Meeting Minutes of the Subcommittee on Disaster Reduction

6 December 2012, 10:00 a.m. to 12:00 p.m., White House Conference Center Lincoln Room

Italics indicate absent members. "T" indicate members participating via teleconference.

Co-chairs

David Applegate (USGS)
Margaret Davidson (NOAA)
Dennis Wenger (NSF)

OSTP Liaison

Tamara Dickinson (OSTP)

Designated Representatives

BLM *Edwin Roberson*
CDC *Mark Keim*
DHS Bruce Davis
DHS/FEMA *TBD*
DHS/USCG *Austin Gould*
DOD *Al Johnson*
DOE Patricia Hoffman
DOT Sheila Duwadi
EOP/OMB *Grace Hu*
EOP/OSTP Tamara Dickinson
EPA *Peter Jutro*
Stephen Clark
FERC Pamela Romano (T)
HUD *Dana Bres*
NASA Craig Dobson
NGA *Paul Lewis*
NGB *TBD*
NIH *Allen Dearry*
NIST Marc Levitan (T)
NOAA Margaret Davidson (T)
Christopher Strager
NPS *Marcy Rockman*
NSF Dennis Wenger
OPHS *Estella Jones*
State *Fernando Echavarria*
USACE *Steven Cary*
Dimitra Syriopoulou
USAID Sezin Tokar
USDA *TBD*
USFS *Elizabeth Reinhardt*
Carlos Rodriguez-Franco
USGS *David Applegate*
USNRC *Jennifer Uhle*

Other Attendees

DHS S&T Mary Ellen Hynes
DHS/FEMA Angela Gladwell
Paul Huang
Kayed Lakhia
Rachel Sears
EOP/CEQ Kevin Bush
EPA Brendan Doyle
Paul Kudarauskas
NGA Jerry Tuttle
State Rajan Sen
USACE Andrew Bruzewicz
USCG Tung Ly (T)
USFS Dale Dague
USGS John Haines
USNRC Brett Rini
Secretariat Bret Schothorst
Barbara Haines-Parmele

Agenda

10:00 Welcome and Introductions
10:05 Roundtable Overview of Updated Agency S&T Activities in Response to Hurricane Sandy
11:20 Discussion of SDR Policy Priorities for the Next Presidential Term
11:40 Report from the Co-chairs and Approval of Minutes
11:45 Report from the OSTP Liaison
11:55 Close and Next Actions

Handouts

- December Meeting Agenda
- Draft November Meeting Minutes
- Agency Slides on S&T Activities in Response to Hurricane Sandy

I. Welcome and Introductions

Subcommittee on Disaster Reduction (SDR) Co-chair Dennis Wenger (NSF) called the meeting to order at 10:00 a.m., and participants introduced themselves.

II. Roundtable Overview of Updated Agency S&T Activities in Response to Hurricane Sandy

As a follow-up to last month's roundtable in the wake of Hurricane Sandy, the SDR continued its discussion of agency S&T-specific activities in response to the storm and looked ahead to lessons learned and interagency S&T coordination needs for the response, recovery, and rebuilding phases. The following agency perspectives were reported as summarized below: FEMA, DHS S&T, NOAA, USGS, EPA, USNRC, NIST, USACE, DOT/FHWA, NASA, NGA, USFS, USAID/OFDA, and NSF.

With regard to flood hazard zones in the areas affected by Hurricane Sandy, Paul Huang (FEMA) kicked off the discussion by noting that FEMA is in the process of creating Advisory Base Flood Elevation (ABFE) maps that will highlight: the one percent and 0.2 percent annual chance flood elevations; areas and limits of structurally damaging wave action; preliminary Hurricane Sandy high-water marks; and coastal barrier resource areas. ABFE maps will be completed in conjunction with the Risk Mapping, Assessment, and Planning (Risk MAP) Program. Risk MAP's vision is to deliver quality data that increases public awareness and leads to action that reduces risk to life and property. FEMA is collaborating with Federal, state, and local stakeholders after the disaster to achieve the following goals under Risk MAP:

- Flood Hazard Data: address gaps in flood hazard data to form a solid foundation for risk assessment, floodplain management, and actuarial soundness of the National Flood Insurance Program (NFIP);
- Public Awareness/Outreach: ensure that a measurable increase of the public's awareness and understanding of risk results in a measurable reduction of current and future vulnerability;
- Hazard Mitigation Planning: lead and supports, local, and tribal communities to effectively engage in risk-based mitigation planning resulting in sustainable actions that reduce or eliminate risks to life and property from natural hazards;
- Enhanced Digital Platform: provide an enhanced digital platform that improves management of Risk MAP, stewards information produced by Risk MAP, and improves communication and sharing of risk data and related products to all levels of government and the public; and
- Alignment and Synergies: align risk analysis programs and develop synergies to enhance decision-making capabilities through effective risk communication and management.

Kayed Lakhia (FEMA) also outlined that FEMA engaged in actions of the Mitigation Assessment Team (MAT) Program in the aftermath of Hurricane Sandy, which are forensic studies following major disaster to assess damage to commercial and residential structures to determine causes of structural failures and document successes. The MAT Program prepares recommendations for improved construction best practice, national codes and standards, collaborates with state and local governments, and draws on private sector technical expertise. FEMA also conducted pre-MAT activities of preliminary field observations to verify reports of damage and validate issues identified for potential study (foundation failures, siting issues, building envelop weaknesses, utility vulnerabilities, unanticipated issues, etc). For the Hurricane Sandy MAT, two- and three-person teams toured the New Jersey coast, New York City, and Connecticut to validate which issues will be studied. Preliminary topics include the following seven areas: 1) Coastal Damage; 2) Urban flooding; 3) Hospitals; 4) Police/Fire/Emergency facilities; 5) Historical; 6) HMA project performance; and 7) Facility infrastructure performance.

