

JNMM

Journal of Nuclear Materials Management

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Mission Statement

The Institute of Nuclear Materials Management is dedicated to the safe, secure and effective stewardship of nuclear materials and related technologies through the advancement of scientific knowledge, technical skills, policy dialogue, professional capabilities, and best practices.



“May You Live in Interesting Times”

Susan Pepper
INMM President



I used to think this saying was a wish for good fortune. It is wonderful to live at a time when there is a lot to stimulate our senses, but 2020 certainly showed us the other, ironic meaning of the saying, which is intended as a curse. The Chinese have a similar proverb that says, “Better to be a dog in times of tranquility than a human in times of chaos.” 2020 has been anything but tranquil, and with it has come threat, uncertainty, and unease. However, there have been several silver linings in that people found creative ways to stay in touch during our quarantines, neighbors helped each other, businesses made innovative changes to serve their customers, scientists rose to the challenge of finding a vaccine for COVID-19, and the INMM was forced to consider an alternate means to delivering the Annual Meeting. We are happy to put 2020 behind us, but 2021 has not yet brought us the tranquility or the resumption of activity that we all long for. But we have hope that circumstances are improving. So, I wish you all the best for this new year.

This edition of the *JNMM* includes the speeches delivered and interviews conducted during the 2020 INMM Annual Meeting. We were very lucky this year to have a distinguished group of plenary speakers, including Ambassador Gustavo Zlauvinen, former National Nuclear Security Administration Administrator

Lisa Gordon-Hagerty, Deputy Director General for Safeguards Massimo Aparo, former Assistant Secretary of Energy Dr. Rita Baranwal, and former Secretary of Energy Dr. Ernest Moniz. We also had a special discussion during the “Women of Mass Distinction” event with Ambassador Bonnie Jenkins—look for the transcript of that discussion in an upcoming issue of the *JNMM*.

As is often mentioned, one of the most fulfilling responsibilities of the INMM Vice President is to present awards to members of the INMM and our international community to recognize their contributions and achievements. At the 2020 Annual Meeting, I shared that responsibility with then-President Cary Crawford. I want to take this opportunity to recognize the individuals who were honored for their service to the Institute and the field of nuclear materials management. Mona Dreicer, Therese Renis, and Kurt Siemon received the Vincent J. DeVito Distinguished Service Award. Melissa Einwechter was given the Early Career Award. The Integrated Support Center for Nuclear Nonproliferation and Nuclear Security was awarded the Charles E Pietri Special Service Award. In addition, Leslie Fishbone and Corey Hinderstein were elevated to the membership grade of Fellow of the INMM. For 2021, we look forward to a new award—“The WINS and INMM

Roger Howsley Medal for Excellence in Nuclear Security”—which will honor Roger Howsley for his work with the World Institute for Nuclear Security. This award will be granted jointly by WINS and the INMM, and the first award will be given in 2021.

While we are still reporting on the 2020 Annual Meeting, the Annual Meeting Committee is already working on the program and other details for the 2021 Annual Meeting, which will be held at the Austria Centre in Vienna, Austria, August 22-26, 2021. The call for abstracts was distributed in late December with a deadline of February 20. The Technical Program Committee will meet in April to develop the technical program. We also plan to expand on our effort to increase the diversity of participants through a competition for travel and registration grants. Because of the success of the virtual Annual Meeting in 2020, the INMM is planning a hybrid meeting in 2021, with in-person and virtual components. A final decision as to whether we can proceed with the in-person component will be made in March.

These are interesting times, indeed. I look forward to working with the Executive Committee, the Technical Divisions, and the Committees this year to meet the challenges ahead and to ensure that the INMM continues to support the nuclear materials management community.



Annual Meeting in an Unusual Format

Markku Koskelo
JNMM Technical Editor

This double issue summarizes the 61st INMM Annual Meeting that was held virtually last summer. The virtual format was necessitated by the ongoing COVID-19 pandemic, of course. Despite the difficulties posed by the circumstances, and the rather short timeline to switch from the traditional in-person meeting to an online meeting, the Annual Meeting Committee and the Technical Program Committee were able to organize a great meeting.

We had more attendees in the meeting than we have had in the last few years. Please see the summary of the attendance on page 6 of this issue. The meeting also included a much larger number of Plenary speakers than has been possible in the in-person meetings.

All of the Plenary talks and the questions associated with them are transcribed in this issue. Susan has already listed the distinguished speakers in her column so I will not repeat their names here.

We were also able to arrange the traditional *JNMM* Roundtable to interview two of the Plenary speakers, Ambassador Gustavo Zlauvinen and DDG Massimo Aparo. The transcript of the Roundtable includes the questions posed by the INMM leadership to the plenary speakers and offers additional, candid insight from them for the future of safeguards and global security.

In his column, "Taking the Long View in a Time of Great Uncertainty," Jack Jekowski, Industry News Editor and the

INMM Historian, offers many interesting insights on how the pandemic has most likely changed the world permanently, at least for certain things that we have been accustomed to doing in a particular way.

In his book review, Mark Maiello gives an overview of *The Senkaku Paradox: Risking Great Power War Over Small Stakes*. The book, written by Michael E. O'Hanlon, discusses how small events may lead to a great conflict and how to find alternative ways to prevent such escalation.

Should you have any comments or questions, feel free to contact me.

Markku Koskelo
JNMM Technical Editor



The 2020 INMM Annual Meeting Technical Program 61st Annual Meeting

Carrie Mathews

Chair, Technical Program Committee

In a year marked by isolation and separation, the INMM Annual Meeting, with its theme of “Connection and Collaboration,” was a welcome respite and timely reminder that we are a resilient community of nuclear materials management professionals. The meeting gathered more than 700 people together for rich discussions and discourse in 75 sessions over 5 days. Five keynote addresses were delivered in daily plenary sessions on topics ranging from the nuclear nonproliferation regime to advancements in the nuclear fuel cycle, and from long-term disposition of spent fuel to strengthening international safeguards and nuclear security. Check out some of their insightful remarks in separate articles in this issue.

Pivoting to a virtual platform just 7 weeks before the meeting started was certainly a challenge. But a small team of organizers had been meeting every other week starting in late March, gathering information and making decisions that ultimately led to the announcement on May 21, 2020 that, for the first time ever, the INMM would be held virtually. INMM partnered with Falcon Events and BlueSky to create a platform that felt as close to our in-person meeting as we could manage. Presenters were asked to upload their pre-recorded slideshows to create online poster and oral sessions. Panelists were invited to participate in live-streamed sessions. The student paper competition was launched, with judges viewing presentations live and on-demand. A “virtual hotel

café” was created to facilitate interaction among participants.

The entire process was dynamic, with everyone learning as they went, and adjusting as information ebbed and flowed. Tech checks were scheduled with plenary speakers, and moderators prepared their scripts to coordinate virtual panels. Everyone learned new audio-visual terminology and downloaded new apps like Slack, Zoom, and Slido. Flexibility, teamwork, and faith were needed in equal measure. The entire AH staff, particularly the Meetings Chair, Ms. Elizabeth Hogan, went above and beyond to make the meeting happen.

The uncertainty surrounding the Annual Meeting led to many withdrawals of accepted abstracts, from 320 accepted to 242 presented, but a few last-minute panel sessions were organized to address timely topics of great interest. One panel discussed how organizations—an inspectorate, a regulator, a production facility, and a research laboratory—continued operating and fulfilled their critical missions during the pandemic. Another described response and remediation of a Cesium source leak at a medical center. A special “Women of Mass Distinction” event was organized by INMM Vice President Susan Pepper, featuring Ambassador Bonnie Jenkins who shared the lessons and insights she’s gleaned from a long and distinguished career.

The technical program featured diversity: of topics, geography, gender, familiarity with INMM, and career levels.

Of the more than 700 attendees, about half were not INMM members and many were first time attendees. Eighty-one were students, and 104 were from outside the United States. The most well-attended sessions included “Nuclear Security—Looking Ahead,” “Emerging Technology in Safeguards,” “Small Modular Reactors: Changing the Game,” “The Nonproliferation Regime,” and “Machine Learning and AI for Safeguards and Nuclear Material Accountability.” If you missed some sessions, don’t worry—you can purchase packages for on-demand viewing at inmm.org, through July 2021, and the proceedings are available for members on the website as well.

The 2020 Annual Meeting was a success and the INMM community was grateful to gather together as we have done every year since 1959. But we also learned much that will help us better serve our community in future virtual meetings. For example, we know that participants prefer to interact with one another via video chat and/or live audio conversations. Although interaction among participants and with speakers was enabled through a Q&A/chat app (Slido) within the sessions, the platform did not enable live connections. In addition, more time was needed in the schedule for breaks and side meetings. The exhibitors’ program for live interactions/demonstrations needed to be easier to access. But the most important lesson we learned was that through a virtual platform, the INMM community grew, and will continue to grow as



we reach beyond borders and eliminate obstacles to Annual Meeting attendance. This challenging experience ultimately taught us just how much we can achieve and how far we can go—through connection and collaboration.

We are now busy planning the 2021 joint INMM-ESARDA Annual Meeting, to be held in Vienna, Austria (and we are working on having an online option as well), from August 22-26. The theme is “Advancing Together: Innovation and Resilience in

Nuclear Materials Management.” We will need our members’ help to make the meeting a success. Would you like to get involved? Contact inmm@inmm.org or JRC-esarda@ec.europa.eu and check the organizations’ websites to learn more.

Programs » Virtual 61st Annual Meeting... » Daily - Monday, July 13, 2020 » Welcoming Remarks & Opening...

Welcoming Remarks & Opening Plenary (On-Demand) View Report Edit

Overview ⚙️ ☰ Resources +

DESCRIPTION

THANK YOU TO OUR EXHIBITORS **SPECIAL EVENTS TODAY**

Women of Mass Distinction
6:30 pm
with Ambassador Bonnie Jenkins

[Welcoming Remarks by INMM President Cary Crawford](#)

Opening Plenary:

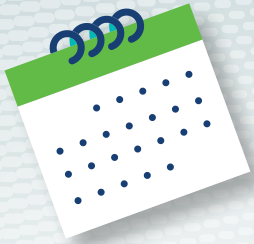
Ambassador Gustavo Zlauvinen, President-designate of the 10th Review Conference of the Nuclear Nonproliferation Treaty (NPT)

Lisa E. Gordon-Hagerty, Under Secretary for Nuclear Security of the U.S. Department of Energy (DOE) Administration and Administrator of the National Nuclear Security

The Online Platform, Showing the Welcome by INMM President Cary Crawford, in Monday's Opening Plenary



INNMM ANNUAL MEETING



7

weeks from the decision to move to virtual to the first day of the Annual Meeting

386

INNMM members

323

non-members

709

participants visited the platform more than 30,000 times over 5 days

81

students

104

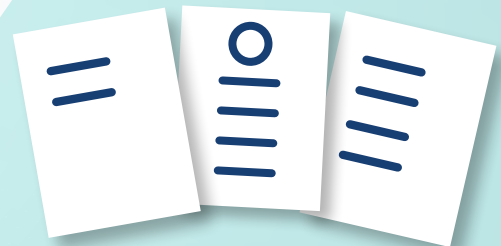
participants outside of the United States

15

meetings of the ad hoc planning group

1341

attendees in the four Plenary sessions



200+ slideshows, **193** papers, **242** abstracts, **320** headshots, **300** bios—all uploaded to the platform by **10** dedicated technicians

75

sessions held in total—now available for on-demand viewing!



Opening Plenary Session 61st Annual Meeting

Plenary Speakers:

Ambassador Gustavo Zlauvinen

President-Designate of the 10th NPT Review Conference

Lisa Gordon-Hagerty

Former Administrator, National Nuclear Security Administration



Dr. Mona Dreicer:

Good morning, and thank you, Susan. Thank you everybody. It's a great honor, both to be an introducer and a moderator in this morning plenary, or this opening plenary, and also for the award. So, thank you very much. I'd like to start by saying good morning, good afternoon, and good evening to everybody.

It's my job to introduce Ambassador Gustavo Zlauvinen. He is currently the President-Designate of the 10th NPT Review Conference. During his career in the diplomatic service, the Ambassador has served as delegate from Argentina to a number of disarmament, nuclear energy, and arms control conferences and meetings, including the IAEA Board of Governors and General Conference, the United Nations General Assembly's first committee, the NPT review process, the conference on the Adoption of the Nuclear Safety Convention, and the Committee on the Peaceful Uses of Outer Space.

Before taking up his role, he has served as the Deputy Foreign Minister, the Undersecretary of State for Foreign Policy, and the Director of International Organizations at the Ministry of Foreign Affairs of Argentina. He was twice seconded to the U.N. system as the Representative of the Director General of the IAEA to the United Nations in New York, the Chef de Cabinet to the Executive Chairman of the United Nations Special Committee

on Disarmament of Iraq or UNSCOM. And he also served as Director for International Affairs of the Argentine National Space Agency. He is a graduate of the Argentine Diplomatic Academy and has a degree in international relations from the National University of Rosario. And now, I'll turn the microphone over to my co-moderator, Irmie, to introduce our second Opening Plenary speaker.

Dr. Irmgard Niemeyer:

Thank you, Mona, and thank you, Susan. Good afternoon from Germany and good morning, good afternoon, good evening to wherever you are. I now have the pleasure and honor of introducing Administrator Gordon-Hagerty. Lisa Gordon-Hagerty serves as the Administrator of the National Nuclear Security Administration and Undersecretary for Nuclear Security of the U.S. Department of Energy and NNSA as confirmed by the U.S. Senate on February 15, 2018. She is the first woman to hold this leadership position.

As many of us know, NNSA is a semi-autonomous agency whose portfolio includes maintaining and enhancing the safety, security, and effectiveness of the U.S. nuclear weapons stockpile, working to reduce the global danger from weapons of mass destruction, providing the U.S. Navy with safe and effective nuclear propulsion, and responding to nuclear and

radiological emergencies in the U.S. and abroad.

Administrator Gordon-Hagerty served on the White House National Security Council staff as the Director for Combating Terrorism, as the Director of the Office of Emergency Response, as acting Director of the Office of Nuclear Weapons Surety, and was a professional staff member on the U.S. House of Representatives Committee on Energy and Commerce.

She began her career as a health physicist at the Lawrence Livermore National Laboratory.

Administrator Gordon-Hagerty holds a Masters of Public Health degree in Health Physics and a Bachelor of Science, both from the University of Michigan. She's a member of the Council on Foreign Relations and the Health Physics Society.

Administrator Gordon-Hagerty, I'm sure that everybody is joining me also to virtually welcome you to our opening plenary. And I will get back to my co-moderator now.

Dr. Mona Dreicer:

Well, I guess if the Ambassador is ready, I would welcome him to begin his remarks. Thank you very much.

Ambassador Gustavo Zlauvinen:

Thank you, thank you, Mona and Irmgard. President of INMM, Mr. Cary



Crawford, Administrator Gordon-Hagerty, distinguished members of the Executive Committee of INMM, as well as moderators and panelists, dear colleagues. It is a pleasure for me to have the opportunity to talk to you in my role as President-Designate of the 10th Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons (NPT). As you are aware, in light of the situation related to the global COVID-19 pandemic, the Review Conference has been postponed to a later date, as soon as the circumstances permit, but no later than April 2021. We have held, on a tentative basis, the dates of April 4-29 2021 to hold the meeting in New York, but we will continue to assess the situation in light of ongoing developments. I hope our interaction today will contribute to a dialogue that will continue through various channels in the period leading to the Review Conference.

You, the INMM membership, include the actual practitioners—the engineers, scientists, technicians, managers, policy-makers, analysts, commercial vendors, educators, and the next generation. In short, you are the experts involved in not only the various day-to-day aspects of nuclear materials management through your national nuclear systems, but on a global basis through the IAEA and other international forums, today and into the future.

Your efforts “to promote leading research and development as well as the practical application of new concepts, approaches, techniques and equipment for managing nuclear materials” provide essential support to the implementation of the NPT and contribute to help make a reality the provisions of the third NPT pillar—access to peaceful nuclear applications—from which many countries derive daily benefit.

2020 is a milestone year for the NPT. It marks both the fiftieth anniversary of the Treaty's entry into force and the twenty-fifth anniversary of the decision to extend it indefinitely. Like many regional and international arrangements, the NPT has faced many challenges and it will continue to face new ones. It is not perfect. But we must keep in mind that for 50 years now, this Treaty has proven vital to the maintenance of international peace and security and central to providing access to peaceful nuclear applications. It is in our collective interest for States Parties to use this milestone year to take a step back and reflect, to reaffirm their commitments to this instrument, and to look ahead to the future and what they can do to ensure that all of them are able to receive the benefits this important Treaty provides.

Discussions on the NPT often turn to the two very important “pillars” of non-proliferation and disarmament. Given the importance of these two issues to peace and security, this is appropriate, but I think it is important to highlight that the third pillar—which provides for access to peaceful nuclear applications—has not always been utilized to its full potential in many parts of the world.

To promote a successful conclusion to the Review Conference I have, in my role as the President-Designate and following my predecessor's approach, undertaken a process to engage a broad range of stakeholders in a comprehensive, balanced and constructive dialogue on all three of the Treaty's pillars—disarmament, non-proliferation, and the peaceful uses of nuclear energy—with the view to reaching the shared goal of a comprehensive and forward-looking outcome at the Review Conference, one that can be accepted and implemented by all and that produces concrete, sustainable, and transparent

implementation of the Treaty.

Let me share with you some of what we have been doing so far. I hope you will have some additional ideas and opportunities that we can discuss later that could contribute to future planning.

The effort began after the 3rd Preparatory Committee Meeting with a strategy to make maximum use of the time before the Review Conference. We wanted to start early to bring the issues that are covered and underpinned by the NPT to the attention of decision-makers and to promote engagement with the actual practitioners that put it to use every day in promoting and maintaining the peaceful uses of nuclear technology.

In addition to the traditional outreach usually conducted by the President-Designate, the strategy envisioned holding a series of regional workshops and thematic symposia in an effort to reflect the diversity of the NPT and its benefits, and to engage all parties to the Treaty in all regions of the world. These events were made possible with generous contributions from the European Union through a Council Decision and implemented through the United Nations Office for Disarmament Affairs (UNODA), from the Governments of the United States and Canada, and with the support of several host countries and international organizations. Let me express my appreciation for all of the assistance we have received to help realize our plans. In particular, let me take this opportunity to thank Administrator Gordon-Hagerty for the amazing level of support provided through the NNSA, as well as the Department of State and others, to help realize the workshop in Nigeria in particular, and the contributions to planning for other events.

While the regional workshops sought to cover all aspects of the Treaty, a special



effort has been devoted to focus on the peaceful uses of nuclear energy and nuclear cooperation. Every effort was made to ensure that the events were inclusive, reflective of the broad and growing global nuclear constituency, and, in addition to the diplomatic community, included representatives of institutions and bodies that play significant roles and perform activities directly linked to the peaceful uses of nuclear energy, nuclear techniques, and applications in each country.

The agendas were designed to stimulate a discussion relevant to the specific regions, and to provide the opportunity to share experiences, help identify where additional assistance might be needed, and consider possible mechanisms for providing that assistance. In this regard, it goes without saying that the International Atomic Energy Agency (IAEA) plays an important role in facilitating access to peaceful nuclear applications while also ensuring that the nuclear materials used remain in peaceful uses.

The strategy was to reach out to all regions, with workshops in Ethiopia, Thailand, and Nigeria last year, and another in South Africa in February. We had planned additional workshops in Asia and South America before the COVID-19 pandemic took hold. A thematic seminar in Vienna was also organized to take place in conjunction with the IAEA TACC meeting, to facilitate participation of experts.

It remains to be seen what we may be able to organize, possibly even virtually, in the period remaining before the Review Conference. Perhaps some of you have ideas on other possible regional events already being planned where it might be appropriate to include a virtual segment with a balanced discussion on the NPT and to highlight peaceful nuclear applications.

All of these events have helped raise

awareness of the NPT as the instrument that underpins the provision of access to important nuclear applications relevant to daily life.

A clear message from the workshops has been the relationship between economic, social, and environmental progress and international peace, security, and stability, and realizing the 2030 Sustainable Development Goals. Moreover, it was also noted that the three pillars of the NPT are mutually reinforcing, including the peaceful uses of nuclear energy and its many applications for energy, health, agriculture, drinking water, protection of fisheries, understanding climate change, and oceans. Implementation of the third pillar is critical to achieving support for the other two. I hope to continue to build on the outcomes from these workshops as we advance preparations for the Review Conference.

As I noted, our strategy is to broaden the conversation to lay the ground for a successful conclusion to the Review Conference. An integral element of this has been continued engagement on matters related to gender, youth, and with the private sector. With this in mind, we hope to highlight the importance of diversity of voices through three dedicated forums, to be held on the margins of the Review Conference:

First, the “Better Together” Forum—to consider ways to improve the diversity of participants at NPT meetings and promote pathways and opportunities for women to advance in the field as well as help identify steps to mainstream gender equality considerations in the context of nuclear policy.

Second, the “NPT and The Next Generation Forum”—designed to help prepare the future custodians of the NPT in guiding the non-proliferation regime through its next 50 years, and help ensure that young

people have the knowledge, insight, and experience needed to think creatively about the future of the NPT. I note that the INMM has an active Youth Forum and I look forward to exploring the possibilities to include its members in this event.

Third, the “NPT and the Global Nuclear Industry Forum”—to provide a unique opportunity for nuclear industry to highlight its many positive contributions to improve the quality of life and well-being of people around the world. It is intended to remind participants of the linkages to the framework provided by the NPT to facilitate access to peaceful nuclear applications worldwide and to consider industry’s role and commitment into the future. For this event, consideration has also been given to endorsing a statement for presentation to the Review Conference President, highlighting the importance of the NPT for the nuclear industry and industry’s role and commitment to the Treaty and its goals.

I remain hopeful that we will be in a position to realize these important events as originally planned in conjunction with the Review Conference, whenever it takes place.

The 50th Anniversary of the NPT offers an opportunity for the international community to work together to plan for the future. I hope that States Parties will make maximum use of the additional time we now have to reflect not only on how to make progress on non-proliferation and nuclear disarmament, but also to think constructively about how many ways that the NPT benefits the lives of people around the world. There are, for example, lessons and experiences that might be drawn from the COVID-19 response such as the additional work the IAEA took on to assist member states in combatting and responding to the COVID-19 pandemic



using a nuclear-derived testing technique.

Certainly, the current situation has reinforced the need in today's world to look for new approaches and to be prepared for unexpected and unanticipated challenges, as well as the importance of international cooperation. I hope States Parties will keep this in mind in the NPT context.

For example, we have all had to learn to conduct business differently, and perhaps to readjust some of our priorities. These changes come with their own sets of challenges that experts like those of you in the INMM may also be in a position to help address, such as the need for greater use of communications technology, and how might we better interact in the future on a global basis. Perhaps greater use of techniques like remote monitoring may be utilized on a broader basis for a variety of applications. There may be other areas you are already considering.

Many States Parties have not been able to fully take advantage of the opportunities for technological development and scientific training provided through Article IV of the NPT. Are there different approaches that could be used to assist these countries rather than in-person interactions? Of course, we need to keep in mind that greater use of technology will also bring the need for more vigilance against the challenges that also come with that technology, including cyber security threats. I have no doubt that you, as experts in the field, are already considering possible solutions to address this aspect.

In the coming months, I will continue to work to engage the broadest constituency possible in dialogue and support for the NPT going forward.

In this regard, during the next two weeks, I will be holding a second round of

virtual consultations with all States Parties, through the NPT regional groups in New York, Vienna, and Geneva, to consider organizational and procedural matters related to the postponement of the Conference. But I will also use the opportunity to encourage delegations to engage in an open discussion on the key substantive issues that will be either a challenge or an opportunity during the Review Conference.

I will also continue to participate in the series of webinars that UNODA is co-organizing, with relevant institutions, on those very same key issues. For example, this coming Thursday there will be a webinar co-organized by BASIC and UNODA on "Youth and the NPT," addressed to the next generation of practitioners, experts, diplomats, and leaders. And by the end of July, the IAEA and UNODA will organize a webinar on the Agency's Safeguards in the 21st Century, related to Pillar II of the NPT. Other webinars will be organized in the coming months, with a view to keep momentum in the lead up to the Conference.

The COVID-19 pandemic has challenged societies and economics across the globe. It has affected international peace and security, exacerbating preexisting tensions between States, and creating further divisions in already fragile multilateral institutions.

But it is also a reminder that global challenges require global, coordinated solutions. The threat posed by nuclear weapons and nuclear proliferation is one such challenge, and the NPT remains the best framework to address the dangers they pose.

The postponement of the 10th Review Conference due to the pandemic is disappointing, but, as I have said in many occasions, it is also an opportunity, and

States Parties should use the delay to redouble efforts at making progress on all aspects and consider all three pillars in a balanced manner, so that we can reach our shared goal of a comprehensive and forward-looking outcome.

Once again, let me thank you for this opportunity to address the INMM. I look forward to any thoughts you, as the practitioners, may have to help maintain the NPT relevant for as long as it is needed. I thank you.

Dr. Mona Dreicer:

Well, thank you very much, Mr. Ambassador. You've given us a lot to think about, and I'm hoping that the audience out there is formulating and typing their questions in the chat function, and Irmie, we will collect those questions as they come in. In the meantime, we have a question to start. As you mentioned, there are the three major pillars of the NPT; disarmament, nonproliferation, and peaceful uses of nuclear energy. The Institute of Nuclear Materials Management works to address and advance all three pillars, but we find it's a challenge to integrate them and not stay in stovepipes and address these different issues separately. The overall theme of this year's annual meeting is "connection and collaboration," and you've had so much experience in this area. We were hoping you might be able to speak about some of those experiences or some of the lessons you have learned while trying to engage and integrate across those pillars during discussions in the international community, and particularly in the context of preparing for the next NPT Review Conference.

