

Headquarters U.S. Air Force

Integrity - Service - Excellence

AF Capability Requirements Driving S&T



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U.S. AIR FORCE



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What We Do As Part of the Joint Team

Global Vigilance, Global Reach, Global Power

Unique responsibilities for political and military leaders and the Nation: Irregular warfare or theater-level engagement – Full Spectrum

- **Survey the planet**
 - From air, space, & cyberspace
 - Detect & analyze enemy activity, capability & intent
- **Range the planet**
 - Threaten & hold those targets at risk, deter & dissuade the enemy
 - Strike, supply, show of force
 - Kinetic / non-kinetic
- **Command & Control our activities**
- **Assess our global effects, across domains**



Fly, Fight and Win as an Integral Part of the Joint Team

Integrity - Service - Excellence



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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



Air Force S&T Strategy

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- Summarizes S&T vision, tenets and priorities
- Signed by SECAF and CSAF, Dec 2010

AF S&T Program Priorities

1. Support the current fight while advancing breakthrough S&T
2. Execute a balanced, integrated S&T Program
3. Retain / shape the critical competencies
4. Address the highest priority capability needs of the Air Force



DoD and AF S&T Priorities

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SECDEF S&T Priorities

- **Autonomy ***
- **Human Systems**
- **EW/EP ***
- **Counter A2/AD Capabilities**
- **Low-cost, Small Footprint Ops**
- **Engineered Resilient Systems**
- **Cyber S&T ***
- **Data-to-Decisions**
- **Tailored and Adaptive Capabilities**
- **Integrated Partnership Capabilities**
- **Counter WMD**

SECAF S&T Priorities

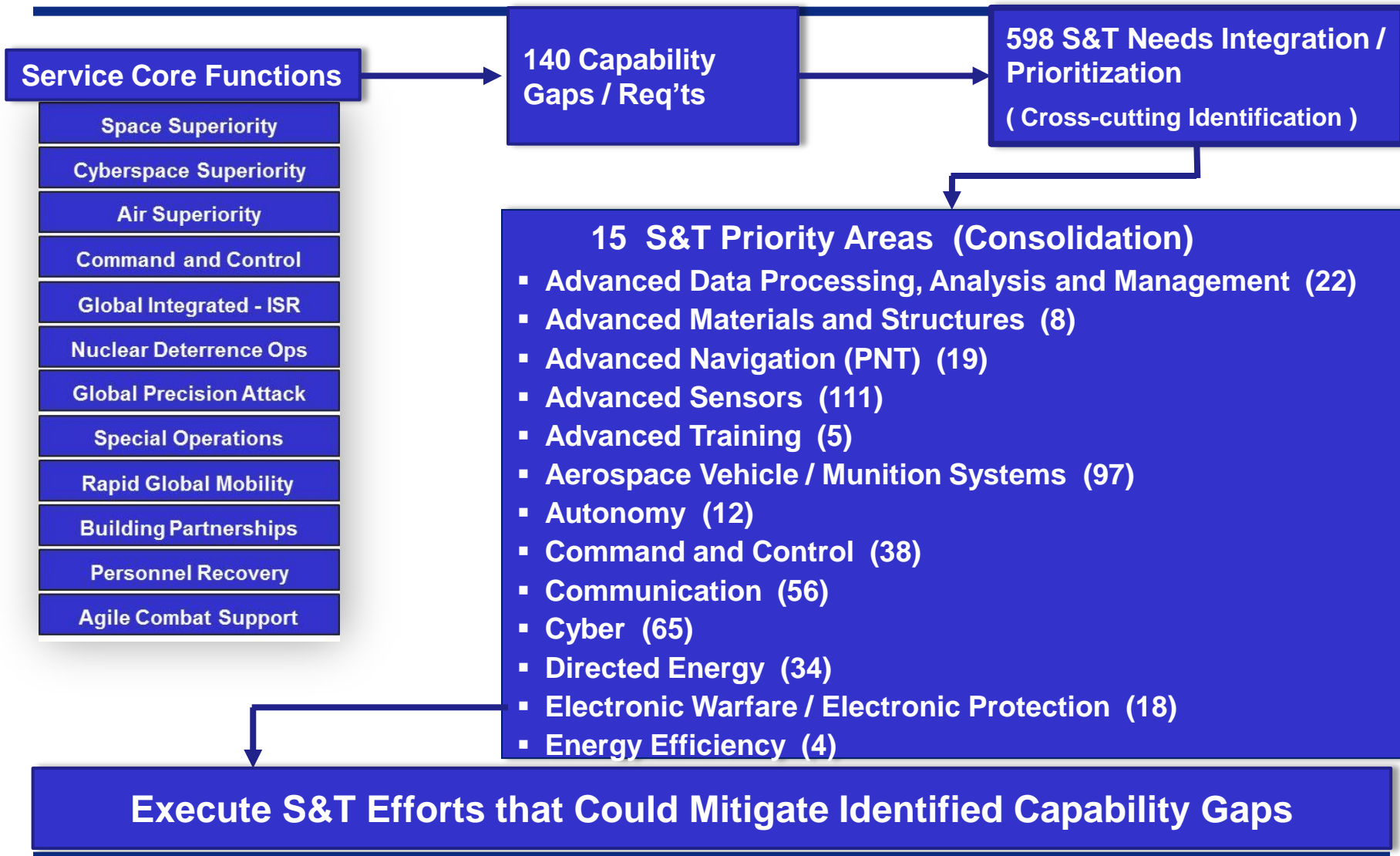
- **Develop autonomous systems and human performance augmentation**
- **Enable long-range precision strike**
- **Improve sustainment, affordability, and availability of legacy systems**
- **Reduce energy dependency**
- **Reduce cyber vulnerabilities while emphasizing mission assurance**
- **Robust SA to enhance decision-makers' understanding -- ISR & PED**
- **Support needs of nuclear enterprise**

