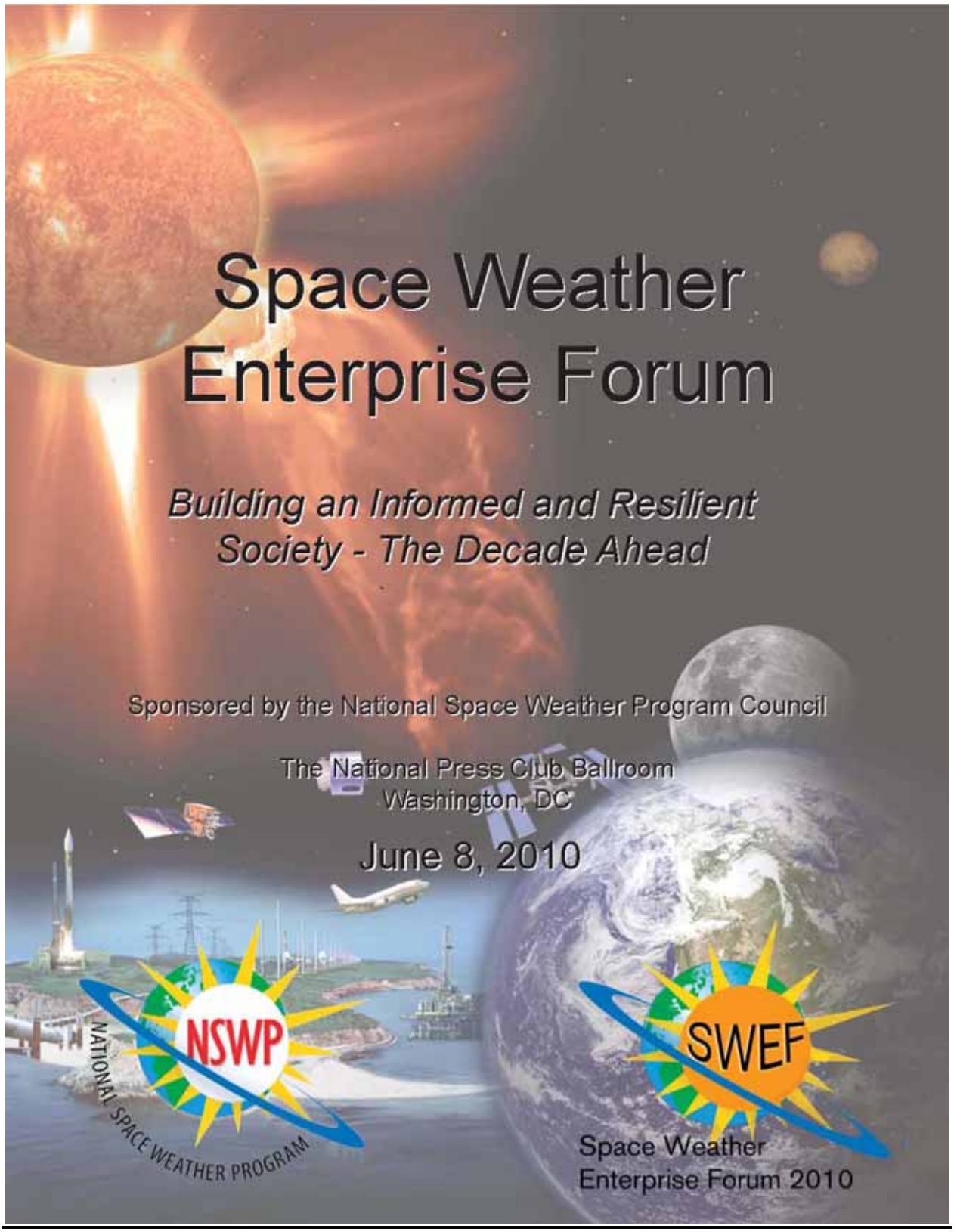
Space Weather
Enterprise Forum
Building an Informed and Resilient
Society - The Decade Ahead
Sponsored by the National Space Weather Program Council
The National Press Club Ballroom
Washington, DC
June 8, 2010
NSWP
NATIONAL SPACE WEATHER PROGRAM
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Space Weather
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Cover graphics by Erin McNamara, OFCM, adapted from NASA graphics.

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June 8, 2010

Dear Colleagues,

Welcome to the 2010 Space Weather Enterprise Forum! The members of the National Space Weather Program Council and I are pleased to present a wide-ranging and informative slate of speakers to address this year's theme: *Building an Informed and Resilient Society – The Decade Ahead*. They are national and international leaders and stakeholders from across government, industry, and academia and represent the array of activities from setting policy to guiding research to providing operational support for both civil applications and national defense.

Our objectives in organizing this year's forum are to share information across the enterprise and raise awareness for new users, decision-makers, and policymakers; to identify effective approaches to raise awareness and build resilience in the broader society, particularly in the area of critical infrastructure support; to improve communication within and external to the enterprise; and to begin collecting information to support a new program Implementation Plan.

In the year since the last forum, we have seen the launch of the Solar Dynamics Observatory and the first awe-inspiring images from this amazing research tool. We have completed two studies for the White House Office of Science and Technology Policy that moved critical observing system capabilities closer to reality than ever before. And we have prepared a new Strategic Plan, built upon a suite of assessments as well as input from last year's forum, and we look forward to sharing it with you for review and feedback. These are just a few of the milestones on our recent journey and pointers to a bright future. The discussions today will help us review progress, look forward, and focus our efforts on preparing for the next decade and the risks and challenges ahead.

I extend my appreciation to the members of the OFCM-sponsored National Space Weather Program Council and all of their representatives who planned and organized the forum. The member agencies and sponsors of the forum are the Departments of Commerce, Defense, Energy, the Interior, State, and Transportation as well as NASA, the National Science Foundation, and the Office of Science and Technology Policy and Office of Management and Budget in the Executive Office of the President. Under Council direction, the Office of the Federal Coordinator for Meteorology has organized the forum you are attending today.

Thank you for joining us in Washington, DC, to exchange ideas, share information, raise awareness of space weather and its effects, and to help build an informed and resilient society in the decade ahead. I encourage you join in the discussions and enjoy the forum!

Sincerely,

Samuel P. Williamson
Federal Coordinator for Meteorology
and Chairman, National Space Weather Program Council

Space Weather Enterprise Forum 2010

Building an Informed and Resilient Society – the Decade Ahead

National Press Club
Washington DC
June 8, 2010

Motivation

As we approach the next peak of solar activity expected in 2013, our nation faces multiplying uncertainties from increasing reliance on space weather-affected technologies for communication, navigation, security, and other activities, many of which underpin our national infrastructure and economy. We also face increasing exposure to space weather-driven human health risk as trans-polar flights and space activities, including space tourism, increase.

The Forum

The Space Weather Enterprise Forum brings together the space weather community to share information and ideas among policymakers, senior government leaders, researchers, service provider agencies, private sector service providers, space weather information users, media, and legislators and staff from Capitol Hill to raise awareness of space weather and its effects on society. This year, we will continue this outreach but will sharpen the focus on critical infrastructure protection, with the necessary underpinnings of research, improved products and services, and applications to serve a broad and growing user community. Our ultimate goal is to improve the nation's ability to prepare, avoid, mitigate, respond to and recover from potentially devastating impacts of space weather events on our health, economy, and national security.

Forum Objectives

- Share information across the enterprise and raise awareness for new users, decision-makers, and policymakers; areas of exchange include the following:
    - New research results
    - New transitions of research into operations
    - New products and services
    - International activities and cooperation
    - Commercial space weather users and providers
- Identify effective approaches to raise awareness in the broader society
    - How can the social sciences help?
- Identify effective approaches to build resilience across society, particularly in critical infrastructure protection and support
- Improve communication within and external to the enterprise
- Collect information to support a new National Space Weather Program Implementation Plan

Sponsor

The National Space Weather Program Council is part of the U.S. Federal meteorological coordinating infrastructure under the Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM). The Council brings together the Federal agencies involved in providing space weather products and services, space weather research, users of space weather information, and other offices that set policy or funding for the Federal portion of the space weather enterprise. The purpose is to facilitate coordination, collaboration, and leveraging of activities, results, and capabilities across the Federal agencies. The participating agencies and their representatives are listed on the inside front cover of this book.