Ambassador Gustavo Zlauvinen:

Thank you, Mona. Yes, it's a very valid question. Based on my experience, although I don't know how much the



previous experiences may apply to the extraordinary circumstances we all live in now. I think this is not business as usual anymore, in particular for organizations like the INMM, the IAEA, but also for the NPT, and the Review Conference is not going to be an exception. Of course, it's difficult to accept changes and our mindset is so much fixed into the old ways of working, that is going to take some times for institutions and persons to adapt. What I'm saying is—I'm repeating myself what I just said in my statement—that in my view, one of the ways to achieve that and to create a more conducive environment for dialogue is to engage with as many as the stakeholders are possible.

And that's why I'm not only talking to States Parties through their delegations in Vienna, New York, and Geneva, obviously, but also, I'm talking to all the other stakeholders. So obviously, INMM is one such opportunity, but also as I mentioned before, the gender perspective, the youth, the next generation's perspective is also that they're welcome in the private industry. I think we have to have a dialogue, an integrated dialogue, because although the NPT has different angles (always I would say the three pillars), at the end of the day, they are interlinked. Interlinked because we're talking about the same technology that can be used for peaceful purposes or for prohibitive purposes under the NPT. And therefore, at the end of the day, each of the practitioners are almost the same. The technologies are the same and therefore the more dialogue we have with all stakeholders, the more chances we're going to have to move forward.

Many ask me, what is my vision about the review conference? And it seems to be a trend to have a vision. When people talk to, or journalists talk to, politicians or even actors or artists, they'll ask, what is

his or her vision? And they ask me about the same things, and I don't think it is necessary to have a vision. You have to have a view, and my view, which is different from a vision, is that first of all, the NPT Review Conference is not the fiefdom of the President-Designate, it belongs to the State Parties. And it's up to the State Parties to decide what they want to do with our Review Conference.

I'm going to be always, as I said, an honest broker to try to help engage all State Parties in all the different topics, as difficult they might be, and for them to engage in that dialogue that not necessarily is going to be nice. It's going to be tough, in some issues. I'm not expecting that, and it is obvious that not all are going to agree on several of the important points, and so be it. The NPT is not asking for an outcome document. The NPT ask for State Parties to meet periodically, every 5 years to discuss implementation of NPT obligations, and for me, if we do that during the Review Conference in itself is going to be a successful outcome, but then it's up to State Parties to move in just ahead and have or not have a final document.

Ambassador Gustavo Zlauvinen:

But again, State Parties obviously are the party to the NPT, but also governments have to look into the abuse of their own constituencies, and that's why the different stakeholders, the practitioners, the industry, and even think tanks have a role to play, indirectly, to lobby the governments obviously, to push for views of actions on several of those topics. So sorry for the long answer, but I think we are learning as we move into this new environment and let's see how things move. But again, I really appreciate the efforts and the initiative taken by the INMM in conjunction with the NPT Review Conference, and I

believe that there's a lot of many linkages that we can devise and we can foresee in the future. Thank you.

Dr. Irmgard Niemeyer:

Thank you, Ambassador. Well, we have a number of questions coming in through the Q&A function now on the web portal, and I will bring three of them in a row to your attention. So, the first question was asked by Nancy Jo Nicholas. The world is busy responding to the COVID pandemic. How can we best concurrently maintain, focus, and support the NPT? The second question was raised by Mark Goodman. He's wondering who would issue the proposed statement on the role of the NPT in facilitating nuclear industry? And as a third question, which was posed by Richard Johnson, the 2015 Review Conference failed to come to consensus document due to debates of the Middle East Weapons of Mass Destruction Free Zone issue. How can we avoid breaking tone this time? Would a different, shorter kind of final document help achieve a better outcome? I turn it over to you, Ambassador.

Ambassador Gustavo Zlauvinen:

Thank you. Let me start with that last one, because many ask me about that, and indeed the establishment of a nuclear-weapon-free zone in the Middle East as provided for by the resolution in 1995 of the NPT Review Conference is an important issue for many, many delegations, many State Parties to the NPT. In my consultation with delegations, I heard again the same questions, that there must be some movements and advancements during the Review Conference with regard to these very important issues, and it's correctly pointed to as was one of the major issues that prevented the 2015 Review



Conference from having an outcome document. It was not the only one, but it was one of the key factors. And yes, chances are, there could be another element that may have derailed a positive outcome from the next Review Conference. I hope there is not, but I believe that there are some informal conversations among key actors on this issue.

There are different views obviously, and I'm trying to induce that dialogue before the Review Conference. You can never replace negotiations, not even through these consultations unfolding with State Parties or the workshops that we are trying to facilitate. Negotiations will only take place at the Review Conference, and my experience is that, of the four weeks they normally have review conferences, negotiations only start to be seriously taken into considerations during the last week, even the last few days. So probably we'll have to wait until then to see what margin of maneuver we have. But again, the nuclear-weapon-free zone in the Middle East is going to be one set of things. I hope that, for example, some progress on that front that has taken place in the last year and that progress may help reach at least consensus or avoid disagreement on this issue.

On the first question, this is exactly what I'm trying to do—to see that the pandemic that obviously is taking the priority in most of the governments' agendas, that it's not overshadowing or totally forgetting about the NPT Review Conference. And that's why I wanted to participate in as many as events like today's, but also the webinars that UNODA is co-organizing with other institutions, my consultations with the State Parties—everything we are doing is to help keep the momentum. It's difficult and the longer the Review Conference is going to be postponed, it's going

to be more difficult. It's a challenge, but I believe that, so far, we are doing okay. Delegations and capitals are still paying attention to the different challenges at the NPT or at least challenges facing the NPT are being considered by main capitals, and I think we're in a good shape for the time being.

And on the second question about energy and who should be pushing for a strong statement at the Review Conference on the peaceful uses, I think it's up to the delegation. There are many delegations, they are very interested in that, and I believe that the workshops that I just enumerated in my presentation will help bring those delegations. I believe South Africa, Indonesia, Argentina, and many others are going to bring up that issue to the Review Conference, and hopefully, there will be agreement on a document, separate document, or a part of an overall document that is going to be more focused on the peaceful nuclear applications. As I say that, the implementation of the different pillars of NPT are in balance and the discussions on those pillars in the past have been in balance. And probably a nuclear application, or peaceful nuclear applications, are lagging behind.

I know they will never be on an equal level as nonproliferation, obviously, but my intention is to level up the treatment of peaceful applications a bit higher for the interests of all. So, we shall see, but I think there's a lot of interest and I believe that key delegations will be raising that issue and pushing for at least a strong document or parts of a document on nuclear energy or nuclear application.

Dr. Mona Dreicer:

Thank you. We have just about five minutes left and one thing I neglected to say at the beginning is that there will be time at the end for some final remarks,

after the Administrator completes her remarks. But the final question I'd like to pose to you is from Susan Pepper. She'd like to hear more about the Better Together Forum and what steps they're taking to improve diversity. That's something that the Institute has taken very seriously and we're very interested to hear more about that.

Ambassador Gustavo Zlauvinen:

No, thank you. Thank you, I really appreciate that question because it's something that is very close to my heart and it's something that has never been done before in the NPT Review context. I think just in how societies are changing dramatically—obviously the role of women, but also of youth—different stakeholders that never have had a voice in this process before is raising their voices. I said in the Security Council briefing in February last that the NPT should not be a closed club. Of course, it's up to the State Parties at the end of the day, the Parties to the NPT are the states, but I believe that the NPTs implementation depends on so many other stakeholders, and therefore we have to have a conversation. I'm not saying that gender participation and the youth have to have formal representation at the Review Conference. It's not possible because you have to change the Treaty, but at least, just that representation of the next generations and more gender representation in the delegations should be welcome.

And therefore, as I said, we are co-organizing with UNODA and Basic this Thursday a webinar on the next generations, on gender equality and improvement of participation in nuclear issues and industries, which has also been taken up by Belgium, Norway, and others. We're working together to organize that forum.



So, I think we are creating a new narrative in the sense that we have to pay attention to those voices on the next generation forum. For example, to take some initiative at the regional basis that it can be, for example, useful for broader networks.

There is a recent small network of young practitioners and diplomats in the nuclear field in Latin America, started in Argentina with Brazil and other countries in Latin America, that is doing its first steps, and it's going to be that experience presented in this webinar on Thursday. They are trying to organize and launch a global network of next-generation leaders related to nuclear nonproliferation. I welcome that. So, there are many good initiatives. We are at the first stages, but I believe that by the time we have the Review Conference, their voices—I hope they will be heard a bit louder than in the past.

Dr. Irmgard Niemeyer:

Thank you very much, Ambassador. It is now my pleasure to invite Administrator Gordon to deliver your remarks. Once again, Administrator, thank you very much for joining us today for opening our Annual Meeting and we are very much looking forward to your remarks. Administrator, the floor is yours.

Administrator Lisa E. Gordon-Hagerty:

Thank you. So as Mona said, good morning, good afternoon, and good evening to all of you joining from around the world for this important event. Thank you to Dr. Irmgard Niemeyer and Mona Dreicer and for Carrie Crawford and the entire team at the INMM for the invitation to speak today. I would also like to thank Ambassador Zlauvinen for your remarks and for your efforts as the President-Designate of the 10th Review Conference on the Nuclear Nonproliferation Treaty.

The Review Conference is a vital forum for the continued implementation and success of the nonproliferation regime, and the United States will continue to be a true partner and supporter of the upcoming RevCom. Ladies and gentlemen, thank you for your kind attention.

Today, I'd like to look ahead and ask you to envision what the next decade will bring. I also want to share how the themes of this Annual Meeting, adaptability, connection, collaboration, and identifying new challenges and opportunities are being implemented by the National Nuclear Security Administration, both in responding to the COVID pandemic and in our nuclear materials management and non-proliferation missions. In particular, I'd like to discuss how we collaborate with like-minded nations through the International Atomic Energy Agency and through our strong partnership with the INMM. I will conclude by issuing a challenge to you in an area of both mutual interest for NNSA and the INMM.

First and foremost, I hope all of you, your families, friends, and colleagues have remained safe and healthy during this global pandemic. The battle against COVID-19 is one we cannot fight, and are not fighting, alone. Indeed, that we are combating the scourge together is part of what gives us the resiliency to overcome the various challenges we have faced over the past few months.

I'm confident that our ability to work together will enable us to overcome COVID-19, to recover from the tragedies endured and to find a new normal that serves us well. Now, when I say new normal, this is not to suggest that we lower our standards for freedom, security, or prosperity around the world, but rather recognize the importance of adaptability to evolving conditions in order to achieve these objectives. Stephen

Hawking famously stated, "Intelligence is the ability to adapt to change." Or someone less accomplished in theoretical physics but with one heck of a fastball, Baseball Hall of Famer Nolan Ryan said, "Enjoying success requires the ability to adapt."

I think these are two of the key lessons NNSA has learned through this crisis; adaptability and the importance of connection and collaboration. Faced with the unprecedented challenges created by the COVID-19 pandemic, NNSA quickly adapted in order to fulfill our national security missions. We maximize telework where possible and where that is not practical, we practice social distancing while continuing to perform our mission's essential operations. Equally important, we were able to connect via conference calls and virtual meetings with our national security laboratories, plants, and sites. We have collaborated as a team with our partners to coordinate our efforts and share lessons learned across our entire nuclear security enterprise. As a result of pulling together as one NNSA, I am proud to say that we have not missed any deliverables or milestones during the COVID-19 pandemic.

Recognizing how challenging this adaptability can be, I am impressed with INMM's leadership for quickly adapting this meeting to a virtual platform and successfully bringing together this community to forge ahead on important issues. This event is a testament to your flexibility, commitment, and spirit of innovation. Hopefully this unplanned shift to a virtual format will prove serendipitous by enabling broader participation in this year's INMM Annual Meeting. Events such as this serve to introduce us to a wide array of frameworks and the concepts to which we might not otherwise be exposed and which subsequently helps foster broader thinking on vital subjects. Through the INMM, already boasting



an impressive 16 professional chapters and 24 student chapters on five different continents, I was excited when Carrie told me recently that the next year's Annual Meeting will be held in Vienna, INMM's first-ever Annual Meeting to be held abroad. This global reach and expanded participation allows for broadening the scope of ideas to be shared, assumptions to be challenged, and solutions to be explored.

I know you've spent the last 24 hours holding technical working group and committee meetings to discuss an extensive range of topics and that you will continue to do so in the coming days. The overarching themes this year are, understandably, adaptability, connection, collaboration, and identifying new challenges and opportunities for the decade ahead. As always, I am eager to learn the outcomes of these sessions.

Let's begin however, by taking a step back in time. Although this year marks NNSA's 20th anniversary, in reality, our history goes back to the Manhattan Project. We are inheritors of the Atomic Energy Commission's legacy, which was succeeded in 1975 by the Energy Research and Development Administration, which itself was dissolved in 1977 and folded into the Department of Energy.

When the United States Congress established NNSA in the year 2000, it made reducing the threat of nuclear proliferation and nuclear terrorism around the world one of our three main primary missions. Indeed, for more than a generation, the fear that terrorists could acquire and use a nuclear device has motivated a range of efforts to place nuclear materials beyond the reach of non-state actors. Although constructing a nuclear device requires significant resources and advanced scientific and engineering skills,

we cannot assume that these obstacles will hinder terrorists indefinitely. The only guarantee that malevolent actors never obtain the world's most powerful weapons is to prevent their acquisition of nuclear material. This is why eliminating excess special nuclear material in civilian applications is such an important component of effective nuclear materials management.

To ensure that materials of concern never fall into the wrong hands, we must work together to reduce the need for these materials and to remove or confirm their disposition wherever feasible. Since its founding in 2000, NNSA has converted or verified the shutdown of more than 100 civilian research reactors and removed or confirmed the disposition of over 7,000 kilograms of highly enriched uranium and plutonium eliminated from 48 countries and Taiwan, enough material for more than 300 nuclear weapons.

Yet even more important than these successes are the new opportunities we are pursuing, initiatives that your American colleagues will be sharing with you this week. In fact, during one of the NNSA-hosted panels later today, you'll hear how we're examining novel ways to work with our domestic and international partners to build a framework for evaluating reactor systems designs that will minimize special nuclear materials production, minimize diversion pathways and maximize reactor performance. We are also working with our national laboratory partners to develop new capabilities that will permit us to eliminate more technically challenging tranches of nuclear material wherever and whenever possible.

As proud as I am of NNSA's achievements in securing nuclear materials, and no matter how brilliant our scientists and engineers may be, I'm fully aware that we cannot tackle these problems

by ourselves. Just as working together across public, private, and international partnerships is key to overcoming and recovering from the COVID-19 pandemic and strategic trade controls, it is also critical to solve difficult challenges associated with nuclear materials monitoring. This is why we have partnered with more than 100 agencies in over 70 countries on six continents to prevent nuclear smuggling. Let me offer one example of collaboration with like-minded nations that is so critical. I think we can all agree that modern technology can be a double-edged sword. We are incredibly fortunate to live in an era in which we can continue to stay connected, work remotely, and hold a meeting like this that would have been unthinkable when the INMM was formed in 1958. However, this technology also has a potential dark side.

Improvements in the speed and ease of knowledge transmission have happened at a revolutionary pace over the last couple of decades. While this shift has been the source of immeasurable good on our planet, it also poses the risk that a malicious intellectual capital could spread and increase the threat of weapons of mass destruction. Consequently, strategic trade controls are an integral component of NNSA's efforts to advance our nuclear nonproliferation and international security goals. Only by engaging the expertise of multiple government agencies and international partners can we address this evolving set of challenges. That is why NNSA is working with foreign partners to ensure countries are building strong export control systems that allow them to protect sensitive commodities and technologies and prevent their misuse.

At NNSA, we are partnering with the U.S. interagency, our national laboratories, and private sector stakeholders to



strengthen our regulations by closing potential loopholes, tracking trends of concern, and reviewing emerging technologies that may be a proliferation concern. We are sharing these findings and best practices with our international partners to facilitate legitimate research and trade while denying would-be proliferators access to the world's most sensitive technologies. By sharing information and keeping our export control lists relevant with today's technological and market trends, we can make the world of proliferators, non-state actors and terrorists much more difficult.

Another important area of collaboration for NNSA is our work with the IAEA. As the world's chief coordinator for nuclear security, the IAEA is the indispensable global body to assist states with improving nuclear security and enabling the peaceful use of nuclear energy. That is why NNSA provides broad support to the IAEA, including technology, expertise, training, and funding to strengthen the international safeguard system. We provide more than a dozen training courses every year to the IAEA's Department of Safeguards on a wide array of essential topics, ranging from fuel cycle technologies to nuclear materials measurements. Although this is a U.S. government-wide effort, the technical base of safeguards support primarily relies on NNSA and our national laboratory partners. This vital mission is a source of great pride to my colleagues and me. This mission requires the IAEA's continued leadership to ensure nuclear materials are available for peaceful purposes, but never misused. Like many other member states, the United States works tirelessly and around the clock with the IAEA to detect and deter diversions of nuclear material and undeclared nuclear activities, thereby increasing the effectiveness and efficiency

of the international safeguards system. The advancement and the universal adoption of the Additional Protocol is an essential part to this effort, and this must remain a priority for all of us as the standard for IAEA verification activities.

Looking forward to the future, let us all commit to doing everything we can to advance this goal and in so doing, take a huge step forward to ensure that continued peaceful use of nuclear technology and materials. I hope everyone will remain fully engaged in the planning process for the IAEA's Convention on Physical Protection of Nuclear Materials and its Amendment Review Conference in 2021. I can certainly assure you that the United States will do so as well.

Returning to the meeting at hand, the INMM and the nuclear community are also integral to ensuring that the highest nuclear safety and security standards are met. This is why NNSA actively organizes and leads sessions showcasing the latest developments for nuclear materials management at the INMM's Annual Meetings. NNSA has enjoyed especially strong collaboration with the INMM Conference Committee in preparation for this year's meeting. In the coming days, you will engage in discussions about pressing nuclear security issues such as insider threat mitigation, cyber security, transportation security, countering unmanned aerial systems, decommissioning of nuclear facilities, and emerging threats and technologies, among other important topics.

We treasure this collaboration because our participation in the INMM provides us with a platform to share our technical accomplishments with the nuclear non-proliferation community, as well as highlight the accomplishments of our international partners to enhance global security. Beyond the Annual Meetings, NNSA

staff members also hold leadership positions in the INMM regional chapters that foster advanced nuclear materials management, promote research in this field, establish standards, improve the qualifications of those employed in this field, and increase and disseminate information of nuclear materials management.

NNSA also engages with the INMM student chapters to help students with an interest in the nuclear security enterprise participate in a wide variety of nuclear materials management and safeguard activities through education and development of professional ethics. We also regularly participate as presenters in international and domestic INMM technical workshops that cultivate new thinking in the areas of nuclear material stewardship.

Because NNSA and INMM share a similar mission space and such strong collaboration, I feel comfortable ending my remarks today with issuing you a challenge. NNSA's most important asset is our people. The effectiveness of both our defense programs and our non-proliferation missions is due to the 50,000 scientists, engineers, technicians, program managers, safety and security experts, and support staff that comprise NNSA's workforce. In the two-plus years since I've become the Administrator, I have been continuously amazed at the dedication, commitment, and achievements of our dynamic workforce. Yet at a time when the nuclear security enterprise's workload is increasing to its highest levels in a generation, more than one-third of our workforce will be eligible for retirement over the next five years. It is an understatement, therefore, to say our ability to recruit and retain the next generation of nuclear security professionals is vital to our national security and our nonproliferation missions.

We are pursuing an aggressive hiring



strategy with a goal of adding approximately 4,000 to 6,000 people annually across our nuclear security enterprise. We have launched a nuclear security enterprise workforce strategy team to attract and retain the best and brightest from colleges, universities, trade schools, community colleges, and industry for a diverse and dynamic workforce for the future. We are holding recruiting events at universities across the country and have adapted to the current pandemic by holding two virtual job fairs this month.

Although we have enjoyed success in our short-term recruiting efforts, we need INMM's help. Today I am challenging you to strengthen your support for both STEM and foreign policy educational programs that are so vital to developing and training the next generation of nuclear security experts. INMM has already been a leader in this field for 62 years and together we can set the conditions today for successful management of nuclear materials for the next 50 years and beyond. I hope you'll take me up on this challenge and we see positive outcomes as a result.

Thank you for the opportunity to speak with you today about the themes that are of paramount importance to us all. Thank you for your time, your support, and for everything you all do to ensure that nuclear and radioactive materials are used safely and securely, and to further the peaceful use of nuclear material and technologies across the globe. I hope you will enjoy a successful Annual Meeting, and I look forward to your questions. Thank you.

Dr. Irmgard Niemeyer:

Thank you very much Administrator, not only for providing very informative insights into the important work of NNSA, but also for challenging the INMM membership. And that's what we are here for in the next days. While Mona is monitoring

the chat for incoming questions, I'll take the opportunity of asking the first question. And I am doing this as a non-U.S. resident INMM member who is interested in international collaboration. In your remarks, you referred to strategic trade control as one of the areas where NNSA is collaborating with like-minded nations. From my own work, I much value the collaboration with NNSA—for example, in the Member States Support Program for the IAEA Department of Safeguards and also the International Partnership for Nuclear Disarmament Verification, IPNDV. Now, international cooperation is also subject to constant change and evolution, given new challenges and opportunities. So, my question is, what are NNSA's strategies or plans to maintain adaptability in international collaboration?

Administrator Lisa E. Gordon-Hagerty:

Well, thank you for the question, Dr. Niemeyer. First of all we will continue, as you rightfully said, our participation in the IPNDV; we will continue to collaborate. We have opportunities ahead of us under the great leadership of Dr. Brent Park, our Deputy Administrator for Defense Nuclear Nonproliferation. He has set out a strategic framework and a plan so that we can continue to support nonproliferation efforts through things like the challenges of verifications of the IPNDV, the work and the technical challenges and potential solutions to disarmament verification, and to work on strategic trade controls. We're working with our Department of State and Department of Commerce on exactly that. And so, we do have challenges as the world becomes more open. We need to continue to strengthen our channel and challenge others that are like-minded, and those that are not necessarily like-minded states, to cooperate with us more fully. When I say us, I mean the international

community, I don't mean just the United States. So, it's imperative that we do exactly that.

Dr. Mona Dreicer:

Thank you very much. I have been trying to look at the questions and find a way to group them. I will pose one question that is internationally-oriented and one that is a little bit domestic-focused. We have a comment from Willem Janssens, saying that he's very pleased to hear about the key importance of strategic trade control, and wondering how you see the opportunities for connecting stronger connections between nuclear safeguards and the export control communities, both at the IAEA and beyond that?

Linked to that question, Carrie Matthews asks, "Speaking of strategic trade controls and keeping commodity control lists current with dynamic technology trends, are there any plans for updating the additional protocol annexes in the near future? In the near term?"

The U.S.-oriented question is: Edwin Lyman notes that the NRC says that NSA has suspended force-on-force security evaluations through the complex, because of COVID-19. He's wondering how NNSA is ensuring the site protective forces are maintaining their capabilities to prevent theft of special nuclear materials.

Administrator Lisa E. Gordon-Hagerty:

Thank you. Let me start with the second one first, in terms of suspending our force-on-force exercises. We did that, again, during the COVID pandemic. Our first priority, first and foremost priority, is the health and safety and welfare of our entire workforce. I do need to stress that. Now, in order to continue to do the necessary safeguards and security work at any of our labs, plants, and sites, we must



continue to have 24/7 operations, both for security and for safety purposes. So, we continue to enhance our workforce, both our security, our protective force security, as well as our health and safety persons. None of that has changed. And none of that has been limited or disregarded. In fact, what we're doing is we're just delaying the exercise parts only to ensure, and to maintain, a modicum of health and safety for our workforce.

It does no one any good to potentially expose our workforce, our security workforce, or our safety workforce unnecessarily during the pandemic. So that then we have hotspots of COVID, and that will serve no use whatsoever. So, the proficiency has not changed whatsoever, nor have we decreased our health and safety or our security work issues associated with any of our labs, plants, and sites. And that also goes for our workforce, whether they're a glovebox workforce, whether they're health and safety personnel, whether they're on the front lines of our work throughout our NNSA complex, their health and safety is our first and foremost priority. Where we can telework, we've been maximizing telework. Where we couldn't we've put in additional safeguards, whether they've been additional hand-cleansing stations or spacing, we've done that. But again, nothing could be further from the truth that we're relaxing our safeguards and security or our health and safety.

That is of paramount importance to all of our labs, plants, and sites throughout the NNSA. So, I appreciate the question, Mr. Lyman, but we are absolutely ensuring our health and safety and promoting safeguards and security though all of our labs, plants, and sites. The situation is temporary. Once the COVID pandemic has passed, we'll return to proficiency training,

not only for our security workforce, but also for our health and safety and for everyone else where we've taken a pause in those efforts. But that does not mean we're disregarding health and safety or security of our nuclear materials of our nuclear weapons complex, our nonproliferation and all of the work at our labs, plants, and sites.

The first question, in terms of strategic trade controls, export controls, commodity trade, and possibly rewriting the Additional Protocol: Those are all working force, we're working very closely and continue to do so well with our international partners, with the IAEA in this absolutely critical area. I've mentioned before in the first question, we're working, finding technical challenges, providing potential technical solutions to disarmament verification. We are doing work, making sure that we have the best tools and techniques available.

