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The International Safeguards Working Group on Open Source and Geospatial Information: Overview, Activities, and Future Plans

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The open source and geospatial information (OSGI) working group is a community of experts, practitioners, and interested parties from within the Institute of Nuclear Materials Management's (INMM) International Safeguards Technical Division (ISD) focusing on open source and geospatial information collection and analysis in support of safeguards verification activities. The working group was formed in 2012 and has seen its membership, interest, and engagement grow alongside the unprecedented availability of open source and geospatial data and the associated software and hardware needed to process it. Most recently, the working group published a special issue of INMM's peer-reviewed Journal of Nuclear Materials Management, highlighting nine technical manuscripts from multi-disciplinary teams across the globe and an introduction from the International Atomic Energy Agency on the evolution of open source and geospatial analytics for safeguards. In this paper, we will describe the working group's background and mission, review its historical activities, and preview upcoming events and plans for future engagement.

BACKGROUND AND MISSION

The Institute of Nuclear Materials Management (INMM) International Safeguards Technical Division inaugurated the Open Source and Geospatial Information (OSGI) working group in 2012, led by co-chairs Irmgard Niemeyer of Forschungszentrum Jülich (FZJ) in Germany and Karl Horak of Sandia National Laboratories in the United States. The working group aims to provide a dedicated forum for the open and free exchange of ideas and concepts in the domain of open source and geospatial information. The group's mission is to promote the use of open-source and geospatial information for addressing some of the most difficult international safeguards and nonproliferation challenges of the day, and to examine the issues, challenges and opportunities of leveraging these expanding information sources and technologies within a safeguards and nonproliferation perspective. This working group shares experiences, expertise and expectations regarding the emerging open source and geospatial information technologies for safeguards and nonproliferation.

The working group is led by two co-chairs, and its membership is open. The two current co-chairs, Yana Feldman of Lawrence Livermore National Laboratory and Zoe Gastelum of Sandia National Laboratories, both located in the United States, have been serving the working group since 2016 when the group's inaugurators stepped down from the role.

Since its inception in 2012, the OSGI working group has held meetings on the sidelines of the INMM Annual Meeting. These working group sessions offer an opportunity for group members and other interested practitioners to discuss their current research, challenges, and questions, to develop their professional networks, and preview upcoming events including sessions of interest at the Annual Meeting.

The OSGI working group has a LinkedIn page, which serves as a forum for group members to share their latest research, announce upcoming events, and network.

PAST ACTIVITIES

Members of the OSGI working group were closely involved in the planning and implementation of the May 2014 *Workshop on Information Analysis Technologies, Techniques and Methods for Safeguards, Nonproliferation and Arms Control Verification*, that took place in Portland, Oregon, USA. The workshop included 27 technical presentations from authors spanning U.S. and European research centers and laboratories, the International Atomic Energy Agency, academia, and the European Commission. The presentations were organized around themes of direct interest to the OSGI working group members, e.g. open source information analysis and societal verification, big data and machine learning, data visualization and analysis, trade analysis and illicit nuclear trafficking. The workshop featured an opening plenary address delivered on behalf of Jacques Baute, Director of the IAEA Department of Safeguards' Division of Safeguards Information Management, and a closing plenary panel on future research and development directions with Joseph Kielman, Science Advisor for the U.S. Department of Homeland Security, Science and Technology Directorate's Cyber Security Division, Peter Sprunger, a Physical Scientist at the U.S. Department of State's Office of Multilateral Nuclear and Security Affairs' Bureau of International Security and Nonproliferation, and Daniel Wurmser, Physical Scientist at the U.S. Department of State, Office of Verification and Transparency Technologies. The workshop also highlighted demonstrations of eight research and commercial software products for information analysis. Workshop proceedings are available via the INMM website.

In 2016, as part of the working group's outreach efforts, the co-chairs of the OSGI working group presented a lecture to the Mercyhurst University INMM student chapter on Information Analysis for IAEA Safeguards, and Current and Anticipated R&D for Information Analysis. The lecture was conducted over video conference between Sandia National Laboratories in New Mexico, Lawrence Livermore National Laboratory in California, and Mercyhurst University in Erie, Pennsylvania. Approximately ten people participated, including student chapter members and their facility advisor, for the hour-and-a-half session.

