



U.S. AIR FORCE



# AFRL

## How to Work with the Air Force Office of Scientific Research

**BENNETT L. IBEY, PROGRAM OFFICER**

**AIR FORCE OFFICE OF SCIENTIFIC RESEARCH | 5 APRIL 2023**





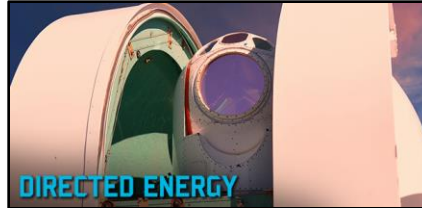
# Air Force Research Laboratory At-a-Glance

## AEROSPACE SYSTEMS

Aerospace Vehicles, Control, Power & Thermal Management, High Speed Systems, Rocket Propulsion, Turbine Engines



AEROSPACE SYSTEMS



DIRECTED ENERGY

Laser Systems, Weapons Modeling, Simulation & Analysis, High Power Electromagnetics (HPEM), Directed Energy and Electro Optics for Space Superiority

## DIRECTED ENERGY

## HUMAN PERFORMANCE

Training, Adaptive Warfighter Interfaces, Bioeffects, Bioengineering, Aerospace & Operational Medicine



HUMAN PERFORMANCE



SPACE VEHICLES

Advanced Space Resilience Technologies, Space Communication & Navigation Technologies, Space Awareness and Command & Control, Space Environment

## SPACE VEHICLES

## MATERIALS & MANUFACTURING

Structural Materials, Functional Materials, Manufacturing Technology, Support of Operations



MATERIALS & MANUFACTURING



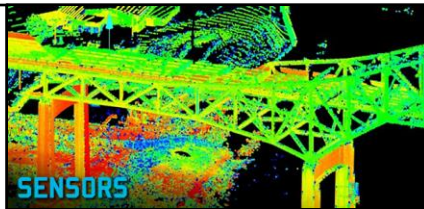
INFORMATION

Processing & Exploitation, Connectivity & Dissemination, Autonomy, Command & Control and Decision Support, Cyber Science and Technology

## INFORMATION

## SENSORS

Radio Frequency (RF) Sensing, Electro Optical (EO) Sensing, Spectrum Warfare, Trusted & Resilient Mission Systems, Multi-domain Sensing Autonomy, Enabling Sensor Devices & Components



SENSORS



MUNITIONS

Munitions Airframe, Guidance, Navigation & Control, Terminal Seeker Sciences, Modeling & Simulation Evaluation Sciences, Ordnance Sciences

## MUNITIONS

## EXPERIMENTATION

Capability & Technology Prototyping



SDPE



AFOSR

Engineering & Information Sciences, Physical & Biological Sciences

## BASIC RESEARCH



# Who we are



A small organization with a big mission ...

to Discover, Shape, and Champion Bold, High Risk, High Reward Basic Research to profoundly impact the United States Air Force and Space Force



200 personnel – Scientists & Engineers and Business Professionals

- Active duty Air Force and Space Force
- All-service veterans
- Renowned academics
- Passionate civil servants



A global network of talent

We partner, grow and discover with a global network of the greatest scientific minds in the world, pulling them into our ecosystem, launching career trajectories, and strengthening their contributions to national defense.

**We are the Air Force Research Laboratory/Air Force Office of Scientific Research!**





## **AFOSR Mission** Discover, Shape, and Champion Basic Research that profoundly impacts the future Air and Space Force

**Span of influence** - 61 World-class Subject Matter Experts manage 1,350 **Domestic** research projects at 212 Universities and small businesses in 47 states. **Global discovery/partnerships:** 300+ projects in 43 countries

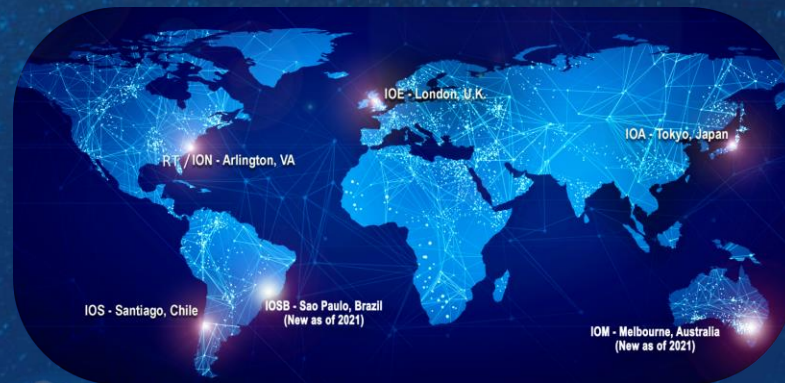
Strengthen and shape the **Science and Engineering talent pipeline** through targeted outreach, research, internships, and fellowship programs to include a focus on Historically Black Colleges and Universities and Minority Serving Institutions. Fund DAF's K-12 STEM Outreach at 30+ bases supporting 500+ competitions!