So, commodities are an important issue. And, like I said, we're working with the U.S. interagency as well as our international partners and trying to figure it out again, instead of thinking about today's issues associated with trade controls. As I mentioned, Dr. Park has a phenomenal group of people, including Kasia Mendelsohn, who many of you know, is his principal deputy. They are looking in these areas of arms control, but thinking about it from a strategic framework, and I hope you will be doing the same thing rather than looking at one or two or three years ahead. Let's look to think about where we can be successful in the next 10 to 15 to 20 years, especially in this area.

Dr. Irmgard Niemeyer:

Thank you so much, Administrator. I have two more questions for you and a comment that was raised in the chat function. First, the question by Susan Smith goes into the direction of advanced

reactors. She's wondering as designs of advanced reactors come closer to realization, how will NNSA address the production and protection of low enriched uranium?

Then we have a comment from Sarah Frazer, who wants to thank you for your support of education programs and nuclear nonproliferation and security for the next generation. Also, Leon Ratz mentioned that he's really delighted to hear that NNSA is seeking to add more than 4,000 people to the nuclear complex. And he's wondering whether you could say a few words more about the NNSA's efforts to recruit and retain a more diverse workforce?

Administrator Lisa E. Gordon-Hagerty:

Okay, great, thank you. In terms of advanced reactor technology, let me say that the United States is firmly supportive of advancing next generation nuclear technology. As you know, the United States has put together—President Trump has made it one of his priorities—to ensure that we're including nuclear energy as part of our "all of the above" strategy for energy approaches. And it's important to do so, not only in the United States, but worldwide. And in order to do that, to support advanced reactor technology, of course it's all about the nuclear materials, no matter its diversion. We can look at the gold standard laid out by the United Arab Emirates. We're pleased to see that not only did they support a 123 Agreement, but an Additional Protocol. They're not interested in having closed-loop nuclear systems. So, both front-end and back-end capabilities. So, I would advocate using UAE as a role model for those emerging nations that are interested in nuclear technology and advanced nuclear reactors.

We are working very closely with



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companies and with the IAEA about the issues associated with diversion of materials and what to do about different materials, whether it's high assay low enriched uranium, which takes you up to about 19.75% enrichment, or other types of materials for reactor technologies. We are working on the front end from the beginning about how we make sure that the world manages that material properly, whether it's in a like-minded nation or emerging nations that are interested in advancing nuclear technologies or nuclear energy in their nations. So, we are at the front end of that, and also with the Office of Nuclear Energy and the larger Department of Energy. They are also working on the advanced reactor technologies and also the materials to fuel them. So, yes, we're absolutely advocating that we're working closely with our counterparts at the IAEA to advance those technologies, and also to make sure that we adhere to safeguards and to safety standards associated with next generation nuclear energy technologies.

With regard to training and NNSA's recruiting and retaining the next-generation workforce: As I mentioned, sadly, in the next five years, 30% of our workforce will be eligible for retirement. That doesn't put us in a good place. Time is of the essence. We need to bring on the next-generation, diverse workforce now so that those who are eventually going to retire can mentor our next generation of scientists, engineers, technicians, administrative staff, nuclear policy experts, non-proliferation experts and security experts. We have done something in the NNSA I'm very proud of, not only because of the unique nature of the NNSA, where we're made up of about 1,900 federal employees and the rest of our workforce at our labs, plants, and sites are hired by them.

We've come together, in terms of a corporate approach, rather than hiring exclusively in stovepipes, across our eight labs, plants, and sites and in our headquarters. What we've done is we've taken a collaborative approach where we're going to colleges and universities together, sharing resumes, sharing opportunities for the next-generation workforce.

We were so successful that last year we exceeded our 7,000-person hiring requirements that we had. We are at about 14,000 employees, for example, at Sandia National Laboratories in New Mexico and California. We're over 11,000 at Los Alamos. One of the things we're also doing that I think is tremendous, and it's been highly successful, is that not only do we need physicists and engineers and scientists with postdocs, but we also need a huge group of technicians. And so, we have started to work with trade schools and colleges and universities, and with different colleges and universities that provide associates degrees and begun training them. I was just down at the Savannah River Site in South Carolina last week. And last year we gave \$5 million for grants, for technicians, for trade schools, for machinists, for glovebox handlers for a number of different areas. If you can state it, we need it.

We're one of across the board, whether, like I said, it's policy analysts, scientists, engineers, administrative professionals; we need everyone to come and work in the nuclear security enterprise. And again, we're all across the United States from California to Washington, D.C., you can find us in Tennessee, Texas, New Mexico, California, Missouri. So, we're very excited about where we're located and the opportunities that we have available to us.

In terms of strengthening our diverse

workforce, I would say that diverse workforce is a force multiplier, in terms of the work we do. We advocate for minority-serving institutions. We have programs with historically black colleges and universities. We've given over \$100 million in grants last year for exploring and strengthening our future workforce at colleges and universities. And like I said, with technicians in trade schools. We're working in collaborative areas.

I'm happy to say approximately 40% of our workforce is female. We have a way to go to balance that. What we're looking for is a diverse workforce; it doesn't matter what color, what creed, what you are. If you are compelling, you can bring a great, different view to our workforce, and you can enhance the work that is ongoing in the National Nuclear Security Administration now, and in the future. It's our responsibility to build that diverse workforce for the next 50 years and beyond. And we can't do it without a diverse workforce. We've got opportunities that abound and it would be really helpful. Like I said, with the challenge to the INMM about collaborating with you and trying to find different ways of advocating for STEM from pre-K all the way from kindergarten through primary and secondary education.

We have a dearth of it here in the United States. We know we have challenges around the world, but it's in all of our best interests to grow the next best and brightest future for not only the NNSA, but for our international community. I'm sure everyone is finding themselves in a similar predicament and we can be stronger together if we work in those areas collaboratively through high school, primary education, high school, college, and university. So, I'm looking forward to that. We've seen tremendous strides in the last couple of years and we've got a long way



to go, but I think we'll get there and we'll get there together. So, I know many of the colleagues that are watching today are part of the NNSA recruitment effort across our labs, plants, and sites. And I thank you for all the work that you're doing.

Dr. Mona Dreicer:

Well, thank you very much. That's very encouraging. I hope INMM can be a strong partner for NNSA across the U.S. and internationally, because our organization is interested in these types of career development activities. And with that, we're going to move to final remarks. And I'd like to ask the Ambassador if he would like to go first. We have, I believe, about 10 minutes left. So maybe each of you could take about five minutes for your closing remarks. I turn it over to the Ambassador first.

Ambassador Gustavo Zlauvinen:

Thank you, Dr. Dreicer. I am grateful for the opportunity to speak with all of you today and for the honor to share the Plenary with Administrator Gordon-Haggerty. We have had a lively discussion and I have heard some good perspectives and food for thought that I will keep in mind as we approach the Review Conference.

Our work in the time before us is clear. There are challenges ahead, and important, yet difficult conversations that need to take place. As the President-Designate of the 10th Review Conference I encourage all States Parties to reflect on the NPT in its 50th anniversary, and to make maximum use of the additional time we have due to the pandemic to work together, collaboratively and constructively, in a balanced consideration of all three of the NPT pillars—nonproliferation, disarmament and peaceful uses—with a view to sustaining this important Treaty for the next 50 years.

My hope over the coming months is to continue to broaden the conversation, to raise awareness and greater recognition that the NPT is the cornerstone of the nuclear nonproliferation and disarmament regime, and the underpinning framework that facilitates access to peaceful nuclear applications, which are so important to improve our daily lives and help countries achieve the Sustainable Development Goals. I encourage all stakeholders to work together to ensure continued safe, secure access to nuclear technologies—for our future and that of our children and grandchildren.

Let me again express my appreciation to Cary Crawford, Carrie Mathews, the INMM leadership, and all of you present today. I wish you a productive Meeting this week and I look forward to any further thoughts from the discussions that I might draw on in the lead up to the Review Conference. And I thank you.

Administrator Lisa E. Gordon-Haggerty:

Again, thank you all for allowing me to participate today and thank you, Ambassador, for sharing the virtual podium with me today. I think we can all agree about the important and often overlooked role of peaceful nuclear energy applications in everyday life. The United States and the NNSA continue to be strongly supportive of the peaceful uses of nuclear energy and associated initiatives. Since the Nuclear Nonproliferation Treaty came into force, cooperation under its framework has expanded to address many contemporary challenges, including food security, medical treatments, and environmental protections. When harnessed peacefully, nuclear energy can help overcome obstacles to raising standards of living across the world and improving the human condition. To echo Ambassador Zlauvinen, the

NPT truly is the cornerstone of the nuclear nonproliferation regime. I strongly agreed that further developments in nuclear energy and technology will continue to help countries reach their sustainable development goals.

Again, echoing the Ambassador's statements, all States Parties need to work together to support the NPT. As we look ahead to the next 50 years of collaboration, particularly in light of the diverse challenges we face throughout the globe today on the 50th anniversary of the Treaty, we continue to express the United States' support for this cornerstone of the global nuclear nonproliferation regime. And we will continue to promote the Additional Protocol's universalization as the de facto standard for safeguards implementation.

To be sure, we fully understand and appreciate the challenges of holding the NPT Rev Con amidst the global pandemic. Yet we are encouraged by the importance that the global community places on working to ensure that nonproliferation standards and values continue to be upheld.

With that, I would again like to thank the INMM for the opportunity to speak with you today. You all do important and tremendous work every day on behalf of your respective countries and the international community. And I am confident we will continue to execute our important missions with the utmost integrity to ensure the benefits of peaceful uses of nuclear energy can be realized by all for decades to come. I wish you all the best for a successful conference. Thank you.

Dr. Irmgard Niemeyer:

Administrator Gordon-Haggerty and Ambassador Zlauvinen, I'm sure that everybody's joining me in thanking you once again for joining us today and sharing with us your achievements,



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views, expectations, and also challenges for nuclear materials management. We started with about 350 participants, and we are still almost at that number. And I guess this definitely tells us that people very much appreciate your time and interest in INMM. It also tells about the dedication of the participants to connect and

collaborate in nuclear materials management, notwithstanding the restrictions due to the COVID-19 pandemic. And I'm sure that we'll take this momentum into the next few days. Mona and I wish everybody an exciting and successful Annual Meeting. Please think about the challenges brought forward by our distinguished

speakers today—how to better promote the peaceful uses of nuclear energy, and how to recruit and retain the workforce in nuclear material management. And no matter where you are, please stay safe and healthy. Thank you very much. The meeting is adjourned.



Tuesday Plenary Session 61st Annual Meeting

Plenary Speaker:

Massimo Aparo

*Deputy Director General and Head of the Department of Safeguards,
International Atomic Energy Agency*



Cary Crawford:

I would like to introduce our moderators who will then introduce our Plenary speaker today. Our two moderators are Susan Pepper and Carrie Matthews. Susan Pepper is the Vice President of the INMM and the Chair of the Nonproliferation and National Security Department at Brookhaven National Laboratory where she's responsible for work in the area of nonproliferation, security, and international safeguards policy, R&D, and implementation support. She served as the ISPO liaison officer in Vienna from 1994 to 1998 and is a Fellow of the INMM. Carrie Matthews is a Senior International Safeguards Advisor at Pacific North West National Laboratory where she has worked for more than 20 years in nonproliferation and safeguards research, engagement, international cooperation, and program management. She also worked in the IAEA Department of Safeguards as a Senior Safeguards Coordination Officer. She is the Chair of this year's Annual Meeting Technical Program Committee, heavily responsible for everything you've seen here, all of the good that you've seen here this week. And she is also a Fellow of the INMM.

I will turn it over to Carrie at this point and have a great day.

Carrie Mathews:

Thank you so much, Cary Crawford. It's really good to be with you all today. Good morning and good afternoon and good evening to everyone. It is a great

honor for me to introduce Mr. Massimo Aparo, who goes by "Max." He is the Deputy Director General and Head of the Department of Safeguards at the International Atomic Energy Agency where he's been working since 1997. Prior to becoming DDG of Safeguards in 2018, Max was the Acting Director for the Office of Verification in Iran. He also was a Section Head in the Division of Technical and Scientific Services in the IAEA and the head of the Tokyo regional office in Japan. Max, we are so grateful that you are spending time with us this morning and we are really eager to hear your remarks. So, with that, I'm going to turn the floor over to you and thank you very much.

Massimo Aparo:

Thank you, Carrie, thank you very much. It is a sunny afternoon here in Vienna and it's really a pleasure to address you today, colleagues and friends. I'm only sorry that it's not in person. This is the second year in a row that I was supposed to come to the INMM symposium. Last year we had difficulties with the Iran deal and I had to cancel my participation. This year we have the COVID-19 pandemic and we are forced to do it with this virtual symposium. But I'm sure that the bonds and the connections that bind us as the safeguarding community together are strong and we will be able to withstand this virus. The virus will also be a topic of my speech because I wanted to tell you how we met and overcame many of the challenges

posed by the COVID-19 pandemic.

But it is important that I also give an overview of the state of affairs regarding the Iran nuclear deal and update you on our effort to streamline the application of state-level approaches (SLA) within the Department of Safeguards. I think it's important that you understand how important it is for us, our effort, and our work on this state-level approach and the state-level concept.

Let me start with Iran.

The Joint Comprehensive Plan of Action—the so-called Iran Nuclear Deal—was a year in the making, after many months of intensive and highly detailed negotiations. Tomorrow will be the fifth anniversary of the signature of this deal and that time was widely regarded as a major triumph for multilateralism and nonproliferation. The agency already started the verification and monitoring before the JCPOA signature because we started already under the Joint Plan of Action, which was the temporary agreement they started 1.5 years before.

By now, it is 4.5 years of the JCPOA plus 1.5 years of JPA, so it is 6 years of an enormous effort by the agency in terms of inspection, analysis, reporting. It has taken up a significant proportion of the Safeguards Department's work. Just to remind you, nowadays the effort in Iran can be counted in about 3,000 calendar days in the field while the total effort in safeguard implementation in the world is something



around 13,500. So, Iran takes up a big portion of our effort.

Now, when we started at the beginning, everything ran fairly smoothly and Iran remained within the boundary of the deal. Today, this situation is much more uncertain. The U.S. withdrew from the deal in May 2018. Sanctions were imposed on Iran and since May 2019, Iran has gradually reduced its nuclear-related commitments. The Parties, apart from the U.S., remain in the deal.

As far as we are concerned, the most important element of the deal is the level of verification and monitoring activity. Iran has continued to allow the Agency to continue its verification and monitoring activity as before—even though it has decided to go beyond the level of enrichment, to increase the LEU stockpile and not respect the limit on their centrifuge activity. The level of verification that was established was to make sure that these nuclear-related commitments were fully met by Iran, and remain the same as before.

The situation, in any case, is cause for concern. The stockpile of low-enriched uranium is increasing well beyond what was the limit established by the JCPOA and, similarly, the heavy water has gone beyond the threshold defined by the JCPOA. But even more worrying is the number of new centrifuges that Iran is now testing and using to enrich uranium. Why is it more worrying? Well, it's more worrying because while the stockpile of LEU or the stockpile of heavy water or even the enrichment level can be reversed and brought back within limits, the knowledge acquired through testing more centrifuges than was originally envisaged in the JCPOA cannot be canceled. From that point of view, Iran is increasing its capability in terms of knowhow in the centrifuge area.

The Agency's relationship with Iran continues to be good with regard to the JCPOA. We had some difficulties in the past that related to an unfounded accusation made against one of our inspectors last year, but apart from that Iran is cooperating and has collaborated with us on the use of charter aircraft to transport inspectors to and from Iran during the COVID-19 pandemic when there were no other flights available from Vienna to Iran. And these charter flights helped us to continue to implement all the verification and monitoring, even during this difficult time, and we have to thank Austria and Iran for helping to facilitate this activity. We have to thank, also, other member states that have provided additional budgetary support to pay for it.

At present, we have a serious issue related to the fact that the Agency has been trying to clarify the information related to the correctness and completeness of Iran declaration under their safeguard agreement and additional protocol. As part of this effort we have identified, in analyzing safeguards-relevant information, a number of questions related to nuclear material and nuclear-related activity at three locations in Iran that Iran did not declare.

We have been trying to engage Iran on these matters since 2019 and we received no response. And therefore, almost 6 months later, we have notified Iran of our intentions to conduct complementary access at two locations in Iran. They objected to these accesses and our inspectors did not gain access. We reported this to the Board for the first time in March. We discussed with Iran several times between April and May the possibility to have this access provided, without success. In June, the Board of Governors passed a Resolution 25 to 2 with 7

abstentions, calling on Iran to fully cooperate with the agency to satisfy the agency request without any further delay.

Let me be clear: providing complementary access under the additional protocol is a legal obligation. In general, together with the declaration of the state, access is one of the basic pillars of the safeguards system. If we remove one of these elements, we destroy the safeguards system. In addition, as the Director General said, there is no “a la carte” additional protocol where the state decides which access to grant and which to deny. For the Agency and for the credibility of the safeguards system, this is fundamental.

Now, even though the activity we want to clarify may have happened quite some time ago, 15 years ago, nuclear material has no expiry date and in order to fully clarify that there is no proliferation concern, we need to receive the answer to the questions that we've asked. We need to have the access to the locations we have notified to Iran. So, I am hoping that we can resolve this issue with Iran in the next few weeks and Iran will provide the access and will allow us to take environmental samples.

Let me discuss more on the impact of the COVID-19 pandemic on safeguards implementation. As you know, the pandemic created a lot of difficulties because a number of countries have adopted and implemented strict health and safety related measures which restricted travel, free movement of people, grounding a number of flights, even closing borders. Now, safeguard implementation that is based on in-field verification has a lot of problems with all these restrictions.

We had a very difficult time for our inspectors to reach a number of nuclear facilities, sites, and other locations. And we had a number of examples where agency



inspectors had to make extraordinary efforts in order to carry out inspections. For example, driving by car for two or three days because there was no other means by which they could reach the nuclear facility from Vienna. We were lucky to have the support of certain member states who provided us with budgetary funding to use charter aircraft, not only for Iran, as I mentioned before, but to a number of other countries where there were no other possibilities to reach these countries. As the DG directed us, the Agency's verification work did not stop for one second.

How did we do that? First of all, we prioritized all the most critical verification activities. Everything that could be delayed or could be postponed was postponed. However, these postponement periods cannot be extended for too long. So, in order to be able to implement a consistent approach of what we could perform and which activities we could and could not postpone, we centralized such decision making in my office. So, on a daily basis, I met in my office with the director of the different operation divisions and we have discussed what kind of activity could be performed, what kind of activity had to be performed, and which could be postponed.

Of course, the safety of our inspectors is very important and we introduced systematic testing for COVID-19 prior to travel. And we also provided equipment to enable our staff to work remotely from Headquarters—and securely—for an extended period of time. I'm very proud of our performance during this period.

There will be an impact for the rest of the year to make up for postponed activities. This will require operational adjustment which may include increased frequency and intensity of in-field verification during the second half of 2020, which

means we will have an increased effort and heavier workload for each agency inspector and other staff.

And, of course, our objective is to continue our verification activity to the end of the year, even if we face an additional wave of coronavirus. Then we will need even more support and cooperation for our member states.

Now, let me conclude with a few words on the state-level approach. It's almost 30 years since the Agency began making greater use of being able to see a state's nuclear capability as a whole. In recent years our folks have been developing and implementing state-level safeguards approaches for states with both a comprehensive safeguarding agreement and additional protocol in force.

By now, we have 131 states—actually by now we have 132—because today I signed an additional state-level approach and these cover 97 percent of all nuclear material under the agency safeguard (by significant quantity). Our ultimate goal remains to develop SLA for all states with safeguards agreements in force.

The project that we launched last year was to refine our state-level safeguard approach by improving the detail of our procedure for acquisition path analysis or development of the state-level approach, but also by defining performance targets that will become the major element for determining the frequency and intensity of our inspection.

After months of discussion and testing different possibilities, we have agreed within the Board to assert our performance targets to be used for diversion and issues of nuclear material for technical objectives that includes diversion on issues of different types of nuclear material. We still have a lot of work to do because we're still refining certain aspects, but we are now

testing this performance on several different states and, hopefully, by the end this year we will have revised a few state-level approaches that we will discuss with our member states to finalize them.

This is the end of my speech. I think that these three issues that I covered today were the importance of the work of the agency safeguard for international principles and security. Also, it demonstrates the resilience, adaptability, and dedication of our workforce. And, hopefully, it shows the enthusiasm of our department of the effective and efficient implementation of safeguards in an objective manner. Thank you very much and I would be open to your questions.

Susan Pepper:

Thank you, Max. I think you chose three topics that are very interesting to the audience and to the INMM. As the co-moderator, I get the honor of asking the first question and I think I will pick one having to do with the pandemic and the Agency's response to that. You've learnt a lot as you have led the Department of Safeguards through this pandemic, caring for the safety of your staff while also meeting your priority mission. What can you recommend to facilities and state authorities to think about as they adjust to the next normal situation and, based on what you've learnt in the past few months, do you anticipate, for example, more reliance on unattended systems, remote operations, or more use of communication technology as you cooperate to implementation safeguards in the future?

Massimo Aparo:

Well, the use of an unattended remote system, of course, facilitated certain situations during this pandemic because it allows us to maintain a certain level of continuity of knowledge on nuclear material



and activity in the facility. However, the presence of our inspector in the field cannot be replaced only by the use of remote monitoring and telemonitoring. I hope that this has convinced a number of member states that remote monitoring can help both the operator and the inspector in both normal and special circumstances. What also we have learned, particularly from our internal approach, is the importance of regional offices in situations where there are restrictions of movement. It's partly because of our two regional offices in Tokyo and in Toronto that we were able to perform our verification activities in Japan and Canada with relatively fewer problems. So, it is possible that in the future we may consider establishing additional regional offices.

Also very important is the use of information technology, both in the field and at Headquarters, so this is another element.

I don't think COVID-19 can drastically change safeguards implementation, so I don't expect much more from the regional/state authority, but maybe it had to make it clearer how important is it to maintain their commitment to our legal obligations.

Carrie Mathews:

Thank you very much, Max. I have the honor of asking you the next question. And thank you for that excellent talk, as this insight into these topics are of keen interest to the INMM community and it's evident in the questions we're seeing coming in, in the chat. So, I want to ask a question posed by Bill Horn. He says after 6 years of monitoring and verification work in Iran, what is the most significant lessons you've learned for the future implementation of safeguards? Are there things you would do differently based on what you've learned in Iran?

Massimo Aparo:

That's a bit difficult to say. In general terms we are talking about JCPOA, you said?

Carrie Mathews:

Yeah, I think the question may be about what have you learned there that might impact the way you think about safeguards implementation elsewhere, perhaps. I'm not sure exactly the nature of the question, but what have you learned in the 6 years with Iran?

Massimo Aparo:

We were never part of the deal, so we just received a set of requirements that we have to implement and we have to produce some verification requirement that we have to implement. I think, independently of whether the idea was good or bad, the verification system that was created as a part of this deal was the strongest that we ever had in the world. You can always improve things but you have to remember, normally a deal is based on a negotiator of two parties—one they want more, and another one they want less. So, it's very difficult to find the perfect combination of items to satisfy both of these. These are for the safeguards system in Iran. In general terms, it is likely that we now have a safer system that is consistent and objective across the world. This has been one of my efforts and will continue to be one of my efforts to build, to maintain a system that implements safeguards in the same way, while, of course, taking into consideration the differences in country-specific factors.

Carrie Mathews:

Susan, would you like to ask the next question?

Susan Pepper:

Sure. There's a comment that I would like to read first. Mashada Da Silva says, "Thank you Max for the nice presentation. We would like to point out all effort that ABACC and IAEA are doing to perform inspections in Brazil and Argentina, with very good cooperation between the agencies and national authorities." So, that's nice to hear that feedback, that things are going well.

Massimo Aparo:

That is very important. ABACC has been very helpful. It even shared some of the cost for our verification activity. In general terms I have to thank both the regional authority and the member states because every time we required their support to access the location, and to sometimes waive certain specific requirements or to reduce the impact of these requirements.

Susan Pepper:

And one other comment from Irmie Niemeyer and this is—I've seen a couple of comments about this—people being surprised that it's 5 years since the JCPOA was put into effect. Irmie points out that we don't have any presentations to mark this anniversary and so let's think of something we can put together in 2021, maybe to have a session to talk about the JCPOA and what it's meant for the safeguards regime. So, let me see if I can find a question here.

There's one, it says it's from Justin. I don't know Justin's last name or where he's from, but it says, "If a country worries that exposure of undeclared activities from years ago could cause them harm today, how might they be transparent with the IAEA while also saving face and protecting themselves?"

**Massimo Aparo:**

Well. It is very difficult to judge the transparency of a country. The judgment to the transparency of a country is only completed when we draw our conclusions and we are able to say that there are no indications of undeclared nuclear activity and material in a country itself. At the moment, what I can say is that the JCPOA had introduced a better environment between us and Iran, especially at the very beginning, in the way we have been working with Iran to help them to be able to accomplish all the different steps that were required to start for the implementation of JCPOA. These help to reduce the conflict level between the two parties and help to have a better trust of each other. That is the only thing I can say and so far, our cooperation in the area of JCPOA remains quite good.

Susan Pepper:

Thank you. I'll ask another question I see in the chat. From Richard Johnson: "What are IAEA's plans to brief member states in detail on the SLA improvement project, perhaps even a public report? It would seem your efforts go far to express concern or to address concerns expressed by some member states about the potential for subjectivity."