Bruce Davis (DHS S&T) stated that DHS S&T provided R&D to FEMA that supported the development of remote sensing imagery specifications that the Civil Air Patrol (CAP) could use in the provision of imagery for response and recovery. CAP collected over 150,000 photographs of the areas affected by

Hurricane Sandy, and, along with 12,000 images from NOAA, FEMA was able to expedite the processing of over 44,0000 individual assistance applications as well as provide greatly improved situational awareness to emergency managers.

Chris Strager (NOAA/NWS) reported that NOAA's National Geodetic Survey (NGS) conducted aerial photographic surveys of coastal areas within 12 hours of storm landfall. Two NOAA Office of Marine and Aviation Operations aircraft were used that carried NGS Digital Sensor Systems to collect spatially referenced imagery. Over 12,000 images were collected and processed covering over 3,000 miles of coastline. Imagery was processed within 6 to 12 hours of collection, and hosted by NOAA National Ocean Service (NOS) and NGS servers and made available via http://storms.ngs.noaa.gov/storms/sandy/. A mobile device compliant/friendly website was also simultaneous available via http://storms.ngs.noaa.gov/storms/sandy/mobile/. To date, there have been over 37 million visits to the website(s) and over 8 terabytes of data downloaded. The data provided emergency and coastal managers with critical information needed to develop recovery strategies, facilitate search-and-rescue efforts, identify hazardous materials spills, locate errant vessels, and provide documentation necessary for damage assessment through the comparison of before-and-after imagery. According to NOAA, FEMA used the NOS/NGS imagery to assess damage, expedite claims from the public, and project temporary housing and subsidence needs. The imagery also provided a useful tool to private citizens for assessing damage to public and private properties in their community.

NOAA's Office of Coast Survey began providing emergency hydrographic services for port areas, mobilizing prior to the storm and beginning their survey work as soon as the storm passed. Navigation Response Teams, mobile emergency response units which use echo sounders to check for shoaling and submerged obstructions that pose hazards to vessels, and other NOAA vessels, provided surveys that sped the re-opening of ports and waterways, allowing the flow of relief supplies, and enabling the resumption of ocean commerce – valued at more than $1 trillion annually to the nation's economy – to resume (http://www.nauticalcharts.noaa.gov/nsd/nrt.html). NOAA ship *Ferdinand Hassler* completed their survey of deep draft ship channels in the mouth of the Chesapeake Bay as 78 large vessels, including portions of the Navy's Atlantic Fleet, waited to transit through the entrance to Chesapeake Bay. NOAA ship *Bay Hydro II* also surveyed channels needed by coal shipments and aircraft carriers at Norfolk.

Strager stated that NOAA's Coast Survey Development Laboratory (CSDL) provided technical support on storm surge, tides, and datums to NWS forecasters during Sandy. CSDL provided graphical output from experimental storm surge models to the National Hurricane Center that captured the vast scale of the storm and combined surge, tide, and wave effects. Storm surge experts in CSDL also assisted NWS forecasters in the assessment of storm surge model guidance as a wide variety of sources were used to assess Sandy, and provided guidance on tidal ranges in New York Harbor. CSDL responded to requests for information about water level and wave conditions in the Great Lakes due to Hurricane Sandy. FEMA received information about NOAA operational and experimental models of the Great Lakes, and how to monitor water level conditions at NOAA gauges.

The progress in NOAA/NWS Hurricane Forecast Improvement Project (HFIP) experimental models indicated Hurricane Sandy development and movement before the first clouds arrived in Caribbean. The benefits of HFIP will significantly improve NOAA's forecast services through improved hurricane forecast science and technology. Forecasts of higher accuracy and greater reliability (i.e., user confidence) are expected to lead to improved public response, including savings of life and property. NOAA/NWS support, use, and interpretation of the Probabilistic Tropical Storm Surge model and the Extra-Tropical Storm Surge model helped to provide the storm surge forecasts. NOAA provided visualization of its Extratropical Surge and Tide Operational Forecast System model.

Throughout the storm, Strager outlined that NOAA's Center for Operational Oceanographic Products and Services regularly posted and updated its Storm Quicklook, a real time water level synopsis of locations most affected by severe storm tides. Providing real time data to emergency responders when they most need it helps save lives and property. NOAA's Office of Response and Restoration is actively supporting the U.S. Coast Guard with on-scene emergency responders and Geographic Information System (GIS) experts, as the Coast Guard receives more reports of pollution incidents and port damage. The Atlantic Environmental Response Management Application (ERMA) site is currently running and is being updated with relevant data for Hurricane Sandy. The site was not intended for public release until December 2012 per an EPA funding agreement. However, due to recent testing at a response drill, the Atlantic ERMA was fully populated with base data and many response data layers (e.g., ESI maps). (http://response.restoration.noaa.gov/maps-and-spatial-data/environmental-response-management-application-erma)

In addition, Strager mentioned that: 1) NOAA's Digital Coast website provided blogs on Sandy Data resources and on post-storm data resources; 2) NOAA coordinated with FEMA Region II on their Advisory Base Flood Elevation mapping effort to make sure users of NOAA resources get and understand this new guidance from FEMA; and 3) documents related to understanding climate variability and change to enhance society's ability to plan for and respond to extreme events like Hurricane Sandy are available online and include the Coastal Technical Input Report to the National Climate Assessment (http://downloads.usgcrp.gov/NCA/technicalinputreports/Burkett_Davidson_Coasts_Final_.pdf) and Global Sea Level Rise Scenarios for the United States National Climate Assessment (http://www.cpo.noaa.gov/reports/sealevel/).