Sessions:

We will again follow a panel session format, including brief presentations by expert panelists followed by ample time for lively exchange across a diverse group of attendees.

- A Year Moving Forward – The National Space Weather Program: In the year since the last forum, we have seen significant progress in many areas of the enterprise and in addressing perennial challenges such as sustaining solar wind monitoring from an L1 orbit. *A Year Moving Forward* presents the highlights of these advances, including contributions to building a resilient society and the successes and challenges in raising space weather awareness in the broader community.

- The Future of Space Weather Science and Research Transition to Operations: In many ways, today's state of the science and state of the art in space weather operations are comparable to terrestrial weather several decades ago. In the last ten years, we have seen great strides in discovery and physical understanding but much work remains. Research is the foundation of the enterprise and the transition of research results into operational capability is the bridge over the National Research Council's "Valley of Death." Without the physical understanding and the related operational capability, we have little hope of building an informed and resilient society. *The Future of Space Weather Science and Research Transition to Operations* examines recent and imminent breakthroughs and the implications for the enterprise and society.

- International Activities and Cooperation: One senior leader in the enterprise has called space weather a team sport and space weather's inherently global nature makes this an international team. An informed and resilient society spans national borders and *International Activities and Cooperation* provides a global update and perspective on the forum theme.

- Critical Infrastructure Support: We depend on critical systems and activities affected by space weather, such as the electric power grid, communications, positioning and navigation, and national security. These effects must be understood, mitigation actions developed, and acceptable levels of risk determined to build and support an informed and resilient society. *Critical Infrastructure Support* examines these areas, including identifying potential approaches to raising awareness and building resiliency, and employing the social sciences for greatest effectiveness.

Congresswoman Donna F. Edwards

Maryland, 4th District

Congresswoman Donna F. Edwards of Fort Washington represents Maryland's 4th Congressional District comprising portions of Prince George's and Montgomery Counties. She was sworn in as a member of the U.S. House of Representatives in the 110th Congress in June 2008, and began her first full-term in the 111th Congress in 2009.

She serves on the Transportation and Infrastructure Committee where she sits on:

- Subcommittee on Highways and Transit
- Subcommittee on Water Resources and Environment where she is the Vice Chair
- Subcommittee on Economic Development, Public Buildings, and Emergency Management

She serves on the Science and Technology Committee where she sits on:

- The Subcommittee on Technology and Innovation
- The Subcommittee on Space and Aeronautics where she is the Vice Chair

She also serves as a member of the Tom Lantos Human Rights Commission.

Rep. Edwards has enjoyed a diverse career as a nonprofit public interest and in the private sector on NASA's Spacelab project. Just prior to serving in Congress, she was the executive director of the Arca Foundation in Washington, DC. During her time at Arca, she gained national prominence in her efforts to:

- Secure a "living wage" for working people.
- Ensure the independence of the federal judiciary.
- End capital punishment.
- Protect Social Security, and
- Promote labor and human rights both nationally and internationally.

Rep. Edwards was the co-founder and executive director of the National Network to End Domestic Violence where she led the effort to pass The Violence Against Women Act of 1994 that was signed into law by President Bill Clinton.

Rep. Edwards completed undergraduate studies at Wake Forest University and received her Juris Doctor from Franklin Pierce Law Center. She is the proud mother of her son who is currently attending college.

Invited Speaker

Christopher J. Scolese

Associate Administrator, National Aeronautics and Space Administration

Christopher J. Scolese currently serves as the Associate Administrator of the National Aeronautics and Space Administration (NASA), the agency's highest-ranking civil servant position. As Associate Administrator, Scolese is responsible for the oversight and integration of NASA's programmatic and technical efforts to ensure the successful accomplishment of the Agency's overall mission. From Jan. 20, 2009, until July 2009, Scolese served as the Acting Administrator of NASA. As the Acting Administrator, he was responsible for leading the development, design, and implementation of the Nation's civil space program. As such, Scolese provided overall leadership for NASA's multiple field installations, worked closely with the Executive and Legislative branches to ensure that NASA was supporting appropriate national policy, and led an international collaboration in carrying out high-profile space missions including the Space Shuttle, the International Space Station, the Hubble Space Telescope, and a multitude of other scientific and technological efforts.

Previously, Scolese served as NASA's Chief Engineer. As Chief Engineer, Scolese was responsible for ensuring that development efforts and mission operations within the Agency were planned and conducted on a sound engineering basis, as well as for the long-term health of the NASA engineering workforce.

Formerly, Scolese was the Deputy Director of the Goddard Space Flight Center where he assisted the Director in overseeing all activities. He also served as the Deputy Associate Administrator in the Office of Space Science at NASA Headquarters. In this position, he was responsible for the management, direction and oversight of NASA's Space Science Flight Program, mission studies, technology development and overall contract management of the Jet Propulsion Laboratory.

Scolese also served as the Earth Orbiting Satellite (EOS) Program Manager and the Deputy Director of Flight Programs and Projects for Earth Science at Goddard. In these positions, he was responsible for the operation and development of all Earth Science missions assigned to Goddard. While there, he also served as the EOS Terra Project Manager. In addition, Mr. Scolese was the EOS Systems Manager responsible for the EOS system architecture and the integration of all facets of the project. During his tenure at Goddard, he chaired the EOS Blue Team that re-scoped the EOS Program; he supported the EOS investigators in the development of the EOS payloads in the restructured EOS; and he has been responsible for the adoption of common data system architecture on EOS and some other earth orbiting spacecraft.

Prior to his 1987 appointment at Goddard, his experience included work in industry and government. While a senior analyst at the General Research Corporation of McLean, Va., he participated in several SDIO programs. He was selected by Admiral Hyman Rickover to serve at Naval Reactors where he was associated with the development of instrumentation, instrument systems and multi-processor systems for the U.S. Navy and the DOE while working for NAVSEA.

Scolese is the recipient of several honors including the Presidential Rank Award of Meritorious Executive, the NASA Distinguished Leadership Medal; Goddard Outstanding Leadership, two NASA Outstanding Leadership Medals and the American Institute of Aeronautics and Astronautics (AIAA) National Capital Section Young Engineer/Scientist of the Year award. He was recognized as one of the outstanding young men in America in 1986, was a member of college honor societies including Eta Kappa Nu and Tau Beta Pi, and was recipient of the 1973 Calspan Aeronautics award. He is a Fellow of the AIAA and a member of the Institute of Electrical and Electronics Engineers. He also served as a member of the AIAA Astrodynamics Technical Committee and chaired the National Capitol Section Guidance Navigation and Control Technical Committee.

Luncheon Speaker

Jay Reich

Deputy Chief of Staff, U.S. Department of Commerce

Jay Reich is the Deputy Chief of Staff at the U.S. Department of Commerce, serving as a senior adviser to Commerce Secretary Gary Locke and as primary liaison between the Secretary and the National Oceanic and Atmospheric Administration, the U.S. Patent and Trademark Office and the Bureau of the Census.

Mr. Reich joined the Department of Commerce in May 2009, after a 35-year legal career in the public and private sectors. He was most recently a partner at the Seattle law firm K&L Gates, where he spent 29 years specializing in public law and finance.

Prior to that, Mr. Reich served as a White House fellow in the office of U.S. Secretary of Agriculture Robert S. Bergland.

Mr. Reich has also served in the King County Prosecuting Attorney's Office, first as a Deputy Prosecuting Attorney and later as the Assistant Chief Criminal Deputy in charge of the Juvenile Section.

While serving in the King County Prosecuting Attorney's office, Mr. Reich was also a visiting lecturer at the University of Washington School of Law and published numerous articles in law journals.

Mr. Reich is a native of Seattle, where he returned after completing his undergraduate work at Amherst College and law school at Harvard. He is married to Jane Reich and has two children, Brian and Emily and two grandchildren.

Featured Speaker

W. Craig Fugate

Administrator, Federal Emergency Management Agency

W. Craig Fugate began serving in the position of Administrator of the Federal Emergency Management Agency (FEMA) in May 2009.

Prior to coming to FEMA, Mr. Fugate served as Director of the Florida Division of Emergency Management (FDEM). In that role since 2001, he managed 138 full-time staff and a budget of $745 million. His agency coordinated disaster response, recovery, preparedness and mitigation efforts with each of the state's 67 counties and local governments.