Massimo Aparo:

Thank you, Richard, for the question. Actually, we had an initial plan at the beginning of the year to have a briefing sometime in the third quarter of 2020. Now, there is some delay in our project due to the fact that established performance targets are quite difficult. The pandemic also prevented us from continuing the level of work that we were used to before. You have to remember that now we use two separate networks, one which is not accessible from outside and one which is.

So, during especially the first period

of working from home, there was no way to access state-level acquisition path analysis, which is on an inaccessible network, so there was an additional delay because of that. We are now getting in better shape. We look to possibly, I would say, maybe in the first quarter of 2021. There was some additional information in the SER [State Evaluation Report] in terms of the project itself. We had different meetings with different member states to keep them informed of the project, but the aim is sometime in the first quarter to have a technical briefing that will describe what we've achieved and what is the impact of that on the state.

Susan Pepper:

Thank you, Max. We have a couple more comments about safeguards and ABACC. John Tracy says, "Great talk Max. With many inspectors required to quarantine before each inspection, is there a consideration for changing approaches to how inspectors travel? Is there any consideration, for example, about having inspectors stay longer in some countries so that they're not having to travel back and forth as much?"

Massimo Aparo:

Yes, of course. Actually, this is what is happening because of the 14 days' quarantine. Of course, in Europe it's a bit easier. We don't have quarantine all over Europe but our inspectors that are resident in Japan have to go into quarantine and similarly, to a number of other countries like Canada and South Africa. Before, the longest period of time our inspector was in the field was 3 weeks, maybe 3.5 weeks. Since the beginning of the pandemic we have been up to 6 to 8 weeks that the inspectors remain in the country, to avoid that they come back and somebody else has to go into another 14 days' quarantine.

Now, you have to realize that is quite heavy for the life of inspector, being away for such a long period. So, we don't want this to become a regular thing. But this is why we are thinking maybe to have one or two more regional offices, to cover a certain area of the globe with reducing the level of travel there.

Susan Pepper:

Thank you.

Carrie Mathews:

We just have about three or four minutes left. I just want to take the opportunity to ask one final question and then Susan can close the meeting.

Max, you've described that a lot of progress has been made to strengthen the guidance for the SLA project and I also noticed in reading the 2019 Safeguards Implementation Report that you used new graphics, you showed new trends. There's a lot more meaningful, rich data in the SIR. I'm just wondering, as you go forward and have SLA's implemented for all states, how do you see that affecting your ability to report new kinds of information in the SIR? Do you see the potential, for example, for reporting on technical objective achievement, performance targets, path coverage, things like that, sometime in the near future?

Massimo Aparo:

You have seen already the new SIR issue in 2020, which has been issued during one of the most difficult times of the pandemic, to include additional information, additional graphs, and additional trends, including a new fancy cover. So, yes, we plan to expand the SIR. This is also the intention of the DG to provide additional information to the member state on the way we are doing our business. Now, how information coming from



the SLA will be introduced to the SIR, it's too early to say.

Certain elements or performance aspects is mainly used for planning purposes. Certainly, we are trying to have more standardized technical objectives but even the technical objectives are depending very much on the different states. So, the SIR at the end is a document that is used by our member state to better understand what we are doing. We have to avoid the risk that we introduce so

much information that again it becomes unreadable.

Susan Pepper:

Thank you, Max. Thank you very much for your willingness to participate in this Plenary and we're glad that we've made it work after you had to cancel last year. So, we're really happy to see you on the screen. And thanks also for the Q&A, that was very interesting. We look forward to seeing you next year in person in the Annual Meeting in Vienna, and we look

forward to working with you and your staff to build a tremendous program for that meeting. For the audience, thank you for your participation and your questions. Sorry we didn't get to all of them, but enjoy the rest of today's program. We look forward to seeing you back at tomorrow's opening Plenary. Just be aware that the next session starts at 10:50. Thank you and have a good day.



Wednesday Plenary Session 61st Annual Meeting



Plenary Speaker:

Dr. Rita Baranwal

Former Assistant Secretary for the Office of Nuclear Energy, U.S. Department of Energy

Corey Hinderstein:

Good morning, everybody. Welcome to day four of our INMM Annual Meeting. We're excited to have another excellent Plenary speaker to start with. For those who don't know me, I'm Corey Hinderstein. I'm the Immediate Past President of the INMM.

So, with that, I'm ready to turn it over to the co-chairs and moderators for this session. Mark Schanfein is a Senior Nonproliferation Advisor at Idaho National Laboratory, and has over 40 years of experience in nuclear nonproliferation and safeguards. He worked for 8 years at the IAEA in Vienna, including 4 years as a Safeguards Inspector, and 4 years as the Unit Head for unintended monitoring systems. And Mark is a Fellow of the INMM. Larry Satkowiak is currently the Chair of the INMM Annual Meeting Committee. And in his day job, he is the Director of Nonproliferation Programs within the National Security Sciences Directorate at Oak Ridge National Laboratory, where he's responsible for efforts on nuclear nonproliferation, security, international safeguards, research and development, and implementation. He is a Past President of the INMM and is also a Fellow of the Institute. So, I'll turn it over to Larry to introduce our morning speaker.

Lawrence Satkowiak:

Good morning, good afternoon, good evening, depending on where you're at. I want to welcome everybody to our first

virtual INMM Annual Meeting. And since I have the podium, I'm going to hijack the whole process because I would personally recognize Carrie Matthews for the incredible job she did, in not only putting together a tremendous technical program, but then converting it in a matter of just a few weeks into the INMM's first-ever virtual Annual Meeting. Thank you, Carrie, a job well done. Now, back to our regularly scheduled program. It's my honor to introduce our Plenary speaker, Dr. Rita Baranwal, who serves as the Assistant Secretary for the Office of Nuclear Energy in the U.S. Department of Energy. Dr. Baranwal leads the Office's efforts to promote research and development on existing and advanced nuclear technologies that sustain the existing U.S. fleet of nuclear reactors, enables the deployment of advanced nuclear energy systems, and enhances the U.S.A.'s global commercial nuclear energy competitiveness.

Dr. Baranwal has a bachelor's degree from the Massachusetts Institute of Technology in material science and engineering, and a master's degree and PhD in the same discipline from the University of Michigan. Rita, we are so grateful that you are spending time with us this morning, and we are eager to hear from you. So, I'm going to turn the floor over to you. Thank you, Rita.

Dr. Rita Baranwal:

Thank you. And thanks to Corey and Carrie and Larry for the opportunity to

speaking. I view nuclear energy as crucial to ensuring the sustainability of our environment now and into the future. Nuclear energy is the nation's largest source of clean, reliable, and resilient electricity and it generates about 20 percent of the electricity in the United States and over 55 percent of this country's clean energy. In 2019 alone, electricity that was generated by nuclear energy in the United States avoided the release of over 476 million metric tons of CO₂ into the atmosphere. That's the equivalent of removing 100 million cars from the road. Many countries see nuclear energy as a means to meeting their energy demand and growth, and supporting their clean energy goals and providing energy, diversity, and security, just like we do. And I'm confident that the United States' nuclear energy technologies can and will play a major role in providing the United States and the world with clean, reliable energy for decades to come.

Nuclear energy is revolutionary beyond just electricity generation, though. It can provide low emission energy for water desalination to achieve worldwide water security. It can decarbonize the industrial sector with process heat. It can decarbonize transportation with hydrogen and electrification. Just recently, my office awarded \$9.2 million for a pilot program to be launched at the Davis-Besse Power Plant outside of Toledo, Ohio to look at using the plant as a means to generate hydrogen for the transportation sector, as



well as the manufacturing sector in those communities. And also, nuclear energy can be used certainly for the betterment of mankind by way of medical applications and space exploration. I believe that the United States has the most innovative technology offerings in the advanced reactor technology space. The United States is developing a diverse catalog of technology options from micro reactors—for small grids, remote or isolated communities—to SMRs, Small Modular Reactors, to large reactors to meet base load generation needs.

We have the right reactor for the application. New, advanced nuclear reactors have the potential to solve the diverse challenges across our nation, as well as across the globe. At DOE we're focusing our efforts around four priorities. The first is to sustain our existing fleet of 95 reactors across this country. And that includes working on development efforts for accident-tolerant fuels, as well as making sure that other efforts are assessed and evaluated through our light water reactor sustainability program. Our second priority is to get advanced reactor technologies across the finish line. That's a top priority of mine, and we're working to do that in the next several years. The third priority is to establish and maintain a critical fuel cycle infrastructure, and I know that's of interest to several folks that are on the webinar today. So, I'm happy to discuss that in more detail as we get to the question and answer session.

And the fourth priority we have is to enhance our global competitiveness. So, we're already seeing the fruits of our labor. One SMR concept is undergoing license review by the NRC, the Nuclear Regulatory Commission, and the first non-light water advanced reactor has entered the NRC license review process as well. So, it's a

very exciting time for our industry. In April of this year, the Administration's Nuclear Fuel Working Group released its report, *Restoring America's Competitive Nuclear Energy Advantage*, which lays out policy options to restore America's leadership in nuclear energy and technology. The report recommends continued support for the demonstration of U.S. advanced nuclear technologies. My office took action on that by launching the Advanced Reactor Demonstration Program, or ARDP for short. This program focuses DOE and non-federal resources on the actual construction of advanced demonstration reactors that are affordable to build and operate. The window to apply to that solicitation is still open and will close on Wednesday, August 12.

Ultimately, our goal is to make awards by the end of this calendar year. The funding that we have for that program is \$230 million. And it's great to be able to witness the bipartisan support that we have for this type of activity in the Office of Nuclear Energy. We're also strongly supporting the National Reactor Innovation Center, NRIC for short, to these demonstrations and the development of the Versatile Test Reactor, VTR, to ensure that we have the infrastructure that's necessary to support the long-term success of U.S. advanced nuclear technologies. Additionally, many of these concepts will require high-assay, low-enriched uranium, HALEU, and we're pursuing multiple pathways for the availability of this fuel source. The Nuclear Fuel Working Group report also recognizes the importance of having a healthy operating fleet of reactors and the market challenges that they are facing today. The Department is investigating alternate sources of revenue for the existing fleet, including, as I mentioned, through the production of hydrogen.

So, I want to talk about recycling for a moment. For a long time, it's surprised me that we continue to be satisfied with using our commercial fuel, only 5 percent. And for those that aren't familiar, I've spent much of my career developing nuclear fuel for our Navy's aircraft carriers and submarines, as well as for the private sector. And so, fuel is something that's very near and dear to my heart. And so, knowing the difficulty that we have with the storage and disposal of our fuel in this country, there certainly has to be options for dealing with used commercial nuclear fuel. Last year, I had the privilege of visiting La Hague in France and was very impressed with what I saw there. They were recycling 96 percent of used light water reactor fuel and putting the most hazardous isotopes into glass logs, and that significantly simplifies long-term storage issues.

So, I, at the moment, am exploring options for dealing with used commercial nuclear fuel, and looking to find ways to enable recycling in our advanced reactors in the future. We need to make sure that the world has access to civilian U.S. nuclear technology. We want the world to adopt and utilize our technology, because it comes with the highest standards in regard to safety and security and standards that our competitors, frankly, do not have or require. Regaining our global leadership through the export of our nuclear energy technology will ensure that our nonproliferation security and safety standards are adopted and maintained globally.

We're moving forward to ensure that the United States regains its nuclear energy leadership building upon the United States' leadership in innovation and advanced technologies. This will not be easy and it will require a lot of work, in particular, if we want to achieve these



aggressive goals by 2030. I really appreciate your time in attending this session and, more importantly, for your dedication to these issues. And I very much look forward to our question and answer session. And again, as was mentioned, I'm a materials engineer, and so being able to speak to you is certainly an extra special privilege for me to be with you today. So, thank you very much.

Mark Schanfein:

Rita, thank you for that. It's really an exciting time. So, for the first question, if you could, Rita, what are your offices' recent achievements and priorities and strategic initiatives for the coming decade, and how have they been evolving?

Dr. Rita Baranwal:

So, one of the objectives has been to certainly ensure that we continue to support the existing fleet. The development of accident-tolerant fuel and the installation of that fuel into commercial reactors has been a really important step to demonstrate that this type of fuel can not only benefit the existing fleet, but also advanced reactors that are going to be launched, hopefully in the next 3, 5, 7, 10 years. And so, it's really important to be working on efforts that can benefit in the near term as well as possibly also in the long term. So, that's one area. And the other is, that I'm really proud of, is the launch of the advanced reactor demo program. And what that entails is making awards to two different teams of developers, supply chain vendors, utilities, universities, et cetera, of up to \$80 million each, to demonstrate their reactor concept in the United States in the next 5 to 7 years. And the reason why we've put this really tight, aggressive schedule out there, is because our competitors are moving ahead at a very, very fast pace. And while our industry

in the United States has enjoyed—I would say, has had the luxury of not having to change very quickly because we've got a tried and true product that works well and working alongside our NRC partners is well-regulated. We haven't had the need to change, but we're in a different time now. And so, wanting to move very quickly, ensuring that the NRC also understands what the advanced reactor technologies look like and what is going to be different about them, is really important. So, we maintain open communication with the NRC and work with them to ensure that their staff and teams also understand what the developers are working on. Those are a couple of areas that I think are going to be really important in the coming decade.

Larry Satkowiak:

Rita, we have a question from the audience. The person in the audience is wondering if you could discuss some of the details of the reprocessing options that your office will study, along with the status of the interim storage design RFP that you discussed earlier.

Dr. Rita Baranwal:

We're really in the preliminary stages of looking at this. Let me back up and tell you why I'm very interested, not only just from a scientific standpoint. But if we really want to be competitive globally, the United States wants to be competitive in the global landscape for nuclear reactor technology. What is already being offered out there to other countries from our competitors is not only top-notch technology, but the ability to take back the fuel, once it's used, so countries don't necessarily have to have a repository in-country for their used fuel, and then also have attractive financing options. And so, with the recent announcement from the DFC [Development Finance Corporation] here in the

United States, fingers crossed, of rescinding the current position of not supporting and not financing nuclear projects abroad, once that hopefully gets reversed, then that might help with the financing piece, right? So that should help. And we're very, very excited about that.

But we still in this country do not have a permanent repository for used fuel. And so, I could not offer to other countries the ability to take back fuel, because we really don't have someplace to put it permanently. And so, to look at the option of recycling and what falls under that umbrella is something that my team has started to do. So, I don't have particular options to talk about today. I will say that we're entertaining a variety of options and a lot of things are on the table. And I think the last part of that question, Larry, was about the RFP [request for proposal] for interim storage, and so that has been prepared and we hope to release that in the near future.

Mark Schanfein:

Thank you. We have another question. What are the economic barriers to conventional and advanced nuclear energy systems and how can policy overcome those barriers?

Dr. Rita Baranwal:

I'll answer it two ways. One, if we're focused on deploying in the United States and the other is overseas. So, I think to deploy in the United States, we at the moment are seeing a lot of competition from economic natural gas. And so, we're competing with those market forces and that, frankly, is the reason why several plants have shut down prematurely—it's because they just can't keep up with the low price of natural gas in those markets. So, for the United States, a policy change that might put nuclear back on a level playing field with those different energy



and electricity sources would be something that gives credit for being a clean energy source. The zero emissions credit that some states have given to their nuclear plants, that's one area. To deploy overseas—I'm not saying they don't exist, but I have not yet encountered a policy change that needs to occur. We are working with several different countries and have executed 123 Agreements, and what's called an NC MOU, Nuclear Cooperation Memo of Understanding. And so, we're working through all of that, but again, the financing piece is what we hear an area where we need to up our game, if you will.

Larry Satkowiak:

This is actually a question from one of our partners, ABACC. Sonia asks, "Within the context of climate change, what is the place of nuclear energy and renewables in the energy matrix forecast?" Sort of a follow on to that is, "And what emphasis is being placed on SMRs?"

Dr. Rita Baranwal:

Let me answer the first part first. I think nuclear energy—and this is not just my personal opinion, there has been study after study over the past, I'd say, at least five years, that have shown that nuclear energy has to be part of any clean energy portfolio, either for a state in the United States or countries around the world, if they are working on a clean energy portfolio that has targets to get to either zero emissions or a net carbon reduction goal, be it by 2030, 2040, 2050—nuclear energy has to be part of that mix. And I'm not advocating that it has to be 100 percent. I don't think that's reasonable. It needs to be a part of that energy portfolio and there's room for other players, certainly. But you cannot get to 100 percent carbon free or emissions free without our industry being part of that mix.

The second part was, what role do SMRs play in that? What's interesting about SMRs...So, for those that aren't familiar, SMRs are defined as a reactor that's 300 megawatts or smaller. And what's great about that is that it offers communities and countries the ability to have reactors that meet their needs. And so, if it's a smaller community that doesn't necessarily need a one-thousand-megawatt reactor, you can start to think about an SMR or if it's an area that has never had nuclear technology and wants to ease into it, you can start with something that's 60 megawatts and then add onto it. SMRs are going to be easier to construct because they're modular, so they can be factory built and then shipped to the site. They're going to be easier to install because they have a smaller footprint.

The regulations around it, the emergency planning zone is anticipated to be smaller as well. And so, there's a lot of benefits to that, but again, it's based on what the customer's needs are. But it's really great to be able to have a variety of sizes that we can offer to different types of communities, be it a country who's looking to add onto their existing nuclear capability or a country that is looking to enter this nuclear energy arena, because of the needs of their populations who may not even have access to electricity at the moment, for example.

Mark Schanfein:

Thank you. So, since we're talking about SMRs and you've mentioned the definition of being below 300 megawatts, do you consider those to be advanced reactors? And can you also elaborate on what DOE is doing to support SMR designs and their vendors? And do you think they have bipartisan support?

Dr. Rita Baranwal:

I think they do. And to be clear, I'm a stickler for being very specific. The S in SMR, is just "small." It means "small." And so, it's just a size constraint. So, we have developers that are working on light water technology, but they're small modular reactors. We also have developers that are working on advanced technologies that are looking at molten salt technology concepts, that are looking at high temperature gas reactor concepts, that are looking at sodium-cooled or lead-cooled concepts that are in that size class. So SMRs are merely a size category. It includes existing light water type of technology, as well as advanced concepts.

Larry Satkowiak:

Our next question is circling back to the whole idea of looking at recycling. And what factors are you considering during this preliminary review of recycling options, for example? Is it primarily a technical review or are you considering nonproliferation, economic public opinion, etc., as well?

Dr. Rita Baranwal:

So, it's technical. Nonproliferation concerns are also being assessed, as well as economic. And with the economic eye, we are looking at it to ensure that, certainly, conditions could be different 5 years from now, 10 years from now, than they are today than they were 10 years ago. And so, I want a broad scope of the economic conditions that would need to exist for this to be favorable. Right now, it may not be favorable just economics-wise, but that may not be the only driver. And so, we're looking at that. At the moment, our input for the nonproliferation side is also taking into account some public opinion, but we have not put a lot of emphasis on that. But that's certainly one of the facets that we will be looking at.



Mark Schanfein:

There's another question we have. This really concerns the IAEA. Any eligible facilities lists that we have as a voluntary state, will DOE advocate for the inclusion of all these new reactor projects, like the VTR, New Scale, or Aurora on this list?

Dr. Rita Baranwal:

Can you explain what the list is?

Mark Schanfein:

So, the eligible facility list is one that comes from NRC, and it basically offers up to the IAEA the ability to select different facilities within the United States government for potential application of IAEA safeguards. So, the question is whether DOE supports having these different reactors on such a list?

Dr. Rita Baranwal:

I am not really familiar with the list and I'm not familiar with the implications of being on such a list. If it means that there's additional scrutiny or safeguards that get put on to the technologies, again, I'm not well read in this area. But I would trust that if a concept is NRC-regulated that also meets the IAEA safeguard standards. And so, I think that would certainly be a good thing, but again, I can't speak to that definitively. I'm not well versed enough on it. That's where we have to leave it. Can I go back to the previous question? I think I did not answer about the support that we have from Congress for SMR development. And it includes some of the companies that you just mentioned Mark, in this question.

We are seeing good bipartisan support for research and development in the advanced SMR space. And so, that's another area that's very exciting. And it's not just one company or one technology class, it's across the board. And so, one of the programs that we continue to

fund is the Industry Funding Opportunity Announcement, the IFOA, wherein companies and teams can apply for funding on a regular basis and get awarded based on the technology level of their application. Be it an 80-20 cost share, that the 80 percent is funded by the government or a 50-50 cost share, if it's more a mature technology. So, 50 percent is funded by the government, and the other 50 is by the company of the host team.

Larry Satkowiak:

Yes. We have another question again from one of our overseas colleagues at the IAEA. I'll interpret the question if I understand it correctly: "In the new designs that are being considered, are you pressing the designers, the companies on how they will look at the whole fuel cycle? For example, the impact on the front end, the enrichment, the recycled fuel, the fuel fabrication, the backend, what backend products there are, etc., the spent fuel forms, the required storage tanks for those spent fuel forms, and are..."— this is a long, involved question. Are you considering repository or recycle? There's a lot there. Pick and choose what you would like to answer right now.

Dr. Rita Baranwal:

Okay. It's perhaps coincidental or prophetic that you use the word answer, because we have just started an initiative that is called ANSWER, A-N-S-W-E-R, that is being led out of Argonne National Lab to look at exactly this, from cradle to grave, to ensure that not only are the technology developers developing their designs, but we have a very heavy nonproliferation security and safeguards team of folks also working with not only the lab folks, but more importantly, I think, the developers to ensure that they are considering all of those aspects that you just mentioned,

or that the person in the question asked about. And so, while some of these companies may not know to answer those questions or know to address them in their designs, we are trying to, the best that we can, make sure that that information is available. Those experts in our national lab complex in the United States can be accessed, should they not know where to go for those answers.

We have an initiative in DOE called GAIN—Gateway for Accelerated Innovation and Nuclear. One of the main purposes is to connect private nuclear technology developers with the capabilities and the expertise at the national laboratories. And certainly, the fuel cycle was one aspect of that.

Mark Schanfein:

We have another question that fits into the last one—one piece of what Larry mentioned. And we've seen this with a lot of ongoing work and also in terms of different kinds of recycling approaches. But is there a timescale? Do you think that there is a timescale for a recycling demonstration project in the U.S.?

Dr. Rita Baranwal:

I have not given that thought just yet. So, I can't give you a timescale now. Again, we're just starting to look at this or relook at it, I guess, since I've been in this office. So, there's a lot of unknown, certainly. I think it's something that we do need to have an understanding of if we really do want to be competitive worldwide.

Mark Schanfein:

Thank you.

Larry Satkowiak:

The next question is really looking at newcomers. For example, some countries in Africa, and perhaps Asia, could benefit from SMRs, especially because of their



geography or demographic distribution. So, the concern here is, in the cooperation to help the newcomer states, are they also considering things like safeguards, security, and safety when engaging newcomers?

Dr. Rita Baranwal:

Yes. That's the short answer. Yes. Those are certainly being considered and shared. Those are requirements for the cost of admission. And so, those are being shared and we in my office are putting together what, for the moment, is being labeled a nuclear concierge, in that countries that are looking to purchase and operate nuclear power plants. If you don't know where to go, or how do you even start, navigating the U.S. government is certainly a very, I'll say, a sticky task, right? So, putting together a how-to, a flow chart, a roadmap on how to navigate and work with us and how we can help them, and all the things that would need to be considered, including the items you mentioned, but also capacity-building. And so, there's a lot of areas that we're trying to assist with and offer assistance. And if the question is really getting at, are we lowering our standards or sacrificing something? The answer to that is no.

Mark Schanfein:

We have another question on how can we improve the relationship and information sharing between nuclear energy and nonproliferation interest when thinking about U.S. domestic pursuit of nuclear energy and support for U.S. exports? There seemed to be some challenges in this area.

Dr. Rita Baranwal:

Are they getting at, is there a limited supply?

Mark Schanfein:

I think the way I would interpret it this is: For example, you have a leadership role for nuclear energy. Then there's the nonproliferation side of whether it's the government or the public, and whether there may be some mistrust or a need for better communication between those different elements.

Dr. Rita Baranwal:

Since I've been in this office, I have regular meetings and phone calls with my nonpro counterparts. And so, I think that was the first step, was to make sure that we're talking often. And then if we don't have anything to chat about during one of our biweekly meetings, we don't have the meeting. But the fact that that avenue is there, I get together with my counterpart twice a month, and then our teams get together once a month. And so, we've got a full agenda of items we talk about, that heads up, this thing's coming down the pike or we're going to meet with this country, and these are the hot topic issues. So perhaps our offices were not so communicative in the past, but I do feel that we have a very good relationship right now. And it really does come down to talking about what we're working on and what our concerns are. And we do air our grievances, if you will. And there are issues that we don't agree on, but we certainly understand each other's position.

Larry Satkowiak:

Yes. And there is another question here, more on the policy side than the technical side: "Do you believe that the U.S. policy on 123 Agreements hampers the ability for American vendors to compete with other vendors from other countries?"

Dr. Rita Baranwal:

I have not seen that. The question is, does the existence of a 123 Agreement prohibit us from competing worldwide? I don't think so.

Larry Satkowiak:

That's the understanding.

Dr. Rita Baranwal:

I think having those agreements in place set the expectations that we expect of the receiving country our expectations for operation, for safety, our nonpro standards. And so, once those are in writing, I think it's a good thing to have those in writing and be understood.