In the wake of Hurricane Sandy, John Haines (USGS) reported that USGS is providing critical information to ensure resources are prioritized to those areas that are most vulnerable and where actions will significantly reduce future vulnerability and build coastal resilience. Going forward, USGS science can support decision makers by assessing Sandy impacts; by identifying where our coasts and communities are particularly vulnerable, including new or increased vulnerabilities as a consequence of Sandy; and by forecasting how vulnerability and resilience change as a result of continuing response and recovery efforts. USGS deployed field crews from Maine to Maryland, totaling 164 personnel, both ahead of the storm and in response to Hurricane Sandy. Prior to the storm, those crews deployed 143 storm-surge sensors, 8 rapid-deployment streamgages, 9 wave-height sensors, and 63 barometric-pressure sensors. After the storm, field crews identified over 800 high-water marks and are well on their way to surveying these; this data is used by FEMA, USACE, NOAA/NWS, and others for storm-surge analysis and to improve storm-surge models. Prior to landfall, USGS scientists used modeled storm surge and wave conditions and observations from LIDAR (LIght Detection And Ranging) remote sensing of beach and dune elevations to determine what types of coastal change might be expected during landfall. Probabilities were provided for the likelihood of: 1) dune erosion; 2) overtopping of dunes and inland penetration of waves and sand (overwash); and 3) inundation of barriers wherein storm forces penetrate across coastal barriers (can lead to catastrophic barrier failure including inlet formation).

Haines outlined that USGS staff members are working to assess the impact of the storm on the coastline from Cape Hatteras to Montauk, Long Island. The USGS conducted LIDAR topography surveys of beaches, and coordination is underway with other groups to make preliminary data available for emergency recovery efforts a week after collection. The USGS conducted topobathymetric LIDAR surveys of the entire ocean coast of New Jersey immediately before and just after the landfall of Hurricane Sandy using the Experimental Advanced Airborne Research LIDAR – B (EAARL-B). The USGS is generating and will soon make available elevation difference maps for the NJ ocean coast that reveal the storm's impacts on beaches, dunes, communities and protected natural areas. Detailed changes in the elevation of barriers show where protection has been removed, and where sand has been deposited.

This information helps target where response efforts should focus, including locations of sand needs and sources, and debris that must be moved. USGS is providing on-line access through its Hazards Data Distribution System to a wide range of imagery products – including pre- and post-event remote sensing and aerial photography from NOAA and the CAP – at http://www.usgs.gov/sandy. The International Charter for Space and Major Disasters has been activated at the request of FEMA. According to Haines, the USGS also issued a landslide alert for landslide-prone areas in Maryland, Delaware, northeastern Virginia, and southern Pennsylvania as a result of forecasts of heavy rainfall. The USGS also is conducting a post-storm landslide inventory in cooperation with state geological surveys and for the first time using the new USGS *Did You See It* website that allows the public to lend a hand providing citizen science on landslides (http://landslides.usgs.gov/dysi/).

As focus shifts from response to recovery, Haines noted that USGS is developing a science plan to provide data, information and tools to guide Hurricane Sandy response and recovery efforts as well as to improve preparedness and responsiveness to the next hurricane. The plan outlines science activities related to impacts to coastal beaches and barriers; impacts of storm surge and disturbed estuarine and bay hydrology; impacts on environmental quality, including exposure to chemical and microbial contaminants; impacts to coastal ecosystems, habitats, and fish and wildlife (DOI lands and trust resources); and coastal topographic and bathymetric data to support hurricane impact assessment and response.

Paul Kudarauskas (EPA) stated that the EPA Airborne Spectral Photometric Environmental Collection Technology (ASPECT) platform was deployed to the New York and New Jersey area. Based out of Philadelphia, PA, the ASPECT Team collected over 1,000 geo and orthorectified images of the Long Island and New Jersey inner and outer barrier islands, Staten Island, Delaware River, the high risk drinking and waste water facilities in New Jersey, and Superfund sites in the impacted region. No chemical or radiation hits were identified. Brendan Doyle (EPA) noted that: EPA assessed impacts to regulated facilities, Superfund removal and remedial sites, and responded to incident notifications for oil and hazardous materials spills in the impacted area; EPA provided technical assistance to support extensive cleanup activities, including de-watering, and support to the Passaic Valley Sewerage Commission (PVSC) and the Middlesex County Utilities Authority; and EPA teams assessed numerous drinking water treatment plants and wastewater treatment plants in New Jersey and New York.

