NSSC: Past, Present, and Future

Dr. Jasmina Vujic
NSSC Director
University

NSSC3 Kickoff Meeting and Advisory Board Review
April 19-20, 2022
The UC Berkeley-led Nuclear Science and Security Consortium is celebrating 10 years of success – with a thriving pipeline from recruitment and mentorship of top students to a large pool of skilled talent transferred to careers at the national laboratories, academia and industry. In addition, the NSSC has demonstrated scientific excellence in innovative BASIC and APPLIED research in nuclear security science and engineering.
In 2011, the National Nuclear Security Administration (NNSA) awarded NSSC $25 million to establish a five-year program with two main objectives: enabling human capital development and fostering a rich collaborative research environment between universities and national laboratories.

The NSSC’s primary objectives are to:

- **recruit and train top students** in relevant nuclear disciplines,
- connect students with a **core set of disciplines** that support the nonproliferation and nuclear security mission,
- **expand university/national laboratory collaboration**—providing students the opportunity to **engage deeply in BASIC and APPLIED research** under the guidance of academic advisors and lab scientists,
- **expand university/national laboratory collaboration** – NSSC faculty engaging in various lab capability reviews / ST&E committees, etc.

Overall, the NSSC has engaged over **600** students, postdocs, specialists, and faculty members.
Through the NSSC1 MSI Initiative, the NNSA-mission-relevant science was encouraged through the NSSC1 MSI Research Grant Program and the NSSC1 MSI Summer Research Fellowship Program. Five multi-year research awards were granted. A total of 18 summer research fellowships were awarded to MSI graduate students to perform collaborative research with NSSC1 partner institutions.

<table>
<thead>
<tr>
<th>University</th>
<th>PI</th>
<th>Research Focus</th>
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<tbody>
<tr>
<td>Clark Atlanta University</td>
<td>Conrad Ingram</td>
<td>Metal Organic Frameworks in Radiation Detection</td>
</tr>
<tr>
<td>Fisk University</td>
<td>Arnold Burger</td>
<td>Decreased Electronic Noise in CZT Gamma Spectrometers</td>
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<tr>
<td>Hampton University</td>
<td>Paul Gueye</td>
<td>Applied Nuclear Physics for Nuclear Security Applications</td>
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<tr>
<td>South Carolina State</td>
<td>Zheng Chang</td>
<td>On the Separation of Beta-emission Fission Products</td>
</tr>
<tr>
<td>University of Texas, El Paso</td>
<td>Chintalapalle Ramana</td>
<td>Investigation of Tungsten Yttrium Based Structural Materials for Nuclear Reactor Applications</td>
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The NSSC Model - Fellowships

Building on our successful model for education and training, the NSSC is innovating in research and facilitating even deeper engagement with the National Laboratories.

NSSC Fellowships are awarded on the basis of:

- Academic merit
- Demonstrated competence in relevant research areas

All NSSC Fellows:

- Are supported by an academic advisor and a lab mentor
- Participate in an extended research internship at a national lab and a topical summer program
The NSSC Model – Mentorship and Lab Experience

We attract the best and brightest students from our 11 partner institutions

Match their interests to 1 of our 6 Focus Areas

Nuclear Physics & Nuclear Data | Radiochemistry & Nuclear Chemistry | Nuclear Material Science | Radiation Detection | Nuclear Chemical Engineering & Nuclear Engineering | Computing & Optimization in Nuclear Applications

In collaboration with our 5 National Lab Partners

Transition students into careers at the national labs supporting the NNSA Nuclear Security Agenda!
The NSSC Model – Facilities and Capabilities

Our scholars are our greatest asset!

UCB, UNLV, GWU, MSU, TAMU, UCD

Analytical Instrumentation Facility, Center for Additive Manufacturing and Logistics at NCSU

Advanced Materials Testing and Evaluation Lab at UIUC

Lead Loop Lab at UNM
# The NSSC Model – Management and Oversight

## NSSC Executive Team

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
<th>Role</th>
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<tbody>
<tr>
<td>Jason Hayward</td>
<td>UTK</td>
<td>Deputy Executive Director</td>
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<tr>
<td>Bethany Goldblum</td>
<td>UCB</td>
<td>Executive Director</td>
</tr>
<tr>
<td>Jasmina Vujic</td>
<td>UCB</td>
<td>PI/Director</td>
</tr>
<tr>
<td>Kai Vetter</td>
<td>UCB/LBNL</td>
<td>NNSA Liaison</td>
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<tr>
<td>Lee Bernstein</td>
<td>UCB/LBNL</td>
<td>Lab Liaison</td>
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## Partner Institutions

