Nuclear Data and Deterrence

Workshop for Applied Nuclear Data Activities (WANDA)

February 10 – 13, 2025
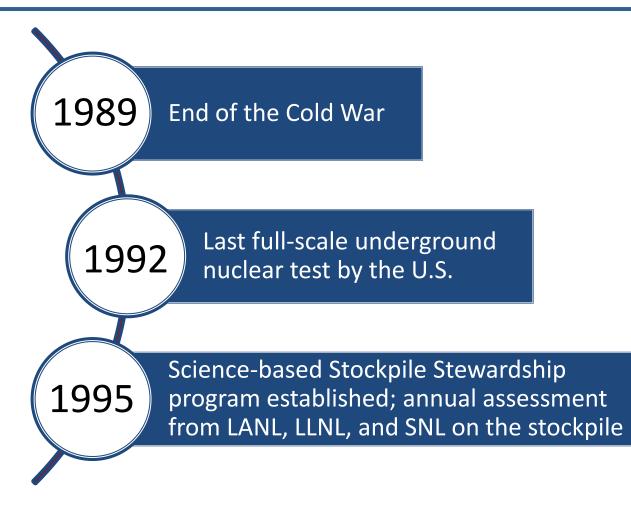
Jo Ressler (LLNL), Todd Bredeweg (LANL), and Aaron Couture(LANL)

Lawrence Livermore National Laboratory

Deterrence is a key element of the current U.S. security strategy

1989 — End of the Cold War

1992 — Last full-scale underground nuclear test by the U.S.

1995 — Science-based Stockpile Stewardship program established; annual assessment from LANL, LLNL, and SNL on the stockpile

- Deterrence: prevent aggression, conflict, war and maintain status quo (ideally, peace)

- Nuclear stockpile supports deterrence

- The world today looks very different than it did in the early 1990's

- Department of Defense (DoD) and NNSA are taking steps to enhance nuclear deterrence and flexibility

Nuclear, and other science-based activities, are foundational to meeting deterrence needs

Stockpile Decisions
Annual Assessments
Life Extension Plans
Future Deterrent

Historic Data

First-principle physical models

Integral Experiments

Nuclear Data

Nuclear Data

Nuclear Data

Collaborations and peer review are critical

- Academic support
  - Stockpile Stewardship Academic Alliance (SSAA)
  - Predictive Science Academic Alliance Program (PSAAP)
  - High Energy Density Laboratory Plasmas (HEDLP), joint with Office of Science Fusion Energy Science (FES)

- Fellowships
  - Stewardship Science Graduate Fellowship (SSGF)
  - Laboratory Residency Graduate Fellowship (LRGF)
  - Computational Science Graduate Fellowship (CSGF), joint with Office of Science

- Cooperative Research and Development Agreement (CRADA)

- Indirect collaboration also important: Global Security applications, criticality safety, nuclear energy…

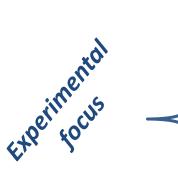**NNSA/Office of Defense Programs**

NNSA National Labs

Office of Science National Labs

Academic Institutions

Industrial Partners

National and International Organizations

Session Outline

Computational focus

- Defining Directions
  - Determining needs; Ali Dreyfuss, Robert Casperson (LLNL)
  - Defining experiments; Denise Neudecker (LANL)
- Next-generation computational methods
  - Opportunities with ML/AI, Scott Vander Wiel (LANL)
  - Capabilities with HPC, GPU, and QIS, Kostas Kravvaris (LLNL)
- Discussion (20 min)

BREAK

Grand challenges?
Unique opportunities/capabilities?
Synergies?

Experimental focus

- Next-generation experimental platforms
  - Nuclear data experiments; Aaron Couture (LANL)
  - Integrated experiments for applications (radiography); Maurice Aufderheide (LLNL)
- Next-generation diagnostics
  - Detection capabilities for nuclear data; Keegan Kelly (LANL)
  - Integrated experiment diagnostics; Samantha Labb, Kelly Kmak(LLNL)
- Discussion (20 min)

NNSA
National Nuclear Security Administration