

Headquarters U.S. Air Force

Integrity - Service - Excellence

FY19 Air Force President's Budget Request

Science and Technology Overview



U.S. AIR FORCE

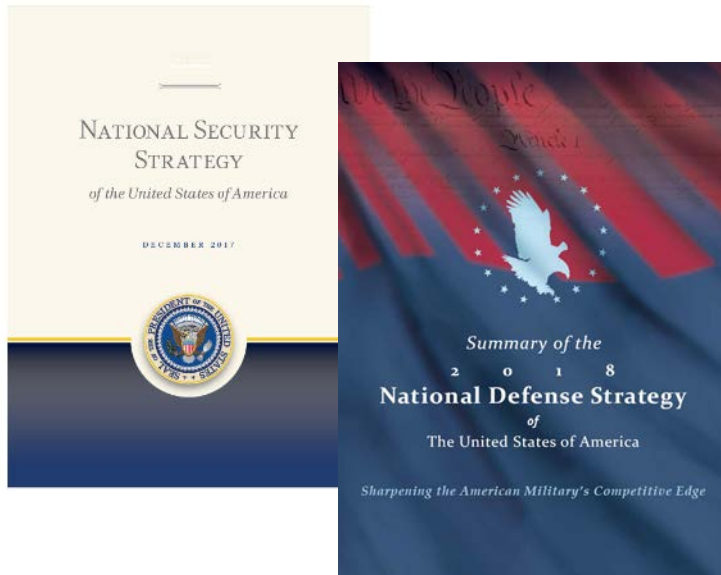
**Mr. Jeff H. Stanley
Deputy Assistant Secretary
Science, Technology and Engineering**



FY 19 President's Budget

U.S. AIR FORCE

- **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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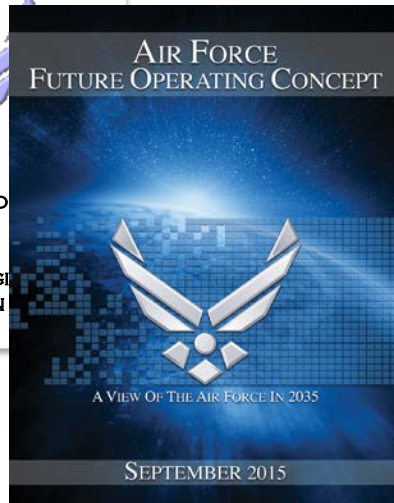


U.S. AIR FORCE

Air Force Strategy

AMERICA'S AIR FORCE:
A CALL TO THE FUTURE

SCIENCE & TECHNOLOGY
ANNEX
TO THE
USAF STRATEGIC
MASTER PLAN
MAY 2016



- 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 defensible 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***

■ **OUTCOMES / GOALS**

- **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



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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

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“Flavors of Experimentation”

Tech Push
Ops Pull
DP-based Push / Pull
Ops Pull
Tech Push

- 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

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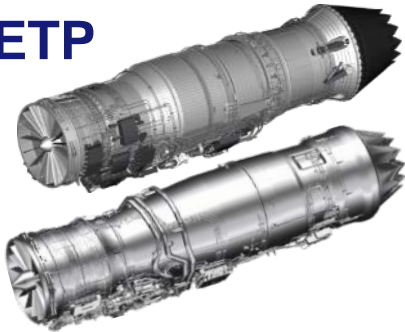
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Adaptive Engine Follow-on EMD Opportunities