Mr. Fugate began his emergency management career as a volunteer firefighter, Emergency Paramedic, and finally as a Lieutenant with the Alachua County Fire Rescue. Eventually, he moved from exclusive fire rescue operations to serving as the Emergency Manager for Alachua County in Gainesville, Florida. He spent a decade in that role until May 1997 when he was appointed Bureau Chief for Preparedness and Response for FDEM.

Within FDEM, Mr. Fugate's role as Chief of the State Emergency Response Team (SERT) kept him busy during 1998. That year, the SERT team was active for more than 200 days as a result of numerous floods, tornadoes, wildfires, and Hurricane Georges.

In September 2003, again under Mr. Fugate's stewardship, the Florida Emergency Management Program became the first statewide emergency management program in the nation to receive full accreditation from the Emergency Management Accreditation Program (EMAP).

During his years at FDEM, Mr. Fugate served as the State Coordinating Officer in Florida for 11 Presidentially-declared disasters and the management of $4.5 billion in federal disaster assistance.

In 2004, Mr. Fugate managed the largest federal disaster response in Florida history as four major hurricanes impacted the state in quick succession (Charlie, Frances, Ivan and Jean). In 2005, Florida was again impacted by major disasters when three more hurricanes made landfall in the state (Dennis, Katrina and Wilma). The impact from Hurricane Katrina was felt more strongly in the Gulf Coast states to the west but under the Emergency Management Assistance Compact or EMAC, Florida launched the largest mutual aid response in its history in support of those states.

Mr. Fugate and his wife Sheree hail from Gainesville, Florida.

Session Moderators and Panelists

Abstracts and Biographies

Moderator

Dr. Richard Behnke
Head, Geospace Section, National Science Foundation

Dr. Behnke received his PhD in Space Physics and Astronomy from Rice University in 1970. His research interests center on studies of the dynamics of the Earth's ionosphere using incoherent scatter radar techniques.

Dr. Behnke joined the National Science Foundation in 1982. Presently he is Head of the Geospace Section in the Division of Atmospheric and Geospace Sciences where he leads a Section that emphasizes forward-looking and transformative basic research in aeronomy, magnetospheric physics and solar physics.

Dr. Behnke is a co-chair of the Committee for Space Weather of the National Space Weather Program.

Session 2: A Year Moving Forward – The National Space Weather Program

Dr. Fred P. Lewis
Director of Air Force Weather

"Department of Defense Modernization of Space Weather Capabilities
In Preparation for Solar Maximum"

In anticipation of the coming solar maximum in 2013, the Air Force (AF) has focused efforts to modernize and upgrade both space environment observing and prediction capabilities during the next five years. The AF Director of Weather will highlight space-based and ground-based collection improvements, as well as initiatives to enhance the Service's space environment prediction capabilities, in the context of key partnerships with other US Government agencies to bring these efforts to fruition. Space weather, after all, is a team sport.

BIOGRAPHY

Dr. Fred P. Lewis, a member of the Senior Executive Service, is Director of Weather, Deputy Chief of Staff for Operations, Plans & Requirements, Headquarters U.S. Air Force, Washington, D.C. As the Director of Weather, Dr. Lewis develops doctrine, policy, requirements, and standards to organize, train, and equip the weather career field to support the Air Force, Army, designated unified subunified commands, and the national intelligence community. He plans, programs, and budgets for vital weather resources; manages the $350 million per year weather program; directs the 1,400-person Air Force Weather (AFW) Field Operating Agency located at Offutt Air Force Base; and provides functional oversight of the 3,900-person AFW total force.

Dr. Lewis' government career began when he entered the Air Force through the ROTC program at the University of Arizona in 1972. While on active duty, he commanded a weather squadron and computer systems group in addition to serving in many weather and joint staff officer assignments. In December 1985 he became the first Air Force weather officer selected for space shuttle duty, but never flew due to the Challenger disaster. He served on the U.S. Transportation Command Staff, including two years spent as Director of the Joint Transportation Corporate Information Management Center.

When Dr. Lewis was previously assigned as the Director of Weather, he led efforts to implement a total force transformation of the Air Force's weather functional area to significantly improve weather support for operators worldwide. He retired from the Air Force in 2000 in the rank of brigadier general. Prior to assuming his current position, Dr. Lewis was Deputy Director of Distribution Portfolio Management, Command, Control, Communications and Computer Systems Directorate, U.S. Transportation Command, Scott Air Force Base, Ill.

Session 2: A Year Moving Forward – The National Space Weather Program

Colonel Mark D. Zettlemoyer
Chief, Integration, Plans, and Requirements Division
Air Force's Directorate of Weather

(For Dr. Fred P. Lewis)

BIOGRAPHY

Colonel Mark D. Zettlemoyer is Chief, Integration, Plans, and Requirements Division within the Air Force's Directorate of Weather, Current Operations Directorate, at the Headquarters Air Force staff at the Pentagon, Washington, D.C. The Division plans weather and space environmental support for the Air Force Weather (AFW) functional area and oversees integration of technology and weather into command and control (C2) and modeling systems.

Colonel Zettlemoyer received a Bachelor of Science degree in Meteorology from the Pennsylvania State University in 1983, and was commissioned on 28 May 1983 through the Penn State AF Reserve Officer Training Corps (ROTC) program. Colonel Zettlemoyer completed his Master of Science degree in Meteorology at Florida State University in 1990, where his thesis examined the propagation of measurement uncertainty through an atmospheric transport model. He earned an additional Master's Degree in National Security and Strategic Studies from the Navy War College, Newport, Rhode Island, in 1997. Operational assignments have included stints as a forecaster at Moody Air Force Base (AFB), Valdosta GA, supporting forecast operations at nine bases across the Southeast U.S. while at Shaw AFB, Sumter SC, and directing forecast operations at Wright-Patterson AFB, Dayton OH, Fort Rucker, near Dothan AL, and at the Joint Typhoon Warning Center, Pearl Harbor HI, and the 17th Operational Weather Squadron, Hickam AFB, Honolulu HI. Staff assignments have included weather support to AF acquisition programs (Wright-Patterson AFB), providing training for joint military weather operations (U.S. Joint Forces Command, Norfolk VA), and leading the Air Force Weather Agency's modeling efforts as its Director, Air and Space Science, before moving into his current assignment.

Session 2: A Year Moving Forward – The National Space Weather Program

Vickie Nadolski
NOAA Deputy Assistant Administrator for Weather Services

"NOAA Space Weather Prediction Center – Planned Improvements in Support of the Nation's Growing Need for Space Weather Services"

The NOAA/NWS Space Weather Prediction Center (SWPC) is the Nation's official source for space weather alerts and warnings. The SWPC monitors, measures, specifies and forecasts the space environment and provides timely and accurate operational space weather services to end users in the USA and around the world.

The rapid advances in the technology sector and our fast growing dependency on space-based systems have resulted in an ever-increasing vulnerability to hazardous space weather. Concerns are heightened as we ramp up into the next solar maximum which is expected to peak in 2013. The NWS is addressing the rapid changes in the space weather customer base by documenting and responding to the evolving needs of sectors impacted by space weather such as national security, aviation, emergency response, communications, global positioning system (GPS) users, spacecraft operations, and electric power grids.

The future of space weather forecasting depends largely on the development and use of numerical prediction. Accordingly, NOAA is introducing a space weather prediction testbed, and is preparing to transition the first physics-based space weather model for use in operations before solar maximum in 2013.

BIOGRAPHY

Vickie Nadolski is the NOAA Deputy Assistant Administrator for Weather Services and Deputy Director of the National Weather Service (NWS). In this role, she is responsible for the day-to-day civilian weather operations for the United States, its territories, adjacent waters and ocean areas.

Ms. Nadolski's career spans more than three decades of dedicated public service at the NWS. Before assuming her current position, Ms. Nadolski served as Director of the NWS Western Region. She held this position from 1999 to 2007, and was responsible for the management and operation of twenty-four Weather Forecast Offices (WFO), three River Forecast Centers (RFC), and four Aviation Center Weather Service Units.

In the early 1980s, Ms. Nadolski began development of sensors and algorithms to support automation and managed demonstration test bed projects at the NWS Sterling, Virginia, Test and Development Center. She served more than a decade in both program management and as the manager of the $230 million tri-agency acquisition of the Automated Surface Observing System (ASOS) at the NWS Headquarters in Silver Spring, Maryland. She oversaw the collaborative efforts of the Department of Commerce, Department of Defense, and Department of Transportation as they defined, developed, and implemented more than 900 ASOS sites.

