US Air Force Office of Scientific Research (AFOSR)

Overview and International Programs

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Discover, shape, and champion basic science that profoundly impacts the future Air Force

• Manage the basic research investment for the Air Force
  – Basic research is the foundation of all scientific discovery
  – Leads to revolutionary new concepts & technology

• Find and fund the most dynamic & promising world-class researchers in academia, industry, & government
  – 325 intramural research projects at AFRL
  – 1215 research grants at 209 U.S. universities in 47 states
  – 348 research grants in 33 countries in 6 continents

• Ensure timely transitions of research results
AF International Office at a Glance

North America (ION)
Arlington, VA & Dayton, OH

Europe (EOARD)
London, U.K., 10 IPOs

Asia (AOARD)
Tokyo, Japan, 9 IPOs

S. America (SOARD)
Santiago, Chile, 2 IPOs

GMT – 5:00
GMT – 0:00
GMT + 8:00
GMT – 4:00

EOARD
168 Projects
$13.9M

AOARD
145 Projects
$9.4M

SOARD, 27 Projects

AFOSR/RT
41 Projects,
$6.9M

SOARD, 27 Projects

AFOSR/RT
41 Projects,
$6.9M

IOARD
4 Projects
$1.6M

FY16 AFOSR/IO Research Grants

Number of Support

Window-on-Science
Conf. Support
Why Engage International R&D?
(2016 vs 2010 Global R&D Funding)

Size of the circles reflects the relative amount of annual R&D spending

- 80% of world’s researchers are outside of the U.S
- China is second-largest performer accounting for 20% of global R&D
- U.S. accounts for 26%

Global Opportunities
- Large national and regional investments
- EU Horizon 2020 ~ $15B/yr in R&D funding
- Korea & Taiwan nanoscience ~ $3B/yr
- Germany’s high investment in R&D ~109B/yr
- Increased openness to collaborate
- Growth in less developed regions
- “Instant” world-class facilities

Australia
Same level over the past 5 years

Scientists & Engineers/Million People

Gross Domestic Product (GDP)
International Office S&T Outreach

- **Research Excellence**
- **DoD/AF Relevance**
- **Potential Impact to Warfighter**

**Promote Awareness**
- Data Analytics
- Journal Articles
- Conferences
- Workshop
- Exploratory Visits

**DoD/AF Relevance**
- Windows on Science
- Research Grants
- Conference Support
- Regional Initiatives

**Engagement**
- Program Reviews
- Collaborations
- Joint Publications
- ESEP Exchange

**Identify and capitalize on emerging trends**
- HyShot scramjet – Partnership with Australia
- Dr. A. Geim received 2010 Nobel Prize in Physics, EOARD PI since 2008

**Transitions / Deliverables**
- Transition to AF S&T portfolio
- Follow-on grant or MURI
- 6.2 Project Agreements
- 6.2 transition to TDs
- SPO and/or Field Use

**Build Relationships**
- Strengthen partnerships
- Leverage foreign resources
- Partner with Services and agencies

**AF Mission & International Guidance**
- Fill tech gaps/ Avoid scientific surprise
FY16 Funded Projects by Country
Countries = 43; Projects = 384; Amount ~ $32M

- U.K., 84
- Australia, 60
- Italy
- Japan
- South Korea
- Germany

Funding Amount ($)

- U.K., 84
- Australia, 60
- Italy
- Japan
- South Korea
- Germany

# of projects

- U.K., 84
- Australia, 60
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- Germany

Countries = 43; Projects = 384; Amount ~ $32M
FY16 Research Funding at Australian Institutions

Funding in 2010 = $1.5M
Funding in 2015 = $4.0M
Funding in 2016 = $5.0M (60 projects)

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<tr>
<th>Institutions Supported in FY16</th>
<th># of Projects</th>
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<td>UNIVERSITY OF TECHNOLOGY SYDNEY</td>
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Institutions: 60 projects
FY16 Projects in Australia
(A few sample projects)

Total Projects = 61
Total Funding = $4.8M

THE UNIVERSITY OF QUEENSLAND, Prof. J. Wiles, Human-robot interactions: Social micro-abilities

UNIVERSITY OF TECHNOLOGY SYDNEY, Prof. I. Aharonovich, Novel single photon sources for new generation of quantum communications.

UNIVERSITY OF NEW SOUTH WALES, Prof. M. Pagnucco, Eliciting emotions from tactile surfaces and kinetic agents.

LA TROBE UNIVERSITY, Prof. F. Ashley, Synthetic Electric Microbial Biosensors.

MACQUARIE UNIVERSITY, Prof. R. Mildren, Scaling diamond Raman lasers and beam combiners into the kilowatt.

UNIVERSITY OF NEWCASTLE, Prof. P. Dastoor, Integration of Peptides into OTFT-based Printable Sensors.

NATIONAL ICT AUSTRALIA LTD, Prof. F. Chen, Trust measurement using multi-modal behavioral analysis & trust calib.

AUSTRALIAN NATIONAL UNIVERSITY, Prof. L. Xie, The Anatomy of Social Media Popularity.

QUEENSLAND UNIVERSITY OF TECH Prof. E. Waclawik, Nano-Lights: Nonlinear Quantum Dot-Plasmon.

MONASH UNIVERSITY, Prof. I. Zuckerman, A decision-theoretic model of interaction between people & device.