### Main Points of Contact (Academic & Lab)

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution</th>
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<tbody>
<tr>
<td>Juan Manfredi</td>
<td>AFIT</td>
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<tr>
<td>Chris Cahill</td>
<td>GWU</td>
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<tr>
<td>Sean Liddick</td>
<td>MSU</td>
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<tr>
<td>Djamel Kaoumi</td>
<td>NCSU</td>
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<tr>
<td>Cody Folden</td>
<td>TAMU</td>
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<tr>
<td>Mani Tripathi</td>
<td>UCD</td>
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<tr>
<td>Jim Stubbins</td>
<td>UIUC</td>
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<tr>
<td>Frederic Poineau</td>
<td>UNLV</td>
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<tr>
<td>Anil Prinja</td>
<td>UNM</td>
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<tr>
<td>Jason Hayward</td>
<td>UTK</td>
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<tr>
<td>Margaret Root</td>
<td>LANL</td>
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<tr>
<td>John Valentine</td>
<td>LBNL</td>
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<tr>
<td>Vladimir Mozin</td>
<td>LLNL</td>
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<tr>
<td>Jennifer Ladd-Lively</td>
<td>ORNL</td>
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<tr>
<td>David Peters</td>
<td>SNL</td>
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## External Advisory Board

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<tr>
<th>Name</th>
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<tr>
<td>Dr. Carol Burns</td>
<td>Chair</td>
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<tr>
<td>Dr. Roger Falcone</td>
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<td>Ms. Elaine Bunn</td>
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<td>Dr. Miriam John</td>
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<td>Dr. Brad Roberts</td>
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<td>Amb Linton Brooks</td>
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<td>Dr. Benn Tannenbaum</td>
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## Support Staff

<table>
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<tr>
<th>Name</th>
<th>Role</th>
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<tbody>
<tr>
<td>Ava Benkhatar</td>
<td>Program Manager</td>
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<tr>
<td>Derek Johnson</td>
<td>Financial Analyst</td>
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NSSC3 Partners (2021 - 2026)

- University of California, Berkeley
- University of California, Davis
- University of Nevada, Las Vegas
- Lawrence Berkeley National Laboratory
- Lawrence Livermore National Laboratory
- University of New Mexico
- Sandia National Laboratory (CA)
- Sandia National Laboratory (NM)
- Los Alamos National Laboratory
- University of Illinois, Urbana-Champaign
- Michigan State University
- Texas A&M University
- Air Force Institute of Technology
- George Washington University
- North Carolina State University
- Oak Ridge National Laboratory
- University of Tennessee, Knoxville
- University of New Mexico
NSSC Focus and Crosscutting Areas

**Nuclear Physics & Nuclear Data**
B. Jacak (UCB)
L. Bernstein (UCB)
S. Liddick (MSU)

**Radiochemistry & Nuclear Chemistry**
R. Abergel (UCB)
K. Czerwinski (UNLV)

**Nuclear Material Science**
P. Hosemann (UCB)
J. Stubbins (UIUC)

**Nucl. Chem. Eng. & Nuclear Engineering**
M. Fratoni (UCB)
R. Scarlat (UCB)

**Radiation Detection**
K. Vetter (UCB)
J. Hayward (UTK)

**Computing & Optimization in Nuclear Applications**
V. Sobes (UTK)

**Education in Nuclear Science, Technology & Policy**
B. Goldblum (UCB)
Focus Area Leads
B. Jacak (UCB)
L. Bernstein (UCB)
S. Liddick (MSU)

Rare isotopes
Neutrino nuclear physics

Nuclear matter at extreme energy and density
(n,x) reactions and fission

FACILITIES: MSU: NSCL, FRIB; UCB: LXe and LHe labs; UCD: LXe and LAr labs, Crocker Cyclotron, McClellan Nuclear Radiation Center (MNRC); LANL: LANSCE, LHe labs, Si pixel labs; LBNL: 88-Inch Cyclotron, LXe labs, Si pixel labs; ORNL: Associated Particle Imaging DT neutron source.
Nuclear Chemistry & Radiochemistry

**Focus Area Leads**
- R. Abergel (UCB)
- K. Czerwinski (UNLV)

**Chemical synthesis and speciation**

**Advanced spectroscopic techniques**

**Chemical synthesis and speciation**

**Chemical separations**

**FACILITIES:** Radiochemistry laboratories and computing clusters at UCB, UNLV, GWU, MSU, TAMU; UCD: McClellan Nuclear Research Reactor; LBNL: Heavy Element Research Laboratory; LANL: TA-48 Radiological Facilities; LLNL: Radioanalytical Facilities.
Radiation effects in materials

