Purdue Conference on
Active Nonproliferation

Hosted By:

The Institute of Nuclear Materials Management (INMM)

The INMM Central Region Chapter (CRC)

Purdue University's Center for Radiological and Nuclear Security (CRANS)

INMM Affiliated Technical Division: Nonproliferation and Arms Control (NAC)

March 22-23, 2019

Welcome

On behalf of the Institute of Nuclear Materials Management (INMM), the Purdue Center for Radiological and Nuclear Security (CRANS), the INMM Purdue Student Chapter, and the INMM Central Region Chapter, I would like to welcome you to Purdue's Conference on Active Nonproliferation (CAN). As one of the original Manhattan project universities and one of the country's leading engineering universities, Purdue has been intimately tied to the development of nuclear technology from the earliest days of the field. It is here that the phrase "barn" was coined for measuring the probability of a neutron reaction with a nucleus and where some of the first reactor-produced radionuclides were used for peaceful purposes in pharmaceutical sciences. Now in its 150th year, Purdue University is proud to host current and future leaders in the "active nonproliferation community" – those that shape the global nonproliferation landscape by implementing treaty verification regimes, combating nuclear terrorism, and supporting the overall nuclear security and nuclear safeguards cultures. This diverse community is represented by policy makers, field personnel employing radiation detection technology and safeguards principles, government agency members, and researchers developing new techniques and capabilities. Encouraging nuclear nonproliferation, verifying success, and deterring diversion is an ever-present challenge that requires input and action across disciplines. This is an important time to be involved in "active nonproliferation", and we are very proud to host this event.

Dr. Jason Harris
Director, CRANS
Member at Large, INMM – CRC

Agenda

Friday, March 22

Purdue Memorial Union, West Faculty Lounge, 2nd Floor

2:30–3:00 pm **Registration**
Outside West Faculty Lounge, 2nd Floor – Purdue Memorial Union (PMU)

3:00–3:30 pm **Opening Remarks**
Dr. Robert Bean (Purdue CRANS, Associate Director) and Jessica White-Horton (INMM – CRC, President)

3:30–4:15 pm **"From Nuclear Rivalry to Nuclear Cooperation: An Imperfect but Important Nuclear History Lesson from the Southern Cone"**
Dr. Sara Kutchesfahani (author of Global Nuclear Order and Director of the N Square DC Hub)

4:30–6:00 pm **Technical Session 1 (Radiation Measurements I)**

4:30–4:50 pm "Characterization of Neutron and Gamma Background Radiation at Varying Altitude by Unmanned Aerial Vehicles (UAVs)"
Midshipman Andrew Lee (US Naval Academy at Annapolis)

4:50–5:10 pm "Radiation Detection Visualized in Virtual Reality and Assisted by Augmented Reality"
Erik Medhurst and Dr. Rizwan Uddin (University of Illinois at Urbana Champaign)

5:10–5:30 pm "A Characterization of Undersea Neutron and Capture Gamma Signatures Resulting from Special Nuclear Material on a Maritime Vessel"
Midshipman Elizabeth Troy, Commander Travis Chapman (USN), and Assistant Professor Marshall Millett (US Naval Academy at Annapolis)

5:30–5:50 pm "Application of Ab Initio Modeling Techniques to Radiation Detector Materials (4H-SiC) toward Relevant Multi-Scale Models"
Timothy Wolfe (Purdue University at West Lafayette)

6:00–8:00 pm **Evening Mixer (appetizers provided)**
East Faculty Lounge, 2nd Floor – PMU

Saturday, March 23

Stewart Center, Room 302, 3rd Floor

7:00–8:00 am **On-site Check In and Vendor Set Up**

7:30–8:00 am **Continental Breakfast**

8:00–9:20 am **Technical Session 2 (Radiation Measurements II)**

8:00–8:20 am "Initial Active Interrogation Experiments at the University of Michigan Linear Accelerator Laboratory"
Christopher Meert, Cameron Miller, Dr. Shaun Clarke, and Dr. Sara Pozzi (University of Michigan at Ann Arbor)

8:20–8:40 am "The Effects of the Urban Environment on Background Neutron Flux"
Midshipman Eric Reddick, Professor John Burkhardt, and Assistant Professor Marshall Millett (US Naval Academy at Annapolis)

8:40–9:00 am "Bayesian Unmixing Algorithms for Identification of Gamma Sources Using Organic Scintillators"
Dr. Angela Di Fulvio[1], Dr. Yoann Altman[2], Marc Paff[3], Dr. Al Hero, and Dr. Sara Pozzi; 1. University of Illinois at Urbana Champaign, 2. Heriot-Watt University at Edinburgh (UK), 3. University of Michigan at Ann Arbor

9:00–9:20 am "US Naval Academy Directional Radiation Detector Capstone Team"
Midshipman Andrew Reinhart (US Naval Academy at Annapolis)

9:30–10:30 am Technical Session 3 (Nuclear Security / Terrorism)