### DAF link to Academia

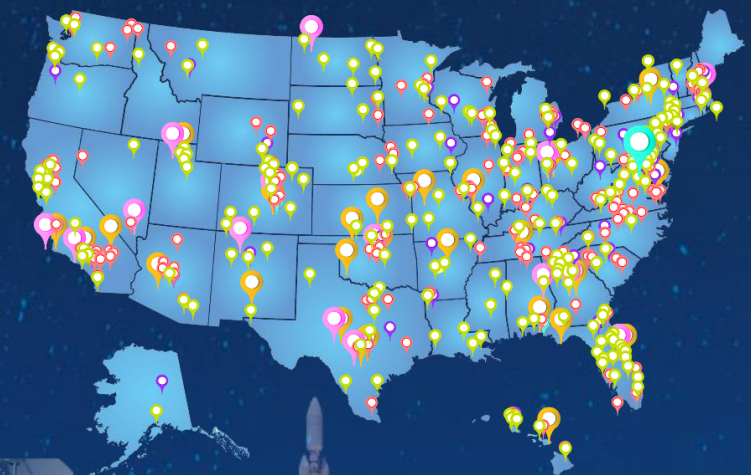


Typical Annual 6.1 Core Budget (~\$330M)  
Typical Annual OSD-controlled 6.1 Budget (~\$160M)

### Global Footprint and Reach



### K-12 STEM Outreach Impact





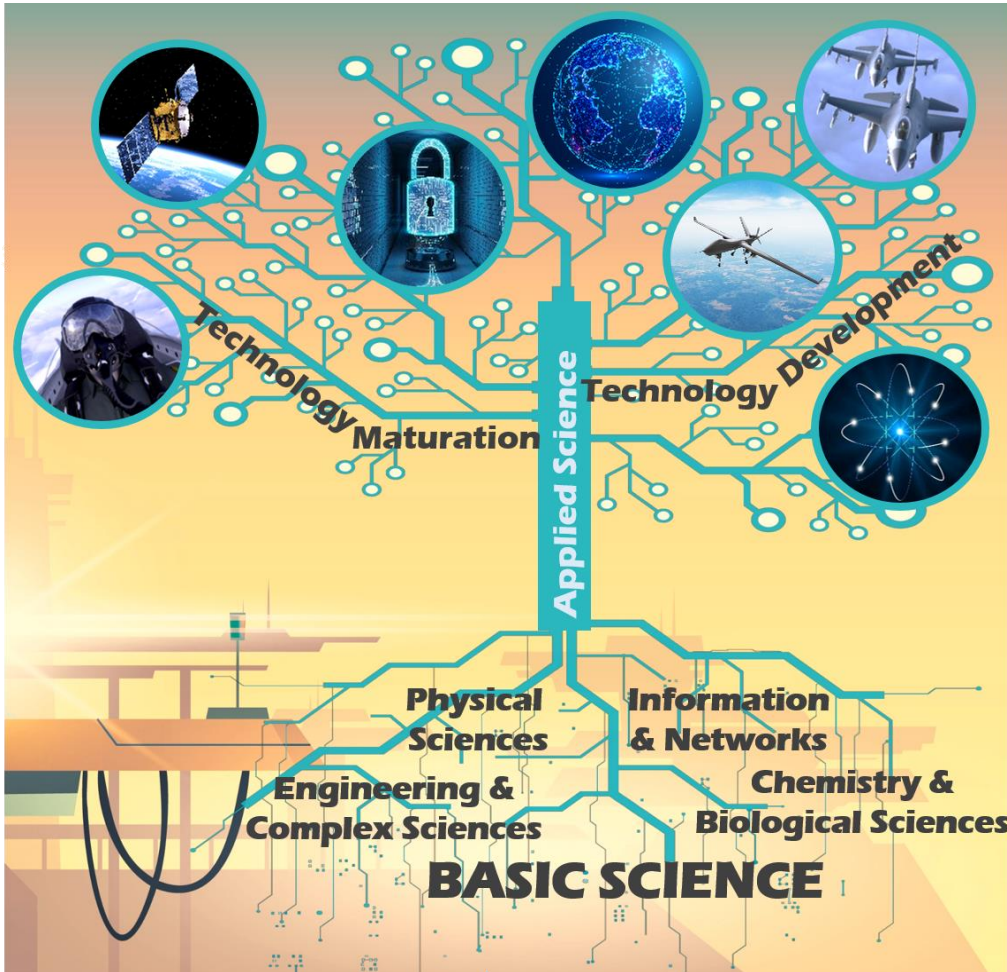


# AFOSR Science Portfolios

Engineering and Complex Systems	Information and Networks	Physical Sciences	Chemistry and Biological Sciences	International Office
Dynamic Materials and Interactions	Computational Cognition and Machine Intelligence	Aerospace Materials for Extreme Environments	Biophysics	Asian Office of Aerospace R&D Tokyo
GHz-THz Electronics	Computational Mathematics	Atomic and Molecular Physics	Human Performance and Biosystems	European Office of Aerospace R&D London
Energy, Combustion, and Non-Equilibrium Thermodynamics	Dynamical Systems and Control Theory	Electromagnetics	Mechanics of Multifunctional Materials and Microsystems	Southern Office of Aerospace R&D Santiago
Unsteady Aerodynamics and Turbulent Flows	Dynamic Data and Information Processing	Laser and Optical Physics	Molecular Dynamics and Theoretical Chemistry	North America - Arlington
High-Speed Aerodynamics	Information Assurance and Cybersecurity	Optoelectronics and Photonics	Natural Materials and Systems	
Aerospace Composite Materials	Mathematical Optimization	Plasma and Electro-Energetic Physics	Organic Materials Chemistry	
Multiscale Structural Mechanics and Prognosis	Science of Information, Computation, Learning, and Fusion	Quantum Information Sciences		
Propulsion and Power	Trust and Influence	Physics of Remote Sensing		
Agile Science of Test and Evaluation (T&E)	Complex Networks	Space Science		
	Cognitive and Computational Neuroscience	Ultrashort Pulse Laser-Matter Interactions		
		Condensed Matter Physics		



