

## **THE NATIONAL SPACE WEATHER PROGRAM: 2010 and the Next Decade**

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### **ABSTRACT**

As the next peak of solar activity approaches, society faces many uncertainties from increasing reliance on space weather-affected technologies for communication, navigation, security, and other activities, many of which underpin the national infrastructure and economy. The National Space Weather Program (NSWP) is a federal interagency initiative established in 1995 to improve timely and reliable predictions of significant disturbances in space weather and to provide tailored information specific to those who may be affected. The NSWP Council, through its Committee for Space Weather, seeks to speed improvement of space weather products and services through research, transition of research to operations, and improvements in operational capability to better prepare the United States for the effects of space weather on technological systems, activities, and human health. The program marked major milestones in 2010 with the publication of two significant documents. Following White House Office of Science and Technology Policy approval, the Subcommittee for Disaster Reduction published the Space Weather Implementation Plan as the fifteenth and final hazard area in the portfolio of Grand Challenges for Disaster Reduction. This plan and the rest of the portfolio are available at <http://www.sdr.gov>. Following review by the White House Office of Management and Budget, the Office of the Federal Coordinator for Meteorology (OFCM) published the new NSWP Strategic Plan, defining a fresh vision, mission statement, and five broad goals in the areas of research, observations, products and services, awareness, and communications. The plan is available on the publications page at <http://www.ofcm.gov/>. Both documents provide the framework for interagency cooperation and collaboration for the next decade. Also in 2010, the NSWP Council organized and hosted the fourth Space Weather Enterprise Forum with the theme of *Building an Informed and Resilient Society – the Decade Ahead*, bringing more than 230 international attendees from government, industry, academia and the public to Washington, DC, to share

information, raise awareness, improve communication, and identify approaches to building resiliency. The forum focused particularly on protecting and supporting critical infrastructure and featured the Federal Emergency Management Agency administrator. For the first time, the forum also explicitly addressed the integration of social sciences to improve space weather services, complementing the expanding awareness of such integration benefits in the terrestrial weather enterprise. To address both space and terrestrial weather social sciences integration, the OFCM is establishing an interagency Working Group for Social Science. In 2011, the Council will move forward under the vision of the new Strategic Plan, beginning to chart specific courses to realize these strategic goals and continue raising awareness of and building resiliency against the effects of space weather.

### **1. INTRODUCTION**

Our nation and the world have come to rely on space-enabled systems that are vulnerable to the effects of space weather. These effects reach ever further into an increasingly technology-dependent society, affecting safety, security, and the global economy with potential impacts reaching into trillions of dollars. (NRC 2008) With Solar Cycle 24 forecasted to peak in 2013, we will soon see an increase in the number and likely the severity of space weather effects, but we can prepare now to reduce the impacts on our lives, activities, and systems.

The National Space Weather Program (NSWP) and its member agencies marked a watershed year in 2010. In February 2010, NASA launched the Solar Dynamics Observatory (SDO) and the year brought increased support for important future observing systems, then saw growing participation in the annual Space Weather Workshop and Space Weather Enterprise Forum, and delivered new plans for disaster reduction and the NSWP's strategic goals.

Major challenges and opportunities lie ahead in the next year and beyond as the agencies press forward to meet the new strategic goals and help prepare the nation for the next solar maximum.

This paper provides a brief description of the NSWP for those readers who are not familiar with the

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program, then summarizes the highlights of 2010 and plans for 2011 and beyond.

## **2. BACKGROUND**

The NSWP is a U.S. federal government interagency program established in 1995 to coordinate, collaborate, and leverage capabilities across the stakeholder agencies, including space weather researchers, service providers, users, policymakers, and funding agencies to improve the performance of the space weather enterprise for the United States and its international partners.

The Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM) is an interdepartmental office established in 1964 because Congress and the Executive Office of the President recognized the importance of full coordination of federal meteorological activities. The U.S. Department of Commerce formed the OFCM in response to Public Law 87-843 and Bureau of the Budget (now Office of Management and Budget) Circular A-62, establishing the interagency coordinating infrastructure which continues in updated form today.

In the mid-1990s, the emerging space weather community mobilized to establish a coordinated federal effort, creating the interagency NSWP under the auspices of the OFCM. To guide the program, the OFCM established the NSWP Council within the federal meteorological coordinating infrastructure and, in 1995, the Council approved and the OFCM published the first NSWP Strategic Plan. (OFCM 1995) The plan documented goals and laid the foundation for the program. Subsequent implementation plans (OFCM 1997, 2000) provided a synopsis of current capabilities, defined more specific direction for the community to achieve program goals, defined program management through the Program Council and the Committee for Space Weather (CSW), defined federal agency roles and responsibilities, and described the roles and contributions of others such as the international space weather community.

