AF Science and Technology
Overview

Mr. Bill McCluskey SAF/AQRT
Deputy International S&T
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Air Force 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
What We Do – Core Missions

- Air and space superiority, cyber assurance
  - Air superiority foundational to joint operations & American way of war
  - Domains likely to be most contested in future
- Intelligence, surveillance, reconnaissance (ISR)
  - Maximizing battlespace awareness
  - ~60 RPA patrols, ~1,200 hrs full-motion video per day
- Rapid global mobility
  - 1M+ airlift & tanker sorties in support of Mideast ops
  - One airlift sortie every two minutes, 24/7/365
  - 97% aeromedical evacuation survival rate
- Global strike
  - Hold any target on planet at risk
  - Two-thirds of America’s nuclear triad
- Command & control
  - Integrates them all

Global Vigilance, Global Reach, Global Power for the Joint Team

Integrity - Service - Excellence
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

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
Technology Focus Areas

Next Gen Aerospace Systems
- Air Vehicles
- Turbine Engines
- Hypersonics
- Unmanned Systems

Weapons
- Directed Energy
- High Speed Strike
- High Velocity Penetrating Munitions
- Flexible Weapons

Space and Nuclear Deterrence
- Space Access
- Novel Payloads/Platforms
- SSA
- Advanced Experiments

Intelligence, Surveillance, & Reconnaissance (ISR)
- Advanced Sensors
- Human-Centered ISR
- Synchronized Operations

Command & Control, Cyber, Communications (C4)
- Processing, Exploitation, and Dissemination
- Cyber
- Space Communications

Affordability & Sustainment
- Manufacturing Technology
- Sustainment
- Energy/Fuels

Electronic Warfare / Electronic Protection (EW/EP)
- EW Plus
- Distributed EW
- Infrared countermeasures

Human Performance
- Autonomy
- Aerospace Physiology & Toxicology
- Training & Decision Making Tech
Major International S&T Engagements

Top Multilateral S&T Forums
- NATO Science and Technology Organization
- The Technical Cooperation Program (TTCP)
- Five Powers Air SNR

Key Bilateral S&T Engagements
- Great Britain
- Australia
- Japan
- Canada
- Germany
- Singapore
- Korea
- Taiwan
- India
- Brazil

AFRL currently leveraging $300M+ in foreign partner resources
Projects with Spain
Top 5 Active Grants ($436K) in FY15 as of April 2015

Universidad Politécnica de Madrid, Prof V. Theofilis
*Hydrodynamic and aeroacoustic instabilities on elliptic cone in high super-sonic and hypersonic flow*

Universidad Del Pais Vasco - Euskal Herrikko Unibertsittea
Prof. A. Rubio
*Science & Emerging Technology of 2D Atomic Layered Materials and Devices*

Real Academia de Ciencias y Artes De Barcelona
Prof S. Gladysz
*Imaging through Turbulence*

Universidad Politecnica de Cataluna, Prof. C. Masoller
*Semiconductor laser complex dynamics: optical neurons to optical rogue*

ICFO-the Institute of Photonic Sciences, Prof. M. Ebrahim-Zadeh
*Compact, High-power, Agile Laser Source for Mid-Infrared Science*

*Generation of tunable coherent radiation in the mid-infrared and THz spectrum based on optical parametric oscillators in combination with difference frequency generation in new nonlinear materials.*
### Current USAF-Spain Agreements

#### Air Force Office of Scientific Research (AFOSR) Activities
- 17 Active Grants with AFOSR and 10 Universities/Institutes in Spain

#### Foreign Comparative Testing (FCT) Projects
- Photonic Enhancements to the Science & Technology in EW Systems
  - Navy Research Lab, USAF Research Lab and DAS Photonics (Spain)
- Increase Spectrum Agility to EW and SIGINT Systems
- Enable countermeasures while threat systems are in still acquisition mode
- Broader surface & airborne spatial/spectral mission options

#### Master Agreements
- Engineer and Scientist Exchange Program (ESEP)
  - Signed: February 2007, Expires February 2027
- Master Data Exchange Agreement for the Mutual Development of Weapons Systems
  - Signed: June 1980, no expiration
- Sonseca Seismic Monitoring MOU (Program MOU)
  - Signed: January 1996, no expiration

UNCLASSIFIED
Proposed Areas of Cooperation

AFRL Space Vehicles Directorate (AFRL/RV)
- GEO Observations with Latitudinal Diversity
- Micro-Gravity, Two Phase Flow Research

AFRL Directed Energy Directorate (AFRL/RD)
- Non-linear Optics

AFRL Human Effectiveness Directorate (AFRL/RH)
- Cognitive Science
- Cognitive Modeling and Human Behavior Representation
- Autonomy
- Pilot inflight Psychophysiological Assessment
- Hex-chrome Lifetime Exposure Monitoring
Proposed Areas of Cooperation Cont.

- AFRL Human Effectiveness Directorate (AFRL/RH) cont.
  - Aircraft Oxygen System Containment Assessment
  - High Fidelity Biodynamic Spinal Injury Modeling for Aircraft Ejection
  - Speech and Language Technologies
  - Live Virtual and Constructive Training
  - Nanotechnology

- AFRL Information Directorate (AFRL/RI)
  - High Performance Computing
Capt Rachel Kolesnikov-Lindsey (2012-2014)
- Air Force Research Laboratory Materials and Manufacturing Directorate (AFRL/RX)
- ESEP Participant at INTA (National Institute for Aerospace Technology) Research area focus: DIANA UAS Target Aircraft, MILANO Strategic ISR UAS, Fabrication Process
- Interviewed by a Spanish Radio Station
- HUGE success

- Air Mobility Analyst/Chief Scientist, AMC/A9 Analyses, Assessments & Lessons Learned
- ESEP Participant to work at Área de planificación y control de la Subdirección, Tecnología e Innovación in Madrid
- Currently at Defense Language Institute in Washington, DC
- Departs for Spain summer 2015 for a two year tour

The USAF welcomes engineers and scientists from Spain to participate in the ESEP in the US!
Summary

- Air Force S&T is balanced between meeting warfighter current needs and discovering/developing new game-changing technologies.

- International cooperation with our trusted partners accelerates S&T results, leverages resources, and facilitates interoperability.

Maintaining our technological advantage is vital to ensuring freedom of access and action in air, space and cyberspace.