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



- 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

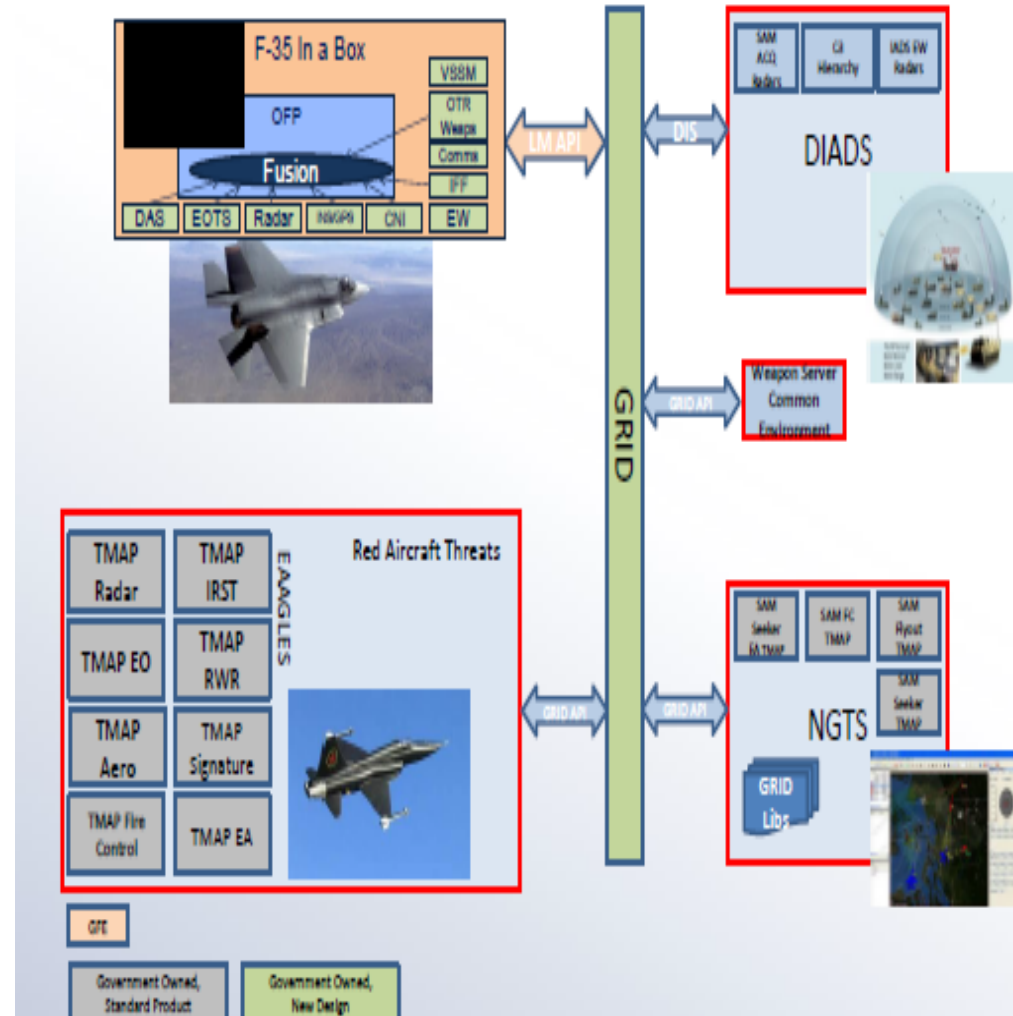




Joint Simulation Environment

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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 cost imposition 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

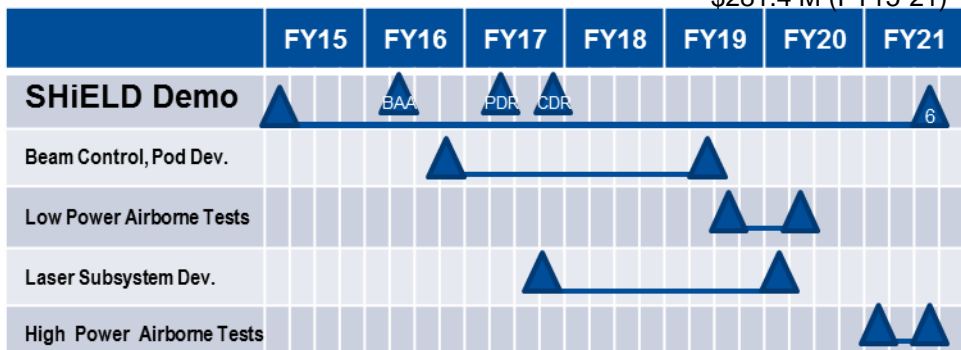
- Conduct a campaign of experiments to explore LCAAT, innovations and capabilities
- Validate cost and performance of key technologies
- Demo LCAAT in a capability context to the Warfighter



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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

Now

0-5 Years

Next

5-15 Years

Future

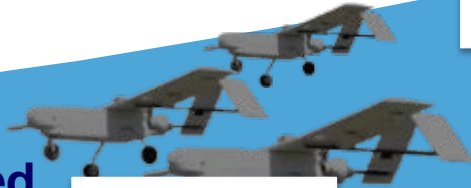
10-25 Years

Dependence on autonomy →

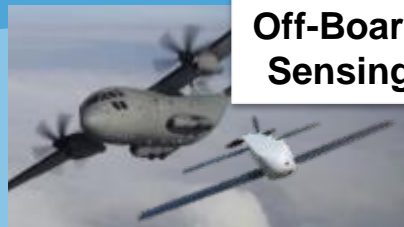
Unmanned Teaming

Manned + Unmanned Pairing

Manned Platform Replacement



Cooperative ISR



Off-Board Sensing



Persistent ISR



Cooperative Strike



Air-to-Ground



Penetrating Strike



DE Strike



Distributed, Cooperative SEAD



Tactical Refueling



Strategic Refueling



AirDrop



AirLand



Manufacturing Technology Vision Applied to Air Force Priorities

Next Generation Agile Manufacturing

Technology Efforts:

