SAND2019-6478 PE

Research Spotlight Forum

6.4.19 Quantum Information Sciences

Partnering with Sandia

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pability Overview

Sandia National Laboratories is a multi-mission laboratory managed and operated by National Technology and Engineering Solutions of Sandia LLC, a wholly owned subsidiary of Honeywell International Inc. for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.
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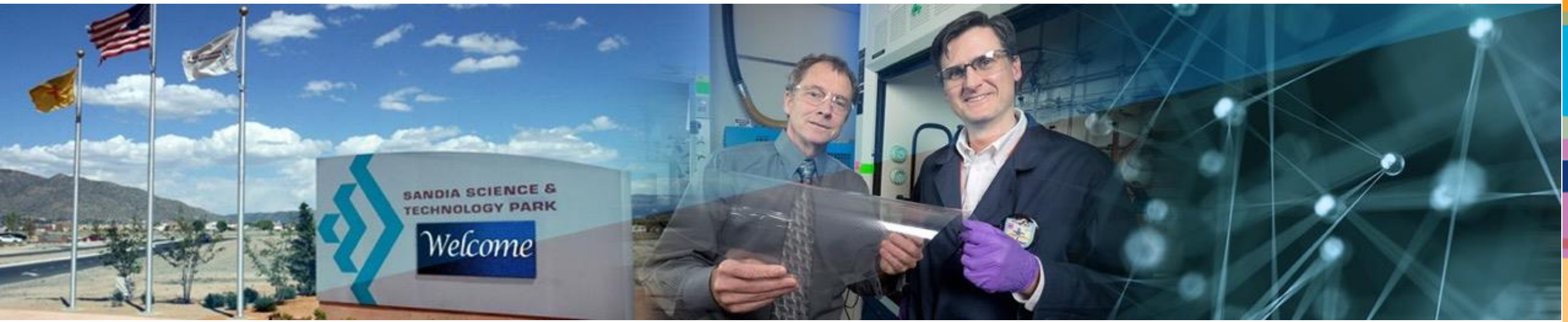
PARTNERSHIPS AND BUSINESS DEVELOPMENT

Partnering with government, industry, and academic institutions to meet national security challenges



Enhance mission delivery: *develop/deploy technologies for mission delivery*

Enable innovation: *facilitate the flow of people and ideas to and from Sandia*

Maximize public good: *enhance the local and national economy*

Meet DOE and legislated requirements: *fulfill our M&O contractual obligation*

PARTNERING IS A STRATEGIC IMPERATIVE

Drivers for a strategic alliance:

- Rapid change in technology
- Complex national security challenges
- Shortage of STEM talent
- Limited R&D funding

INCREASING TALENT EXCHANGE

Faculty Liaisons facilitate the university's institutional partnership with Sandia, serving as the university's local interface to Sandia staff and leadership.

Edl Schamiloglu is a Distinguished Professor of Electrical and Computer Engineering and associate dean for Research in the School of Engineering, as the Special Assistant to the Provost for Laboratory Relations at the University of New Mexico.

Chip White is a professor and holds the Schneider National Chair in Transportation and Logistics in the Stewart School of Industrial & Systems Engineering at GT.

Philip Varghese is the Director of the Center for Aeromechanics Research at UT and a professor of Aerospace Engineering and Engineering Mechanics.

Timothée Pourpoint is an associate professor of aeronautics and astronautics at Purdue.