Mark Schanfein:

Another question has to do with the U.S. International Development Finance Corporation. They recently said they plan to update their procedures to include financing for nuclear power. So how significant of a change will this be for U.S. exports of nuclear power plants?

Dr. Rita Baranwal:

So, the public comment period for that change closed on Friday. So now we are waiting for, I guess, digestion of what the comments are, and then for, hopefully, the policy to actually change. The impact of that policy change, I think, is going to be really favorable for developers because financing options are one major sticking point from us being more competitive around the world and competing with state-owned enterprises.

Larry Satkowiak:

So, there's, again, another question about SMRs that is somewhat interesting: "Is it possible to streamline/coordinate certification of SMR designs with other countries?" I guess the NRC interacting with the regulatory agencies of other countries in



order to bring down the cost of implementing these new designs for the first time in new countries, both nuclear newcomers and countries, perhaps like the United Kingdom.

Dr. Rita Baranwal:

Are they talking about regulatory harmonization?

Larry Satkowiak:

I think so. I think that's what they're trying to get at.

Dr. Rita Baranwal:

There is a lot of activity on this. One example that I want to point to is the MOU that was recently signed between CNSC in Canada and the U.S. NRC. And so there certainly is an effort afoot to want to collaborate and implement best practices around regulation of reactors and certainly of SMRs and new reactor technologies, and not have to reinvent the wheel, if you will. And so, a lot of those discussions are occurring for countries that we have been in conversations with. Most of them have a very robust regulatory body, an impressive regulatory body, already in place. And certainly, we have offered to them the ability to interact with our NRC and answer questions and things like that. Regulatory harmonization is something that is very much being discussed worldwide, and it's being brought up in venues such as IFNEC [International Framework for Nuclear Energy Cooperation] and other event venues like that, where we have multinational participation and several different topics that will affect not just one country or a handful of countries, but many countries.

Mark Schanfein:

Another question here: "What's the difference between recycling and reprocessing? The U.S. set a positive nonproliferation standard over 40 years ago by

ceasing reprocessing. And the question is, what tactical, nonproliferation, economic, and political factors would cause the U.S. to change that position?"

Dr. Rita Baranwal:

I'm going to really give a simple answer to the first part. And recycling is an umbrella of which reprocessing is one part of, so recycling covers reprocessing. The reason I'm talking about recycling is, certainly you do have to reprocess the fuel, but then I want to reuse it, right? I don't want to just extract different piece parts from that used fuel. I want to reuse it for additional commercial applications. So that all falls under the recycling umbrella. What was the second part?

Mark Schanfein:

The second part was a pretty challenging question.

Dr. Rita Baranwal:

I forgot it.

Mark Schanfein:

The U.S. set the standard on ceasing or reprocessing. And now the question is, what tactical nonproliferation, economic, and political factors would cause the U.S. to change this position?

Dr. Rita Baranwal:

So, the first piece has been to talk about it. And the first ask I had of my team that's looking at this is: tell me why I cannot do this right now, show me the policy or the law, or the statute that says we can't do this right now. And we haven't found that that exists. So, it's a position. It's a posture that we have, and that's fine. But the first was, am I asking to do the impossible? And that is not necessarily the case. So that was step one. The next one is, what's the motivator to be looking at this? And it's a commercial driver. It's that, if I want

to sell a turnkey reactor concept, an entire package that my competitors are offering around the world, fuel take-back has to be part of that option. And if I want to offer fuel take-back, I need to do something with it. I don't have a repository to store it in at the moment, and recycling is another option to look at.

Interim storage, as we talked about earlier, is certainly a third avenue. But again, in my heart of hearts, I feel we can reuse this slightly used fuel. And so, let's look at that as an option as well, so that we can compete globally.

Mark Schanfein:

Thank you.

Larry Satkowiak:

Dr. Baranwal, I wanted to thank you. And I was wondering if you had any additional final remarks that you'd like to make before we close out the session.

Dr. Rita Baranwal:

I just want to thank all of you for having me, and all of you who are participating, I wish you continued good health and stay safe. And I very much look forward to seeing all of you in person at the next conference.

Mark Schanfein:

Okay. Thank you very much. It was great. We've gotten more questions pouring in, but we're running out of time. It's certainly an exciting time for nuclear energy. I wanted to thank Larry for co-moderating, Falcon for their support, and especially the audience for joining us. I wish everyone a good day. Enjoy the rest of the conference. We are adjourned.



JNMM Roundtable 61st Annual Meeting

Featured Distinguished Speakers:

Ambassador Gustavo Zlauvinen

President-Designate of the 10th NPT Review Conference

Massimo Aparo

Deputy Director General and Head of the Department of Safeguards, International Atomic Energy Agency



Markku Koskelo:

For those of you who are new to this venue, my name is Markku Koskelo. I am the current Technical Editor of the *Journal of Nuclear Materials Management* for the INMM. I work for Aquila Technologies Group in Albuquerque, New Mexico. Before we get into the actual questions, let me introduce our distinguished guests, even though Ambassador Zlauvinen spoke this morning and was introduced. Perhaps not everyone was there. Thank you very much for your talk and very interesting thoughts for all of us. Welcome to this Roundtable event. Ambassador Zlauvinen is the President-Designate of the 10th NPT Review Conference. Before taking up this role, he has served as the Deputy Foreign Minister, the Undersecretary of State for Foreign Policy, and the Director of International Organizations, all in the Ministry of Foreign Affairs of Argentina. He was twice posted to the U.N. system as the Representative of the Director General of the IAEA to the United Nations in New York, and the Chef de Cabinet to the Executive Chairman of the United Nations Special Committee on Disarmament of Iraq or UNSCOM, and served as Argentina's Alternate Representative to IAEA in Vienna, and as Director for International Affairs of the Argentine National Space Agency.

Mr. Massimo Aparo is the Deputy Director General and Head of the Department of Safeguards at the IAEA during his

tenure at DDG Safeguards. Mr. Aparo has successfully launched a number of initiatives aimed at improving the efficiency and effectiveness of safeguards, including the SLA improvement project, among other internationally-focused projects. He has been an advocate for transparency across the department and with member states and the recently published and newly-formatted Safeguards Implementation Report for 2019, and was highly praised for this effort. Recently, Mr. Aparo led that safeguard staff through a remote working period due to COVID-19, ensuring that all critical activities were able to continue, despite the global pandemic. He will speak for us tomorrow morning, and I encourage all of you to attend his Plenary talk tomorrow. Beyond the introductions, let me get a couple of housekeeping issues out of the way.

Again, for those of you who are not familiar with this venue, this is being recorded. This event has always been recorded for a transcript of this event that will be published in a future issue of the *JNMM* and the protocol is that our distinguished guests will get the first chance to review that transcript. And if there is anything that they do not want published in writing, they have the right to edit that transcript. Once they have edited their transcript, it will be sent to everyone who asked questions and they are allowed to make sure that their questions are

transcribed correctly. If the Plenary speakers make changes to their answers, please make sure that your questions match. And once we have all of that in writing, we will publish this in a future issue of the *JNMM*.

We normally have this in a physical Roundtable, and I ask the person to my left to start introducing themselves. However, since we are in a virtual situation, I did send out a document where I suggested an order in which people would introduce themselves. If you would do that briefly and mention two things: one is your role in the INMM, and whatever you wish to say briefly about your day job. And then we will launch into the questions in the same order. And if there's someone who wishes to pass on their turn in the question, then let's do that. So, with that, Carrie, if you would kick off the introductions.

Carrie Mathews:

Hi everyone. Thank you, Markku and thank you, Max and Ambassador Zlauvinen for being with us today. I'm Carrie Mathews. I'm the Technical Program Chair of the INMM and the Deputy Chair of the Annual Meeting Committee. And I work at Pacific Northwest National Laboratory.

Cary Crawford:

I'm Cary Crawford, the current President of the INMM. I'm a Program Manager at Oak Ridge National Laboratory and have been for 27-plus years in the Nuclear Safeguards and Security Field. And it's good to



have our guests. Thanks for joining us.

Susan Pepper:

Hi, I'm Susan Pepper. I'm the current Vice President of the INMM and I work at Brookhaven National Laboratory where I'm the Chair of the Nonproliferation and National Security Department.

James Andre:

Awesome. Jim Andre. I'm currently a Member At Large on the INMM Executive Committee and I work at the Pacific Northwest National Lab.

Irmgard Niemeyer:

Hello, Irmgard Niemeyer, I'm the Chair of the International Safeguards Technical Division and I work in Forschungszentrum Juelich, Germany, being the Head of the Nuclear Safeguards and Security Division. Thank you.

Corey Hinderstein:

I'm Corey Hinderstein. I'm Vice President for International Fuel Cycle Strategies at the Nuclear Threat Initiative and at the INMM. I am the Immediate Past President.

Sarah Frazar:

Hi, I'm Sarah Frazar from the Pacific Northwest National Laboratory. I lead the Public Relations and Outreach Subcommittee for the Communications Committee on INMM.

Dr. Alicia Swift:

Hi, I'm Dr. Alicia Swift, I'm an Associate Editor of the *JNMM*. And for my day job, I am a Program Manager at the Consolidated Nuclear Security, which operates in the National Security Complex, where I'm based, as well as Pantex Plants.

Leslie Fishbone:

I'm Les Fishbone. I'm retired from Brookhaven National Laboratory, though I still keep a hand in things as a consultant

occasionally. I was at the IAEA as a staff member from 1989 through 1993 in the System Study Section in the Department of Safeguards, and I assist you, Markku, in technically editing the *Journal*.

Dick Donovan:

I'm Dick Donovan. I've been with The U.S. Department of Energy since the mid-1980s. And I'm currently the Safeguards and Security Senior Advisor for the Office of Enterprise Assessment, switching between, among other things, overseas Department of Energy, safeguard and security programs.

Rian Bahrn:

Hi, Rian Bahrn. I'm an Associate Editor for the *Journal*. As a day job, I'm a scientist at Los Alamos National Laboratory currently on assignment in Washington, D.C. at the Department of Defense.

Jack Jekowski:

I'm Jack Jekowski. I'm the Historian for the Institute and I'm a Principal Partner with Innovative Technology Partnerships. We do national security work for DOE and NNSA and other federal agencies.

Lawrence Satkowiak:

I'm Larry Satkowiak. I'm the INMM Annual Meeting Committee Chair. And as a day job, I run the nonproliferation programs at Oak Ridge National Laboratory.

Lisa Hilliard:

I'm Lisa Hilliard, and I'm supporting Ambassador Zlauvinen for the NPT Review Conference.

Megan Porter:

My name is Megan Porter. I am the Communications Chair for the INMM now, and I work directly with Max as a Communication Officer in Safeguards.

Maite Unzaga:

Good morning, everyone. I'm from Argentina and I'm also on the team supporting President-Designate Ambassador Zlauvinen.

Deanna Bright:

Deanna Bright. I support the *JNMM* and in an Administrative role for INMM in general. I'm typically involved with membership committees and chapters.

Elizabeth Franks:

Hi everyone, I'm Elizabeth Franks. I'm the Executive Director for the INMM since November, working with the team at AH Headquarters and the Executive Committee and the other committees to oversee all the day-to-day operations. And, of course, the meetings and the *Journal* for INMM.

Lisa Howard-Fusco:

I am Lisa Howard-Fusco and I work primarily with the *Journal* in a Managing Editor role where I collect all the content, make sure it looks good, edit it, and get it designed and uploaded. That's pretty much my function and I work very closely with Deanna.

Markku Koskelo:

Well, thank you. Ambassador Zlauvinen, as I was listening to your talk this morning, I had at least a half a dozen questions that I would love to ask, myself. However, in the interest of time, since we do have limited time and I would very much like to give everyone on this event an opportunity to ask their questions, let me yield the floor. Cary?

Cary Crawford:

Sorry Markku. I'll pass for now and maybe circle back later if that's okay with you.



Susan Pepper:

This might be a question that's better suited for the end of the discussion, but it's one that's on my mind, and for Max's benefit and at the end of the Opening Plenary today. Administrator Gordon-Hagerty challenged the INMM to promote STEM and policy education in the hopes of creating a larger pool of candidates for the National Nuclear Security Administration's human resources needs. Those human resources needs pretty much cover the same needs as the INMM's community and the IAEA's community. So, I was wondering, actually, if this could be a question for both DDG Aparo and Ambassador Zlauvinen. How would you suggest that the INMM become involved in promoting education in these areas with the hope of creating a larger candidate pool?

Ambassador Zlauvinen:

Thank you. And before addressing your questions Susan, let me express how delighted and honored I am to share this Roundtable with so many distinguished and experienced colleagues. I have to say, after hearing about your day jobs, the INMM, and your backgrounds, it's almost a reflection of what, in one way or another, I also experienced firsthand or second-hand throughout my 34-year career. Since I joined the Foreign Service back in 1987, I've been dealing with nuclear disarmament and nonproliferation issues. It's an honor and a privilege, but also an amazing opportunity for me to be with you today not only to try to answer your questions, but also to pick your brains in the sense of what else we can do as a community to achieve the shared goals that are enshrined in the NPT and ensure we are well positioned to keep the nonproliferation regime alive and healthy into the future.

Massimo has a key responsibility from his position at the IAEA, but as I said today in my Plenary statement, we need to consider how we can achieve better and greater access to nuclear applications which are so important in the daily life of many people around the world. A big challenge is to create the conditions under which the next generation of practitioners, experts, leaders, and diplomats are going to be involved, engaged, and get their first experiences in all these issues. I believe that there are many ways to engage and reach out to the next generation through the INMM, with different projects, and also through the gender champions in nuclear policy initiative and your gender forum. But we also need to look at how to attract the younger generation to nuclear applications. In my experience, when I have the opportunity to talk to them, for many younger people nuclear matters seem to be so far from their daily life, unfortunately, unless they have the dedication to deal with these issues. So, we have to help make that connection with the next generation—the nuclear industry may be helpful in this regard with opportunities like internships and/or mentor programs.

And I don't know whether the INMM offers mentoring opportunities, but that could be something to look at. For example, in Argentina, in the Foreign Ministry, 30 or 31 years ago, I had the opportunity to mentor a young intern, and now she is responsible for defining Argentina's policy on nuclear non-proliferation and nuclear disarmament. I think there could be many, many opportunities, and I believe that the IAEA is also looking into this, and the European Union and others as well. The next question may be how to coordinate the different efforts of individual organizations and institutions. I may be wrong, but I haven't seen a coordinated

approach. I will talk to my colleagues at the U.N. Office of Disarmament Affairs, which has a program for youth in disarmament, to see whether they have something more coordinated or a collaboration between institutions—public institutions, civil society, international organizations, and industry—to work on this. It's something that we all have to work on together.

Massimo Aparo:

If I may add something more to what the Ambassador said, very correctly. We generally face a problem that didn't exist at this level 30, 40 years ago. Nuclear technology and nuclear energy is not a fear like it was in the 60s and the 70s.

Even so, already the number of people, especially the younger generation who are approaching the nuclear field, are quite limited. And therefore, because nonproliferation and nuclear security is just a branch of the nuclear field, we find ourselves with a lot of problems finding the right candidates for the number of different jobs. In addition to that, our Director General has stressed the need and the Agency's objective to reach gender equality. That's why he has started the Marie-Curie Fellowship to attract the young generation to the area of the Nuclear Field and Nuclear Technology.

I think this kind of initiative is very important, specifically because, as the Ambassador was saying, if you don't have a specific dedication for these kinds of fields, like nonproliferation or nuclear security, most of the younger generations don't understand what we are talking about. And both INMM and JNMM have their entities in this field. They have a very important responsibility to help in increasing the number of people represented from the younger generations, an interest in this field. But it would be important to have a more coordinated program, as the



Ambassador was saying, to have a more structured approach.

James Andre:

One for the Ambassador. Ambassador, I appreciated your comments this morning regarding the third pillar of the NPT, specifically the peaceful use of nuclear energy. And I'm curious about your perspective on the role the NPT can play in the development and implementation of advanced reactor designs. We're going to hear about that this week, especially in regard to developing nations where energy security is an issue, but they may not have a mature regulatory framework or even a modernized grid that can accept the nuclear technologies.

Ambassador Zlauvinen:

Thank you, Jim. As I mentioned this morning, there is an important and direct linkage between the NPT pillars of nonproliferation and access to peaceful nuclear applications, including nuclear energy. The question of the new generation of reactors is something that may be farfetched for many countries. There are only a few of the most advanced, in nuclear terms, countries that currently access that technology, but I believe that the more the demand for energy supply, the more countries will be looking into those options. But you correctly pointed out that it will be almost impossible for a country without a nuclear regulatory body, the nuclear infrastructure, the know-how, to go into such a project.

Again, I will resort back to the IAEA in the sense that they're also doing a lot in nuclear applications to help countries learn how to start building up and developing their own nuclear framework, including nuclear regulatory bodies, but also the—sorry to use this expression—the “critical mass” of nuclear scientists and technicians

that you need to look into realizing those projects.

However, I wouldn't be so negative to say that it cannot be done. If I look back into my own country's history in the nuclear field, some 40 to 50 years ago, probably Argentina was not on the short list of countries that were going to be developing an advanced nuclear program. I believe that 50, 60, or 70 years ago, it was also only about—aside of the P5 or the Big Five, there were Germany, Japan, South Korea, and few others. No one thought that a country like Argentina, Brazil, or others were going to manage to put together the complex system, to be maintained over time, necessary to develop a decent nuclear program.

And yet, Argentina, as well as Brazil and others, have proven that, even with limited human and technological resources, when you have that political will, you can do it over time. Today in my own country, for example, not only do we have 3 nuclear power stations, we have 10-plus small nuclear research reactors. They're working on a project for a small middle-sized power generation reactor, the CAREM. So, Argentina is an example that you shouldn't limit your concept of which countries can develop this type of sophisticated technologies, to only the top 20 or 25 countries in the world. If well-managed, well-encouraged, and under control, other countries can develop and benefit from the use of these technologies; in particular, the advanced generation of reactors that you mentioned. I don't know if Massimo can also just amplify a bit more on that. Thank you.

Massimo Aparo:

Well, he said already everything from our point of view. Even in this case, we are trying to make an effort to improve from our side, the area of safeguards. Of

course, when you need the regulatory authority that can cover all the different tasks of the three S's—safety, security, and safeguards—we have different initiatives at various levels, exactly to address these things. We are also, from the safeguards point of view, launching a new project to improve the capability of the state regulatory authority with regard to safeguards implementation.

I think that a number of countries may have the ambition to develop nuclear technology and use nuclear energy. But a lot needs to be done to reach this level of maturity; that would allow them to properly take advantage of these things. But I think that there is a general effort in the world. My only point is that I don't think that the new generational reactor, like a small modular reactor, would change the need of a country to have a proper infrastructure in terms of regulatory authority, in terms of the generation of scientists and the researchers and technicians that can support this kind of ambition. Thank you.

Irmgard Niemeyer:

I have questions for both distinguished speakers. Ambassador, as you pointed out, postponements of events like the RevCon usually come with some extra time for the stakeholders involved, and you are hoping, certainly not without good reason, that NPT State Parties would use this additional time to raise awareness on the opportunities of the NPT for every country, particularly when it comes to peaceful use of nuclear energy. Do you feel that for other RevCon related discussions and initiatives, the momentum of early this year may be lost? And if I may modify this question slightly for the DDG—as I guess you didn't even have time to think about what to do with some potential extra time—in terms of initiatives foreseen for early this year, what has probably lost



momentum due to the COVID-19 pandemic? Thank you.

Ambassador Zlauvinen:

As I said this morning, it is disappointing that the 10th Review Conference did not and probably is not going to take place in 2020 due to COVID-19. This year marks a milestone: the 50th anniversary of the entry into force of the NPT. And despite the expected challenges, I think many were looking forward to this Review Conference to commemorate and recognize that this Treaty—although some critics may call it unbalanced, imperfect, even outdated—but that this Treaty has served the international community extremely well for 50 years. And so far, it's the only international global treaty on this issue that we have, with non-nuclear weapons states and all five nuclear weapons states in the same treaty. And that it also encompasses the three pillars, as we have discussed: non-proliferation, nuclear disarmament, and peaceful uses. When you look back into the history of the Treaty and you see how difficult it was to reach agreement when the Treaty was negotiated, it is amazing that the negotiators saw the big picture. But perhaps even more interesting is to look at 25 years ago, when negotiators met in New York to discuss the extension of the Treaty. Many take for granted that it was easy to extend it indefinitely, and it was not. There were other options, including a proposal to extend the Treaty for another 25 years. In the end, the view to extend it indefinitely prevailed along with the other decisions in the 1995 Review Conference, such as the recommitment by the nuclear weapons states to nuclear disarmament, the resolution on the Nuclear Weapons Free Zone in the Middle East and others, but it was extended indefinitely.

Now, let's think for a moment what would have happened, or what the

situation could be today had the negotiation 25 years ago concluded that it was better to extend the Treaty for another 25 years—to 2020. The NPT would have ceased to exist legally this year or negotiators would have been working very hard to extend the NPT for, I don't know, another 25 years, indefinitely, 50 years, 1 year? Or what if, in those negotiations, they would have failed to reach agreement? My view, my personal view, and taking into account the current international security environment, I believe that today it would have been very difficult to reach agreement to extend the Treaty. So, we could have been in a much worse situation had our predecessors 25 years ago not decided to extend the Treaty indefinitely.

The extra time that we have before the Review Conference due to the pandemic also presents additional challenges because we cannot meet in person, and it is never the same to conduct a formal consultation with delegations in a virtual manner rather than person-to-person. Also, understandably, the pandemic is at the top of the list in priority for all governments, so we also have a challenge to keep momentum on the NPT. But, if we use this extra time to work very closely with an open mind and try to understand all positions, we may have a better chance whenever we meet at the Review Conference for a better outcome. What that outcome may look like, I don't know. It is not up to me to decide, it's up to the States Parties, and we may not know until the very last day of the Review Conference. So, sorry for, again, a long answer to your question, but it's a very complex one.

Massimo Aparo:

If I may add something. Gustavo describes the situation perfectly and I fully agree with him, that it's disappointing that we could not have this Review Conference

and commemorate this important milestone. The most important point that I see in what Gustavo said is that what we have to do is to try to see this delay as an opportunity. Now, when you look at the 1995 Review Conference, which at the time was extended indefinitely, the political situation at that time was completely different from what we have now. And it was a much more optimistic view of how the world was evolving. And I think that while the decision to have an indefinite extension of the treaty may sometimes be criticized, it has provided a very important element for world peace.

Maybe this is an opportunity for us to rethink certain aspects of the complete world system after the impact of the terrible impact of the pandemic, which may allow us to reconsider certain aspects. Then, it's true that it's disappointing not to have this Review Conference of the Non-Proliferation Treaty.

But there were also a number of negative aspects in the period leading up to 2020 in terms of nonproliferation. When I was at an event in Moscow in October last year, there was a general pessimism on what the nonproliferation Review Conference could bring. People were even thinking that it could be the starting point of a collapse. Let's forget about the fact that we did not have the occasion to celebrate an important event. Instead, let's think how we can improve our effort in nonproliferation. This is what I hope the member states will do in this situation, taking into consideration all the other aspects of this pandemic.

Corey Hinderstein:

My question is really about the positives of COVID-19, which is hard to think about, but what I'm interested in is the idea that we may be learning lessons from the restrictions that we're currently operating



under. And so, my question to DDG Aparo is, are there any efficiencies, improvements to process, or engagements that may actually follow beyond this current situation and help with the effective implementation of safeguards going forward? And for Ambassador Zlauvinen, similarly: so much of diplomacy is meeting people face to face, and going to capitals and going to conferences, etc. And I'm wondering if there is any kind of skill development or evolution of that diplomatic process that can come out of the current environment and make us all more effective as we go forward? Thank you.

Markku Koskelo:

Max, would you? That was the first part of the question. Would you please take the first answer?

Massimo Aparo :

We have to say that this period of pandemic forces us to operate completely different than before, as you can imagine. I have to say that despite a number of difficulties we've been able to implement most of our critical activities around the world. For the first month of lockdown we only had about five percent of staff physically in the office, which has now risen to about 10 percent, with the rest working from home. And with all the limitations the pandemic has imposed on traveling, accessing facilities, and also with the challenges in terms of safety for our staff and for the operator of the nuclear facility, we have learned to cope. We have been forced to work in a different situation, where we had to limit certain aspects of our activities and focus on the most important element of our business.

And I think this is something that can help us in looking at how we can find efficiencies, looking exactly to this experience in order to be as efficient as possible.

We can expect the demand from the member states to increase in this respect even while they regard our work as very important. Now, this will have an impact on our budget. So, we need to have a flexible budget.

On the other side, we also have recognized how important is an IT infrastructure, to be able to cope in a most agile way, in difficult situations. So, we have to balance our capability to improve efficiency and to reduce certain costs with our objective to improve certain aspects of our infrastructure that can help us in facing a difficult situation, like the one we are experiencing under COVID-19.

Ambassador Zlauvinen:

Thank you. I think that Massimo has touched upon exactly the critical issue in this regard, in the sense of the way we diplomats have conducted our business since the very beginning of our profession, the Thirty Year's War I think it was, when the first emissary was sent to negotiate a peace treaty. Since then, one way or another, diplomats have been meeting face to face, to discuss sometimes tough issues. Our work depends very much on knowing the personalities of our counterparts, building trust, and knowing how to work through differences of opinions. Sometimes we manage to achieve that; sometimes we don't. You cannot replace that person-to-person interaction on a video or virtual platform, but we have been forced to try. So far, I understand that all the meetings, at least at the U.N., including the Security Council meetings, are being held virtually, and do not reach the level of negotiations that person-to-person meetings provide. I don't know at the IAEA. I understand that the Board of Governors was meeting, or was going to meet virtually, but with some in-person participation. So, it could be a hybrid approach at the

very beginning.