# Why we do what we do



"BASIC RESEARCH LEADS TO NEW KNOWLEDGE. IT PROVIDES THE SCIENTIFIC CAPITAL. IT CREATES THE FUND FROM WHICH THE PRACTICAL APPLICATIONS OF KNOWLEDGE MUST BE DRAWN.

NEW PRODUCTS AND NEW PROCESSES DO NOT APPEAR FULL-GROWN. THEY ARE FOUNDED ON NEW PRINCIPLES AND NEW CONCEPTIONS, WHICH IN TURN ARE PAINSTAKINGLY DEVELOPED BY RESEARCH IN THE PUREST REALMS OF SCIENCE."

— SCIENCE, THE ENDLESS FRONTIER

Unleashing Science Against Our Adversaries





## S&T 2030 Strategy

OBJECTIVE III; Deepen and Expand the Scientific and Technical Enterprise

AFOSR is looking to enhance the recruitment of national and global talent, advancing workforce development, creating a stronger pipeline of technology-proficient military airmen and guardians, and implementing agile workforce practices will significantly strengthen Air Force and Space Force scientific and technical expertise.



# Reinforces Existing Priorities/Demand Signals

## Conduct bold, high risk, high reward research

- Existing emphasis area: Space
- Emerging Challenges: Climate, Arctic
- Strategic demand signals:
  - OSD modernization priorities
  - S&T 2030
- Directors Research Initiative
- Portfolio assessments

## Bolster Space Force basic research

- New portfolio: Astrodynamics
- Space University Research Initiative (SURI)





## Reinforces Existing Priorities/Demand Signals continued

- **Strengthen human talent pipeline: emphasize HBCU/MSI and STEM**
  - \$1M increase to HBCU Program
  - New STEM coordinator
  - Develop new Human Capital strategy
- **Expand partnerships: both existing and new**
  - Internal: Technical Directorates, AFWERX, SpaceWERX and more!
  - External: National Science Foundation, National Reconnaissance Office, DARPA and others!
- **Accelerate the use of data analytics**
  - Business Analytics
  - Science Analytics



# Growing Our Investment in Space Basic Research

## Space Force Superiority and Warfighting



The infographic features a central circular seal of the United States Space Force, Department of the Air Force. The seal contains a stylized white arrow pointing upwards, a globe, and the text "UNITED STATES SPACE FORCE" and "DEPARTMENT OF THE AIR FORCE". A superhero figure in a red cape stands on a rocky surface in the foreground, looking up at the seal. Surrounding the seal are seven circular callouts, each representing a research area:

- Satellite Swarms**: A cluster of small satellite icons.
- Quantum Communication**: A diagram of quantum entanglement with particles and wavy lines.
- Antifragile Systems**: A hammer labeled "Robust" and a dandelion labeled "Antifragile".
- Self-healing Machines**: A close-up of a metallic, humanoid face.
- Servicing Satellites**: A satellite in space with a servicing vehicle nearby.
- Artificial Intelligence**: Two human profiles with a digital grid overlay.
- Multi-Domain C2**: A network diagram with nodes and connecting lines.

**AIR & SPACE FORCE BASIC SCIENCE**





# Capacity Building



# ARL



HOWARD UNIVERSITY





# AFRL Minority Leaders – Research Collaboration Program

AFRL Minority Leaders Program (MLP) initiated in 2005

MLP evolved into the AFRL Minority Leaders –Research Collaboration Program (ML-RCP) in 2013 –2021 (16 year effort in total)