Collaboration Opportunities

- Faculty Sabbaticals
- Invited Tech Talks
- Grad Student Advisory
- Internships/Student Hires
- Visiting Researcher Programs (CINT & CRF)

MECHANISMS FOR COLLABORATION

Funding mechanism used to foster collaborations and technical advances

Mission Campaigns
Provides an agile, strategic process to bridge ST&E and mission and move intentionally from idea to impact. *(5-7 years)*

Grand Challenges
Address major research challenges to develop bold solutions to important national security challenges. *(3 years)*

PI Driven Projects
Conduct applied research in areas directly relevant to current/anticipated missions to develop and demonstrate new capabilities and prototype new solutions. These include LDRD Proposals, Joint Publications, Filing Joint IP/Technical Advances, Commercialization Agreements. *(1-3 years)*

Exploratory Express
An agile mechanism to test and mature novel R&D ideas. *(<6 months)*

MISSION CAMPAIGNS

Mission Campaigns provide an agile, strategic process to bridge ST&E and mission and move intentionally from idea to impact. Each limited-duration Campaign combines strong leadership and coordination with a guiding roadmap to develop key capabilities and overcome high-risk technical hurdles.

- **Limited Lifetime** (5-7 years)
- **Funding** ($25-40M over length of campaign)
- **Well-coordinated, strategic** portfolio of projects

FY19 MISSION CAMPIGNS:

1. Autonomy for Hypersonics (A4H)
2. Science and Technology Advancing Resilience for Contested Space (STARCS)
3. Resilient Agile Deterrence (RAD)

MISSION CAMPAIGN: AUTONOMY FOR HYPERSONICS (A4H)

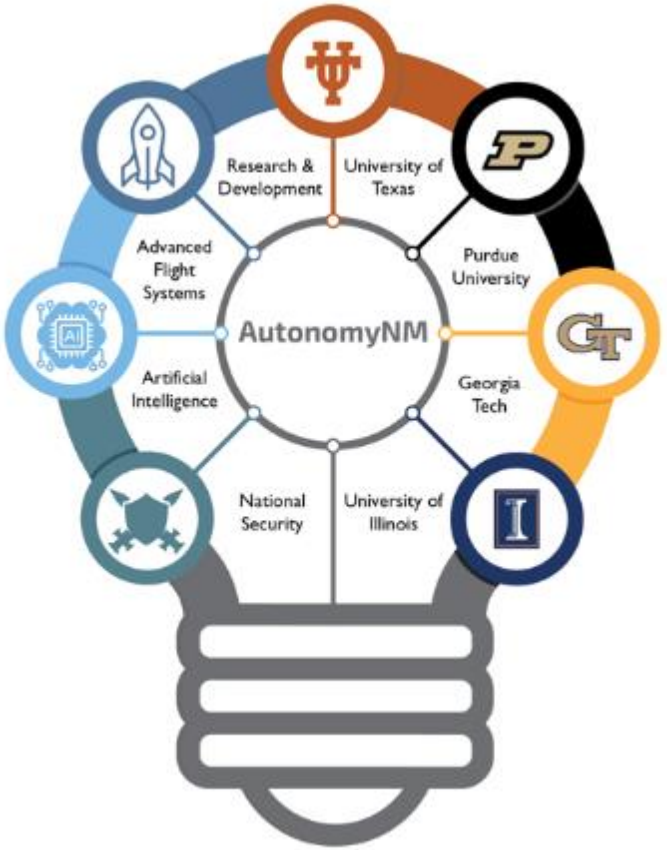
THE CHALLENGE

Proposed U.S. hypersonic flight vehicles have limits on their ability to operate in contested environments with rapidly changing countermeasures, targets, geopolitical constraints, and other complicating factors.

CAMPAIGN OBJECTIVES

Research and develop autonomous technologies that will enhance hypersonics' warfighting ability by:

- Enabling autonomous mission planning for rapid response to time-sensitive threats
- Providing intelligent, adaptive, and highly maneuverable vehicles that autonomously navigate and home in on targets



A4H PARTNERING OPPORTUNTIES

We will leverage partnerships with universities and initiate a new Autonomy Incubator at Sandia's Innovate ABQ center in Albuquerque to conduct basic research and explore new, high-risk ideas and to build a pipeline for autonomy and artificial intelligence talent.