* AF Lead



Capability Development and S&T Needs

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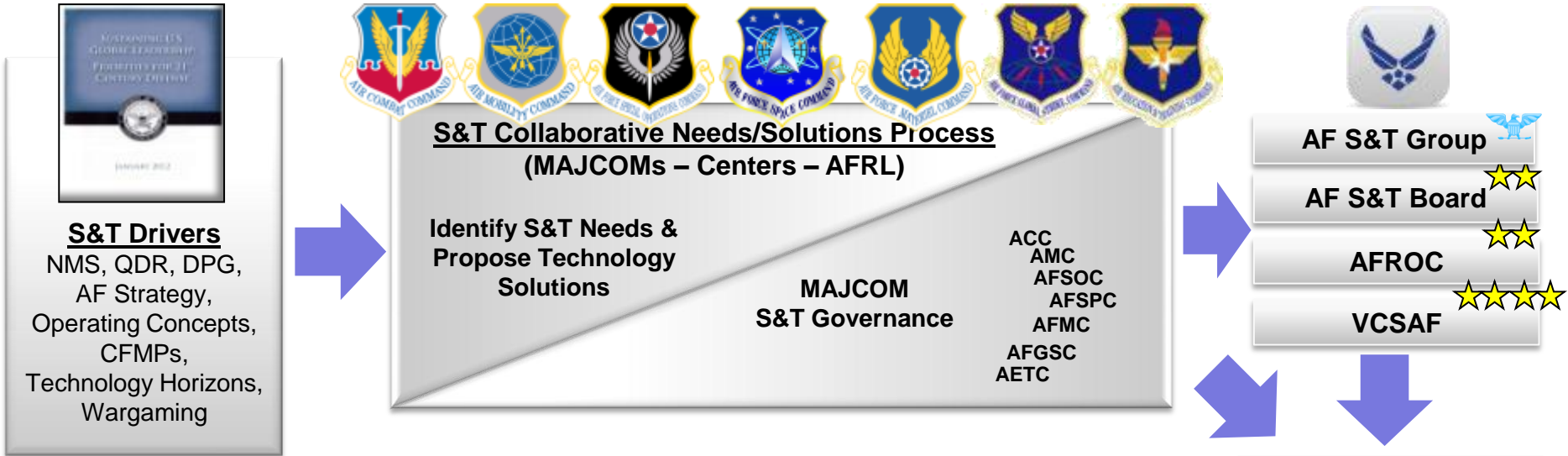




Air Force S&T Planning Process

Identifying Highest Priority Capability Needs

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- Core Function Master Plans – AF-level planning
 - COCOM needs represented in CFMPs
- Capability Collaboration Teams – MAJCOMs, Centers, AFRL
- Applied Tech Councils – MAJCOM-level S&T Governance
- S&T Group/Board and AFROC – AF-level S&T Governance

