National Oceanic and Atmospheric Administration

2011 SATELLITE DIRECT READOUT CONFERENCE

April 4 - 8, 2011
Hilton Miami Airport Hotel, Miami, Florida

http://directreadout.noaa.gov/miami11

Conference Report

Real-Time Access for Real-Time Applications

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1 Executive Summary

Background

The National Oceanic and Atmospheric Administration (NOAA) Satellite and Information Service (NESDIS) hosted the 2011 Satellite Direct Readout Conference: Real-time Access for Real-time Applications, at the Hilton Miami Airport Hotel in Miami, Florida, April 4-8, 2011. This conference was primarily organized to benefit users of environmental satellite direct broadcast data and for those operating their own satellite data receiving stations. It also provided a forum to help NOAA GOES and POES customers prepare for upcoming changes in direct broadcasts from NOAA satellites. This conference was organized to include all global users who receive data directly from NOAA's environmental satellites. Nearly two hundred participants from 32 countries participated in the conference.

The success of the conference can be attributed to several government organizations that made significant contributions in providing planning, financial, and meeting support. The contributing organizations included the GOES-R Program Office, the Joint Polar-orbiting Satellite System (JPSS), the Office of Systems Development (OSD), the National Weather Service and the Office Satellite and Product Operations (OSPO).

Objectives

The objectives of the conference were to continue discussions initiated during the 2002, 2004 and 2008 Satellite Direct Readout Conferences (SDRC), to present specifics on the progress of the JPSS and GOES-R projects, provide an overview of the current direct readout and broadcast services and obtain feedback on how well NOAA is meeting user needs.

A number of excellent ideas, suggestions, questions and recommendations emerged from the conference plenary sessions, the conference survey, question and answer sessions and breakout groups. These conference findings were discussed and major recommendations were identified and agreed upon. These major recommendations were grouped into four overall theme areas; Transition from GOES to GOES-R; Transition from POES to NPP/JPSS; Satellite Services; and Frequency Issues. The major issues and recommendations from the NOAA 2011 Satellite Direct Readout Conference were:

1. GOES environmental data users consisting of various international partners and public users such as Universities wanted to know what their options are for collecting GOES-R GRB data. Users have indicated they cannot update their GVAR systems to GRB due to the significant cost increase in GRB ground stations.

2. Users requested the ability to collect smaller file sizes or subsets of the full imagery from GOES-R to ease data processing requirements and focus in on areas of interest. For example, collection of data from a particular region/country rather than a full hemispheric image.

3. There was an ongoing need expressed to identify resources and approaches to train international users by providing translations of training material in other foreign languages, expanding the proving ground concept to include foreign users, participate in WMO conference in 2012 in Rio, and extend outreach efforts to Regional Associations (RA) III/IV/V.

4. A very important area of concern was antenna upgrades and equipment needs. The users need NOAA to provide signal specification to users in 2012, provide notional geographic coverage maps/antenna size, explore a prototype GVAR/GRB receiver – backward compatibility, and develop SW to unpack GRB feed for Direct Readout Users.

5. Develop a robust suite of LRD products by using day and nighttime AVHRR baseline channels for LRD initial specifications and conduct a final analysis of ideal channel combinations for LRD.

6. The user recommendations about the LRD Downlink Frequency issue were to explore the possibility of dropping center downlink (1707 MHz) frequency below 1690 MHz to avoid future interference with mobile cellular industry, and in the short-term, move center downlink frequency below 1707 MHz to avoid the current 4G interference.

7. With regard to the HRD Processing Packages, users prefer NOAA supported IMAP vs. IPOPP software and they need access to software and source code at the NPP launch date. They also need consistency between local and global processing software and support for the HRD processing software.

8. The DCS Transition Plan to new transmitters needs to be clearly defined and communicated to user communities.

9. DCS users want to update the DCS stream into LRIT with modern quality indicators (which are currently available in DCS) and have more reliable delivery mechanisms and better latency.

10. Users want to make the GERBER (plan for printing circuit boards) files available to the general public.

11. NOAA will work with NTIA to advocate additional exclusion zones, as there will be a compelling argument required, as current U.S. law and NTIA rules do not allow exclusion zones for non-U.S. government sites.

12. The L-Band user community should collaborate on innovative approaches like the use of dispersed antennas -- “hot back-ups” and antenna placement. The users believe that Government and intergovernmental bodies should facilitate this.

13. Users think that NOAA, together with the WMO and national meteorological organizations, should facilitate enhanced communication among the L-Band user community to: update, re-

activate, and maintain the WMO user database, establish informal networks, and organize user forums, etc., for unconstrained user communication

1.1 Summary of Conference Significance

The 2011 Satellite Direct Readout Conference reaffirmed the value of targeted, user meetings and substantiated the need for continuing these types of conferences at regular intervals. The Conference theme was: "Real-time Access for Real-time Applications." The goal of the conference was to meet with users who receive data directly from NOAA's environmental satellites and provide a forum to help them prepare for upcoming changes as NOAA transitions into new technologies for direct readout and broadcast services. Participants unanimously agreed that the conference was a success.

The 2011 conference was an opportunity for NOAA, as well as the international community, to interface with one another to foster global data exchange and scientific collaboration. The conference format consisted of nine general sessions organized around: International Cooperation, Polar Systems, Geostationary Systems, Training and User Applications. Several facilitated discussion sessions were used to address specific topics. NOAA also presented information on current GOES and POES data access, distribution, and user preparation required for the upcoming changes to NOAA's satellite programs.

This year's conference was especially important, considering the restructuring of the National Polar-orbiting Operational Environmental Satellite System (NPOESS) program and subsequent creation of the Joint Polar-orbiting Satellite System (JPSS) as the follow-on civilian polar satellite program. NOAA made available details on the NPOESS Preparatory Project (NPP), now an operational component of JPSS and future JPSS platforms, JPSS direct readout services, high rate data (HRD) X-band broadcast and low rate data (LRD) L-band broadcast. NOAA presented new information on the next generation GOES-R ground system development and direct readout services. In addition, NOAA provided an update on the proposal by the National Telecommunication and Information Administration (NTIA) to re-allocate and share the 1675-1710 MHz frequency band with broadband Internet and cell phone services. As many of the attendees were aware, these frequencies are currently used by many earth observation satellites to transmit satellite telemetry and environmental observations to users. These data and observations provide critical information to decision-makers for the protection of life and property through improved accuracy in environmental forecasts and warnings.

An important element of the Direct Readout Conference was the tremendous international participation generated. This was one of the key strengths of the conference and provided a unique opportunity to bring together the users of environmental satellite data from around the world to work together. It is this spirit of international cooperation that enabled several important projects to become a reality. NOAA highlighted its efforts for supporting the international communities by sharing a spreadsheet showing the responses to the recommendations from the 2008 conference. This spreadsheet represented a combined effort from all of the line offices to demonstrate NOAA's ongoing support for the international community. NOAA also called attention to the major accomplishments from the 2008 recommendations. These included: 1) continued support over the Caribbean Sea, Central and

South Americas, 2) assist in the acquisition of GEONETCast Americas receive stations to help in the exchange of data, 3) outreach on the transition from GOES-N/O/P to GOES-R, 4) provide the HRIT/EMWIN Software Defined Receiver information for GOES-R, 5) provide users access to the NPP software for data access called the International Polar Orbiter Processing Package (IPOPP) and 6) proceed with DCS upgrades in technology and capacity.

During the 2011 conference, the users articulated their appreciation to NOAA for moving the GOES-12 to 60^{o}W and how the region continues to benefit. The users also expressed their concerns for the future of the frequency band 1695-1710 MHz. There is a strong desire for an APT-like service in the future, as well as a craving for additional information on the resources to transition from GVAR to GRB and, from APT/HRPT to JPSS LRD. Because of this feedback, NOAA will carefully examine the recommendations gathered during the 2011 conference and will report back to the user community.

This conference represents the fourth time in the last decade that NOAA has hosted this international conference in Miami. As NOAA moves closer towards significant changes in its satellite programs over the next decade, the need for interaction with Direct Readout users becomes even greater. NOAA looks forward to working with all its users and the continuing cooperation with national and international partners into the next decade. The time to address the "Real-time Access for Real-time Applications" of future satellite data is now upon us. Since the launch of the first meteorological satellite, "real-time access" has led to "real-time applications" that translated into improved environmental forecasts and warnings that save lives and minimizes property damage. The information presented at the 2011 conference was extremely important for all agencies and organizations that provide and use real-time satellite information to issue environmental forecasts and warnings and make informed decisions to mitigate the effects of man-made and natural disasters. Ongoing Direct Readout Conferences are a critical part of that effort and reflect NOAA's ongoing commitment to prepare the user community for these changes.

1.2 Status of the 2008 SDRO Actions and Recommendations

Actions and Recommendations from 2008 SDRO					
Customer Support/Information Access					
Actionee	**Action**	**Description**	**Action feedback/closing document**	**Deadlin**	**Status**
NOAA/NESDIS	SDRO 2008-1	Establish a prominent link (in Spanish) on the front page of the NOAA web site to a special page (in Spanish) detailing how to navigate the NOAA pages, especially to locate products and services.	NOAA has restructured its website to make it easier to navigate the NOAA pages. Currently, NOAA has not developed a special link in Spanish detailing how to locate products and services. (http://www.osdpd.noaa.gov/ml/index.html).	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-2	Consider hiring at least one Spanish speaking NOAA technical representative for the Help Desk.	NOAA continues to improve the quality of service provided to its customers. To provide reliable, accurate and prompt response to customer needs, NOAA employs several qualified bi-lingual employees to assist in translation support.	4-Apr-11	CLOSED
NOAA/NESDIS	SDRO 2008-3	Explore offering documentation, specifically technical documents and messages, in additional languages.	NOAA continues to investigate the resources needed to provide technical documents and messages in other languages. Each individual Office is encouraged to provide technical documents and messages in additional languages. Considering there is no agency wide initiative to provide documents and text in other languages, it must be understood that each Office must have sufficient funds in their budget to support these activities. Translation into Spanish for technical documents and messages could be arranged through the COMET program. Funds will be required to provide these services (see SDRO 2008-4).	4-Apr-11	CLOSED

NOAA/NWS	SDRO 2008-4	Continue to encourage the COMET ® Program to translate their training modules into Spanish and other languages.	COMET has provided translations (mostly in Spanish and a few in French) for many of their training modules for several years with funds primarily coming from NWS International Affairs Office. Starting in FY 2011, these funds are primarily targeted for the Aviation Program and will not be used for any satellite training materials. NWS and COMET would welcome satellite program funds that could be provided to support translations specifically for satellite training materials.	4-Apr-11	CLOSED
NOAA/NWS	SDRO 2008-5	Encourage the COMET ® Program to develop training modules on the NOAA direct readout and re-broadcast satellite services.	The development of training modules for NOAA direct readout or re-broadcast satellite services needs to be prioritized as part of the NWS National Strategic Training and Education Plan (NSTEP). These requirements are generally reviewed during the annual Satellite Training Requirements Workshop held at COMET in Boulder in May. If funds are provided specifically for this training, the process is accelerated and can be moved up the satellite training priority list.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-6	Improve the satellite product suite documentation.	NOAA continues to review it current product suite and it usefulness to its users. The Satellite Products and Services Division (SPSD) and the NOAA Satellite Product and Services Review Board (SPSRB) ensures the product documentation is accurate and up-to-date. For additional information, please see: http://projects.osd.noaa.gov/spsrb/.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-7	Increase the availability of products in a spatial data format that can be used in a Geographic Information Systems (GIS). Consider leveraging NESDIS and EOS Cooperative Institutes to assist.	Currently, NOAA provides products in spatial data format that can be used in geographical data system. Users are encouraged to submit their requests to the GIS Web site: http://www.osdpd.noaa.gov/ml/gis/index.html.	4-Apr-11	CLOSED
NESDIS/OSD	SDRO 2008-8	Improve the CLASS user interfaces to acquire and use the data contained in the system.	NOAA continues to improve user interface to the CLASS system. Currently, the system is being moved from the NOAA Satellite Operations Facility (NSOF) in Suitland, Maryland, to the National Climatic Data Center in Ashville, NC. For more information on using the CLASS services, see: http://www.class.ngdc.noaa.gov/saa/products/welcome.	4-Apr-11	CLOSED

NESDIS/OSPO	SDRO 2008-9	Explore alternative data distribution methods to the Internet, which is not reliable in many countries.	NOAA employs several distribution services that are not reliant on the Internet. These services include: LRIT, GVAR, HRPT, EMWIN and APT. Future services will include: HRIT/EMWIN, GRB, LRD and HRD.	4-Apr-11	OPEN
NESDIS/OSD	SDRO 2008-10	For Polar Data, enable near real-time access to safety-net down-linked imagery through re-broadcast, CLASS, or other method.	As a key part of the NOAA plan to utilize MetOp data, the NPOESS Program Executive Officer has agreed to fund service upgrades to the existing NASA McMurdo Ground Station (MGI) antenna system. NASA will also install a refurbished 5.4 meter S/Ka-band antenna system as the second McMurdo Ground Station (MG2). This will allow NASA to transfer their S-band missions from MG1 to MG2, and provides for a single antenna data recovery capability for MetOp at McMurdo on MG1. MG1 readiness to capture Metop data is planned for early 2011, with 7-10 contacts available for MetOp data recovery each day until the MG2 antenna system is operational. MG2 is scheduled to be operational in early 2014; once operational, full MetOp data recovery (14 contacts per day) will be possible. The 2011 Initial Operational Capability (IOC) date is the same as that proposed in October 2007. The Full Operational Capability (FOC) date has changed, however, from 2012 to 2014.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-11	Create a one-stop-shopping information portal for polar data and information to include real-time polar imagery and associated algorithms.	NOAA's one-stop information portal is managed by the Satellite Products and Services Division. All polar-orbiting and geostationary derived products and real-time data can be found at http://www.osdpd.noaa.gov/ml/index.html.	4-Apr-11	CLOSED
	SDRO 2008-12	For Geostationary data, create a one-stop-shopping portal for GOES data to include: real-time imagery, archives, “special events’, messages and status charts including real time status pages.	NOAA's one-stop information portal is managed by the Satellite Products and Services Division. All polar-orbiting and geostationary derived products and real-time data can be found at: http://www.osdpd.noaa.gov/ml/index.html.	4-Apr-11	CLOSED

Outreach - User Conferences/Meetings					
Actionee	**Action**	**Description**	**Action feedback/closing document**	**Deadlin**	**Status**
NESDIS/Outreach	SDRO 2008-13	Give high priority to annual and bi-annual satellite user conferences involving Central and South American countries including regional outreach and technical meetings coordinated with the National Weather Service.	The SDRO conference is NOAA's premier bi-yearly outreach to the South and Central American countries. Currently, there is no NOAA/NESDIS annual direct satellite data users' conference. During SDRO, NESDIS includes NWS as a contributor to the conference. We continue to develop ways to incorporate all relevant areas of NOAA products and services into our conferences as NOAA's technologies improve and evolve.	4-Apr-11	CLOSED
NOAA/NESDIS	SDRO 200-14	Provide translation support at any scheduled regional meetings in cooperation with the WMO where appropriate.	WMO is responsible for the format of its meetings. If the WMO requests translation support, NOAA would review the request and inform WMO of its position.	4-Apr-11	CLOSED
NOAA/NESDIS	SDRO 2008-15	Work with the GEOSS Americas to also have regional meetings with translation support.	GEOSS is responsible for the format of its meetings. If the GEOSS requests translation support, NOAA would review the request and inform GEOSS of its position.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-16	Expand the role and participation of secondary, High School and collegiate students and educators at the next Direct Readout Satellite Conference.	NESDIS is working with the Florida Explores Program to allow high school and collegiate students the opportunity to participate in the Satellite Direct Readout Conferences. NESDIS provided invitations to the HBCUs and the National Alliance of State Universities and Land Grant Colleges, as well as numerous universities across the country asking for their participation in the SDRO conference.	4-Apr-11	CLOSED

Direct Re-broadcast Services: LRIT, DCS, Argos, EMWIN, NOAAPORT, RANET					
Actionee	**Action**	**Description**	**Action feedback/closing document**	**Deadlin**	**Status**
NESDIS/OSPO	SDRO 2008-17	Develop an inventory of stations and services for all direct readout and broadcast programs most importantly for the GOES DCS Service.	NOAA provides a list of the direct readout and broadcast stations to the WMO on a routine basis. This data, in response the CGMS Permanent Action 05: CGMS Members to provide information for the WMO database of satellite receiving equipment, as appropriate, is used to update the WMO database of satellite direct readout users.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-18	Identify direct broadcast service requirements for all the services and most importantly for LRIT and GEONETCast.	NOAA makes the service requirements for all the direct readout and direct broadcast services at the following locations: • GVAR - http://www.osd.noaa.gov/gvar/documents/GOES-O-GVAR_Change.pdf. • LRIT - http://noaasis.noaa.gov/LRIT/. A complete product list is currently available on http://noaasis.noaa.gov/LRIT/about.html • HRPT/APT - http://www2.ncdc.noaa.gov/docs/klm • HRIT/EMWIN - http://www.goes-r.gov/hrit_emwin/index.html • GRB - The GOES-R project will provide technical specifications and transition information on the new GRB service. • LRD/HRD - The Joint Polar-orbiting Satellite System (JPSS) will provide specifications on the LRD and HRD services. • GEONETCast Americas is responding to requirements gathered by the WMO Regions III and IV in a February 2010 meeting in cooperation with the WMO, INPE and the other meeting participants. The GEONETCast Americas www site is located at:http://geonetcastamericas.noaa.gov/. The GEONETCast Product Navigator is located at the GEONETCast Americas Web Page. The EUMETSAT Web Page is at: http://www.eumetsat.int/Home/Main/DataProducts/ProductNavigator/index.htm is broadcast over the GEONETCast Americas service.	4-Apr-11	CLOSED

NESDIS/OSPO	SDRO 2008-19	Assess whether LRIT and EMWIN data are meeting user needs.	The EMWIN program is constantly assessing their user requirements and has a Review Group that takes requests and gives approval. The LRIT program is currently working with the NWS Pacific Region and the WMO Region V on updated requirements for the LRIT West Broadcast.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-20	Expand LRIT information on the NESDIS website for those who are using or are contemplating using LRIT.	The www.noaasis.noaa.gov LRIT section has been reviewed and updated as well as has the entire noaasis web page.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-21	Develop and make available software to extract the EMWIN information from LRIT.	Several manufacturers have made the software available in their commercial offerings. It is also available at http://noaasis.noaa.gov and as the software for the HRIT/EMWIN prototype receiver (http://www.goes-r.gov/hrit_emwin/index.html).	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-22	Consider including some EOS and NPP data on NOAAPORT.	The U.S. National Weather Service would have to consider the requirements for EOS and NPP data before such a decision can be made.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-23	Include MTSAT imagery on GOES-West LRIT broadcast.	MTSAT Imagery is in a graphic (JPEG) format. A project is underway to add MTSAT LRIT imagery directly to the LRIT WEST broadcast.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-24	Include additional Pacific related graphical products on GOES-West LRIT broadcast.	LRIT is currently working with the NWS Pacific Region and the WMO Region V in addressing expanded product requirements.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-25	Expand EMWIN coverage to the Western Pacific.	The EMWIN I broadcast is currently part of the content on PeaceSat. No further expansion is planned at this time.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-26	Identify direct broadcast service requirements and options for the Pacific Region.	LRIT is currently working with the NWS Pacific Region and the WMO Region V in addressing expanded product requirements.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-27	Investigate whether GEONETCast can help cover the Pacific Region with a re-broadcast of satellite information and environmental products.	The RANET presentation will highlight efforts to launch RAPIDCast in 2011. RAPIDCast is a pilot to provide Pacific wide satellite broadcast service utilizing GE23. The pilot is funded by the USAID Office of U.S. Foreign Disaster Assistance (USAID OFDA) in partnership with the NOAA National Weather Service International Activities Office and Pacific Regional Headquarters. It is also coordinated in partnership with the Australian Bureau of Meteorology.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-28	Investigate the feasibility of acquiring a FUNGYUNCast receiver for Pacific Region	Based on other information, this action was not pursued.	4-Apr-11	CLOSED

NESDIS/OSPO	SDRO 2008-29	Initiate action, through the GEONETCast Implementation Group, with the Chinese Meteorological Agency (CMA) to determine their FUNGYUNCast coverage and relay the information to the Pacific Region.	This was completed on January 15th, 2009.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-30	Acquire the FENGYUNCast ground station specifications and relay these to the Pacific region.	This was completed on January 15th, 2009.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-31	Work with partners to locate a FENGYUNG Cast demonstration station in the Pacific Region.	Based on other information, this action was not pursued.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-32	Identify future CMA plans for FENGYUNCast.	The China Meteorological Administration is currently implementing a new service called CMACast to replace FENGYUNCast. This service will use an entire 36 MHz bandwidth transponder in CBand, allowing up to 70 Mbps effective data rate in DVBS2 standard. The new FENGYUNCast 1 will be operated by CMA/NMIC, the uplink will be at the Beijing ground station of NSMC, and will use the Asiasat4 satellite. Receiving will be possible with on-the-shelf equipment together with a USB key containing the decryption software, with prior registration and authorization.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 208-33	Develop options for improving satellite data for the Central/South Pacific.	LRIT is currently working with the NWS Pacific Region and the WMO Region V in addressing expanded product requirements. Information was provided to the Pacific Region on costs related to expanding the GNC-A coverage. The RANET presentation will highlight efforts to launch RAPIDCast in 2011. RAPIDCast is a pilot to provide Pacific wide satellite broadcast service utilizing GE23. The pilot is funded by the USAID Office of U.S. Foreign Disaster Assistance (USAID OFDA) in partnership with the NOAA National Weather Service International Activities Office and Pacific Regional Headquarters. It is also coordinated in partnership with the Australian Bureau of Meteorology.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-34	Investigate whether older satellites can be used as communications satellites similar to GOES-7.	3-axis satellites are required to have their fuel tanks purged prior to decommissioning. This standard procedure makes the spacecraft unusable for any extended service.	4-Apr-11	CLOSED

NESDIS/OSPO	SDRO 2008-35	Identify direct broadcast service requirements and options for the Caribbean Region.	GEONETCast Americas is responding to requirements gathered by the WMO Regions III and IV in a February 2010 meeting in cooperation with the WMO, INPE and the other meeting participants. A side meeting was held before the Direct Readout Conference in Miami in April, 2011. The GEONETCast Americas www site is located at: http://geonetcastamericas.noaa.gov/. The GEONETCast Product Navigator is located at the GEONETCast Americas Web Page. The EUMETSAT Web Page is athttp://www.eumetsat.int/Home/Main/DataProducts/ProductNavigator/index.htm and is broadcast over the GEONETCast Americas service.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-36	Improve the capacity in Central America to use the products that are provided in BUFR format.	Many of the products listed in the WMO Region III and IV data requirements list from a February 2010 meeting are in BUFR format and can be broadcast if available.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-37	Aid in the acquisition of GEONETCast Americas receive stations to help in the exchange of data.	Funds were identified to place one station at Bowie State University, one at the University of Puerto Rico at Mayaguez, eight (8) Stations in Mexico, four (4) Stations in Costa Rica and Seven (7) Stations in El Salvador.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-38	Continue to foster participation in GEOSS in the Americas.	A GEOSS in the Americas Symposium is tentatively planned for September 2011. A Symposium was held in Puerto Rico in March, 2011 and a Symposium was held in Washington D.C. at the Canadian Embassy concurrent with the GEO Plenary meeting in December of 2009.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-39	Investigate whether the EUMETSAT's EUMETCast Americas broadcast could be used to distribute a more frequent suite of imagery (better than the current 3 hour periodicity).		4-Apr-11	OPEN
NESDIS/OSPO	SDRO 2008-40	Focus on issues relating to the transition of the services to the GOES-R era	HRIT/EMWIN will be a combined service with a 400 kilabit per second data rate on the GOES-R Series of Satellites.	4-Apr-11	CLOSED

NESDIS/OSPO	SDRO 2008-41	Provide specifications on the ground equipment for GOES-R services (especially for DCS) so that users can make funding decision for the transition to GOES-R.	The GOES-R project continues to work with its Ground System contractor, Harris Corporation, to develop the field terminal specifications for the GOES Re-Broadcast (GRB) service. In addition, Harris is working on plans for a GRB-Lite service as a transition from GVAR to GRB. These specifications will be provided to manufacturers and users as soon as they are available.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-42	Provide guidance to users about DCS frequencies on GOES-R.	NOAA and the GOES-R project are finalizing downlink frequencies for DCS on GOES-R. There are no changes planned on the uplink for DCS. Frequencies will be provided to the manufacturers and users as soon as final allocation has been made.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-43	Provide information on other changes in user systems due to changing bandwidth and future DCP two-way enhancements.	NOAA has published a notification of the changes in bandwidth in the Federal Register. Two-way communication is still being investigated, with no resources at the present time to make this an operational project.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-44	Address user concern that, as currently planned, there is not enough expansion of DCS capacity in the GOES-R program.	Due to concerns of frequency restrictions due to the proposed auction of the frequencies used for the DCS downlink and because of GOES-R contract status, NOAA has not pursued this topic. NOAA has, however, continued to make improvements in the ground segment to make better use of frequency, and to expand capacity. NOAA will continue to investigate use of expanded bandwidth in future satellites as appropriate.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-45	Proceed quickly with DCS upgrades in technology and capacity.	NOAA is proceeding as quickly with upgrades in technology and capacity as resources allow. NOAA must also carefully coordinate changes with the user community to make sure that user requirements are compatible with associated upgrades.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-46	NOAA to provide estimated costs for DCS conversion to users in the GOES-R era.	At this time there are few anticipated satellite changes for DCS on GOES-R. Most major changes are being made on the ground, in the transmitter and receiver segment. NOAA is coordinating with manufacturers and users as these changes are made.	4-Apr-11	CLOSED

NESDIS/OSPO	SDRO 2008-47	Ensure GOES DCS Bandwidth is adequate to meet forecasts of increasing system usage.	NOAA is doing everything possible to make most efficient use of bandwidth to allow expansion for future requirements.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-48	Consider permanent archiving for DCS data.	DCS data are permanently archived as part of the NOAAPORT data stream at NOAA's National Climatic Data Center (NCDC). However, because of the diverse formats and the lack of reliable metadata for DCS stations, retrieving the data from the archive is problematic.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-49	Work with Pacific Region to get some DCS frequencies allocated to the Pacific region.	NOAA has worked closely with groups in the Pacific (especially the National Weather Service and the National Weather Service Pacific Tsunami Warning Center) to assign DCS frequencies as requested.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-50	Provide a database of DCS stations that will assist users in systems' performance evaluation.	NOAA has developed a report listing the status of all DCS stations, including the last report time. That report is posted on https://dcs1.noaa.gov. Currently this report must be created manually, but NOAA plans to make it operational when DADDS is completed.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-51	Publish how to route DCS observations using the WMO routing headers.	WMO headers are assigned by the National Weather Service, who communicates them to NESDIS.	4-Apr-11	CLOSED
Direct Re-broadcast Services Related Breakout – HRIT/EMWIN Software Defined Radio Prototype Receiver for Transition to GOES-R					
Actionee	**Action**	**Description**	**Action feedback/closing document**	**Deadlin**	**Status**
NESDIS/OSPO	SDRO 2008-52	As soon as available, provide the HRIT/EMWIN Software Defined Receiver information for GOES-R.	Now available on: http://www.goes-r.gov/hrit_emwin/index.html. It was updated with a new version in March 2011.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-53	Ensure that the GOES-R Program notifies stakeholders when the HRIT/EMWIN Software Defined Receiver Information is posted on the GOES-R WWW Site and work with users to demonstrate capability.	Completed. The updated document is provided here: http://www.goes-r.gov/hrit_emwin/index.html.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-54	Explore the feasibility of setting up a HRIT/EMWIN Software Defined Receiver test site with small user group's perspective in mind. (ex. Remote Imaging Group and EXLORES!)	The HRIT/EMWIN team has provided the software and relevant information on the GOES-R web site. Vendors and interested users are able to access this information to assist in their own design work. The HRIT/EMWIN team continues to work with Aerospace on improving the functionality of the prototype.	4-Apr-11	CLOSED

