Oak Ridge National Laboratory
Overview

Benjamin Thomas, Jr.
Nuclear Nonproliferation Division

2023 NSSC Fall Workshop & External Advisory Board Meeting
Berkely Labs, October 17-18, 2023

https://dnn-consortium.ornl.gov
DISCUSSION

• Overview of ORNL’s Mission
  – Roots
  – Present
  – The Future (Based on Facts & Figures)

• What Makes ORNL Special
  – People
  – Discoveries
  – Facilities

• Highlights of NA-22 Relevant Work
  – Nuclear Nonproliferation at ORNL
  – Examples of Work Performed by NSSC Interns

• Closing Remarks
  – Career Opportunities
  – Imagine YOU at ORNL
Roots of ORNL
ROOTS – 80 YEARS AGO

Clinton Laboratories, 1943
Mission: Produce gram quantities of plutonium for chemical and engineering research

- Construct the world’s first continuously operated nuclear reactor
- Develop chemical processing techniques to separate plutonium from irradiated fuel
Mission: Deliver scientific discoveries and technical breakthroughs needed to realize solutions in clean energy and national security and provide economic benefit to the nation.
Meeting national needs through discovery and innovation

Defending the nation

Improving human health

Developing energy solutions

Protecting the environment

Enhancing energy security

Advancing US competitiveness

Our work leads to solutions in clean energy and national security and provides economic benefit to the nation.
Future Mission of ORNL: Will evolve to meet national needs based on historical facts and figures

- Nation’s most diverse energy portfolio
- Nation’s largest materials research portfolio
- World’s most intense neutron source
- World-class research reactor
- Forefront scientific computing facilities
- $2.7B FY22 budget authorization
- ~6,200 employees
- 3,200 research guests annually
- >$1B modernization investment
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- 2,562 journal articles published in FY22
- 68 patents issued in FY22
- 220 invention disclosures in FY22
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What Makes ORNL Special?

• People
• Discoveries
• Facilities
The strength of laboratories like ORNL lies in the interdisciplinary composition of their staffs. Over and over again it has been demonstrated that the whole can be greater than the sum of its parts, that good people from diverse fields working together can make major scientific discoveries that are denied geniuses working in isolation.”

— Alvin M. Weinberg, 1967
Discoveries: Delivering solutions to challenging problems in science and technology *(signature strengths)*

- Deliver exascale computing from system to ecosystem
- Accelerate deployment of fusion and advanced fission energy
- Discover and design next-gen materials and chemical processes for clean energy
- Unlock complexity in biological and environmental systems
- Provide strategic isotope R&D and production
- Transform integrated energy systems to accelerate decarbonization
- Maintain global leadership in neutron sciences
- Address pressing national security challenges
Discoveries: Delivering translational research for national priorities

We apply our signature strengths to the most compelling S&T challenges

Mission first. People always.
Facilities: ORNL’s distinctive facilities bring thousands of R&D partners to Tennessee each year

ORNL user facilities

- Building Technologies Research and Integration Center
- Manufacturing Demonstration Facility
- Carbon Fiber Technology Facility
- National Transportation Research Center
- Center for Nanophase Materials Sciences
- Oak Ridge Leadership Computing Facility
- High Flux Isotope Reactor
- Spallation Neutron Source
Highlights of NA-22

Relevant Work

- Nuclear Nonproliferation
- Internships of Consortiums Fellows

https://dnn-consortium.ornl.gov
NUCLEAR NONPROLIFERATION at ORNL: REDUCING NUCLEAR RISK
Delivering science, technology, and operational solutions to nonproliferation challenges
## Recent Consortiums Fellows at ORNL: Interns and Research Staff