- Moving Manufacturing Left



- Cradle to Cradle Digital Thread



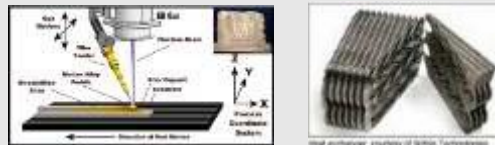
- Factory of the Future



- Responsive, Integrated Supply Base



Ex: Additive Manufacturing



Ex: Digital Thread



Select Applications

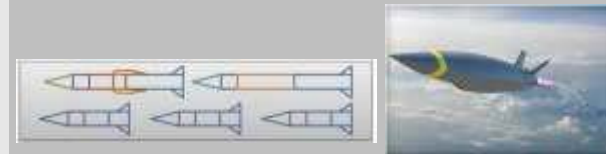
Advanced Turbine Engines



ISR Open Systems



Weapons



F-35



Complex of the Future





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STEM Education and Workforce Development Initiatives

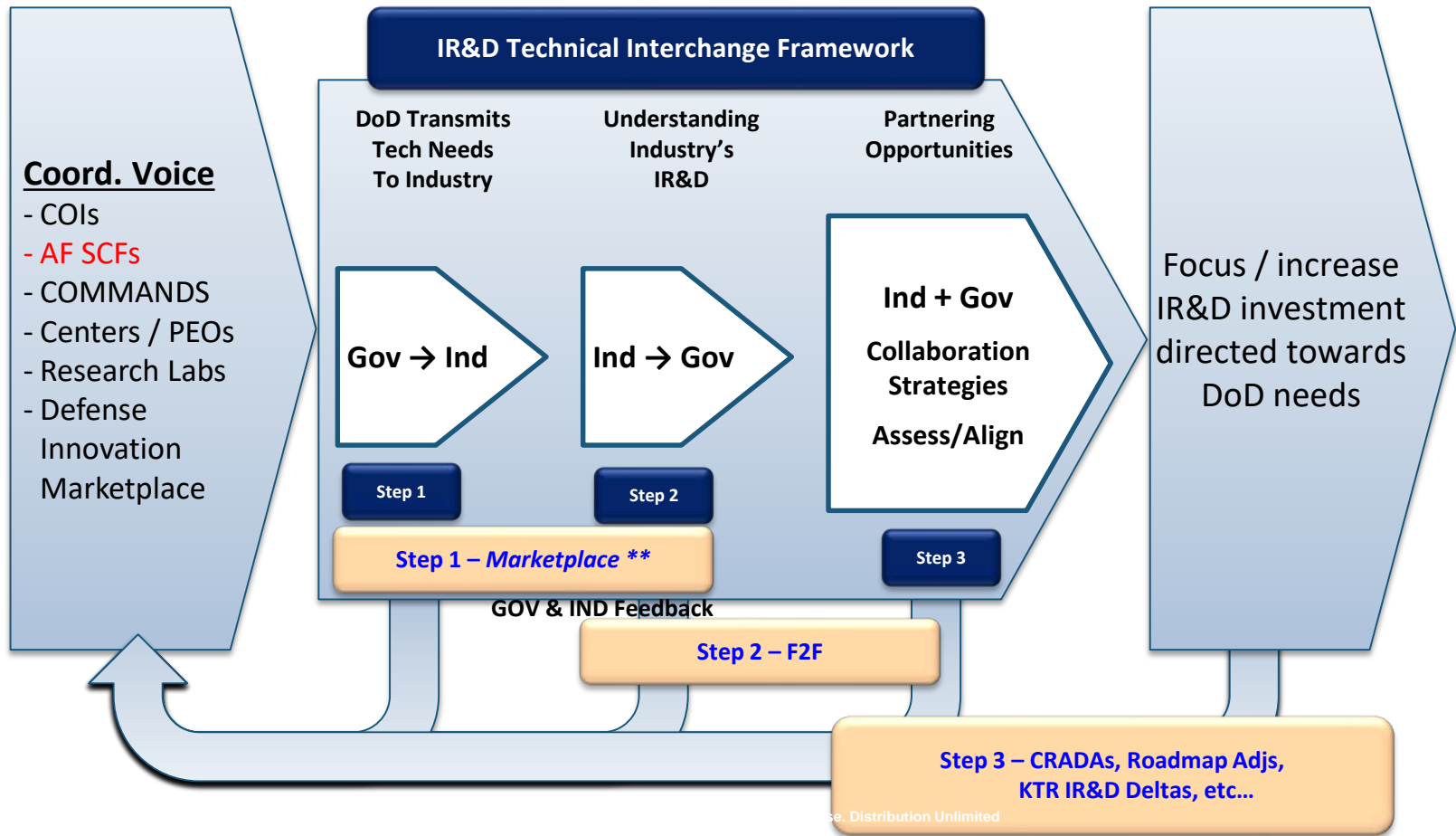
- **National Defense Science & Engineering Graduate (NDSEG) fellowship**
 - Air Force PE ~\$50M, award ~260 fellowships annually (\$6M PDM increase)
- **Science Mathematics And Research for Transformation (SMART)**
 - Sponsored 743 SMART scholars in past 12 yrs; 387 completed program, 85% working for 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