NESDIS/OSPO	SDRO 2008-55	Define restrictions and regulations regarding use of the HRIT/EMWIN Software Defined Receiver software, receiver, and applications.	Notice Regarding Use of ETTUS Corp Documentation is posted at: http://www.goes-r.gov/hrit_emwin/ETTUS-Copywright-Notice.pdf The issue of releasing Gerber Files is still under consideration as there are copyright restrictions.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-56	Provide information to the user community, including vendors, on the prototype HRIT/EMWIN Software Defined Receiver through a wide variety of sources such as: 1) Federal register, 2) WMO space programme, 3) Group for Earth Observation (user group) (GEO), 4) the Remote Imaging Group (RIG) and 5) others.	User guide, software, and executables are posted at: http://www.goes-r.gov/hrit_emwin/index.html. NOAA will continue to publicize this information through a variety of outreach methods, to include conferences, and will consider other sources as described above.	4-Apr-11	CLOSED
Direct Readout: Current and Future, Geostationary and Polar, Satellite Systems Including GVAR and E-GVAR					
Geostationary Satellites					
Actionee	**Action**	**Description**	**Action feedback/closing document**	**Deadlin**	**Status**
NESDIS/OSPO	SDRO 2008-57	Explore the possibility of a replacement for the WEFAX System that is 1) low cost, 2) uses a small antenna and is analogue based without the need for specialized technology.	NOAA transitioned from WEFAX to LRIT in 2006. NOAA does not plan to support an analogue service on any of its spacecrafts, geostationary or polar-orbiting, in the future.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-58	Put a high priority on finding a replacement for GOES-10 support over South America.	In December 2009, NOAA decommissioned GOES-10. As a replacement to continue support over the Caribbean Sea, Central and South Americas, NOAA moved GOES-12 to 60o W. This valuable support continues with operation of GOES-12 at this critical location.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-59	Recommend a review of NOAA internal (NESDIS/NWS) procedures for calling Rapid Scanning Operations (RSO)	Initiation of Rapid Scan Operations will be a topic at the next GOES Users' Conference (Oct 2011, in Birmingham, AL)	4-Apr-11	CLOSED

NESDIS/OSPO	SDRO 2008-60	Need for outreach on the transition from GOES-N/O/P to GOES-R.	NOAA and the GOES-R Project continue to expand outreach activities for GOES-R through events at the annual AMS conference, the GOES-R Users' Conferences (GUC) and the Satellite Direct Readout Conferences and other topical meetings at which the user community is typically in attendance. The GOES-R System Program Director will provide an annual program status to the Office of the Federal Coordinator for Meteorology (OFCM), which will be responsible for its distribution to agencies that will be users of GOES-R data and products. The GOES-R Project has commenced the development of a Communications Plan to describe how external stakeholders will be notified of GOES R progress, status changes, and other relevant activities. The plan will be a comprehensive summary of the outreach efforts that will be undertaken to identify users of GOES-R products and to inform them of GOES-R development. The plan includes mechanisms for providing updated status and information as GOES-R development proceeds and as progressively more detailed information becomes available. Information will include product formats, transition plans, test schedules, and other pertinent information that end users will need to be informed and to prepare for the transition to GOES-R.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-61	Consider a shift in the focus of user conferences from requirements to actual technical aspects of GOES-R.	The focus of the recent GOES Users' Conferences has shifted from requirements to user readiness. User readiness includes ensuring that the users are aware of the technical aspects of GOES-R. Also, the Cooperative Program for Meteorology Education and Training (COMET) will continue to generate training modules that cover the technical aspects of GOES-R.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-62	Continue to have workshops/conferences on the technical aspects of and transition to GOES-R including a special session or breakout group topic for direct readout users at the next GOES-R Users Conference (November, 2009).	At the 2009 GOES Users' Conference (GUC), there was a breakout session on the transition from the current generation GOES to the GOES-R series. That will also be a topic at the next GUC in Birmingham, AL in October 2011.	4-Apr-11	CLOSED

NESDIS/OSPO	SDRO 2008-63	Publish contingency plans in the case of a GOES-R series failure, including how users would shift back to GOES-N/O/P.	NOAA is in the process of developing a contingency plan for a GOES-R failure to include planning for implementing a single satellite strategy of operations. This plan will address immediate actions to transition to a single GOES operation, to relocate the satellite to a center location, and to provide continuous products and data services to all users. NOAA will provide timely notification to the user community to best use this single satellite to meet their requirements. This plan will also address operational options, taking into account the potential support of international partners, to provide additional data and products to the user community. The relocation plans, emergency imaging schedules, staff roles, timetables, user requirements, and possible international support strategies will be discussed in the plan.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-64	Plan a topic for the GOES Users Conference on contingencies for 1) possible GOES-R failures, 2) how to shift back to GOES-N/O/P if there is a failure, and 3) how to upgrade receive stations to GOES-R and downgrade them back to GOES N-P if necessary.	This information will be made available to the user communities well before the GOES-R launch. Contingency planning for a GOES-R failure will be included in the "User System Readiness Plan."	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-65	During the next GOES-R Users Conference address the GOES-R related questions and recommendations from the 2008 Direct Readout Conference.	Many of the topics were addressed at the 2009 GUC held in Madison, WI. Additional items and new issues from the 2011 DRO will be covered at the 2011 GUC in Birmingham, AL.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-66	Request to extend the post launch evaluation period of GOES-R up to a year and make the test data and procedures available.	NESDIS senior management is aware of this recommendation and it is under consideration.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-67	Inform the user community as soon as possible if NOAA will make GOES-R available immediately after initial testing or put it in on-orbit storage as planned.	When a decision is made to place GOES-R into operation, the user community will be notified as soon as possible.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRo 2008-68	Continue outreach efforts to the user community in order to promote a smooth transition from GVAR to E-GVAR and GOES-R GRB.	NOAA will keep the user communities informed through the GOES Users' Conferences, the Direct Readout Conferences, the Annual AMS Meetings, and by postings on the GOES-R.gov web site.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-69	Include the NOAA National Hurricane Center as a GOES-R proving ground site	NOAA and the GOES-R Project plan to keep the National Hurricane Center as a Proving Ground site. At the SDRO, the NHC will provide information on their Proving Ground activities. For more information, see the GOES-R.gov web site.	4-Apr-11	CLOSED

Direct Readout: Current and Future, Geostationary and Polar, Satellite Systems Including GVAR and E-GVAR					
Polar Orbiting Satellites					
Actionee	**Action**	**Description**	**Action feedback/closing document**	**Deadlin**	**Status**
NESDIS/OSPO	SDRO 2008-70	Provide training on new polar direct readout systems (LRD and HRD).	NOAA will investigate training opportunities for the new LRD and HRD systems and make users aware of when training is available.	4-Apr-11	OPEN
NESDIS/OSPO	SDRO 2008-71	Provide an equivalent capability for Polar imagery reception to inexpensive direct readout ground station similar to that used for Automatic Picture Transmission (APT) reception.	Before the last of the TIROS satellites was launched, NOAA did not have or plan to build any more AVHRR instruments. During the initial stage of the NPOESS development, NOAA worked with the Integrated Program Office to conduct studies to provide an APT service. The studies revealed that the feasibility of supporting this service was not possible. As the JPSS era started, NOAA asked the same questions for an APT or APT-like service. Since the spacecraft bus is the same as NPOESS, an investigation by JPSS was carried out. There will not be an APT or HRPT service on JPSS.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-72	Consider implementing an equivalent capability to inexpensive, direct readout ground station similar to that used for the reception of Automatic Picture Transmission (APT).	To support this type of service, NOAA would have to design and fly a free-flyer satellite equipped with an AVHRR and a Manipulated Information Rate Processor (MIRP) to produced both APT and HRPT data streams. To build, fly and maintain these satellites is not a part of the NOAA direct readout plans and most importantly, is not a part of the agency policy, plans or budget. The agency has adopted the new L-band service on JPSS as a replacement for APT and HRPT.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-73	Consider assisting APT users to find alternate solution options for receiving low resolution images to include the possible solutions of: Rebroadcast through re-broadcast services (GEONETCast, LRIT or EMWIN, Internet delivery or other methods).	NOAA is investigating the feasibility of incorporating low resolution polar-orbiting imagery in the LRIT data stream. The users will be notified of changes in the LRIT content.	4-Apr-11	CLOSED

NESDIS/OSPO	SDRO 2008-74	While realizing that there would be an impact to satellite design, consider a redesigned broadcast system or add a helical transmitter.	NOAA re-visited the design of the L-band broadcast for JPSS. Considering the requirement from NPOESS and the capability of JPSS-1 and JPSS-2, trade studies to determine the optimal configuration of the direct readout services is currently in progress. The evaluation of an APT-like service is not under consideration since the decision to move forward to a Low Rate Data service was agreed by NOAA, IPO, CGMS and the WMO in 2002.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-75	Work with EUMETSAT to see if there is still a possibility of fixing the LRPT broadcast as there is some possibility that HIRS instrument will not be used (Perceived as the reason for HRPT not being deployed).	EUMETSAT informed NOAA that a LRPT service would not be available on the MetOp satellites. The AHRPT service will be available on MetOp-B and MetOp-C.	4-Apr-11	CLOSED
NESDIS/OSPO	SDRO 2008-76	Inform users on what IPOPP data are available and who is receiving and/or distributing possibly via a graphic chart.	Information on the IPOPP software and data are available at: http://directreadout.sci.gsfc.nasa.gov/.	4-Apr-11	CLOSED

2 Introduction

The National Oceanic and Atmospheric Administration (NOAA) Satellite and Information Service (NESDIS) hosted the 2008 Satellite Direct Readout Conference: Real-time Access for Real-time Applications, at the Hilton Miami Airport Hotel in Miami, Florida, April 4-8, 2011. This conference was primarily organized to benefit users of environmental satellite direct broadcast data and for those operating their own satellite data receiving stations. It also provided a forum to help NOAA customers prepare for upcoming changes in direct broadcasts from NOAA satellites. The 2011 conference continued discussions initiated during the 2002, 2004 and 2008 Satellite Direct Readout Conferences. This conference was organized to include all global users who receive data directly from NOAA's environmental satellites.

The success of the conference can be attributed to several government organizations that assisted NESDIS and made significant contributions in providing planning, financial, and meeting support. The contributing organizations included the Office of Systems Development, GOES-R Program Office, the Joint Polar-orbiting Satellite System (JPSS) Program, and NOAA's National Weather Service. The 2011 conference represents the fourth time in the last decade that NOAA has hosted this international conference in Miami.

The objectives of the conference were to continue discussions initiated during the 2008 Satellite Direct Readout Conference (SDRC), to present specifics on the progress of the JPSS and GOES-R projects, provide an overview of the current direct readout and broadcast services and obtain feedback on how well NOAA is meeting their needs. It also provided NOAA the opportunity to inform users of the innovative new changes in direct readout technologies and new applications with future satellite data.

Nearly two hundred participants from 32 countries participated in the conference. Some of them had participated in the 2008 Direct Readout Conference, while others had come for the first time. Conference participation included speakers representing NOAA satellite programs, representatives from other hydro-meteorological agencies, NASA, research organizations, universities, the WMO, and EUMETSAT.

The conference format consisted of nine sessions organized around the following topics: 1) Welcome and Keynote Addresses, 2) Roundtable: Use of Satellites in Disaster Response and Mitigation, 3) Current Geostationary Satellite Systems, 4) Future Geostationary Satellite Systems, 5) Current & Future Polar-orbiting Satellite Systems, 6) Training Resources and Poster Session, 7) User Applications, 8) Communications and Breakout Groups, and 9) User Services and Impacts. Panel discussions were used to address specific topics such as: the lunch-time panel discussion on the use of satellite data in numerical models and the panel discussion on frequency issues. The conference provided the attendees the opportunity to voice their opinion

in several breakout groups. These groups allowed NOAA to obtain user feedback on the transition from GOES to GOES-R, the transition from POES to JPSS, Users Services and Frequency issues. There were also opportunities for conference attendees to circulate through 16 vendor exhibits and attend a demonstration of the prototype receiver card developed for reception of HRIT/EMWIN for the future GOES satellites. The poster session attracted over 50 posters and displays. Attendees were asked to complete a Satellite Direct Readout Survey and were able to attend interactive focus groups for discussion on the JPSS L-band and the GOES-R program.

In addition to keynote addresses, plenary sessions, an EMWIN/HRIT demonstration, a poster session, and concurrent breakout groups; additional Question and Answer sessions were scheduled to promote information sharing, networking, collaboration and problem solving. Government representatives were also available to speak with participants at the NOAA exhibits. During scheduled breaks, there were numerous opportunities to exchange information with colleagues and for open discussions with speakers and exhibitors. These multiple venues gave government managers and scientists excellent opportunities to hear directly from the user community.

Please note that presentations and a photo collection are available at the conference web page (http://directreadout.noaa.gov/miami11/ .

2011 NOAA Satellite Direct Readout Conference:
Real-time Access for Real-time Applications
April 4 - 8, 2011 Miami, Florida
Conference Report
Session 1: Welcome and Keynote

Introduction to the Session:

This opening session introduced the purpose of the conference and the organization of the agenda. Leaders from NOAA, NASA, WMO, and the U.S. Geological Survey presented specifics on the progress that has been made since the last Direct Readout Conference and offered information to the user community on current and future satellite programs and the need for users to prepare for the new series of satellites. Also, they highlighted international cooperation and the need for increased collaboration, as well as the necessity for feedback from both users and partners. Each representative stressed the significance of this feedback in making decisions for the future of Direct Readout and satellite programs.

Session 1: Welcome and Keynote Addresses

1.1 Welcome and Logistics

Marlin O. Perkins, NOAA Satellite and Information Service

Marlin O. Perkins, the Co-chair welcomed the participants and presented conference logistics and information.

1.2 Conference Opening Remarks and Introductions

Kathy Kelly, Director, Office of Satellite and Product Operations (OSPO), NOAA Satellite and Information Service

Kathy Kelly welcomed all attendees to the 2011 Satellite Direct Readout Conference. She informed the participants that NOAA has made impressive progress in the 2 and a half years since the last conference; in the areas of future satellite systems development and in the continued support of providing satellite data and products to direct readout users.

Ms. Kelly reminded the group that NOAA operates a system of environmental satellites in geostationary and polar orbits that provide the capability to continuously monitor space weather, the atmosphere, ocean and land environmental phenomena throughout the world. These satellite systems support NOAA programs and the Department of Commerce (DOC) strategic goals to observe, protect, and manage the Earth's resources through effective environmental stewardship.

Today, more than ever, the world relies on satellite environmental observations for weather, ocean, and climate monitoring and issuing forecasts that protect life and property.
Ms. Kelly stated this year's Conference theme is: “Real-time Access for Real-time Applications.” The primary goal of the conference is to meet with users like yourselves who receive data directly from NOAA's environmental satellites and to help you prepare for upcoming changes as NOAA transitions to new technologies for direct readout and broadcast services.

A number of excellent ideas, suggestions and recommendations emerged from the 2008 Direct Readout conference. In your registration packet, we have included a list of these 2008 suggestions and an update on the progress that NOAA has made in addressing these concerns. Some major accomplishments from 2008 SDRO include:

- **Recommendation: Put a high priority on finding a replacement for GOES-10 support over South America**
  - In December 2009, NOAA decommissioned GOES-10. To continue support over the Caribbean Sea, Central and South Americas, NOAA moved GOES-12 to 60° W. On April 2, 2010, this valuable support continued with the operation of GOES-12 at this location.

- **Recommendation: Aid in the acquisition of GEONETCast Americas receive stations to help in the exchange of data.**
  - In 2009 - 2010: Stations were installed at the University of Puerto Rico at Mayaguez, 3 stations in Costa Rica and Bowie State University.
  - In 2011: Projects to install 8 Stations in Mexico, 2 additional stations in Costa Rica and 4 stations in El Salvador are underway.

- **Recommendation: Need for outreach on the transition from GOES-N/O/P to GOES-R**
  - GOES-R Project is developing a Communications Plan to describe how external stakeholders will be notified of GOES R progress, status changes, and other relevant activities.
  - NOAA outreach activities for GOES-R are part of the following conferences:
    - annual AMS conferences.
    - Sixth Annual Symposium on Future Operational Environmental Satellite Systems.
    - Seventh Annual Symposium on Future Operational Environmental Satellite Systems.
    - GOES User’s Conferences (GUC).
    - Satellite Direct Readout Conferences.

- **Recommendation: As soon as available, provide the HRIT/EMWIN Software Defined Receiver information for GOES-R.**
  - The HRIT/EMWIN software is available at http://www.goes-r.gov/hrit_emwin/index.html.
  - The site was updated with a new software version in March 2011.

- There is a demonstration of the HRIT/EMWIN Prototype Receiver tomorrow, Tuesday evening at 5:30 PM.

- **Recommendation: Provide user's access to the NPP software for data access called the International Polar Orbiter Processing Package (IPOPP).**
  - Information on the IPOPP software and data are available at http://directreadout.sci.gsfc.nasa.gov/.

- **Recommendation: Proceed quickly with DCS upgrades in technology and capacity**
  - NOAA has developed and installed the DCS Administration and Data Distribution System (DADDS) to provide improved customer service.
  - To increase system capacity, NOAA worked with the WMO and CGMS to obtain and transition International Data Collections Service (IDCS) channels to regional use on the GOES DCS system.
  - NOAA also began phase in of new Version 2 transmitters, which will double the available channels over time.

Considering that the current suite of NOAA satellites collects billions of observations daily, the overall objectives of NOAA are to:

- Maintain precise and reliable operational, environmental, and satellite-based storm detection capabilities to protect life and property;
- Monitor the Earth's atmosphere, ocean, land surface, and space environmental conditions;
- Receive and relay data from ground-based data collection platforms, such as in-situ platforms for water management, fire detection, tsunamis, and volcanic activity; and
- Relay distress signals from people, aircraft, or marine vessels to the search and rescue ground stations of the Search and Rescue Satellite Aided Tracking (SARSAT) system.

NOAA also uses measurements and observations on an operational basis from several research satellites (particularly from NASA) in an effort to improve its forecasting and monitoring capabilities. As the benefits of these research measurements are realized, NOAA selects some of them to be transitioned from research missions to operational missions. In addition to the operational satellite systems it manages, NOAA develops partnerships with international agencies. NOAA is a crucial partner in, and also dependent on, the continued success of interagency and international efforts to integrate observing systems such as the U.S. Group on Earth Observations (USGEO) and the Global Earth Observation System of Systems (GEOSS).

Ms. Kelly emphasized the importance of this year's conference, considering the restructuring of the NPOESS program and the creation of the Joint Polar-orbiting Satellite System (JPSS) as the follow-on civilian polar satellite program. She added that there will also be new information presented on the next generation GOES-R ground system development and direct readout services. In addition, a panel of experts will discuss the proposal by the National Telecommunication and Information Administration (NTIA) to re-allocate and share the 1675-1710 MHz frequency band with broadband Internet and cell phone services. These frequencies are currently being used by many earth observation satellites to transmit satellite telemetry and

environmental observations to users and provide critical information to decision-makers for the protection of life and property-saving environmental forecasts and warnings.

In looking ahead to future environmental satellite capabilities, NOAA plans to:

- Ensure the continuity of NOAA's satellite broadcast service capabilities at or better than today's levels.
- Study options to reduce or reallocate use in the L-band.
- Invest in required enhancements of operational satellites to improve satellite performance, and improve the quantity and quality of satellite data to enhance the nation's environmental prediction capabilities.
- Work with NASA and foreign partners to transfer vital operational research data to NOAA operations to improve forecasting and monitoring capabilities.
- Investigate and secure foreign partnerships to reduce cost, foster international collaboration, and expand environmental data availability.

This conference represents the fourth time in the last decade that NOAA has hosted this international conference in Miami. NOAA looks forward to working with all of its users and continuing the cooperation with national and international partners into the next decade. Ms. Kelly thanked the conference presenters, vendors and all the organizations represented. She stated that the time to address the "Real-time Access for Real-time Applications" of future satellite data is now upon us. Since the launch of the first meteorological satellite, "real-time access" has led to "real-time applications" that translated into improved environmental forecasts and warnings that save lives and minimize property damage. The information that NOAA plans to present at this conference is extremely important for all agencies and organizations that provide and use real-time satellite information to issue environmental forecasts and warnings and make informed decisions to mitigate the effects of man-made and natural disasters.

Ms. Kelly thanked the audience and welcomed everyone to the NOAA 2011 Satellite Direct Readout Conference.

1.3 NOAA Satellite Program

Charles S. Baker, Deputy Assistant Administrator, NOAA Satellite and Information Services

Mr. Baker provided the NOAA welcoming remarks for the conference. He mentioned the NOAA mission and vision, and informed the group that NOAA touches the lives of every American every day.

Mr. Baker accentuated the leadership of Dr. Jane Lubchenco. He pointed out that Dr. Lubchenco wants NOAA to focus on developing the science to help society and to meet our vision: Healthy ecosystems, communities, and economies that are resilient in the face of change. He spoke about NOAA's organizational goals of Climate Adaptation & Mitigation, a Weather Ready Nation, Resilient Coastal Communities & Ecosystems and Healthy Oceans. He acquainted the group with NOAA'S Science and Technology Enterprise -- which is a holistic understanding of the Earth system through research, accurate and reliable data from sustained and integrated Earth observing systems and an integrated environmental modeling system.

Mr. Baker provided details about NOAA's recent satellite launches. He reported on the successful launch and operation of NOAA-19 (February 6, 2009), GOES-14 (June 27, 2009) and GOES-15 (May 4, 2010). Mr. Baker emphasized that NOAA listens to their partners' suggestions and requests, and where possible, tries to fulfill them. An example he gave was the repositioning of GOES 12 to 60^{o}W, replacing GOES-10 to continue the support for the Caribbean Sea and South America. Mr. Baker also provided insights into the improvements at the Fairbanks Alaska Satellite Operations Facility (FSOF). These enhancements were completed September 30, 2010 and the transition to operations continues through June 2011. He reported on the product support for the earthquake in Haiti drawing attention to the activities at the Port Facility of St. Marc, Haiti, as analyzed images were updated with a new type of Lidar data. The initial St. Marc imagery went to planners and ships 15 hours after the earthquake hit.

He discussed how critical satellite data provided extensive support for the Icelandic Volcanic Eruption and the Deepwater Horizon Oil Spill. He brought to their attention new satellite derived ocean and land products put into operation between 2009 and 2010. These included: Chesapeake Bay Regional Chlorophyll-a Algorithm Product, GOES-SST Project, Jason-2 Operational Geophysical Data Records, Microwave Integrated Retrieval System (MIRS), MTSAT-1R Winds, Operational Implementation of an Ensemble Tropical Rainfall Potential (eTRaP), Operational Implementation of Tropical Cyclone Formation Parameters, POES-GOES Blended Hydro-meteorological Products, Polar Winds, Using MERIS as a Failsafe Ocean Color Data Stream, GOES-O Wildfire ABBA Upgrades, Microwave Integrated Retrieval System (MIRS), and Polar Winds.

Mr. Baker further highlighted the importance of satellite data in analyses and forecasting. He used two recent events over the continental U.S. to demonstrate the increased error in precipitations rates and snowfall potential without the use of satellite data. The impacts would cause less time to react, and increased risk to life and property.

There have been several organizational changes in NESDIS since the last Satellite Direct Readout Conference. The Office of Satellite Operations and the Office of Satellite Data Processing and Distribution were merged to form the new Office of Satellite and Product Operations (OSPO). The Director of OSPO is Ms. Kathy Kelly. Also, a new decision directive required the restructuring of the National Polar-orbiting Satellite System (NPOESS) program. NOAA and the United States Air Force (USAF) will no longer continue to jointly procure the polar-orbiting satellite system called NPOESS. The United States Department of Defense (DOD), NOAA and NASA have and will continue to partner to ensure a successful way forward for the respective programs, while utilizing international partnerships to sustain and enhance weather and climate observations.

NOAA and NASA will take primary responsibility for the afternoon orbit, and DOD will take primary responsibility for the morning orbit. The agencies will continue to partner in those areas that have been successful in the past, such as a shared ground system. NOAA's portion will be named the "Joint Polar Satellite System" (JPSS) and will consist of platforms based on the NPP satellite. The DOD satellite portion will be named the "Defense Weather Satellite System" (DWSS). Partnership with Europe through the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) will continue to be a cornerstone of the polar-orbiting constellation, and will ensure the ability to provide continuous measurements.

Mr. Baker provided a status of the JPSS transition. The NPOESS Preparatory Project (NPP) is scheduled for launch in late 2011. NPP will support the afternoon mission as an operational spacecraft until the launch of JPSS-1. Selection of NPP-like spacecraft for JPSS-1 was announced in June 2010. The contractual arrangements for the spacecraft, instrument and ground system contract are on schedule. The ground system transferred from the U.S. Air Force to NASA management control on November 1, 2010.

The instrument configuration for JPSS-1 consist of the Ozone Mapping and Profiler Suite (OMPS), Cross-track Infrared Sounder (CrIS), Visible/Infrared Imager/Radiometer Suite (VIIRS) and the Advanced Technology Microwave Sounder (ATMS). The scheduled launch of JPSS-1 is very important to NOAA as it will ensure the continuity of service for its polar-orbiting constellation avoiding a data gap in the 2017 timeframe. The next generation of geostationary satellites, GOES-R, is set for launch in 2015 and will be a significant improvement over the older generation of GOES satellites.

Mr. Baker highlighted the importance of international cooperation with current and future polar orbiting systems noting that the current POES and future JPSS are a partnership with EUMETSAT. EUMETSAT supports the morning orbit while NOAA flies in the afternoon orbit and NOAA and EUMETSAT exchange all of the data. NOAA instruments fly on EUMETSAT satellites and EUMETSAT instruments fly on NOAA satellites. The benefits are cost savings on both sides, common technology and, common data for weather, climate, and oceans. EUMETSAT and NOAA also exchange GOES and METEOSAT data. In the advent of a spacecraft failure or major instrument malfunction, NOAA and EUMETSAT have a satellite backup agreement for contingency planning.

NOAA spends about $1 billion annually on its current 17 satellites in orbit. Mr. Baker noted that if there is a big cut to the budget – it could mean the JPSS program would be affected because satellites are on the chopping block of this budget package. Though many in Congress understand their importance and value to the planet, the next few years may bring severe budget reductions.

Mr. Baker noted that the Jason mission is a joint collaboration among four organizations: National Oceanic and Atmospheric Administration (NOAA), National Aeronautics & Space Administration/Jet Propulsion Laboratory (NASA/JPL), Centre Nationale d'Etudes Spatiales (CNES) and European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT). Planning for the Jason-3 mission is already underway. A Jason-3 launch in 2013 will provide about a six-month overlap with the Jason-2 mission. The overlap period will be used to conduct initial cross-calibration and validation activities, complete on-orbit check-out operations, and maintain consistent observations of sea surface height between the successive altimeter missions. The Jason-3 mission will ensure the continuity of the nearly 20-year data record. He pointed out NOAA's participation in international organizations such as the Committee on Earth Observation Satellites (CEOS), Coordination Group for Meteorological Satellites CGMS), World Meteorological Organization (WMO) and the Group on Earth Observations (GEO).

In summary, Mr. Baker reminded the attendees of the importance of Direct Readout Conferences as NOAA continues its dialog with partners and users about upcoming changes in satellite data

and direct services. He emphasized that NOAA continues to make progress on future programs and he encouraged the users to prepare and be ready for new data streams from JPSS and GOES-R. As needs for new satellite data increase, expanded partnerships will be important for bridging gaps and meeting new requirements. International partnerships, both multilateral and bi-lateral, will play a key role to coordinate satellite-based observations to help implement a Global Earth Observation System of Systems as NOAA emphasizes "better data, better science, and better decisions!"

1.4 National Weather Service Welcome

Edward Johnson, Director, Strategic Planning and Policy Office, NOAA National Weather Service

Dr. Johnson presented an Overview of the new NWS Strategic Plan which is almost ready for printing. This new strategic plan's theme is "Building a Weather-Ready Nation." It recognizes that new and increasing needs from the public require more integration among the environmental services. The new plan also recognizes that forecast uncertainty is playing a more critical role in decision-making and that there is growth in the private sector weather and climate industry.

The NWS Vision is "A Weather-Ready Nation: Society is prepared for and responds to Weather Dependent Events." Its mission is to provide weather, water, climate data, forecasts and warnings to protect life and property and to enhance economy. Dr. Johnson emphasized the increasing importance of water forecasts. The key concepts he outlined in the new plan are: integrating data and information systems (necessary for realizing the capabilities of new observing systems), exploiting science and technology, and strengthening both domestic and international partnerships.

