



Space Weather

MEETING REPORT

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Key Points:

- Space Weather requires partnerships between government, industry, and academia
- Space weather awareness is growing and has congressional bipartisan support
- Operational space weather is established, but has a long way to go to becoming fully operational.

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Partnerships form the basis for implementing a National Space Weather Plan

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Abstract The 2017 Space Weather Enterprise Forum, held June 27, focused on the vital role of partnerships in order to establish an effective and successful national space weather program. Experts and users from the many government agencies, industry, academia, and policy makers gathered to discuss space weather impacts and mitigation strategies, the relevant services and supporting infrastructure, and the vital role cross-cutting partnerships must play for successful implementation of the National Space Weather Action Plan.

Plain Language Summary The 2017 Space Weather Enterprise Forum, held June 27, focused on the vital role of partnerships in order to establish an effective and successful national space weather program. Experts and users from the many government agencies, industry, academia, and policy makers, gathered to discuss space weather impacts and mitigation strategies, the relevant services and supporting infrastructure, and the vital role cross-cutting partnerships must play for successful implementation of the National Space Weather Action Plan.

“Space Weather is a team sport,” declared Mr. Ralph Stoffler, Director of Weather, U.S. Air Force, at the annual Space Weather Enterprise Forum (SWEF) held 27 June 2017 in Washington DC. This sentiment was shown to be widely held, as it was echoed throughout the day by experts and users from the many government agencies, industry, academia, and policy makers, who gathered to discuss space weather impacts and mitigation strategies, the relevant services and supporting infrastructure, and the vital role cross-cutting partnerships must play for successful implementation of the National Space Weather Action Plan.

The space weather community is buoyed by current bipartisan support for space weather awareness as evidenced by (1) the presidential executive order of 13 October 2016 (<https://obamawhitehouse.archives.gov/the-press-office/2016/10/13/executive-order-coordinating-efforts-prepare-nation-space-weather-events>) that coordinates agency efforts to prepare the nation for space weather events, (2) the 2 May 2017 unanimous passing of Senate Bill S.141—Space Weather Research and Forecast Act (<https://www.congress.gov/bill/115th-congress/senate-bill/141>), and (3) the similar House Bill introduced the same day as the SWEF. A sense of realism was expressed by the key agencies tasked with space weather efforts, recognizing that there is still much to do. A fully operational space weather program is currently at “about 5%” offered Dr. Louis Uccellini, NOAA Assistant Administrator for Weather Service and Director, National Weather Service, nevertheless, “the operational level has a positive gradient—so it is a positive time. The mark of leadership is to maintain the gradient positive,” added Dr. Thomas Zurbuchen, NASA’s Associate Administrator for the Science Mission Directorate.

The need for a coordinated space weather program was well expressed by Major General Scott Vander Hamm, Assistant Deputy Chief of Staff, Operations Headquarters U.S. Air Force, when he shared two historical vignettes: the 23 May 1967 incident, when a confrontation between the U.S. and the Soviet Union was averted due to recognition that a high-frequency communication blackout over the North Pole was caused by a solar flare and not enemy action [Knipp *et al.*, 2016] and the March 2002 episode at Roberts Ridge in Afghanistan where seven special service troops lost their lives due to communication failures that were likely caused by ionospheric disturbances [Kelly *et al.*, 2014]. These are two stark examples of the importance of having a robust operation space weather program. His personal testimony as a pilot on U.S. Air Force flight missions with conventional and nuclear weapons, some lasting 32 h, is that he found himself “in precarious and uncomfortable situations because of GPS [signal] degradation.”

The need for collaboration in space weather is broad and global. “As we look to the future, are we ready for the space weather storm when it comes? Its impact will not be lessened by its delay. It will take an effort from

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all of us. Our sponsors need to be aware of the value that we bring to the problem.” concluded NOAA’s Dr. Stephen Volz, Acting Assistant Secretary for Environmental Observation and Prediction. Dr. Bill Easterling, the NSF Assistant Director Geosciences, noted, “Space weather impacts don’t respect political boundaries. Space weather is a global, around the clock challenge.”

A portion of the SWEF was devoted to the status of the National Space Weather Action Plan (https://obama-whitehouse.archives.gov/sites/default/files/microsites/ostp/final_nationalspaceweatherstrategy_20151028.pdf). The federal agencies with lead roles in the SWORM reported that of the six goals composed of 99 actions, 80% are complete or are on track to be completed. This is remarkable, noted Mr. Steve Clarke, NASA’s Heliophysics Division Director. There has been “great collaboration between all the agencies,” he added.

Industry and academic leaders shared the importance of a balanced program to address the space weather needs of the nation. Dr. Sarah Gibson, representing the National Academy Space Studies Board Committee on Solar and Space Physics, expressed the need for cross-cutting teams with critical mass, diversity, and expertise to address space weather challenges as conveyed in their report on Heliophysics Science Centers [*National Academies of Sciences, Engineering, and Medicine*, 2017]. Members of the American Commercial Space Weather Association provided examples of how their organization can support the space weather enterprise including commercial shared launches, innovative technologies, data purchases, tax incentives for expanding space weather activities, and business-to-business cooperation.

The meeting was concluded with comments from Dr. William Schulz, Director the Office of the Federal Coordinator for Meteorology (OFCM). He noted that since its inception in 2007, this is the first SWEF for which there has been a government-approved space weather program. Furthermore, he opined that “a little bit of investment wisely deployed around the world can result in great dividends.”

Mr. Michael Bonadonna, of the OFCM and convener of the 2017 SWEF, summarized the meeting by saying that “the National Space Weather Strategy recognizes the need to leverage all national capabilities to address space weather concerns, understand the drivers of space weather, develop operational capabilities, and prepare for and mitigate societal impacts. This can only be achieved through conscientious efforts to foster private-public partnerships, civil-military partnerships, domestic and foreign partnerships and a strong foundation of government, commercial, and academic cooperation.”

There is much to be done for space weather, but based on the indicators presented at the 2017 SWEF, the support of stakeholders, the commitment of those engaged, and the momentum of action are all positive. It will be exciting to celebrate the accomplishments of these increasingly solid space weather enterprise partnerships at next year’s decadal SWEF meeting.

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