MISSION CAMPAIGN: SCIENCE AND TECHNOLOGY ADVANCING RESILIENCE FOR CONTESTED SPACE (STARCS)

THE CHALLENGE

Our space capabilities monitor the proliferation of nuclear weapons, monitor treaties, and reduce the threat of nuclear terrorism across the world. However, our current space architectures lack the robustness mandatory for vital warfighting capabilities, especially given increasing adversary strategic capabilities in space.

CAMPAIGN OBJECTIVES

STARCS seeks to establish Sandia as our nation's leader in the development of hardened-engineering concepts for the protection of critical systems in our space systems. The resulting resilience will ***assure*** Sandia's critical nonproliferation and proliferation-assessment missions—our systems will have the resilience needed to ***deter*** attacks on these vital systems, and to ***operate through*** any attacks that occur.

Threat-Defended Hardware

- Develop modeling, and design tools
- Environmentally-testable Hardware
- Run cognitive analytics algorithms
- Demonstrate resilience to attack

Cognitive Analytics

- Analytics tools to identify attacks
- Adaptation software to operate-through
- Demonstrate on threat-defended hardware
- Operate with Hardware In the Loop (HWIL)

Sensor Protection

- Materials/system to block high energy attacks
- Threat-degraded data recovery techniques
- Demonstrate protection against threats
- Operate algorithms on threat-defended HW

STARCS PARTNERING OPPORTUNTIES

STARCS will need specialists in fields including: computer information science, electrical science, materials science, radiation effects and high energy density science. We will also draw on new and existing university relationships to pursue innovations in software development and big data analytics and small satellite technologies.

MISSION CAMPAIGN: RESILIENT AND AGILE DETERRENCE (RAD)

THE CHALLENGE

Cutting-edge technology has always been central to the U.S. nuclear deterrent. The rapid pace of change on many fronts poses a threat. Incremental modernization of our weapons systems is no longer sufficient to counter the diversity of nuclear and non-nuclear strategic threats our adversaries are developing or the dynamism and uncertainties of the evolving international security environment.

CAMPAIGN OBJECTIVES

RAD will invest in **fundamental science and predictive capabilities needed to design and qualify innovative advanced barriers** essential to the long-term credibility and effectiveness of U.S. nuclear weapons. We will also **ensure that our nuclear deterrent is flexible and adaptable**, we must shorten our current deployment timelines and develop advanced functionality in advance of mission need.

RAD PARTNERING OPPORTUNTIES

Sandia seeks collaborative projects with university partners to fuel high-risk/high-reward innovation and we need specialists in the following fields: materials science and materials interface design; simulated environments; threats, and responses; external environments management; and model-based design and reliability.

POSTDOC FELLOWSHIP PROGRAMS

Attracting leading scientists and engineers

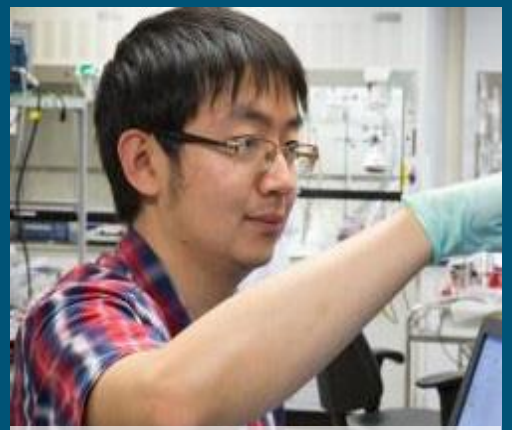
Truman Fellowship

Provides the opportunity for new Ph.D. scientists and engineers to pursue independent research of their own choosing that supports Sandia's national security mission.

Ethan Secor
2018 Truman Fellow

Daniel Ruiz
2018 Truman Fellow

Pauli Kehayias,
2019 Truman Fellow



Yiyang Li
2019 Truman Fellow

Thomas O'Connor
2019 Truman Fellow

Jill Hruby Fellowship

Aims to develop women in the engineering and science fields who are interested in technical leadership careers in national security.

Mercedes Taylor
2019 Hruby Fellow

Chen Wang
2019 Hruby Fellow