Ms. Nadolski first came to the NWS in 1976 as a staff meteorologist in Cleveland, Ohio, where she issued public, aviation, and marine weather forecasts and warnings for 32 counties in OH, PA, and Lake Erie.
Ms. Nadolski holds a B.S. in Mathematics from the University of Georgia with a B.S. equivalent in Meteorology from Pennsylvania State University. She became a Fellow of the American Meteorological Society (AMS) in January 2006. Her numerous awards include the Department of Commerce Silver Medal and several awards from local, state, and national organizations for her work on automating surface observations.
Ms. Nadolski serves on the AMS Board on Women and Minorities. She also serves as the gender focal point for the World Meteorological Organization (WMO), WMO Commission for Basic Systems, and WMO Commission on Instruments and Methods of Observations.

Session 2: A Year Moving Forward – The National Space Weather Program

Dr. Richard Fisher
Director, Heliophysics Division
Headquarters, National Aeronautics and Space Administration

"Heliophysics Research: Moving Forward in 2010"

The Heliophysics Division plans and manages the heliophysics research programs and projects assigned to the NASA Science Mission Directorate. This involves a broad program of flight assets for the production of research grade data, development of new physical theories to account for the physical processes and physical characteristics encountered in the dynamic environment of the solar system, and the development of new physical models for estimating the behavior of the coupled elements of the Sun and the solar system.

In the upcoming year a number of events influencing the national capability in Space Weather and Situational Awareness will be occurring. It is anticipated that the Solar Dynamics Observatory space weather abstracting activity will be in production with products distributed via the Internet. It is expected that the SDO will become a fundamental source of near real time data concerning the temporal, thermal, spatial and magnetic variation of the Sun. The Radiation Belt Storm Probes, a two spacecraft research investigation of the Earth's charged particle belts will be nearing its test phase, heading for a 2012 launch. This system incorporates an SWx beacon mode, and over the next year that concept will reach maturity in design and operational concept. The open Heliophsyics Data Environment will remain fully operational, and more extensive database tools are expected to reach a state of development that will enable researchers to consider multi-spacecraft investigations and model these via the capability of the Combined Community Modeling Center.

BIOGRAPHY

Director of the Heliophysics Division, Dr. Fisher has overall responsibility for developing policy and providing guidance for NASA's program of the investigation of the variable Sun, its effect on planets of the solar system (including the Earth) and the structure and evolution of interplanetary space. At the present time the Division has a number of extended missions in operation and is actively developing new flight projects. Recently launched missions for the Division include payloads for the Solar Dynamics Observatory (SDO), JAXA's (Japan) HINODE (Solar-B) mission, the ST-5, STEREO, THEMIS, and AIM missions. The Division also manages the NASA Explorer and Sounding Rocket Programs for the SMD.

Dr. Fisher graduated with honors, Phi Beta Kappa, in Mathematics from Grinnell College in 1961. After receiving his Ph.D. degree in Astrogeophysics from the University of Colorado in 1965, he subsequently held positions on the faculty of the University of Hawaii, and the staff of the Air Force Cambridge Research Laboratory and later the National Center for Atmospheric Research where he was a Senior Scientist.

Dr. Fisher joined the Goddard Space Flight Center in Greenbelt, MD in 1991, and in 2000 he was designated as the fifth Director of the Laboratory for Astronomy and Solar Physics. He participated in space experimentation via sounding rockets, stratospheric balloons, and a variety of space flight missions both human and robotic. While supervising the Laboratory, he was the Senior Project Scientist for NASA's Living with A Star Project and Co-Investigator for the COR1 instrument for the SECCHI investigation included in the STEREO payload. He moved to NASA HQ in an administrative capacity in 2002.

Dr. Fisher is a life member of the American Geophysical Union, and a member of the International Astronomical Union, the American Astronomical Society, the American Meteorological Society, and the American Institute of Aeronautics and Astronautics. He is the recipient of both the NASA Exceptional Achievement and Exceptional Service Medals (two awards). His non-scientific interests range across a variety of activities including swimming, marksmanship, horsemanship, motorcycles and the study of Tai 'Chi Chuan (Yang style). He collects 19^{th}-20^{th} century Japanese woodblock prints from the Ukiyo-e movement.

Session 2: A Year Moving Forward – The National Space Weather Program

Mary E. Kicza
NOAA Assistant Administrator for Satellite and Information Services

"A Year Moving Forward: NOAA Observation Contributions to the Space Weather Community"

NOAA has made significant strides in beginning to transition new space weather observation technology into long-term operational measurements. The FY 2011 President's Budget submission includes funding for solar wind, coronagraph and GPS radio occultation measurements. Future missions may also include opportunities for commercial partnerships. NOAA is also making progress on space weather sensor improvements in the next-generation geostationary satellite system GOES-R.

BIOGRAPHY

Mary E. Kicza is the NOAA Assistant Administrator for Satellite and Information Services. NOAA Satellite and Information Service is dedicated to providing timely access to global environmental data from satellites and other sources to promote, protect, and enhance the Nation's economy, security, environment, and quality of life. In this role, Ms. Kicza leads the acquisition and operation of the Nation's civil operational environmental satellite system. She also leads efforts for research and development of products and programs to archive and provide access to a variety of Earth observations via three national data centers.

Ms. Kicza is a leader in the international Earth observation community, serving as Chair of the Committee on Earth Observation Satellites Strategic Implementation Team. In this capacity, she leads efforts to coordinate global satellite-based observations among international space agency partners to further the development of a Global Earth Observation System of Systems. In addition, Ms. Kicza serves as the Co-Chair of the NOAA Observing Systems Council, a group which coordinates observing systems requirements and provides resource recommendations for NOAA's observation platforms. She is also a member of the NOAA Executive Council, NOAA's executive decision making body.

Ms. Kicza has served with distinction in a variety of technical, managerial, and leadership posts, supporting the development, launch, and operation of satellite systems as well as multi-faceted research and development programs. She has significant experience in building and maintaining effective relationships with the Office of Management and Budget, the Office of Science and Technology Policy, the Defense Department, Congress, the aerospace industry, and a diverse research community. Ms. Kicza has earned two SES Meritorious Service Awards, NASA's Distinguished Service and Scientific Achievement Medal, and numerous other awards.

Session 3: The Future of Space Weather Science and Research Transition to Operations

Moderator

Dr. Louis J. Lanzerotti

Louis J. Lanzerotti, PhD, Distinguished Research Professor of Physics at New Jersey Institute of Technology (NJIT), has spent over four decades contributing to research that includes studies of space plasmas and geophysics, and engineering problems related to the impact of atmospheric and space processes on terrestrial technologies, and those in space. Prior to joining NJIT in 2003, Lanzerotti spent 37 years at Bell Laboratories-Lucent Technologies, Murray Hill, NJ. Lanzerotti holds a BS in engineering physics from the University of Illinois and master's and doctoral degrees in physics from Harvard University.

Much of Lanzerotti's research has involved close collaborations with telecommunications service providers on commercial satellite and long-haul (principally transoceanic) cables. His research has also involved geomagnetism, solid earth geophysics, and some oceanography. This research has been applied to design and operations of systems associated with spacecraft and cable operations. He has conducted geophysical research in the Antarctic and the Arctic since the 1970s, directed largely toward understanding of Earth's upper atmosphere and space environments. He has co-authored one book, co-edited four books, and is an author of more than 500 refereed engineering and science papers. He is founding editor for *Space Weather, The International Journal of Research and Applications*, published by the American Geophysical Union. He has seven patents issued or filed.

He has served as principal investigator or co-investigator on several United States NASA interplanetary and planetary missions including IMP, Voyager, Ulysses, Galileo, and Cassini. Currently, he is principal investigator for instruments on the dual spacecraft NASA Radiation Belts Storm Probes mission scheduled for a May 2012 launch.

Lanzerotti has also served as a member or chair of numerous committees of the National Academy of Engineering (NAE) and the National Research Council (NRC) of the National Academies. In the NRC he most recently chaired the Committee to Assess the Safety and Security of Spent Nuclear Fuel, and chaired the Committee on Assessment of Options for Extending the Life of the Hubble Space Telescope. In 2006, on behalf of the Office of the Federal Coordinator for Meteorology, he chaired the Committee on the Assessment of the National Space Weather Program.