Align Air Force S&T with Air Force and DoD Priorities

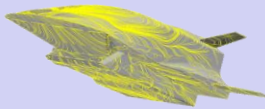


Support to New Defense Strategy

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High Speed Strike Weapon



Hypersonic Tech



Supersonic Small Turbine

HIGH-SPEED



CHAMP JCTD



HPM



Laser Technologies



5th Gen Weapons

WEAPONS



Adaptive Engine



F-35 Thermal Mgt

ENERGY EFFICIENT PLATFORMS



EW Plus EW System of Systems

ELECTRONIC WARFARE



SCOTI Cyber



PCPAD-X



Advanced ISR



Comm & C2



Passive ISR Contested Environ

C4ISR

AUTONOMY

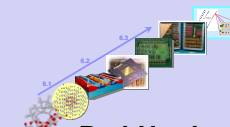


Autonomy



ANGELS

Ground SSA



Rad-Hard Electronics

SPACE

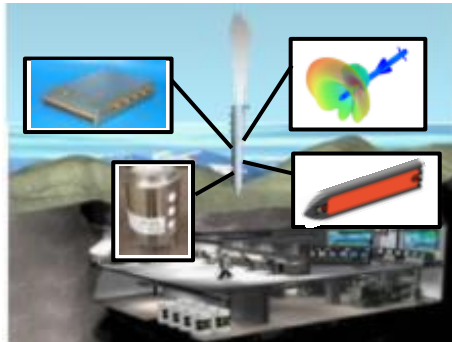


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Air Force Flagship Capability Concepts

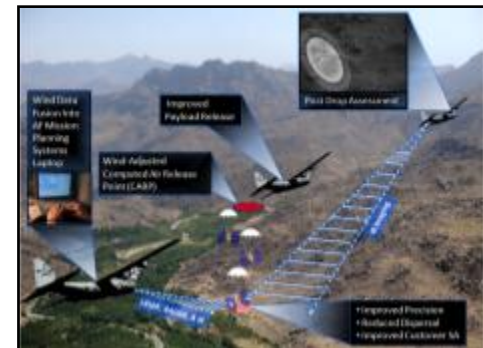
- AF-level S&T Programs addressing high priority warfighter needs with focus on transitioning capabilities
 - High Velocity Penetrating Weapon (HVPW)
 - Selective Cyber Operations Tech Integration (SCOTI)
 - Precision AirDrop (PAD)

HDBT and a/c loadout



Mission assurance

Reduce deployment



VCSAF APPROVED

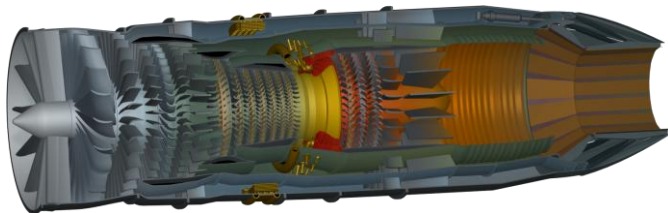


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Air Force High Visibility Technology Demonstrations

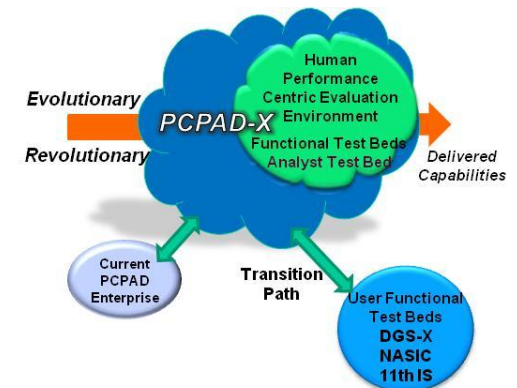
- AF S&T demonstration programs providing affordable technology options to the warfighter across Services
 - Adaptive Engine Technology Development (AETD)
 - High Speed Strike Weapon (HSSW)
 - Planning, Collecting, Processing, Analysis, Dissemination Experimental(PCPAD-X)

Energy Efficiency and Performance



Speed, Range, and Survivability

Resolve data/maintain decision making advantage



Balanced capability and affordability across options



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Cyber DoD and AF S&T Priority

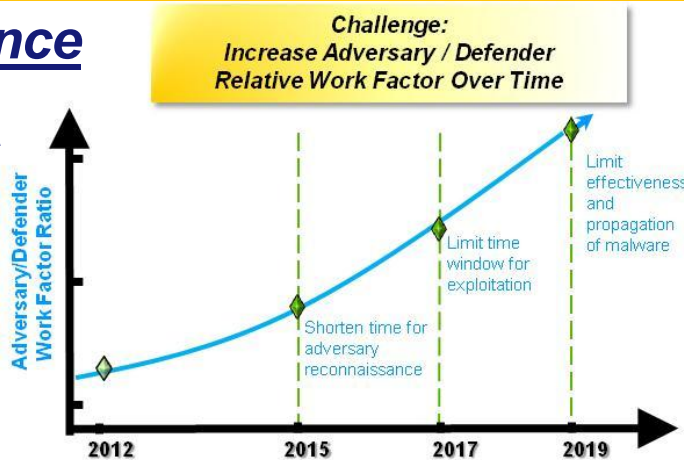
Provide agile cyber operations and resilient infrastructure to assure military missions