<table>
<thead>
<tr>
<th>Name</th>
<th>Position/Role</th>
<th>Institutions</th>
<th>Research Areas</th>
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<tbody>
<tr>
<td>Bernadette Brezinski</td>
<td>NSSC – 2022 Intern</td>
<td>UTK – BS / Nuclear Engineering</td>
<td>Signal processing</td>
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<tr>
<td>Dinara Ermakova</td>
<td>NSSC – 2022 Intern</td>
<td>UCB – PhD / Nuclear Engineering</td>
<td>Renewable energy sources</td>
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<tr>
<td>Krysten Stiefel</td>
<td>NSSC – ORNL Staff</td>
<td>MSU – PhD / Nuclear Chemistry</td>
<td>Criticality safety in high radiation environments (isotope production)</td>
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<tr>
<td>Lance Drouet</td>
<td>NSSC – 2023 Intern</td>
<td>UTK – PhD / Nuclear Engineering</td>
<td>AI/ML techniques for nuclear data</td>
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<tr>
<td>Jordan Stomps</td>
<td>ETI – 2022 Research Collaborator</td>
<td>UWM – PhD / Nuclear Engineering</td>
<td>AI/ML for nonproliferation applications</td>
</tr>
<tr>
<td>Patrick Snarr</td>
<td>ETI – 2023 Research Collaborator</td>
<td>PSU – PhD / Nuclear Engineering</td>
<td>Signatures for nuclear forensics</td>
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<tr>
<td>Brad Nethercutt</td>
<td>MTV – 2023 Intern</td>
<td>UM – PhD / Physics</td>
<td>Nuclear detection technologies</td>
</tr>
<tr>
<td>Jason Nattress</td>
<td>MTV – ORNL Weinberg Fellow</td>
<td>PSU – PhD / Nuclear Engineering</td>
<td>AI/ML for nonproliferation applications</td>
</tr>
</tbody>
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[https://dnn-consortium.ornl.gov](https://dnn-consortium.ornl.gov)
Lance Drouet, 3rd Year PhD, Nuclear Engineering, UTK

ORNL 2023 Summer Internship

• **Mentor:** Rike Bostelmann (Nuclear Energy & Fuel Cycle Division)

• **Assignment:** Investigate the impact of nuclear data uncertainties for safeguards applications

• **Results:**
  - An enhanced understanding of the impact of nuclear data for the prediction of spent fuel inventory
  - Confidence in his career pursuit and continuing his PhD

**Doctoral Research:** Investigating the use of AI / ML techniques on nuclear data and data generated from simulated low-fidelity models to improve the optimization of nuclear system design.
ORNL 2023 Summer Internship

• Mentors:
  – Chad Parish (Materials Sciences & Technology Division)
  – Holden Hyer (Nuclear Energy & Fuel Cycle Division)

• Assignment: Understand both the processing & characterization sides of additive manufacturing

• Results:
  – Learned to print samples via LPBF
  – Learned to characterize the grain structure of samples using microscopic instruments
  – Learned to improve data collection
  – Collected data useful for his dissertation

Doctoral Research: Characterization of additively manufactured materials to determine how the microstructure of oxide dispersion strengthened (ODS) steel synthesized via Laser Powder Bed Fusion (LPBF) is influenced by changes in the preceding metal powder.
Closing Remarks

• Opportunities at ORNL
• Imagine YOU at ORNL

https://dnn-consortium.ornl.gov
Educational Programs Information

Academic Year 2023 - 2024
ORNL Undergraduate and Graduate Opportunities

INTERNSHIP PROGRAMS

• DOE WDTS Program: Science Undergraduates Laboratory Internships for Undergraduates (SULI)
  o Summer 2024: 10 weeks - Apply by January 9, 2024

• NNSA-Minority Serving Institutions Internship Program (NNSA-MSIIP)
  o Summer 2024: 12 weeks – Apply by October 22, 2023

• ORNL Programs
  o Undergraduate Research Student Internship and the Technical and Professional Internship Programs
    • Summer 2024: 10 weeks – Apply by February 22, 2024
  o Graduate Research Student Internship and the Technical and Professional Internship Programs
    • Summer 2024: 10 weeks – Apply by February 22, 2024

• The GEM Fellow Internship Program at ORNL
  o Summer 2024: Apply by November 15, 2023

RESEARCH COLLABORATIONS PROGRAMS

• DOE WDTS Programs
  – Office of Science Graduate Student Research Program (SCGSR) for PhD Students
    • Award period is 3-12 consecutive months
    • 2024 Applications due by November 8, 2023
    • Participants must start between June 20, 2024 and October 7, 2024

• ORNL Programs
  – Graduate Research at ORNL (GRO) for PhD Students
    • Award period is 3-12 consecutive months
    • Award vary based on arrangements between ORNL mentor(s) and the student’s university
    • Program is designed to be flexible in the time spent doing research at the student’s home university and ORNL

Apply to one of each type before the deadlines at https://education.ornl.gov
Imagine YOU at ORNL: Helping to build a diverse and talented STEM workforce

- Postdoctoral research programs
- Distinguished staff fellowships
- Visiting faculty opportunities
- Undergraduate and graduate programs
- Innovation Crossroads
Imagine YOU at ORNL: Helping Change the World

- Conducting world-leading research
- Ensuring the nation’s energy future
- Strengthening national security
- Focusing on the most difficult problems
- Expanding energy justice through innovation
- Delivering impactful breakthroughs

Oak Ridge National Laboratory
Thank You!