9:30–9:50 am "International Nuclear Cyber Security Threat Landscape"
Dr. Shannon Eggers and Charles Nickerson (Idaho National Laboratory)

9:50–10:10 am "Development of a Small Modular Reactor"
Midshipman Trent Baker, Midshipman Ray Benitez, Midshipman Jack McMahan, Midshipman Josh Monge, and Midshipman Kayla Robinson (US Naval Academy at Annapolis)

10:10–10:30 am "Nuclear Posture Review"
William Keller (Defense Intelligence Agency)

10:30–12:00 pm Poster Session / Vendor Face-Time (co-located)

12:00–1:30 pm Lunch
STEW 306

1:30–3:30 pm Technical Session 4 (Nuclear Policy)

1:30–1:50 pm "Denuclearization Case Summaries and Analysis: Lessons Learned"
Jonathan Parker, Christian Young, and Richard Johnson (Purdue University at West Lafayette)

1:50–2:10 pm "Regulatory Design for Transport Security Regulations of Nuclear and Other Radioactive Material"
Dr. Marc Fialkoff (Oak Ridge National Laboratory)

2:10–2:30 pm "Nuclear History of Southern Cone and Steps Leading to SCCC and ABACC"
Dr. T. Douglas Reilly (Los Alamos National Laboratory, retired; first of three listed editors for Passive Nondestructive Assay of Nuclear Materials (PANDA) Manual published in 1991 out of LANL)

2:30–2:50 pm "International Reprocessing: Proliferation Considerations and Implications"
William Richards and Peter Nowicke (Purdue University at West Lafayette)

2:50–3:10 pm "Overview of the United States Withdrawal from the Intermediate-Range Nuclear Forces Treaty"
William Steinberger (University of Michigan at Ann Arbor)

3:30–4:00 pm Coffee Break

4:00–4:45 pm "Identity Sciences: The Intersection between Computational Sensing and Intelligence"
Dr. Hector Santos-Villalobos (Group Leader for Multi-Modal Analytics & Architectures at Oak Ridge National Laboratory)

5:00–5:30 pm Closing Ceremony

Keynote Speaker

Dr. Sara Kutchesfahani

From Nuclear Rivalry to Nuclear Cooperation: An Imperfect but Important Nuclear History Lesson from the Southern Cone

Abstract: Between the 1950s and 1980s, Argentina and Brazil were suspected by the international community – as well as by each other – to be pursuing covert nuclear weapons programs. Yet the two countries did not become nuclear weapons states. Instead, they became nuclear partners through a gradual nuclear rapprochement process that started in the late 1960s/early 1970s, culminating in the creation of the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) in 1991. ABACC is the world's only existing bilateral mutual safeguards inspection agency, and was crucial in helping Argentina and Brazil assuage suspicions by verifying each other's non-nuclear weapons status, and to officially renounce any interest in nuclear weapons.

ABACC's creation may provide a useful framework for both Koreas to contemplate as they move forward with their rapprochement. Skeptics may argue that ABACC might not be the best model to use as a comparison for the Korean Peninsula. It's true that the challenge in Argentina and Brazil was to verify each other's non-nuclear weapon statuses, while the challenge today is about persuading North Korea to denuclearize for the sake of regional stability and security. Nevertheless, the creation of ABACC is relevant. This talk will analyze the process behind the creation of ABACC, and outline how the experience of Argentina and Brazil may be applicable to solving the crisis on the Korean Peninsula today.

Biography: From April 2019, Dr. Sara Kutchesfahani will be the Director of the N Square DC Hub, and Research Associate at the Center for International Security Studies at the University of Maryland (CISSM). N Square is a path-breaking initiative built on the idea that new forms of cross-sector collaboration will accelerate the achievement of internationally agreed goals to reduce nuclear dangers. Together with her N Square responsibilities, she also works at CISSM in both a teaching and research capacity.

Most recently, she was a Senior Policy Analyst at the Center for Arms Control And Non-Proliferation where she led the Fissile Materials Working Group (FMWG), focused on efforts to reduce the risk of nuclear proliferation and terrorism. She was previously the Executive Director for the Center for International Trade and Security and the Director for the Master of International Policy (MIP) Program at the University of Georgia, where she worked on nuclear security-related projects and nuclear non-proliferation policy issues, and taught graduate courses on nuclear non-proliferation history and the global nuclear order. She has held research positions at Los Alamos National Laboratory, the RAND Corporation, the European Union Institute for Security Studies in Paris, and the International Institute for Strategic Studies in London. She holds a PhD in Political Science from University College, London, and is the author of Global Nuclear Order (Routledge: 2019) and Politics and the Bomb: The Role of Experts in the Creation of Creation of Cooperative Nuclear Non-Proliferation Agreements (Routledge: 2014).