For the 2017 Annual Meeting, the OSGI working group presented a paper, as part of a special session on open source and geospatial analytics organized by the working group, on the history and envisioned plan for the working group, which included a wide range of technical and outreach activities which the working group hoped to execute within the next five years. This paper served as a planning and strategy document for the working group, and will be updated by 2022 with revised vision and plans for the working group based on the rapidly evolving state of technology in this domain.

One of the working group's most recent accomplishments was the year-long effort to edit a special issue of the peer-reviewed Journal of Nuclear Materials Management (JNMM), on the topic of open source and geospatial information analysis research and development. The JNMM special issue was edited by the co-chairs of the working group and Joshua Rutkowski, from FZJ, and included an introduction from Jacques Baute, a note from the editors, and nine peer-reviewed research articles. The articles were presented by data type, beginning with textual data, then moving to ground-based and overhead imagery, and finally multimodal data.

Contributors to the selected articles came from the following institutions:

- Argonne National Laboratory, Argonne, USA
- Atomic Weapons Establishment Plc., Aldermaston, UK
- International Atomic Energy Agency, Vienna, AUSTRIA
- Joint Research Centre, Ispra, ITALY
- Jülich Research Center**,** Jülich, GERMANY
- King's College London, London, UK (and EGYPT)
- Lawrence Livermore National Laboratory, Livermore, USA
- Sandia National Laboratories, Albuquerque, USA
- Technical University of Denmark, Lyngby, DENMARK

UPCOMING EVENTS

The 2019 OSGI working group meeting will serve as a trial for a new focus for our working group meetings: training and education. For this year's working group meeting, we have paired with Heidi Smartt, chair of the ISD and Nonproliferation and Arms Control Joint Working Group on Containment and Surveillance to invite a technical demonstration from the satellite start-up company Black Sky. Black Sky will discuss their platform, analytics, and current project work directly relevant to the nuclear materials management mission area.

Members of the OSGI Working Group routinely solicit relevant papers for the INMM Annual Meeting and organize and chair special sessions focusing on open source and geospatial information analysis topics. This trend will continue at the 2019 INMM Annual Meeting, during which a special session on open source and geospatial data analytics will include two open source and two geospatial papers.

The OSGI is also making plans to support the technical program of the INMM Emerging Digital Technologies (EDT) workshop, which is being planned for April 2020 on the campus of Lawrence Livermore National Laboratory in Livermore, California, USA. The workshop is a collaboration between the INMM's Southwest, Pacific Northwest, and California chapters. The EDT workshop's technical program is expected to include various topics relevant for open source geospatial data analytics, such as deep learning models for object detection and image classification in both ground-based and overhead imagery, novel data collection methods such as crowdsourcing or the use of drones for image collection, and novel data visualization techniques. The EDT workshop is intended to serve as an expanded follow-on to the 2014 Information Analysis workshop, encompassing broader techniques, methods, and data sources that are directly or tangentially relevant for OSGI working group topics of interest.

Finally, the October 2019 Joint Meeting of INMM and the European Safeguards Research and Development Association (ESARDA) in Tokyo, Japan, will offer a unique opportunity for the OSGI working group to engage with other INMM and ESARDA working groups. Previously (see Feldman et al. 2017), we identified the ESARDA Verification Technologies and Methodologies (VTM) working group as a potential partner. We continue to be interested in that engagement and seek the right forum and opportunity to do so.

PLANS FOR FUTURE ENGAGEMENT

As part of the ongoing growth and development of the OSGI working group, we plan to continue our educational and training opportunities for working group members through demonstrations and technical briefings at our annual meetings and via videoconference throughout the year. In addition, we

would like to expand on our education and training focus with a longer, dedicated training activity, in the next several years. This could take the form of a half- or one-day training on the sidelines of the INMM Annual Meeting, or the organization of members to jointly attend a third-party training activity.

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