

Space Weather Advisory Group (SWAG)

Public Meeting

Via Webinar

Meeting Minutes

Friday, April 12, 2024

10:00 AM – 2:00 PM EDT

Meeting Attendees

Committee

Nongovernmental End User Representatives

Dr. Tamara Dickinson, Committee Chair, Science Matters Consulting

Mr. Mark Olson, North American Electric Reliability Corporation

Mr. Michael Stills, United Airlines (retired)

Mr. Craig Fugate, Bent Ear Solutions

Dr. Rebecca Bishop, Aerospace Corp.

Commercial Sector Representatives

Dr. Nicole Duncan, BAE Systems, Inc.

Dr. Jennifer Gannon, Computational Physics, Inc.

Dr. Seth Jonas, Lockheed Martin

Dr. Conrad Lautenbacher, GeoOptics, Inc. (not in attendance)

Dr. W. Kent Tobiska, Space Environment Technologies

Academic Community Representatives

Dr. Tamas Gombosi, University of Michigan, Ann Arbor

Dr. Delores Knipp, University of Colorado, Boulder

Dr. Scott McIntosh, National Center for Atmospheric Research

Dr. Heather Elliott, Southwest Research Institute

Dr. George Ho, Johns Hopkins University Applied Physics Laboratory

Designated Federal Officer

Ms. Amy Macpherson, Acting National Space Weather Program Manager, National Weather Service

Meeting Minutes

10:02-10:08: Welcome (Amy Macpherson, NOAA NWS; DFO, SWAG; and Assistant Executive Secretary, SWORM)

Ms. Macpherson welcomed attendees and viewers to the eighth Space Weather Advisory Group (SWAG) meeting. This meeting focused on the results of the user-needs survey findings and recommendations, as directed by Section 60601 of the Promoting Research and Observations of Space Weather to Improve the Forecasting of Tomorrow (PROSWIFT) Act.

Ms. Macpherson reminded attendees that the PROSWIFT Act directed the National Oceanic and Atmospheric Administration (NOAA) to establish the SWAG to provide advice to the White House Space Weather Operations Research and Mitigation (SWORM) Subcommittee. SWAG is comprised of 15 non-governmental representatives who were appointed in October 2021 with the charge to provide stakeholder input from the academic community, the commercial space weather sector, and space weather end-users to inform the interests and work of the SWORM.

Ms. Macpherson thanked the SWAG Chair, Dr. Tamara Dickinson, for her leadership and the Advisory Group members for their hard work leading up to this meeting, and led the SWAG members in a round of introductions.

10:08-10:12: Opening Remarks, Recap of Meeting 7 (Dr. Tamara Dickinson, Science Matters Consulting, and Chair, SWAG)

Dr. Dickinson also thanked the SWAG members for their efforts. Meeting 7 in March 2024 focused on a brief-out and discussion of the findings and recommendations of the user-needs Survey. SWAG approved findings and recommendations for the electric power grid, aviation, emergency management, space traffic management/coordination, and human space flight. Guest speakers included SWORM Co-Chair Jinni Meehan, Geoff Crowley from the Space Weather Roundtable, and Nicole Duncan from the National Aeronautics and Space Administration (NASA) National Space Weather Council.

Dr. Delores Knipp moved to approve the minutes from the January 2023 meeting as written with any minor edits needed for clarity. Dr. Rebecca Bishop seconded the motion. The motion passed without opposition or abstention.

10:12-10:14: Overview of Today's Meeting (Dr. Tamara Dickinson, Science Matters Consulting, and Chair, SWAG)

Dr. Dickinson reviewed the agenda for Meeting 8, which was largely devoted to reviewing and approving the user-needs survey report findings and recommendations that were not approved at the previous meeting. Although SWAG had allotted four hours for the meeting, Dr. Dickinson anticipated finishing by lunchtime if no unforeseen issues arose.