According to Doyle and under FEMA Emergency Support Function 10, EPA: conducted household hazardous waste (HHW) assessment and collection efforts in the affected area; coordinated with USACE, the New York Department of Sanitation, and the Director of the Fresh Kills Landfill to provide space, logistical support, and equipment at both Fresh Kills Landfill and Jacob Riis Park for HHW assessment and collection; managed the HHW pad at the segregation sites and conducted the segregation and identified and addressed orphan containers in New Jersey and New York; coordinated with various New York entities on issues relating to air monitoring of air curtain incineration of vegetative debris in New York City; advocated for other management methods such as re-use and composting; and, at New Jersey's request, sampled for fecal coliform in the New York and New Jersey harbors and at the PVSC outfall. Doyle also stated that EPA also reviewed, and, as warranted, issued fuel waivers and no action assurances (NAA). The fuel waivers were temporary and necessary to help ensure that an adequate supply of fuel was available, particularly for emergency vehicle needs. The NAAs addressed operational issues resulting from Hurricane Sandy and inability to use the usual routes for transportation of fuel. For an NAA, the EPA exercised its discretion not to pursue certain enforcement violations (e.g., vapor recovery requirements for fuel loading and unloading) subject to particular conditions.

Brett Rini (USNRC) reported that, as of December 6, 2012, the three nuclear facility units that shut down in addition to Oyster Creek were all back at full power. There were no significant impacts to the plants as a result of the storm. The USNRC initiated a Special Inspection at the Oyster Creek nuclear power plant

in response to issues that arose during Hurricane Sandy. The team of three inspectors is reviewing the circumstances surrounding the company's overall event declaration activities related to water level increases at the plant's water intake structure during the storm. There were no actual impacts on the plant's, USNRC's or state's emergency response posture, as all three entities were monitoring the storm's arrival and potential impacts, with the emergency response facilities already staffed. A Special Inspection was determined using the guidance in Management Directive 8.3, "Incident Investigation Program," (http://pbadupws.nrc.gov/docs/ML0312/ML031250592.pdf) and is the lowest level of event follow-up other than routine inspection activities.

Marc Levitan (NIST) noted that Dr. S. Shyam Sunder, Director of the Engineering Laboratory at NIST, will serve on the New York State Ready Commission formed by Governor Andrew Cuomo to recommend ways to ensure critical systems and services are prepared for future natural disasters and other emergencies. The expert commission is one of three that Cuomo launched in the aftermath of recent major storms, including Hurricanes Sandy and Irene, which devastated parts of the state and revealed weaknesses in New York's transportation, energy, communications and health infrastructures. The Ready Commission will review critical systems and services and recommend measures to prepare for future natural disasters and other emergencies. It also will advise the governor on ways to ensure: new, modified and existing construction is resilient; adequate equipment, fuel, food, water and other emergency supplies are available; first responders and other critical personnel can communicate efficiently and have access to adequate resources; reliable, real-time information is available for decision makers; and lines of authority are clear and officials have the authority to react rapidly to emergency situations.

Levitan mentioned that one NIST Research Structural Engineer will be participating on the FEMA MAT study of Hurricane Sandy. The primary objectives of NIST's role in the study will be to: 1) collect data/observations on the performance of critical facilities and infrastructure systems in the affected area to support the development of resilience metrics for buildings in a dense urban community; and 2) examine the effect of cascading infrastructure failures on the performance and recovery of critical facilities. The collected data by the FEMA MAT study will include information on the performance and design criteria for the American Society of Civil Engineers (ASCE) 7 Risk Category IV structures – such as hospitals and data centers – for power and communication and emergency response facilities. These observations are important for evaluating the concurrent failure of multiple critical facilities within a community. Data on recovery plans and impact on economics and business continuity will be collected where available. The field deployment will begin on approximately December 6, 2012.

Levitan also underlined that NIST's Manufacturing Extension Program (MEP) centers in New York and New Jersey were directly affected by the storm and have provided first-hand accounts of the damage, relayed the needs of local small businesses, and communicated the specific issues that manufacturers face during the recovery phase of the storm. Primarily, these issues have revolved around quick access to financing and loans to repair infrastructure and maintain business operations.

Pre-Hurricane Sandy, Andrew Bruzewicz (USACE) stated that the USACE Costal Hydraulics Lab assisted the effort with the Advanced Circulation and Gridded Surface Subsurface Hydrologic Analysis modeling runs to predict surge and inundation. Several modeling cycles were run as the storm data evolved as part of an attempt to come up with the best inundation mapping for these large coastal storms. USACE also did post-event work with a hand-held data system known as the Mobile Information Collection Application, which is designed to more rapidly collect storm-related information in the field as quickly as possible and relay it to response and recovery managers. Regarding lessons learned, Bruzewicz noted that all responding Federal agencies need to be assured of back-up electric power at their facilities. Hurricane Sandy showed that large areas may lose power and back-up locations that have been safe during other disasters may be affected if generators are not on site. Second, it is imperative that data

requirements be considered proactively, or there may be delays in the ability to acquire the data. With the second storm following on the heels of the first, some LIDAR data requirements were not developed in time to enable acquisition before the second storm precluded the capturing of morphological changes in coastal areas as a result of the first storm. A final observation from Bruzewicz was that in managing temporary shelter requirements, this storm showed us that tropical storms may be followed by cold weather, adding additional considerations to the provision of adequate shelter.