The plan's six goals are: 1) improve weather decision services for those events that threaten human life and livelihood, 2) improve water forecasting for better water management, 3) support climate services to help businesses and communities understand climate-related risk, 4) improve sector related information for economic productivity, 5) enable integrated forecast services that support health decisions and ecological prediction services, and 6) sustain a highly professional workforce to meet the mission.

In summary, Dr. Johnson said to achieve their mission; the NWS must invest in people, infrastructure, science and technology, and partnerships. He was particularly concerned about the accumulative effect of under investment in infrastructure that has occurred which will eventually create major problems if not addressed. The strategic plan can be downloaded at http://weather.gov/com/stratplan.

1.5 National Aeronautics and Space Administration Welcome

Dr. Patrick Coronado, National Aeronautics and Space Administration

Dr. Coronado presented an overview of NASA's role in direct broadcast and direct readout. NASA, as a research organization, is focusing on the changing planet, science applications, and science application implementation. The Earth's energy balance is changing. The Intergovernmental Panel on Climate Change (IPCC) report summarized changes stating that it is

very likely that human activities are causing global warming. Temperatures are rising; sea levels are rising; arctic ice is melting. It is likely that we will experience more heat waves and tropical storms as a result. Most environmental issues are regional. Success depends upon the ability to provide decision makers with information relevant to their geography.

Greenhouse gas is a driving force impacting our planet. Increasing carbon dioxide is impacting global climate change. Global changes like these are some of the greatest challenges of our time. NASA is identifying what they do not know and segmenting their work into these disciplines. They will then research these unknowns and see how one leads to another. These science areas include: Water and Energy Cycle; Atmospheric Composition; Carbon Cycle and Ecosystems; Climate Variability and Change; Weather; and Earth Surface and Interior. NASA's research, technology, and application process framework was discussed. The research to operations process is: Models to Applied Research Domain to End Users/Decision Makers to Benefits. NASA partners with operational end users to adapt or, adopt and demonstrate science applications and the resulting societal benefits. Some of the partners include DHS, DoD, EPA, USAID, USFS, BoR, EPRI, GEO, Chesapeake Bay Program, World Bank, International Red Cross, and several other international organizations. Also, public agencies and organizations that have a mandate to serve the public through resource management, environmentally-related predictions and decision-making.

In summary, NASA must conduct Science for Society – Applications. The majority of the societal problems are regional in nature. The source or cause may be far from the area under study. Long-term data sets play a vital role in establishing boundary conditions. Direct Readout offers an excellent source for investigating regional or meso-scale problems. Direct Readout provides a great opportunity to many nations where large space investments may not be easily achievable. Direct readout is an essential capability for the World community to build capacity and apply space observations for societal benefits.

1.6 World Meteorological Organization (WMO) Space Program

Jerome Lafeuille, Chief, Space-based Observing Division, World Meteorological Organization (WMO) Observing and Information Systems Department

Mr. Jerome Lafeuille provided an overview of the WMO Space Programme. He noted that this is a collaborative activity of WMO members and programs. The main objectives of the space programme are: enhance space-based Global Observing Systems (GOS), improve availability of and access to satellite data and products, and strengthen the users' capability to benefit from satellites.

Mr. Lafeuille identified and discussed some challenges for the space-based global observing system. These were: a) Coordinate and optimize the space-based GOS, through the rolling review of requirements and gap analysis of needs and capabilities, b) Build up a sustainable climate observing system by addressing gaps in observations, and c) Maintain the continuity and to upgrade operational meteorological missions. It was noted that an architecture concept is being developed within the structure of the CEOS and CGMS. This effort will require broad cooperation with all partners. This includes radio-occultation, scatterometers, hyperspectral IR observations from LEO & GEO, and higher resolution of both GEO and LEO.

There is also an increased need for inter-calibration with reference sensors. Mr. Lafeuille also mentioned the success of the Global Space-based Inter-Calibration System (GSICS) program and gave credit to NOAA for leadership of GSICS. He stressed that we have to make sure that data becomes products. This is not an insignificant task. It is necessary to share development and validation efforts, encourage responsibility and make available validated, documented and quality-controlled data and products.

Also, Mr. Lafeuille discussed the need for increased data and products accessibility. An important point is to make sure we can increase data discovery in metadata searchable catalogs and databases. Further, he stressed the need to emphasize climate services and products for decision-making, especially in the areas of air quality, volcano and plume monitoring and space weather. He also stressed the need to make sure that the increased data flows from new monitoring systems are quantified and verified. He informed the group of an initiative in Asia and Africa on requirements gathering.

Mr. Lafeuille acknowledged that as part of the Virtual Laboratory for Education and Training, there are 12 Centres of Excellence worldwide and that there will be three upcoming related conferences: the Asia-Oceania Meteorological Satellite Conference, the EUMETSAT Meteorological Satellite Conference and the NOAA GOES Users' Conference.

In summary, Mr. Lafeuille noted that the WMO Space Programme constitutes a privileged framework for collaboration among satellite operators and user communities -- benefiting all through sharing best practices. Enhancing data access through a range of distribution means, including Direct Readout on coordinated frequencies, and fostering standardized data management, is equally important. This entails interaction with user communities from various programs and various regions, e.g., through pilot project mechanisms. The Direct Readout Conference is seen as a particularly valuable venue in this respect -- as an excellent opportunity for informing the user community, soliciting feedback, promoting best practices and stimulating the exchange of experience among users.

1.7 The International Charter for Space and Major Disasters: Monitoring and Management Support for Disaster Response

Timothy Stryker, Executive Officer, Committee on Earth Observation Satellites, U. S. Geological Survey

Dr. Stryker presented remarks on the "The International Charter – Space and Major Disaster." The International Charter provides a one-stop, unified system of emergency space data acquisition and delivery to those affected by natural or man-made disasters. Each Charter member agency has committed resources to help mitigate the effects of disasters on human life and property. The Charter has been in formal operation since November 1, 2000. Through it, an authorized user can call a single number to request the mobilization of satellite imagery and associated ground station support from Charter members, to obtain data and information on a disaster's occurrence.

Since its inception, the Charter has been activated more than 300 times (as of February 2011), in response to nearly every major disaster that has occurred worldwide. In recent years, the Charter has averaged approximately 40 activations per year. In 2011, it has been activated eight times,

as of the end of February. The Charter was most recently activated for the earthquake in Christchurch, New Zealand. Its most recent activation in the Americas was on January 14, in response to heavy flooding in the region of Rio de Janeiro, Brazil.

The Charter is supported by Argentinean, Canadian, Chinese, European, Indian, Japanese, and U.S. satellite operators, as well as through U.S. and foreign commercial satellite firms and consortia. These operators can provide a wide and growing variety of imagery and information under various environmental conditions (including, in many instances, through cloud cover and darkness).

USGS and NOAA are members of the Charter, which enables them to reduce the risks and effects of natural disasters in the United States and worldwide through use of U.S. and foreign satellite data. USGS also serves as the U.S. lead agency and current Charter Chair (through April 2011). As part of its work in the Charter, USGS maintains agreements with U.S. commercial firms GeoEye and DigitalGlobe, to provide valuable imagery in times of greatest need. Through increased U.S. domestic training in recent years, the number of U.S. Charter activations has increased dramatically, providing valuable foreign optical and radar data to support on-site response to hurricanes, floods, and tornadoes. Absent the Charter mechanism, much of these data would not be available to U.S. authorities.

The Charter works closely with the intergovernmental Group on Earth Observations (GEO), and with United Nations bodies such as the UN Office of Outer Space Affairs (UNOOSA) and the UN Institute for Training and Research (UNITAR) Operational Satellite Applications Program (UNOSAT). Both UNOOSA and UNOSAT are authorized to request data from Charter members in response to an emergency, and UNOSAT has also provided value-added information processing services for many Charter activations over the years. These organizations play an important role in maximizing the Charter's use for UN humanitarian operations.

Charter members support the principle of universal access, and in recent years have made significant efforts to broaden the global distribution and informed use of satellite-derived data and information. The Charter is working with national authorities and international organizations (such as the UN and GEO) in underserved areas (e.g., parts of Africa, Asia, Latin America, and the Caribbean) to support enhanced communications and analytical capacity, and operational response capabilities. USGS works closely with partner agencies and organizations to support training in Latin America.

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Session 2: Use of Satellites in Disaster Response and Mitigation

2.1 Panel Discussion: Use of Satellites in Disaster Response and Mitigation

Moderator: Timothy Stryker, Executive Officer, Committee on Earth Observation Satellites, U. S. Geological Survey

Panel Members: Dr. Jack Beven, National Hurricane Center (NHC)
Jerome Lafeuille, Chief, Space-based Observing Division, WMO
Edward Young, Jr., Deputy Director, National Weather Service, Pacific Region

Dr. Timothy Stryker spoke on the growing impacts of disasters on larger populations, cities, etc. He stated, "Populations are widely concentrated in disaster-prone areas. We need better science and understanding of how disasters occur and their impacts to society." Challenges come with vast improvements in available data from new satellites (e.g., JPSS, GOES-R). There are very similar challenges globally, although with slightly different details. Use of the continuously developing and expanding GTS for data management comes with some interesting challenges. The use of experimental and research data/programs vs. operational data/programs, sometimes distorts the line. The goal is to maximize use of all available data, even experimental, so long as doing so does not come with unacceptable risks (e.g., availability or accuracy of data). Dr. Stryker introduced the panel members and opened the panel for discussion.

Dr. Jack Beven, Senior Hurricane Specialist at NHC, instructor at the Tropical Prediction Center and winner of the State of Florida Emergency Preparedness Award stated that good forecasts and warnings allow people time to respond and prepare for dangerous weather conditions and for tropical cyclones, since preparations can take days. The NHC relies heavily on satellite data in its forecast and warning process. He then quoted two former Hurricane Center Directors concerning the importance of satellite data. "The greatest single advancement in observing tools for tropical meteorology was unquestionably the advent of the geosynchronous meteorological satellite," said Bob Sheets, in Weather and Forecasting, 1990 and "We cannot live without satellite data, period," stated Max Mayfield, former NHC Director.

Dr. Beven discussed the use of satellite data at the NHC. Qualitative evaluation of imagery, conventional and microwave, the use of the Dvorak Technique and AMSU Intensity Estimates have been essential tools the NHC uses for analyzing tropical cyclone location and intensity. For analyzing the size of tropical cyclones, the NHC relies on scatterometer data, passive microwave winds and satellite motion vectors. Satellite motion vectors and moisture data are used to assess the near-tropical cyclone environment. NHC does not directly use satellite soundings, but they are used in other ways, including in numerical weather prediction (NWP) models.

Future use of satellite data at the NHC could be some of the best yet for tropical cyclone analysis. Multispectral imagery, JPSS, GOES-R and the NASA Global Precipitation Measuring Mission will provide advanced data sets to enhance and improve operations at the NHC. Forecasters, modelers, and other users of satellite data have a steep learning curve ahead of them!

Meteorological satellites provide data on areas impacted by severe weather. Accurate depiction of the location and severity of the impacts can aid warning and disaster response. Many satellites provide estimates of location and amount of heavy rainfall from tropical cyclones and other weather systems. The AVHRR instrument on NOAA polar orbiters can see areas of storm surge inundation and river flooding. GOES-R and other planned satellites will provide both higher spatial and temporal resolution for monitoring impacts.

Current satellite-based instruments (even the GOES-R ABI) lack the right combination of ingredients necessary to monitor the details of the surface impacts of tropical cyclones. Improved instruments (e.g., synthetic aperture radar, next generation scatterometers) may lead to better real-time monitoring. However, satellite-based monitoring of surface conditions in a tropical cyclone is likely to remain problematic for some time. Several challenges are ahead to improve the use of satellite data in tropical storm prediction. Even with successes, there are still limitations in satellite-based monitoring of surface conditions in a tropical cyclone.

Edward Young, Jr., Deputy Director NWS Pacific Region, said the
Pacific Risk Management `Ohana (PRiMO) is a consortium of local, national, and regional agencies, institutions, and organizations committed to enhancing the resilience of Pacific communities to hazards. PRiMO partners are working together to increase collaboration on development, delivery, and application of risk management information, products, and services for Pacific communities while cultivating an appreciation for the unique physical and cultural characteristics of the region. PRiMO is based on a mutual recognition of the benefits of collective action. Activities are characterized by shared leadership and shared resources. PRiMO partnerships have improved product development and service delivery, strengthened the regional capacity to manage hazard risks, and resulted in significant cost savings by minimizing duplication of effort and improving efficiency.

Drivers for PRiMO include: islands are isolated geographically and inherently hazard prone; risk to local economies and the environment is increasing; budgets are limited and some are shrinking; and there is increased need for sound science to inform decision-making related to climate adaptation. PRiMO collaborative activities include sharing and leveraging human and financial resources, integrating service delivery and product development, and engaging stakeholders in issue identification and needs assessment. These activities result in: cost savings (travel, logistics, deployment, personnel, etc.); increased program awareness; improved service delivery and product quality; efficiencies in program/activity integration; strengthened regional capacity; formal partnership agreements; and strengthened relationships.

PRiMO has been successful in increasing collaboration. A few examples include the following activities: hosted numerous regional coordination meetings, initiated data development efforts, supported development of a regional climate service, initiated risk and vulnerability assessments, provided technical assistance, developed data sharing mechanisms, developed and evaluated decision support tools, and conducted joint needs assessments. The demand for the type of

service PRiMO provides is increasing. Since 2002, PRiMO has hosted coordination meetings at least once a year to engage stakeholders from across the Pacific. These meetings have allowed PRiMO to expand the network of partners, share information, and establish and strengthen critical partnerships. In 2009, PRiMO held its first meeting in the Western Pacific at Tumon, Guam with 80 participants from 9 different island jurisdictions attending. PRiMO now has over 50 domestic and international participating partner agencies, institutions, and organizations from the conterminous United Sates and the Asia-Pacific Region.

In American Samoa, Samoa, and elsewhere throughout the Pacific Islands which are close to seismic source regions, much progress has been made in getting warning messages, such as for tsunamis from the Pacific Tsunami Warning Center to the national disaster management and national weather service offices in the main capital islands via satellite communications, such as EMWIN, but there are thousands of populations living on outer islands and remote atolls who have very limited means to receive warning messages, even though they are within satellite footprints.

The challenges of the Island States are to concentrate on coordinated use of the data and effective outreach and the use of satellites to fill the void of surface observations throughout the Pacific Ocean. The distance between islands is a challenge with regard to transportation and communication. A lack of competition among telecommunications companies means limited network connectivity. Island States must rely on satellite and high frequency (HF)-based communications. Another important challenge for the Island States is the wide array of languages. There are more that twenty-two (22) major languages among the Island States in the Pacific basin. For warnings and watches to be effective, we must be able to communicate with these communities.

EMWIN is an effective way to communicate hazardous information. However, there is no EMWIN available at 150^{o} E. We must replace or refresh the EMWIN systems in Pacific Island countries. This is the only reliable warning system for most countries. The PEACESAT funding levels are in jeopardy, so the EMWIN rebroadcast on GOES-7 is in danger. We can investigate expanding the use of digital HF networks. VHF rebroadcast is another option.

Jerome Lafeuille, WMO Space Programme, informed the group that space-based observations are essential for forecasting, detecting and monitoring many disaster types. Observing is a precursor factor for risk assessment. Detecting and monitoring the event and measuring its driving forces are critical to forecasting its evolution. Early warning systems require coordination across many levels and agencies. National to local risk reduction plans include legislation and coordination mechanisms.

There is evidence of a tremendous increase in the cost of natural disaster in recent history. Strategies for the coordination and collaboration of Early Warning Systems include effective Hazard Data and Forecasts, Risk Information, Communication and Dissemination Mechanisms and, Preparedness and Early Response have enabled the number of causalities to remain stable.

The three stages of a disaster are Before, During, and After. In the Before stage, risk assessment consists of identification and mapping, sector planning and emergency planning. The During stage addresses monitoring, detection and crisis management. Damage assessment contributes to the After stage. Observations from space support all these stages. Understanding risks provides

evidence for preventing disaster risks. This information is critical for decision-making and developing strategies to reduce risks.

Jerome discussed the WMO Disaster Risk Reduction (DRR) Framework. Several factors of the DRR comprise the risk assessment: a historical hazard databases, statistics, trends analysis, risk analysis tools, risk reduction, preparedness, early warning system, prevention and planning, and risk transfer, insurance and bonds as well as derivatives.

In-situ and satellites data as well as forecast products are critical for supporting various policies and processes of the DRR. The DRR is an alignment of clear policies, legislation, planning and resources at national to local levels. The Programme addresses risk assessment, risk reduction and risk transfer. It encourages information and knowledge sharing as well as education and training across agencies. Satellite products are critical for the DRR. There are several satellite derived products that are essential for some disaster types. Potential for widening the use of satellites in the DRR is currently being managed by the WMO. Specific satellite product requirements need to be identified by the stakeholder. The WMO will specially concentrate on the challenges of using satellite observations to support the DRR through the initiative: Strengthening Regional Cooperation for Development and Sustainability of Meteorological, Hydrological and Climate Services to support Disaster Risk Assessment and Reduction in Southeast Asia.

Key questions and responses from the Panel:

1. What are some of the major challenges in the Future?

   a. Jack Beven – The GOES-R series of satellite. The instruments will have double the spatial resolution of the current satellites and there will be an increase in the number of channels. This will increase the data volume, but provide better analysis for understanding new features in atmospheric and ocean events. The spacecraft will provide a full disk image every five minutes. This will allow the forecaster more time to observe the movement and development of tropical features. Learning how to use these new tools and data sets will take considerable spin-up. Initially, training will essentially grant "learner's permit status," but the real expertise will come with operational forecasting experience.

   b. Edward Young, Jr. – Infrastructure Challenges. The existing Internet infrastructure is "quite poor" for many island areas. The cost and reliability are critical factors for disseminating and receiving warnings and watches. There should be a reliable and timely process for getting seismic data. These data sources are critical elements in tsunami warnings. Sea level stations are needed for tracking tsunami and non-tsunami events, and distributing warnings as necessary.

   c. Jerome Lafeuille – Evolution of the GTS. Present challenges for getting information out of the met services.

2. Is the WMO involved in your disaster charter?

a. Tim Stryker – No, WMO is not part of the charter, but WMO's hydro-meteorological group does play a role in response. They do not play a role in management of data. Most of the data are related to land remote sensing -- therefore FEMA and other land agencies are providing input.

b. Jerome Lafeuille – Charter requests priority of acquisition and quick delivery. In most cases with meteorological data sources there is no need for special delivery requests, because it is already available. Therefore, there may not be as great of a need for WMO involvement, but WMO does support the intention of the program.

3. Regarding the use of data from traditionally "research" satellites: How will these data sources be used increasingly in the future? How will they be classified in regards to continuity and operational missions?

a. Jack Beven – For the forecaster, the line between operational and research data sources is pretty well blurred. TRMM, Quikscat, AIRS (Aqua), are all used in qualitative forecasting and some are used as operational inputs to numerical models as well. So long as the forecaster can plan to use the data, even experimental data may add value. We should try to look ahead at research data sources that could be added as tools in the future (see Jack's slide of future satellites from his talk).

b. Jerome Lafeuille – It is important to document the operational benefit of research satellites, so that continued resources can support the programs. c. Edward Young, Jr. – There are 7 ground stations between the west coast of the U.S. and Guam. The experimental satellite data is crucial to filling the gaps. Any data source is used, experimental or not.

d. Jack Beven – NWS showed that AIRS "experimental" data sources were one of the most important contributors to numerical models. The complementary operational IASI was also shown to be very important to model impact & success.

4. Do you see research data as being more accessible going forward in the future?

a. Jack Beven – Yes. Folks at NASA in particular are hearing of the operational benefit and access appears to be generally improving.

5. To what degree is user understanding of satellite capabilities an issue?

a. Jack Beven – Sometimes the users have to be told what is feasible/possible. Sometimes users don't know what can be delivered from an engineering standpoint.

b. Edward Young, Jr. – Many of the Pacific Island met-service agencies are using only the lowest resolution of data and rely on New Zealand for hydrology and tsunami model information.

c. Tim Stryker – There is more funding available for warnings than there are for actual disaster response.

6. Summary – Tim Stryker

Satellites have a unique spatial ability to support disaster mitigation and response. The challenge for the transition from current to future capabilities must address the sheer amount of data. Future satellites will provide an increased data volume and a refresh rate several times faster to monitor and analyze meteorological events.

The forecast community must have the ability to absorb the new technology, despite the steep learning curves. They also need to understand how to use the new spectral bands with the improved environmental data and new products. Training and learning modules must be upgraded to support the data and products. The training is more a 'learner's permit' than being an expert. Operational systems will need communication and display upgrades. Hopefully, GTS capacity improvement will accompany the greater satellite data resources.

Key questions and responses from attendees:

1. Is the WMO a part of the Disaster Charter?
   Response: Not directly. WMO is instrumental in providing data to emergency managers who are direct members of the Disaster Charter.

2. On user requirements vs. operational capabilities, which is more important especially in light of challenges with new satellites?
   Response: Communication, customer engagement, outreach, education (e.g., SDRCs) are the important areas satellite operators address the needs of the communities.

Action Items/Recommendations:

- What resources are needed to get ready for new EMWIN on GOES-14 (December 2011)?
- NOAA should assess use of RANET Chatty Beetles by Met Offices.
- Can the inter-operable digital HF networks and VHF re-broadcast be expanded? If so, what resources are needed?
- Since MTSAT-3 will not have a downlink option for users, can NOAA investigate alternatives for acquiring the data?
- Users need to access non-NOAA data as well. Will there be up-keep on local sensors?
- Users will need processing for handling the data. Can NOAA investigate resources for getting the processing needed or provide training to determine the minimum datasets to meet local mission requirements?

- Data needs to be open to all. Can NOAA investigate ways to get unique data sets to specific users?
- What are OSPO's processes for determining user needs/requirements compared to capabilities (with due respect for fiscal & other limitations) – especially in light of new capabilities?

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Session 3: Current Geostationary Satellite Systems

3.1 Introduction

Kathy Kelly, Director, Office of Satellite and Product Operations, NOAA Satellite and Information Service

3.2 Keynote: The Perspective of WMO RA III

Alejandro Muñoz, Jefe Subdepartamento Pronósticos, Dirección Meteorológica de Chile, representing Myrna Araneda, Director, Dirección Meteorológica de Chile, and President, WMO RA III (South America).

Mr. Alejandro Muñoz's presentation focused on the current use of satellite data and products in Latin America and the Caribbean, as well as recommendations for improvement. He focused on: service organizations and their relationship with other agencies, satellite stations networks, the type of data in use, the primary applications of data, and a few case studies related to disaster events.

Unfortunately there is very little information on the use of satellite observations in Latin America and the Caribbean and there are only a few direct readout users. Many countries in Latin America and the Caribbean do not have the financial resources to install and operate satellite direct readout systems and many regions do not have high-speed Internet access.

Mr. Muñoz offered several recommendations related to broadcast services. He asked that operators publicize the products that are currently available through GEONETCast Americas, and strengthen the system. He advocates that a permanent solution to the possible end of the EUMETCast broadcast should be found and publicized. He also wants improved access to GTS. For future systems, he would like NOAA to improve the flow of information on changes to NOAA broadcast systems that will be necessary for GOES-R and JPSS. Finally, he asked that communication and coordination between Met Services and Space Agencies be improved.

3.3 NOAA Geostationary Operational Environmental Satellite (GOES) Overview

Cynthia Hampton, NOAA Satellite and Information Service

Ms. Hampton's presentation covered the GOES Mission, GOES Services, Scan Operations, Spacecraft Status, and the GOES-WEST transition. The GOES mission supports environmental warning products for the U.S. public by providing scientists the data required to detect, track and characterize weather using imagery for weather forecasting and derived products for analysis and forecasting. GOES environmental data collection platforms provide critical data from buoys, rain gauges, river levels and ecosystem monitoring. Solar instruments provide data for space

weather monitoring and forecasting. Dedicated GOES communications systems provide vital data for U.S. Search and Rescue Operations. Thus, GOES provides critical real-time environmental information to the nation. She next outlined the GOES Services: GVAR, EMWIN, LRIT, DCS, SARSAT, and Space Environment Monitoring.

GOES Variable Format Data (GVAR) transmits full resolution Imager (5 channels) and Sounder (16 channels) meteorological data to the western hemisphere. GVAR includes telemetry, calibration data, text messages, and spacecraft navigation data.

Emergency Managers Weather Information Network (EMWIN) provides critical data for Emergency Managers to obtain weather information in near real-time from a variety of sources, including the National Weather Service.

Low Resolution Image Transmission (LRIT) is used to relay satellite and weather products. These products are broadcast via a radio signal that can be received by users in remote locations that do not have landlines or Internet connections.

Data Collection Systems (DCS) provides near real-time relay of information from over 19,000 data collection platforms located in remote areas. The platforms consist of oceanographic buoys, balloons, and weather stations and are used to collect data on seismic events, ocean currents, tsunami detection, forest fires, river flow rate, and floods.

Search and Rescue (SARSAT) is a Partnership between NASA, NOAA, USAF and USCG. NOAA satellites are used to relay distress alerts from aviators, mariners and land-based users. Approximately 250 people are rescued in the United States annually and 38 countries participate in the program internationally. Transponders are on airplanes, ships, and are also available in handheld devices.

Space Environment Monitoring (SEM) services provide data to the Space Weather Prediction Center in Boulder, CO from the X-Ray Sensor (XRS) and the Solar X-Ray Imager (SXI). This sensor provides the primary measure of solar x-ray flux and flare magnitude. The imager monitors solar disk activity, including solar flares, coronal holes, and coronal mass ejections. Both the sensor and the imager provide data that is used to issue space weather forecasts and alerts.

GOES Scan Strategy: Scan Coverage for GOES-East and GOES-West was reviewed. Routine Scans are 15 minutes (CONUS coverage). Rapid Scans are 5 minutes (CONUS coverage) and Super Rapid Scans are 1 minute and give Satellite Rapid Scan Operations (SRSO) coverage. She then described the current spacecraft status:

GOES-11: Currently operates as GOES-West. It is 11 years old and the X-Ray positioners have failed and it can't track the Sun. NOAA has turned off components to save battery power during eclipse while being careful to maintain user services. It is also having some transmitter failures.

GOES-12: Currently operates as GOES-South America. It has Sounder problems. SXI prototype failed while it was GOES-East.

GOES-13: Currently operates as GOES-East. Large solar flare caused some damage. It is used in back up mode only during eclipse. There are also some propulsion and XRS problems.

GOES-14: Currently in storage mode. No spacecraft or instrument problems.

GOES-15: Currently in standby mode. It has a sound patch temperature control problem. Also since the SXI initial turn-on is a problem—the system is left on.

There are stray light correction problems on 13, 14, and 15 and they can't operate during eclipse season. The good news is that there is a new effort underway to correct this problem using longer wavelength signals, and if it works, will allow images during eclipse. GOES-14 and 15 have improved water vapor imagery and spatial resolution. These spacecraft also provide improved navigation and improved radiometrics. Finally, Ms. Hampton described the upcoming GOES-WEST transition planned for December 2011, where GOES-14 will replace GOES-11 and become GOES-West. She also mentioned that GOES-14 will be taken out of storage before the fall eclipse to begin preparations for the transition. (For additional information, go to www.oso.noaa.gov/goesstatus).

3.4 Status of the Current GOES Services (Low Rate Information Transmission and the Emergency Managers Weather and Information Network)

Paul Seymour, NOAA Satellite and Information Service
Santos Rodriguez, National Weather Service (NWS) EMWIN Program Manager

An overview of the GOES services Low Rate Information Transfer (LRIT) and the Emergency Managers Weather Information Network (EMWIN) was presented jointly by Mr. Paul Seymour, NOAA Direct Broadcast Program Manager and Mr. Santos Rodriguez, National Weather Service (NWS) EMWIN Program Manager. Both services rebroadcast a variety of NOAA products and services into a single stream, making reception low cost and manageable by most agencies. They are available anywhere in the footprint of GOES, which covers 2/3 of the earth's surface. Mr. Seymour provided characteristics of the LRIT broadcast including the downlink frequency (1691.0 Mhz) and transfer rate (128 kps). The LRIT broadcast contains a copy of the EMWIN stream, the GOES Data Collection System (DCS) data translated into a stream, and administrative messages giving users system information. He previewed some of the upcoming improvements to the LRIT, which include insertion of MTSAT data, and a redundant system at the Office of Satellite and Products Operations (OSPO) Continuity of Operations (COOP) site. Mr. Seymour stated that LRIT will not be impacted by the anticipated transition to GOES-14 as GOES-West in December, 2011.