10:14-10:17: Status of User-Needs Survey (Dr. Tamara Dickinson, Science Matters Consulting, and Chair, SWAG)

Dr. Dickinson reviewed the purpose and objectives of the user-needs survey under the PROSWIFT Act, which include assessing the adequacy of the federal government's goals for lead time, accuracy, and data quality for space weather observations and forecasting, identifying data collection opportunities to address the needs of space weather product users, identifying new technology and research opportunities, and identifying methods and technology to improve space weather event preparedness, among other requirements. For 2023-2024, the SWAG focused on the following survey sectors: electric power grid, space traffic management/coordination (STM/C), emergency management, aviation, human space flight, research, and GNSS. Dr. Dickinson reviewed the survey process, which primarily consisted of anonymized focus groups. The focus groups were asked sector-specific and general questions on topics such as current uses of observations and forecasts and future needs, technologies and components currently affected by space weather, current risk reduction and resilience activities and future needs, new and/or potential future data sources, and next-generation technologies, research instrumentation, and models.

10:17-11:09: Discussion and Approval of User-Needs Survey Report Findings and Recommendations

Dr. Dickinson thanked the SWAG members and staff for their hard work and support that led up to this report. She hoped to present on the report at the upcoming Space Weather Workshop on April 16, pending approval by the SWAG at this meeting. The purpose of the meeting was to discuss any findings and recommendations for the research sector, as well as any additional ones for others or ones that had been updated since the last meeting. SWAG will be able to revise these if needed as it prepares the full report. Dr. Dickinson hoped that only minor revisions will be necessary.

The report contains two types of recommendations that are clearly labeled. The first consists of recommendations that follow directly from the input of the users. The second comprises issues the SWAG wanted to highlight that did not come up in focus groups. SWAG members led the focus groups but did not participate in them.

Research Sector

Dr. Scott McIntosh presented the revised findings and recommendations. They have been regrouped into two categories: planning and investment, and observational capabilities.

Planning and Investment

- **Finding 7.1.** The national space weather enterprise needs an integrated and detailed functional implementation plan that enables appropriate research efforts to support the National Space Weather Enterprise.
 - **Recommendation 7.1.1.** SWORM should update the 2023 Implementation Plan to include results from this end user survey and the 2024 decadal survey with the addition of timelines and key milestones to optimize, prioritize, and sequence actions necessary to advance space weather forecast capabilities.
- **Finding 7.2.** Focusing on the full Research-to-Operations (R2O) and Operations-to-Research (O2R) cycle is critical to improving space weather nowcasting, forecasting, and mitigation.

- **Recommendation 7.2.1.** NOAA, NASA, NSF, and DOD should improve coordination across the entire R2O-O2R selection and implementation process to include development standards and consistent procedures for testing, nowcasting, and forecasting capabilities.
- **Finding 7.3.** An Observing System Simulation Experiment (OSSE) framework would transform the space weather enterprise's ability to assess the impacts of future potential observing systems for forecasts and predictions.
 - **Recommendation 7.3.1.** NOAA, NASA, NSF, USGS, and DOD should develop, in consultation with the research community (federal, commercial, and academic), a framework based on OSSE analysis to prioritize space weather observations.
- **Finding 7.4.** Users need consistent and reliable data access and availability for historical and ongoing critical measurements, and improved spatial and temporal resolution of key parameters, to sustain and advance R&D programs and prediction capabilities.
 - **Recommendation 7.4.1.** NASA, NOAA, NSF, USGS, and DOD should preserve the continuity of long-term, historical key space, ground, and airborne network and sensor data by ensuring existing and new observations have the appropriate level of redundancy and capability to sustain these multi-decadal datasets in perpetuity.
 - **Recommendation 7.4.2.** NASA, NOAA, DOD, DOE, NSF, and the commercial sector should collaborate to ensure access to ancillary data are included as data products as part of observational datasets.
 - **Recommendation 7.4.3.** NASA, NOAA, NSF, and DOD should archive and maintain existing and future space weather, solar, space physics, and geophysical data.
 - **Recommendation 7.4.4.** NOAA, NASA, NSF, USGS, and DOD should augment the facilities' infrastructure and instrumentation capabilities to obtain real time or near real time observations.
- **Finding 7.5.** Users need next generation computational resources and data analysis techniques for application to space weather research.
 - **Recommendation 7.5.1.** NASA, NOAA, NSF, and DOD should expand investment in and use of new computing architectures and resources.