Sheila Duwadi (DOT/FHWA) mentioned that DOT Deputy Secretary John Porcari submitted written testimony to the U.S. Senate Subcommittee on Surface Transportation and Merchant Marine Infrastructure, Safety, and Security, Committee on Commerce, Science, and Transportation regarding the damage that was done to the transportation system during Hurricane Sandy, how local authorities and DOT acted to mitigate and repair the damage, and what needs to be done to reduce the severity of such disasters in the future. Most damage in the transportation area was to highways, mass transit, and rail tunnels in and out of Manhattan and the surrounding areas:

- Regarding transit and rail lines, all seven subway tunnels under the East River, the Hudson River subway tunnel, the East River and Hudson River commuter rail tunnels, and the Lower Manhattan subway tunnels were flooded. Three of the four highway tunnels were flooded (Lincoln Tunnel was left open). Some subway service was restored three days after the storm; however, the PATH train service to the World Trade Center was restored four weeks after the storm and subway service between the Rockaway Peninsula and Howard Beach is not expected to reopen for months;
- In New Jersey, flood damage was sustained to 72 locomotives and 311 cars, and damage was incurred to three moveable bridges and to catenary structures on the New Jersey Transit's Gladstone line;
- Highways were damaged in all affected areas, including tunnels, movable bridges, and traffic signals. The estimated overall cost in damages to highways is $310 million;
- LaGuardia, JFK, and Newark airports were closed due to the effects of the storm, with normal traffic restored by end of the week. The estimated overall cost in damages to airport facilities is $41 million;
- Amtrak was shut down in the NY area for two days during Hurricane Sandy. Four tunnels were flooded and damages were sustained to signal systems and pumps, tracks, and power stations with the overall cost estimated at $31 million; and
- The Port of NY/NJ lost electrical power during the storm and experienced damage to equipment and marine petroleum terminals, which halted petroleum delivery for several days.

Duwadi also stated that DOT responded to Hurricane Sandy with support in the FEMA Emergency Support Function 1 role capacity and released the following emergency relief funds immediately and after the disaster: $29 million to five states for emergency repairs (NY, NJ, NC, RI, and CT) along with $20 million to NY last week. DOT also: expedited the movement of overweight and oversize loads into affected areas; temporarily lifted hours of service requirements and other regulations on interstate trucking carriers; established an Interstate Petroleum Transport team to resolve issues; provided buses to replace lost commuter rails and transit; secured signal equipment; opened an Emergency Relief Docket; and activated training ships to provide emergency relief support and reserve ships to house emergency responders and volunteers. 58 DOT employees were deployed at Joint Field Offices in NY and NJ, and although the assessment is still ongoing, the overall estimated cost of damages to subways, highways, rail lines, and other transit equipment in NY/NJ from Hurricane Sandy is $7.6 billion.

Craig Dobson reported that NASA's Earth Science Division actively supported response and recovery efforts for Hurricane Sandy. Specifically, NASA provided satellite imagery and higher level data products for use by state officials, response agencies, and those emergency managers providing logistical ground support. Images were captured from all pertinent NASA instruments including ASTER, MODIS,

VIIRS, EO-1, and TRMM. Products developed for this effort included flood extent maps, daily and multi-day composites of rainfall totals, and VIIRS day/night images. The VIIRS data products were of particular value aiding in the response to vast power outages following the storm. These products helped guide recovery experts in the deployment of mobile power generation targeting those areas where little or no power was available. Accurate and timely advance forecasts allow adequate time for preparation, evacuation and pre-staging of resources for response and scheduling acquisition of future observations. NASA products are routinely integrated into the NOAA forecast – which for Hurricane Sandy was superb. According to Dobson, this is another chapter in a continuing success story and highlights the need for the nation to retain sufficient on-orbit observational capacity to maintain our forecast capability. Noting that this exceptional forecast capability is made possible by a rich observational space complemented by modeling capacity, there is great opportunity to evolve similar capability for other natural hazards.

Dobson mentioned that situational awareness is a critical need during the sometimes chaotic period after the onset of a hazardous event. Remotely sensed data augments ground reports and in situ data to help determine damage extent and severity and is both objective and synoptic. Various sensor tools are available including electro-optical sensors, IR, imaging radar, and LIDAR, each with a role to play. Electro-optical and IR sensors provide photo-like information surface conditions and chemical composition. Imaging radar and interferometric SAR provide information on surface structure, moisture conditions, and deformation. LIDAR provides exquisite characterization of surface morphology and above ground structures and vegetation. Electro-optical sensing can only be done during the day and requires cloud-free conditions as does LIDAR survey (typically low altitude), while SAR/InSAR operates day or night and is independent of cloud conditions -- an important factor in adverse weather hazards like Hurricane Sandy and the ensuing storm. Situational awareness includes before and after comparisons of data for things such as damage assessment, but is most effective when there is a continuity of data to examine and understand events as they evolve. Thus, there is often the need for repeat observations over periods of hours to days. The value of change-detection approaches to event impact is highly dependent upon the consistency and timing of before and after data acquisitions, and this consideration should be systematically implemented in tasking decisions. Satellites have fixed orbits; thus, intelligent planning for resilience should take advantage of the time window provided by forecast to pre-schedule satellite tasking of U.S. civil resources, foreign resources (including commercial as appropriate), and National Technical Means (as appropriate). A similar statement can be made for airborne assets which have greater flexibility in time of acquisition, repeat coverage interval, and viewing geometry.

In the research domain, NASA has been prototyping capabilities for near real-time change detection approaches for surface deformation and damage assessment related to natural hazards. While the initial focus has been on earthquakes and volcanoes, application to extreme weather events is also possible and was tested by NASA's Jet Propulsion Laboratory for Hurricane Sandy using X-band SAR data from the Italian Cosmo-SkyMED system. These results were posted on November 7, 2012. In addition, NASA has been developing a rapid-deployment airborne capability for nominal use with earthquake and volcanic hazards. Under research grants, NASA is currently updating airborne InSAR coverage of volcanic hazards on an annual basis (Cascadia, Aleutians, Hawaii, Central and South America) and seismic hazards on a semi-annual or better basis (San Andreas and associated faults from Santa Rosa, CA south into Baja California, Mexico). Part of NASA's current investments are focused upon improvements to near real-time processing to reduce data latency and also automation of high volume data flows for derivation of event-relevant informational products.