Today, the member agencies include the U.S. Departments of Commerce, Defense, Energy, Homeland Security, Interior, State, and Transportation as well as NASA and the National Science Foundation. The White House Office of Science and Technology Policy and Office of Management and Budget provide observers on the Program Council.

## **3. AN EXCITING AND FRUITFUL YEAR**

### **3.1 Building Observational Capability**

The February 2010 launch of the first Living with a Star mission, SDO, and the stream of incredible imagery and data from the spacecraft have exhilarated the space weather community and already raised many questions about our understanding of the physical processes on our nearest star. At the same time, the Solar Terrestrial Relations Observatory

(STEREO) continued to push the boundaries of our knowledge outward as we gained new perspectives of the Sun and, in early 2011, will allow us to observe the entire Sun at the same time.

As a result of recommendations from the NSWP in 2009, the administration included funding for both the Deep Space Climate Observatory (DSCOVR) and the second international collaborative Constellation Observing System for Meteorology, Ionosphere and Climate (COSMIC-II) in the President's Fiscal Year 2011 budget request to Congress. A refurbished DSCOVR will provide real time solar wind monitoring from the L1 libration point to replace the current capability from the Advanced Composition Explorer spacecraft that is well beyond its design lifetime. The COSMIC-II program follows on the success of the first COSMIC project that has provided a wealth of global observations of ionospheric conditions.

### **3.2 Building Community Momentum**

In 2007, the National Oceanic and Atmospheric Administration's Space Weather Prediction Center organized the first Space Weather Enterprise Forum (SWEF) as a Washington, DC-based extension of their long-running annual Space Weather Workshop in Boulder, Colorado. The annual forum helps bring policymaker attention to the growing space weather service needs of a technological world. The forum also extends outreach efforts to an expanding user base and the 2010 forum saw greater participation, interest, and a strong sense of momentum building as the next solar maximum approaches.

Since 2009, the NSWP Council has organized and hosted the forum, and in 2010 drew more than 240 international attendees from government, industry, academia, and the public to hear 24 nationally and internationally renowned speakers in 6 sessions. The theme of the 2010 forum was: "Building an Informed and Resilient Society—the Decade Ahead." Congresswoman Donna Edwards from the U.S. House of Representatives provided the keynote address and Jay Reich, Deputy Chief of Staff, U.S. Department of Commerce provided luncheon remarks. The forum also benefited from the perspectives of featured speakers Christopher Scolese, NASA Associate Administrator, and Craig Fugate, Federal Emergency Management Agency (FEMA) Administrator. The forum explored finding effective means to raise public awareness and identifying effective approaches to build resiliency across society, particularly in critical infrastructure protection and support. Other objectives included improving communication within and external to the enterprise and sharing information across the different sectors of the space weather enterprise.

In the final session of the 2010 forum, Dr. Louis Lanzerotti from the New Jersey Institute of Technology summarized the following key points:

- The potential impacts of space weather are not widely known or understood by the public.

- We are not ready for an extreme space weather event, and our ability to cope with routine impacts is modest.
- The NSWP has been very successful over the years in fostering cooperation among agencies, encouraging public outreach and education, and advancing the science, but much work needs to be done to improve the research to operations chain, and operational services.
- We are beginning to recognize and expand our interaction and collaboration with international and foreign organizations possessing and developing important space environmental science and space weather capabilities.

A longstanding objective of the forum is education and outreach and the 2010 forum proved particularly successful in reaching the media and the Internet, with nearly a million hits on the NASA online stories, forum mentions on 45,000 web pages, and coverage reaching the United Kingdom, Germany, France, Italy, Poland, Ireland, Canada, and Japan—ultimately exceeding coverage of the preceding 3 years combined.

The forum also facilitated distribution of the just-approved and printed Space Weather Implementation Plan as part of the Grand Challenges for Disaster Reduction and, during the forum itself, the Office of Management and Budget approved the new NSWP Strategic Plan. The following sections provide additional information on these plans and upcoming activities.

### 3.3 Setting Course for the Future

The National Science and Technology Council's Subcommittee on Disaster Reduction (SDR) developed "The Grand Challenges for Disaster Reduction" as a ten-year strategy to reduce disasters through science and technology. Addressing these Grand Challenges will improve the United States' capacity to prevent and recover from disasters. The Grand Challenges provide a framework for prioritizing the related Federal investments in science and technology in 15 hazard areas, including space weather. Participants from the NSWP worked closely with the SDR to develop and publish the Space Weather Disaster Reduction Implementation Plan. (SDR 2010) This succinct document will help guide national efforts to improve resiliency against the most severe space weather impacts.