UNIVERSITY OF MELBOURNE, Prof. S. Prawer, High temperature superconductivity in diamond.

CURTIN UNIVERSITY OF TECHNOLOGY, Prof. I. Bray, The Strength of Chaos: simulation of resonant electron scatter.

UNIVERSITY OF TASMANIA, Prof. B. Kang, Intrusion Detection Systems with Live Knowledge System.

UNIVERSITY OF ADELAIDE, Prof. P. Medwell, Application of Mild combustion to gas turbines.

UNIVERSITY OF BALLARAT, Prof. K. Ting, Algorithms that defy the gravity of learning curve.
IO Global Initiatives

- **U.K.** - Leverage in Space Sciences
- **Germany** - Leverage in hypersonics
- **Korea Initiative** – Leveraging cyber-info sciences & nanosciences
- **Taiwan Initiative** - Leveraging nanotechnology
- **Australia Initiative II** - Focused on hypersonics
- **Australian Initiative** - Focused on autonomous systems
- **Argentina Initiative** - Focused on computer sciences
- **Chile** – Leverage research in space sciences & materials
- **Mexico Initiative** – Focused on basic sciences
- **U.K.** - Leverage in Space Sciences

Approved for FY17
Planned
Proposed
Australian Autonomy Initiative

• Focuses on collaborative research activities in autonomous systems between Australian and U.S. institutions
  – AOARD has partnered with Australian DST
  – Integrated proposals from Australia and U.S. are required
  – Australian gov’t will fund the Australia-based university partner
  – AOARD funds the U.S.-based partner, plus some seed projects in Australia

• Strong support from AFRL Directorates (RQ, RH)

• FY17 kick-off year
  – $500K investment each from AOARD and DST Group
  – Plus up:
    • $75K from Dr. Ben Knott, AFOSR
    • $50K from Dr. Jason Wong, ONRG Tokyo
  – AOARD & DST select participant pairs & invite proposals
Australian Autonomy Initiative

• Out-years
  – Minimum of $500K each per year, up to 5 years (2021)
  – Potential for expanded ONR and ARO involvement

• Benefits AFRL’s overall autonomy program leveraging large Australia S&T investment in autonomy
  – 4-6 three-year projects per year at $500K+

• 4 Australian, 3 US university teams, 3 gov’t. labs
  – RMIT
  – University of Queensland
  – Queensland University of Technology
  – UNSW
  – DST Adelaide
  – 711th HPW/RHXS
  – UC San Diego
  – Indiana University
  – NRL
  – Wright State Univ.

Dr. M. Lech, Royal Melbourne Institute of Technology: Fostering positive team behaviors in human-machine teams through emotion processing: Adapting to the operator’s state

Dr. P. Bruza, Queensland University of Technology: Contextual Models of Information Fusion
How to Apply for a Grant?  
(General Process)

– Researchers submit white papers (1-2 page) to POs that describe their research, impact, high potential for breakthroughs, …, etc.

– Promising white paper lead to request for full proposals

– Proposals merit reviewed for *technical excellence, relevance, and budget reality*

– Individual grants may be awarded up to 3-years in duration

More info on how to apply for a grant including our S&T interests are in our current Broad Agency Announcement (BAA):

http://www.afosr.af.mil or http://www.grants.gov/

Contact Info:
AOARD – afosr.aoard@us.af.mil
EOARD – eoard.orgbox@us.af.mil
SOARD – theamericas@us.af.mil
Summary

- Discover and support world-class research
- Accelerate achievements & transitions
- Identify and capitalize on emerging trends
- Strengthen partnerships and collaborations
BACK-UP
Global Research in Autonomy
(A few sample projects)

Universitaet der Bundeswehr Muenchen
Prof. M. Gerdts
Model-Predictive Control Strategies for Distributed Multi-Agent Systems

Universit Degli Studi di Roma, Prof. M. Falcone
Efficient numerical methods for optimal control problems.

Imperial College. Dr. H. Krapp, Develop bioinspired self-navigating autonomous systems with visual cue.

Orta Dogu Teknik Universitesi Prof. Murat Koksalan, Develop algorithm for UAV route planning in continuous space.

Eotvos University, Hungary, Dr. T. Vicsek, Autonomously control large-scale flock of drones

Hanyang University, Prof. I.H. Suh, Autonomous Learning & Human Intention for Enhancing Trust

University of Queensland, Dr. J. Wiles Human-robot interactions: Social micro-abilities

Dr. T. Shima, Technion—Israel, Develop cooperative evasion and pursuit applicable to groups of autonomous vehicles

– AFOSR/IO Funded Countries
How we make a difference...

A few sample transitions

AFOSR Sponsored 76 Nobel Laureates

Rotorcraft Brownout
Joint Precision Air Drop
Chip-Scale Silicon Photonic Device
Anubis—Prosecute fleeting targets
Command & Control Network Assurance
Autonomous Agents for Air Traffic Control
Speckles—Persistent ISR
Rotorcraft Brownout
MAX POWER — Directed Energy Counter-IED
WebTAS — Web-enabled Temporal Analysis System
Blue Devil Block I — Near Real Time Multi-INT ISR
Sand Dragon — IED, Mobile Communication Detection
Airborne Hostile Detection System — IED, VHF/UHF PTT Direction Finding

HyShot scramjet — Partnership with Australia

Autonomous Agents for Air Traffic Control: Czech Technical University