Regarding lessons learned from the storm, Dobson underlined that during times of crisis and disaster, there is often a desire to "throw everything at it" and this can lead to a crowd sourcing of both observations and analysis. While there may be some great potential in such an approach, it is not necessarily very efficient or effective and has the potential to overwhelm both analysts and end users with

a glut of information that cannot be effectively exploited in a timely fashion. Careful attention needs to be placed on observational needs along a timeline matched to the workflows of the response and recovery communities and templates generated that can be tested for various hazard and disaster scenarios.

Jerry Tuttle (NGA) from the NGA office for disaster response – the Integrated Work Group, Readiness, Response, and Recovery (IWG-R3) – provided a brief overview of Hurricane Sandy support and highlighted initial lessons learned from the event. The office also offered to return in January for a full briefing on the final results of its after action report. As a member of the intelligence community, NGA is bound by Intelligence Community oversight regulations and policy and cannot work domestic mission support unless requested by a lead Federal agency. In the case of Hurricane Sandy, FEMA requested support with enough lead time for NGA to deploy support personnel and equipment well in advance of the storm making landfall. The early lead time was a result of implementing lessons learned from past hurricane events, improved coordination with FEMA leading up to the event, and overall improvements in hurricane forecasting.

Another success noted by Tuttle was the effective stand-up and operation of the Hurricane Sandy dashboard and landing page, an unclassified web presence that provided a consolidated place for data, products, and services to support geospatial analysis for both NGA and other Federal agencies. A universal username and password was established and quickly distributed to Federal users, facilitating widespread use of the site while maintaining an adequate level of security. There was a dedicated web support team to quickly resolve problems and immediately implement needed fixes. Feedback from the user community was generally positive. While the Hurricane Sandy web presence was an improvement over previous events, there is still a tremendous amount of effort needed to enable a fully functional unclassified operating environment. As an IC member, NGA has traditionally focused on intelligence problems and secure working environments. The IWG-R3 mission clearly highlights the need for a robust infrastructure in the unclassified domain for improved data sharing, communication, and collaboration.

Tuttle stated that NGA also developed a tool to help analysts quickly produce flood polygons during Hurricane Isaac. Unfortunately, the tool did not work in the urban environments for Hurricane Sandy. IWG-R3 will need to re-work the tools and tradecraft surrounding it to meet future mission requirements. Part of what NGA brings to the table is access to classified source information that can be utilized by analysts to produce products and perform analysis in support of relief efforts. This ability is hampered by slow and ineffective capability to transfer data and products between network domains. Hurricane Sandy relief efforts highlighted the need for an effective and automated cross domain transfer solution. IWG-R3 agreed with many other agencies that there needs to be a greater emphasis put on coordinating collection of airborne and satellite imagery (both pre- and post-event) and a more coordinated method for access to the data.

Carlos Rodriguez-Franco (USFS) and Dale Dague (USFS) reported that more than 1,200 interagency firefighting personnel were mobilized – including about 900 USFS personnel – as follows: 43 twenty-person fire crews from 17 states; 10 Incident Management Teams; and 30 FEMA Emergency Support Function 4 (ESF-4) USFS personnel liaisons with FEMA. Firefighting resource support following any Presidential emergency declaration or major disaster is coordinated by the USFS through ESF-4 under the National Response Framework. ESF-4 qualified USFS personnel were embedded with FEMA at several locations, including: the New York State Emergency Operations Center; the New Jersey State Emergency Operations Center; the FEMA Regional Response Coordination Centers in FEMA Regions 1 (Massachusetts), 2 (New Jersey), and 3 (Philadelphia, Pennsylvania); the FEMA Joint Field Office in New Jersey; and FEMA's National Response Coordination Center in Washington, DC. These USFS liaisons provided the theoretical bridge between FEMA and the wildland fire system.

Although USFS firefighters are most well known for their wildland firefighting, Rodriguez-Franco and Dague noted that wildland firefighters and overhead personnel have skills applicable to all types of emergencies and have significant experience with hurricane response. For example, USFS Incident Management Teams (IMT) operated mobilization centers, managed staging areas, coordinated emergency response, and supported local and state Emergency Operations Centers. Another key mission for the wildland fire agencies following hurricanes is clearing roads to provide first responder access for search and rescue and other emergency response missions. Providing access is also the essential element in allowing power companies to restore electricity and for the delivery of life-sustaining commodities and supplies to occur. These were by far the majority of the missions that USFS wildland fire personnel were tasked with in following Hurricane Sandy. These missions took place in both highly urban areas (New York City) and extremely rural areas (parts of West Virginia).

In West Virginia, heavy wet snow and wind brought down trees and blocked roads. Rodriguez-Franco and Dague underscored that wildland fire crews were able to work with West Virginia National Guard and power companies to clear over 235 miles of roads to provide access and power to communities cut off because of the blizzard, which was one of the most prominent cascading secondary effects from the hurricane. A USFS IMT managed those crews and managed two FEMA incident support bases in the state where water, baby formula, and other life-sustaining commodities were staged for distribution to impacted counties. In New York, New Jersey and Connecticut, crews cleared numerous roadways and provided access for power crews. IMTs and crews managed and supported FEMA Incident Support Bases, mobilization centers for response workers, and points-of-distribution where citizens receive life-sustaining supplies, and staging areas.