Advanced manufacturing and materials synthesis

Post-detonation nuclear forensics

Pre-detonation nuclear forensics

Radiation Detection

Focus Area Leads
K. Vetter (UCB)
J. Hayward (UTK)

Radiation detection and imaging systems
Detector materials
Detector development, readout, and characterization

FACILITIES: Research and teaching laboratories at UCB, UTK, MSU, and UCD; UTK: Scintillation Materials Research Center, Joint Institute of Advanced Materials, Ion Beam Materials Lab; MSU: NSCL, FRIB; UCD: MNRC Reactor facility, Crocker Nuclear Laboratory; LBNL: 88-Inch Cyclotron, low-background counting facility, semiconductor detector laboratory, scintillator discovery and production laboratory; research labs at LANL, LLNL, ORNL, and SNL.
Focus Area Leads
M. Fratoni (UCB)
R. Scarlat (UCB)

In situ monitoring of alternative fuel cycles

Radioisotope production

Proliferation resistant fuel technology

Safeguards for emerging fuel cycles

Volatility, solubility, and speciation

FACILITIES: MSU: UCB: Savio compute cluster, Biomolecular Nanotechnology Center, Heavy Elements Research Laboratory, SALT Laboratory, NSUF Material Characterization Laboratory; UIUC: Blue Waters and Delta Supercomputers; UTK: NE compute cluster; UNLV: Radiochemistry laboratory; TAMU: Thermal-Hydraulic Research Laboratory; research labs at LANL, LBNL, LLNL, ORNL, and SNL.
Computing & Optimization in Nuclear Applications

Focus Area Lead
V. Sobes (UTK)

Stochastic media radiation transport and nuclear signature analysis

AI optimization and networked detection

Characterizing reactor fuel isotopics

Al-based identification of nuclear resonances

Neutron spectra tailoring optimization

FACILITIES: UCB: Savio Compute Cluster; UIUC: Blue Waters and Delta Supercomputers; UTK: Joint Institute of Computational Sciences, NE Compute Cluster; AFIT: Bridgman Cluster, DoD Supercomputing Resource Center; UNM: UNM Center for Advanced Research Computing (CARC); LBNL: 88-Inch Cyclotron, NERSC; LLNL: National Ignition Facility (NIF).
Education in Nuclear Science, Technology, & Policy

Focus Area Leads
B. Goldblum (UCB)

All Partner Institutions contribute to this crosscutting focus area

NSSC LANL Keepin Nonproliferation Science Summer Program

Summer Schools and Boot Camps

Webinars, online lectures, and electronic engagement

National Laboratory internships and rotation

Program and curriculum development
NSSC: A Decade of Accomplishments!

NSSC has supported 611 students, postdocs, specialists, and faculty members

- 120 Bachelors Degrees
- 85 Masters Degrees
- 136 PhDs
- 887 Oral Presentations
- 569 Poster Presentations
- 214 Awards
- 412 Peer Reviewed Publications

Since 2011 NSSC has sponsored:

- 53 Webinars
- 9 Courses
- 45 Summer Programs
- 39 Conferences or Special Events

141 NSSC Alumni are currently working in the National Laboratories or Other Gov.
NSSC: Success Story

NSSC Postdoc Fellow

UCB Fellow during NSSC1 and NSSC2 (from 2013-2016)

Faculty Advisor: Jasmina Vujic

UIUC Assistant Professor

Blue Waters Assistant Professor at University of Illinois Champaign Urbana / and Chair of the Fuel Cycles and Waste Management Division of ANS

Department of Energy

Senior Advisor in the Office of the Secretary. Prior to her current role, she served as the Principal Deputy Assistant Secretary for the Office of Nuclear Energy.

Kathryn Huff
141 of our alumni are working in the national laboratories or other government positions!

Kelly Kmak
UCB → LLNL

Caleb Redding
UTK → ORNL

Rebecca Krentz-Wee
UCB → IAEA

Roy Ready
MSU → US Naval Research Lab

46% of NSSC scholars to national labs and other government positions!
46% of NSSC Fellows and Affiliates that graduated are currently in careers in the National Laboratories or other government positions.

NSSC Alumni have also gone on to careers in nuclear security related academia and industry.

As the NSSC begins the third phase, NSSC Alumni are now connecting with new NSSC Fellows as Academic Advisors and Lab Mentors.

We look forward to working with our community to continue to develop the next generation of nuclear security experts.
Acknowledgements

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