The NSWP also took a major step forward with the approval and publication of a new strategic plan to guide another decade of activities. (OFCM 2010) The NSWP Strategic Plan resulted from a comprehensive approach to improving national space weather services and supporting research based upon 10 key documents, 185 recommendations, input from the Space Weather Enterprise Forums, and many other gatherings and individuals. Some of these documents include a number of National Research Council

reports, the National Space Weather Program assessment conducted in 2006 (OFCM 2006), the National Security Space Architecture for Space Weather, and NASA's Heliophysics Roadmap. These authoritative documents provided the analytical foundation to develop a bold vision, state a clear mission, and promulgate five program goals:

## 4. VISION FOR A NEW DECADE

The new National Space Weather Program Strategic Plan states the following vision for the new decade:

### Vision

*A nation that capitalizes on advances in science and forecasting to better cope with the adverse impacts of space weather on human activity and on advanced technologies that underlie our global economy and national security.*

To achieve this vision, the plan identified five strategic goals and their associated objectives. The goals are described in the next section.

### 4.1 Goals Provide the Framework

The following are the goals prescribed in the new NSWP Strategic Plan:

- Discover and understand the physical conditions and processes that produce space weather and its effects.
- Develop and sustain necessary observational capabilities.
- Provide tailored and accurate space weather information where and when it's needed.
- Raise national awareness of the impacts of space weather.
- Foster communications among government, commercial, and academic organizations.

These five goals are further supported by objectives that will be implemented through subsequent plans. The complete Strategic Plan is available on the OFCM web site. (OFCM 2010)

### 4.2 Achieving Strategic Goals – The Year Ahead

With the Strategic Plan as a guide, the NSWP agencies will continue development of a new Implementation Plan to describe the collection of activities needed to achieve our strategic goals and objectives and the means by which to measure progress. In the near term, an Action Plan and a Strategic Communications Plan will guide early action and the 2011 Space Weather Workshop and Space Weather Enterprise Forum will continue to strengthen the community and reach out to new users.

Plans are progressing for the 2011 forum to be held in Washington, DC, in June to raise public and policymaker awareness of space weather effects,

seek ways to improve services for the spectrum of users across the economy, facilitate the transition of research to operations, and help prepare the nation for the coming solar maximum. The forum will also provide an opportunity to introduce the NSWP Strategic Communication Plan and seek information to refine the Action Plan. These plans are discussed in more detail in the following section.

### 4.3 Preparing for Solar Maximum

To address the most urgent needs first while the National Research Council (NRC) Decadal Survey on Solar and Space Physics is completed, the NSWP will develop two short plans in 2011, the first of which is a Strategic Communications Plan. Awareness and comprehension of space weather and its potential impact on the nation is important for the spectrum of users and stakeholders ranging from the general public to specific industries and activities such as electric power generation and distribution, communications, spacecraft design and operations, military operations, airline operations, and air traffic management to name a few. The Strategic Communications Plan identifies targeted audiences, key messages, key communicators, and measures to determine effectiveness of this communication. As the next solar maximum approaches, the urgency to communicate an appropriate understanding of risk as well as preparatory and mitigation actions is rising. This plan will directly support the fourth strategic goal of the new NSWP Strategic Plan.

To begin addressing other strategic goals with early high-priority, high-payoff activities, an Action Plan will be developed to coordinate Federal agency activities, establish collaborative efforts where possible, and determine the interagency priorities for actions supporting each goal and objective. This Action Plan, in conjunction with the Strategic Communications Plan, will provide part of the supporting foundation for the overall Implementation Plan. The NRC Decadal Survey will provide another cornerstone.

A description of the decadal survey is outside of the scope of this paper, but the NSWP agencies and particularly NASA and the U.S. Congress are expected to rely heavily on the survey in planning and funding future research missions and activities. Together, the decadal survey results and the communications and action plans, with additional information, are the pillars of the new NSWP Implementation Plan to replace the current plan (OFCM, 2000) and align activities to the new Strategic Plan. The new Implementation Plan will be completed in 2012 following completion of the decadal survey and as we approach the next maximum in solar activity and its related effects on systems and citizens.

## 5. SUMMARY

The last year has been an exciting and fruitful year as we have launched the Solar Dynamics

Observatory, been awestruck by the images it has returned, and marveled at the STEREO images to complement SDO. The National Space Weather Program also won support for future space weather sensing systems in the President's budget and saw the continued expansion of the enterprise through the growing Space Weather Workshop and Space Weather Enterprise Forum. The program also established new guidance and vision in the form of the Space Weather Implementation Plan in the portfolio of Grand Challenges for Disaster Reduction and a new NSWP Strategic Plan.

We look forward to a successful 2011 with another Space Weather Workshop and Enterprise Forum, a new Strategic Communications Plan, a near-term Action Plan, and a focus on preparation for the upcoming solar maximum. These plans and the NRC's decadal survey will be the foundation of the new Implementation Plan under development to guide specific actions to achieve our strategic goals in 2012 and beyond.

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