



“We take scientific discoveries from across ORNL and transition them into real-world national security solutions.”

Jeff Johnson,  
Nuclear Engineer



## The Science Behind National Security

Oak Ridge National Laboratory (ORNL) is a global leader in science-based solutions for complex security threats that put public safety, national defense, and the economy at risk. Through a multidisciplinary approach, the Laboratory applies signature strengths in nuclear science, high-performance computing, energy, advanced materials, neutron science, and other areas to enduring and emerging threats to national security. The results are real-world technological solutions, critical scientific input to decision makers, and vital training for federal agencies and international partners.

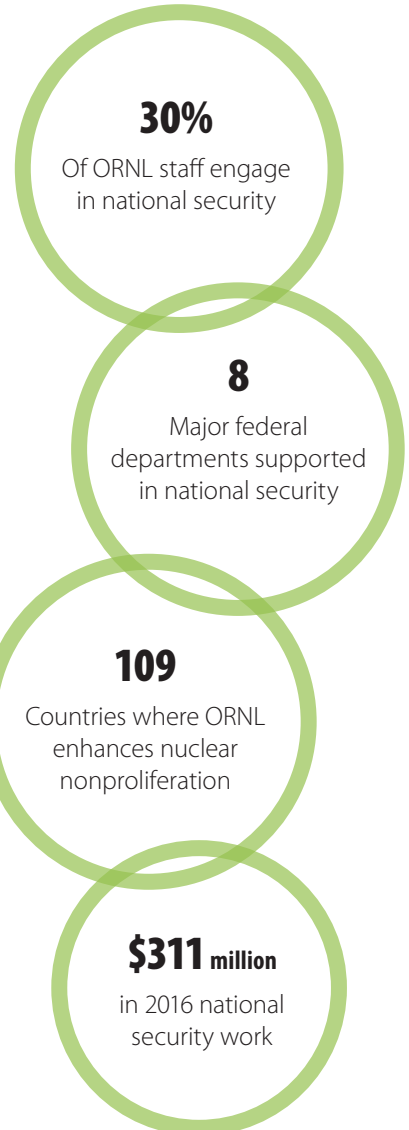
### Ensuring Global Nuclear Security

ORNL’s fundamental contribution to global nuclear security is its basic and applied nuclear research. The Lab fulfills an international role in advancing scientific and technical capabilities to detect illicit nuclear activities, secure fissile and radiological materials, and counter the threat of weapons of mass destruction.

- **Forensic sciences**—ORNL’s forensic experts analyze high-risk materials to identify sources, track transit routes, and provide evidence for attribution.
- **Uranium fuel cycle**—ORNL has unparalleled facilities, resources, and expertise in understanding the uranium fuel cycle.
- **Safeguards and protection**—ORNL develops next-generation technology for safeguarding nuclear materials on-site and for detecting illicit movement of sensitive materials on public roads, railroads, and waterways.

### Protecting the Power Grid

The combination of high-performance computing infrastructure and staff expertise in cyber-security and energy systems enables ORNL to improve the electric power grid’s resiliency and cybersecurity. Signature strengths include robust power systems design, reliability engineering, and cybersecurity for physical systems. The Lab’s software and hardware advances allow rapid vulnerability discovery that enables utilities to defend against emerging and previously unseen threats, including both cyberattacks and extreme events.



## Innovating Software to Manage Risks

ORNL researchers have developed vital software applications that enable government agencies to track high-risk materials and respond more quickly to incidents.

- G2 geospatial toolkit—ORNL assists federal agencies in safeguarding and tracking high-risk nuclear and radiological materials through its G2 advanced software, which tracks thousands of projects and inventories across large geographical areas around the world, improving response times to incidents.
- CSAT—ORNL works closely with the US Department of Homeland Security to keep high-risk chemicals out of the hands of terrorists and other bad actors through the Laboratory-developed Chemical Security Assessment Tool (CSAT).
- IMPACT toolkit—ORNL assists first responders in managing natural and human-induced disasters and emergencies in real time with the Laboratory-developed Incident Management Preparedness and Coordination Toolkit (IMPACT).

## Applying Materials Science to Defense Missions

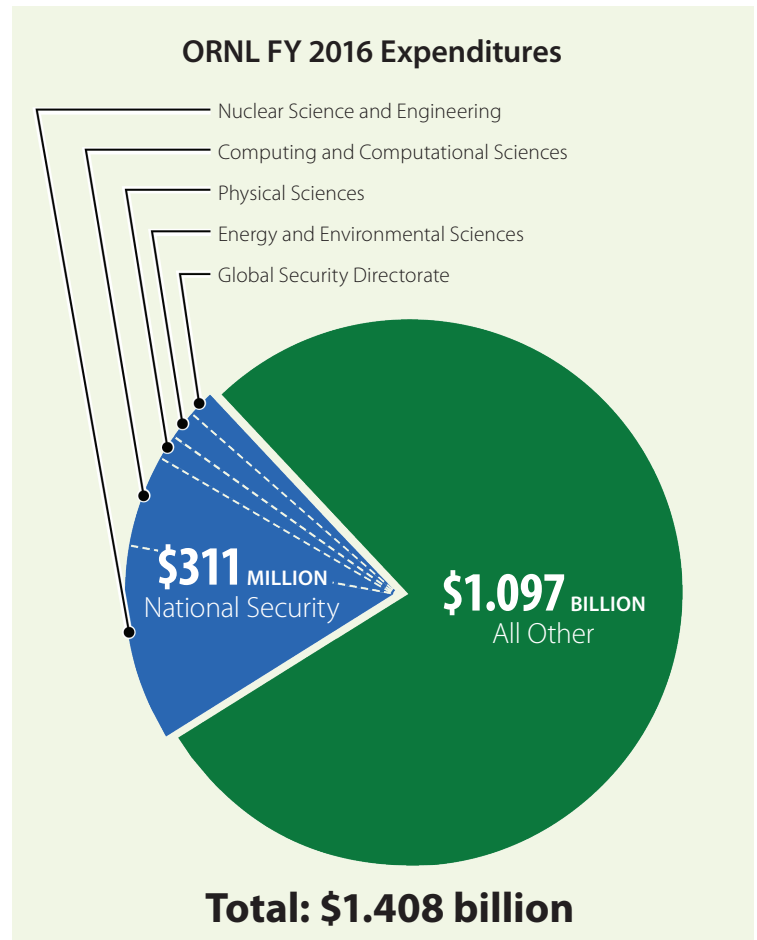
ORNL researchers apply material science discoveries to national defense missions. One example is ORNL's breakthrough process for producing graphite foam with heat transfer capabilities, which is used to cool soldiers and their weapons in hot climates and to increase the longevity of satellite radiators. Other research has led to anticorrosion coatings and novel materials used in additive manufacturing for military applications.

## Solving Challenges in Data Analytics

ORNL applies its world-leading research and development in data science to help defense and intelligence agencies triage overwhelming volumes of data into actionable information based on in-depth analysis, often in real-time. The Laboratory is home to the Extreme-Scale Systems Center, a national center of excellence in high-performance computing infrastructure, software, and data analytics funded by the US Department of Defense.

## Engineering Border Security

Working closely with federal agencies, ORNL researches and develops identification systems that capture biometrics such as facial features for use in homeland security missions. One such research project aims to better secure US borders by identifying travelers in moving vehicles at border crossings. ORNL researchers have customized algorithms and have characterized the key challenges involved in designing the optimum optical and image-processing solutions.



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