offense use

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Gray Wolf
Cruise Missile S&T Demo

DESCRIPTION

- Prototype flight demonstrations of low-cost subsonic cruise missiles that use;
  - Open architectures and modular design for rapid prototyping and spiral capability growth
  - Networked, collaborative behaviors to ensure mission success against enemy Integrated Air Defense Systems (IADS)
- Spiral demos of variant payloads (e.g., kinetic warheads, Electronic Attack, ISR) every 18 months

TECHNOLOGY

- Innovative manufacturing for low unit costs at low quantities and without long-lead timelines
- Low-cost, multi-function seekers and sensors
- Affordable and efficient small engines
- Robust networked collaborative (semi-autonomous) algorithms aligned with operator-defined CONOPs and Tactics/Techniques/Procedures
- Highly contested environment nav/comm suites
- Flexible/effective lethality in smaller form factors
- High-fidelity MS&A for op effectiveness studies

BENEFITS TO WARFIGHTER

- Affordable counter-IADs strike capability at range in highly-contested A2/AD environment
  - Range enhances launch platform survivability
  - Networked ops enhance missile navigation, survivability and target attack
- Low unit costs support affordable missile attrition and imposes high-cost adversary response
- Spiral experimentation framework provides rapid technology prototyping and provides multiple transition opportunities

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Unmanned Systems

Systems of air systems yield operational agility

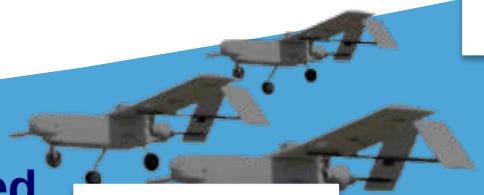
Dependence on autonomy →

Now
0-5 Years

Next
5-15 Years

Future
10-25 Years

Unmanned Teaming

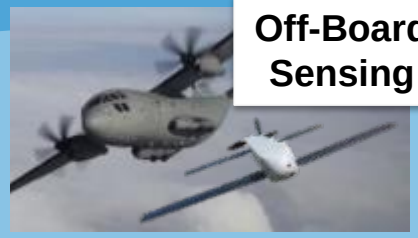


Cooperative ISR

Cooperative Strike

Distributed, Cooperative SEAD

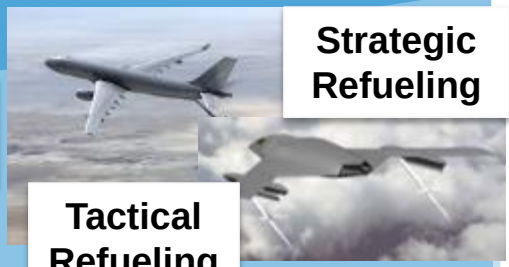
Manned + Unmanned Pairing



Off-Board Sensing

Air-to-Ground

Def, Off Counter-Air



Strategic Refueling

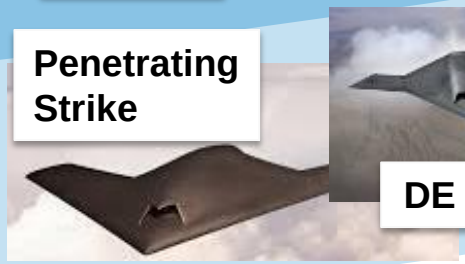
Tactical Refueling

AirLand

AirDrop

Manned Platform Replacement

Persistent ISR



Penetrating Strike

DE Strike

Manufacturing Technology Vision
Applied to Air Force Priorities

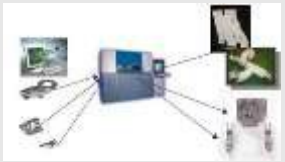
Next Generation Agile Manufacturing

Technology Efforts:

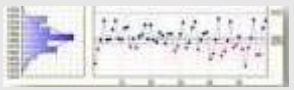
- **Moving Manufacturing Left**


- **Cradle to Cradle Digital Thread**


- **Factory of the Future**




- **Responsive, Integrated Supply Base**

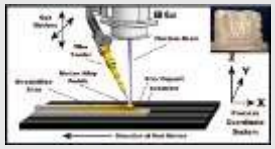
AFRL and Partners

Joint Defense ManTech Panel

ENERGY | Advanced Manufacturing Partnership

DARPA

Ex: Additive Manufacturing



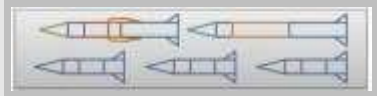

Ex: Digital Thread

Select Applications

Advanced Turbine Engines

ISR Open Systems

Weapons




F-35

Complex of the Future

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STEM Education and Workforce Development Initiatives

- **National Defense Science & Engineering Graduate (NDSEG) fellowship**
  - Air Force PE ~$50M, award ~260 fellowships annually ($6M PDM increase)
- **Science Mathematics And Research for Transformation (SMART)**
  - Sponsored 743 SMART scholars in past 12 yrs; 387 completed program, 85% working for AF, 10% getting adv deg, and 4% left due to hiring or location of facility issues; 332 scholars currently in the program
  - SMART Scholars are an essential recruitment source to replenish workforce and enable key technology advances and future STEM leaders
- **Launching LEGACY apprentice scholarship pilot**
- **Expanded AFA StellarXplorers from 131 to 180 teams; scholarships being given by Air Force and matched by ULA**
- **Cyber/EW ROTC Pilot Program Phase 2 on contract**
  - **Air Force and Navy funded ~$6M; 140 plus cadets and midshipman**

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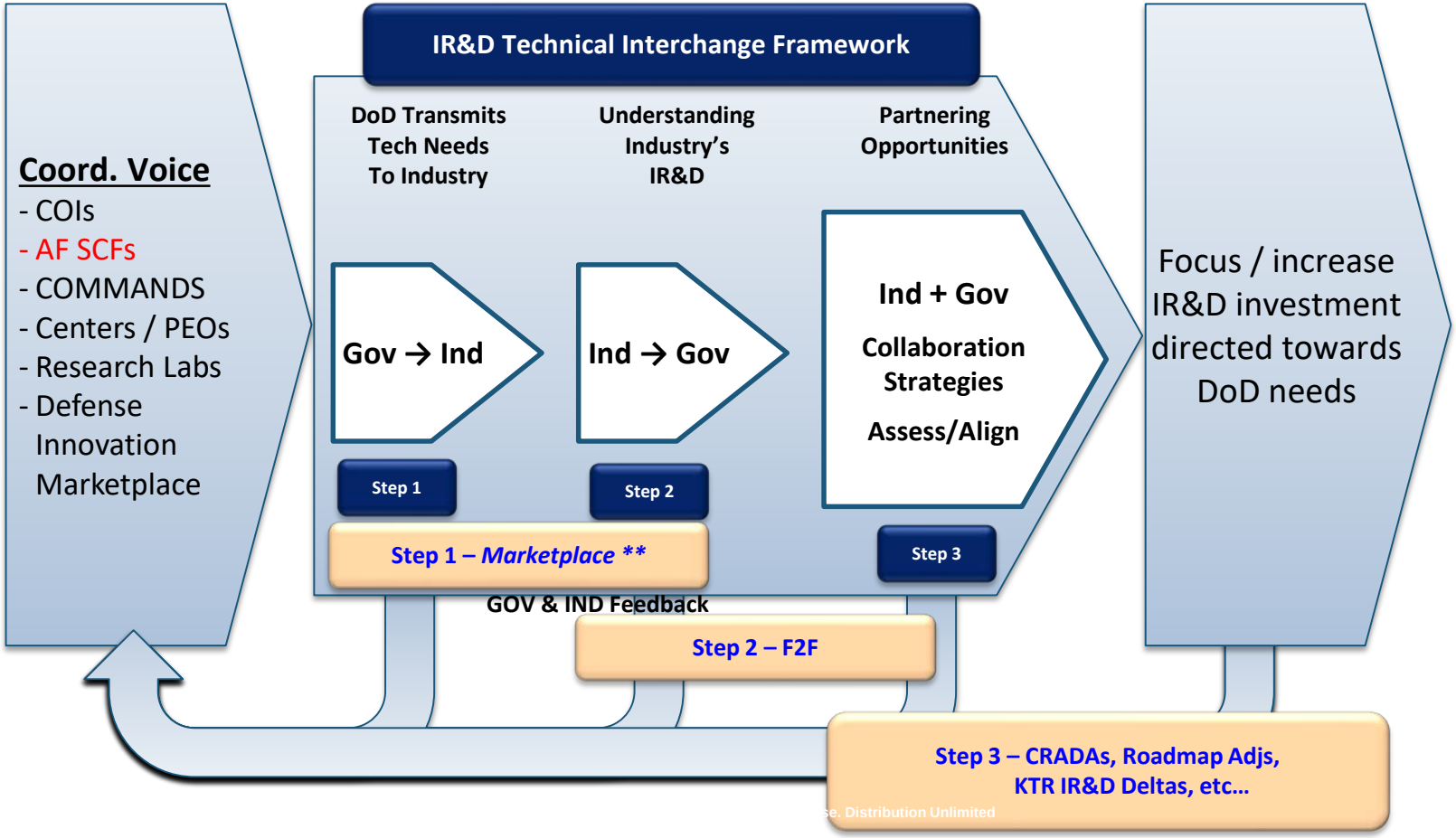
IMPLEMENTATION of the AF IR&D INTERCHANGE FRAMEWORK