Mr. Rodriguez followed up with an overview of the EMWIN system. EMWIN provides many benefits to emergency managers, especially its reliability and availability in a disaster situation. It is low cost, reliable, and requires little infrastructure during a catastrophic event. Improvements have already been made in the GOES NOP series of satellites (data rate doubles, forward error correction, offset QPSK modulation allows enhancement of data stream, coding gains used to retain current user dish size, dedicated transponder and no eclipse outage). In the GOES-R series of satellites the LRIT and EMWIN streams will be combined onto one transponder called HRIT/EMWIN (HRIT is High Rate Information Transfer). These combined

services will have a rate of 400 kps, and will be downlinked at 1697.4 Mhz. Please see the web page http://www.goes-r.gov for more information.

3.5 Access to Real-time Satellite Products from Mobile Devices and Desktop Browsers through a Web Map Service

Dr. Dave Santek, Space Science and Engineering Center (SSEC)

Dr. Santek spoke on the access to real-time satellite products from mobile devices. Recent advances in web-enabled handheld mobile devices have revolutionized the availability of real-time geophysical data to a global spectrum of government agencies and public institutions. The so-called 'Smart Phone' technology can now provide a link between sources of advanced satellite derived environmental products and end users independent of location. An Open Geospatial Consortium Web Map Service (WMS) has been implemented to provide overlays of varied data types (e.g., satellite imagery, weather text, warning polygons). By using a WMS, the visualization of these data is independent of clients (e.g., GIS, web browsers, Google Earth, Bing, mobile devices, etc.). Also, we have integrated notifications of weather events based on location through the use of GPS on mobile devices.

The WMS is an open geospatial consortium standard with URL based addressing. It allows dynamic zoom and roam and can overlay many types of data. WMS can do enhancements, animation and overlays of graphic types and has a product manager that uses a list of products. It also can drag and drop, has an animation control (same features on desktop and mobile devices) and can use Google maps and other applications. Though it still can be used on older type mobile phone, smart phones have more capabilities to take full advantage of the enhancements. It can get a full warning text and has highway road information. Developers are looking into event notification -- that can be regionally configurable. In the near future, native apps under development will provide real-time notification of events and product display.

Dr. Santek also talked about PAW – previously known as the PDA animated weather. The PAW is designed on a web enabled cell phone. There will be a new and improved PAW in the near future that will incorporate advances in server technology and be able to take advantage of increased capabilities on new devices.

3.6 Current Status and Planned Activities of SSEC/UW-Madison Direct Broadcast Processing Packages, Real-time Data Processing and Near Real-time Applications

Allen Huang, Cooperative Institute for Meteorological Satellite Studies (CIMSS), Space Science and Engineering Center (SSEC)

The Space Science and Engineering Center (SSEC) of the University of Wisconsin-Madison has been developing direct broadcast (DB) processing software to convert level 0 (raw data) to level 1 (calibrated and navigated data), and level 1 to level 2 (retrieval of sounding profile, clouds, land and ocean surface temperature, etc.). SSEC has been developing and distributing DB processing packages since the early 1980s, including the International TOVS Processing Package (ITPP), the International ATOVS Processing Package (IAPP), and the International MODIS and AIRS Processing Package (IMAPP). Since 2007, SSEC has been selected by the Integrated

Program Office (IPO) that manages NPOESS (now JPSS) as a partner/developer to create a processing package to convert raw (sensor) data records (RDR) to Environmental Data Records (EDR) for three major sensors to be flown on the NPOESS Preparatory Program (NPP) and subsequently the JPSS. These are the JPSS international component, EUMETSAT of the European Union (EU) who operates MetOp-A which flies a hyperspectral sounder, IASI and AMSU, among others. ATOVS Processing Package (AAPP) developed by UK Met Office is to provide S/W to convert level 0 to level 1 data for these sensors. With recent JPSS program support, the IASI processing package will be extended to include a capability to produce level 2 products.

Since 2009, SSEC has advanced their DB effort in developing Numerical Weather Prediction (NWP) and air quality models to directly assimilate real time products (i.e., clouds, water vapor, and aerosol) to demonstrate the optimal use of DB products in both these applications. Moreover, in addition to the advancement of these processing packages and applications, in 2010 SSEC successfully teamed with Orbital Systems (a manufacturer of Earth station antenna positioning pedestals and antenna systems for low and medium Earth orbit satellites) to deliver a turn-key, end-to-end, real-time data acquisition, processing and distribution system. This state-of-the-art direct broadcast system provides various real-time data processing and near-real-time weather and environmental applications, and will serve as the technology backbone for polar orbiting meteorological satellite users and provide the ability to receive, process and make applications from systems that are flying and are to be flown by NASA/US, NOAA/US, and EUMETSAT/EU.

IMAPP (International MODIS and AIRS Processing Package) allows direct broadcast users to produce local Terra and Aqua products; and software is available for download. The Direct Broadcast Processing and Application System (DBPAS) takes EOS raw data and produces products. They are currently working on air quality applications using direct broadcast data, and the software is free. He reports that there are 54 NWS offices using MODIS data in AWIPS for Proving Ground activities. He also mentioned that the Cooperative Institute for Meteorological Satellite Studies (CIMSS) supports a wide variety of civil, military and international users and is committed to supporting the NASA and NOAA Direct Readout activities. CIMSS will also maintain current software packages and develop new capabilities and applications for NPP/JPSS and MetOp and offer direct broadcast users training workshops.

3.7 INPE Applications of the Geostationary Operational Environmental Satellite - 12 (GOES-12) Data

Carlos Frederico Angelis, Instituto Nacional de Pesquisas Espaciais (INPE), Brazil

INPE/CPTEC has been receiving GOES-12 data since May, 2010 when this satellite was moved to its new orbit at 60 West. GOES-12 imager scanning schedule allows the ingestion of data covering all of South America each 15 minutes. The generation of images at high temporal resolution is crucial to support the production of information and products which are useful for many areas, decision-makers and stake holders. From its two ground receiver stations, INPE/CPTEC develops a series of products which are used by several applications all over South America and other countries like the U.S. and the United Kingdom. All processes involved in the ingestion, processing, product generation, storage and data dissemination are part of the

operational duties of INPE/CPTEC. Since NOAA kindly decided to move GOES-10 and GOES-12 to its current orbit, meteorology in South America has begun a journey to a new level of development. The new satellite position allowed the improvement of several areas like weather forecast, agriculture, now-casting, water resource management, mitigation of natural disasters, flight safety, capacity building and many others. Products like rainfall estimation, tracking of convective cells, cloud classification and others are used not only for agriculture, energy, aviation, weather forecasts and other applications, but also to produce secondary products such as number of days without rain and the risk of lightning occurrence, among others. These products are continuously generated at near real-time on an operational basis.

Mr. Angelis expressed his gratitude to NOAA for moving GOES-12 to cover South America. INPE has two main facilities to bring down polar and geo satellite data and he showed a list of satellites being received and provided a list of users for the GOES-12 Data. He said that they are actively coordinating with other countries in the generation of products, which are:

- Satellite precipitation estimates
- Drought monitoring
- Fire monitoring
- Cloud classifications
- Forecast and tracking of active convective cells
- Tracking of convective systems and associated satellite information, and lightning data
- UV index
- Cloud drift winds He also showed other products generated from other satellite systems (SST, fog, NDVI). INPE's main means of transmission is the Internet and they combine GOES with their own generated products. They also disseminate GOES-12 data over GEONETCast and are continuing to build capacity for training.

3.8 CONAE Applications of the Geostationary Operational Environmental Satellite - 12 (GOES-12) Data

Dr.Sandra Torrusio, Servicio Meteorológico Nacional, Argentina

Dr. Torrusio's presentation centered on the availability of GOES-12 data from CONAE and she focused on the National Meteorological Survey and the relationship with other users. She gave an overview of the Space Center in Córdoba – where they have a satellite mission and training test facility. They are developing a satellite with INPE which will be tested in March of 2011. On their webpage is a list of the capabilities and it also gives information about the data available for public use.

She also announced a program called "2MP" which is based on the fact that they will have 2 million children involved in their education program designed to help kids learn about satellites and their uses. CONAE will be putting some of these education materials over GEONETCast. Since the Chilean Met Service is the biggest user, they had an extensive training session for them that focused on the GOES-12 and now many are relying on this data where they had not even used it before.

Dr. Torrusio confirmed that this effort has saved many lives because of improved forecasts – in particular she highlighted a series of tornados in 2009 that decimated a village, but because of adequate warning, the residents were able to take shelter before the storm. Finally, she mentioned the possibility of including the GOES-12 data into GEONETCast in the near future.

3.9 Costa Rica Applications of the Geostationary Operational Environmental Satellite - 13 (GOES-13) Data

Dr. Werner Stolz, Costa Rican Meteorological Service

Dr. Stolz spoke on the growing and enduring relationship between NOAA and Costa Rica. The technical cooperation between NOAA and the National Meteorological Institute (IMN) of Costa Rica has been very active for many years. Currently, IMN has implemented the following systems, "with great success and impact for the attention and prevention of extreme weather events:" EMWIN, GEONETCast, RAMDIS and CAFFG. He indicated that they had installed four () antennas for GEONETCast in four of the provinces: Limon (Caribbean), Alajuela (Central Valley), Guanacaste (North Pacific) and San Jose (Central Valley); and NOAA and IMN have plans to install other antennas.

RAMSIS has been used now for about 10 years. IMN is using the Internet to send satellite images every 30 minutes to Central America in 3 channels. CAFFG is a system that was implemented about 4 years ago and has the capacity to predict the probability of floods in critical basins with six hours advance notice. Dr. Stolz noted that one key concern is that all of Costa Rica's systems need to be upgraded within the next 5 years. He also noted that NOAA products used in Costa Rica have saved many lives.

3.10 Panel Discussion: Current and Future Use of Satellite Data in Numerical Models

Moderator: Dr. Jack Beven, National Weather Service
Panel Members:
David Bradley, Environment Canada
Daniel Vila, Instituto Nacional de Pesquisas Espaciais (INPE), Brazil
Dr. Gloria Pujol, Servicio Meteorológico Nacional, Argentina

Dr. Jack Beven, from the National Hurricane Center, opened the panel discussion by stating that in addition to NOAA there are 2 other data centers in the U.S; AFWA and FNMOC that assimilate satellite data into their operational models. He said that tropical cyclone track forecast errors have decreased 1 to 2 percent over the past 30 years or so. This increased skill makes it difficult to produce better forecasts with today's models and data. However, the intensity forecast skill has only shown small improvements due to the difficulty of assimilating satellite data from the Tropical Cyclone's inner core.

He further stated that many of the improvements in tracking Tropical Cyclones come from the use of satellite IR and microwave sounding data. Satellites also help by providing data over the data sparse oceans. Model assimilation systems need to be upgraded to handle the greatly

increased data volume anticipated from the new generation of satellites along with the continuing problem of assimilating a tropical cyclone within a global model. These increases in available data from new satellites (e.g., GOES-R) will be both a challenge and a significant opportunity for modelers. A major challenge and question will be whether computer speeds will actually be fast enough to process all possible data and output forecasts in a timely manner.

Mr. David Bradley, Environment Canada, gave an introductory presentation on "Future Use of Satellite Data in NWP at Environment Canada." The Canadian Meteorological Center (CMC) is located in one building that synergistically combines both modeling R&D and operational functions. He outlined the four steps for processing data at CMC – data acquisition, computer analysis, computer forecast, and data interpretation and dissemination. CMC will soon be able to assimilate AIRS and IASI data which will represent a two-fold increase in the amount of data assimilated. They also have plans to assimilate SAR to retrieve wind data. He ended his presentation with four challenges of assimilating satellite data – 1) data access – unique solution for each new observing system, 2) data timeliness – prefer data in less than 1 hour after observation, 3) maintaining a supercomputing facility, 4) assimilating new data – it takes a long time to assimilate a new data source/type.

Mr. Daniel Vila, CPTEC/INPE, began by saying they assimilate both conventional and satellite observations but that satellite observations represent the largest source of data. INPE recently acquired a new Cray supercomputer to conduct their data assimilation activities. Their assimilation program began in 1995 and uses Ensemble Kalman Filter techniques, the physical-statistical space assimilation system, and a surface modeling system. In addition, they will soon have a 4-D version method and are working on assimilating aerosol data. They are assimilating COSMIC data and are working with JCSDA and their Met Office to determine what radiances are best to assimilate.

Dr. Gloria Pujol, Argentine Met Service, emphasized that the Argentine Met Service is very interested in assimilating soil moisture and humidity data. They have made extensive use of AMSR-E data that they receive through the University of Colorado. They are working on forecasting volcanic dust dispersion using the WRF model.

Key questions and responses from the Panel:

1. What new satellite sensors would you like to see in the future?

Responses:

Dr. Beven would like to see a microwave imager/sounder on a geostationary satellite.

Mr. Vila mentioned the new sources of GPS occultation data.

Dr. Pujol expressed a need for new monitoring and sensing for soil moisture, humidity, and volcanic ash.

2. How secretive are researchers concerning the sharing of information?

Responses:

Dr. Beven said, “Sometimes it happens & sometimes it doesn’t. There are good pros & cons either way.” He mentioned that there are more community models being developed today which by their nature foster the exchange of information and knowledge.

Mr. Vila was not certain but expects there is competition. He also said that what model a developer uses depends a lot on his computing resources.

Dr. Pujol believes there is some dialog and inferred that modeling is frequently done through partnerships and mentioned that they are using a supercomputer in Barcelona.

3. What are the challenges between mid-latitude and tropical regions?

Response:

Dr. Beven stated, “Models should continue to improve as we understand the tropics better.” That said, there are definitely some challenges with how quickly things can change compared to global (mid-latitude) models.

2011 NOAA Satellite Direct Readout Conference:
Real-time Access for Real-time Applications
April 4 - 8, 2011 Miami, Florida
Conference Report
Session 4: Future Geostationary Satellite Systems

4.1 Session Introduction

Dr. Steve Goodman, Senior Scientist, NOAA GOES-R Program

Dr. Goodman opened the session by introducing Mr. David Corbett, the NOAA GOES-R deputy program manager. He then briefly summarized the session agenda by mentioning the title/topic and the presenter's name for each of the presentations.

4.2 European Organization for the Exploitation of Meteorological Satellites (EUMETSAT): Geostationary Satellite Systems

Joaquin Gonzalez, Head of System Engineering Support Division, EUMETSAT
on behalf of Ernst Koenemann, Director Programme Development, EUMETSAT

Mr. Gonzalez provided an overview of the EUMETSAT Geostationary satellite coverage, space segment, and launch schedule. He briefly discussed the current Meteosat-6 and 7 (first generation satellites), Meteosat-8 and 9 (second generation satellites), MetOp-A, and Jason-2 currently in orbit and then provided information on future satellites. Future satellites include Meteosat-10 and 11 Second Generation (MSG) and Meteosat Third Generation (MTG) satellites. The remaining MSG satellites are scheduled to launch in 2012 and 2015 respectively and MTG is schedule to launch in 2018. On the Polar side, MetOp-B, Metop-C, and EPS Second Generation satellites are planned. MetOp-B is scheduled to launch in 2012, MetOp-C in 2016, and EPS-SG in 2018. Jason-3 is scheduled to launch around 2013 and Jason follow-on is planned around 2017. GMES Sentinel third party programs are planned for 2013, 2018, and 2020 respectively.

The MSG geostationary satellites are weather satellites that deliver image data and meteorological products for the detection of rapidly developing localized convective weather systems. The MSG series, current and future, consists of four weather satellites that will operate consecutively until 2018.

An overview of the MTG system and orbit configuration was provided. The MTG series that follows MSG will provide improved data through new instruments that include full disk high spectral imagery, high spatial resolution fast refresh imagery, lightning imagery, and infrared soundings. The MTG series provides channels extended to serve the fire community. The infrared soundings focuses on time evolution of vertically resolved water vapor structures including water vapor flux, wind profile, and transport of pollutant gases. Temperature and humidity profiles will be more frequent, instability and early warning monitoring will continue, and support for chemical weather and air quality applications will be provided. The lightning monitoring will include lightning flashes in cloud, cloud to cloud, and cloud to ground during the day and night. The detection efficiency is maximized over Europe. The GMES Sentinel-4

sounding mission has ultraviolet, visible and near-infrared instruments on the MTG satellites covering Europe every hour.

4.3 GOES-R Overview

Greg Mandt, System Program Director, NOAA GOES-R Program

GOES-R is the next generation of NOAA geostationary Earth-observing systems, scheduled for launch in 2015. Superior spacecraft and instrument technology will support expanded detection of environmental phenomena, resulting in more timely and accurate forecasts and warnings. The satellites will provide the user community, including the general public, meteorologists, private weather companies, the aviation and agricultural communities, oceanographers, hydrologist, climatologists, and national and international government agencies with about 30 times the amount of data provided by current GOES satellites. The Advanced Baseline Imager (ABI), a sixteen channel imager with two visible channels, four near-infrared channels, and ten infrared channels, will provide three times more spectral information, four times the spatial resolution, and more than five times faster temporal coverage than the current system. Other advancements over current capabilities include total lightning detection (in-cloud and cloud-to-ground) and mapping from the Geostationary Lightning Mapper (GLM), and increased dynamic range, resolution, and sensitivity in monitoring space weather provided by the Extreme Ultraviolet and X-Ray Irradiance Sensors (EXIS), Magnetometer, Space Environment In-Situ Suite (SEISS), and Solar Ultraviolet Imager (SUVI).

GOES data are the mainstay of weather forecasts and environmental monitoring in the United States. In addition to providing critical atmospheric, hydrologic, oceanic, climatic, solar, and space weather data, GOES-R will also offer improved direct services, including GOES Rebroadcast (GRB), Search and Rescue Satellite Aided Tracking (SARSAT), Data Collection System (DCS), and the Emergency Managers Weather Information Network (EMWIN)/High Rate Information Transmission (HRIT). GOES has provided direct broadcast of meteorological data since 1975. In the GOES-R era, GRB will replace the current GOES Variable (GVAR) system and provide 30 times more data, at a faster rate (31 Mbps compared to 2 Mbps), with improved resolution. A dual circular polarization approach will be utilized to accommodate the new data transmission rate. GRB will distribute the full set of level 1b products directly from the spacecraft, through custom developed Earth stations, to a variety of users, including NOAA weather forecasters, research scientists, and the general public.

The GOES-R Program is committed to ensuring that the user community is prepared for the new types of satellite imagery and data that will be available from the GOES-R satellites. The intended outcomes for the user community are day-one readiness, maximum utilization of GOES-R products, and an effective transition to operations. GOES-R is engaging users early in the process through Proving Ground and NOAA Test Bed activities, simulated data sets, scientific and user conferences, user education training modules through COMET, VISIT, and SHyMet, and the GOES-R website. The new instruments, improved spacecraft, and advanced

ground segment will allow for a host of new environmental products and services, while enhancing products and services that are currently provided. The new observations will contribute to dramatically improving weather, water, and space environmental services in the next decades, advancing public safety, and expanding economic benefits to the U.S. and our international partners.

Mr. Mandt displayed the GOES-R Satellite Program schedule which includes GOES T and U, which are in the 2012 budget. He stated that the life of the GOES-R series satellites is 15 years (5 yrs on orbit storage, 10 years operations use). He also provided an overview of the GOES-R spacecraft, highlights of some major instruments, and the operational view from space to ground. He mentioned that the GOES-R ground system feeds the access system. He announced that the development of an eGVAR (emulated GOES Variable Data) capability as a way to transition to GRB is no longer being pursued as GRB will be the only rebroadcast. He provided websites to obtain up-to-date information on GOES-R activities. Finally, he provided a broad view of the L-Band frequency shift as part of the Presidential Broadband Initiative. He closed with an advertisement for the 7th GUC to be held in October 2011 in Birmingham, AL.

4.4 The Advanced Baseline Imager (ABI) on the GOES-R series

Tim Schmit , NOAA Satellite and Information Service

The next generation geostationary satellite series will offer a continuation of current products and services and enable improved and new capabilities. The Advanced Baseline Imager (ABI) on the GOES-R series will monitor a wide range of weather, oceanographic, climate, and environmental applications. The ABI will improve upon the current GOES Imager with more spectral bands, faster imaging, higher spatial resolution, better navigation, and more accurate calibration. The ABI will expand the current five spectral bands on the current GOES imagers to a total of 16 spectral bands in the visible, near-infrared and infrared spectral regions. There will be an increase of the coverage rate leading to full disk scans at least every 15 minutes. ABI spatial resolution at the satellite sub-point will be 2 km for the infrared bands and 0.5 km for the 0.64 um visible band. ABI will improve every product from the current GOES Imager as well as introduce a host of new products. Current planned products include: retrieved Atmospheric Motion Vectors (AMVs), Quantitative Precipitation Estimates (QPEs), cloud parameters, clear-sky radiances, and surface (skin) temperature; and detection and characterization of fires, volcanic ash, fog and cloud-top information. ABI will also provide cloud-top phase/particle size information and improved snow detection, aerosol and smoke detection for air quality monitoring and forecasts. Other new products include vegetation monitoring and upper-level SO2 detection. High-quality simulated data are being used in a number of ways to prepare for the ABI information.

Mr. Schmit provided the Advanced Baseline Imager (ABI) overview describing the many improvements over current image and sounding data. Spectral coverage will go from the current 5 bands to 16 bands and spatial coverage and resolution both will be improved. He provided an example of CONUS coverage going from approximately 4 per hour currently to 12 per hour and the resolution is planned for .5 km visible and 1.0 km on other visible/near-IR. The on-orbit calibration of GOES-R ABI visible band scans will be about 5 times faster than the current GOES imager. Two scan modes are planned for ABI: Full disk images every 15 minutes + CONUS view every 5 minutes + mesoscale images every 30 seconds; or full disk every 5

minutes. These images are used for routine monitoring of continental U.S. events such as storms, dust, fires, winds, etc. Also, mesoscale images are available every 30 seconds for rapidly changing events such as thunderstorms, hurricanes, fires, etc. while still scanning other important regions. Image examples were provided to demonstrate improvements.

He also provided ABI Visible/Near IR bands sample use information and images for each of the 16 bands. He stated that when using true color or RGB color to view images, vegetation tends to be green and clouds tend to be white in images from bands. He also provided an overview of selected products from ABI. He stated that the Algorithm Working Group (AWG) is developing algorithms for L2 products currently used and also expanding the products in most areas. Product development planned and in process includes imagery for clouds and moisture, temperature and moisture, total precipitation water, aerosol, winds, fire/hot spots, land and sea surface temperature, volcanic ash and visibility, rainfall rate, snow cover and depth, ice cover, solar insolation, turbulence, low cloud and fog, aircraft ice threat, long wave radiation, total ozone, vegetation, ocean currents, and others. A slide was presented showing the baseline products now and additional new products planned for GOES-R.

4.5 High Impact Weather Forecasts and Warnings with the GOES-R Geostationary Lightning Mapper (GLM)

Dr. Steve Goodman, Senior Scientist, NOAA GOES-R Program

A major advancement for GOES-R over the current GOES include a new capability for total lightning detection (cloud and cloud-to-ground flashes) from the Geostationary Lightning Mapper (GLM). The GLM will operate continuously day and night with near-uniform spatial resolution of 8 km with a product refresh rate of less than 20 seconds over the Americas and adjacent oceanic regions. This will aid in forecasting severe storms and tornado activity, and convective weather impacts on aviation safety and efficiency. In parallel with the instrument development, a GOES-R Risk Reduction Team and Algorithm Working Group Lightning Applications Team have begun to develop the Level 2 algorithms, cal/val performance monitoring tools, and new applications. Proxy total lightning data from the NASA Lightning Imaging Sensor (LIS) on the Tropical Rainfall Measuring Mission (TRMM) satellite and regional ground-based lightning networks are being used to develop the pre-launch algorithms, test data sets, and applications, as well as improve our knowledge of thunderstorm initiation and evolution.

Dr. Goodman described the GOES-R Geostationary Lightning Mapper (GLM) instrument characteristics. The imager is a single band with a 2 ms frame rate and 7.7 Mbps downlink data rate. The near uniform spatial resolution is to 52 deg N lat with70-90% flash detection efficiency. Product availability for event, group, and flash has less than 20 second latency compared to 1 minute now for satellite rebroadcast and Internet.

The GLM will provide improved data for natural hazards and lightning including tornadoes, hailstorms, wind, thunderstorms, floods, hurricanes, volcanoes, forest fires, and air quality/NOx. Dr. Goodman noted a 7 minute increase in lead time for tornadoes with the current national average at 13 minutes; critical success index improvements of 55% better than NEXRAD; and 8 times improvement in imagery with GLM. Several images were provided for volcanoes,

tornadoes, and lightning. A new lightning image was superimposed on a current TRMM image to show more intense and detailed images that can be expected from the GLM on GOES-R. Dr. Goodman provided information on the GOES-R testing and validation for the lightning mapper. He described a risk reduction science lightning jump algorithm testing case study and other testing focused on proving total lightning utility using data from over 700 storms for testing and validation. He provided an overview called the Ground Processing Algorithm Block Diagram. In October, a Joint Campaign with InPE, USP, Eumetsat and Commercial data providers will begin. He also shared forecaster feedback for new applications. Some forecasters stated that the new data gives them reassurance to make warnings earlier because they can see indicators sooner. The GOES-R Proving Ground also provides mechanisms for involvement in testing and user readiness; getting prototypes in the hands of forecasters; keeping lines of communications open between developers and forecasters; and allowing end users to have input into the final product, and how it is displayed and integrated into operations.

4.6 Information on the GOES-R User Readiness Planning

Dr. Kathleen S. Fontaine, National Aeronautics and Space Administration

Dr. Fontaine, the User System Readiness Plan Lead for the GOES-R Ground System Project described the approach, systems, plans, and status of the User Systems Readiness plan. Their approach is to work system by system with ground, flight, program, and relevant NOAA and/or NWS contacts to (1) identify users and user groups, (2) identify changes in GOES-R to that system, and (3) prepare awareness, communication, training plans and schedules to bring users up to speed. The systems were defined as the Comprehensive Large Array-data Stewardship System (CLASS), Advanced Weather Interactive Processing System (AWIPS), Environmental Satellite Processing Center Product Distribution and Access (ESPC PDA), and GOES Rebroadcast (GRB).

Dr. Fontaine stated that the goal was to have appropriate communications to appropriate users at the appropriate time. She told users at the conference that she would be talking to them and that as soon as the program office knows, users will know. The User Readiness Plan will address communications and training needs and approaches from the NOAA and NWS sides. She wants users to be aware of NOAA/NWS effort plus training, simulators, and end-to-end testing activities from the ground segment side. Many paths will be used for communications such as the Proving Ground, User Conferences including the Direct Readout Conference, product user guides, and presentations at relevant meetings such as AMS.

The approach to gathering information and reporting on the Users Systems Readiness Plan has been approved. Dr. Fontaine noted that she is currently gathering information and working on the status of each system now and that the Plan is under development. The target date for the User Systems Readiness Plan including schedules, training and other pertinent information is early summer 2011 and will be posted on the GOES-R web site. Currently there is nothing under the 'User Readiness' link, but there will be more information there as it becomes available. She closed by saying that it is still early in the process and that any questions, concerns, or comments should be sent to her (kathy.fontaine@nasa.gov) or Mr. Jim Gurka (james.j.gurka@nasa.gov).