*ML-RCP remains largest HBCU/MSI research initiative in USAF and USSF*

Single largest endeavor with HBCUs/MSIs funded by the Air Force and Space Force

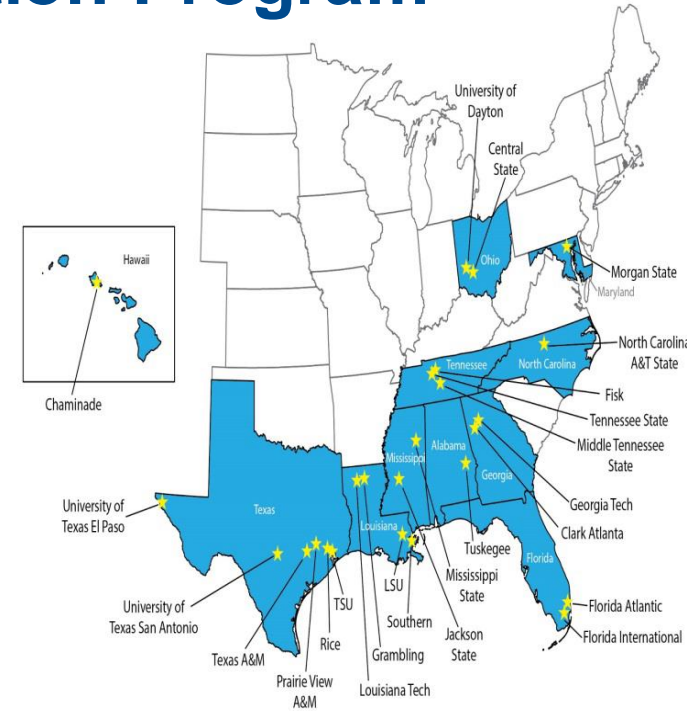
Over 700 students and 200 professors participate to date

Energizes students across the U.S. to pursue to STEM degrees

79 research efforts across five technical directorates including: Materials Lab, Sensors Lab, Information Lab, Aerospace Lab and Human Effectiveness Lab

Students and faculty have access to unique lab facilities and world class experts

Expanding the program in 2021 with the Office of the Under Secretary of Defense (OSD) to educate and reach out further







# Funding Opportunity Announcement for HBCU/MSI's

DoD Research and Education Program sponsored by  
USD(R&E)

- **Solicitation open to all HBCU/MSI's, closed on 16 August 2021**
- **Equipment range from \$100,000 to \$600,000**
- **DoD intends to award approximately \$30M**
- **Three applications per institution**
- **AFOSR looking to do our own Broad Agency Announcement (BAA), working out the details**





We are AFOSR and  
we science!