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DoD/AF IR&D Technology Interchange Meetings

Jun 17	2017 HS COI IR&D TIM	Washington DC
Aug 17	2017 C4ISR & Cyber SCF IR&D TIM	Rome NY
Sep 17	2017 AFGSC NDO Innovation Summit	Barksdale AFB, LA
Dec 17	2017 Space SCF IR&D TIM	Los Angeles AFB CA
Mar 17	2018 Personnel Recovery SCF IR&D TIM	Wright Patterson AFB OH
April 18	2018 Weapons COI IR&D TIM	Kirtland AFB NM
May 18	2018 Nuclear Deterrence Operations SCF IR&D TIM	Kirtland AFB NM
Dec 18 or Jan 19	2018 Air Platforms SCFs IR&D TIM	San Antonio TX or Tampa FL
Apr 19	2018 Special Operations SCF IR&D TIM	SOCOM, Tampa FL

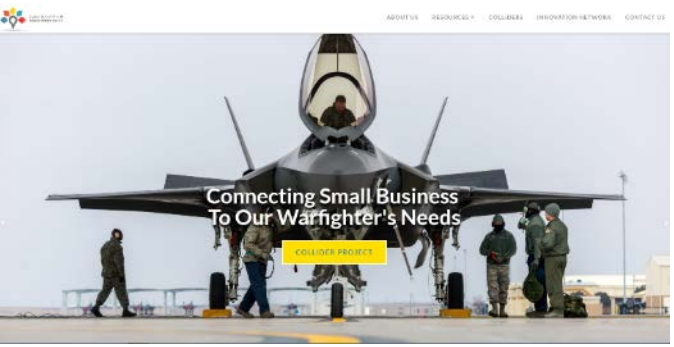
UNITED STATES AIR FORCE

