Headquarters U.S. Air Force

Integrity - Service - Excellence

AF Capability Requirements Driving S&T



Dr. David E. Walker Deputy Assistant Secretary (Science, Technology, and Engineering)

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



AF S&T Vision



Create compelling air, space, and cyber capabilities for precise and reliable Global Vigilance, Reach and Power for our Nation

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Air Force S&T Strategy



- 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

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 decisionmakers' understanding -- ISR & PED
- Support needs of nuclear enterprise

* AF Lead



Execute S&T Efforts that Could Mitigate Identified Capability Gaps



- 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

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Solutions

Responsive to Needs FCCs

JCTDs

Adv Tech Demos Hi-Viz S&T Programs

S&T Base Program



Support to New Defense Strategy

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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)





Mission assurance

Reduce deployment

Air Force



VCSAF APPROVED



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



Cyber DoD and AF S&T Priority

Provide agile cyber operations and resilient infrastructure to assure military missions



Kinetic, cyber, and combined missions cyber dependency strengthened

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Electronic Warfare DoD and AF S&T Priority

Full Spectrum Electronic Warfare Enables Access with Increased Survivability

<u>Goal: Control the EM</u> <u>spectrum during</u> <u>military action</u>

EA/EP DE



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

<u>Goal: Shared Perception</u> 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

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Planning, Collecting, Processing, Analysis, **Dissemination Experimental (PCPAD-X)** AF S&T Priority **U.S. AIR FORCE**

Improve ability to process, exploit, and disseminate information

Goal: Enhance analyst *performance*

Data Analysis

Uncertainties

New data sources and access/volume of data

Holes in data/signature databases

Physical and cognitive variation

Immersive Analyst Environment



<u>Approaches</u>

Data management

Automated tracking and analysis

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

Automated text analysis

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



Autonomous Systems Reduce Friendly Exposure in A2/AD Environments

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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

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 multiagent cooperative systems operating in dynamic, uncertain adversarial



AFRL Technology Days

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



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

Note: Kirtland venue date still in progress



Framework: AFRL Focus Areas

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

Joint industry/gov't facilitated sessions





- 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



BACKUPS



Revolutionary Innovation Technology Push