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UNITED STATES AIR FORCE



INDUSTRIAL STRATEGY INNOVATION GAME CHANGER SYNTHESIS MAKER-BUYER CONNECTIONS AGILE COMBAT NEXT GENERATION COMMERCIALIZATION
DATA LEGACY CYBER CONNEC COMMUNITY
EFFICIENT FUNDS HIGH TECH CONTRACT COMPOSITE DEPLOY PRODUCT VET
AWARD SUSTAIN INNOVATION MANUFACTURING RESEARCH TECHNOLOGY TRANSFER
INTELLIGENT INTEGRATION
INTELLECTUAL PROPERTIES BUSINESS PRACTICES

Small Business Programs



AIR FORCE RESEARCH LABORATORY SMALL BUSINESS DIRECTORATE
SMALL SOURCE | RIGHT VALUE | BIG PERFORMANCE



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Connect with AF S&T



The COLLIDER PROJECT

SMALL BUSINESS HUB AT WRIGHT BROTHERS INSTITUTE

Home Members Sponsors Photos Pages Discussions More [Join us!](#)

SMALL BUSINESS HUB AT WRIGHT BROTHERS INSTITUTE

Dayton, OH
Founded Aug 7, 2014

Members: 703
Group reviews: 24
Upcoming Meetups: 11
Past Meetups: 124
Our calendar

Organizers:
Jim Masonbrink, Bill Harrison, Lee McFawn, Ryan Clarke, Ryan Holboob

The Small Business Hub was created to link entrepreneurs, businesses, industry and governmental organizations in support of tech driven business growth, strengthening the Air Force industrial base and commercializing technologies for new market opportunities. It was established in 2014 as a dual effort by the Wright Brothers Institute (WBI) and the Air Force Research Lab (AFRL).

COLLIDERS

Free and open business events, known as *Colliders*, are hosted by the Small Business Hub to drive opportunity discovery and identify supporting resources. Attendance allows for engagement with fellow community members from business, government and academic circles.

Focused around technology, entrepreneurship, and business growth, there are four styles in the Collider Series, each of which offers a networking component. These include:

- **Information Series** - educational or learning sessions
- **Partnership Series** - networking, partnership opportunities, matchmaking, Q&A panels, and problem solving
- **Innovative Technology Series** - targets specific leading-edge research areas and technology needs
- **Regional Ecosystem Series** - cross-promotes events happening throughout the region

ONE-ON-ONES

While the Collider Project is a resource that enables connections to happen organically, the Small Business Hub also works to formally engage individuals and organizations through

GET CONNECTED

▶ COLLIDER EVENTS ▶ SOCIAL MEDIA ▶ WEB SITES

AFRL SMALL BUSINESS HUB
WRIGHT BROTHERS INSTITUTE
5000 SPRINGFIELD ST | SUITE 100 | PATTERSON ROOM
WRIGHT POINT OFFICE PARK | DAYTON OHIO 45431

In 2014, the Small Business Hub was formed with the Air Force Research Laboratory to attract innovative small businesses to solve tough Air Force problems, strengthen the Air Force industrial base and to commercialize AFRL technologies. Three of the primary services provided are Colliders, One-on-Ones and Electronic tools.

Colliders are free and open business events that promote a networking and a social component for government, academia, and businesses to engage in topics focused around technology, entrepreneurship and business growth.