4.7 GOES-R Rebroadcast Services

Dr. Satya Kalluri, Randy Race, Andrew Royle, NOAA GOES-R Program

Dr. Satya Kalluri presented information on the transition from Geostationary Operational Environment Satellite (GOES) N/O/P era Direct Broadcast services. He indicated that the changes proposed for GOES-R pose a number of challenges for the end-user community. The 30-fold increase in data volume and the increase in the number of spectral bands require potentially costly re-engineering of user data acquisition terminals as well their data applications. The GOES-R project office is evaluating several approaches to support legacy GVAR (GOES VARiable format) users from two perspectives. The first is to support the transition from GVAR to GOES ReBroadcast (GRB). The second is to look at options to support those users who would not be transitioning to full GRB. The existing GVAR user base was studied to understand different user communities and their use of GOES data. For users who plan on migrating to GRB, the GOES-R Program will develop a GRB data simulator that will be made available for development and user terminal testing. For those users who may not require the full fidelity of GRB, the GOES-R Program is evaluating approaches to reduce the Level 1b data volume through a variety of compression methods. The GOES-R Program is also analyzing the trade space for data delivery, including commercial SATCOM and terrestrial options. This talk will describe these approaches.

Dr. Kalluri provided an overview of the current GOES constellation and the GOES-R system operational view. He noted that GRB data under GOES-R is very similar to the existing GOES legacy system, but will be an improved version with 2742% more data than GOES-P. He described the operational view noting that the ground segment has primary and remote backup and that the GRB downlink signal goes to NSOF. In case of failure in primary sites, backup sites for MM, GRB, and KPP Product Generation is available at Wallops in VA and in Fairmont, WV. Space to Ground communication links were further explained. Raw data comes down in X-Band, creates 1b and bounces back to the satellite. GRB uplink is X-band, HRIT/EMWIN and DCP data is S-band, and SAR DCPR is UHF. Users can downlink raw GRB data in X-band. Downlinks for the other data streams use L-band Earth Coverage downlink.

GRB will contain the Level 1B data from the GOES-R series instruments and is the GOES-R version of today's GOES Variable format (GVAR). Additional instrument information including ABI, GLM, SUVI, EXIS, SEISS, and Magnetometer was provided comparing current GOES instrument capability for GVAR and the improved GOES-R instrument capabilities. Full Disk can be done in 5 minutes with GOES-R compared to 30 minutes with the current GOES series. ABI, the largest component of GRB, was described with GOES-R providing 16 band images, with 12 of those bands having 1.6 gig pixels per image with one image every 5 minutes in Mode 4 providing 12 images per hour totaling 14 billion pixels per hour. Mr. Kalluri also described GRB downlink characteristics, provided dual polarized signal, GRB data rates, and GRB channel content information. The slides provide details.

The GOES-R program will provide GRB resources for Users including Product Users Guides to be finalized in 2012, 5 GRB simulators available in 2013, and GRB downlink specifications in 2012. Antenna design specifications will be completed next year.

4.8 NOAA Report on the Development of the GOES-R Access Subsystem (GAS) and Future Products

Reginald Lawrence, NOAA Satellite and Information Service

The National Environmental Satellite, Data, and Information Service (NESDIS) is responsible for the collection, processing, archival storage and dissemination of environmental data collected by a variety of in situ and remote sensing observing systems, operated by NOAA. In support of the GOES mission, the Environmental Satellite Processing Center (ESPC) provides ingest of telemetry data, processing, and dissemination services. The Environmental Satellite Processing and Distribution System (ESPDS) will be ESPC's next generation system (enterprise solution) for the delivery of these services. The ESPDS GAS capabilities will enable external entities and users to interact with and receive GOES-R data and products in real-time or near-real-time. The GAS consists of Data Reception, Data Storage, Data Access, and Data Distribution. Users will be able to obtain archived GOES-R data and products from the Comprehensive Large Array-data Stewardship System (CLASS). The GAS, as part of the ESPDS PDA, operates at the NSOF for the life of the GOES-R mission.

The GAS facility will be an integral part of the GOES-R ground system and will provide both push and pull product delivery to support product subscriptions as well as ad-hoc product queries. The baseline GAS will support 1,000 simultaneously connected users, 200 simultaneous subscription requests, 100 simultaneous ad-hoc requests, and provide an initial continuous data delivery capability of 500 Mbps. GAS will be developed and integrated as a part of an enterprise NESDIS Data Processing and Distribution operational capability; i.e., as a part of the ESPC's new Product and Distribution Access (PDA) subsystem.

The derived enterprise PDA evolution plan and services were discussed. The PDA services include push and pull data, routing of data to users, subscription services, data distribution including user interfaces, internal short term data storage including interface to CLASS, and support for future data and product enhancements. Slides were presented showing current and planned data flow and the notional architecture. A phased acquisition approach is planned which will segment the process into phases beginning in 2011, transition in 2013, and reaching full consolidation and completion in 2015.

4.9 GOES-R Proving Ground Demonstrating New Products to Ensure User Readiness

Jim Gurka, Physical Scientist, NOAA GOES-R Program

GOES-R, while providing a great leap forward in observing capabilities, will also offer a significant challenge to ensure that the users are ready to exploit the vast improvements in spatial, spectral, and temporal resolutions. In order to ensure user readiness, forecasters and other users must have access to prototype advanced products well before launch, and have the opportunity to provide feedback to product developers to ensure that the end products truly meet their needs.

The GOES-R Proving Ground (PG) engages the National Weather Service (NWS) forecast and warning community as well as other agency users in pre-operational demonstrations of select products with GOES-R attributes (enhanced spectral, spatial, radiometric, and temporal resolution). In the PG, developers and forecasters test and apply algorithms for new GOES-R satellite data and products using proxy and simulated data sets, including observations from current and future satellite instruments (MODIS, AIRS, IASI, SEVIRI, NAST-I,

NPP/VIIRS/CrIS, LIS), lightning networks, and computer simulated products. For NWS operations, the products are integrated into AWIPS, and transitioning to AWIPS-II. The products to be evaluated in 2011 will include: cloud and moisture imagery, cloud phase, cloud/snow discrimination, low cloud and fog product, convective initiation, volcanic ash detection and height, sulfur dioxide detection, aircraft icing threat, enhanced "V"/overshooting top detection, hurricane intensity estimates, red-green-blue (RGB) air mass product, Saharan air layer (SAL) product, super rapid scan imagery, tropical cyclone rapid intensity index, lightning detection, hail probability, a "near casting product," and some additional products to be selected in consultation with the NWS and their partners.

Mr. Gurka described the GOES-R Proving Ground (PG) as a collaborative effort between the GOES-R Program Office, select NOAA/NASA Cooperative Institutes, NWS forecast offices, NCEP national centers, JCSDA and NOAA Test Beds. Proxy and simulated GOES-R data are tested and integrated into operations to bridge the gap between research and operations before the launch. This is a key element of GOES-R User Readiness for risk mitigation. The Proving Ground puts prototype GOES-R products in the users' hands and gives them a say on the final product for maximum readiness and utilization for both the developers and users of GOES-R products ensuring an effective transition to operations.

The goal of the PG is to maximize the use of GOES-R products as soon as data is available and provide lessons learned and user input for products. Proving Ground (PG) partners are across CONUS plus HI and AK. Baseline products include: volcanic ash, imagery, hurricane intensity, rainfall rate, etc. and are based on the desires of the NWS. The 2010 Hazardous Weather Test bed Spring Experiment included the development of a pseudo lightning mapper. The National Hurricane Center PG work was included for 2010 hurricane intensity, super rapid scan imagery, and an aerosol/dust product. A Hurricane Igor movie loop was shown as an example of using one minute imagery refresh. Work is going on with the Aviation PG on detecting valley fog. The Proving Ground continues to expand and improve.

4.10 Cooperative Institute for Meteorological Satellite Studies Proving Ground Activities

Dr. Bernadette Connell, Cooperative Institute for Research in the Atmosphere (CIRA)

Dr. Bernadette Connell focused on many of the Proving Ground (PG) activities being carried out at the Cooperative Institute for Research in the Atmosphere (CIRA. One of the responsibilities of their PG activity is to help with the transition from GOES to GOES-R. This comes in many forms: enhanced understanding of the basic channels, enhanced products created from the basic channels, assimilation of satellite imagery into models, and adaptation/enhancement of technology to display this new information. A smooth transition from GOES to GOES-R requires a good understanding of basic information, product development and evaluation, assimilation of basic information into models, and adaptation/enhancement to display this new information. This is accomplished through research and training cooperatively with NOAA. A listing of CIRA PG products was provided in the presentation followed by slides providing images and additional information on PG products and testing.

Synthetic ABI imagery coming from model output familiarizes users with characteristics of new ABI bands. See this image at http://rammb.cira.colostate.edu/ramsdis/online/goes-r_proving_ground.asp. The Low cloud Fog (GOES Bi-Spectral) image was also provided with

detailed information in the slide presentation. The Orographic Rain Index (ORI) product was discussed along with the MSG RGB Air Mass Example from the NHC PG and other products. Proving ground product demos can be found online, through AWIPS, and Google Earth. The website link is http://rammb.cira.colostate.edu/training/visit/.

4.11 Cooperative Institute for Meteorological Satellite Studies Proving Ground Participation

Wayne Feltz, Cooperative Institute for Meteorological Satellite Studies (CIMSS)

The University of Wisconsin-Madison Cooperative Institute for Meteorological Satellite Studies (CIMSS) has been participating in GOES-R Proving Ground activities since 2008. UW-CIMSS in 2009-2010 primarily focused on the demonstration of satellite-based convective initiation, overshooting-top/enhanced-V, and WRF ARW simulated NWP decision support at the NOAA Hazardous Weather Test bed to prepare forecasters for future availability of GOES-R/ABI WES radiances and products. These activities are part of the larger GOES-R Proving Ground program with participation from other institutes including CIRA and NASA SPORT which provide valuable lightning data proxy and other related decision support aids. The primary focus in 2011 will be delivery of volcanic ash, SO2, low cloud/fog, cloud property, and turbulence products to the Aviation Weather Center (AWC), Alaska Region and Pacific Region. His talk focused on how the products are delivered and feedback with regard to utility within AWIPS/N-AWIPS environment, training, and forecaster feedback.

Mr. Feltz presented the Proving Ground (PG) goals from a CIMSS perspective. He stated that the CIMSS PG goals are to (1) provide pre-launch GOES-R real proxy and satellite simulated data and products to end-users, (2) make data available by various means with end-user decision support systems, and (3) provide strength and weakness documentation along with in-field training including collaborative feedback to guide incremental improvements.

Mr. Feltz described an ambitious 2011 PG test bed demonstration schedule. A spring experiment is planned at SPC/HWT in May 2011, the AWC will be testing in several areas from June-December, the OPC/HPC and NESDIS SAB will be testing cloud top temperature/phase/height overshooting top imagery from June-July. Other plans for 2011 include a Pacific Region demonstration, a high latitude test bed for the Alaska region, an NWS operational test bed and a hurricane test bed.

NWS WFO feedback is key and necessary to guide proving ground efforts. The CIMSS PG wants to provide GOES-R like products to end-users such as NWS forecasters and the FAA for decision support. The PG activities have also shown new ways to use polar and geostationary data for NOAA decision support guidance.

4.12 NASA Short-term Prediction Research and Transition (SPoRT) GOES-R Proving Ground Activity

Dr. Andrew Molthan, Principal Investigator, SPoRT Program, NASA

The NASA Short-term Prediction Research and Transition (SPoRT) program is a partner with the GOES-R Proving Ground (PG) program helping forecasters understand the capabilities and unique products to come from the GOES-R instrument suite. SPoRT is working collaboratively with other members of the GOES-R PG team and Algorithm Working Group (AWG) scientists to develop and disseminate a suite of proxy products that address specific forecast problems. SPoRT will use these products to train forecasters on the capabilities of GOES-R and foster feedback to develop additional products, visualizations, and requirements beneficial to end users' needs.

Dr. Molton described the NASA Short-term Prediction Research and Transition (SPoRT) center goal to help NOAA with transition of GOES-R products to the operational community. SPoRT is a NASA project to transition unique and research capabilities to the operational community and it is actively involved in the current GOES-R Proving Ground activities in a number of ways. SPoRT is located near the NWS office in Huntsville, AL, which works with SPoRT on some proving ground activities. SPoRT's role in the GOES-R proving ground leverages its strengths including linking products to known forecast problems, test and transition; utilizing GLM, selected ABI products, and data display in AWIPS/NAWIPS/AWIPSII; and product training and impact assessments.

SPoRT's focus is on a zero to 48 hour forecasts on a regional scale using the southern region collaborations and partnerships initially -- with plans to address new challenges in other regions in the future. SPoRT is developing new capabilities to transition products to the next generation AWIPS software (AWIPS II) also.

4.13 NHC Test Bed

Dr. Jack Beven, NOAA National Weather Service

Dr. Beven provided an overview of GOES-R and preparation activities including the Algorithm Working Group (AWG), GOES-R Risk Reduction (R3), and the GOES-R Proving Ground (PG). The National Hurricane Center (NHC) is involved with evaluating the Hurricane Intensity Estimate (HIE) baseline product and the GOES-R decision aids/imager products including the RGB Air Mass Product, Saharan Air Layer (SAL) product, super rapid scan imagery, and the rapid intensity index.

Dr. Beven summarized the NHC PG activities to date as a learning experience. He stated that several seasons would be needed for adequate GOES-R preparation. The SRSO data was useful for infrastructure tests and the NHC obtained useful feedback on HIE, RGB imagery products, and lightning algorithms from forecasters. He said that the N-AWIPS and later AWIPS-II format is preferred. Dr. Bevens said forecaster availability, data display systems, and time constraints limit the number of products that can be tested per season.

4.14 Storm Prediction Center

Chris Siewert, Oklahoma University, Storm Prediction Center

The GOES-R Proving Ground 2010 Spring Experiment at NOAA's Hazardous Weather Test bed (HWT) and Storm Prediction Center (SPC) in Norman, OK provided a unique opportunity to interact with and study, in an operational framework, new products available from the next generation GOES-R satellite to be launched in 2015. The overall goal of the Proving Ground is to prepare forecasters by providing them with the knowledge, training and experience needed to effectively use the products in day-to-day operations once they become routinely available. Mr. Siewert is the liaison between GOES-R and the Storm Prediction Center (SPC). He described how the GOES-R Proving Ground supports both the EFP (Experimental Forecast Program) and EWP (Experimental Warning Program).

A summary of the 2010 spring experiments at NOAA's Hazardous Weather Test bed and SPC was provided. Real-time forecast and warning exercises using operational decision support tools were conducted. The feedback from the experiment included relating products to the forecaster's conceptual model. This is crucial as forecasters would like 'product tracks' for temporal trends and background fields such as cooling rates, etc. Most products increased short-term situational awareness and forecast/warning confidence. A summer fire weather experiment is also planned for 2011.

4.15 University of Wisconsin Direct Broadcast Experience and Plans

Kathleen Strabala, Cooperative Institute for Meteorological Satellite Studies (CIMSS)

The University of Wisconsin – Madison (UW) has supported the Direct Broadcast (DB) community through the creation and release of free software packages that allow users the capability to create local science products from data acquired through their own antennas for more than 25 years. UW plans to continue to support the DB community in the future through a processing package system for a variety of polar missions including JPSS NPP.

Ms. Strabala described current activities including Infusing satellite Data into Environmental Applications International (IDEA-I), future IMAPP plans for polar products, SwathViewer, new release of DBCRAS, air quality trajectory forecast, and a training workshop in China. IMAPP has funding through 2012. NPP plans were also discussed. Six months after the NPP launch, CIMSS will release the 1st version of research grade NPP SDR and EDR processing software. Ms. Strabala also referred to the Poster for the Geographic Information Network of Alaska that shows the combined IMAPP, SwathViewer, and OGC Web Services Virtual Appliance.

A Direct Broadcast Workshop schedule was reviewed including past workshops that focus on the needs of the users world-wide.

Key questions and responses for Session 4:

Dr. Goodman was asked, "Is there was a way to use the lightning mapper data to help predict the occurrence of forest fires based on the data from cloud-to-ground strikes?"

Response: Dr. Goodman replied that they currently do not have a method to separate in-cloud lightning from cloud-to-ground lightning but they are working on a method to differentiate the two types of lightning.

Jerome Lafeuille requested information on how users should prepare for the transition from GOES to GOES-R since many users were expecting GVAR data, and there are big changes for people to use GOES-R GRB instead?

Response: Greg Mandt said, "The GOES-R program will be preparing a transition plan for the users. Once GOES-R is launched there will be a 6-month period of data collection for checkout before it is placed into storage. Data collected during that period could probably be accessed via CLASS by users interested in getting more familiar with the GOES-R data." Mr. Mandt stated that he would like to start talking about how users can transition from current services to new systems in the break-out sessions. Therefore, more time can be spent on GVAR questions.

4.16 HRIT/EMWIN Prototype Demonstration

Craig Keeler, NOAA GOES-R Program, and Paul Seymour, NOAA Satellite and Information Service

In the late afternoon on Tuesday, April 5th, NOAA had an extra session on a prototype, software defined radio receiver designed to receive LRIT, EMWIN and HRIT/EMWIN. Rob Wagner and Santos Rodriguez, the National Weather Service, and Paul Seymour, NESDIS, gave a slide presentation on the LRIT, EMWIN and combined HRIT/EMWIN programs. Dr. Esteban Valles, Aerospace, also had a presentation on the technical aspects of the prototype development and Craig Keeler (GOES-R Program Lead Systems Engineer) provided introductions and facilitated the Q&A session.

EMWIN and LRIT are NOAA data broadcast services from the GOES satellites that provide users a variety of weather forecasts, warnings, and imagery. With the GOES R-T satellite constellation, changes will occur to these services that will affect these broadcasts and their users. This presentation described the EMWIN and LRIT services and the changes that will occur with the transition, culminating in a merged 400 kbps broadcast in the GOES R era. Also discussed was the proof of concept system that was developed to be backward compatible and transition ready. This design takes advantage of software defined radio techniques for greater flexibility and reduced user cost.

The prototype HRIT/EMWIN card is both backward and forward compatible. A video was shown with the heavy rain we had on Tuesday demonstrating that it had no impact on the EMWIN antenna. Dr. Valles of Aerospace provided a broad overview of the schematics for the prototype card. It was built for less than $100 in parts. The throughput is greater than 1.4 Mbps depending on the computer used. It is expected this will increase with future computer systems. It was estimated that a commercial version will cost $700-$1400 (USD). A user manual and technical document can be found on the GOES-R web site, www.goes-r.gov, on the left side under User Readiness.

Key questions and responses:

1. Will LRIT or HRIT be available from GOES-13?
   Response: LRIT will test HRIT on GOES-13.

2. What is the status of the LRIT/HRIT software licenses?
   Response: The software is in the public domain.

3. Are the HRIT specifications defined?
   Response: The specifications are fully defined, but there may be changes from the lessons learned.

4. Will the specifications be available to vendors for comments?
   Response: Yes.

5. How long will it take to send a message?
   Response: With HRIT, the message will be almost instantaneous. The current warnings are issued under a minute.

2011 NOAA Satellite Direct Readout Conference:
Real-time Access for Real-time Applications
April 4 - 8, 2011 Miami, Florida
Conference Report
Session 5: Current and Future Polar-Orbiting Satellite Systems

5.1 Session Introduction

Gary Davis, Director, Office of Systems Development, NOAA Satellite and Information Service

5.2 Keynote: Region Association (RA) V

Dr. Sri W. B. Harijono, Director General, Agency for Meteorology, Climatology and Geophysics (BMKG), Indonesia, and President, WMO RA V (South-West Pacific)

Dr. Harijono began her keynote address by describing the climate regime for Region V countries as Tropical Maritime Continental. One of their largest needs is Warning Centers that can anticipate and accurately predict the various types of significant weather and climate variability events of the Region. Some of the most important weather events that affect Region V are: Typhoons, Tropical Storms, Monsoons, Land Fires, Floods, Haze and other types of severe weather. Understanding climate variability and environmental change is also important for the region.

There are numerous polar and geostationary satellite downlink stations serving Region V that provide real-time data critical to monitoring and forecasting these life and property sensitive environmental events. In Southeast Asia, MTSAT and NOAA polar satellite data are primarily used. In Australia, New Zealand and the U.S., they use MTSAT, GOES West, MetOp and NOAA polar orbiting satellite data. In the small island developing states, satellite data is limited to MTSAT and GOES West low-resolution satellite data.

Dr. Harijono next outlined the future expectations from Region V. For the Polar-Orbiting Satellite Products, there will be an extension of areal coverage of the satellite scatterometer data and higher spatial and temporal resolution. There is expected to be an increasing resolution of wind velocity products at the ocean surface as well as better capabilities to identify local convection processes leading to better understanding of tropical cyclones and tornado's using the Radar-Polarimetric Satellite (RPS). There will be an increasing capability to monitor the tropical air-sea interaction process – a critical aspect in the generation of extreme weather events. For Geostationary imagery products, they will require an increase in image frequency and low-light visible imagery. She also mentioned that the southern hemisphere countries are adversely impacted when GOES images are cut off when the northern hemisphere rapid scan is occurring. Finally, she addressed the issue of capacity building in Region V related to satellite data acquisition, processing, analysis and interpretation, and expanded training. They also hope to continue to use the Data Collection System, upgrade existing receiving stations when possible to high resolution data, and provide assistance to small island nations for equipment upgrades.

In conclusion, Dr. Harijono thanked the world satellite community for considering the importance of user readiness and conducting these types of conferences and training sessions. She said that user readiness in many parts of Region V is a slow, step-by-step process, especially for developing countries. They also need longer lead times to either secure internal funding or solicit donor funding to support these investments. Many preparations must be done over the next 2-3 years to submit proposals, allocate budgets for purchasing the completely new receiving stations together with capacity building infrastructure including new training on satellite processing, analysis and interpretation.

5.3 Polar-orbiting Operational Environmental Satellite (POES) Program Overview

Cynthia Hampton, NOAA Satellite and Information Service

Ms. Cynthia Hampton from NOAA's Satellite and Information Service focused her presentation on an overview, services, and satellite status of NOAA's POES spacecraft.
The POES program currently consists of six spacecraft:

- MetOp-A: AM Primary, Launched 10/19/2006, orbit 21:31
- NOAA 19: PM Primary, Launched 2/06/2009, orbit 13:33
- NOAA 15: AM Secondary, Launched 5/13/1998, orbit 16:36
- NOAA 18: PM Secondary, Launched 5/20/2005, orbit 14:13
- NOAA 16: PM Secondary, Launched 9/21/2000, orbit 19:26
- NOAA 17: AM Backup, Launched 6/24/2002, orbit 20:58

While there is a good compliment of orbits, there is no ability to change orbits which drift over time. More recent orbits are more stable which has led to better coverage for users. Next, she showed a picture depicting the basic satellite components and instruments and outlined the services provided by POES including HRPT, APT, Argos DCS, and SARSAT. Then she showed a diagram about the POES communication links, depicting the complex multiple bands and transmitters.

There was a lengthy discussion on the status of each of NOAA 15 – 19 spacecraft which reported on all subsystems currently not green on the POES Spacecraft Status Summary web pages accessed through http://www.oso.noaa.gov/poesstatus/index.asp. This part of the talk covered higher level current statuses including a brief synopsis of the current status and problems. MetOp-A status detail was not covered.

5.4 Argos Data Collection System

Scott Rogerson, NOAA Satellite and Information Service

Mr. Scott Rogerson, NOAA's Argos Program Manager, described the Argos Data Collection & location System (DCS) as a data collection relay system that adds the benefits of providing global coverage and platform location. The Argos program is administered under a joint agreement between NOAA and the French Space Agency, Centre National d'Etudes Spatiales (CNES). The system consists of in-situ data collection platforms equipped with sensors and transmitters and Argos instruments aboard NOAA and EUMETSAT polar-orbiting satellites. The global environmental data sets are collected at telemetry ground stations in Fairbanks,

Alaska; Wallops Island, Virginia; and Svalbard, Norway; and pre-processed by NESDIS in Suitland, Maryland. Two CNES subsidiary companies, Collecte Localisation Satellites (CLS) in France and CLS America in Maryland process the data and deliver it to users.

Flying the Argos system aboard polar-orbiting satellites provides worldwide coverage. Additionally, incorporating the Argos instrument on a moving satellite allows for locating an in-situ platform using Doppler shift calculations. This positioning capability permits applications such as monitoring drifting ocean buoys and studying wildlife migration paths, among many others. There are currently over 20,800 active Argos Platforms being tracked by 1,700 users in 107 countries. An overview of current Argos DCS users and applications was provided – with a focus on NOAA products & services – along with a summary of coming changes to the overall system (e.g., SARAL launch in 2011, MetOp-B launch in 2012). There is hope Argos will fly on JPSS-2.

Question: Dr. Jack Beven from the Hurricane Center asked: Is there anything that can be done about Argos drifting coverage? Sometimes there are several hour dropouts precisely during crucial forecast periods.

Response: If the platform, satellite, and ground station are all within sight of each other, then data relay is quick (~ 15-30 minutes). In some areas with poor spatial coverage of ground stations, the best we can do with 6 satellites is 2-3 hours. In the future, we anticipate we will use the Svalbard station to cover the blind orbits, so that we will no longer have to wait for Wallops or Fairbanks to get those orbits. This would be a big help, but there are resource issues and some minor engineering issues to be overcome.

5.5 European Organization for the Exploitation of Meteorological Satellites (EUMETSAT): Polar-orbiting Satellite Systems

Sean Burns, EUMETSAT

Mr. Sean Burns described Europe's first polar-orbiting satellite dedicated to operational meteorology. It represents the European contribution to a new co-operative venture with the United States providing data to monitor climate and improve weather forecasting. MetOp has brought about a new era in the way the Earth's weather, climate and environment are observed and significantly improves operational meteorology, in particular Numerical Weather Prediction (NWP). In particular the Infrared Atmospheric Sounding Interferometer (IASI) instrument has the ability to detect and accurately measure the levels and circulation patterns of gases that are known to influence the climate (such as carbon dioxide), and heralds a breakthrough in the global monitoring of the climate.

The EPS programme consists of a series of three polar orbiting MetOp satellites, to be flown successively for more than 14 years from 2006, together with the relevant ground facilities. The Initial Joint Polar-Orbiting Operational Satellite System (IJPS) is an agreement between EUMETSAT and NOAA and comprises a MetOp satellite from Europe and a NOAA satellite from USA. The data services from EPS are provided by the MetOp and NOAA polar-orbiting satellites. These include data from instruments, direct readout and generated products derived from the global data dumps and regional direct readout acquisition.

Question: Are there any plans to put on an AMSU like microwave instrument and advanced scatterometry with a broader coverage on the next generation of EPS? **Response:** The member nations are determining which sensors will be on the future EPS.

5.6 Analysis of Extreme Rainfall in Cusco in Summer 2010

Jorge Chira La Rosa, Director, Oficina General de Operaciones Tecnicas, Servicio Nacional de Meteorología e Horología, Peru

Dr. Jorge Chira La Rosa presented a case study of extreme rainfall in Cusco, Peru. On January 21-25 a line of thunderstorms became nearly stationary over Southern Peru, generating locally heavy rainfall and flooding from Puno to Cusco region. A research project was conducted in relation to the meteorological aspects of the flood event that devastated several cities in the Cusco region. The January 2010 event showed the importance of NOAA satellite observations revealing strong southeasterly flow, probably caused by the intensity of South Atlantic convergence zone that persisted for several days and brought much moisture to Peru.

The floods caused loss of life, injured people, destroyed farms, bridges, railroads, and caused an economic loss of around $250 million (USD). The Peruvian Weather Service issued a weather warning for the entire region before the event. A Civil Defense Institute report showed many cities impacted. Many people, including tourists were isolated. The exact places, where the floods were expected to occur, were quite difficult to predict because of the limited observational network. In 2011, an increased number of automatic weather stations in this area will allow the Peruvian Weather Service to improve monitoring in this region.

The lesson learned on this event confirmed the need to establish an Early Warning System in the Cusco region, to warn the population against natural disasters. NOAA and COMET (UCAR) also used this event as an example to publish a very good flash flood early warning system reference guide. He concluded by thanking NOAA for this Flash Flood Early Warnings guide to prepare for future events.

5.7 MyOcean

Frédérique Blanc, CLS France

Ms. Frédérique Blanc presented a talk on MyOcean (http://www.myocean.eu.org) which is a large implementation project whose objective is to reply to the need of the EU GMES program (Global Monitoring for Environment and Security, http://www.gmes.info/) and consequently define and set up a concerted and sustainable pan-European capacity for ocean description and ocean prediction, a marine core service. This marine environmental service is free and guaranty, providing regular and timely access for all users requesting information on the ocean (ocean currents, temperature, salinity, sea level, primary ecosystems, and ice coverage). The system integrates, transforms and harmonizes observations data (space and in situ) into ocean information, and uses data combination and assimilative models to monitor various ocean zones.