Goal: Mission Assurance

*Agile Cyber Operations
Resilient Defenses
Trusted Foundations*

Uncertainties

Any element of the cyber infrastructure may be compromised and manipulated; much of which we do not own



Approaches

Cyber & mission situational awareness

Deflect, resist, absorb attacks

Next gen cyber warrior dev

Dynamically changing network architectures to avoid attacks

Trusted design, verification, and fab of ICs; Trusted boot and secure attestation



Kinetic, cyber, and combined missions cyber dependency strengthened



Electronic Warfare DoD and AF S&T Priority

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Full Spectrum Electronic Warfare Enables Access with Increased Survivability

Goal: Control the EM
spectrum during
military action

EA/EP
DE

Uncertainties

*Rapidly evolving capabilities
around the world*



Approaches

Cognitive/Adaptive

*Coordinated/Distributed/Net
work-enabled systems*

*Preemptive/proactive
effects*

*Broadband/multispectral
systems*

*Open architectures/
Adv EP techniques*

Enable US Operations in Anti-Access/Access Denied (A2/AD) Environments



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Autonomy DoD and AF S&T Priority

System capability and freedom to self-direct to achieve mission objectives but not necessarily in isolation from humans

Goal: Shared Perception Towards Mission Success

*Human – Agent Teaming
Agent – Agent Teaming*

Uncertainties

*Dynamic and Complex
Mission Requirements*

*Dynamic and Complex
Operational Environments*



Approaches

*Human/Autonomous System
Interaction and Collaboration*

*Scalable Teaming of Autonomous
Systems*

*Machine Reasoning and
Intelligence*

*Testing and Evaluation,
Verification and Validation*

Autonomous Systems Reduce Friendly Exposure in A2/AD Environments



Planning, Collecting, Processing, Analysis, Dissemination Experimental (PCPAD-X)

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AF S&T Priority

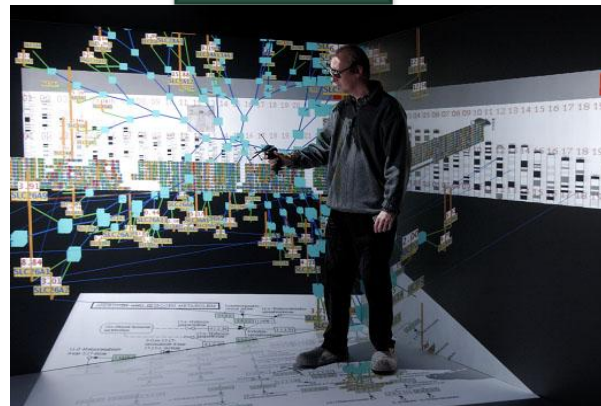
Improve ability to process, exploit, and disseminate information

Goal: Enhance analyst performance

Approaches

Data Analysis

Immersive Analyst Environment



Data management

Automated tracking and analysis

Increase ability of analyst to manage objects, activities, and events

Automated text analysis

Uncertainties

New data sources and access/volume of data

Holes in data/signature databases

Physical and cognitive variation

Increase capability of analyst to manage data and information



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Affordability and Sustainment AF S&T Priority

Affordability throughout the life cycle a fundamental principle guiding our investment approaches from the outset