There are four styles in the Collider series: Information, Partnership, Innovative Technology and Regional Ecosystem.

Register for Collider event notifications at www.meetup.com/collider

One-on-One's allow representatives from small businesses, industry, AFRL and other regional assets to interconnect organically and the needs and capabilities are needed and connect them to the right person or organization in the region.

Electronic tools provide 24-hour-a-day, seven days-a-week access to a toolkit that allows innovative small businesses to capture opportunities and build symbiotic relationships and partnerships with others in their ecosystems. (See back)

AIR FORCE | SMALL BUSINESS OPPORTUNITIES RESEARCH AND DEVELOPMENT

Facebook: www.facebook.com/afsbizsttr, www.facebook.com/AirForce2

Twitter: @AFRLBIZHub, @AFRLSBDirector, @AF_SBIR_STTR

YouTube: www.youtube.com/channel/UCb3EQQNk0pwsEFv0rAKtBg

DEFENSE INNOVATION MARKETPLACE

HOME BUSINESS OPPORTUNITIES COMMUNITIES OF INTEREST NEWS / EVENTS PAGES

Your Centralized Resource for IR&D Market Research

GOVERNMENT IR&D Searchers

INDUSTRY IR&D Providers

Sec. Carter, Tech industry reach to the future at DARPA event

CONNECTING INDUSTRY AND DoD

The Defense Innovation Marketplace is a communications resource to provide industry with improved insight into the Research and Engineering investment priorities of the Department of Defense (DoD). The Marketplace contains DoD R&E strategic documents, solicitations, and News/Experts to better inform independent Research and Development (R&D) planning. The IR&D Secure Portal houses project summaries that provide DoD with visibility into the IR&D efforts submitted.

NEW BUSINESS OPPORTUNITIES	TECHNOLOGY INTERCHANGE MEETINGS	DEFENSE INNOVATION INITIATIVE (DI)
Have a solution to a DoD Technology need? Find links to: <ul style="list-style-type: none"> • IR&A • RFPs • Press Releases 	Teams allow DoD and industry/academia to cooperate on R&E technology challenges. <ul style="list-style-type: none"> • Aeronautical Enterprise (Oct. 16-22) • Air Force Space Enterprise (Dec. 7-11) • Cybernetics (Feb. 20-28) 	The DI is an effort to identify and invest in innovation for the future. <ul style="list-style-type: none"> • Defense Innovation List - Experimental (DILx) • Long-Range Research and Development Planning Program (LRORPP)
STRATEGIC ORIENTATION	SMALL BUSINESS RESOURCES	NEWS & EVENTS
Where is the Department of Defense headed? Gain insight by linking to key DoD and Services information. <ul style="list-style-type: none"> • Strategic Documents 	Small Business Resources can help your growing enterprise. <ul style="list-style-type: none"> • Small Business Innovation Research (SBIR) program • Rapid Innovation Fund 	What DoD news, events, or meetings do you need to know about? <ul style="list-style-type: none"> • News • Events • Weekly SET Bulletin

CONNECTING INDUSTRY AND DoD

HOME IMAGE GALLERY ABOUT HISTORY AFRL USA 2014 ACRONYMS CONTACT US 1-800-452-7622 WEB FEED

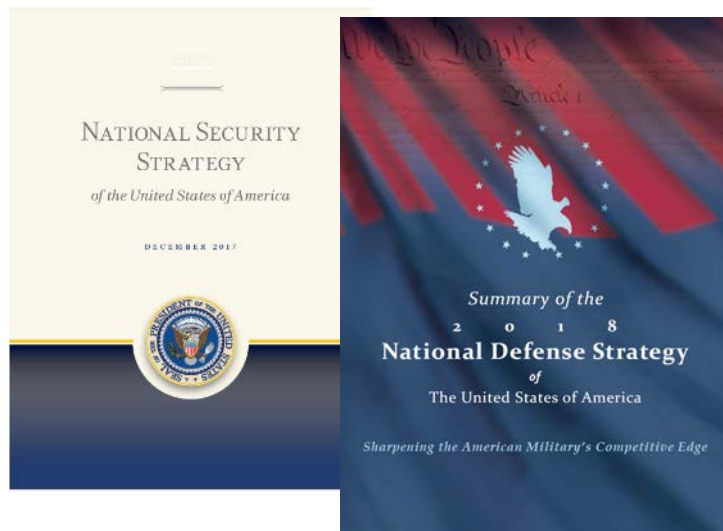
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Summary

U.S. AIR FORCE

- 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, Nontraditional and Small Businesses





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Questions?

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