Ms. Blanc then discussed the MyOcean project, including the values, production portfolio, services and the system. It is also a Marine Core Service for Europe (European Network). There are 61 partners from 29 countries with producers, R&D, and users. There are 7 monitoring and forecasting centers, and 5 thematic assembly centers. And there is only one single service desk. There are more than 200 users (signed). This new service version 1.0 was launched on Dec 16, 2010.

5.8 NPOESS Preparatory Project – Joint Polar-orbiting Satellite System Program Overview

Gary Davis, Director, Office of Systems Development, NOAA Satellite and Information Service

The NPOESS program was terminated in September 2010 and the polar constellation split into three orbits: NOAA (13:30), DoD (05:30) and EUMETSAT (09:30) orbits. The common ground system goal is to reduce data latency. NASA will procure and integrate JPSS for NOAA, similar to the GOES model. NPP will be completed as planned, to provide continuity and risk reduction. JPSS-1 will be a clone of NPP, so that it's done in time. Yet, it has no SARSAT or A-DCS. These two sub-systems may be launched on a free-flyer.

There are many benefits planned from the JPSS program: continuity, increased timeliness, and several advanced instruments (e.g., VIIRS, CrIS). These instruments will greatly improve monitoring capability for a number of phenomena: clouds, land, ocean and the atmospheric. Dr. Mitch Goldberg showed how important the afternoon orbit was for a heavy snow event for the East Coast.

There is a need for increased funding to get ready on time. NPP hardware is being assembled and has only a high data-rate downlink option. If funding allows, a low-rate option will be added to JPSS-1. A question was asked if Japan can still provide their support. The answer was yes.

5.9 Overview of the Defense Weather Satellite System (DWSS) and Planned Activities of DMSP at McMurdo

Capt. Harvey S. Gaber, Ground System Chief, Defense Weather Systems Directorate, USAF

The Department of Defense has assumed responsibility for the early morning polar environmental satellite orbit after the restructure of the National Polar-orbiting Operational Environmental Satellite System program. In this presentation, Captain Harvey Gaber from the Defense Weather Systems Directorate (DWSD) provided an overview of the current DMSP capabilities, the new DWSS capabilities and status, along with a description of the effort at the Joint Satellite Operations Facility at McMurdo, Antarctica. He included information on requirements, sensors, data products, and the spacecraft for DMSP and DWSS. The presentation also addressed the cooperation between the DWSS and the Joint Polar Satellite System in sharing a new ground system.

The Defense Weather Systems Directorate's (DWSD) portfolio of projects includes not only DMSP, DWSS, weather weapon systems but also Space Situational Awareness Environmental

Monitoring (SSAEM), Environmental Effects Fusion, and the Communication /Navigation Outage Forecast System C/NOFS) projects. Two DMSP satellites remain to be launched: F19 and F20. F19 is currently undergoing TVAC testing and F20 is currently having its sensors integrated. F19 is scheduled for launch in October 2012, and F20 is scheduled for launch in 2016 or beyond. He would not be surprised if the launch date for F19 slipped some. Presently there are 2 operational DMSP satellites, but 4 other DMSP satellites have some operational capability.

AFWA and FNMOC are the two primary users/customers for the DMSP data. Surprisingly FNMOC uses the DMSP data more than AFWA because it provides data over the oceans. DMSP flies two ultraviolet imager sensors, SSULI and SSUSI. Detection of UHF scintillation is very important because of its impact on GPS performance and U2 flights, for example.
The DWSS program was approved when the Acquisition Decision Memorandum was signed on 13 Aug 2010. DWSS will fly VIIRS, a microwave sensor MIS (microwave imager/sounder), and the Space Environment Monitor - Next (SEM-N). The MIS sensor is a relative large sensor requiring a larger satellite bus. It is too large for the NPP bus. VIIRS is basically identical to the VIIRS flying on JPSS. The SEM –N will replace the space sensors flying on DMSP. DSWD is installing an antenna at McMurdo Station to reduce the data latency for DMSP and also to support the JPSS common ground system. When the antenna is operational in 2012 the DMSP latency will range from less than 15 minutes to no more than 60 minutes. Currently latency can be high as 101 minutes.

Capt. Gaber closed by announcing that DMSP-18 with its OLS nighttime visible imagery, was able to capture the destruction of the Japanese earthquake/tsunami by showing the reduction of nighttime lights from pre- to post-earthquake.

Key questions and responses:

1. Will the AF consider eliminating the encryption of the data from 55 N to 55 S so civil users can access the data without the current 3-hour delay?
   Response: Given the AF military mission, the data will likely remain encrypted. However, all the data is openly available after a 3-hour hold.

2. To reduce costs, why did the AF not consider locating a ground station in southern Chile or New Zealand instead of McMurdo Station?
   Response: The McMurdo site offers significantly better satellite coverage than is possible at New Zealand, southern Chile or similar locations. Also there is an existing station infrastructure in place which the AF can leverage.

3. Will the AF consider reducing or eliminating encryption of some of the DWSS data since it is replacing NPOESS C2 and C4, which would not have been encrypted under most conditions?
   Response: DWSD is currently working on a plan that will address this issue/need. Capt. Gaber is hopeful that a good solution will be found.

4. Could you provide more detail about the microwave sensor, MIS?
   Response: MIS will at a minimum contain 23 channels and will likely have a cross-track design.

5. Will the data be disseminated by direct broadcast?
   Response: Yes, it will have both a low rate and high rate downlink. DWSS will retain the L-band for the low rate data. A decision has not been made on the frequency to use for the high rate data.

5.10 Status of the National Aeronautics and Space Administration (NASA) Earth Observing System (EOS) and NPOESS Preparatory Project (NPP) Direct Readout Mission

Dr. Patrick Coronado, NASA Direct Readout Laboratory

Dr. Patrick Coronado presented a talk on NASA's Earth Observing Systems (EOS) Terra, Aqua, and Aura Status. He noted that there are about twice as many X-band users now as there were back in 2008 when he reported at the last SRDC. The following are the status of the current NASA satellites:

The Terra satellite was launched December 18, 1999.

- **Spacecraft status** - Green.
- **Instruments/Status** - Green: ASTER/VNIR and SWIR nominal with SWIR ops ending 2008, CERES/normal, MISR/normal, MODIS/normal, and MOPITT/normal.
- **Data Capture/Processing** - Green—no issues. Predicted fuel available through 2017, 2019 possible with slight time shift.
- **Ground system upgrades** - in process.

The Aqua satellite was launched May 4, 2002.

- **Spacecraft status** – Green.
- **Instruments/Status** - Green: AMSR-E, AMSU, AIRS, CERES, MODIS status nominal. HRS/Survival mode since 2003.
- **Data latency** – excellent. Predicted fuel to maintain current orbit within afternoon constellation through FY 2018 and beyond.

The Aura satellite was launched July 15, 2004.

- **Spacecraft status** – Green. Only sends direct broadcast data to selected sites.
- **Instruments/Status** – Green. MLS, OMI, TES status normal. HIRDLS chopper stalled 3/17/08—not collecting science data.
- **Data capture/Processing** - Green. Predicted fuel to maintain current orbit within Afternoon constellation through FY2018 and beyond.

NPP/JPSS/HRD/LRD Status

- Updates were provided on what NASA is doing now, up to JPSS-1. The goal is to have a turn-key end-to-end processing framework functioning as a real-time science data processing and distribution system. X-band transmitting frequency at launch 15 Mbps; HRD 15 Mbps; and LRD 4 Mbps.
- Mechanism for the user community to process HRD and LRD will be through use of International Polar Processing Package (IPOPP).
    - IPOPP is a software package that acquires data, processes packed data in a CCSDS package that is sent to the ground.

- IPOPP is being developed by JPSS Field Terminal segment at NASA.
- NASA GSFC wants feedback on mission processing requirements and end user recommendations.
- Beta version has been released; an NPP post-launch version will be released with instrument specific radiometric calibration and geo registration algorithms.
- IPOPP is specifically designed for ease of integration into decision support systems that supports the creation of products for use in models, vegetation monitoring, atmospheric conditions, and sea surface properties.
- Users will need a:
  - Front End system that provides the ability to parse out data in real-time by instrument and provide real time data anywhere in the world; and
  - Data system that provides information to be used as end products using science processing algorithms (SPA).
- IPOPP characteristics
  - Programming language is JAVA with distributed xml hybrid data and configuration file that is portable to Linux x86 platforms.
  - Embodies mission formats so users don't have to worry about it.
  - Efficient to run on workstation class hardware - simple to use and install.
  - 2.7 gigabyte system compressed-150K lines of code with existing complement of MODIS algorithms.
  - Innovation: Simulcast-distributed, real time data monitoring. Client will know where to get data from, but will not know there are multiple clients or sites.
  - Development processing and testing tools will be disk.
  - Capable of forward processing and reprocessing.
  - Compliant with International Traffic in Arms Regulations (ITAR).

In summary, Dr. Coronado stated that the IPOPP Development Process uses an approach driven by user needs. Collaboration with users including scientist, researchers, government, academia, business, private sector, and corporations is utilized and the standardized packaging approach for pubic release is scalable, multi-platform stable, configurable, and easy to use. Users are able to ingest and process Direct Broadcast overpasses of arbitrary size and able to produce core and regional value-added Environmental Data Record (EDR) products. The distribution mechanism is through the DRL web portal: http://directreadout.sci.gsfc.nasa.gov.

Question: What will be the geo registration regarding orbital elements and spacecraft algorithms on the web? Is it improved or not?

Response: Ephemeris and altitude information will be provided. Model tools will be provided for pointing vectors.

5.11 NPOESS Preparatory Project – Joint Polar-orbiting Satellite System Product Overview

Heather Kilcoyne, NOAA Satellite and Information Service

Ms. Heather Kilcoyne presented the status of present NPP Cal/Val plans, their relation to the Direct Readout Community and the potential for their participation. She described how

customers will be included in the Calibration/Validation (Cal/Val) process to respond better to user needs. There will be 4 Phases for Cal/Val: pre-launch, early orbit check-out (30-90 days), intensive cal/val up to 24 months after launch, and long-term monitoring – for life of sensors. Each phase will have exit criteria established and have a summary of activities. Products matriculate through the phases individually (i.e., all products do not need to make it through early orbit checkout before products such as imagery proceed to intensive cal/val and beyond). There will be a need to have Direct Broadcast users as part of teams to ensure the program is meeting Direct Broadcast (DB) user needs for NPP and JPSS. They are planning to encourage use of web interface to communicate with the program.

Key questions and responses:

1. Who are POCs and how do we get information?
   Response: POCs are Heather Kilcoyne (Heather.Kilcoyne@noaa.gov, Heather.Kilcoyne@nasa.gov) and John Furgerson (John.Furgerson@noaa.gov). Information can also be found at these websites: http://npoess.noaa.gov/index.php and http://www.nesdis.noaa.gov/jpss/

2. How can support for Cal/Val activities be improved?
   Response: The direct readout community could better help with Cal/Val if they had the IPOPP version which included the NPP/JPSS algorithms. Patrick Coronado said it would be discussed in the "JPSS L-band Discussion."

5.12 Advances in Imagers from AVHRR to VIIRS

Lihang Zhou, NOAA Satellite and Information Service

The VIIRS instrument will transition much of the capability of the experimental MODIS instruments into the operational domain. This should improve Ocean Sea Surface products, ocean color products, Active Fire Application Related Products (ARP), Land Surface Albedos, Land Surface Temperatures, the Vegetation Index, Surface Types, and Surface Reflectance Intermediate Products (IP). VIRRS Cryosphere EDRs will improve ice and snow charting and forecasting. The Cryosphere Products are fundamental to: Weather prediction, Hazard detection, Transportation, Recreation and Climate monitoring. VIRRS Aerosol EDRs will enhance the understanding of Aerosol Optical Thickness, Aerosol Particle Size Parameter, and Suspended Matter. Aerosol Products are important to: Weather and Water, Air Quality, Aviation/Ship Operation, Climate applications and as an input to VIIRS Surface Reflectance and Net Heat Flux.

In summary, Mr. Zhou stated that VIIRS incorporates technological advances from previous operational and R&D sensors. VIIRS will provide a continuation of global change monitoring for Land, Ocean, Cloud, and Atmosphere and these observations and derived products will be used to improve operational environmental forecast skills and enhance our understanding of climate change processes. For more VIIRS products information, please join the IGARSS 2011 NPP Users' Workshop, July 2011 in Vancouver, Canada.

5.13 Observation of Our Planet, and of the Argentine Territory via the SAC-C/D Aquarius Missions

Dr. Sandra Torrusio, Servicio Meteorológico Nacional, Argentina

Dr. Sandra Torrusio presented the talk for Dr. Conrado Varotto, Director Servicio Meteorológico Nacional, Argentina. Dr. Torrusio presented Argentina's plans to describe the Observation of our Planet and the Argentine Territory via the SAC-C/D Aquarius Missions. The SAC-D/Aquarius mission, scheduled for launch in June 2011, is a partnership between the United States (NASA) and Argentina (CONAE), and includes participation from other space agencies such as Italy, France, Canada and Brazil. It will provide a spectrum of microwave passive and active measurements to derive ocean salinity, ocean rainfall, ocean winds and sea ice cover, land soil moisture, and other independent measurements.

This Observatory will make fundamental new measurements of surface salinity over the open ocean and investigate the interaction between variations in ocean circulation, global water cycle and climate. Ocean salinity is a tracer for the variations in precipitation, evaporation and ice melt. Aquarius, developed by NASA, will also be able to obtain low resolution (150 km and 7-day) soil moisture retrievals using both passive radiometer and active radar measurements.

The Aquarius L-band microwave instrument (LeVine, et al, 2007) will make passive polarimetric (H, V, +45, -45) measurements at 1.413 GHz and coincident radar backscatter measurements at 1.26 GHz. The Ka-band Microwave Radiometer (MWR), developed by CONAE, carries a 23.8 GHz V-pol channel, and 36.5 GHz (H, V, +45, -45) polarimetric channels which are intended to provide the coincident rain rate, wind and sea ice measurements, besides water vapor and cloud liquid water. The sensors will collect data over the globe (ocean, land and ice surfaces) from a 6pm/6am sun-synchronous polar orbit.

Other onboard instruments included in this Observatory are: a) the New InfraRed Sensor Technology (NIRST) camera to observe high surface temperature events (fires, volcanoes) and to estimate sea and land surface temperature, developed in collaboration with the Canadian Space Agency, b) the High Sensitivity Camera (HSC) for observing nighttime light sources, fires, snow and ships detection, c) the Data Collection System (DCS) to receive *in situ* data from ground platforms, and d) the Technological Demonstration Package (TDP) to estimate specific satellite parameters. The international instruments are: the GPS Radio Occultation for Sounding the Atmosphere (ROSA, from Italian Space Agency), and the CARMEN 1 (from CNES-France) instrument to study the influence of space radiation on advanced components and measure micrometeoroids and micro-orbital debris in space.

The facilities for environmental tests were provided by Brazil. CONAE is also responsible for the ground segment control of the Mission and NASA for the launching. A summary of SAC-D applications and current status were also provided.

2011 NOAA Satellite Direct Readout Conference:
Real-time Access for Real-time Applications
April 4 - 8, 2011 Miami, Florida
Conference Report
Session 6: Training Resources and Posters

6.1 Introduction

Anthony Mostek, NOAA/NWS – Office of Climate, Weather, and Water, Weather Services (OCWWS) Training Division

Mr. Anthony Mostek outlined various training initiatives and successes over the past several years as evidenced by national and international training courses and workshops conducted by the National Weather Service and Cooperative Institutes.

6.2 Cooperative Institute for Meteorological Satellite Studies (CIMSS) VISITview

Scott Bachmeier, CIMSS

VISITview is a collaborative, long-distance learning tool (software). It is designed to fill in limitations with other distance learning training material and can be used to bring in GOES and POES. It is Java-based (platform independent), is free, and can be used either as tele-training or as real-time collaboration. Prior to VISITview, users could not see loops, enhancements, or zoom and it was more expensive.

VISITview was custom built according to user requirements for available data sets in the software and many different visualization options (e.g., enhancements) are available, as well as visualization manipulation (e.g., zoom) and annotation options (e.g., point and draw). The core of the software is the "Lesson Builder." A homepage is readily available with user guidance and side windows allow for multi-panel looks. It can be used as a tool for GOES-R Proving Ground Spin-Up activities, including looking at data sets in AWIPS format.

Question: What has been the utility internationally?

Response: The potential for international use is there. No specifics on particular use by any nations. Mr. Bachmeier emphasized portability and the ability to transport the software to users and utilize the low bandwidth feature.

6.3 COMET Program: Satellite Meteorology Training Resources for the Atmospheric Science Community

Tim Spangler, University Corporation for Atmospheric Research (UCAR) Cooperative Program for Operational Meteorology, Education, and Training (COMET®)

The COMET® Program receives funding from NOAA-NESDIS, the JPSS Program Office, the GOES-R Program Office, and EUMETSAT to support education and training efforts in the area of satellite meteorology. This partnership enables COMET to create training materials of broad global interest on geostationary and polar-orbiting remote sensing platforms and their data, products, and operational applications.

Over the last few years, COMET's satellite training has primarily focused on the capabilities, applications, and relevance of both the current and future polar orbiting and geostationary systems to operational forecasters and other user communities. These materials and activities are discussed in a poster presentation entitled "**Satellite Meteorology Education Resources from COMET: What's New?"** by Schreiber-Abshire, et al. In addition to modules intended to specifically cover satellite meteorology, the program has created the Environmental Satellite Resource Center which provides a location for instructors and other interested users to find instructional materials on meteorological satellites and their application to operational meteorology.

COMET will continue working to prepare users for forthcoming advanced satellite observations and products associated with both the GOES-R and JPSS eras. This will be accomplished through development of modules that specifically address new capabilities that will come on line as a result of these satellite programs. COMET will also integrate satellite proving ground examples into other training modules in a variety of topic areas. Whenever possible, the training will emphasize the synergy between GEO and LEO observations and how advances in both platforms will benefit operational forecasters and earth-system observations.

Other international efforts include the African Satellite Meteorology Education and Training project (ASMET) which was restructured in 2010 with the goal of producing shorter modules in a faster time frame. Under ASMET Phase 2, the teams from the regional training centers in Kenya and Niger and the South African Weather Service are producing their own modules, with assistance for data collection and processing from EUMETSAT and instructional design, graphics, and programming from COMET. The first three modules are case studies on flooding in South and West Africa and drought in East Africa, and will be published in the first half of 2011.

The COMET training website (www.meted.ucar.edu) has over 175,000 registered users from 200 countries and is an active and integral resource for the satellite meteorology community. During the last year, this community has engaged in more than 12,000 hours of training focused on satellite meteorology, and approximately another 250,000 hours of online training where the use of satellite meteorology is embedded in other relevant topics.

6.4 Satellite Training Activities: Cooperative Institute for Research in the Atmosphere (CIRA)

Dr. Bernadette Connell, Cooperative Institute for Research in the Atmosphere (CIRA)

Dr. Bernadette Connell highlighted the training activities being carried out collaboratively at CIRA and CIMSS. Over the past 15 years, satellite related training for forecasters has been used to supplement gaps in education and as means to present new and improved operational products. The Virtual Institute for Satellite Integrated Training (VISIT) was launched in 1998 to

provide distance training to U.S. forecasters. VISIT training focuses on individual topics: image interpretation, winter weather, severe convective thunderstorms, tropical, hazardous weather and others. The Satellite Hydrology and Meteorology (SHyMet) program was launched in 2006 with a focus on organizing modules into coherent topics. This program utilized the structure and content developed by VISIT as well as content from other sources such as the COMET program, and developed new content where it was lacking. International training has included close interaction with WMO Regional Training Centers of Excellence in Costa Rica and Barbados since 1996, and Argentina and Brazil since 2006. Training has included both face to face events and distance methods. The monthly online sessions of the WMO Focus group of the Americas and the Caribbean has been a very successful way to engage forecasters, researchers, students and others in real time usage of satellite imagery and products.

Key questions and responses:

1. Is there GOES-R training available in Spanish?
Response: There is one in English and this will be brought up at next month's Proving Ground training meeting.

2. Can products and training be made available to other countries?
Response: This will be taken under consideration.

6.5 Training in the Satellite Proving Ground

Anthony Mostek, NOAA/NWS – Office of Climate, Weather, and Water, Weather Services (OCWWS) Training Division

The GOES-R program is developing a new series of satellites that will be used to support NOAA's environmental analysis, warning and prediction operations. User training for NOAA staff and education of NOAA's many partners are critical to the success of current and future satellite programs. The needs for training and education activities are clearly articulated in NOAA's Strategic Plan through the need to establish and maintain a "World Class Workforce." NOAA and its partners face many challenges as we try to keep up with the rapid pace of technological change and to keep users informed and trained. If we fail in these critical user readiness efforts, NOAA and its partners face the prospect of being unprepared for the next Environmental Emergency! To help ensure that this does not happen, NOAA has launched a new program called the GOES-R Proving Ground. The GOES-R Proving Ground was launched in 2008 and has rapidly grown to encompass many operational programs involving many operational offices across NOAA. A critical component to the continued success of the Proving Ground is ensuring that the training and related user readiness activities are effectively integrated into the program. Mr. Mostek reviewed the current status of the NOAA satellite training program. He highlighted the key steps needed to ensure that training and user readiness is an integral part of the GOES-R Proving Ground program. The satellite training program will point to the early successes working closely with the Proving Ground and look to the future of linking with the proposed NWS Operational Proving Ground in the future. In his summary, he announced that NOAA is taking several steps to prepare its staff and its partners for rapid changes as its satellite programs and dissemination systems continue to evolve by: continuing to build the GOES-R Proving Ground to include all new data and products, expand cooperative training programs to provide materials that reach a broad audience, use innovative distance

learning approaches that include multimedia modules and simulations, and build and enhance partnerships with key stakeholders.

6.6 WMO Virtual Laboratory for Training in Satellite Meteorology

Jerome Lafeuille, Chief of Space-based Observing Division, World Meteorological Organization (WMO) Observing and Information Systems Department

The Virtual Laboratory (VLab) is a worldwide collaborative network of training centres called "Centres of Excellence" (CoE) and satellite operators. VLab was established in 2000 by the WMO and the Coordination Group for Meteorological Satellites (CGMS) to improve the utilization of data and products from meteorological and environmental satellites.

The VLab strategic goals are to provide training on meteorological and environmental satellite systems, data, products and applications through CoEs, to strengthen each CoE's regional training activities and to foster the development of applications for societal benefit at the local level by the NMHS. The key points for the VLab strategy are: the partnership between space and training centres, covering all WMO Regions and official languages, sharing training resources, offer blend learning and each CoE supporting a Regional Focus Group holding online meetings to analyze satellite imagery and other products.

In his conclusion, Mr. Lafeuille reported that VLab has been a very successful collaboration and he described what the scope is for further expanding the activity. Finally, he thanked all the sponsoring agencies.

6.7 Satellite Training at the Caribbean Institute for Meteorology and Hydrology

Kathy-Ann Caesar, Department of Meteorology, Barbados Center of Excellence

Ms. Caesar provided a brief introduction for the Caribbean Institute for Meteorological and Hydrology (CIMH) which has been in place for 43+ years. It is a primary training and education facility for meteorological personnel in the Caribbean. It also operates as a research unit with a staff of about 35 (+15 academic) people. Training is concentrated on all levels of meteorology, including satellite technology, imagery interpretation and analysis with a concentration on WMO competencies such as: analyzing and monitoring weather situations, and forecasting aeronautical meteorological phenomena. NOAA and RAMSDIS provide valuable training information. They also started using MM5 mesoscale NWP products as well and produce model runs, and provide information on continuous operational data. CIMH is a user of COMET and VLab products. They participate in regional focus groups and Caribbean Weather Discussions.

Ms. Caesar discussed the following special events forecasting examples.

- Cricket World Cup Final in April 2007. Rain interrupted the event but CIMH informed organizers about it.
- They advised on storm surge, wind, and wave height during Hurricane Tomas (2010).
- Soufriere Volcanic Eruption (event monitoring).

- TRMM data use for real-time flood forecasting. They integrated models with ground data to formulate forecasts. WRF outputs to assist with Haiti recovery efforts during hurricane season.

They are expanding training by including computer-aided learning materials. There is a need to increase bandwidth and integrate new satellite products. In addition, a GEONETCast proposal is now in place. One of their main issues is insufficient funding.

6.8 Monitoring Urban Night-Time Lights

Dr. Carlos Cotlier, Facultad de Ciencias Exactas, Ingeniería y Agrimensura, Centro de Sensores Remotos, Universidad Nacional de Rosario, Argentina

Dr. Cotlier described an innovative method of monitoring urban population centers in Argentina by using satellite data at night. Night-time lights remotely sensed were used to analyze Gross Domestic Product (GDP) by monitoring night-time radiance (urban energy dome) and linear energy detection over roads.

Using the analysis of multi-temporal data, correlations were made between economic activities and energy consumption and the national economy, both at the regional and county level. Since Argentina has had different periods where the economy has been up and down, this offered opportunities to establish correlations between known high energy use and low energy use and intensity of night-time lights as measured by satellite data. Archived data from SAC-C and NOAA DMSP data, as well as data from SAC-D HSC sensor, were used to measure the urban light energy data with periods when the economy of Argentina was low and when the GDP was rising at unusual levels.

6.9 Satellite Demonstration and Education at the National Research Laboratory (NRL)

Thomas Lee, National Research Laboratory

The Naval Research Laboratory (NRL) provides near real time, state-of-the art satellite products on a public domain website called “NexSat” (http://www.nrlmry.navy.mil/NEXSAT.html).

The image products are specifically designed to demonstrate the capabilities of the Visible Infrared Imager Radiometer Suite (VIIRS) sensor onboard NPP and JPSS. Included in this product suite are new applications emerging from research-grade satellites operated by NASA that provide a glimpse into future capabilities. A large number of our simulation products come from the NASA MODerate resolution Imaging Spectroradiometer (MODIS) sensor, with its 36 channel suite that serves as the quintessential simulation of VIIRS. NexSat coverage includes the United States, Caribbean, most of the northern Atlantic and Pacific basins, Europe, Africa and South America. NexSat also monitors 29 volcano sites globally. It provides MODIS close-ups of cities worldwide. In partnership with COMET (http://www.comet.ucar.edu/), online tutorials and educational modules are also a part of NexSat.

He pointed out that the Direct Readout Community, especially those member countries without extensive satellite processing capability, can use NexSat as a “one-stop shop” for near real-time satellite support. The VIIRS sensor will have a Day/Night Band (DNB) which will leap two

generations ahead of the nighttime visible sensor aboard the Defense Meteorological Satellite Program (DMSP) satellite. The new DNB will have higher spatial and spectral resolution, much lower noise, sophisticated calibration, and fewer artifacts and glare. It will be capable of seeing cloud and other reflective features with much lower levels of moonlight than presently possible. It will see smaller emitted light features than detected by the current DMSP satellites, e.g., fires and lights. Its biggest advantage will be its potential co-registration with 21 other VIIRS channels, enabling nighttime multispectral products. Important daytime products from VIIRS include satellite-derived true color, smoke detection, dust enhancements, volcanic ash, precipitation and biomass monitoring.

6.10 Poster Session Overview

Tim Schmit, NOAA Satellite and Information Service

An integral component of the Satellite Direct Readout Conference was the poster session. This format allowed for direct interaction between the presenters and other attendees and even between the poster presenters. While the formal poster session was Wednesday afternoon, the posters were displayed for most of the week during the conference, allowing more informal interaction. The formal poster session was introduced with a presentation by Mr. Tim Schmit. On behalf of the poster presenters, Mr. Schmit showed a summary slide from many of the poster presenters. These slides hinted at the great range of topics associated with direct broadcast and applications. Topics covering applications such as: education, international uses, soil moisture, visualization systems, GOES-R and JPSS plans, stray light, GOES applications, direct broadcast applications, data collection system/uses, and many other topics. There were approximately 50 posters, from over 30 different countries. While most of the posters were of the traditional format, several were electronic demonstrations.

See http://directreadout.noaa.gov/miami11/2011_presentations.html for an overview of the 2011 SDRC poster session.