Lanzerotti has been elected a member of the National Academy of Engineering and of the International Academy of Astronautics. He is also a Fellow of the Institute of Electrical and Electronics Engineers (IEEE), the American Institute of Aeronautics and Astronautics (AIAA), the American Geophysical Union (AGU), the American Physical Society (APS), and the American Association for the Advancement of Science (AAAS). He was elected in 2008 to a five-year term as Chair of the Governing Board of the American Institute of Physics. He is the recipient of two NASA Distinguished Public Service Medals, the NASA Distinguished Scientific Achievement Medal, the COSPAR William Nordberg Medal, and the Antarctic Service Medal of the United States. Minor Planet 5504 Lanzerotti recognizes his space and planetary research, and Mount Lanzerotti (74.50° S, 70.33° W) recognizes his research in the Antarctic.

Session 3: The Future of Space Weather Science and Research Transition to Operations

Dr. Steve Butler

Executive Director, Air Force Materiel Command

BIOGRAPHY

Dr. Steve Butler, a member of the Senior Executive Service, is Executive Director, Air Force Materiel Command, Wright-Patterson Air Force Base, Ohio. Dr. Butler advises the AFMC Commander in managing all aspects of the command's mission to deliver war-winning capabilities, aircraft and weapon systems on time and on cost to America's warfighters. The command's 74,000 people manage $59 billion annually in research, development, test and evaluation while providing the acquisition management services and logistics support required to develop, procure and sustain Air Force weapon systems. As the command's senior civilian, Dr. Butler also advises the AFMC Commander on labor union relations and development of the civilian work force. Civilians make up more than 70 percent of the command -- the highest percentage among all Air Force major commands -- and AFMC employs 40 percent of the total Air Force civilians.

Dr. Butler has served in many broad assignments within the military departments. His assignments range from developing precision guided weapons to senior advisory roles in the Office of the Secretary of Defense. He served as the Deputy Program Director for the F-22 and the Technical Director for most of the Air Force's munitions inventory, including the Joint Direct Attack Munition. Dr. Butler served in the Air Force Research Laboratory and the 46th Test Wing where he was known for his hands-on expertise in electro-optical and radar guided weapons. Prior to his current assignment, he was Executive Director of Warner Robins Air Logistics Center, Robins AFB, Ga. Dr. Butler joined the Senior Executive Service in 1997.

Session 3: The Future of Space Weather Science and Research Transition to Operations

Captain Paul Stewart, USN
Commanding Officer, Naval Research Laboratory
Washington, D.C.

Space research and space technology has been a productive and vibrant activity at the Naval Research Laboratory [NRL] from the 1940's to the present. The Laboratory is well known as one of the most successful designers and builders of spacecraft in the United States. More than 90 satellites encompassing a variety of purposes have been built and launched, with an enviable record of success. In addition, numerous other space science and development activities have been performed in conjunction with US Air Force [USAF] and National Aeronautics and Space Administration [NASA] programs, as well as the many hundreds of space instruments and subsystems that the Laboratory has been called on to achieve. By any standard of measure – such as productivity, sponsor satisfaction, innovation, quality of personnel, archival publications – NRL's record compares most favorably with any major industrial, academic, national or Government laboratory. The NRL space program is important to C^4ISR, precision navigation and timing, orbital tracking, space situational awareness, maritime domain awareness, battlespace environmental awareness, and the fundamental understanding of geophysical phenomena and natural radiation sources. NRL space researchers advance understanding and predictive capability of the space domain in order to exploit the extended operational environment and its impact on Navy and DoD activities, and they envision, design, fabricate, integrate, test, launch, operate and experiment with forefront assets that preserve, protect, and enhance space platforms in the performance of functions that are of critical importance to Naval Fleet operations. The NRL space work represents cost effective coordination across the broader Office of Naval Research science and technology program, and that of other US Government Services and Agencies, to achieve significant progress.

BIOGRAPHY

Captain Stewart reported to the Naval Research Laboratory as the Commanding Officer in September 2008. From 2005 to 2008, Captain Stewart was assigned to the Office of Naval Research as the Deputy Director for the Ocean Battlespace Sensing Department and the Division Director of the Ocean, Atmospheric and Space Sensing and Systems Division; additionally, he served as the U.S. National Liaison Officer to the NATO Undersea Research Center in La Spezia, Italy.

In 2003, Captain Stewart was selected and served as the Commanding Officer/Director of the National Ice Center in Washington, DC, a NOAA, USN and USCG Command. From 2002 to 2003, Captain Stewart attended the National War College; prior to that he served as the Special Assistant for Ocean Resources and International Activities to the Assistant Secretary of the Navy (Installations and Environment) and in 2000, Captain Stewart reported to the Oceanographer of the Navy (OPNAV 096) as a special requirements officer. Captain Stewart was assigned as the assistant Oceanography and Meteorology assignment and placement officer from 1997 to 2000 at the Bureau of Naval Personnel in Washington, DC, also making the Bureau's transition to Tennessee in 1998.

Prior to his Bureau tour, Captain Stewart was on the staff of Commander, Cruiser-Destroyer Group Two aboard the USS *George Washington* (CVN-73) as Staff Oceanographer and Assistant Operations Officer. The Battle Group participated in extensive operations in the Mediterranean, Adriatic, Red Sea and Arabian Gulf; additionally, he qualified as Fleet Tactical Action Officer.

Captain Paul Courtney Stewart, a native of Longmeadow, Massachusetts, graduated Cum Laude from Hartwick College of Oneonta, New York, in May 1983 with a Bachelor of Science in Mathematics. He was commissioned an Ensign in 1984 at Officer Candidate School in Newport, Rhode Island. Captain Stewart holds a Master of Science degree in Physics (Meteorology and Oceanography) from the Naval Postgraduate School and a Master of Science degree in National Security Strategy from the National War College. A member of the Acquisition Professional Community, Captain Stewart is a certified level III Acquisition Professional in Science and Technology Management (STM).

Captain Stewart's awards include: Legion of Merit, Meritorious Service Medal with gold star, Navy and Marine Corps Commendation Medal with gold stars in lieu of third award, Navy and Marine Corps Achievement Medal with gold stars in lieu of fourth award, National Defense Service Medal with bronze star, Armed Forces Expeditionary Medal, Southwest Asia Service Medal, Military Outstanding Volunteer Service Medal, NATO Medal, Expert Rifleman Medal and Expert Pistol Medal.

Session 3: The Future of Space Weather Science and Research Transition to Operations

Dr. Arthur Charo

Senior Program Officer, Space Studies Board
National Research Council

"Space Weather Transition to Operations and Planning for the 2013-2022 NRC Decadal Survey in Solar and Space Physics"

National Research Council (NRC) decadal science strategy surveys provide decade-long retrospective and forward-looking assessments of the status of and outlook for a research field, and they provide broadly based recommendations for explicit scientific and programmatic priorities for future investments in the field. With the support of NASA, the NSF, and NOAA, the Space Studies Board of the NRC has begun a decadal survey to guide initiatives in solar and space physics ("heliophysics") during a ten-year period beginning in 2013. This presentation will provide an overview of plans for the survey with particular attention to tasks related to space weather and the transition to operations. It will also summarize NRC findings and recommendations from studies that have examined issues in the transition to operations and the extension of operations for NASA Earth science missions.

BIOGRAPHY

Arthur Charo is the senior staff officer at the National Research Council supporting the work of the Committee on Solar and Space Physics and the Committee on Earth Studies. Dr. Charo has been employed by the Space Studies Board of the NRC since 1995. During this time, he has directed studies that have resulted in some 30 reports, notably the first NRC decadal survey for solar and space physics (2002) and the first decadal survey for Earth science and applications from space (2007).

Dr. Charo received his Ph.D. in physics from Duke University in 1981 and was a post-doctoral fellow in chemical physics at Harvard University from 1982 to 1985. He then pursued his interests in national security and arms control at Harvard University's Center for Science and International Affairs, where he where he was a fellow from 1985 to 1988. From 1988 to 1995, he worked as a senior analyst and study director in the International Security and Space Program in the Congressional Office of Technology Assessment (OTA).