Rodriguez-Franco and Dague also reported that USFS recently released the new Early Warning System components for *ForWarn* (http://forwarn.forestthreats.org/), a satellite-based monitoring and assessment tool that provides a near real-time national overview of potential forest disturbances to direct attention and resources to locations where forest behavior seems unusual or abnormal. A prototype *ForWarn* has produced national maps every eight days since January 2010, identifying locations that may require further investigation. The satellite imagery is interpreted and delivered through a suite of products, including the web-based Forest Change Assessment Viewer (http://forwarn.forestthreats.org/fcav/#), a tool that provides an eight-day, coast-to-coast snapshot of the U.S. landscape and produces geographically relevant maps. *ForWarn* is intended to complement and focus efforts of existing forest monitoring programs. *ForWarn* is being developed in partnership with NASA Stennis Space Center, USGS, DOE, and the University of North Carolina-Asheville's National Environmental Modeling and Analysis Center.

According to Sezin Tokar (USAID/OFDA), the lack of hydrometeorological observation networks and limited operational capacity to forecast hurricanes and rainfall – in addition to secondary hazards such as floods, storm surges and landslides – made it difficult to provide early warning to public in some of the host nations in addition to USAID/OFDA and other USG teams on the ground. Therefore, USAID recognizes a need to improve *in situ* observation networks in some of the host nations. In addition, strengthening capacity of authorized entities such as National Meteorological and Hydrological Services in the host nations will improve lead time for warnings to save lives and prepare for potential hazards and will aid the USG teams on the ground. USAID/OFDA, in partnership with NOAA, has supported the development of a flash flood guidance system in Central America and in Haiti and the Dominican Republic. The system was used to monitor potential for flash floods during Hurricane Sandy to provide warnings of these conditions to USG staff on the ground; however, there is also need to strengthen capacity to model and forecast urban flooding in the Caribbean and storm surge modeling in Central America. Additional in-situ data from countries outside the U.S. will aid in strengthening the forecast of trans-boundary hazards such as hurricanes and its secondary, cascading impacts.

USAID also relied on NOAA for the early warning of hydrometeorological extremes and worked closely with NOAA to build capacity abroad. Data sharing and coordination are critical in trans-boundary extreme events such as hurricanes. There are various efforts by NOAA and the UN World Meteorological Organizations (WMO) on both the sharing and interoperability of hydrometeorological data. WMO, in partnership with national meteorological and hydrological services organizations around the world, is working on the standardization of meteorological data globally. Although there is a common protocol and process in place for meteorological data, hydrological data standardization and interoperability is still a big challenge which needs to be addressed. Countries in the Caribbean, Central America, and South America rely on hurricane warnings and watches from NOAA National Hurricane Center. Tokar noted that NOAA hurricane forecast tracks aided USAID/OFDA to deploy teams and provide disaster assistance to countries that were expected to receive a significant impact from Hurricane Sandy. The forecast track for Sandy was fairly accurate; however, additional improvements in these models to give longer lead time and provide more specificity will enhance USAID/OFDA response capacities as well.

Wenger reported that approximately 20 grants for the NSF Rapid Response Research (RAPID) program are being made available focused on a wide variety of disciplines associated with the aftermath of Hurricane Sandy, including geospatial imagery, infrastructure interdependencies, the use of social media and evacuation behavior, and structural failure and engineering. Once the complete list of awards is distributed, it will be shared with SDR members to identify interagency S&T coordination opportunities. Results of the research will be known in May 2013.

Please email our OSTP Liaison Tammy Dickinson (tdickinson@ostp.eop.gov) copying the SDR Secretariat (bret.schothorst@mantech.com) if you'd like to submit updated information regarding your agency's S&T activities and lessons learned in response to the disaster.

III. Discussion of SDR Policy Priorities for the Next Presidential Term

Building on this conversation of the impacts, response activities, and interagency S&T coordination opportunities from Hurricane Sandy, the last portion of the SDR meeting was devoted to a discussion identifying SDR interagency disaster risk reduction policy priorities – as well as future Subcommittee goals, objectives, and outcomes – going forward during the first year and a half of the next Administration. Although the discussion was cut short due to the previous roundtable and will continue in full at the January meeting, one potential policy objective that did arise was the issue of LIDAR geospatial data availability and interoperability pre- and post-disaster. Although the issue is not specific only to LIDAR, SDR members from DHS S&T, USGS, USACE, NOAA, NASA, NGA, and EPA volunteered to provide a few sentences describing the problem at their agency level in order to inform the creation of a policy white paper for OSTP leadership, including: 1) what the issues are; 2) why they are issues; and 3) what could be done from an SDR interagency S&T coordination standpoint to address the issues. Other potential lessons learned from Hurricane Sandy that may dovetail into and inform interagency S&T policy priorities for the SDR to address during the next Administration include:

- Public risk communication and warning information processing;
- Information needs for understanding and forecasting risk and vulnerability;
- Effective crowdsourcing and information verification;
- Resiliency of the electric power grid; and
- Cascading events and interdependencies.

On a related note, all SDR members additionally were asked to review and comment on a draft proposal that recommends the establishment of an ad hoc working group with broad representation from SDR member agencies and strong linkages to other NSTC interagency coordination bodies – in particular, the Infrastructure Subcommittee and the Subcommittee on Ocean Science and Technology – to address several issues related to the post-Hurricane Sandy coordination of interagency Federal science and

technology planning and investment for response, recovery, and rebuilding. This could include, but not be limited to, the following areas: 1) assessing the probabilities of different scales of extreme events by location; 2) engineering solutions to make buildings and infrastructure more resilient to strong winds and flooding; and 3) long-term mitigation measures to lessen the impact of floods and other coastal inundation threats. Please provide your feedback on these potential taskings to the SDR Secretariat (bret.schothorst@mantech.com).