Observational Capabilities

- **Finding 7.6.** Users need improved spatial and temporal observations to enhance space weather forecasting.
 - **Recommendation 7.6.1.** NOAA, NASA, NSF, USGS, and DOD, in collaboration with commercial providers, should utilize current and future ground-, air-, and space-based sensors along with improved downlink and associated ground infrastructure to increase the resolution and coverage of key space weather, solar, space physics, and geophysical data.
 - **Recommendation 7.6.2.** NASA, NSF, and DOD should work with commercial providers and the research community to develop robust platforms to reduce risk and cost, and prioritize increased reliability, availability, and spatial sampling of space-based systems.

SWAG Recommendations

- **Finding SWAG 7.1.** Non-Keplerian observations are required to improve forecast lead time and accuracy.

- **Recommendation SWAG 7.1.1.** NASA should develop and demonstrate pointing stabilized alternative propulsion methods and small-satellite buses to explore, and station at positions along the Sun-Earth line, off the Sun-Earth line, and out of the ecliptic plane.

Discussion

Dr. Bishop commented that the focus group findings reflect the users' perspectives. She stressed that a lot of the things the groups recommend are going on, they just need more of it, and it needs to be faster. Dr. McIntosh agreed, adding that a primary issue is communication.

Dr. Gombosi suggested that the Department of Energy (DOE) be included in Recommendation 7.5.1, citing the centrality of the Los Alamos dataset to magnetospheric space weather work. Dr. Dickinson noted that DOE is included in 7.4.2. Dr. McIntosh allowed that the recommendations should be consistent, and asked Dr. Gombosi to make sure that DOE is included in all the appropriate recommendations. Dr. Gombosi argued that 7.4.3 should reference DOE because the DOE treaty verification spacecraft measures magnetospheric information. Dr. Knipp commented that the data is still being archived; it's just not publicly available. Dr. Dickinson pointed out that 7.4.3 does not say anything about making the data available, just that it be archived and maintained. Dr. Knipp argued that data is not very useful if researchers can't use it. Dr. Dickinson suggested adding a phrase recommending that the data be publicly available.

Members agreed that DOE should be added to Recommendations 7.4.1 and 7.4.3. For 7.4.4, Dr. Knipp posited that SWAG would receive pushback because real-time data has never been available from DOE.

Dr. Jonas asked if it would be appropriate to add language indicating if the request was improvement, enhancement, or continuation. He also raised the possibility of explicitly mentioning whether SWAG intends the data be made public. Dr. McIntosh responded that his underlying assumption is that the data would be publicly available. Dr. Bishop suggested adding the phrase, "according to open data policy." Dr. McIntosh pointed out that some of the information is not subject to open data policy, so SWAG would need to specify where applicable.

Dr. Tobiska supported eschewing "open data" and "public access" in favor of "research access." Dr. Bishop observed that a lot of the researchers are now part of commercial companies and the public. Dr. Duncan stated that the data is valuable outside the research context. Dr. Dickinson suggested keeping the emphasis on public access while adding in the surrounding text an acknowledgment that this is a big push but that the desired endpoint is publicly accessible data. Dr. Tobiska agreed to this proposal as long as the appropriate caveats are in place.

A member of SWORM informed the SWAG that DOE does have an ongoing pilot program that involves enhanced grid monitoring, which should be able, once procedures are worked out, to provide a near real-time observation. Mr. Olson commented that this product could really help the grid operator in real time.

Dr. Knipp asked whether Recommendation 7.6.2 was comprehensive enough to include federally funded R&D centers (FFRDCs). There was also the question of whether to insert FFRDCs into the recommendation or put something in the supporting text. Dr. Bishop felt parenthetical phrasing just gets messy and dilutes the recommendation. Dr. Jonas suggested adding "research community" or "research and development community" after "commercial providers," which should capture the role FFRDCs play. If necessary, specific language on what is meant by "research and development community" could be included in a laundry list in the preceding text. Members agreed to this suggestion.