It's too early to say whether the new reality that forces us to interact virtually, not personally, is going to have an impact on the way that diplomats work. You also have to take into account the varying levels of technology, communication capabilities, and platforms in many states and governments. I have proposed to the regional groups of the NPT to maybe consider the possibility of having the Review Conference in a hybrid mode. I have to say that a large majority initially rejected that noting that their own capitals don't have the capability to fully participate through video conferences. Some very important States Parties also made it clear to me on an individual basis that they want to have a full-fledged, traditional, face-to-face meeting because of the relevance of the issues at hand during the Review Conference. Massimo mentioned non-proliferation issues, and we have at least one particular one that is going to be a big challenge at the Review Conference, but there are others. We will see whether the circumstances will force everyone to accept hybrid or virtual meetings. For the time being I don't see that consensus, but if this new reality will continue for many more months—I hope not—we may be forced to accept that.

Markku Koskelo:

Thank you. Before we move on to the next question I see Brian Boyer has joined us a little late. Brian, would you introduce yourself and what is your role in the INMM and what is your day job?

Brian Boyer:

My name is Brian Boyer, I am the Associate Technical Editor. I assist Markku in putting together the *JNMM* for the reviews and making sure that the *Journal* quality is what we want, and continue to encourage



people to contribute to *JNMM*. Right now, my day job is at the International Atomic Energy Agency, where I am in the Department of Nuclear Energy, where I am the section head of In-Pro, Innovative Nuclear Project. So, we're looking at innovative reactors, innovative fuel cycles, evaluating fuel cycles. It's a very interesting and exciting experience right now. So, thank you.

Sarah Frazar:

Thanks very much for entertaining this question. It's a little bit different from the ones that were raised previously. Public relations and outreach play a really critical role in any organization's impact on their mission and their overall sustainability, and we're at a really critical time when our interactions with the stakeholder community within safeguards has been impacted significantly. And I'm curious if you had suggestions on areas that we might focus on when crafting a public relations strategy? How might we think about that to ensure that INMM as the safeguards professional organization is prepared to help its membership meet the safeguards challenges of the future, and also highlight the work that the agency is doing in this regard? Do you have thoughts on that?

Ambassador Zlauvinen:

I think I will leave it to Max.

Massimo Aparo:

That's a very difficult situation. I mean I think that the lack of interaction or the reduction of the interaction makes our work much more difficult, apart from the fact that our inspection activity had to continue even in this situation; even our interaction with the member states to address the different issues cannot really be done via virtual connection. As Gustavo was saying before, the diplomacy for negotiation or discussion needs to have

a face-to-face, direct presence in order to be able to cover all the different aspects. In this situation, the only thing that we can do is to increase our transparency. This is what the Agency is trying to do.

You can see that we recently held the very first Board of Governors where the member states didn't sit in the same room. They only saw themselves via a video virtual link. This increased the relevant information that they wanted to distribute to the different member states, so they could better understand the activity that the Agency had been carrying out in this format. The other aspect, again a part of the DG's approach, is to increase our level of communication with the member states, our way of reaching out to the different member states and those other entities that are not a traditional interface, to help the agency to cope with this difficult situation.

Leslie Fishbone:

Okay. So, this is a question for both the Ambassador and the DDG. Mr. Ambassador, do you see any possibility that the conference will address in detail any further moves toward the disarmament pillar? One possibility that's been discussed in the past is a convention on limiting the production of this material, which would mainly be before the Conference on Disarmament, but perhaps the Review Conference could make a strong recommendation on this. And Mr. Aparo, if that were to come to pass, how long might it take the IAEA, if it were designated as the verifying organization, to build up its staff to verify something like that?

Ambassador Zlauvinen:

Thank you, Leslie. Nuclear disarmament, the progress towards nuclear disarmament or the lack of progress towards nuclear disarmament, is going to be one of those key issues, as I mentioned this

morning, at the Review Conference. Based on my consultations with the States Parties I got the sense that there is a growing frustration by a large number of States Parties due to what they consider as lack of progress—actual, tangible, concrete actions towards nuclear disarmament.

You may recall that at the 1995, then 2000, and 2010 Review Conferences there have been commitments or practical steps to move on nuclear disarmament. There are diverging views, and I can sense a growing frustration that progress has not been as rapid as those delegations may have wished. Therefore, they're pushing to have a recommitment of those steps in the next Review Conference, or the adoption of new commitments.

The Nuclear Threat Initiative (NTI) recently has been working on those issues. I think they have identified three or four areas where they think that the Review Conference could work, in particular, related to nuclear risk reduction and how the nuclear weapons states and others can work in the future, including transparency regarding nuclear strategies and arsenals, and so forth. And I think the NTI has also done some work on what you mentioned, fissile material management, including a possible convention or treaty on the prohibition of the production of fissile materials.

I'm not in a position to say whether that particular issue is going to be raised during the Review Conference, and if it is, whether it's going to have consensus or large support. It is a very complex initiative, not only from the technical point of view, but also from the political point of view, and I suspect that if there is progress during the Review Conference on additional steps toward nuclear disarmament, nuclear risk reduction and greater transparency will have a better chance at



being adopted rather than a prohibition on fissile materials. But again, it's not up to me to decide or even to forecast what the Review Conference may or may not do, on the technical aspect of verification of a possible prohibition on fissile materials or a cut-off treaty. It's all yours, Massimo.

Massimo Aparo:

Well, thank you. The disarmament part is completely outside the IAEA's mandate so I don't want to discuss any element of that. It is a political issue, it's not part of our activity. What may be different is some kind of fissile cut off treaty, which was already analyzed in the past. However, any operation of this type, even coming from the nuclear nonproliferation Review Conference, will have to be authorized by the Board. So, if a request is submitted for consideration, how much would it cost? What would be the impact? What kind of resources would be required? We have the capability, of course, for certain aspects that are purely technical, yes. We know very well the nuclear material. We have all the technology, the expertise to handle something like that, but how much would it cost? What are the political impacts or certain type of verification formats, etc.?

Ambassador Zlauvinen:

If I may interject an additional comment, a fissile material cutoff treaty has been on the tentative agenda of the Conference on Disarmament (CD) in Geneva for many, many years, and they have not started those consultations due to objections by some delegations. But I think if there were going to ever be such a treaty, I think it should come from the Conference on Disarmament rather from the NPT. But again, it's a personal view.

Dick Donovan:

I'm going to get a little more finite in international relations. Our organization assesses both security and safety, and we have for the past few years conducted a number of reviews of safety culture at Department of Energy sites. I think, overall, what we're seeing is that it is growing, although it is not perfect at this point. Even the United States Congress has taken some interest in the safety culture at particular sites, and has tasked us to look at the status of that culture. However, we don't seem to see security culture getting the same traction, and I was wondering in particular how IAEA feels that's going internationally?

Massimo Aparo:

Well, from my point of view I will even make your observation wider. If you look at the regulatory authority in different countries, then you look at the people that are dedicated to the safety aspect and to the security aspect. On the safety aspect, you would see that there is a strong decrease in terms of resources and funding moving from safety to security to safeguards. So, safeguards remains the one at the national level. It will be the one with lower funding resources, because it's considered that there is an international organization of the Agency that takes care of these things.

However, the international organization, the Agency, our delegation or activity, requires that the state have a strong system of accounting control, without which our capability to do our job is limited. So yes, there is an issue in terms of security culture, there is an issue in terms of safety culture. I don't imagine that in a situation of limited economical expansion of the work, this issue would be easily addressed.

Rian Bahrn:

I'm going to pass and just thank the speakers for their interesting comments so far. Thank you.

Jack Jekowski:

Yes, thank you both for joining us today, this was incredibly informative. This is the third anniversary, last week, of the Treaty for the Prohibition of Nuclear Weapons, TPNW. There's been a lot of articles written about the interaction between the NPT, particularly Article VI on that. Do you see interactions occurring next year during the Review Conference between those two entities?

Ambassador Zlauvinen:

Thank you, John. I'm the President-Designate of the NPT Review Conference, so, therefore, I have no connection to the new treaty, the TPNW. However, based on my consultation with NPT States Parties, it seems this is a new issue that may be debated during the Review Conference. Why? Because there is an important number of States Parties to the NPT that have signed, and some have ratified, the TPNW and those countries would like the NPT Review Conference to acknowledge the new treaty, and also to acknowledge that their work is complimentary. On the other hand, you have another important number of States Parties to the NPT that have not signed and not ratified the other treaty, and they are strongly opposed to any reference to that treaty during the NPT Review Conference. Many of these states see a legal clash between the two treaties, not the least of which is because Article XVIII of the new treaty states that it is legally above any other treaty without directly mentioning the NPT, but obviously it doesn't exclude the NPT. Those who are very familiar with the new treaty may also know that the verification system that the



new treaty established is not like the international safeguards system implemented by the IAEA and used by the NPT as the standard for verification.

There is already a complex relationship between the two treaties and it's going to continue to be so, and unfortunately, I'm expecting to have a very difficult debate at the NPT Review Conference between those two groups of State Parties on whether the Review Conference should acknowledge and take into account the new treaty or not. I don't know how this will be resolved, but it will be another in a long list of challenges that the Review Conference is going to face.

Lawrence Satkowiak:

This has to do a little bit with what we heard from Administrator Lisa Gordon-Haggerty, in terms of personnel and the acquisition of trained personnel to meet the needs to execute your mission. And this is directed towards Max within, in terms of having the right number, the right quality, the capacity that you need to implement safeguards around the world. And what is the current situation that you're facing in terms of personnel constraints, and what is the Agency doing to address that?

Massimo Aparo:

We have general difficulties in identifying a large number of potential candidates, especially for some specific jobs. Again, I think that partly is due to the reduction in many countries in the areas of nuclear energy and nuclear technology, which reduces the number of people that may be attracted by these kinds of jobs. In the Agency, we have a rotation policy that requires that after 7 years staff depart the Agency. We already started a discussion with the DG to look at the specific areas of safeguards where we need at least a

couple of years before the staff member is fully knowledgeable and, therefore, fully equipped to do their job.

It requires a couple of years before a new staff member has gone to all the training sessions that are required, and has collected enough experience to be able to coordinate an activity in the field. You have to remember that, for example, they need to be able to negotiate with facility operators. This is not a skill that is needed outside the IAEA setting. We have been preparing everything to expand this 7 years to 9 years, to be able to at least absorb part of the cost that we invest in training.

From our point of view, we have realized that the most important thing is to have a training program with these particular boosts so we can afford to hire people perhaps with a limited knowledge of the nuclear fuel cycle, but with certain other skills and capabilities. This can make them attractive to our point of view, and then we provide them all the necessary knowledge through these training programs. It's very expensive. We are trying. As you mentioned, if you look at the cost of the training an inspector goes through within 5 years, we spend about €200,000 for each inspector. So now you have 250 inspectors. That is how costly is the training program for us, and how important it is to make sure that you have people that have the right capability, the right knowledge to perform the job.

If I may also interject on this more, just on a broader perspective, not only from the point of view of how to train the IAEA's inspectors, but I'm talking about how we encourage the next generation to get involved with these issues. Not only, as I say as practitioners, but maybe as diplomats, even as a future leaders. I think we should, and when I'm talking we, I say that

governments, institutions like INMM, but also the IAEA and others, even the U.N.—we should also be looking at what more we can do to help prepare the next generations for future challenges. Because they are the ones who are going to be facing the new challenges 20, 30, 40 years from now.

It's not us, I'm sorry to say that. Yes. But also, for them to help facilitate a broad base and balanced considerations of the issues that we as a nuclear community are facing, not just today, but also in the future. So, I think we need more investment. Investment in the next generations, and as I said, also in improving gender imbalance, are going to be crucial. I think so, and this should be a longer-term priority. And I believe the INMM just has a lot to contribute to that, in this perspective. Thank you.

Markku Koskelo:

Thank you. I'd like to go back to some of the people who were passed on and perhaps we can allow the two "Carries" and with Cary Crawford getting the last word, but Carrie Matthews, you passed and then indicated that you have changed your mind, that you have a question. So please ask your question and then we will let Cary Crawford ask his question and close our session. We've run through everyone at least once. So, Carrie.

Carrie Matthews:

Thanks, Markku. I have a question that's directed at both the Ambassador and Max, but perhaps Max first. This morning when Ambassador Zlauvinen made his remarks, he really called attention to this balance in the three pillars of the NPT and trying to elevate the technical nuclear applications and cooperation aspect pillar. And this got me thinking about the important message to the countries that maybe aren't making as much



use of nuclear applications, but that are interested in doing so, and how we communicate with them and bring safeguards into that message. So that when we say nuclear applications have great promise for development and health and security, but that comes also with the requirement to establish some regulatory capability to implement safeguards effectively.

And I'm wondering, Max in particular, are there ways that you see that technical cooperation and safeguards could collaborate a bit more in the Agency to try to bring a coherent message to countries that are in stages of development and interested in nuclear applications? And to Ambassador Zlauvinen, have you experienced in your regional workshops and so forth, any discussion that brings those two topics together? And would you have any ideas on how we could do that going forward? Thank you.

Massimo Aparo:

Maybe I can start. First of all, there is cooperation apart from technical cooperation. You have to realize the mission is in two parts. They are, let's say, complementary. The cooperation is there to help the country develop its presence in the nuclear field. Safeguards are there to implement verification. Now, the cooperation, at this point in time, is focused on making sure that the certain TC project does not introduce a proliferation risk—considering the type of nuclear fuel cycle, the expertise of the country, and providing direction if a risk becomes present.

So, we review all the different technical cooperation projects. We provide advisors both to the technical cooperation department, and the DG in terms of a possible impact of the results of a technical cooperation project, in terms of nonproliferation. When we started just a few weeks ago, we had to make sure that

any of the technical proliferation projects that were being done were being started with all the requirements, including the fact that certain technical expertise or technical division is supposed to be approved by the procurement working group of the commission.

So, even though the Agency is not the member state, we have to make sure that we avoid the way that certain goods or certain expertise were provided, because we are going through the regular approval process. In general terms, it is strengthening the state authority for accountants in control.

Ambassador Zlauvinen:

Yes, Massimo correctly pointed out that technical cooperation and safeguards are separate categories, but at the end of the day, they are intertwined, like the three NPT pillars. TC, from the point of view of the NPT's access to nuclear applications for peaceful purposes is linked to the nonproliferation obligations, and is mutually supporting, as Massimo has already noted. In the regional workshops that we organized with support from the UNODA, the European Union, and others, in Africa, Asia, and one in South America, there was a lot of interest by States Parties in how to expand access to nuclear technologies. And obviously not only the transfer of know-how and technologies, but also the requirements that those technologies and know-how are used in a manner that is safe, secure, and under safeguards.

So clearly, there is a connection and I expect this issue also to be discussed at the Review Conference. Why? Because in 1995, when the mutually reinforcing and balanced nature of NPT's "grand bargain" was solidified with the Treaty's indefinite extension, the non-nuclear weapons states undertook to continue with their obligation not to develop or

produce nuclear weapons in exchange for two things: one, the recommitment by the nuclear weapons states to one day forge a complete nuclear disarmament, and two, to have greater access to nuclear technologies. I have to say that some of the States Parties are questioning whether this "grand bargain" is actually being implemented by the P5, and I am expecting this issue to be debated at the Review Conference.

Markku Koskelo:

Thank you. Cary Crawford, you have the last word. If you wish to make a couple of comments please keep your questions short. We have officially approximately 10 minutes left.

Cary Crawford:

Thank you, Markku. I thought I had a question and I think what I'll do is make it a statement that you're welcome to respond to. And if you prefer, we can just kind of make it a closing. My question was going to be very much related to the one Corey Hinderstein asked, but maybe more with a technology spin to it, related to the many times disruptive processes and procedures and technologies come from some of the most difficult of circumstances. And so, it was going to be along the lines of what, if anything, from the COVID-19 pandemic has come in terms of innovative technologies that may not have been even on the table prior. For example, I know at Oak Ridge National Lab, we and other national labs have come up with opportunities to work on the COVID problem that we never would have realized, with advanced manufacturing, with high performance computing, with other technologies.

So, many times researchers are challenged by not knowing the application space in which you need their research, but you're sometimes challenged by



not necessarily knowing what they have to offer. And I think the INMM plays this middle ground role, where if we talk about our collaboration properly, we can frame the questions in such a way that we can turn it into a challenge to the Institute. So, I was gratified to hear Ambassador Zlauvinen and Administrator Gordon-Haggerty today throw some challenges to us. And I guess my comment would be formulating those challenges in such a way that they're meaningful challenges that can be tackled, so that we can come back with out-of-the-box solutions that maybe you don't have the bandwidth for in your current job of getting it done now, that it's a good marriage.

And so, I would thank you for your challenges, and I maybe would end with that statement and thank you for spending time with the INMM. And you're welcome to comment if you like. If not, I can leave it at that.

Ambassador Zlauvinen:

Well, if I may, Cary, thank you very much, and also to all the participants in this Roundtable. We heard today many good questions and ideas. The globalization

of today's nuclear supply chain calls for better communication, coordination, and collaboration across sectors and across borders, not only to improve the benefits of nuclear technology, but also to protect the international community and our countries against possible misuses of that very same nuclear technology and applications, while still ensuring that they are accessible to all who need those technologies—with of course safety, security, and safeguards, regulatory authorities, and so on. I believe that the INMM membership has a lot of potential and capability to help deal with these challenges, to look at emerging technologies and consider what measures could be considered today to help “future proof” relevant technologies before they are even commercialized or readily available on the open market. I think Massimo is also working on that. This includes, for example, designing in safeguards, security and safety measures as practicable, training the next generation, and ensuring they have all the basic information that they need to maintain adequate levels of expertise that this very important field requires. Thank you for giving me this

amazing opportunity. I'm ready to work with all of you in the near future.

Massimo Aparo:

Just few words more because Gustavo was very good in describing everything, and stressing the need for collaboration and the fact that it helps us to achieve all the different objectives. So, from that point of view, they can only look forward to the future when the situation will change. I look forward to the future, where a symposium—hopefully—will be here in Vienna. Thank you very much for producing this event. I'm looking forward to my keynote tomorrow.

Markku Koskelo:

On behalf of the *Journal*, let me thank our distinguished panelists for their participation in this event. And all of you who took the time to think about questions and participate in this event. So, with that, I think we are just about exactly on time. So, let me close this event and wish for all of you a good week participating in our annual event, and please do participate in the ADG talk tomorrow morning. Thank you everyone.



Closing Plenary Session 61st Annual Meeting

Plenary Speaker:

Dr. Ernest Moniz

Former Secretary of Energy, U.S. Department of Energy



Cary Crawford:

Hello, and welcome to the final Plenary and close out of this year's Annual Meeting. We have a great Closing Plenary coming up. It's a great honor to introduce you to our moderators who will then introduce our speaker and moderate the session.

We're privileged to have Miss Jill Hruby and Nancy Jo Nicholas with us. Jill is Emeritus Director and President of Sandia National Labs and an independent consultant providing services to the Nuclear Threat Initiative, Carnegie Endowment for International Peace, and numerous boards and advisory committees. She served as the Director of Sandia National Labs from 2015 to 2017. After 34 years at Sandia, enrolls with increasing responsibilities. Jill has worked in nuclear weapon systems, nuclear nonproliferation, defense and homeland security technologies and systems, renewable energy materials, and engineering sciences and micro-systems technology. She serves on advisory committees at Purdue University and the University of California at Berkeley, where she earned her bachelor's and master's degrees in mechanical engineering respectively. Jill has received the Department of Energy Secretary's Exceptional Service Award, the National Nuclear Security Administrators Distinguished Service Gold Award and the Office of the Secretary of Defense medal for exceptional public service. Joining her to moderate will be Nancy Jo Nicholas.

Nancy Jo has worked in the global security field at the Los Alamos National Laboratory since 1990. She was appointed Associate Lab Director for Global Security on November 1st, 2018. The Director was focused on nonproliferation and counter-proliferation R&D associated with weapons of mass destruction, space defense and systems applications, war fighter support, homeland security, and intelligence analysis. She's also currently serving on the National Academy of Science's nuclear and radiation studies board. She's the Past President and Fellow of the Institute of Nuclear Materials Management. Currently the Chair of the Fellows Committee, she served on the Board of Directors for the World Institute for Nuclear Security, the American Physical Society panel and Public Affairs' study on potential U.S.-Russian nuclear reductions after New START, and the Defense Science Board Task Force on the assessment of nuclear treaty monitoring and verification technologies. I'm excited for this panel and I will turn the microphone over to Jill.

Jill Hruby:

Well, thanks Cary for that great introduction. It's my pleasure to start this Closing Plenary by introducing Dr. Ernie Moniz. As most of you know, Dr. Moniz served as the Secretary of Energy from 2013 to 2017. During his time as Secretary, he garnered bipartisan support for energy, science and technology, and advanced clean energy. He negotiated the Iran Agreement along

with Secretary John Kerry and he strengthened the Department of Energy's partnerships with the National Laboratories and with the Department of Defense. Since Ernie left government, he has continued to energetically pursue his twin passions of reducing nuclear dangers and promoting clean energy. He is now the CEO and Co-Chair of the Nuclear Threat Initiative, as well as the President and CEO of the Energy Futures Initiative. In addition, he keeps his finger in academia after a 40-year distinguished career at MIT, and is now the Cecil and Ida Greenway Professor of Physics and Engineering Systems Emeritus, and a Special Advisor to the MIT President.

He is engaged in a number of other endeavors that are too numerous to name. Dr. Moniz has a Bachelor of Science degree from Boston College and a doctorate from Stanford, both in physics. He has nine honorary doctorate degrees and a host of national and international awards. He is a committed champion of diversity and a gender champion in nuclear policy. It has been my pleasure to work with him both as Secretary and again at NTI to promote science and technology to inform sound policy decisions. Dr. Moniz will provide some brief opening comments. After his comments, Nancy Jo and I will alternate asking questions before turning to the audience for questions. Please join me in welcoming Dr. Ernie Moniz.



Dr. Ernie Moniz:

Well, thank you Jill. Let me begin by thanking the Institute and its leadership for this invitation to be with you. NTI certainly has a long history with INMM. And just to remind some of you, that includes former NTI President Charlie Curtis's Plenary speech at the Annual Meeting in 2005 resulting in the so-called "Curtis Challenge," leading to the joint effort between our two organizations, in cooperation with DOE and the IAEA to create WINS, the World Institute for Nuclear Security. And WINS has been extremely successful in its 12-year history. Today, it has more than 6,000 members in 149 countries, and is now preparing for its first leadership change, as Roger Howsley prepares to depart as Executive Director at the end of August. He leaves WINS strong and worthy of the legacy of that cooperation that started with Charlie's challenge. NTI experts have contributed dozens of papers, presentations, and panels at annual meetings and workshops. NTI has been an INMM sustaining member for many years, and even donated Corey Hinderstein to the Executive Committee for 6 years of service, ending this September. Most recently, we've been very pleased to have supported the participation at this Annual Meeting of almost 20 African and African-American participants as part of our commitment to improve the diversity of the nuclear materials management field.

If I can say a few words about my own career, I've had experience in federal government, nongovernmental organizations, and academia, among others. Engagement across these communities is vitally important to develop, implement, and sustain efforts to reduce nuclear risks, promote peaceful nuclear activities, and innovate to address the complex challenges we all face. It is sometimes difficult,

however, to build bridges between and among these communities. Similarly, I've worked on issues related to nonproliferation, nuclear security, nuclear science, safety, safeguards, back-end, front-end, transportation, disposition, you name it. But I have to say, it's probably a little known, including to my close colleagues who are on this call, that I was a conscript in this field in 1976. My mentor at MIT, Herman Feshbach—some of you may remember him and may have learned from his methods in theoretical physics—was head of the MIT Physics Department and a real driver in the creation of the American Physical Society Panel on Public Affairs [POPA]. He basically ordered me, as a junior faculty member, to be part of the study group on nuclear fuel cycle to waste management that was formed in 1976. And I led the chapter on nuclear safeguards and then later became POPA chair. But that was really the beginning of my now-long engagement with these nuclear opportunities and risks.

I'm really glad I was conscripted. In fact, in the first decade of the century at MIT, when I started the MIT Energy Initiative, we also started a series of, frankly, quite influential reports on the future of various energy technologies. Nuclear power was the first in that series, and another report on nuclear fuel cycles helped contribute, for example, to the Blue Ribbon Commission Report.

So just to say that this goes back, perhaps longer than I wanted to admit. But since Jill already revealed my many decades involved at MIT, I'm not really revealing any new information there! But today, we do face critical challenges in all of these areas. These challenges require the skills and expertise of the people in this virtual room. Stovepipes are obstacles to progress, so it's great to bring people

together from different backgrounds in professional societies in meetings like this. It gives us the opportunity to work across those lines, including nationality, to share research results, ideas, and perspectives. Your work comes at the intersection of technical understanding and policy. And again, we need your engagement in helping shape policy and define what is smart and what is possible. I want to commend the Institute for focusing on this mission and highlighting the themes of connection and collaboration during this Annual Meeting. As this is the last session, I hope you've been able to accomplish that, even while we are still obviously socially distant.