IV. Report from the Co-Chairs and Approval of Minutes

The November meeting minutes were approved with no changes.

Wenger reminded members that the SDR's International Working Group (IWG) will continue to meet the first Thursday of every month from 1:00 p.m. to 2:30 p.m. in the WHCC's Lincoln Room. At the working group's December meeting, the IWG will: 1) welcome Joan Rolf (OSTP), Assistant Director of International Relations at OSTP, to discuss an international meetings road mapping exercise for OSTP Director John Holdren that will be the basis for his 2013 activities abroad; and 2) discuss restructuring options for the U.S. National Platform for the UN International Strategy for Disaster Reduction (ISDR).

V. Report from the OSTP Liaison

Dickinson reminded SDR members that the January meeting will be devoted to a discussion identifying disaster risk reduction policy priorities – as well as future SDR goals, objectives, and outcomes – to use as the basis of a transition roadmap forward for OSTP during the next Administration. Please consider brainstorming interagency disaster reduction S&T priorities in advance of the meeting and send your input to the SDR Secretariat (bret.schothorst@mantech.com) with a copy to Dickinson (tdickinson@ostp.eop.gov).

VI. Adjournment

Wenger adjourned the SDR December meeting at 12:03 p.m.

VII. Future Meetings

SDR meetings in 2013 will be held from 10:00 a.m. to 12:00 p.m. on the dates listed below in the Lincoln Room of the White House Conference Center:

2013

- ✓ Thursday, January 10 (to avoid proximity to the New Year's Day Federal holiday)
- ✓ Thursday, February 7
- ✓ Thursday, March 7
- ✓ Thursday, April 4
- ✓ Thursday, May 2
- ✓ Thursday, June 6
- ✓ Thursday, July 11 (to avoid proximity to the Independence Day Federal holiday)
- ✓ Thursday, August 1
- ✓ Thursday, September 5
- ✓ Thursday, October 3
- ✓ Thursday, November 7
- ✓ Thursday, December 5

VIII. Agenda Items and Other Communications with the Subcommittee

Please send proposed agenda items and any other items intended for distribution to the full Subcommittee to the SDR Secretariat Bret Schothorst (bret.schothorst@mantech.com).

IX. Contact Information

SDR Leadership

David Applegate	Co-chair	703-648-6600	applegate@usgs.gov
Margaret Davidson	Co-chair	843-740-1220	margaret.davidson@noaa.gov
Dennis Wenger	Co-chair	703-292-8606	dwenger@nsf.gov
Tamara Dickinson	OSTP Liaison	202-456-6105	tdickinson@ostp.eop.gov

Secretariat

Bret Schothorst	703-388-0312	bret.schothorst@mantech.com
Barbara Haines-Parmele	703-388-0309	barbara.haines-parmele@mantech.com

X. Summary of December Actions

Action	Lead	By When
Email Tammy Dickinson (tdickinson@ostp.eop.gov) copying the SDR Secretariat (bret.schothorst@mantech.com) to submit updated information and lesson learned regarding your agency's S&T activities in response to Hurricane Sandy.	SDR Members	ASAP
Email Tammy Dickinson (tdickinson@ostp.eop.gov) copying the SDR Secretariat (bret.schothorst@mantech.com) with interagency disaster risk reduction S&T policy priorities for an SDR roadmap forward for OSTP during the next Administration.	SDR Members	ASAP
Contact Tammy Dickinson (tdickinson@ostp.eop.gov) copying the SDR Secretariat (bret.schothorst@mantech.com) to participate in the initiative to incorporate natural hazards data sets to the Safety Data Community.	SDR Members and Federal Colleagues	Standing
Email Tammy Dickinson (tdickinson@ostp.eop.gov), copying the SDR Secretariat (bret.schothorst@mantech.com) to participate in a small working group or task force to discuss a disaster reduction- or community resilience-focused grand challenge or incentive prize highlighting Federal interagency programs, partnerships, and collaborations.	SDR Members and Federal Colleagues	Standing
Please consider supporting the work of the SDR and its Secretariat through a contribution from your agency. Let Dave (applegate@usgs.gov) know if you need an agency-specific request letter.	SDR Members	Standing
Contact Tammy Dickinson (tdickinson@ostp.eop.gov) if it would be helpful for OSTP to issue a letter to your Department requesting new (or re-affirmed) designation of representatives. Ideas for other entities that should be represented on the SDR are also welcome.	SDR Members	Standing
Contact Dennis Wenger (dwenger@nsf.gov) if your agency is able to provide funding support to the University of Colorado-Boulder's Natural Hazards Center.	SDR Members and Federal Colleagues	Standing

Contact the Secretariat (bret.schothorst@mantech.com) if you are interested in participating in the SDR Coastal Inundation Working Group.	SDR Members and Federal Colleagues	Standing
Send Sezin Tokar (stokar@usaid.gov) your ".gov" e-mail address to receive USG-only updates from USAID on global disaster response activities.	SDR Members and Federal Colleagues	Standing
Contact Bret (bret.schothorst@mantech.com) to receive copies of the Grand Challenges for Disaster Reduction.	SDR Members	Standing