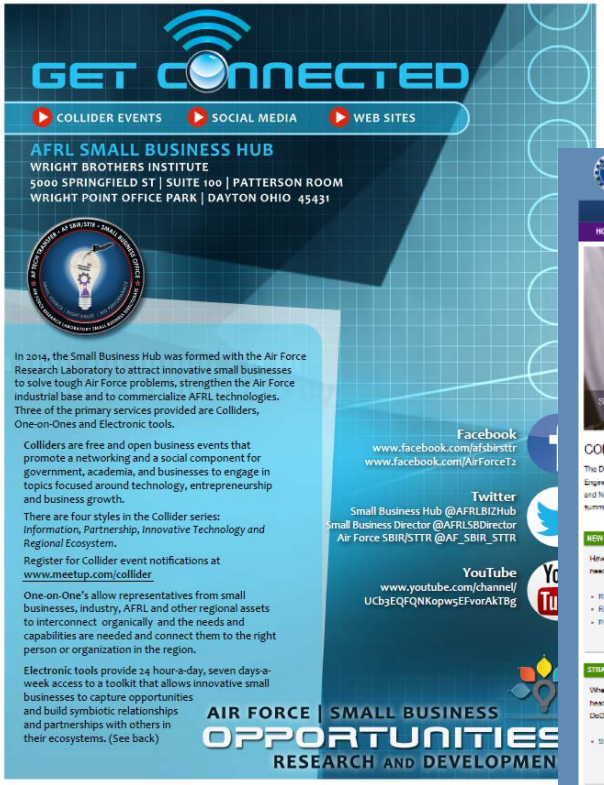
AIR FORCE RESEARCH LABORATORY SMALL BUSINESS DIRECTORATE

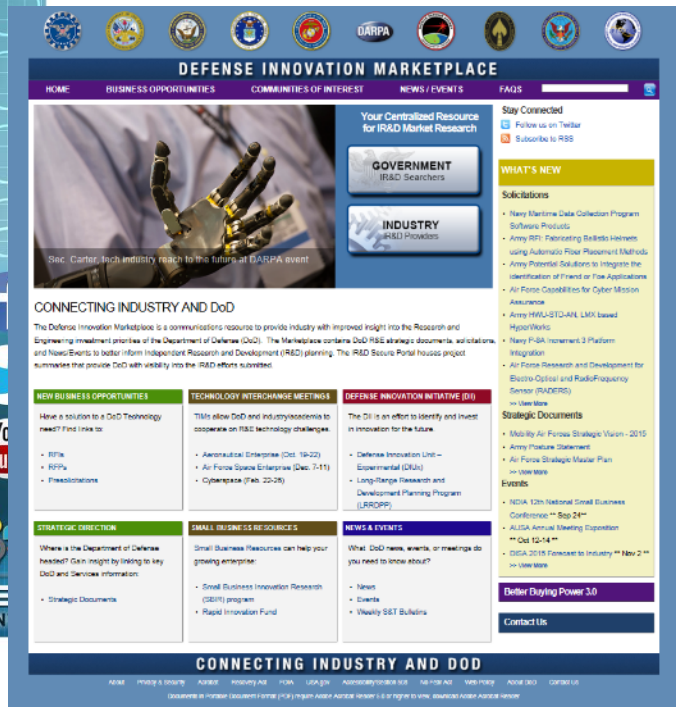
SMALL SOURCE | RIGHT VALUE | BIG PERFORMANCE

U.S. AIR FORCE

Connect with AF S&T







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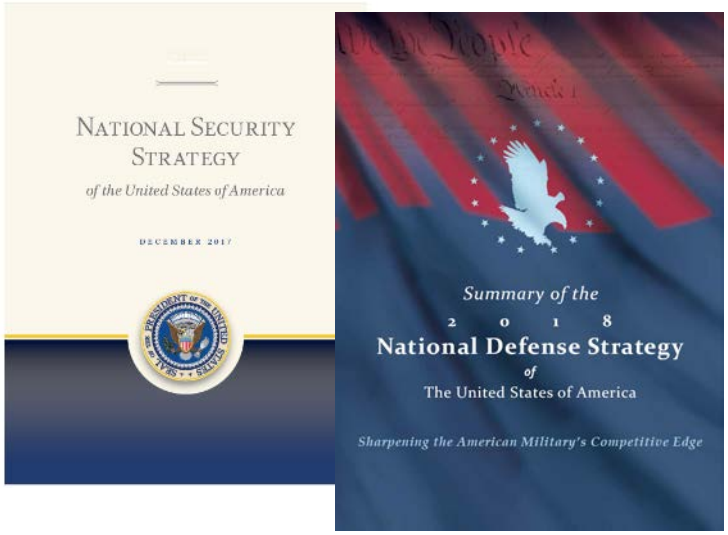
Summary

- S&T invests in a broad portfolio aligned to National Security Strategy and Air Force Strategy
- Continues to emphasize technologies that are revolutionary, relevant and responsive
- Strong AF & AFRL leadership commitment to sustain an IR&D dialogue with our Defense Industrial Base, Academia, Nontraditionals and Small Businesses



Questions?