Dr. Charo is a recipient of a MacArthur Foundation Fellowship in International Security (1985-1987) and a Harvard-Sloan Foundation Fellowship (1987-1988). He was the 1988-1989 American Institute of Physics AAAS Congressional Science Fellow. His publications include research papers in millimeter-wave and molecular beam/far-infrared laser spectroscopy; reports for OTA on arms control, Earth remote sensing, and space policy; and a monograph, *Continental Air Defense: A Neglected Dimension of Strategic Defense* (University Press of America, 1990).

Session 3: The Future of Space Weather Science and Research Transition to Operations

Dr. Devrie S. Intriligator

Senior Research Physicist and Director of the Space Plasma Laboratory
Carmel Research Center

"Growing the Space Weather Enterprise:
It Requires Coordination, Cooperation – and Data"

In the past decade scientists have greatly advanced our understanding of space physics, but we cannot hope to monitor — much less predict — space weather and its potentially devastating impacts without access to reliable real-time and long-term data sources. Thus, prompt launch of the DSCOVR spacecraft remains our top priority. At the Space Weather Workshop in April 2010, I organized and moderated a roundtable called "Growing the Space Weather Enterprise." That group discussed specific policy recommendations, including:

- Working toward the urgent launch of DSCOVR
- Partnering between government agencies and the private sector
- Fostering a ten-fold increase in the size of the entire space weather enterprise
- Promoting the creation of a Space Weather Coordinator at the Office of Science and Technology Policy.

Today we know more than ever about how solar disturbances move from the Sun, past the Earth, and to the edges of our solar system and beyond. This knowledge is critical for understanding space-weather effects in the near-Earth environment. Progress in this area has been fueled by interdisciplinary cooperation that bridges basic and applied fields. In this presentation I will briefly discuss some of the latest advances in this field, how some of these are moving toward operational readiness, and how this work has only been possible thanks to timely, reliable, and accurate data sources.

BIOGRAPHY

Dr. Devrie S. Intriligator has been actively working in space weather research and developing forecast applications for many years.
Policy and Advising: She has served as Chair of the National Academy of Sciences (NAS) - National Research Council (NRC) Committee on Solar-Terrestrial Research and as U.S. National Representative to the International Commission on Scientific Union's Scientific Committee on Solar-Terrestrial Physics. Intriligator cochaired with Dr. Herbert Friedman the NAS-NRC study "Solar-Terrestrial Research for the 1980s" and chaired the NAS-NRC study "National Solar-Terrestrial Research Program." These studies led to satellite missions and programs including the International Solar Terrestrial Physics (ISTP) Mission, the National Space Weather Program, and NASA's Sun-Earth Connections program. Intriligator has been a member of numerous NAS-NRC boards and study groups; and of NOAA, NASA, and NSF advisory panels. Intriligator has presented many briefings to key U.S. government officials, including the President's Science Advisor.
Research: Dr. Intriligator has published more than 120 papers in refereed publications, 80 as principal author. She worked as both a lead and a co-investigator on plasma experiments, including on Pioneer 10 and 11, Pioneer Venus Orbiter, and on heliocentric spacecraft. She has worked on all phases of mission and experiment development from the initial conception and planning to instrument design, hardware, calibration, integration, testing, spaceflight operations, and data analyses. Intriligator holds a Ph.D. from the University of California, Los Angeles, and an S.B. and S.M. in physics from the Massachusetts Institute of Technology.

Moderator

Dr. Joseph M. Davila
Laboratory for Solar & Space Physics
NASA Goddard Space Flight Center

Joseph Michael Davila is currently an Astrophysicist in the Solar Physics Branch at Goddard Space Flight Center in Greenbelt, Maryland. Born December 30, 1948, Dr. Davila earned a BS in Mechanical Engineering from Lamar University, Beaumont, TX in 1972, a BS in Physics from the University of California, Irvine in 1978 and a PhD in Astronomy from the University of Arizona in 1982. He is a member of the American Astronomical Society, the American Geophysical Union and the International Astronomical Union. His research interests have included the linear and non-linear theory of hydromagnetic waves; hydromagnetic instabilities due to energetic particle beams, resonance absorption in inhomogeneous plasmas, the acceleration of high speed wind streams in solar and stellar coronal holes, and plasma heating in closed magnetic structures. Dr. Davila has also published research on the acceleration of cosmic rays, the transport of energetic, particles within the Galaxy, the modulation of Galactic cosmic rays by the solar wind and the propagation of solar cosmic rays in the interplanetary medium. Dr. Davila was Principal Investigator for the Solar Extreme-ultraviolet Research Telescope and Spectrograph (SERTS), he was the Project Scientist for STEREO, and is the lead scientist for COR1 on the STEREO mission, and Co-Investigator on the Hinode and Solar orbiter missions.

Session 4: International Activities and Cooperation

International Space Weather Initiative (ISWI)

Hans J. Haubold
United Nations Office for Outer Space Affairs, Vienna International Centre,
A-1400 Vienna, Austria, hans.haubold@unvienna.org

The United Nations Committee on the Peaceful Uses of Outer Space (UNCOPUOS), in its fifty-second session in Vienna from 3 to 12 June 2009, noted the importance of continuing to build upon the successes of the International Heliophysical Year 2007 (IHY 2007, http://ihy2007.org/), in particular by deepening the understanding of the function of the Sun and its effects on the Earth's magnetosphere, environment and climate, and noted with satisfaction the agreement reached by the Scientific and Technical Subcommittee at its forty-sixth session to consider, beginning at its forty-seventh session in February 2010, a new agenda item entitled "International Space Weather Initiative (ISWI)" under a three-year work plan (2010, 2011, 2012) with specific focus on the effects of space weather on the Earth. ISWI has been endorsed by the UN General Assembly as one of the priority activities of the UN Programme on Space Applications. ISWI will utilize the ground-based world-wide IHY instrument arrays under deployment since 2005. International ISWI workshops have been tentatively scheduled to be hosted by Egypt (2010; http://iswi.cu.edu.eg/) for Western Asia, Nigeria (2011) for Africa, and Ecuador (2012) for Latin America and the Caribbean. Major elements of ISWI will be issuing of an ISWI Newsletter by Bulgaria and an ISWI Website (http://www.iswi-secretariat.org/) by Japan on a continuing basis in the period of time 2010-2012 to assure world-wide delivery of the results of ISWI and its instrument arrays. This will cover all 192 Member States of the United Nations.

BIOGRAPHY

Dr. Hans J. Haubold is pursuing research in astrophysics and co-authored four books, on nuclear astrophysics (with A.M. Mathai; Akademie-Verlag Berlin, 1988), on the early universe and formation of structure (with S. Gottloeber, J.P. Muecket, V. Mueller, Akademie-Verlag 1990), on special functions for applied scientists (with A.M. Mathai, Springer 2008), on the theory and applications of the H-function (with A.M. Mathai, R.K. Saxena, Springer 2009), and two major review articles on the sun (with A.M. Mathai; Encyclopedia of Planetary Sciences, Chapman and Hall, London, UK, 1997, and Kluwer Academic Publishers, The Netherlands, 2000) and on the structure of the universe (with A.M. Mathai; Encyclopedia of Applied Physics, Vol. 23, Wiley-VCH, New York and Weinheim, Germany, 1998). He is a member of the editorial board of the international journal "Astrophysics and Space Science" and "Earth, Moon, and Planets" (both published by Springer) and STARS (St. Thomas College, Pala, India). He is the (co-)author of more than 250 scientific and technical papers in the fields of astrophysics, mathematics, history of physics, and international cooperation in space science and technology.

Since 1988 he has also been with the United Nations Office for Outer Space Affairs, firstly in New York and latterly in Vienna, Austria, since 1993. At the United Nations he spearheaded the development of education curricula in remote sensing and GIS, satellite meteorology and global climate, satellite communications, and space and atmospheric science for the UN-affiliated Regional Centres for Space Science and Technology Education. Since 1991 he is the principal organizer of the United Nations Basic Space Science Initiative and co-editor of 12 volumes of Proceedings that emanated from this initiative. The decadal report on this initiative titled "Developing Basic Space Science World-Wide" was published by Kluwer Academic Publishers, Dordrecht, The Netherlands, in 2004 (co-edited by W. Wamsteker, R. Albrecht, and H.J. Haubold).