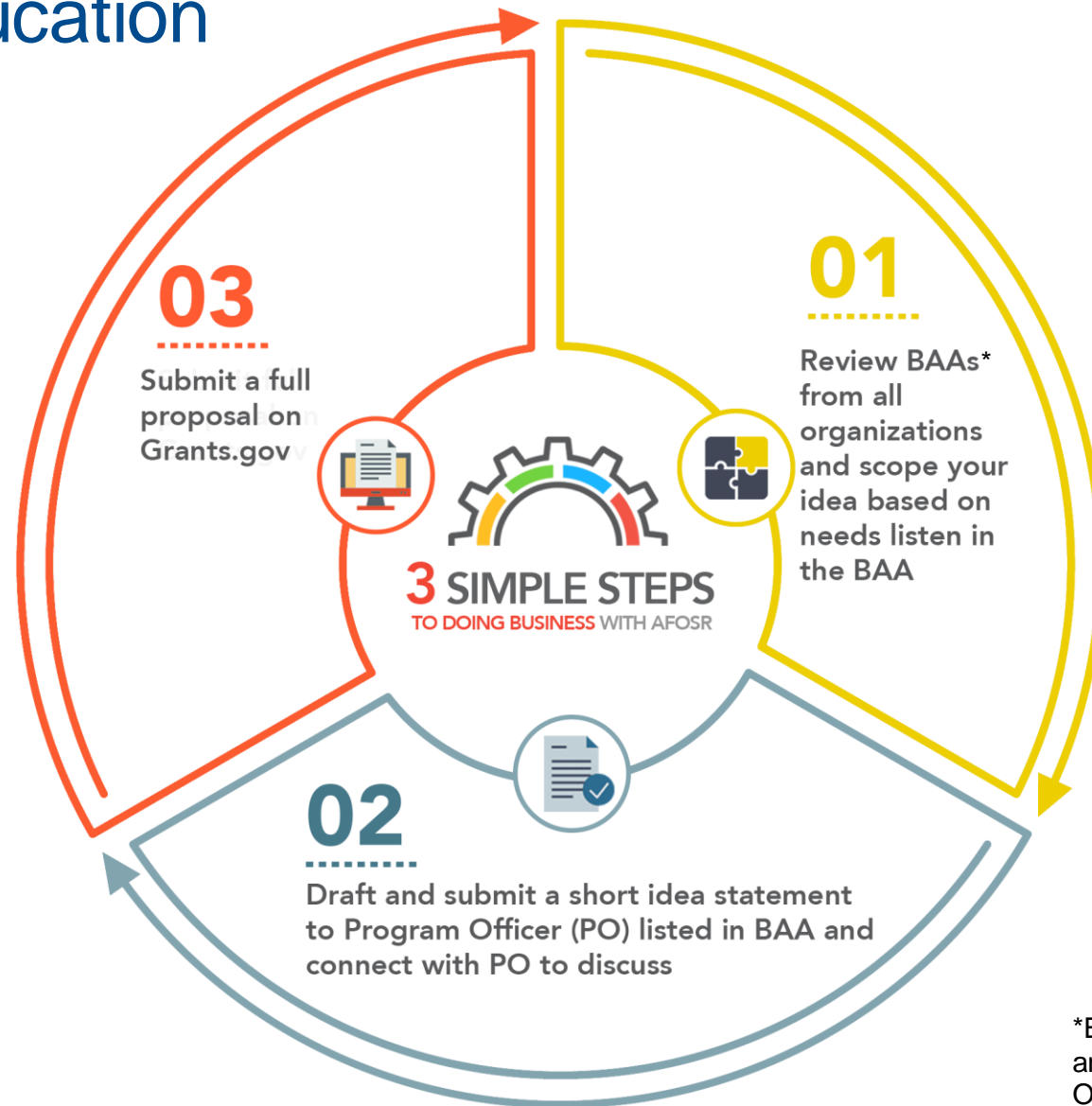




# How to Work with Us



# Higher Education

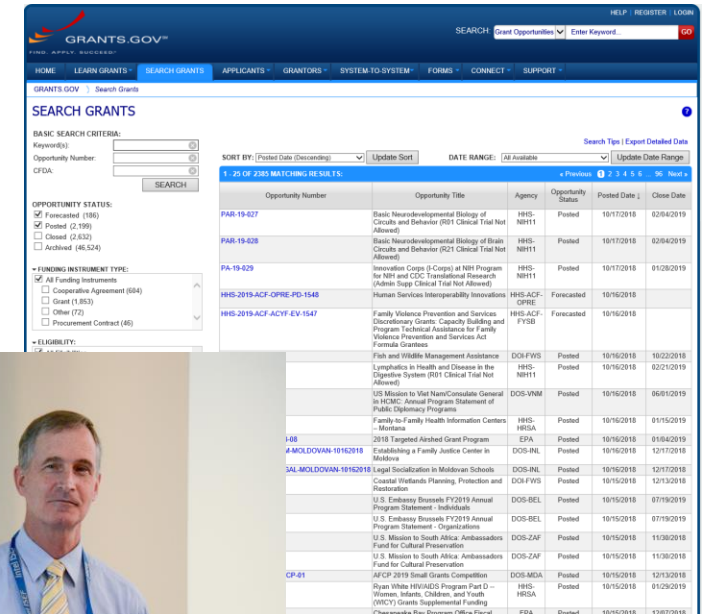


\*Broad Agency Announcement. Some announcements may also be called Funding Opportunity Announcements (FOAs)



# Review Broad Agency Announcements

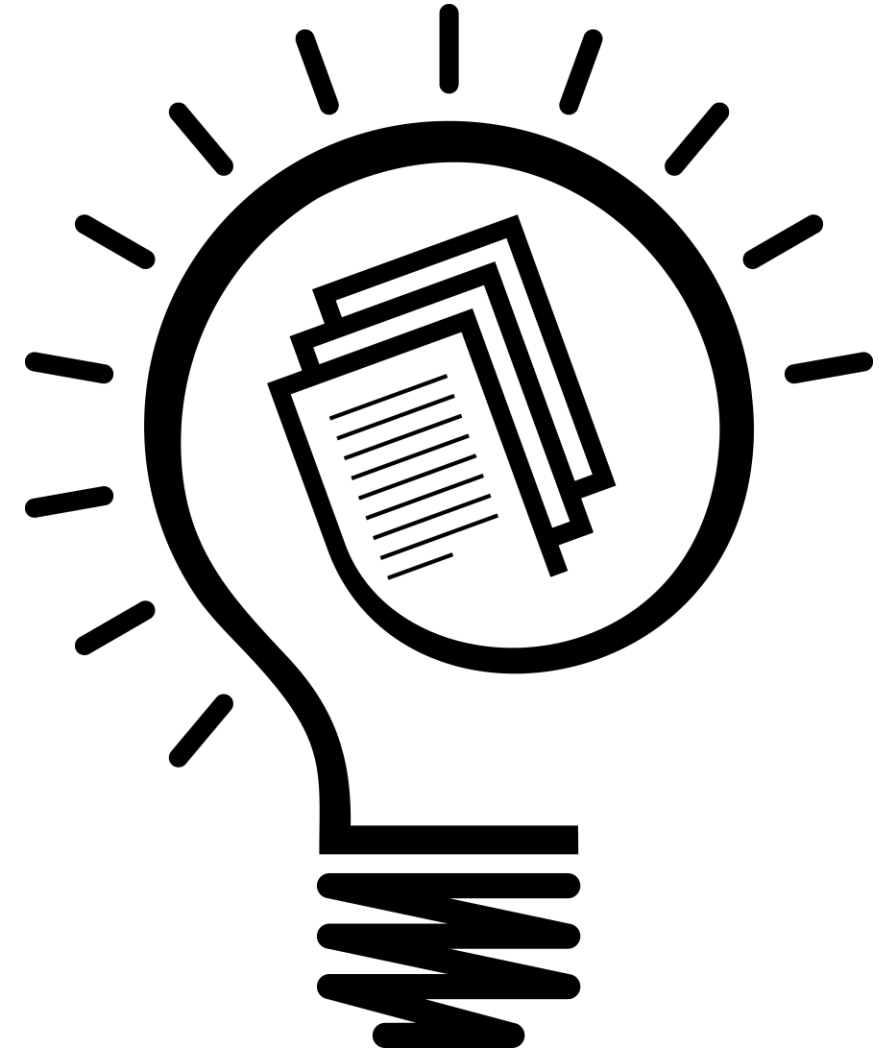
- Researchers should visit [www.grants.gov](http://www.grants.gov) – the official source for finding and applying to Federal grants
- Find opportunities that match interests. Search by:
  - Keyword
  - Eligibility
  - Category
  - Agency etc.
- Study and keep current with BAAs
- Attend program reviews to understand the directions and needs of program





## Scope and Draft Idea Statement

- Statement doesn't have to be all-inclusive, but should address the unique value proposition of the research
- Statement needs to be specific enough that it catches the interest of the Program Officer







## Connect with Program Officer

- At this point, some Program Officers will want a specifically formatted white paper
- Others will want to have a conversation
  - In person
  - Over the phone
  - Via email
- If the idea seems promising, Program Officer will initiate an ongoing dialogue setting expectations and explaining the process for full proposal submission.