Keynote Speaker

Dr. Hector Santos-Villalobos

Identity Sciences: The Intersection between Computational Sensing and Intelligence

Abstract: Hector, the lead for the Multi-Modal Analytics and Architectures group at the Oak Ridge National Laboratory (ORNL), will discuss the depth and breadth of ORNL's Identity Science research program, which intersects the fields of computer vision, computational imaging, machine learning, chemistry, biology, and many others. He will show latest biometric technological advances ORNL is making in order to enhance the nation's energy, economic, and national security, which include work on non-ideal face and iris recognition, face phenotype prediction from DNA samples, and through-the-windshield face recognition.

Biography: Dr. Hector J. Santos-Villalobos is the Group Leader for Multi-Modal Analytics & Architectures in the Cyber & Applied Data Analytics Division.

Hector was an R&D Staff member of the Imaging, Signals, and Machine Learning Group (ISML) at the Oak Ridge National Laboratory since 2012. He received B.S. and M.S. degrees in 2003 and 2005, respectively, from the Department of Computer and Electrical Engineering at the University of Puerto Rico. In 2010, he received a Ph.D. from the School of Electrical and Computer Engineering at Purdue University.

Shortly after receiving his PhD, Hector joined the ISML group as a post doctorate student. In 2011, he was one of the recipients of the Journal of Imaging Science and Technology (JIST) & Journal of Electronic Imaging (JEI) Itek Award for an outstanding and original research publication on imaging science and engineering concerning his doctorate work. During his time at ORNL, he has worked on a variety of imaging modalities with a common goal of developing capabilities and a reputation for computational imaging and identity sciences at ORNL. Key project areas include biometrics, coded aperture imaging, plenoptic imaging, and elastic ultrasound imaging. His research has produced several technical publications, three issued patents, and multiple research grants.

Consolidated Presentation Listing
(Alpha Order by Speaker)

"Development of a Small Modular Reactor" by Midshipman Trent Baker, Midshipman Ray Benitez, Midshipman Jack McMahan, Midshipman Josh Monge, and Midshipman Kayla Robinson (US Naval Academy at Annapolis) [Nuclear Security / Terrorism]

"Bayesian Unmixing Algorithms for Identification of Gamma Sources Using Organic Scintillators" by Dr. Angela Di Fulvio1, Dr. Yoann Altman2, Marc Paff3, Dr. Al Hero, and Dr. Sara Pozzi; 1. University of Illinois at Urbana Champaign, 2. Heriot-Watt University at Edinburgh (UK), 3. University of Michigan at Ann Arbor [Radiation Measurements II]

"International Nuclear Cyber Security Threat Landscape" by Dr. Shannon Eggers and Charles Nickerson (Idaho National Laboratory) [Nuclear Security / Terrorism]

"Regulatory Design for Transport Security Regulations of Nuclear and Other Radioactive Material" by Dr. Marc Fialkoff (Oak Ridge National Laboratory) [Nuclear Policy]

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"Application of Ab Initio Modeling Techniques to Radiation Detector Materials (4H-SiC) toward Relevant Multi-Scale Models" by Tim Wolfe (Purdue University at West Lafayette) [Radiation Measurements I]

Consolidated Poster Listing
(Alpha Order by Presenter)

"A Review of Saudi Arabia's Nuclear Weapons Capabilities" by Captain Logan Brandt and Cadet Marshall Foster (US Air Force Academy at Colorado Springs)

"Characterization of Multilayered Composite Heavy Oxide Inorganic Scintillators Analysis" by Cadets Nicholas Donze, Seth Bailer, Anmol Narang, Joseph Kyburz, Thomas Weatherford, LTC (P) Peter Chapman, MAJ Jacob Capps, and MAJ Gabriel Lucero (US Military Academy at West Point)

"Advancements on Spent Fuel Pools through Passive Cooling" by Daniel Hartman, Sean Alcorn, Tyler Naughton, Chris Duff, and Gavin Webb with Mentor Dr. Martin Grossbeck (The University of Tennessee at Knoxville)

"Exploring Laser Induced Breakdown Spectroscopy (LIBS) for Post-Detonation Nuclear Forensics Debris Analysis" by Cadet Justin Knoll1, Colonel Chad Schools2, and Captain David Fobar1; 1. US Military Academy at West Point, 2. Nuclear Science and Engineering Research Center, Defense Threat Reduction Agency

"Effectiveness of Model-based Defenses for Digitally-Controlled Industrial Systems: Nuclear Reactor Case Study" by Yeni Li, Dr. Elisa Bertino, and Dr. Hany Abdel-Khalik (Purdue University at West Lafayette)

"Analysis of Proliferation Resistance of Small Modular Reactors (SMR) for the Expansion of Civilian Nuclear Power Systems" by Professor A.S. Mollah (Military Institute of Science and Technology of Bangladesh)

"Mn-54 Radiation Measurement through Use of a NaI (Tl) Scintillation Detector Under Vacuum" by Luke Tyree (Purdue University at West Lafayette)

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