Hans J. Haubold is a member of the Centre for Mathematical Sciences (Pala and Trivandrum, India). He is also a member of the German Physical Society, German Mathematical Society, American Mathematical Society, Society for Industrial and Applied Mathematics, American Astronomical Society, History of Science Society, Committee on Space Research, and the International Astronomical Union. He is maintaining websites at *neutrino.aquaphoenix.com* and *www.cmsintl.org*.

Session 4: International Activities and Cooperation

Juha-Pekka Luntama

Space Weather Manager, ESA SSA Preparatory Programme

European Space Agency (ESA) has started in 2009 a new programme called Space Situational Awareness (SSA). The overall objective of the ESA SSA Programme is to support the European independent utilisation of and access to space research or services. This will be performed through providing timely and quality data, information, services and knowledge regarding the environment, the threats and the sustainable exploitation of the outer space surrounding the planet Earth. SSA serves the implementation of the strategic missions of the European Space Policy based on the peaceful uses of the outer space by all states, by supporting the autonomous capacity to securely and safely operate the critical European space infrastructures. The first phase of the programme covering the period 2009 - 2011 is called SSA Preparatory Programme. Its objective is to establish the initial system elements that will eventually lead into the full deployment of the European SSA services. The objectives of the SSA preparatory programme include the implementation of a number of precursor services in the areas of Space Surveillance, Space Weather and Near Earth Objects (NEOs).

The Space Weather (SWE) segment of the SSA will provide user services related to the monitoring of the Sun, the solar wind, the radiation belts, the magnetosphere and the ionosphere. These services will include near real time information and predictions about the characteristics of the space environment and space weather impacts on man made systems, and a permanent database for analysis, model development and scientific research. These services are aimed at supporting for example spacecraft designers, spacecraft operators, human space flights, users and operators of transionospheric radio links, other SSA segments, and space weather research community.

International cooperation is a vital element both in collection of the observations enabling the SWE services and in enhancing the services to better meet the needs of the users. The SWE team in ESA has already strong links with the respective teams in the US and in many other countries around the world. The effort to strengthen these links is one of the key aspects of the ongoing work in the SWE segment of the SSA Programme.

BIOGRAPHY

Mr. Luntama is the manager of the Space Weather (SWE) Segment in the Space Situation Awareness (SSA) Preparatory Programme in the ESA. He is leading an Agency wide team establishing operational SWE services in the framework of the programme. The approach adopted by ESA is to develop the services by exploiting the European expertise in the SWE domain under the coordination of ESA. Thus, Mr. Luntama is also managing the industrial contracts and studies related to the establishment and development of the services. Mr. Luntama is the point of contact in ESA for the SWE services related international collaboration activities.

Before joining ESA in 2009, Mr. Luntama was working in the Finnish Meteorological Institute (FMI) leading the research on GNSS based ionospheric monitoring and error mitigation techniques. His main area of interest was high resolution ionospheric imaging by tomography. Before that Mr. Luntama worked for many years in the European meteorological satellite organisation EUMETSAT in Darmstadt, Germany. In EUMETSAT he was leading the development of the Radio Occultation observation system GRAS (GNSS Receiver for Atmospheric Sounding) for the EPS (EUMETSAT Polar System) mission.

Session 4: International Activities and Cooperation

Dr. David Kendall

Director General, Space Science and Technology, Canadian Space Agency

"A Canadian Perspective"

Canada has been a leader in space weather activities since the launch of its first satellite, Alouette-1, in 1962. Since then, three other indigenous space weather satellites as well as numerous scientific instruments have been flown on international missions, including those of the United States, Japan, Sweden and Russia. Given its geographic location, Canada is probably more susceptible to space weather effects than any other country. The nine-hour total power blackout that occurred in the province of Quebec in 1989 caused by space weather effects illustrates the significant issues faced through induced currents from solar storms. Canada continues to cooperate with international partners in working towards the elusive goal of being able to reliably predict space weather events, and, next year, will launch its next indigenous small satellite dedicated to elucidating space weather phenomena – the so-called extended Polar Outflow Probe (e-POP) mission that includes contributions from the US and Japan. Canada is also contributing an electric field instrument to ESA's SWARM mission and is in the planning stage of both a new indigenous two-satellite Molniya orbit program that will include advanced space weather instrumentation, a mission to the Earth's outer radiation belts as well as potentially contributing to new space weather programs of China (Kuafu) and Japan (SCOPE).

BIOGRAPHY

Dr. Kendall is Director General of the Space Science and Technology Branch of the Canadian Space Agency. He is also a faculty member of the International Space University based in Strasbourg, France.

Dr. Kendall's scientific interests include upper and middle atmospheric chemistry and physics, atmospheric spectroscopy, Michelson interferometry, auroral imaging and space environment interactions. He was principal investigator of an experiment that was flown on Space Shuttle mission STS-41G to measure "shuttle glow". He has also been a visiting scientist at the Service d'Aeronomie (CNRS) in Paris, France.

Dr. Kendall is author or co-author of approximately 30 publications in refereed journals, a book chapter on the space environment, and over 100 other scientific reports, articles, presentations and conference papers. He serves on numerous national and international advisory committees and working groups, is the past Canadian National Representative to both the Committee on Space Research (COSPAR) and the Scientific Committee on Solar-Terrestrial Physics (SCOSTEP), is currently a COSPAR Bureau Member, a full member of the International Academy of Astronautics (IAA), a Vice-President and Bureau member of the International Astronautical Federation (IAF), a member of the Board of the Canadian Foundation for the International Space University, and a past co-chair of a subgroup of the international ad hoc Group on Earth Observations (GEO). In 2002, Dr. Kendall was awarded the Queen Elizabeth II Golden Jubilee Medal in recognition of significant achievement to Canada. Dr. Kendall has a deep interest in science education and has talked and lectured extensively to school and university groups. He is a member of the American Geophysical Union and is listed in Canadian Who's Who.

Session 4: International Activities and Cooperation

Richard H. Buenneke
Deputy Director, Space Policy, U.S. Department of State
Washington, DC

BIOGRAPHY

Richard H. Buenneke is the deputy director for space policy in the Office of Missile Defense and Space Policy, Bureau of International Security and Nonproliferation at the United States Department of State in Washington, D.C. In his current position, Mr. Buenneke leads the planning and implementation of diplomatic and public diplomacy activities relating to U.S. national security space policy.

Before joining the State Department as a Foreign Affairs Officer in March 2007, Mr. Buenneke was a senior policy analyst at The Aerospace Corporation, a federally-funded research and development center. In this position, he led Aerospace's support to the planning and strategy directorate of the National Security Space Office in U.S. Department of Defense's Executive Agent for Space. In this assignment, he served as lead analyst for NSSO's work on commercial satellite protection.

From 2001 to 2003, he led Aerospace's Center for Space Policy and Strategy. Prior to joining Aerospace, Mr. Buenneke was a space policy analyst at Booz Allen Hamilton in McLean, Va., and the RAND Corporation in Santa Monica, Calif. In these positions, he participated in studies on the health of the U.S. space industrial base, military use of commercial space capabilities, and operational requirements for satellite early warning systems.

Mr. Buenneke holds bachelors degrees in economics and systems engineering from the Wharton and Engineering schools of the University of Pennsylvania. He also holds masters' degrees in policy analysis from George Washington University's Elliott School of International Affairs and the Pardee RAND Graduate School.