Of course, I should also mention that today is the 75th anniversary of the Trinity Test at Alamogordo, another reminder of the importance of our work. Pivoting from this, I want to highlight an upcoming NTI event. Next week, on July 22, NTI will release the Fifth Edition of the Nuclear Security Index, a one-of-its-kind assessment of nuclear security conditions around the world and a premier resource for governments and experts. Without giving away any of the results, this year's Index validates concerns many of us have about waning political attention on nuclear security, despite clear and significant security gaps in areas like cyber security. I hope you'll join us for the online launch event on July 22nd to learn about where progress has been made, where the world is still falling short, and what more countries can do to strengthen nuclear security globally. And if you're unable to join us, you'll be able to see the results, view the webinar, and download the report at www.ntiindex.org. So, again, thank you for the opportunity to be here and I'm looking forward to our conversation today with Jill and Nancy Jo.



Nancy Jo Nicholas:

Thank you, Dr. Moniz for those opening remarks. And in particular, I appreciate you highlighting the Curtis Challenge. I remember that like it was yesterday. It's hard to believe it's been a decade. Let's kickoff the questions. I would like to start with one about arms control. So, when New START was negotiated, also about a decade ago, the Russians were really interested in making sure that China was included in the next treaty. Now, the U.S. is pushing to maybe have China come to the table, be part of a new treaty. So, my question is, what do you think the future might be for bilateral arms control? Where are we going to go?

Dr. Ernie Moniz:

Well, that's a really important question of the day. And frankly, I'll say a bit more about this, but I'm certainly concerned, as are many of us, that this insistence on China as being party to a New START extension is fundamentally a poison pill, in terms of making progress. The fundamental reason is pretty clear. The United States and Russia continue to have over 90 percent of the world's nuclear weapons. We are really the only two countries that pose, what I would call, genuinely existential threats to the other. We have a special responsibility that was exercised for decades to minimize nuclear risks, minimize the risks of miscalculation, for example.

We really need to do this extension with New START because, even if you thought it was possible, the idea of China joining New START as an extension is not legally plausible. This is a treaty between the United States and Russia that only requires administrative action—essentially the initials of the two presidents—to add the 5 years. I would add that, in addition

to being implausible, it's actually a really bad idea. This goes back again to the numbers. China has an order of magnitude smaller stockpile compared to Russia or the United States and a negotiation on numbers is likely to end up in a bad place when you have a big asymmetry.

We think that there is good reason to start to try to draw China into arms control and disarmament discussions. But right now, it should not be around treaties or setting limits, or, frankly, getting into difficult verification measures. We should start with a much more normative discussion, which China could join with the United States and Russia, and, potentially, with the remainder of the P5 to make some real progress.

And finally, going back to the bilateral issues, I would just say that on New START, I think it's a no-brainer to go forward. But the reality is, we have a lot of hard work to do in terms of reinvigorating, or you might say even “restarting,” the kinds of discussions that we had for many, many years, including with the Soviets at the height of the Cold War: Exercising our responsibility as the world's leading nuclear weapons powers to minimize risk rather than perpetuate the current situation, which we fear is drifting in the opposite direction, opening up an all-too-real possibility of a miscalculation leading to a very bad outcome.

Jill Hruby:

Okay Ernie, I'm going to ask the next question. And as you mentioned, today is the 75th anniversary of Trinity, the world's first nuclear explosive test. Therefore, it seems important to discuss the current status of nuclear testing, as the U.S. has signed but never ratified the Comprehensive Test Ban Treaty, although we have been abiding by its provision that prohibits all nuclear tests that produce yield since 1992. Recently, the U.S. has alleged

that Russia and China may be violating the no-yield provision of the CTBT and conducting low yield tests. Then the U.S. administration has suggested that the U.S. may resume underground testing. Can you just share with us your opinion about whether the U.S. should be seriously considering resuming underground testing or anything else you have to say about nuclear tests at this point?

Dr. Ernie Moniz:

Sure. First, the little bit of history in introducing me did not mention that I had a practice run at the Department of Energy, which was as Undersecretary in the second term of President Clinton. In that position, I had the misfortune of being at the witness table in the 1999 ratification hearings of the Comprehensive Test Ban Treaty, along with the three weapons lab directors. Those hearings, and the subsequent vote, did not go well for advocates of the Comprehensive Test Ban Treaty.

I say that because the two principal arguments at that time for not ratifying the CTBT—and I frankly, think that there was some merit in those arguments at that time—were that:

- we did not have an established, science-based stockpile stewardship program that could back up safety, security, and reliability of the stockpile without testing, and;
- the world did not have the comprehensive detection network, including seismic and other forms of detection, for nuclear tests.

I start out with that because, I would argue, that on the former in particular, we have a pretty robust science-based stockpile stewardship program without testing. So, both of those arguments, I think, are overtaken by events with science and technology led by the labs. That takes us to today. Especially given that we have those



two technology-based advances, there is nothing but advantage to the United States in continuing at least a moratorium, if not a treaty obligation, to have no more nuclear tests. We have certainly done the most nuclear tests of anyone by far.

If we were to do a test now, it clearly would open a Pandora's box for testing by other countries. At a minimum, I would say Russia and China, but probably not at a maximum. That would be a national security detriment for us.

Now, there are these accusations, or assertions, that Russia and/or China may have done very, very low yield tests, below the threshold of seismic detection. I can't say whether that's true or not. I can say that merely detecting a lot of ground-based activity around testing sites is not sufficient to defend that statement. If it were, the United States would be accused of the same since we carry out subcritical tests at our test site.

The way to handle this, certainly with Russia, is the traditional way, when we had functioning agreements and functioning understandings. It would be a discussion, possibly even followed by mutual verification visits. But it's that dialogue that is missing. To turn that around by threatening to do a test, to get negotiating leverage as was reported, it's just completely going in the wrong direction for our own national security.

Nancy Jo Nicholas:

My next question, Dr. Moniz, is about Iran. So, as you pointed out, our audience here at INMM is a nice mix of technology developers and policy influencers. Of course, you're an expert in both those domains. So as one of the architects of the Iran nuclear deal, how do you assess the long-term impacts of the innovative technical verification elements of the JCPOA?

Dr. Ernie Moniz:

Well, first of all, I'm very pleased to address that issue of the technology and the verification. To make sure we're on the same page, let me give the most elementary, streamlined description of the JCPOA. It's two elements. One is that Iran had specific restrictions on its nuclear activities for 15 years. In particular, Iran was restricted to only 300 kilograms of enriched uranium with enrichment below 3.67 percent. That's a pretty big constraint in terms of the kind of program that Iran could have for 15 years.

Let me also add that we mentioned today as the anniversary of Trinity, but two days ago was the fifth anniversary of the JCPOA signing, on July 14, 2015. Ever since that day, the discussions about the Iran Agreement keep focusing on centrifuges and enrichment. I'm not saying that's unimportant. However, it misses the fact that the second element of the JCPOA, in my view, was by far the more important—the unique verification regime that it put forward. Iran agreed to both IAEA “boots on the ground” and many technology-based monitoring capabilities that were (and still are) absolutely unique in the world. That included all kinds of surveillance technologies. It included special seals. It included the opportunity to transmit data from some of these devices. It included novel approaches such as that Iran remains the only country in the world that agreed to 25 years of surveillance of the entire uranium supply chain. So, these are very, very powerful constraints.

Now, Iran clearly has, and very openly, step by step said, “Okay, we're going beyond the JCPOA constraints on nuclear activity.” But the reality is, and while there's a little ambiguity here, fundamentally, Iran has stuck with the verification regime. I would argue that is because

Iran recognizes that the confidence in their not restarting a nuclear weapons program (which they never conceded to have, but we know they had) is because of the verification regime. So, in order for Iran, for example, to continue to have the support of the Europeans, the verification regime, frankly, was more important than the steps they actually took in violating their nuclear restrictions.

I will pivot from that just to make one last point. The JCPOA very clearly said that these unique verification regimes, way above their safeguards agreement with the IAEA, were special to Iran. That is, it was put forward in the context of Iran and Iran's having had a previous weapons program up through 2003. However, since I'm not in government, I am perfectly free to say that many of those unique elements really should now be part of the discussion about the nuclear security posture of the future, about what the IAEA has the prerogative to do in terms of nuclear inspections. That goes everywhere from the use of some of their technologies for remote monitoring, for example, to supplementing the Additional Protocol for a finite time to allow access to undeclared sites. There's a lot to do and frankly, at NTI and with Corey Hinderstein, we are very actively looking at how that kind of agenda could be pursued. No matter where the JCPOA is right now, between life and death, we can be building on some of the unique elements of the deal for a future nuclear security regime.

Jill Hruby:

We have so many questions but we're dedicated to turning this over to the audience after this one, I think, so we get plenty of time for audience questions. So, I think, Ernie, it might be good to change topics a little bit from security to nuclear energy. And I know this is an area where



you've been active, but the U.S. has not had a nuclear power resurgence. But meanwhile, nuclear power continues as a principal and low carbon energy source and other countries such as China, Russia, France, and countries in the Middle East and elsewhere are planning nuclear power production going forward. Do you think nuclear power should be more widely adopted? And if so, what do you see as the national security implications?

Dr. Ernie Moniz:

Well, Jill, let me first talk about the climate change-driven construct that we need to head to. 2015 is when we did the JCPOA in July, but you may remember that December of 2015 was the signing of the Paris Agreement at COP 21. I could say a lot about that and I was also a partner with John Kerry there. The Paris Agreement, if you recall, basically called for a two-degree centigrade maximum warming, and to really try to do better to get even lower warming. That all got summarized in what you might call an 80 percent reduction in greenhouse gas emissions by mid-century.

Well, going on 5 years since the Paris meeting, the science community in particular has come to the realization that we actually have to do better. Now the one-and-a-half-degree goal is viewed as the one we have to really get behind. To do that, at least for the industrialized countries, one is now talking not about an 80 percent reduction but about a net zero goal for 2050.

Let me define net zero because the net is important. That means having some contributions from negative carbon technologies to offset any remaining nonzero emissions in the economy so that you have a net zero. The more now that we tighten those objectives, the more we need every tool in the toolbox that we can bring to bear on carbon emissions reductions. That

is number one.

Number two is that no matter what the goal is, including net zero, it's pretty clear that decarbonization of the electricity sector comes first. So, if we're going to go to net zero by mid-century for the entire economy, we better get there by 2040 or a little bit earlier in electricity.

Now that brings us back to nuclear as one of the big tools in the toolbox for decarbonizing—in particular, the electricity sector. So, technically do we need nuclear? Technically not. But in reality, the job goes from herculean to whatever some superlative is beyond herculean to meet those goals.

I personally think that it's not for everybody, and there will be major regional differences. I do believe, for example, that Germany will stick to its no-nuclear commitment. Of course, they're having a hard time figuring out what to replace it with.

I'm a very, very strong supporter of strengthening public-private partnerships to make sure that, in this decade, we demonstrate and have the techno-economic dimensions clarified for small modular reactors, both light water and Gen IV-type technologies. Also, the micro-reactors that are getting more and more attention will be very important, not for baseload power but for mining and especially for remote places. I think we need to get those out there so that we can be prepared to start scaling the new technologies, let's say in the 2030s, to meet that strong decarbonization goal.

It's not simple. It's also not simple because in the United States, we still have roughly 100 gigawatts of nuclear power. If those plants retire after 60 years, then the big retirement wave starts just about at the same time, in the 2030s. So, it's not only building new nuclear power, it's also replacing the nuclear power. If life

extension to 80 years becomes relatively common, then of course, we have another 20 years. That would be a big leg up in terms of trying to reach net zero. So, it's both extending the existing plants and bringing the new kinds of technologies on.

Now, the last part of your question was about implications for security, and this is very important. There are a number of dimensions. You mentioned in the introduction that I am also leading something called the Energy Futures Initiative, and if anybody wants to go to <https://energyfuturesinitiative.org> you'll find a 2017 paper written specifically on the national security implications of the nuclear power sector.

Number one is that the United States was able to establish very strong norms for nonproliferation, largely through bilateral peaceful uses agreements with other countries (so-called 123 Agreements for the experts). We could advance strong 123 Agreements because, frankly, we were the big dog in the nuclear supply chain. If we don't rebuild and strengthen our nuclear supply chain, we will continue to lose leverage in those nonproliferation agreements.

Secondly, having an incomplete supply chain domestically has other implications. I'll mention one specifically. In the United States today, we do have some uranium enrichment capability. It's in New Mexico but it's Urenco, European technology. It is not usable for national security purposes. I will mention two areas. Even if the Navy can convert from HEU to LEU, we need enriched uranium using a fully American supply chain, including enrichment.

The second area is to provide tritium for the nuclear weapons stockpile. We, again, need an enrichment capacity to provide fuel for the reactors from which the tritium is extracted. We do not have such capability. The barn is not on fire,



in the sense that we still have lots of stockpiled enriched uranium that can be used for those purposes. But it's a finite resource. We also know that the time for building any nuclear facility tends to be counted in the decades as opposed to the years. So, I personally believe that that's an example of a broken supply chain in the United States in the nuclear arena, where I think we should be moving on it right now, frankly, and not saying, "Well, we've got 40 years to wait. 40, 50 years, plenty of time." Not in the nuclear business. So, lots of national security implications in that supply chain being rebuilt.

Nancy Jo Nicholas:

Okay, Dr. Moniz, we have a number of questions coming in from the audience. Quite a few of them are in the area of arms control. So, let's start with this one, it's about trust. Could you please comment on the role of trust in arms control? And rather than ask you to comment on what the U.S. government should be doing, could you give us some advice on what the Russian and Chinese side ought to be doing to build that trust?

Dr. Ernie Moniz:

Well, first of all, I have to start with a comment that goes back to the last question that you asked, Nancy Jo. Some of the collateral damage of the pullout by the United States of the Iran agreement is that it is going to take a long time to rebuild the reputation of reliability that underpins a lot of the trust issues. I have to say, and I'm not being partisan here, but it's just a fact that we have clearly a "shaking" of the pillars of things like NATO, and that's with our allies. If we weaken that trust, it's a little bit harder to project that trust in our discussions with the Russians and the Chinese. It's incumbent on all those countries, it's not just the United States, as you say. We

have to rebuild the really intense level of discussions at all levels, including military to military.

Right now, we have Congress discouraging military-to-military interactions. Those are critical for our stability. We used to have diplomat-to-diplomat discussions, and I don't mean president-to-president. I mean foundational work. We had scientist-to-scientist collaboration. The National Labs, including Los Alamos and Sandia and others, were absolutely critical and paid big dividends, especially around the time of the dissolution of the Soviet Union. We need to go back to doing that. That's where the cut-off of the kinds of significant efforts in the nuclear domain between the United States and Russia erodes the trust that we build up through personal interactions and personal ties.

I signed two R&D agreements when I was at the DOE. One was in the Clinton years, when I was Undersecretary. I signed an agreement with Deputy Minister Ryabev, who headed their weapons program. This agreement had the U.S. and Russian weapons labs literally collaborating on nuclear weapons issues. Not on the design of nuclear weapons but on the safety of those systems, etc., tremendously building up trust in the nuclear weapons arena. Then, with President Obama when I was Secretary, I signed the agreement with Mr. Kiriyyenko, who headed Rosatom, on what could have been an expansive nuclear R&D collaboration. That was signed in September of 2013. The Russian incursion into Ukraine in early 2014 basically prevented any activities under that agreement, but it's sitting there. It's signed. It's the kind of thing that I think we should, at least selectively, go back to so that we can start building that trust.

With China, I would say we've never had that discussion. So, it's not about going

back to it, it's about building it. Frankly, in the late 90s, Los Alamos was the leader in trying to build laboratory-to-laboratory discussions with China. Those ran into issues and that never got off the ground. Well, as a result, we have a situation with very little transparency and very little, almost none, of the kind of discussions and cooperation that can build that trust. But as we said earlier, we need to start building up that trust with China to negotiate, not arms control agreements, but all the kinds of normative discussions that I believe we could do right now. Sorry, I give long answers.

Jill Hruby:

We're adjusting accordingly. We have a lot of great questions but I think this will probably be the last one, given our time constraints. And I'm selecting this question because I know this is important to you, Ernie. It's also important to me. And the question is, what advice do you have for students and early career staff in nuclear safeguards and security? How has your advice changed with the current global pandemic and the challenges it presents to our field?

Dr. Ernie Moniz:

Maybe I'll think in real time here. I haven't thought too much about the pandemic, specifically, and safeguards, but more broadly it has had enormous impact. If I may, since NTI also has a large program in pandemic preparedness and now of course in COVID-19, I would like to first put out a rather unpleasant fact. And that is, depending on how you count, the COVID-19 pandemic right now is either the sixth or the seventh identifiable epidemic/pandemic of this century. We're talking about every 3 years, starting with SARS in 2002 in China. And mentioning SARS, the Middle East Respiratory Syndrome



and COVID-19: these are all three coronavirus. Yet, after each of those events we have not answered the wake-up call about preparing for the next pandemic.

And today, the pandemic has had such an impact on social structures and learning structures. So again, it's not only about safeguards, but in general today we have many unanswerable questions about how there may be a permanent change. For example, will all of our conferences be Zoom conferences or not? My fear is that if we don't answer the call this time, we may have another pandemic of the century in a few years. I think another one of these in a few years would have dramatic changes in all areas of social interaction, of education, and the like.

Now, in terms of the safeguards and the all the issues around nuclear, I'm not going to answer the question directly. I guess but to say instead that I can't help it, that I've been drawn to climate change, pandemics, and nuclear weapons, topics you might call three of the least-arguably existential threats that we face. None of these are short term. So, what I think is that the importance of a new generation filling the pipeline to address these issues,

whether it's climate or nuclear security or pandemics, is absolutely essential. For those of you out there who are in that age group, it's going to be your problem. I'm trying to help, but it's what you're going to live with. I think it's of critical importance coming into this field. To pick up another theme that you mentioned in the introduction, it's clear, especially as our society evolves and addresses some of its other structural problems, making sure that that new cadre is as diverse as possible is very important for maximizing the talent upon which we can draw to address these problems.

Nancy Jo Nicholas:

That's a great answer. And I think one of the big benefits, or silver linings for the pandemic and social distancing, virtual conferences, is that we have access to outstanding speakers like Dr. Moniz and all of our Plenary speakers. It's a great opportunity for early career staff or students to engage in this kind of a forum and dialogue. So I really appreciate that, fantastic session. Thank you, everybody, for the wonderful questions and comments. I think this has gone really well. I know Jill

and I have enjoyed it quite a bit. As we're wrapping up, I want to point out that there's a polling question about the ribbons that INMM normally gives out at all our conferences. I'm sure Dr. Moniz has been to lots of conferences with colorful ribbons and the question is about whether you miss those ribbons or not. But as we're wrapping up, Dr. Moniz, this is an opportunity for you to say any closing remarks.

Dr. Ernie Moniz:

I think the last answer I gave would be my closing remark. Young people, we need you. All genders, races, across all the spectrum of humanity, we need you badly. You need to do this for your own futures.

Nancy Jo Nicholas:

Thank you. We really appreciate you being a gender champion. I think it says a lot and INMM has really been a leader in this area as MTI has. So that's fantastic as well. So, thank you again to everyone for participating in this Closing Plenary. Thank you, Jill. You're a wonderful co-moderator. And now I'd like to hand the podium back over virtually to Susan Pepper, who will pivot us all to the closing award ceremony. Thank you.



CONGRATULATIONS TO INNMM'S 2020 AWARDS WINNERS!

Each year, the Institute of Nuclear Materials Management recognizes the hard work and success achieved by nuclear materials management professionals through its special awards.

VINCENT J. DEVITO DISTINGUISHED SERVICE AWARD (DSA)

2020 Winners: Dr. Mona Dreicer, Therese Renis, and Kurt Siemon

This award, previously known as the Distinguished Service Award, was renamed in honor of long-time INNMM Secretary Vincent J. DeVito, in 2009.

Criteria: The Vincent J. DeVito Distinguished Service Award (DSA), named for the Institute's long-time Secretary, recognizes individuals who have made long-term, noteworthy contributions to the nuclear materials management profession. Eligible candidates are not required to be INNMM members, but are expected to be internationally recognized for their contributions to nuclear materials management.

CHARLES E. PIETRI SPECIAL SERVICE AWARD (SSA)

2020 Winner: Integrated Support Center for Nuclear Nonproliferation and Nuclear Security

This award, previously known as the Special Service Award, was renamed in honor of Charles E. Pietri in 2011.

Criteria: The Charles E. Pietri Special Service Award (SSA), named for the long-time Chair of the Technical Program Committee, recognizes individuals or organizations who have made a specific, noteworthy contribution to the Institute. The award can also be given to an organization that has advanced the knowledge and effectiveness of the nuclear materials management field. The eligible organization does not have to be a Sustaining Member of the Institute in order to be considered; however, eligible individual candidates are required to be active members in good standing of the Institute.

EARLY CAREER AWARD

2020 Winner: Melissa Einwechter

Criteria: The Early Career Award recognizes members of the INNMM who are 35 years of age or younger (as of the date of the nomination deadline) and who have made a singular outstanding achievement or a series of notable achievements in an area of nuclear materials management relevant to the Institute and its technical divisions. A candidate's notable achievement must not be related to work performed in pursuit of an academic degree. In the case of a series of achievements, work related to a degree may be considered. The notable achievement or series of achievements must be accomplished by the nominee while a member of the Institute. The nominee must be the sole or main contributor to the notable achievement. Candidates must not have already been a recipient of the Vincent J. DeVito Distinguished Service Award or the Edway R. Johnson Meritorious Service Award. Eligible candidates are required to be active members in good standing of the Institute.



J.D. WILLIAMS STUDENT PAPER AWARD

In 2003 the Student Award was officially named the J. D. Williams Student Paper Award to honor the memory of James D. Williams, INMM President in 2001-2002, for his energetic backing of young professionals and tireless support of the INMM to stimulate interest in, respect for, and proliferation of nuclear materials management principles. Students who enter this competition will be judged on their written papers and oral presentations. Winners will be determined by judges composed of the Awards Committee and Technical Division Chairs or their designees. Cash prizes for first place (\$1,000) and second place (\$500) are awarded and announced during the Annual Meeting.

2020 WINNERS:

First Place: Integrating Acquisition Pathway Analysis into the Cyclus Fuel Cycle Simulator

by Kathryn Mummah, University of Wisconsin Madison

Second Place: Multi Sphere Neutron Spectrometer Based on Elpasolite Scintillators

by Stuti Surani, University of Illinois at Urbana Champaign

Poster Winner: Optimization of a K-nearest Neighbors Regression Algorithm For Improved Pulse Shape Discrimination Of Gamma Rays And Neutrons In Organic Scintillators

by Matthew Durbin, Pennsylvania State University

DIVISION FINALISTS

Cross-Cutting Topic:

Autonomous Inspection of Nuclear Repositories: Current State of the Art and Future Directions

by Chris Lee, Oregon State University

Cross-Cutting Topic: Feasibility of Generation IV Small Modular Reactors as a Path to Achieving Energy Justice

by Ezra Cockram, University of Florida

RESOLUTIONS OF RESPECT

In addition to the various awards provided by INMM, the Institute recognizes members who have made significant contributions to the Institute and have passed since the prior Annual Meeting with Resolutions of Respect. Candidates for this honor are required to have been active members in good standing of the Institute.

2020: Darryl Smith, Felicia Duran, Gennady Pshakin

2020 SENIOR MEMBER APPOINTEES:

- David Chichester
- Edward Ifft
- Jason Harris
- Gerard Jackson
- Heidi Smartt
- Yosuke Naoi

2020 FELLOWS:

- Dr. Leslie (Les) Fishbone
- Corey Hinderstein



Our World Has Changed Forever

Jack Jekowski

Industry News Editor and INMM Historian

I was on a Zoom meeting, my third of the day, when I realized our world has changed forever.

It happened to be a virtual INMM Nonproliferation and Arms Control (NAC) Technical Division meeting, and as usual, some of the conversation focused on how everything had changed since the global pandemic first turned the world upside down, and how nice it would be to get back to “normal.”

New vaccine science (which began to demonstrate breakthrough solutions at the beginning of the millennium)¹ has apparently succeeded in producing multiple solutions to stem the spread of the virus,² unlike the slow recovery from the pandemic that struck the global community a little more than 100 years ago. However, despite this apparent success, there is growing concern that the world, as we have known it, has changed forever.

Organizations such as the United Nations are now creating long-range plans not only for a path to recovery, but also plans to operate in a new world,³ as reality sets in that we all must adapt to a new way of doing things. Fortunately, humans have proven to be resilient over the millennia, and able to adapt to new environments.

Those of us who are “essential workers” in nuclear careers have experienced the changes firsthand, in real time, while others, in different situations, have had to deal with these changes at an even more fundamental level that has disrupted socio-economic stability.

INMM’s New World

Certainly, the most direct impact to INMM last year was the necessity of holding a virtual Annual Meeting, originally scheduled to be held at the Inner Harbor in Baltimore, Maryland. And this year, after careful consideration, the INMM/ESARDA Annual Meeting Committee and the Executive Committee of INMM have announced plans to proceed with a virtual Annual Meeting for this August, rescheduling the use of the Vienna venue for 2023.