Dr. Rebecca Bishop moved to accept Chapter 7 with the caveat that minor wording changes for clarity may be made. Dr. Deloris Knipp seconded the motion. The motion passed without opposition or abstention.

Aviation Sector

Dr. Dickinson reported that two basically identical sets of recommendations, one on communications and one on navigation, had been merged into one set.

11:09-11:25: Next Steps (Dr. Tamara Dickinson, Science Matters Consulting, and Chair, SWAG)

Dr. Dickinson outlined the schedule for SWAG's panel at the Space Weather Workshop (SWW) on Tuesday, April 16, in Boulder, Colorado. The panel will run from 10:45 to 11:45 AM. Dr. Dickinson and Ms. Macpherson will serve as co-chairs. Dr. Dickinson will spend the first ten minutes providing an overview of the PROSWIFT user-survey initiative, then various members will take five minutes each to present on the survey sectors. Dr. Jonas will present on emergency management, Dr. Knipp on space traffic management/coordination, Mr. Olson on electric power, Dr. Tobiska on both human spaceflight and aviation, and Dr. McIntosh on research. The session concludes with a 20-minute period for panel and audience discussion.

Dr. Dickinson noted that she is still waiting to receive slides from some presenters. She reminded them that they will have to choose which findings and recommendations to address, because it will not be possible to sufficiently cover them all in five minutes. She also instructed them to let her and Ms. Macpherson know if there are any questions they would like to see asked during the discussion.

After SWW, SWAG will continue to edit chapter text. This will require chapter Zoom meetings. It will continue to refine findings and recommendations, perhaps with minor changes as it writes the chapters. The Science & Technology Policy Institute (STPI) is helping SWAG develop sidebars, text boxes, and figures. The report still needs a title; Dr. Dickinson encouraged attendees to offer ideas. The official rollout of the full report is scheduled for the summer of 2024.

11:25-11:45: Break

The only item remaining on the agenda was the public comment period, which was specifically noticed for 11:45, so the SWAG took a break.

11:45-11:57: Public Comment

Ms. Macpherson opened the public comment period and explained that each commenter would have a maximum of two minutes to speak. She first read the comments that were received in writing before and during the meeting. Jerry Sanders of the U.S. Air Force expressed an interest in the discussion topics related to the Department of Defense space weather requirements. Dr. Dickinson pointed out that there were also a lot of findings and recommendations relating to DOD at SWAG's March 26 meeting.

David Vallado of the Commercial Space Operations Center's Center for Space Standards and Innovation commented that the recommendation regarding Lagrangian points makes sense because there are Lagrangian points off the Sun-Earth axis. However, he expressed confusion about the term "pointing attitude stabilization propulsion." Dr. McIntosh explained that the idea

is to have a platform that's stable enough to house instrumentation sensitive to vibration. Dr. Duncan allowed that the recommendation could be reworded.

Michael Hardinger asked why Recommendation 7.6.2 is exclusive to space-based platforms. Dr. McIntosh answered that the emphasis here is on improved coverage. Dr. Tobiska added that there needs to be a look at other methods of hosting different kinds of observational platforms. Dr. Dickinson stated that findings and recommendations need to be based on what participants said during focus groups. Dr. Elliott said her recollection is that this recommendation came up in the context of space-based platforms. Dr. Bishop noted that sensor development on the ground, air, and space is covered in 7.6.1.

11:57-11:58: Closing Remarks (Dr. Tamara Dickinson, Science Matters Consulting, and Chair, SWAG)

Dr. Dickinson thanked the SWAG members and staff for their hard work.

11:58: Adjourn

Ms. Macpherson seconded the chair's comments thanking SWAG members for the efforts. She reminded SWAG members of the dates of the upcoming Space Weather Workshop, and adjourned the meeting at 11:58 a.m.