# Program Manager Roles

- Topical / Program Expert
- Educator / Communicator
- Team Builder
- Advocate
- Evaluator
- Administrator
- Active Member of AFRL, DoD & Scientific Communities



**Program Officers' empowerment is a key component of our success**





# Determine the Correct Funding Mechanism

- There are many different mechanisms for universities to obtain basic research grant funding:
  - Traditional grants
  - University Research Initiatives (i.e. Multidisciplinary University Research Initiative (MURI), Defense University Research Instrumentation Program (DURIP))
  - Special Programs (i.e. HBCU/MSI, Young Investigator Program (YIP), Presidential Early Career Awards for Scientists and Engineers (PECASE))
- Traditional grants can be awarded year-round from the general Broad Agency Announcement
- Other opportunities have specific deadlines

# Funding Mechanisms

## Technology Transition

- Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) Program
- Partnerships for Transition

## Basic Research Grants

All qualified, responsible organizational applicants from higher education, the non-profit sector, and industry are eligible to submit research proposals.

## Strengthening Academic Research Capabilities

- Multidisciplinary University Research Initiative (MURI) Program
- Defense University Research Instrumentation Program (DURIP)
- Presidential Early Career Award for Scientists and Engineers (PECASE)

## Strengthening Air & Space Force Research Capabilities

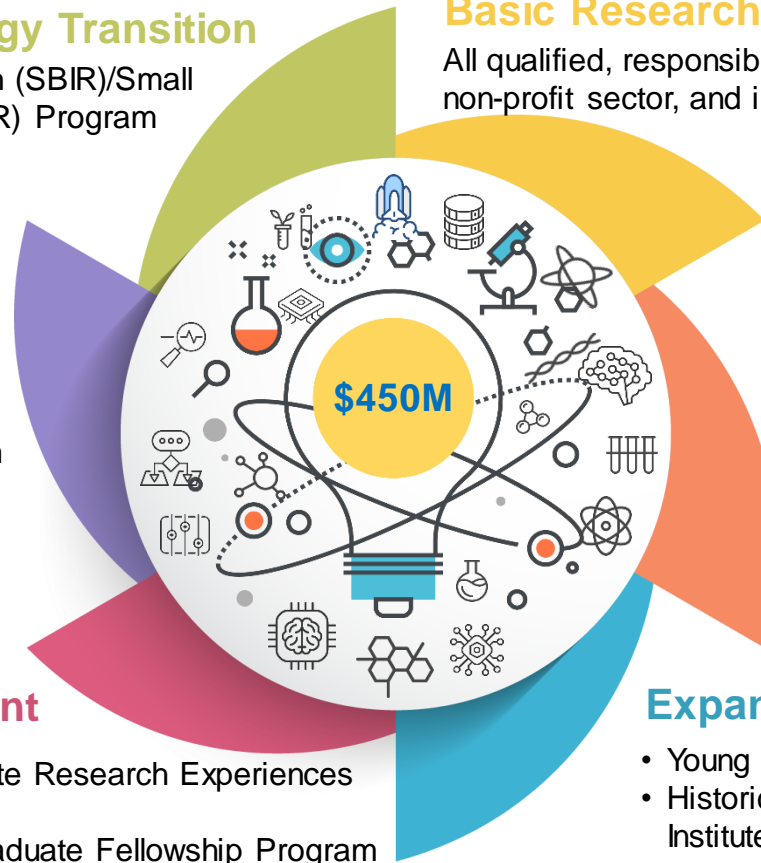
- US Air Force Academy Program
- Summer Faculty Fellowship Program (SFFP)/Science & Technology Fellowship Program (STFP)

## Workforce Development

- Awards to Stimulate and Support Undergraduate Research Experiences (ASSURE)
- National Defense Science and Engineering Graduate Fellowship Program (NDSEG)
- K-12 STEM

## Expanding Air & Space Force Academic Reach

- Young Investigator Program (YIP)
- Historically Black Colleges & Universities/Minority Serving Institutes (HBCU/MSI) Program



Diversified investment strategy for maximum discovery potential

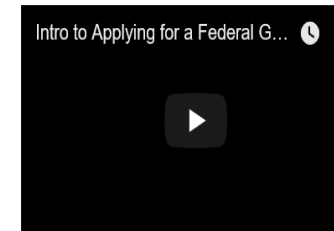
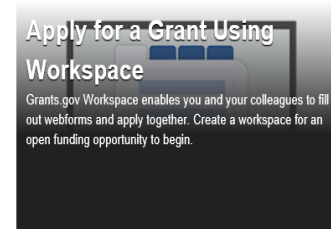






# Submit Full Proposal

- Full proposals should include
  - Strong technical merit
  - U.S. Air Force or U.S. Space Force relevance
  - Solid budget justifications
- Full details can be found in the Broad Agency Announcement
- Grants.gov also provides a number of tutorials for using the site





# Peer Review

## **TECHNICAL:**

Proposal subject area is appropriately addressed in the AFOSR Broad Agency Announcement.

