NATIONAL SECURITY PROGRAMS
Argonne National Laboratory

Argonne NATIONAL LABORATORY

NATIONAL SECURITY PROGRAMS

Securing our nation through science

Delivering customized research teams and world-class facilities to solve R&D challenges in:

- Energy for Maneuver
- Preventing Weaponization
- Data to Decision

ENERGY FOR MANEUVER

Military advantage requires new ways of providing energy and power to fulfill national security missions.

- **Hypersonic Flight**
  In defense circles, hypersonics is a game changer. Capable of flight in excess of five times the speed of sound, hypersonic aircraft may elude detection, tracking, and interception. U.S. development efforts in this arena have intensified as adversaries continue to make and test hypersonic weapons. Argonne's leading capabilities in X-ray science, advanced materials, high-fidelity combustion chemistry, and high-performance computing can advance hypersonic flight technology to ensure our nation's military preeminence.

- **Energy Storage**
  Unlike commercial applications, storage solutions for national security missions must provide reliable, energy-dense performance under extreme conditions. From dismounted operations to the vehicle to the platform, Argonne's expertise in materials science, electrochemistry, and sophisticated simulations advances the state of the art for military energy storage.

- **Tribology and Surface Science**
  Engineers in Argonne's Tribology Laboratory conduct research on advanced tribological systems (surface engineered materials, lubricants, fuels, and fuel/lubricant additives) for use in aggressive environments. The laboratory is equipped with a full range of coating development, friction/wear testing and characterization facilities. This expertise is helping the U.S. military improve its transportation and propulsion systems by rendering them more reliable, simplifying maintenance, and extending lifetimes of critical components.

- **Advanced Materials and Manufacturing**
  Argonne's award-winning expertise in the creation and analysis of novel materials contributes to wide-ranging advances that improve industrial processes and manufactured products, saving energy and reducing waste. Magnetized nanomaterials will revolutionize communications systems for the military and intelligence communities. X-ray studies of additive manufacturing at Argonne's Advanced Photon Source will help the military to better understand and certify key components for high reliability in harsh environments and operating conditions.

U.S. DEPARTMENT OF ENERGY
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PREVENTING WEAPONIZATION

Since its inception, Argonne has delivered solutions to prevent the malicious use of peaceful technology.

- **Nuclear Nonproliferation**
  To counter the threat of nuclear material misuse, Argonne continues to lead U.S. (DOE/NNSA) efforts to convert research and test reactors worldwide from highly enriched uranium fuel to low-enriched uranium fuel. Argonne has led the conversion of 70 research and test reactors in 31 countries, directly reducing the risk of nuclear material loss, theft, or diversion from peaceful purposes.
- **Cybersecurity**
  Cybersecurity is the adversary's asymmetric tool for mass disruption and destruction. With recognized leadership in critical arenas frequently targeted for vulnerabilities (i.e., transportation, energy delivery, distributed supercomputing) Argonne provides leading-edge insight into effective infrastructure vulnerability assessments and hardening strategies for tomorrow's commodity technology.
- **Nonproliferation of Chemical and Radiological Weapons**
  Our experts analyze and test radiation detection systems, test instruments, validate results, and analyze data to support the identification of best-in-class technologies for the detection of potential chemical and radiological threats. Argonne provides unique and critical analysis of nuclear smuggling around the globe. We also assist other nations and national alliances in establishing standards and procedures for the prevention of misuse of chemicals and radiological materials.
- **Computational and Synthetic Biology**
  Biological warfare and the malicious use of biological agents coupled with accelerated developments in synthetic biology constitute a continuing threat to our nation's security. In response, the U.S. Department of Energy has called for an escalation of related research. With expertise in biology, computational science, supercomputing infrastructure, and in dual-use technology, Argonne leads efforts to detect engineered changes within biological systems through bioinformatics, genomics, and systems biology.

DATA TO DECISION

Informing those making decisions on matters of national security requires targeted, sophisticated data collection and lightning-paced parsing.

- **Advanced Sensors and Detectors**
  Thanks to Argonne's heritage in cutting-edge, highly precise physics experimentation, the laboratory offers unique expertise in sensor and detector technology. In this era of big data, collecting the right data is key. Advances in materials design and manufacturing techniques, as well as in power sources with enhanced features, positions Argonne to assist the national security community in collecting better and more relevant data.
- **Planning, Analysis, and Decision Support**
  Argonne has a decades-long track record of contributing to homeland security and assisting the Department of Defense in making informed, complex decisions by employing unique toolsets, subject matter expertise and data elicitation. Argonne researchers use expertise, in systems science and stochastic methods (such as agent-based modeling) to predict a broad range of events—from supply-chain risks to spread of disease.
- **Machine Learning and Big Data**
  Using computer algorithms that make predictions on data, machine learning collapses time to decision by churning through massive data sets to hone in on relevant information. Edge computing—machine learning at the point of data collection—further accelerates this targeting process. Argonne's recognized expertise in advanced programming and sophisticated computational tools leverages the science to provide data-supported, strategic options to stakeholders in national security.
- **Information Technology Authentication**
  Rapid, nanoscale imaging of integrated circuits at Argonne's Advanced Photon Source using fast-scan ptychography, coupled with unique instruments provides the foundation for the ability to produce 3-D reconstructed models at 10nm resolution. This capability is critical for hardware assurance programs supporting national security missions.

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