Session 5: Critical Infrastructure Support

Moderator

Dr. Daniel Baker
University of Colorado-Boulder
Director, Laboratory for Atmospheric and Space Physics
Professor, Astrophysical and Planetary Sciences
Professor of Physics

Dr. Daniel Baker is Director of the Laboratory for Atmospheric and Space Physics at the University of Colorado-Boulder and is Professor of Astrophysical and Planetary Sciences and Professor of Physics there. His primary research interest is the study of plasma physical and energetic particle phenomena in planetary magnetospheres and in the Earth's vicinity,. He conducts research in space instrument design, space physics data analysis, and magnetospheric modeling. Dr. Baker has published over 750 papers in the refereed literature and has edited six books on topics in space physics. He is a Fellow of the American Geophysical Union, the International Academy of Astronautics, and the American Association for the Advancement of Science (AAAS). He currently is an investigator on several NASA space missions including the MESSENGER mission to Mercury, the Magnetospheric MultiScale (MMS) mission, the Radiation Belt Storm Probes (RBSP) mission, and the Canadian ORBITALS mission. He has won numerous awards for his research efforts and for his management activities including recognition by the Institute for Scientific Information as being “Highly Cited” in space research. Dr. Baker was chosen as a 2007 winner of the University of Colorado’s Robert L. Stearns Award for outstanding research, service, and teaching. Honors in 2010 include the AIAA James A. Van Allen Space Environments Award/Medal and the University of Colorado Council on Research and Creative Work Distinguished Research Lecturer Award. Dr. Baker was elected to membership of the National Academy of Engineering in 2010. Dr. Baker presently serves on several national and international scientific committees including the Space Studies Board of the National Academy of Sciences. He presently serves on advisory panels of the U.S. Air Force and other federal agencies. He was a member of the NRC’s 2003 Decadal Survey Panel for solar and space physics and he was a member of the 2006 Decadal Review of the U.S. National Space Weather Program.

Session 5: Critical Infrastructure Support

Rear Admiral Diane E. H. Webber

Director, Command Control Systems
North American Aerospace Defense Command and United States Northern Command

United States Northern Command (USNORTHCOM) is responsible for providing Homeland Defense and Defense Support of Civil Authorities (DSCA). Under the DSCA mission USNORTHCOM responds to natural disasters or other emergencies when directed by the Secretary of Defense. If major critical infrastructure damage is caused by a severe space weather event, USNORTHCOM could be called upon by the Department of Homeland Security (DHS) to assist with mitigating the effects on advanced technologies. USNORTHCOM has a robust relationship with DHS to address the full range of DSCA support, to include supporting issues within the Nation's critical infrastructure. USNORTHCOM will use established processes and procedures to respond to a space weather event just as it would in other crisis situations. Given the unique aspects of space weather, USNORTHCOM will have a key role in helping to educate mission partners, facilitating information sharing, understanding effects of space weather on critical infrastructure, sharing space weather warning data, being prepared to provide proper level of response, and exercising our response options with DHS.

BIOGRAPHY

Rear Admiral Diane E.H. Webber is the Director, Command Control Systems, for the North American Aerospace Defense Command and United States Northern Command, Peterson Air Force Base, Colorado. She is responsible for synchronizing command-wide information superiority and architecture efforts to enable the Commander, NORAD and USNORTHCOM, in planning and executing military operations throughout his area of responsibility, and providing military assistance to civil authorities, including critical infrastructure protection.

Rear Admiral Webber's career consists of many diverse assignments, to include assignments within the Navy's Integrated Undersea Surveillance System; Officer in Charge of the Surface Ship Anti-Submarine Warfare (ASW) Analysis Center (SSAAC); Enlisted Plans and Community Management Branch at the Bureau of Naval Personnel; Intern on the Joint Staff in the Military Education Division (J7); several tours at the Naval Computer and Telecommunications Command; Combat Systems Officer on board the USS GEORGE WASHINGTON; Director, Communications and Information Systems (CIS) Coalition Force Plans/Joint Network Control Center (JNCC), Multi National Forces, Iraq (MNF-I); Director, Communications Information Systems at Commander, Second Fleet; and Executive Assistant to the Deputy Chief of Naval Operations for Communication Networks.

Rear Admiral Webber holds a Master of Arts in Management from the University of Redlands (California), and a Master of Military Science from the United States Marine Corps Command and Staff College. A recipient of the Naval Historical Center's Admiral Samuel E. Morison Supplemental Scholarship, she has completed doctoral coursework in International Relations at Catholic University. She holds certificates in Chief Information Officer and Information Assurance from Information Resource Management College, and Information Operations (IO) from the Naval Postgraduate School.

Session 5: Critical Infrastructure Support

Dr. Chris Beck
Senior Advisor for Science and Technology
House Committee on Homeland Security

BIOGRAPHY

Chris Beck is the Senior Advisor for Science and Technology for the House Committee on Homeland Security (CHS), where he has worked since May 2005. His portfolio includes several homeland security related areas including, WMD prevention and protection, critical infrastructure protection, emerging threats, cybersecurity, and science and technology. Prior to CHS, he worked in the office of Congresswoman Loretta Sanchez for three years, beginning as a Congressional Science Fellow and then as a legislative assistant. Prior to government service, Chris was a postdoctoral fellow and adjunct professor at Northeastern University. Chris holds a PhD in physics from Tufts University (2001) and a B.S. in physics from Montana State University (1994). He served in the Marine Corps Reserve for five years (1987 – 1992).

Session 5: Critical Infrastructure Support

Dr. Denise Stephenson Hawk

Consultant and Former Director, Societal-Environmental Research and Education Laboratory, National Center for Atmospheric Research

Space weather affects the daily activities and lifestyles of the public in ways that include access to satellite-based communication networks; and the availability of power, which is needed to support transportation systems; water and food safety; hospitals and health care; and myriad additional electrical needs from computer systems to lighting. In general, the public is not aware of the fact that space weather can adversely impact their lives. This is due, in large measure, because of the work performed by managers and operators to mitigate the risk of catastrophic failures that would disrupt the lives of people and compromise many economic, military and civilian systems. Their work is accomplished through the use of space weather forecasts provided by NOAA's Space Weather Prediction Center and public-private sector partnerships. Historical records suggest that the risk of large-scale failures is low; however, the risk does exist. Subsequently, to safeguard the public welfare during a severe space weather event that results in widespread failure of power grids and communication systems, decision-makers must ensure that the public is prepared to respond. Preparedness must begin well before catastrophic failure occurs because at the moment of failure, traditional avenues of communication will be rendered inoperable. To ensure the public's resilience in the event of failure requires the existence of an education and awareness agenda designed to mitigate widespread panic and ensure safety without loss of life. Resilience across large geographical areas that affect the lives of millions of people can only be accomplished through partnerships among organizations that support the public. Viable partnerships are essential.

BIOGRAPHY

Denise Stephenson Hawk, Ph.D., is an environmental and educational consultant and holds the position CEO of The Stephenson Group, LLC, a consulting organization based in Atlanta, Georgia. She is the former Director of the Societal-Environmental Research and Education Laboratory at the National Center for Atmospheric Research (NCAR) in Boulder, CO, which engaged in the use of weather, water and climate data and information to address the need for societal resilience. As a consultant, Dr. Stephenson Hawk provides strategic, operational and tactical planning advice to federal, state and local organizations that support the public's need for preparedness and resilience when confronted by weather, climate and water related events. Her work focuses on analyses and development of policies and plans for purpose of improving the way that decisions are made and actions taken by elected officials, managers, and the public regarding these events.

Dr. Stephenson Hawk has conducted research at the National Aeronautics and Space Administration (NASA) where she analyzed and modeled earth radiation budget satellite measurements for use in understanding changes in climate and the dynamics of the troposphere. Additionally, she has worked for AT&T Bell Laboratories as a systems analyst engaged in applied atmosphere-ocean-acoustics research designed to detect, locate and track submarines in support of U.S. Navy operations. She served as professor of physics and founding director of the Earth Systems Science Program at Clark Atlanta University. This academic and research program examines the interdisciplinary and multidisciplinary coupling of the atmosphere, hydrosphere, biosphere, and geosphere.

Dr. Stephenson Hawk currently serves on the National Academies Roundtable on Science and Technology for Sustainability and has served as a member of the science advisory boards for the Department of Interior's Minerals Management Service (MMS); the National Oceanic and Atmospheric Administration (NOAA), NASA, the National Science Foundation (NSF) Geosciences Directorate, and the Ocean Research Advisory Panel (ORAP) for the National Oceanographic Partnership Program (NOPP.) Dr. Stephenson Hawk earned Ph.D. and M.A. degrees in geophysical fluid dynamics from Princeton University; and the M.S. degree in environmental modeling from The George Washington University.

ACKNOWLEDGMENTS

The 2010 Space Weather Enterprise Forum would not have been possible without the direction and support of the National Space Weather Program Council, the support of the Committee for Space Weather, and the staff of the Office of the Federal Coordinator for Meteorology. We thank our sponsoring agencies and contributors, and especially all of our speakers, moderators, panelists, and participants.

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We thank the University Corporation for Atmospheric Research and Susan Baltuch for their help in planning the forum and arranging for the venue.

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