6.12 JPSS L-band Discussion with the HRPT Users: Questions and Answers

Dr. Patrick Coronado, NASA Direct Readout Laboratory

Dr. Coronado opened the meeting by saying that efforts to provide LRD service capability has been reinvigorated under the new JPSS program and he wanted to use this opportunity to better understand how users see their path from HRPT to JPSS LRD. This effort has been renewed because NOAA wants to continue serving the well established HRPT community. He summarized the LRD technical information with emphasis on educating the users on the difference or likeness between the HRPT service and the JPSS LRD service. Some of the key facts provided in the overview were a) the top priority EDR is imagery using VIIRS moderate resolution channels, b) other channels will be available for download (he mentioned that EDR selection is programmable), c) L-band will be at 1707 MHz with 6 MHz BW (will border interference zone from the current 3G network), d) field terminals will require 1.8 m aperture antenna with a G/T of 6db/K, e) transmission is CCSDS format compliant, and f) NPP will not have LRD service.

Mr. Mike Jamilkowski asked if any priority had been given to the original NPOESS KPP EDRs. Dr. Coronado said this approach is no longer possible because downloading the KPP EDR data required compression which will not be available for JPSS LRD. He presented information showing the channel comparison between the AVHRR and VIRRS. Tentatively, six VIIRS channels were proposed for transmission during the daytime segment of the orbit. These channels closely correspond to AVHRR channels that are available in the NOAA HRPT service. Depending on the channel configuration, equivalent sounder channels could be accommodated in the transmission. Using these channels would maintain continuity. The attendees were asked to think and comment on how they would change the channels selected for download, day and night parts of the orbit, to meet their operational needs. Fewer VIIRS channels are useful at night; however, it was mentioned that VIRRS channels M12, M15, and M16 are also useful at night. Dr. Coronado asked the group if they knew of any other channels they would like included for LRD transmission. Dr. Mitch Goldberg, NOAA, asked if LRD transmission could accommodate two additional VIIRS channels, one of which is M13 used for fire detection. Dr. Coronado stated if the two channels were added, more bandwidth would be required or they would have to eliminate some other channels.

It was noted that geo-registration and calibration data will be in included in the data packets. He asked the participants if they needed two-line element (TLE) data. He said that TLE information could be obtained from the altitude and ephemeris data. Ron Andrews said that the VIIRS solar diffuser data which is very dynamic would allow another way to derive the TLE info. The solar diffuser data is uploaded to the spacecraft. John Overton said this information is most needed by stations which use program tracking. Dr. Coronado brought to the group's attention that the 1.8 meter antenna gives a 22 db/K at X-band and X-band downlink will give them all of the data. Thus some HRPT users may want to upgrade their ground system to handle X-band. Someone asked what type of polarization the L-band downlink would have. Dr. Coronado replied that it would have right-hand polarization. A comment echoed from the group stipulated that since some HRPT users will upgrade to X-band, the future LRD community will only be a subset of the HRPT community. SeaSpace, Inc. noted that some of their shipboard customers only have a 1.6 meter antenna and will not be able to upgrade.

In summary, the discussion was very beneficial in obtaining input from the direct readout community for the new broadcast services. The intent was to talk about the LRD, but the discussion also included concerns and comments on the HRD. The group discussed and agreed upon the following actions:

1) NASA should talk to NOAA about the possibility of adding two additional VIIRS M-band channels.

2) NASA will provide information (charts) showing which VIIRS channels are needed to produce specific products.

6.13 GOES-R Discussion with the Users: Questions and Answers

James Gurka and Dr. Satya Kalluri, NOAA GOES-R Program

Key Points Discussed:

- Full set of level 1b products, including data from all ABI channels and the other GOES-R instruments (GLM, MAG, SEISS, SUVI, EXIS) will be available with GOES-R.
- GOES users **must** acquire new hardware or upgrade their existing GVAR systems in order to receive GOES-R data.
    - Preliminary specifications were discussed. Specifications will be finalized in 2012 and will be available on the GOES-R website (www.goes-r.gov).
- Existing GVAR systems will need new receiver antenna hardware, as well as new signal demodulation hardware and computer hardware so that they are able to handle the large amount of GOES-R data.
- CLASS will provide permanent archive for GOES-R data as part of its mission to be the single data repository for NOAA.
- Raw data downlink to Wallops (primary) and Fairmont (remote backup) ground sites:
    - 100 Mbps data rate (120 Mbps after CCSDS overhead, 7/8 LDPC coding, and fill from C&DH).
- Space Ground communications uplinks include X-Band (for GRB), S-Band (for HRIT/EMWIN and DCRC), and UHF (for SAR and DCPR). Downlink bands include X-Band for raw sensor data and L-Band for everything else. Seven elements include the raw data downlink and six bent pipe transponders.
- GOES Rebroadcast (GRB)
    - GRB will contain the Level 1b data from each of the GOES-R Series instruments and is the GOES-R series version of today's GOES Variable format (GVAR).
    - GRB transponders- Dual polarized x-band uplink to dual polarized L-Band earth coverage downlink, 12 MHz bandwidth x quantity 2.
    - GRB download content for each of two polarization channels- LHCP and RHCP includes:
        - L1b data, QC data and metadata: ABI, SUVI, EXIS, SEISS, MAG
        - L2 data, QC data, metadata-GLM
        - GRB Information Packets.
    - GRB downlink data rate: 31 Mbps maximum data rate; 15.5 Mbps instantaneous maximum for each polarization channel; Downlink margin: 2.5 db.
    - Compression – Lossless compression required: JPEG2000 and SZIP are candidates that are being considered in studies.
    - Preliminary specifications for planning purposes includes preliminary format, coding, modem, and other specifications as noted below:
        - Format: Inner Frame Format is CCSDS Space Packet and Outer Frame Format is DVB-S2
        - Coding: BCH + LDPC (2/3) for 8-PSK or LDPC (9/10) for QPSK
        - Modem Required C/No (dB-Hz): 78.6

        - Required Eb/No (dB) for $1x10^{-10}$ BER: 4.8
        - System G/T (dB/K): 15.2
        - Reminder: Specifications will not be finalized until 2012 and the final approved specifications will be posted on the GOES-R website as previously discussed.
- Information Network (HRIT/EMWIN)
    - New high data rate (400 kbps).
    - HRIT/EMWIN transponder will have S band uplink to L-Band Earth coverage downlink narrow bandwidth transponder.
    - Combination of today's LRIT (Low Rate Information Transmission) and EMWIN services.
    - Delivers selected imagery, charts, other environmental data products, and text messages (NWS Watches and Warnings) to hemispheric users.
- Data Collection System (DCS)
    - GOES-R spacecraft relay data transmissions for nearly 30,000 in-situ environmental data platforms from across the hemisphere.
    - GOES-R will support 300 bps, 1200 bps, and CDMA platforms.
- SARSAT
    - All GOES-R satellites support the Search and Rescue Satellite Aided Tracking (SARSAT) service by relaying distress signals from in-situ Emergency Position Indicating Radio Beacons (EPIRBs) and other transmitting devices.
- Terrestrial data download summary:
    - GOES-R access subsystem part of Product Distribution and Access System and limited to 1000 concurrent users
    - CLASS
    - L1b radiances in NetCDF full disk, Conus, mesoscale
    - L2+ Products in NetCDF and McIDAS full disk, Conus, and mesoscale
- Simulators will be available for testing and GOES-R proving ground activities are also supporting the validation and testing efforts.

Key questions and responses:

<u>Legacy GOES to GOES-R</u>

1. What is the timeframe for the current GOES series?
Response: Ms. Kathy Kelly responded that the goal is to use as much operational life as possible from current GOES satellites. The current projection is 2017-2019 and perhaps beyond for the current GOES series. Currently projecting GOES-R turn-on in 2017 or so.

2. What will happen with the current GOES series if they still have life when GOES-R becomes operational?
Response: Current data streams will still be available from current satellites until they are decommissioned. GVAR will be in use for a long time. Both GVAR and GRB will be supported when GOES-P and GOES-R are operational.

3. Will GOES-R become GOES EAST or GOES WEST?
Response: The logical order will be to take over operations for GOES-14 in the WEST.

4. Will there be a longer transition period between GOES-R and current GOES satellite it will replace since the capabilities of GOES-R are so different from the current GOES series and will GOES-14 be decommissioned early to allow for immediate GOES-R operations after test period?
Response: Because GOES-R is a new satellite, the 6 month checkout period will likely be closer to a year after launch. It is unlikely that GOES-14 would be decommissioned early since the goal is to use the legacy satellites as long as they are useful.

5. Could a longer lasting N-Series satellite be moved a little further West (after GOES-R is operational) to provide coverage of Japan and broadcast data using GVAR?
Response: Unlikely. Our past coverage in Japan was to assist them during a gap. We only have so much capability/budget to support ongoing use of N/O after R become operational.

Transition from GVAR to GRB

6. What happens with countries currently using GVAR that cannot upgrade to receive full set of GRB data?
Response: Option 1: As a stopgap, possibly could use HRIT. Option 2: Use Internet distribution (GAS) if your Internet pipes can support it.
Users are asked to provide GOES-R with their suggestions for other options!

7. What if a user doesn't need all the data, could there be a way to obtain data for a sub-region? Would the server have some subset of data instead of getting all GRB data?
Response: If the data is compressed that results in some loss—the question is whether the users can live with that. GOES-R will look into options for data subsets.

8. Can the program look at GVAR user needs today and determine how to satisfy those needs by providing the same quality of data they are receiving now to satisfy their needs by using bands, etc.? This was a suggestion from the users.
Response: GOES-R will look into it.

9. What will happen to systems like EMWIN/LRIT and GEONETCast in the GOES-R era?
Response: EMWIN/HRIT will be a combined downlink.

GOES-R Specifications and Equipment

10. a. How does the satellite architecture look regarding separate transmitters for GRB and EMWIN and separate power levels?
Response: Transponders are separate for GRB and DCS. The satellite has one antenna for L-band and one for X-band. Power levels are not yet defined. Graphic slide presentation was reviewed.

b. Is DCS at the same frequency?
Response: No. Slight changes are needed to accommodate the DCS feed. Users can use the same antenna, but there are some changes to the demodulator/receiver. Most DCS receiver manufacturers are accounting for the changes.

c. Are all 3 L-band transmitters combined and sent out from one antenna?
Response: Yes. Same for X-band.

d. What are the impacts of losing the L-band to cell phones?
Response: A study is underway to determine where to put L-band so it has the least amount of interference. Not worried about it for another 10 years.

11. Is there a timeframe for more details regarding requirements? How will the user community know when the specifications that will impact them are completed and available for GOES-R?
Response: The requirements will be completed early next year and the documentation will be posted to the GOES-R website, www.goes-r.gov, in the summer of 2012.

12. Will the user community be asked for feedback on specification before it is finalized? Suggestion made by users in group that they would like to see documentation specifications before finalized to provide input or perhaps suggest small changes regarding power levels of transmitters, size of dishes, etc. By the time the documents are posted on the website, the spacecraft will be post-CDR which is too late to influence design decisions and make changes to specifications.
Response: The information users need to develop a ground processing unit are available now. GOES-R will take under advisement user feedback on bandwidth, coverage patterns, and polarization details.

13. Could a geography map of antenna size needed to receive data at different locations be made available to assist users in planning?
Response: GOES-R will create a geographic map to show users expected coverage areas based on receiver size (3m vs. 3.5m vs. 4.5m) for decision support.

14. What will it cost to convert a location with a small antenna to be GOES-R ready to receive GRB data? User gave example of having a 3.5 meter antenna now and needs to know estimated cost to put in their budget for both equipment and installation.
Response: If you try to convert your existing system (3.5m antenna), it will not be highly reliable. For the highest data reliability/quality, you will need to upgrade your system. You will need a new dish, new receivers, etc. The cost is mostly in the dish size—antennas are typically $2k-$10k. A conservative estimate of antenna size is 4.6m. The receiver cost depends upon the size of the antenna and is usually fairly cheap—in the hundreds of dollars. Installation is the expensive part.

15. Will the GRB Simulator use IF?
Response: Yes.

Use of GAS

16. a. Users would like a better understanding of the land line via the GAS portal option and the products that would be available using this option?
Response: There is only one terrestrial link from GOES-R and that is to the NWS AWIPS. Other users can use GAS.

b. What is the latency of the products in GAS?
Response: Depends upon the product. It is different for GRB and McIDAS. Radiance is

about 300 seconds.

17. a. Is the plan for GAS to mirror the GRB data stream?
Response: No. GRB is streaming data (level 1b) and GAS is NetCDF files of complete End Products. The Radiance product is put into GAS as NetCDF. GRB data is transmitted to NSOF and NetCDF file is created for GAS use once a full disk of data is received. Streaming GRB will not be put on Internet before going to GAS.

b. Can users obtain data from GAS before a full disk is complete?
Response: No. A full disk must be run in which all the products are written.

c. Why can't you stream GRB from GAS?
Response: That's an option, but it's expensive.

18. What is the latency definition in general?
Response: The latency clock starts at the receipt of the last packet of a scene. GAS has full files, so one must wait for the entire scene to come down and be processed. This allows for metadata and end-of-file processing. Although data might be FTP as streaming, it's the entire file that is used, not real time streaming.

19. Couldn't it take 15 minutes for the image to complete (scan of North Pole was discussed as a reference)?
Response: As the data comes down, the end product file is being written so once the last packet is received, it take a few seconds to complete the file.

20. Is there a way to obtain data through different mechanisms to fill in the holes in direct readout streams? If our primary reception method is from an antenna, could we use GAS as a backup to supplement missing packets? Will using the Internet as primary solution verses a direct connection possibly provide data to fill in the gaps?
Response: Not really. GAS is full scene files, so it would be difficult to translate. CLASS could possibly be used to fill in the gaps via web-based data access. If you want a reliable system, then use the specifications provided to upgrade your antenna. Depending upon where you are in the CONUS coverage, you can get all of the data all of the time.

21. What is in CLASS?
Response: CLASS will contain the archive files.

Action Items/Recommendations:

- The GOES-R program will review questions asked in this session again to better understand user needs and further explore how to satisfy those needs.
- Participants were reminded to complete the GOES-R feedback form in the registration package for any other questions not addressed in this session and to follow up directly with GOES-R program staff at the conference.
- Participants were provided with the GOES-R web site address during the session and via the GOES-R feedback form for continuing updates on GOES-R activities and status.

2011 NOAA Satellite Direct Readout Conference:
Real-time Access for Real-time Applications
April 4 - 8, 2011 Miami, Florida
Conference Report
Session 7: User Applications

7.1 Session Introduction

David Benner, NOAA Satellite and Information Service

7.2 Keynote: Perspective of WMO RA IV

Trevor Basden, Senior Deputy Director, Bahamas Department of Meteorology representing Arthur Rolle**,** Director, Bahamas Department of Meteorology, and President, WMO RA IV

Mr. Basden provided an oral presentation on behalf of the WMO Region IV, Regional President, Arthur Rolle. Region IV relies upon and benefits greatly from all of the satellite services provided by NOAA. The key systems for imagery, models, and the telecommunications needed for forecasting severe weather events form the technological base of all national met services in RA IV. For these systems, Mr. Rolle expresses gratitude to NOAA and NASA for these contributions. He recognizes that meteorological telecommunications rely on satellite communications and hopes that this conference will serve as a forum for the exchange of knowledge and especially to enlighten participants on the changes that are currently taking place in the NOAA satellite systems. GOES-12 has been very effective in providing meteorologists in RA IV with data to make improved forecasts of local weather events, tornadoes, flash floods, severe thunderstorms and other extreme weather events. RA IV has strong interest in the new GOES and POES coming on line in the future – especially GOES-R.

Mr. Rolle expressed how satellite observations enhanced the work of the WMO Space Program, which is tasked to facilitate and promote the wider availability and meaningful use of these products and services around the globe. The WMO Integrated Global Observing System and the WMO Information System when implemented will make full use of satellite observations to enable decision-makers to realize socioeconomic benefits derived from the wide range of products and services applicable to weather, climate, water and related disasters.

RA IV is very appreciative of the NOAA International Satellite Communications System – ISCS 2E, but anxious to understand the evolution of this system which is essential for receiving GTS/WAFS products that enable forecasting for aviation and all sectors. He is concerned that despite the capabilities and services offered that many in RA IV lack the training and equipment to be able to utilize the satellite products and services available.

The emphasis of this conference is “Real-time access for real-time applications,” and real-time access is absolutely necessary for disaster risk reduction from multi-hazards. Recent events of meteorological, hydrological and other natural hazards in the Region have illuminated the growing needs for real-time application of satellite data. Only a small percentage of the RA IV countries have direct readout ground stations and so access to the data in real-time is not readily

available. As President of RA IV, Mr. Rolle requests NOAA's help to "level the playing field" and provide more assistance and training opportunities to help all the countries in the region to take advantage of the services and technology available. We request more training to assist in getting and using data in real-time for improved forecasting.

7.3 The LSU Earth Scan Laboratory: A History of Research to Real-Time Operations

Dr. Nan D. Walker, Director Earth Scan Laboratory, Louisiana State University

The Earth Scan Laboratory (ESL) at Louisiana State University was founded in 1988 by Oscar Huh, when it became apparent that affordable capture systems for satellite remote sensing were within financial reach of an educational institution. Over the past two decades, the ESL has built a reputation for providing access to real-time image products, animations, and archival products via its web site. It focuses on access to real-time meteorological and oceanographic data for research, education and emergency response. In the early 1990s, the ESL faculty provided real-time analyses of Gulf of Mexico currents in a unique collaboration between academia, the oil/gas industry, and the Minerals Management Service. Data sharing was a key component of this "operational research" which pre-dated the Internet. This led to a long-term partnership, beginning in 1994, with Horizon Marine Inc, initiators of the "Eddy Watch" program, a subscription service for ocean current information in support of safe oil and gas exploration. ESL's contributions to this partnership have included real-time tracking of Argos buoys and provision of "de-clouded" nighttime SST composite images. Nighttime GOES composites have provided much more frequent ocean imaging, revealing current features and variability in the Gulf of Mexico, the Caribbean Sea, and along the coast of Brazil in support of oil and gas activities on a daily time-scale. Finally, real-time access to MODIS, AVHRR and GOES data was essential for tracking the rapid changes of the 2010 Deepwater Horizon oil spill and the currents that were responsible for its motion.

In summary, the real-time access to the transmitted telemetry from both polar orbiting and geostationary satellites has enabled the development of new products and applications in support of emergency response (hurricane and oil tracking, mainly). It has also led to the development of specialized regional image products that support safer oil and gas operations in the Gulf of Mexico, the Caribbean Sea and along the coast of Brazil.

7.4 Applications of Satellite Data (Chile)

Alejandro Muñoz, Jefe Subdepartamento Pronósticos, Dirección Meteorológica de Chile
(Presentation is in Spanish.)

The Meteorological Service of Chile has made significant advances both quantitatively and qualitatively in using satellite data during the past two years. On Feb 27, 2010 Chile suffered an 8.8 earthquake for approximately 3 minutes. The earthquake impacted an area from 32 S to 39 S affecting 13 million people or 80% of the Chilean population. The earthquake was followed by a tsunami which affected a coastal area from 33 S to 35 S. Much of the port infrastructure in the southern part of the affected area was severely damaged. The earthquake killed 525 people and destroyed 380,000 homes.

The Meteorological Service of Chile consists of six regional offices. The six offices allow the coverage of Chile's unique geography which is a relatively narrow strip of land ranging from 19 S to 52 S. The Meteorological Service of Chile works closely with the National Emergency Office and the Seismological Office of the University of Chile. The Meteorological Service of Chile has an integrated satellite network which is able to acquire both L-band and X-band transmission of satellite data. This network ingests GOES-11 and GOES-13 data, and NOAA-15, 16, 18, and 19. These satellites are particularly important for monitoring cyclones and short waves and were very useful in forecasting conditions following the earthquake.

They are also able to receive MODIS data which were especially useful for indentifying low cloud areas after the earthquake which signaled that organic material would decay fast and promote the spread of infection. Routinely, MODIS and other satellite data are used to identify concentrated areas of chlorophyll which affects salmon fishing, a major industry in Chile; and to monitor volcanic ash (Chile has 20 to 30 active volcanoes).

7.5 Development of a New High Rate Data Collection Platform (DCP)

Sean Burns, EUMETSAT

Data Collection Systems are operated by EUMETSAT, NOAA, Japanese Meteorological Agency, Chinese Meteorological Administration, Roshydromet (Russia) and the Indian Meteorological Department. A new Multi-mission DCP Facility for all GEO Programmes was developed and implemented in 2011. Real-time functions are the acceptance, processing and distribution of quality DCP messages and bulletins. Its administration functions include the allocation of resources. The DCP Facility automatically finds free slots based on input criteria. It also has the capability to make deletions and generate reports and analysis.

The Meteosat Data Collection and retransmission Service (DCS) enables Data Collection Platform (DCP) operators to use the Meteosat Meteorological Satellite System to retransmit DCP data collected from remotely located platforms to their own reception stations. Data is processed and transmitted to the user via EUMETCast, Internet (ftp push and manual download), direct dissemination via the prime Meteosat Satellite (MSG-2 LRIT), and the Global Telecommunication System (GTS) community of the World Meteorological Organization (WMO).

EUMETSAT plans to introduce a new system of High-Rate DCPs (HRDCPs) in 2011. DCPS transmits at 1200 baud. Several design improvements have been introduced which provide significant advantages over the standard rate DCP. The use of Offset QPSK modulation scheme gives bandwidth efficiency and phase noise tolerance. Concatenated Forward Error Correction (FEC) using CCSDS (CCSDS, 2006) recommended convolution coding & Reed-Solomon codes provide robustness against interference. The binary message system with error checking using a 32 bit Cyclic Redundancy Check, is suited to compressed or uncompressed data of any type. One application area where HRDCPs will provide significant benefit is in Tsunami Warning Systems, in particular the Indian Ocean Tsunami Warning System. These new type of platforms will allow Tsunami Warning Systems to receive data more frequently thereby improving the effectiveness of the overall system.

The current DCS consists of 11 IDCS (3 kHz), 44 regional (3 kHz), 144 (1.5kHz) and 8 HRDCPs (2.25 kHz) channels. Changes are being implemented to the Ground Station and the

DCP Facility in EUMETSAT to support the new Service (i.e., new digital receivers, flexible allocation scheme, etc.). Both standard and high rate DCPs will be supported for the foreseeable future.

NOAA inquired about users in the Caribbean and South America. EUMETSAT stated there were no users in those regions and it was not due to policy reasons. No one has approached them yet. Another inquiry dealt with the coverage of Meteosat-7. It has good coverage east of the Philippines. NOAA NWS was also approached to donate rain gauges to the Philippines. EUMETSAT says they will be happy to receive rain gauges for the Philippines and pass them on.

7.6 Real-Time Access for Private Individual Users of Weather Satellites

Dave Cawley, United Kingdom

Mr. Cawley gave a short presentation about Private Individual Users (PIU). The Remote Imaging Group (RIG) has approximately 1600 members, and it is the largest group of its type. The members are comprised of golfers, yachtsmen, private plane owners, and weather enthusiasts. RIG started in 1984 by Henry Neale. Its first members were ham radio operators. The popularity of the direct readout service increased very rapidly. It spread to anyone wanting now-casting information and allowed companies to sell APT units by the thousands. Eventually, schools picked up WEFAX and APT with their early PCs and Apples, and suddenly it was fun to do science!

Dave has presented at several conferences in the past, including Weather Satellites in Education, SDRO 2004 and 2008, and others. Mr. Cawley gave a brief historical overview of the development of APT and showed the decline of private satellite users in Europe and the U.S. over the last ten years. He stated that the reason was that WEFAX is no longer available and there are no small antenna systems. Equipment is so difficult that only computer buffs can get it to work. Last year the Meteosat Internet group had over 1000 messages from distraught individuals. Currently, we are relying on the Internet, that isn't really up to it.

Mr. Cawley raised the following questions in his talk. For the future, will there be an APT equivalent? Will LRIT ever be easily receivable? Will there be something we have not thought of yet, like an iPod or iPad plug in receiver? In the UK they use several iPhone applications for visible animation. There are about 1000 HRPT users and they need new demodulators. Vendors are not capable of doing it. Mr. Cawley asked NOAA to keep 1707 MHz frequency band going.

In conclusion, the goals of the PIU community for 2011 and beyond are a) develop some sort of low cost direct readout system, b) make it an easy to use system, c) the system must use a small antenna and d) a system that does not require any specialised technology. He reminded the audience that the PIU is often considered the least important group of users, but it has the largest number of users! You can find out more at www.rig.org.uk.

7.7 Processing and evaluating NPP Direct Readout Data using the AAPP Software Package

Dr. Nigel Atkinson, Meteorological Office, United Kingdom

Dr. Atkinson spoke on the preparation for the NPP satellite in the context of Numerical Weather Prediction (NWP). Instruments of primary interest are ATMS (microwave sounder), CrIS (infrared sounder) and the VIIRS (imagery). Direct broadcast continues a long tradition from the current generation of NOAA, MetOp and EOS satellites. Direct broadcast is the best option for NWP applications. Timeliness is key for ensuring forecast runs have access to the latest data. The WMO "breakthrough" value is 30 minutes for global and regional NWP models. Many forecast centres use locally-received ATOVS in regional models. The Regional ATOVS Retransmission Services (RARS) have expanded in recent years to near global coverage (EARS (EUMETSAT), Asia-Pacific RARS, South American RARS, etc.). RARS timeliness is typically <30 minutes (cf. ~2 hours for global data).

The ATOVS and AVHRR Pre-processing Package (AAPP) is a well-known tool for performing level 1 processing of the current generation of NOAA and MetOp polar-orbiting satellites. The package is freely available and maintained by the EUMETSAT Satellite Application Facility for Numerical Weather Prediction (NWP SAF) for which the Met Office is the Leading Entity. It is used as a pre-processor in the Regional ATOVS Retransmission Systems (RARS), which facilitate international exchange of direct broadcast sounder data. In 2011, there is a planned release of an NPP-compatible version of the package. Dr. Atkinson's presentation described the new features of the software that will be introduced, and also the cal/val activities planned for NPP at the Met Office.

AAPP has been designed to be compatible with both direct readout and global NPP data, since many NWP centres reply on both forms – direct readout data for timeliness and global data for spatial coverage. The primary focus for AAPP (at least initially) will be the sounder data from ATMS and CrIS, since these instruments will be critical for NWP. For direct-readout applications the user will first need to run the International Polar Orbiter Processing Package (IPOPP) to generate Sensor Data Record (SDR) files.

Following the launch of NPP, the Met Office and ECMWF will be contributing to the cal/val campaign, by comparing the ATMS and CrIS radiances with those predicted from the NWP models. Such comparisons have proved invaluable in past campaigns (e.g., with SSMIS) as they enable even small biases to be characterized and corrected. The work will also include checks of global/local consistency. The main benefit of these activities should be to facilitate a rapid implementation of NPP (and later JPSS) data at all NWP centres.

7.8 The Gulfstream Hazard Scale

Dane Clark, Jenifer Clark's Gulfstream

Mr. Dane Clark and his wife, oceanographer Jenifer Clark, conduct a business in which they analyze and chart the Gulfstream and provide this data to customers. The Gulfstream is a western boundary current like the Kuroshio Current off Japan and is primarily generated by the prevailing winds. Their company, Jenifer Clark's Gulfstream (JCG), utilizes many different types of geostationary and polar-orbiting environmental satellite data to produce their charts.

The Gulfstream also produces eddies which can be important features for mariners and fishermen. Cold eddies typically form south of the Gulfstream and can last up to two years. Warm eddies are shorter-lived and form north of the Gulfstream. Cold eddies can have current speeds up to 7 kts and are very important features for marine transit, especially sailboats and other slow moving vessels. "Catching a ride" on the Gulfstream can save thousands of dollars of fuel for the larger vessels. JCG has many sailboat customers who receive optimal routing information for sailboat races based on the location of the Gulfstream.

The "North Wall" of the Gulfstream has a very steep gradient as depicted on satellite altimetry data, with up to a three foot height difference between the warm and cold sides. Various examples of hazardous weather in the Gulfstream region were shown. In the Gulfstream, waves tend to be higher and steeper due to surface winds opposing the direction of the current. Many mariners call these waves "square waves," due to their shape and their tendency to break, causing navigation hazards. Rogue waves are more prevalent in high current areas. One area off the East Coast of the U.S. with higher currents, sometimes as high as 7 knots, occurs near the Charleston bump, a raised bottom feature near where the Gulfstream flows. In 2005, a cruise ship in this area during a major east coast storm was struck by twin 80 foot waves and sustained damage as high as the tenth deck of the ship, injuring 400 people.

