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We need to ensure U.S. technological superiority and advantages.

Basic research provides the greatest potential for fundamentally new ways of creating technological advances with national security and economic implications. Materials innovations have been at the core of the majority of big technological advances since the start of the industrial revolution. MaRIE will provide a comprehensive materials discovery facility with a unique capability to address the control of strategic materials at a middle (mesoscale) of material structure, the scale recognized as a major science grand challenge.

The Fact of the **Matter**

The Case for the
Matter-Radiation Interactions in Extremes
(MaRIE) Project

A skilled workforce is crucial for U.S. national security.

MaRIE will transform our ability to compete for intellectual capital and signal to the international community, allies, and adversaries that the nation's best and brightest are prepared to solve any national security challenge.



marie.lanl.gov

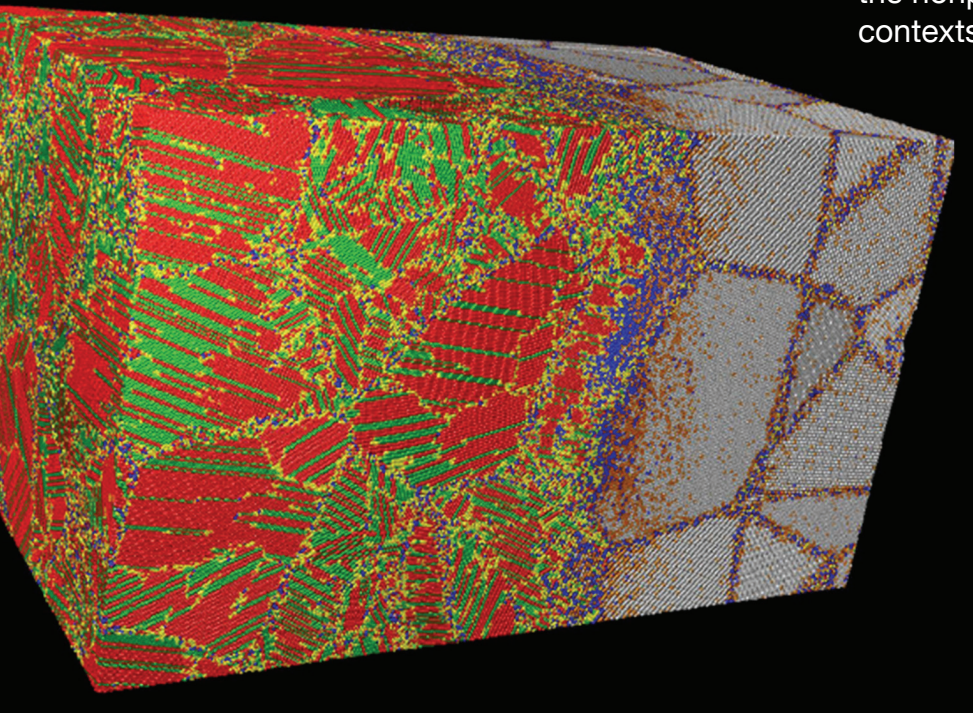


For more than 20 years the science and engineering capabilities of the nation's Stockpile Stewardship Program have allowed the United States to sustain a safe, secure, and effective nuclear deterrent.

Most of the problems identified within the nuclear stockpile are related to its aging materials. MaRIE will advance this record of excellence in addressing such materials problems.

MaRIE provides the ability for control of both performance and production of materials vital to national security missions.

The National Nuclear Security Administration (NNSA) requires the ability to understand and test how material structures, defects, and interfaces determine performance in extreme environments such as in nuclear weapons. To do this, MaRIE will be an x-ray source that is laser-like and brilliant with very flexible and fast pulses to see at weapons-relevant time scales, and with high enough energy to study critical materials.



The Department of Energy (DOE) has determined there is a mission need for MaRIE to deliver this capability. MaRIE can use some of the existing infrastructure of the Los Alamos Neutron Science Center (LANSCE) and its accelerator capability. MaRIE will be built as a strategic partnership of DOE national laboratories and university collaborators.

There is an urgent need for accelerated delivery of integrated materials solutions to the nuclear deterrent and other national security missions

The nation must annually assess whether the aging stockpile will continue to work as designed. These assessments (performance, reliability, safety, and security) are increasingly reliant on detailed scientific understanding of material properties. MaRIE will provide NNSA with more rigorous science-based approaches to manufacturing and certification supporting a more responsive, agile enterprise for U.S. stockpile needs and meet new security challenges in the nonproliferation and counter proliferation contexts.



The United States must prepare for an uncertain future.

National security in the 21st century requires state-of-the-art computing platforms as well as experimental facilities like MaRIE to generate data to inform models and challenge the computations. Addressing current and new threats will require higher fidelity and resolution models, which in turn will require greatly increased computing capacity. Exascale computing for materials needs experimental data at that high fidelity and resolution at scale. Together, MaRIE and exascale computing allow more accurate calculations of component manufacturing processes and weapon safety and performance, enabling more rapid and confident deployment of new parts and systems.



Artist's rendering of a MaRIE preconceptual design.

Los Alamos National Laboratory's proposed experimental facility

- A facility in the making for discovering and designing the advanced materials needed to meet 21st-century national security and energy security challenges.
- Will provide the tools scientists need to develop and manufacture next-generation materials that will perform predictably and with controlled functionality in extreme environments.
- As a national user facility, MaRIE will enable Los Alamos National Laboratory to attract the best and the brightest scientists across a broad range of disciplines.