- What will be the results of this work and how novel are they?
- How will the results advance the state of the art and how significant will the advancement be?
- Will the proposed approach produce the desired results? What are its strengths and weaknesses?
- Comment on the key personnel's qualifications, capabilities, related experience, and past performance.
- Additional comments and relevant issues?

## **RELEVANCE & RELATION OF USAF or USSF**

## **OTHER CRITERIA:**

- Comment of the adequacy and/or availability of the facilities, equipment, hardware, simulation tools and techniques integral to the objectives of the proposed research.
- Comment on the realism and reasonableness of the proposed project cost.

**IS THERE AN ASPECT OF THE PROPOSED RESEARCH THAT WILL LEAD TO A SIGNIFICANT TRANSFORMATION IN OUR UNDERSTANDING OF THE STATE-OF-THE-ART? IF SO, PLEASE BRIEFLY DESCRIBE THE TRANSFORMATIONAL ASPECT OF THE WORK.**





# Budget Justification

- **For Personnel Management:**

Discuss realism and reasonableness of the (a) number of personnel, (b) labor mix, (c) level of effort etc.

- **For Permanent Equipment (>\$5,000/unit and useful life > 1 year)**

Are all the permanent equipment items special purpose and/or test equipment, interconnected and interdependent, reasonable and acceptable for the work to be performed and of significant value to the project.

- **Consumables and facility Chargers:**

Provide JUSTIFICATION and explanation with respect to proposed research. Provide quotations and/or links to the price structure of consumables, materials supplies, and facility charges.

- **Other Direct Costs**

Provide Justification for direct costs

- **Travel:**

For travel or quantity of trips, (a) rationale for travel, (b) the amount of travel or quantity of trips, and (a) the number of personnel traveling in terms of realism and reasonableness for the work

- **Subcontract:**

Discuss (a) rationale for these costs, (b) why it is necessary, (c) what does it add to the research, and (d) why can it not be accomplished by the awardee/grantee.



# Get Funded! Get started and stay involved

- POs weigh several factors in selecting proposals for funding:
  - Identify overlap with program interests, and connection to DOD's labs
  - Potential for scientific breakthroughs
  - Strategic directions
  - Budget realities
  - Peer review to gauge scientific merit
- Once funded, remain engaged and continue with the process.
  - Continue reviewing BAAs
  - Request invitations to program reviews of interest
  - Collaborate with other PIs in the program