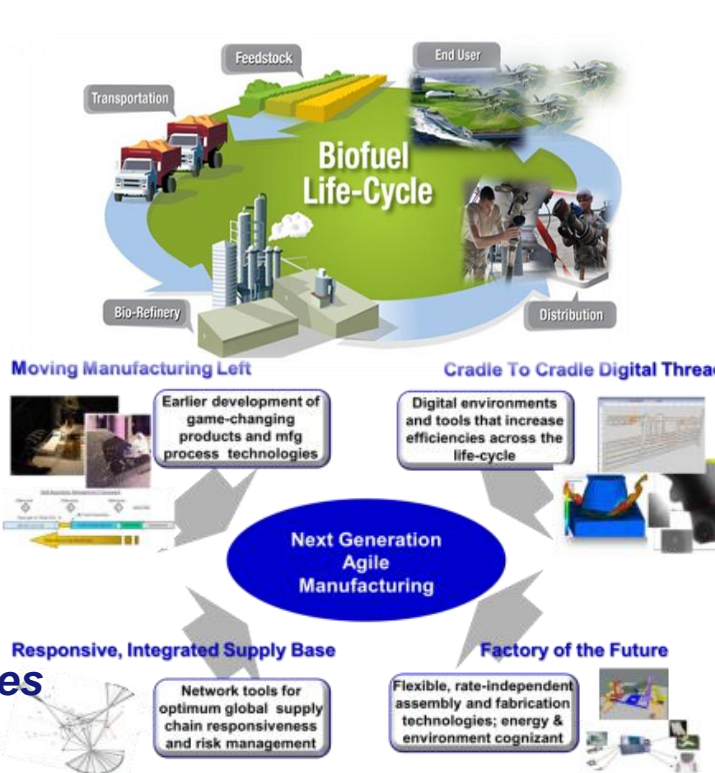
Goal: Reduce cost throughout system

*Development costs
O&M costs
Disposal costs*

Uncertainties

Costs of new technology difficult to predict

Switching costs and timelines driving mission risks



Approaches

Reduce energy consumption/costs

Apply technology to address legacy fleet sustainment cost drivers

Focus on affordability early in S&T applied research and advanced development

Autonomous Systems Reduce Friendly Exposure in A2/AD Environments



Diversity of AF Basic Research Activities

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Nation is counting on us

Hypersonics Research

Identify, model and exploit critical physical phenomena in turbulent and high-speed flows.

Potential Impact

Enable efficient propulsion and structural systems for long range hypersonic strike in access denied environments.



Funding of world's only quiet hypersonic wind tunnel to examine aerodynamic characteristics of hypersonic vehicle.

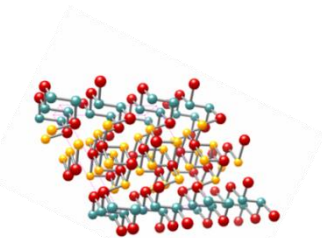
Rest of the world is out in front

Superconductivity

New superconductor with $T_c = 23$ K found! Explore layered metallic systems for optimal synergy between magnetic, structural & superconducting instabilities.

Potential Impact

Enables compact airborne power generation and gyrotron magnet for airborne high power microwaves.



Naturally occurring sulfur-bearing mineral Canfieldite ($Ag_8(Sn,Ge)S_6$) and related crystallographic structure.

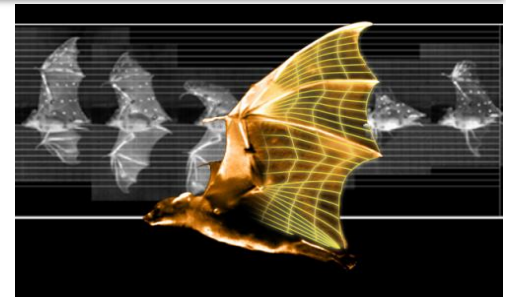
Potential Game Changers

Bio-Sensing of Magnetic Fields

Discover the receptor mechanism(s) for biological magnetic sensitivity, especially at field strengths comparable to the geomagnetic background.

Potential Impact

Enable long-range navigation in a GPS denied environment by orientation to the geomagnetic field.



Bio-inspired research to develop multi-agent cooperative systems operating in dynamic, uncertain adversarial



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AFRL Technology Days

Populate Defense Marketplace and Dayton Defense websites with data by 1 Jun



Framework: AFRL Focus Areas

- Human Performance*
- Next Gen Aerospace*
- Affordability & Sustainment*
- Cyber & Communications*
- EW/EP*
- Space & Nuclear*
- C2 & ISR*
- Weapons*
- Basic Research*

Venue: Hope Hotel
Date: 23-24 July with potential Industry only on 25 July

Note: Kirtland venue date still in progress

Joint industry/gov't facilitated sessions



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Summary

- Air Force Depends on the S&T Program to discover, develop, and demonstrate high-payoff technologies across all domains – *Tech Push*
- S&T Program Priorities, Program Tenets, and Processes aligned to turn science and knowledge into militarily relevant capabilities – *Tech Pull*
- AF S&T must continue to deliver technology options to the warfighter in the near, mid, and far-term even as opportunities to transition technology are reduced with pressures on the Department's budget



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BACKUPS



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Revolutionary Innovation Technology Push

New Global Horizons Study in Work



**Human
Performance
Augmentation**

**Rapid
Response**

**Highly
Adaptable
Autonomous
Systems**

**Cyber
Resiliency**

**Robust
Situational
Awareness
ISR - PED**

Long Range Strike

**Reduce
Energy
Dependency**