Nuclear Science Advisory Committee Recommends Future Directions for Nuclear Science

In October 2023, the Nuclear Science Advisory Committee (NSAC) released its latest roadmap for advancing the nation's nuclear science research over the next decade. The 2023 Long Range Plan (LRP) for Nuclear Science highlights the scientific opportunities for maintaining world leadership in this vital area of research. It also describes the impact of nuclear science on the training of a workforce that is critical for many applications and in demand by national laboratories.

What is Nuclear Science?

Nuclear science studies matter in all its forms, touching on the smallest components of our universe (subatomic particles) to some of the largest (e.g., stars). Scientists in the field investigate how protons and neutrons are formed from elementary particles and how the forces between those particles produce both atomic nuclei and the vast variety of nuclear phenomena (e.g., supernovae, fission and fusion, production of heavy elements) that occur in the universe. The field addresses profound scientific questions: Where does the mass of visible matter come from? How do stars ignite, live, and die? How do nuclei illuminate the search for new laws of nature? This science points the way to using nuclei to build new technologies that benefit society in the fields of medicine, energy, data science, national security, and more.

Benefits of Nuclear Science to the Nation

Discoveries in nuclear science advance our understanding of nature and also enable new technological breakthroughs and innovations, leading to applications with broad societal benefits, like:

- medical diagnostics and treatment
- nuclear energy
- detection of illicit cargo material
- oil-well drilling
- radiation hardening for electronics

In addition, nuclear science produces highly sought-after trainees with skills in:

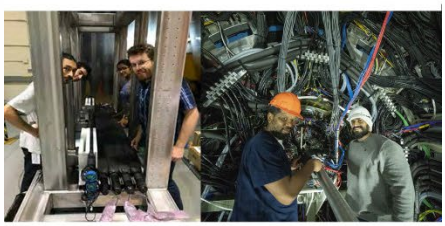
- handling nuclear materials
- complex calculations
- data science
- production of isotopes for medical applications

The NSAC Long Range Plan includes proposals for attracting a broad pool of talent to the science and retaining them by ensuring a welcoming and inclusive environment.

The NSAC Long Range Plan

The NSAC Long Range Plan, produced by the research community every five to eight years, is designed to ensure that federal investments in this field reflect the national interest and maintain U.S. leadership. It is produced in response to a call from the U.S. Department of Energy (DOE) Office of Science and the National Science Foundation (NSF), the primary funders of the major programs, accelerators, instruments, and experiments that enable nuclear science research in the U.S. The plan will serve as community input and a framework for these agencies as they consider their research funding plans and priorities for the future.

The plan also features detailed information about the field's national and international research programs and partnerships, describes the initiatives to advance science through cross-discipline collaboration, and details how efforts to promote and sustain a vibrant and inclusive nuclear science workforce are fully integrated into the vision for the future of U.S. nuclear science.



Recommendations of the Plan

The 2023 Long Range Plan lays out a compelling vision for nuclear science in the U.S. under multiple budget scenarios. Implementation of its recommendations will maintain the nation's leadership and workforce in this critical field.

Invest in Research and Operations (Recommendation 1): Capitalize on the extraordinary opportunities for scientific discovery made possible by the substantial and sustained investments of the United States. We must draw on the talents of all in the nation to achieve this goal. This recommendation requires:

- Increasing the research budget that supports theoretical and experimental research across the country.
- Continuing effective operation of national user facilities—ATLAS at Argonne National Laboratory; the CEBAF at Thomas Jefferson National Accelerator Laboratory; FRIB at Michigan State University—and completing the science program at RHIC at Brookhaven National Laboratory.
- Raising the compensation of graduate researchers to levels commensurate with their cost of living—without contraction of the workforce—to lower barriers and expand opportunities in STEM and boost national competitiveness.
- Expanding policy and resources to ensure a safe and respectful environment for everyone.

The plan reaffirms the exceptionally high priority of two investments in new capabilities:

- **Support New Experiment Construction (Recommendation 2):** A campaign including expeditious construction of ton-scale neutrinoless double beta decay experiments using different isotopes and complementary techniques is the highest priority for new experiment construction. These experiments have the potential to dramatically change our understanding of the physical laws governing the universe.
- **Complete EIC Construction (Recommendation 3):** The expeditious completion of the Electron-Ion Collider (EIC) is the highest priority for facility construction. The EIC will elucidate the origin of visible matter in the universe and significantly advance accelerator technology.
- **Invest in Projects and New Capabilities (Recommendation 4):** Capitalize on the unique ways in which nuclear physics can advance discovery science and applications for society by investing in additional projects and new strategic opportunities.

Please find the full **2023 Long Range Plan for Nuclear Science** at **NuclearScienceFuture.org**

Questions? Contact NSAC Chair Gail Dodge at **gdodge@odu.edu**