As we look across the nuclear community that the INMM operates within, we find many activities that have been re-imagined to meet mission requirements, resulting in an extraordinary evolution of technology products, internet access improvements, and other dramatic developments. These changes will bring new perspectives in a post-pandemic world, and potentially change the fundamental ways of performing work. Some of the issues that have changed our world, and the impact they will have on all that we do include:

- **INMM**—The Institute successfully implemented a multi-faceted Annual Meeting using a special technology platform coordinated by our Executive Committee and Association Headquarters (AH), INMM’s professional management organization. Subsequently, regular business of the Institute, including Executive Committee meetings, Technical

Division meetings, and workshops have been conducted using various virtual platforms, with experimentation in using chat rooms and other tools to create a more realistic environment for discussions and interactions. One benefit of the virtual platform for the Annual Meeting was that we had over 700 participants this year, including 330 first-timers, 323 non-members, and 81 students. By most accounts, the event created a new era of participation with the ability to go back and review paper presentations and Q&As that might have been missed the first time around (the presentations will now be online for attendees through June of 2021).⁴ Most notably, sponsoring organizations realized significant savings in travel costs, although the virtual environment does not allow for the important professional and social interactions that often create critical information exchanges. However, many organizations are already beginning to question the effectiveness of returning to the “old way” of participating in large conferences and meetings, and we may see some reductions placed on travel for such activities in the future, even when the current restrictions are lifted.

- **International Atomic Energy Agency (IAEA) Activities**—With the disruption to international travel



and the variable restrictions placed on travelers by individual country mandates, the IAEA has been challenged to continue their critical role of inspections for various treaties and agreements. However, they have implemented effective plans to ensure that critical activities can be continued.⁵ This included the use of charter airplanes where necessary to get inspectors into and out of countries. In a post-pandemic environment, one might envision a growing reliance on remote monitoring activities and the use of virtual platforms to conduct activities, although there will always be a need for onsite inspection and verification activity.⁶

• **National and International Meetings**—The pandemic has disrupted long-scheduled meetings of many organizations, including the IAEA, the European Safeguards Research and Development Association (ESARDA), the World Institute for Nuclear Security (WINS), and the U.S. Nuclear Industry Council (NIC), all collaborators with the INMM. Many technical and scientific societies and organizations have also faced dramatic changes to their normal operating calendar. This situation has caused the virtual meeting platform “world” to dramatically expand, as various vendors have added to their product lines and offerings, and a new environment of virtual meeting management companies has emerged. There is a dizzying array of product from the highly popular Zoom to Cisco Webex, Microsoft Teams, Google Meet, Adobe Connect, GoToMeeting, and many, many others.⁷ Once global pandemic

virtual meetings became commonplace, cybersecurity issues arose and continue to be an issue in many environments, although vendors are increasing the capability of platforms to provide a higher level of security, including passwords and other verification measures. One can imagine in a post-pandemic world that, at a minimum, there may be a high demand for a virtual platform offered to individuals who cannot travel, whether restricted because of funding, scheduling, or other issues.

• **Nuclear Power Plant and Facility Operations**—Much of the work that must be done at nuclear sites requires the physical presence of people. This also extends to environmental remediation activities and new construction, as well as other critical infrastructure support efforts. During the pandemic, nuclear power plant construction has continued unabated around the world. The U.S. Nuclear Regulatory Commission (NRC) has implemented extraordinary actions designed to allow the continuous operation of U.S. Nuclear Power Plants (NPPs) under COVID-19 restrictions (such as reducing regulatory burdens and streamlining approval processes) and continues to monitor that environment, as do other global regulatory organizations, to ensure safe operations during these extraordinary times.⁸ As with the activities of the IAEA, one could envision a movement in a post-pandemic world to a greater reliance on remote monitoring and virtual meeting platforms.

• **Training, Certifications, and Education**—This has become a global issue as educational institutions

(and students, parents, companies, regulatory agencies, and government offices) have had to adjust to a new virtual learning environment. The issues associated with adapting to the new pandemic social distancing requirements have put technology and internet access under the magnifying glass, as remote learning has become a necessity. These challenges become particularly acute when dealing with training that requires physical activities, such as Protective Force Training. Cybersecurity has also become a difficult issue to deal with as many employers implement teleworking. As an example of the extraordinary efforts underway, the Energy Facility Contractors Group (EFCOG), working with the Department of Energy and National Nuclear Security Administration, has engaged the expertise of the large National Laboratory Management & Operating (M&O) contractors and others to bring nationwide expertise together to share lessons learned and other information to meet the training and certification requirements of the Nuclear Security Enterprise, as well as other DOE Office of Science Laboratories.⁹ Similar issues exist worldwide for nuclear facility operators. Similarly, public and higher education institutions have made dramatic changes during this period to migrate their educational offerings to remote access, including the need to provide additional training to teachers and professors to provide them the tools to operate in this new environment. In a post-pandemic world, one might envision a significantly different interaction



Taking the Long View in a Time of Great Uncertainty

with students across the globe, and the design of new curriculums and degree programs using virtual reality to supplement the normal lab and field learning environments.

• **New Technology and Internet**

Access—The pandemic-driven requirements of virtual meetings and remote learning have demonstrated the need for multiple solutions to obtain high-bandwidth internet access, particularly to remote geographic areas. It has also shined a light on the disparity of access in remote areas across the globe, including Native American pueblos and reservations in the U.S., and similar situations in economically-deprived countries. Many new solutions to global access includes such technology breakthroughs as the SpaceX Starlink;¹⁰ Skeye¹¹ and other dirigible-based or long-endurance, solar powered drones; and enhanced fiber and Wi-Fi connectivity through the deployment of new 5G technologies. As these new technologies are deployed to solve the virtual environment issues, the world will see even greater connectivity than it has—connectivity that can lead to social unrest (as occurred in the Arab Spring), misinformation sharing, and other issues that have emerged in the second decade of the new millennium.¹²

• **Military operations**—The COVID-19 pandemic has created a national security issue when it impacts the ability of military forces to perform their missions. This has been particularly visible because of early breakouts of infections on U.S. nuclear-powered aircraft carriers with complements of more than 5,000

personnel in confined spaces.¹³

Similarly, military operations worldwide have been disrupted by the pandemic, including the cancellation of NATO exercises and other activities.¹⁴

• **Social-Economic Impacts**—Global impacts to the socio-economic environment will have long-lasting effects, driven by loss of income, deterioration in family cohesiveness, food insecurity, and education. These issues are being addressed by many organizations, including the United Nations Development Programme (UNDP).¹⁵

Where Do We Go from Here?

Our world has changed forever. The sooner that we accept that fact and begin to adapt to this new environment the more quickly we will be able to establish a “new normal” that will allow economic and social activities to continue in a more globally connected-community.

This column is intended to serve as a forum to present and discuss current strategic issues impacting the Institute of Nuclear Materials Management in the furtherance of its mission. The views expressed by the author are not necessarily endorsed by the Institute but are intended to stimulate and encourage JNMM readers to actively participate in strategic discussions. Please provide your thoughts and ideas to the Institute’s leadership on these and other issues of importance. With your feedback, we hope to create an environment of open dialogue, addressing the critical uncertainties that lie ahead for the world, and identify the possible paths to the future based on those uncertainties that can be influenced by the Institute. Jack Jekowski can be contacted at jjjekowski@aol.com.

Endnotes

1. See <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1123275/> (12-20-20) for an early discussion of using engineered DNA sequences to evoke an immune response.
2. See <https://www.sciencemag.org/news/2020/12/messenger-rna-gave-us-covid-19-vaccine-will-it-treat-diseases-too> (12-20-20), that discusses the use of messenger RNA (mRNA) to not only create a vaccine for COVID-19 but may potentially be effective in treating many other diseases.
3. See <https://www.un.org/en/pdfs/UNCOVID19ResearchRoadmap.pdf> (12-20-22) for a global master roadmap for COVID-19 recovery. The U.N. also has a special COVID-19 website: <https://www.un.org/en/coronavirus/response> (12-20-20).
4. To access recorded sessions, simply log into the virtual meeting platform with the same credentials you used to login to the meeting in July. Attendees who registered for the full event will continue to have access to all recorded sessions. Attendees who registered for single days will have access to the sessions available from those days.
5. See <https://www.iaea.org/covid-19> (12-20-20) and the various links on that page for more detailed information on IAEA activities during this global pandemic.
6. See <https://www.iaea.org/newscenter/news/despite-lockdown-iaea-continues-nuclear-verification-and-supports-countries-fighting-covid-19-in-largest-ever-operation-director-general-tells-agencys-board> (12-21-20).
7. See <https://www.techfunnel.com/information-technology/11-best-virtual-meeting-platforms-for-business/> (12-20-20) as one example of a list of popular virtual platforms available today.
8. See <https://www.nrc.gov/about-nrc/covid-19/index.html> (12-20-20) for more information on the actions taken by the NRC, including temporary flexibilities offered to licensees, reductions in non-essential maintenance, and streamlining other



- regulatory processes.
9. See <https://efcog.org/efcog-covid-19-lessons-learned-discussions/> (12-20-20) for more information on EFCOG's, overall COVID-19 assistance to the DOE/NNSA, and <https://efcog.org/training/> (12-20-20) for more information on the efforts to coordinate training and certification activities with the DOE National Training Center.
 10. See <https://www.starlink.com/> (12-20-20) for the official site, and <https://www.cnet.com/features/how-spacex-starlink-broadband-service-will-envelop-earth-transform-the-sky/> (12-20-20) for more information on how this new technology works.
 11. See <https://www.abqjournal.com/1487318/sceye-inc-to-build-stratospheric-airships-in-nm.html> for more information on a pilot program being implemented in New Mexico on the Navajo reservations.
 12. See *JNMM* Volume 39, No.4, "Taking the Long View in a Time of Great Uncertainty, A Strategic Inflection Point," pp. 23-24, where a quote is cited by then-U.S. State Department's Under Secretary for Public Diplomacy and Public Affairs, Judith McHale.
 13. See <https://www.nejm.org/doi/full/10.1056/NEJMoa2019375> (12-21-20) for a medical analysis of the COVID-19 breakout on the U.S.S. *Theodore Roosevelt*.
 14. See <https://thesoufancenter.org/intel-brief-how-will-covid-19-impact-u-s-military-readiness/> (12-21-20).
 15. See: <https://www.undp.org/content/undp/en/home/coronavirus/socio-economic-impact-of-covid-19.html> (12-21-20) for a discussion on U.N. efforts to develop a long-term recovery plan for global socio-economic issues.



Book Review

Mark L. Maiello, PhD

Book Review Editor

The Senkaku Paradox: Risking Great Power War Over Small Stakes

Michael E. O'Hanlon

Soft cover, 258 pages, ISBN: 9780815736899

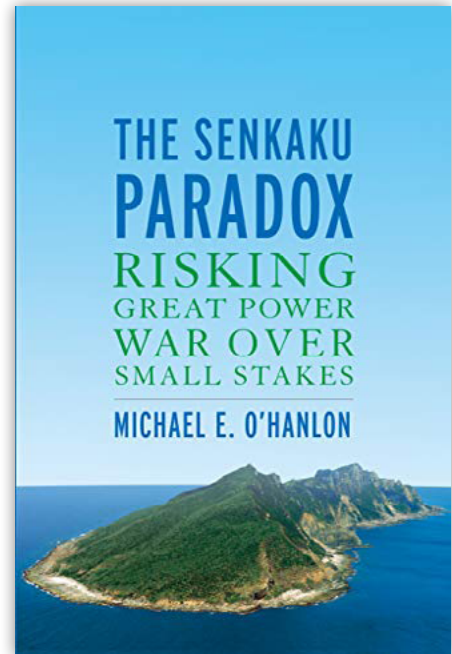
Brookings Institution Press, Washington, D.C. 2019

Ever wonder what escalation to nuclear war may look like? Given the propensity to transition from diplomacy to bullets, that ladder may be a very short one. And if it is that short, one could ask, it is ever worth it? Many will argue that it is never is. But the reality is, for better or for worse, that the “many” are not in charge. For some, diplomacy, even saber rattling, may not be enough. In some circumstances—say a NATO treaty violation—the case for military action may be very hard to resist. And if that first step toward armed conflict involves countering a Russian or Chinese incursion into disputed or even undisputed territory, then one can see that the nuclear card could be played should things go sour for one of the involved powers. Fortunately, cooler heads offer a means to forgo the path to nuclear war. One such person is Michael O'Hanlon who, in *The Senkaku Paradox*, offers a realistic alternative and an education in modern economics and warfare.

The Senkaku Paradox poses a scenario in which a U.S. administration faces an emboldened China and/or an aggressive Russia in pursuit of a power grab. Rather than all-out war, either may attempt to test U.S. resolve by taking a sliver of a Baltic State by force of arms or a disputed territory, such as the Senkaku Islands in the Pacific, claimed by both Japan and

China. Bound by a NATO treaty in one instance and by similar allied commitments in the other, the U.S. would be obliged to respond. But what exactly should that response look like? Some would argue it should be a military enterprise because allies, treaties, and perhaps even the aggressor expect it to be so. But must such an incursion be faced solely with military strength? Not necessarily, O'Hanlon argues. Something different may, in fact, be more effective and more aligned to the magnitude of the aggression. The reason is that the Senkaku Islands or that village in Latvia is not worth an all-out military retaliation. Thus, the paradox: the reason to fight may be in the alliance and treaty commitments. The will do so may be there, but the effort to mount such an assault, the complexity, the cost, and the consequences to the U.S. do not meet the value of what was taken—especially not when an escalation to nuclear war is factored in. The strategic response to a fully committed military operation that satisfies allied commitments is, the author contends, a response that should be proportionate to what was lost.

O'Hanlon's dissertation goes further to explain that the U.S. does not possess the military hegemony it owned in the 1990s. China has arisen economically and militarily. Russia, too, has recovered from the dissolution of the Soviet Union to



become a worthy antagonist again. Both have access to technology that has closed the military gap with their primary foe, the U.S. In fact, although the U.S. continues to improve its military capability, technology acquisitions by nuclear-armed China and Russia have diminished the probability of American battlefield success in territories and waters far from its shores where logistics become problematic. The U.S. may be able to mount a military response in Eastern Europe or in the western Pacific, but it will be a difficult enterprise, will not be assured of success, will involve loss of life and assets, and could, under certain



circumstances, bring the world to the brink of nuclear war.

The recommendation O'Hanlon makes is to formulate a retaliatory action that accommodates the scale of the aggression. His action does not completely forgo military action, but instead, puts it in a supportive role rather than employing it as the primary response. U.S. retaliation to a small scale territorial aggression, so the author's argument goes, should be considered carefully. There are other means besides bullets and cruise missiles. The other weapon is, for now, something that the U.S. can still brandish with great effect: it can wield a very hefty economic stick.

To support his contention that a costly military action is inadvisable when small stakes are involved, O'Hanlon provides a wonderful, easily understandable journey into military technology and its applications in the theater of war. As mentioned, the globalization of technology has all but eliminated U.S. air, naval, and ground forces hegemony. How that effects U.S. field operations is described from a comfortably high level that will be accessible to most readers. It is as interesting as it is cautionary. He focuses of course, on comparisons with Russian and Chinese assets, the two potential aggressors postulated in his initial argument of proportional response. The bonus here is that O'Hanlon is unafraid to predict what the future of military technology will look like. He must, because to make his case he must convince the reader to abandon the notion that the U.S. will easily and inevitably prevail in any military action. If the gap between U.S. enemies has closed, any military exercise, especially one far from U.S. shores and, in fact, proximal to the aggressor as O'Hanlon postulates, will be a difficult and costly venture. The trend is likely to continue with the U.S. in

a continuous technology race with China and Russia for the foreseeable future. O'Hanlon is a fearless analyst unafraid to predict what the conventional military comparison between the nuclear powers could look like in 40 years. He provides a very readable analysis of how the narrowing technology gap has affected the calculus of military response and the probability of success (the bits of statistics he presents should not dissuade the curious reader). In fact, in two appendices, O'Hanlon explains how he predicts such technological change and even grades himself on predictions he made of current military tech 10 years earlier in a separate publication (Incidentally, he gave himself an "A-")!

Similarly, there is an equally digestible survey of the machinations of the world economy from the military perspective, and where the vulnerabilities of the U.S. economy lie. To me, this was a fascinating chapter because, as I suspect, the economy remains a black box of complication to most of us. This is not a very in-depth chapter nor does it contain any math, modeling, or even a few predictive economic equations. It is a high altitude overview, mainly focused on strategic materials useful for manufacturing the equipment that have implications in a conflict, but it also covers how these materials move around the globe to build the products we are so familiar with (computer technology being the most prominent). Again, China and Russia as the primary competitors are the focus of a comparison with the U.S. Here, O'Hanlon's crystal ball is also invoked to help predict what the strategic economic landscape of 2040 will look like. The end result: the military hegemony of the U.S. is not likely to assure success in faraway theaters now or 40 years hence. The world has already changed to meet

current U.S. might and will continue to do so. Despite O'Hanlon's predictions that U.S. prowess may prevail now or perhaps even in the future, it may pay dearly in the process. But in economics, the U.S. has a meaningful weapon it can leverage to inflict harm on an enemy that exceeds the gain of its aggression.

O'Hanlon does not propose that we totally abandon armed responses. Instead, he proposes other purposes for the armed forces that, together with economic strategies, would make continuing the aggression as difficult for the aggressor as it would be for the U.S. to respond. In short, the author proposes economic sanctions coupled to naval or ground interventions that are far from the Chinese or Russian mainland, and utilizing allied assistance that, for the most part, slow or curtail the flow of money or goods into either nation's economy. This tactic takes the U.S. military effort far from the aggressor, stretching out the enemy's assets and logistical efforts as far or farther from their homeland than those of the U.S. For China, that might mean slowing maritime freight (strategic minerals) out of Africa or the Middle East (oil for example), employing U.S. naval intervention to ultimately slow elements of the Chinese economy. Coupled to this would be economic sanctions imposed on the aggressor nation. Russia could expect the U.S. and its allies to purchase gas elsewhere. Incorporating the assistance of U.S. allies is key as they are more dependent on Russian supplies and, with their assistance, the economic noose can be tightened as much as is needed. This two pronged approach, while not necessarily immediately effective (in fact, it is unlikely to be), is proffered as a much more proportional response to a small stakes power grab by either U.S. rival and one more likely to be accepted politically



at home and by U.S. allies, as long as the aggression is seen to be so serious that should it go unanswered it may preclude more significant aggression.

With this narrowly-focused problem, the added attraction of comparisons with the two major rivals of the U.S. for global political influence, and predictions of what the military strengths of the nation will be based on economic prowess in 2040, one has a supremely fascinating read made only more accessible by O'Hanlon's gift of interesting expository writing. It is far from dry, to the point, and yes, comprehensible. It is thoroughly well-written from stem to stern. It is not a novel but it almost achieves the level of enjoyment one experiences when reading a good story. O'Hanlon is gifted. It is that simple.

O'Hanlon's argument is presented in six chapters. The first two introduce and expand on the issue of proportionate response, while the third is a "crystal ball" chapter, projecting what the technological and military world of the great powers will look like in 20 years. Chapter four explains O'Hanlon's limited military intervention, supported by his plan to introduce economic sanctions as described in chapter five, and the argument is completed by a final chapter of conclusions and recommendations. But that is not all. There is bonus material. O'Hanlon, who rightfully provides as much material to support his contention as possible included the two aforementioned appendices: one discussing military developments from 2000 to 2020 and one projecting the advances in military tech from 2020 to 2040. The first includes O'Hanlon's self-assessment looking back on his predictions made in 2000, which he uses to imply that his clairvoyance about the next 20 years can be considered acceptably accurate.

These appendices are as well-written as the main text is. Moreover, the information they contain on military technology is fascinating. The author—avoiding a rabbit hole—emphasizes only key areas that are impactful to U.S. security. It is supportive of his arguments and simultaneously informative. His self-assessment of predicting military technological progress is also quite a learning experience. It goes without saying that showcasing the author's predictive ability does not come off as a conceit (it was fun to read about), but is meant to illustrate how military progress is made, in what areas, and what those impacts are on field capability and the risk/benefit decision to initiate war. O'Hanlon has gifted the reader with an estimate of where the U.S. will be militarily in 40 years and thus how well it can perform against future Chinese and Russian forces in a real conflict. The conclusion, that the effort will be difficult, supports his contention for smart, strategic, thoughtful responses to small scale incursions designed to test U.S. and allied resolve—responses that may slow, divert, and perhaps even end the conflict before it can escalate towards a nuclear conclusion.

This fine discussion is supplemented with three black and white maps of potential areas of conflict, notably the Pacific, Indian, and European theaters. There are 39 full pages of notes followed by a nine-page index. I counted 13 useful tables, including those in the two appendices. That is all this book needs. It rests on the firm bedrock of good writing, persuasive arguments, some interesting data, a bit of statistics (again, do not fear) and the author's broad understanding of political science and the logistics of warfare. Because it goes beyond just military strategy, the book is a resource. There may be

precious little about nuclear weapons, but remember that a reason for the existence of this book is to present a policy to avoid escalation of a limited aggression by an adversary and the potential military escalation to a level where nuclear weapons may be considered.

Coincidentally, as I write this review, tensions between China and the U.S. over Taiwan have escalated. Twenty-six Chinese warplanes recently entered Taiwan's air defense zone over a consecutive two-day period (January 2021). The Chinese apparently also carried out an exercise against the U.S.S. *Theodore Roosevelt* aircraft carrier stationed in the area. A spokesperson for the U.S. Indo-Pacific Command indicated that this is a continued attempt by China to use its military as a "tool to intimidate." China's development of anti-ship missiles is no doubt fueling this muscle-flexing. This is a very harsh reminder that O'Hanlon is not speaking theoretically. The U.S. is facing a new reality in which potentially aggressive antidemocratic nations, fueled by their relatively newfound wealth, have become worthy battlefield opponents. O'Hanlon is trying to shake up old-school American thinking. We won't necessarily win a fight far from our shores that are proximal to the enemy—or find it advisable to enter into it over small stakes (that may be obliterated in a full-scale response). We need to exploit our strengths: the economic clout of the U.S. and its allies. Together that power is much greater than China's or Russia's. With a shrewd supportive military response, a U.S. coalition can inflict enough economic damage to stem further aggression before the nuclear option is ever considered.



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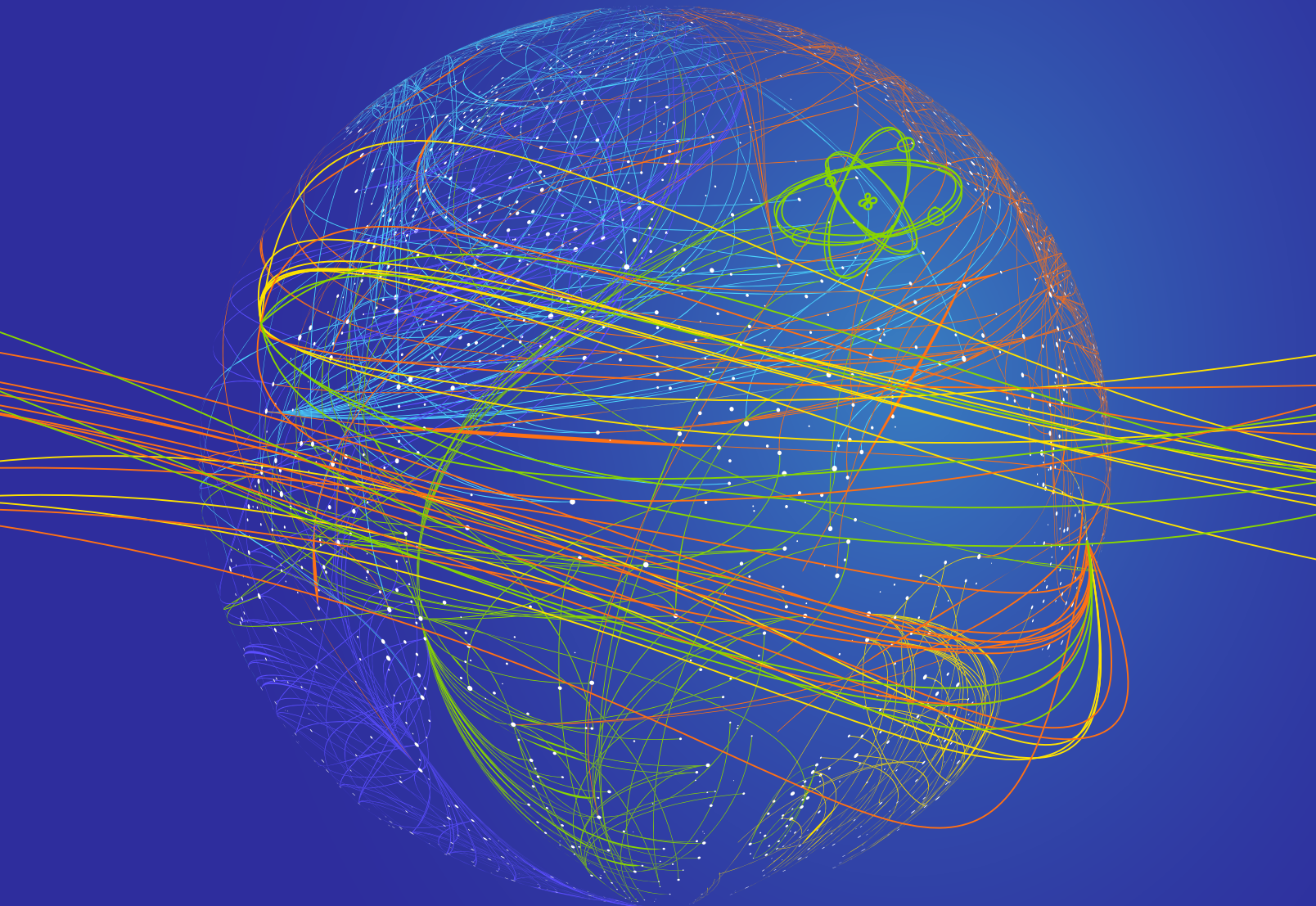
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