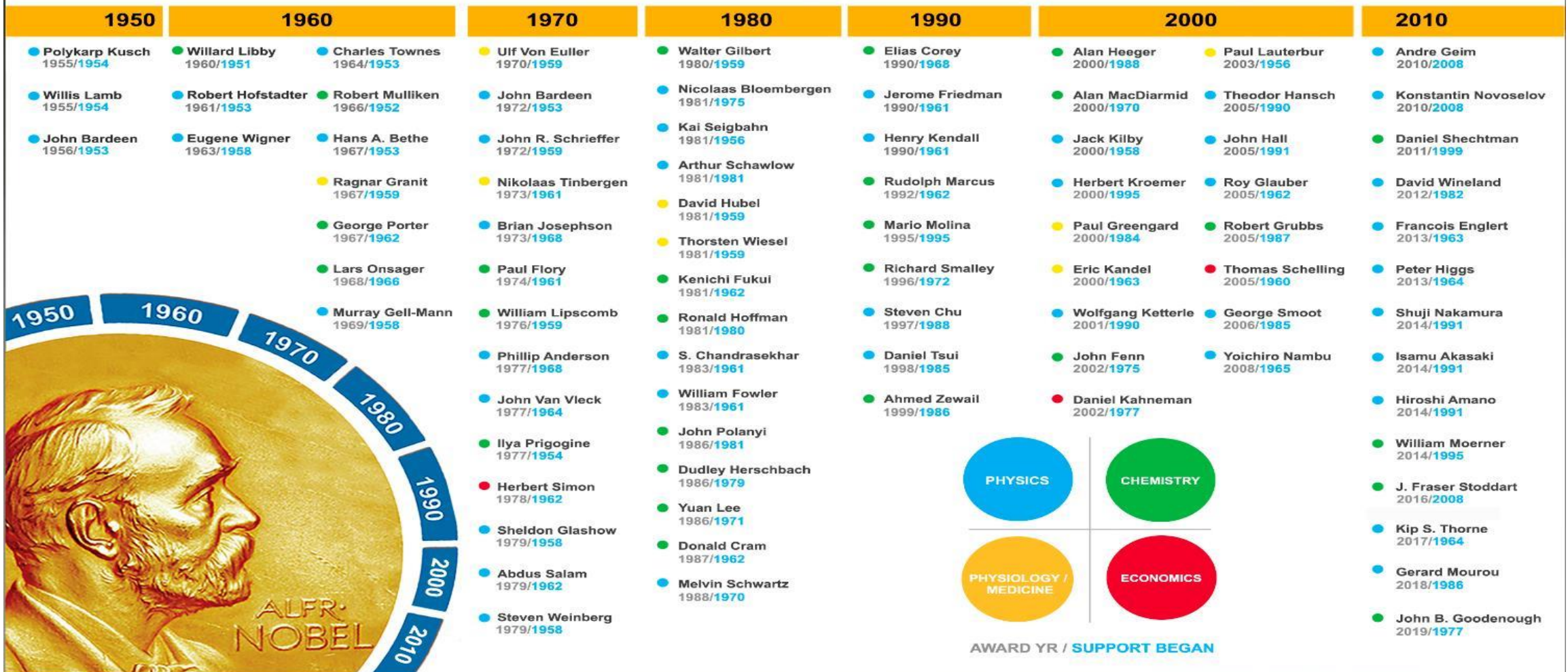
Workshops and Reviews





# AFOSR-Funded Nobel Laureates

## AFOSR SUPPORTED NOBEL PRIZE LAUREATES







We are AFOSR and  
we science!

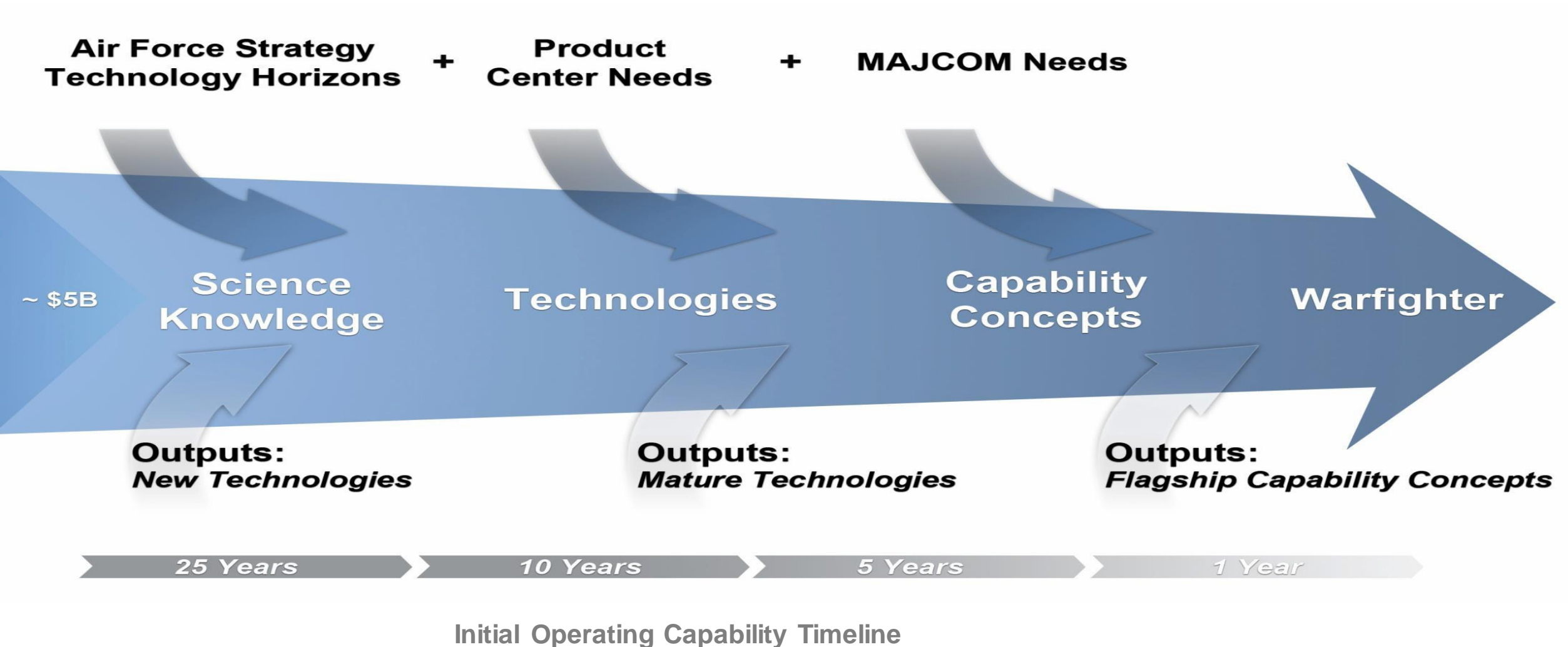




# Questions?



# Turning Science Into Capability







# Develop a Research Plan

- Personal drive plays a huge role in this step
- Advisors and mentors are often helpful in steering researchers to areas with available funding like national defense
- Position oneself as a scholar, a researcher, and a grant writer
  - Author publications
  - Contribute to community (present and get feedback)
  - Join professional societies
  - Serve on review panels
  - Develop long-term research goals
  - Understand and leverage resources
  - Identify a unique value proposition