7.9 Frequency Re-Allocation Overview

Mark Mulholland, NOAA Satellite and Information Service

Mr. Mark Mulholland provided a timeline of activities that have taken place on the President's Broadband Initiative, focusing on the 1675 to 1710 MHz. This has been reduced to 1695 to 1710 which is the Polar portion of L-Band. There will be some exclusion zones for the Polar downlinks and he showed a map of the NOAA identified exclusion zones. He next showed an example of interference on polar imagery.

The GOES-R communications subsystems will have to be modified. The NEXRAD radar band still remains in the 10 year plan. He then showed the 1675 to 1710 MHz spectrum, where GOES-R and JPSS fit in the spectrum and then reviewed the FCC public notice – the response to this was overwhelmingly negative.

Since polar satellite receivers are not required to register their systems, the database has a suspected low number of registered receivers. Mark asked anyone with unregistered receivers to register. He also mentioned that the Internet is not considered suitable to send timely imagery. Mark outlined the next steps to be taken, including outreach at conferences such as the DRO.

- Conduct technical analyses to fully understand impacts to operations
  - Adjacent band interference around key sites, especially Wallops
  - Atmospheric ducting along coastlines – Wallops is vulnerable
  - Results may show that L-Band must be relocated from the DC area
- Continue user outreach initiatives
  - Encouraging users to provide views to FCC and others
  - AMS – HRPT equipment manufacturers and broadcast firms
  - NOAA Direct Readout Conference – Miami, April 4-8, 2011

- Initiate GOES-R and radiosonde redesign as soon as possible when funding becomes available
- Coordinate with NTIA, which is responsible for working with the FCC to formalize exclusion zones
- Develop long-term strategy for efficient use of spectrum

Mark provided a list of web links.

- Presidential Broadband Initiative:
  - http://www.whitehouse.gov/the-press-office/presidential-memorandum-unleashing-wireless-broadband-revolution
- Fast-track Recommendation Report:
  - http://www.ntia.doc.gov/reports/2010/FastTrackEvaluation_11152010.pdf
- Ten-Year Report:
  - http://www.ntia.doc.gov/reports/2010/TenYearPlan_11152010.pdf
- FCC Public Notice (Proceeding 10-123):
  - http://fjallfoss.fcc.gov/ecfs/proceeding/view?z=zgk6j&name=10-123

Questions were held until the panel discussion.

7.10 Panel Discussion: Frequency Re-Allocation and the Future of the L-band

Moderator: Mark Mulholland, NOAA Satellite and Information Service

Panel Members:
Eddie Davison, National Telecommunications and Information Administration (NTIA)
Cynthia Hampton, NOAA Satellite and Information Service
Jerome Lafeuille, Chief, Space-based Observing Division, WMO
David Bradley, Environment Canada
Karen Dubey, Seaspace Corporation
Dr. Nan D. Walker, Earth Scan Laboratory, Louisiana State University

Mark gave the makeup of the Panel and introduced the panel members. Then each panel member gave an opening statement followed by open questions from the conference audience.

Ed Davison Opening Remarks

1. Organizational setup
   a. NTIA is the President's principal advisor on telecommunications issues. They support the President. FCC is an independent agency that does not necessarily support the president.
   b. NTIA is also the manager of federal use of radio spectrum.
   c. NTIA – Federal Users.
   d. FCC – Non-Federal Users, including states and local users.
   e. The two agencies coordinate with each other.
   f. IRAC (Interdepartmental Radio Advisory Committee) is an advisory group to NTIA and liaison with FCC.
2. Direction from the President to NTIA – Find 500 MHz over 10 years.
3. Users say they need a minimum of 20 MHz "chunks" of band in order to even be useful.

4. DoD and NOAA provided the exclusion zones around, mostly, urban areas with critical receiving stations.
5. FCC will initiate a rulemaking, could come at any time, on the use of the band. NTIA will only consult and there will be public comment period.
6. Every one of the bands has incredibly important uses, and NTIA has the challenge of picking from those.

Cindy Hampton

1. All 3 transmitters are used from the satellites, in order to avoid interference between separate data relays. Data sets include telemetry, all instrument data (including AVHRR, AMSU, MHS, HIRS), and direct HRPT broadcast to user terminals.
2. Different bands are organized as "STX" (see Cindy's slide with STX details for each NOAA polar orbiting satellite).
3. Cindy shared a nice animation of polar-orbiting satellites and how they transmit data to the Fairbanks and Wallops receiving stations. Mark commented that the collision avoidance at the poles is quite interesting for polar orbiters.

Jerome Lafeuille

1. Acknowledged that managing the spectrum is the responsibility of each country, but is pleased to see emphasis on international cooperation as a consideration.
2. WMO has mission to lead cooperation on weather, climate observation networks, standardization, and data exchange.
3. With due respect, the L-Band is shared and is not "NOAA L band."
4. Shared appreciation of global cooperation and sharing of satellite data. He shared a nice photo of 1963 with First APT reception from Tiros-8 in Lannion, France.
5. Direct Readout services remain the foundation of global cooperation in satellite meteorology.
6. Nice slide of CGMS baseline configuration of polar satellite orbits.
7. Potential impacts
    a. All operational LEO systems (except NPP) use L-band and plan to use it throughout the decade. All of those LEOs are required to provide necessary temporal, spatial coverage, as well as data robustness.
    b. While exclusion zones would guarantee reception at federal sites, users outside of exclusion zones would be exposed to severe interference preventing operational use.
    c. Societal benefit – The result will never be perfect.
8. International Impacts
    a. Risk of propagation to other countries. Invite U.S. to not set this precedent.
    b. Detrimental to global standardization effort.
    c. Impact to radiosondes also needs to be strongly considered.

David Bradley

1. Provided an overview of Environment Canada
    a. 11 GOES GVAR stations
    b. 4 HRPT stations (all L-band)
    c. 5-meter antennas downlink
    d. EC National coverage
2. Discussed Environment Canada's use of the available spectrum.

    a. Radiosondes are not in L-Band
3. Reviewed an analysis of last year's activities:
    a. plotted MetSat receivers
    b. Performed a 200 and 400 km buffer
    c. Cconcluded all things are pretty safe.
4. Next steps, have to deal with FCC issues, "exclusions zones" for Canada.

Karen Dubey

1. SeaSpace is a provider of direct readout systems worldwide.
2. Shipboard, research, military, meteorological agencies.
3. Disappointed in the administration's stance to auction off the L-band.
4. Led a letter writing effort to the NTIA.
5.
6. There are still cases of noise getting through and making the transmission unusable.
7. Their operational customers include USCG ice breakers, USMC, and other international operational customers.
8. Karen's questions
    a. Plan for interference enforcement? Please plan well in advance.
    b. Plans to transition activities inside and outside of government, including those with limited resources to X band?

Dr. Nan Walker

1. Spent 20 years managing a satellite ground station at a large university at a state with many disasters – Louisiana.
2. GOES imagery tracking of cyclone intensity and location are extremely valuable.
3. The imagery was also extremely useful during the Deepwater Horizon oil spill.
4. Access to any and all data in real-time is essential.
5. Concerns for her laboratory
    a. Expense.
    b. Accessibility to data in real-time.

Key questions and responses:

1. Mark Mulholland directed Karen's questions To Ed Davison:
    a. Regarding enforcement, rule-making must first be conducted before allocation occurs. This includes looking at transmission characteristics and looking at receiver standards (none exist today on how receiving stations protect themselves). That will be open to public comment. The FCC has an enforcement bureau, NTIA does not. Need rules to eliminate or facilitate sharing. The more users that are packed into bands, the more opportunities for interference.
    b. Regarding transition payments, there is a bill CSCA to move bands to give up the spectrum. There is nothing occurring in Congress on this front.
2. Ivan Navarro (NWS) question to Ed Davison (follow up on Karen's question):
    a. Ed's Response - Instead of using exclusion zones based on theory and then seeing whether the practical application actually works, why can't the rule be based on a received power study at the sites to ensure effective protection. This would be site-specific analyses instead of geographic zones.
    b. Ed responded there was first of all a time constraint in putting this together. Secondly, nothing is off the table and there is some time to do more work.

NOAA may come back to NTIA with recommendations for just this sort of approach.

3. Question regarding 1675-1695 was not recommended for sharing, but since nothing is off the table, could other users be moved into that lower part of the band?
    a. NTIA is NOT looking below 1695. 1755-1850 may be the next band put on the table for consideration.
4. Dr. Jack Beven (NHC). Question for Ed Davison. Surprised to hear you are looking at bands for DoD radar and telemetry. What is the mentality that even has those bands are on the table? The fact that they are on the table does not bode well for those considered a bit less essential.
    a. Response - 3.6 GHz is a Ymax band. Radar altimeters actually take up VERY little band space and NTIA and FCC operate as if their use almost doesn't even exist.
5. Question for Mark Mulholland. What's to keep the cell phone companies from taking over the band entirely including exclusion zones without any sharing?
    a. Response - Protection of essential government services will be the major point of consideration. Major telecommunication companies have every right to take the decisions to court.
6. Question to Mark Mulholland. Spectrum grab by Light Squared is taking part of L band. What does this mean for all the GPS transmitters that we use and how do we protect the critical GPS services?
    a. Response - DCS transmitters use the GPS to synchronize clocks on transmitters. The GOES-R operational downlink was restructured to support the 1675-1695 MHz frequency band. This will require DCS to move to a new frequency below 1695 MHz,–?
7. Sean (Aquila Systems) – We are on the cusp of GOES-R and JPSS. For the new spacecraft, why don't we just move everything to the X-band? Shouldn't the new satellites be moving services off of L-band and onto X-band? Let the telecoms have the L-band, but only after the NOAA satellites have moved off entirely? Also, what about a new band above 4 GHz?
    a. Mark Mulholland response – There are restrictions (power, point-to-point) with X-band, so NOAA actually cannot move to X-band due to the X-band downside. A big portion of NOAA's operations is continuity. In order to preserve our role in WMO and other international partnerships, we don't want to price users out of the market.
    b. Craig Keeler response – X-band technicalities would defeat the purpose of direct readout. MODIS uses X-band for direct readout and has for over a decade.
8. Question – Will this go forward if the current administration is replaced during the next election?
    a. Mark Mulholland response – No idea.
9. Question from Ed Young. This needs to be more of an international discussion and not so U.S.-centric. Are international impacts being considered?
    a. Response from Ed Davison – It is first being addressed domestically and with neighboring nations in North America. There is a lot of work to be done on this front.

Mark Mulholland comment – At the 2011 Annual AMS conference in Seattle, there was a push for hand-held distribution of weather information and less-so at personal computers or TVs. Mark was told by vendors, that the 3rd most popular application for smart phones is weather

applications. The only two applications that were more popular than weather were search engines and Facebook. Additionally, the average amount of time spent on those weather applications was 2 minutes. It appears people are going to their phones for quick weather updates…perhaps coming and going from their offices. It is clear that there is a need for providing good weather information for use on mobile smart phones, so this may show a great cause for cooperation between the telecommunications industry and the weather provider industry.

2011 NOAA Satellite Direct Readout Conference:
Real-time Access for Real-time Applications
April 4 - 8, 2011 Miami, Florida
Conference Report
Session 8: Communications and Breakout Groups

8.1 Session Introduction

David Benner, NOAA Satellite and Information Service

8.2 GEONETCast and GEONETCast Americas

Paul Seymour, NOAA Satellite and Information Service

GEONETCast is a near real-time, global network of satellite-based data dissemination systems designed to distribute space-based, air-borne and in situ data, metadata and products to diverse communities. GEONETCast is led by four regional infrastructure providers: EUMETSAT in Europe (EUMETCAST), GEOMETCast Africa, Chinese Meteorological Administration (CMA) in the Asia-Pacific region (CMACast), and NOAA in the Western Hemisphere (GEONETCast Americas).

GEONETCast Americas is the Western Hemisphere component of GEONETCast. Maintained by NOAA, the GEONETCast Americas service uses the commercial Intelsat-9 (IS-9) satellite to broadcast environmental data to an area covering most of North, Central, and South America, including the Caribbean Basin.

GEONETCast Americas uses commercial Digital Video Broadcast for Satellites (DVB-S) to broadcast file-based products. Following commercial DVB standards, GEONETCast Americas uses the C-band broadcast frequency. It is broadcast on PID 4201 from the Intesat PAS 9 satellite on a frequency of 3840 MHz.

The receive terminal for GEONETCast broadcasts should have an antenna (normally 2.4 meter C band), LNB, receiver or receiver card, and a PC running Kencast datacasting client software. The datacasting client software necessary to receive the files is either KenCast Fazzt Standard or Professional Client software. There is also an “Edge Span" version for networks. The software can be purchased from KenCast Incorporated (www.kencast.com).

International partners providing data and information include: NOAA National Weather Service, NOAA Satellite and Information Service, the U.S. Environmental Protection Agency, the International Center for the Investigation of the El Niño Phenomenon located in Ecuador, the Argentine National Space Activities Commission, the Brazilian National Institute for Space Research, the National Meteorological Institute of Costa Rica, the Radio and Internet for the Communication of Hydro-Meteorological and Climate Related Information Program (USAID/UCAR/NWS), the Project at Water Center for the Humid Tropics for Latin America and the Caribbean (CATHALAC) in Panama, and EUMETSAT. The GEONETCast Product Navigator - http://www.eumetsat.int/Home/Main/DataProducts/ProductNavigator/index.htm - is

a search engine allowing discovery of all the information located on GEONETCast broadcast services.

8.3 RANET Program Overview

Kelly Sponberg, Program Manager, IEPAS / RANET, Joint Office of Science Support, University Corporation for Atmospheric Research

RANET is an international collaboration of national hydro-meteorological services and similar organizations working to improve rural and remote community access to basic information such as forecasts, observations, and warnings. The program typically focuses on training and system development and demonstration. It has activities in parts of Africa, Asia, the Pacific, and Central America/Caribbean. Mr. Sponberg gave recognitions to several people, including RANET partners (Australia BoM and NNW's International Activities Office and Pacific Regional HQ).

Mr. Sponberg talked about Chatty Beetle (he also came up with its name) and provided a status update. The concept was presented at the DRO in 2008. This 3-year "global" pilot was to develop and test a two-way text paging system – for alert and notification. Chatty Beetle is funded by USAID/OFDA in partnership with NOAA NWS (IAO, PR HQ), Australia BoM and many others. It uses Iridium Short Burst Data (SBD) as the primary communication link.

RAPIDCast (Remote Asia Pacific Information Dissemination BroadCast) will start as a 3-year pilot/demo in 2011. Funding will be provided by USAID/OFDA in partnership with NOAA, NWS, and Australia BoM. A DDS broadcast (coverage initially SW and SE Pacific beams) should start in August 2011 as a 128 kbps service bursting to 512 kbps. The initial content will be a regionally relevant subset to LRIT.

Mr. Sponberg mentioned other major activities that included a 64 kbps channel on GEONETCast Americas and GEOMETCast Africa maintained by RANET. Lots of content development work has to be completed, but processing and adding new stations will take place later this fiscal year. The HF E-Mail is a network that collects observations that the New Zealand Meteorological and Australia Bureau of Meteorology organizations developed and maintain. The Community FM Radio is popular in areas where no broadband services exist, and RANET takes its name from this radio.

8.4 The Role of the Polar Communications and Weather Mission for Canada

Mike Manore, Project Coordinator, Space-Based Monitoring, Meteorological Services of Canada (David Bradley represented Mike Manore)

Environment Canada, in association with the Canadian Space agency, is planning a Polar Communications & Weather (PCW) Mission. The reasons for an Arctic mission are: a rapidly changing environment, a growing need for operational information infrastructure, a gap in global communications and observation systems, and support for Canada's Northern Strategy. The objectives of the mission are to provide reliable communications and navigation services in the high latitudes (North of 70º). The mission will enhance the temporal and spatial resolution of meteorological data above 50º N in support of numerical weather prediction (short to medium range), environmental monitoring, and climate monitoring. In addition, the mission will provide

space weather information and emergency response which are most important for northern latitudes, and greatly improve 2-way broadband communication.

The mission will consist of two satellites in High Elliptical Orbit (HEO). The satellite payload will include an image spectroradiometer, space weather sensor, and Ka band and X band two-way communications capability. The imagery will be refreshed every 15 to 30 minutes. The resolution of the visible imagery will be 0.5 km and the resolution of the IR imagery will be 2 km. The imager sensor will have 20 channels which include 16 ABI and three MODIS channels. There are secondary payload sensors being considered for manifest on this mission.
The meteorological data will be processed at the Canadian Metrological Center in Montreal and the space weather data will be processed at the Space Weather Center in Ottawa. They have established a NOAA – Canadian coordination group which among other things will define areas of cooperation and identify other U.S. agencies who may want to partner.

8.5 International Satellite Communications System (ISCS) and NOAAPort Activities

Robert Gillespie and Scott Christensen, NOAA National Weather Service

The International Satellite Communications System (ISCS)

Robert Gillespie, PMP - NOAA/NWS, Office of Operational Systems, Silver Spring, MD

The International Satellite Communications System (ISCS) is a United States Federal Aviation Administration (FAA) contracted satellite broadcast service providing support to (1) the World Area Forecast System (WAFS), and (2) the Region IV Meteorological Telecommunications Network (RMTN). ISCS support for WAFS is on behalf of the International Civil Aviation organization (ICAO) and World Meteorological Organization (WMO). The purpose of ISCS/WAFS is to provide the worldwide aviation community with operational meteorological forecasts and information about meteorological phenomena required for flight planning and safe, economic, and efficient air navigation. ISCS support for RMTN is part of a cooperative effort between National Weather Service (NWS) and WMO to improve the Global Telecommunications System (GTS) in WMO Region IV (North and Central America). The ISCS operates on a 24-hour/365-day basis.

Underway are a number of activities which will impact the current ISCS and its users. The main activities include the FAA decision to cease their participation in the ISCS broadcast of aviation related (WAFS) data, and make aviation data available to the ISCS aviation community via their WAFS Internet File Service (WIFS) after 30 June 2012. The NWS has committed to continue providing GTS data to the ISCS users in WMO RA-IV via a GTS Internet File Service (GIFS) in advance of the 30 June 2012 shutdown of the ISCS satellite broadcast. NWS is identifying future ISCS alternative methods/technologies to provide GTS data to the WMO RA-IV users within the next 12 months.

Future alternatives to the ICSC were highlighted. The primary method for product availability will be through an Internet based, NWS File Service. NWS is also considering a satellite-based broadcast service. GEONETCast-Americas (GNC-A) is under consideration. The NWS is working with NESDIS to fully understand and investigate GNC-A's ability to adequately address an ISCS broadcast role in the future.

NOAAPort: Satellite Broadcast Network
Scott Christensen, NOAA National Weather Service

NOAAPort – also known as the Satellite Broadcast Network (SBN), is the primary vehicle through which hydro-meteorological products are provided to NWS field office AWIPS systems. The vast majority of NOAAPort products are freely available to NOAA's partners. There are four NOAAPort data streams, each with a unique DVB PID: GOES/NESDIS, NCEP/NWSTG, NCEP/NWSTG2 and OCONUS Imagery/Model/DCP.

Existing NOAAPort channels are highly utilized. Emerging requirements, such as for NPP, GOES-R, JPSS, NCEP model, and dual polarization radar, necessitate network expansion. A NOAAPort network expansion is currently underway. New features of the expansion include the transition from DVB-S to DVB-S2 and the Network bandwidth increase from 10 to 30 Mbps. The new upgrades support MPE and VCM. A thirty (30) day window of "dual illumination," April 18 to May 17, 2011 will allow users to test the new features. The new product additions for the AWIPS SBN Channel Resizing are planned for July-August 2011.

8.6 User Services for NESDIS Satellite Products and Services

Matthew Seybold, NOAA Satellite and Information Service

NOAA's National Environmental Satellite, Data and Information Service (NESDIS) provides satellite-based products and services to the global user community from NOAA's Geostationary and Polar Orbiting satellite programs. NESDIS provides hundreds of operational products daily, each requiring a different level of support for the community. Many users have a critical dependency on these data, products, and services in order to perform and carry out their missions. For instance, rapidly updating GOES satellite images support local forecasts and warning operations; while daily global analysis of sea surface temperature support model projections. NESDIS continually strives to provide the highest quality customer service through constant communication with its users. Such customer feedback allows for continuous improvement of user services. To that end, the Office of Satellite and Products Operations (OSPO) maintains a User Services Team. Mr. Seybold focused on OSPO's current level of support to users, including information dissemination regarding satellite operations, status, product processing, and distribution. Current initiatives within OSPO, like an improved Help Desk process, will continue to build better customer relationships. Finally, Mr. Seybold discussed the OSPO support on user readiness for the GOES-R and JPSS future systems. Additional information on OSPO User Services can be obtained at the following websites:
Satellite Products & Services Division/Satellite Analysis Branch: www.ssd.noaa.gov
Office of Satellite and Product Operations: www.ospo.noaa.gov

To subscribe to the ESPC Notification list, send an e-mail to Matthew.Seybold@noaa.gov and/or Natalia.Donoho@noaa.gov, or call (301) 763-8051.
Contact information for theESPC Help Desk: ESPCOperations@noaa.gov or (301) 817-3880.

8.7 McIDAS-V: Advances in Data Analysis and Visualization for Satellite Data and Products

Dave Santek, Space Science and Engineering Center (SSEC)

The University of Wisconsin's Space Science and Engineering Center (SSEC) has been at the forefront in developing data analysis and visualization tools for environmental satellites and other geophysical data. The fifth generation of the Man-computer Interactive Data Access System (McIDAS-V) is a java-based, open-source, freely available system for researchers, algorithm developers and operational users.

For geostationary applications, McIDAS-V provides visualization and analysis support for GOES, MSG, MTSAT and FY2 data. NOAA is supporting the McIDAS-V development program for ABI imagery and products for the GOES-R/S series. For polar orbiting applications, McIDAS-V can display and analyze imager and sounder data from POES, Metop and NASA/EOS satellites. The U.S. NPP/JPSS program is supporting McIDAS-V development for the VIIRS, CrIS and ATMS imager and sounder instruments. In addition, data from the GEONETCast and EUMETCast broadcasts can be imported into McIDAS-V. McIDAS-V is free, open source software available at http://www.ssec.wisc.edu/mcidas or Google – mcidas.

8.8 Breakout Group Instructions

Scott Rogerson, NOAA Satellite and Information Service

8.9 Breakout Groups

Breakout Group #1: Transition from GOES to GOES-R

Moderators: Greg Mandt and Dr. Satya Kalluri
Subject Matter Experts: Tim Schmit, Craig Keeler

The presentation covered the transitioning to GOES-R, GRB Resources for Users, GRB Simulator, GRB Downlink Specification and Product Definition & User Guide (PUG) status and timing for completion, GRB information, Level 0, 1b, and 2+ products, terrestrial distribution, mock up of PDA User Interface, training and education resources websites for online training modules.

Information gathered and provided from the GOES-R Question and Answer session held earlier at the conference was reviewed by Dr. Kalluri to share information with this group of users and obtain additional feedback. Note: Several users attended both sessions, demonstrating a strong interest in learning more about GOES-R. Specifically, the timeframe for the current GOES series was reviewed including the previous day's responses from Kathy Kelly that the goal is to use as much operational life as possible from the current GOES satellites, and the current life span is 2017-2019 or perhaps beyond for the current GOES series. She estimated that the current projected GOES-R turn-on would be 2017 or so and legacy systems would be used until then providing current data streams including GVAR until the legacy systems are decommissioned. Regarding the previous question of whether

GOES-R would become GOES- East or GOES-West, the response from the previous session was that if the current logical order is used, GOES-R would replace GOES-14 and become GOES-West. Some users at this session expressed an interest in GOES-R becoming GOES-East due to the improved forecasting capabilities and expressed an interest in GOES-R becoming operational as soon as it completed the check-out stage after the launch instead of waiting--check out could be done in 6 months to 1 year after the launch. It was stated in the previous session by Ms. Kelly that both GVAR and GRB would be supported when GOES-P and GOES-R are operational assuring those users concerned about losing GVAR data that GVAR would be available for several more years through the legacy systems.

Key questions and responses:

1. How long will the legacy system be usable –how long will the existing GVAR capabilities be available to users?
   Response: As long as GOES-15 is operational, the GVAR service will be maintained.

2. Users asked if it would be possible to get a subset of GRB data instead of the entire 30 Mbps.
   Response: Dr. Kalluri asked what the users would like to see if they could get 4-6 Mbps in a more limited version, if it were available, until they upgrade to receive the full GRB data? He indicated that GOES-R would need user input to identify the kind of data they would need.
3. Is there an option to get data from GEONETCast? There was a general interest in this as an option. One user commented that he would like to get Level 1b from GEONETCast and do his own thing from there and asked if that is possible.
   Response: Dr. Kalluri noted that the GEONETCast has 2 Mbps and GRB will have 30 Mbps. The downlink to Wallops will increase and GEONETCast may not be able to get the data because of size. Dr. Kalluri asked users what they would want to include in the more limited 2 Mbps if it could be provided. This question could not be answered at this time so an action was noted to work with GEONETCast users to determine this. See action section.
4. Could there be regions and products by region to define what people are interested in from GOES-R instead of receiving all GRB data? Specific discussion commenced about South America as an example of a region.
   Response: It was noted in the discussion that the responses from only the users at this conference may not represent what other users in the region would want. It was discussed that the 2012 WMO meeting is scheduled for Rio de Janeiro Brazil and that would be an opportunity to present more information. In the meantime, the GOES-R program could look for expanded opportunities to get information to Brazil. See action section.
5. Are there any alternative suggestions for getting GRB data without substantial equipment upgrades?
   Response: Obtaining data through GAS is a possibility if users can't convert to GOES-R right away. Work to support the distribution of GRB via GAS is planned and information for users will be made available as soon as possible.

6. Is anything being done with GRB that would allow use and maximization of current hardware and software to reduce cost to users? What can one do with the legacy

hardware when GOES-R starts---many users such as the National Hurricane Center (NHC) have a lot of equipment? If the equipment could be upgraded to a GRB capable system, could you still receive old GVAR on the system also?
Response: Unknown at this time. It was stated that the transmitters may not have to be changed. The GRB Downlink Specifications and the Product Definition and User Guides are in draft form currently and expected to be finalized in February 2012. The final specifications will be provided on the GOES-R website allowing users to compare their current equipment to that needed for GRB to determine upgrade needs at that time.

7. Some users at this session expressed an interest in using GOES-R when it is ready instead of waiting for the existing satellites to finish their planned cycles and be decommissioned.
   Response: Mr. Mandt stated that all options are a consideration for further discussion with users.
8. What kind of educational resources can GOES-R provide to users regarding moving from legacy GVAR to GRB?
   Response: Dr. Kalluri asked the users what kind of educational materials they would like the program to provide. No specifics were identified — more work is needed in this area.
9. International users want to be part of things now and not wait until they are told that things are happening that will change their processes. They have questions on how to fundamentally get their current products, not just future products.
   Response: Dr. Mandt said that there may need to be a Direct Readout proving ground including international users.
10. One user said they heard that Alaska would not be updating the station to use GRB. Mr. Keeler confirmed this. Dr. Kalluri asked if Fairbanks will get L-Band. Another question was asked regarding how Alaska gets their GOES data today
    Response: Through the NWS. They would have to get GVAR data today. Anchorage and Fairbanks have protected exclusion sites that are being negotiated. Dr. Kalluri asked if a protected exclusion site would be needed for L-Band real-time reception and Mr. Keeler said yes. The issue is regarding cell phone interference. There is a similar issue at Wisconsin also. It was stated that NOAA is participating in several discussions beyond the exclusion. Mr. Gurka said he could follow up with someone to check on the location of the GVAR antenna in Alaska.
11. What data will be available through EUMETSAT?
    Response: Dr. Kalluri asked the users what the plans are for EUMETSAT to get a receiver to receive GRB data. Users are interested in ensuring that the European Community gets a receiver to obtain the data and the location will be critical so all countries would get the signal.

Action Items:

1. Mr. Mandt noted that some international users had asked him questions about the dish size needed as the distance from the satellite expands.
   Response: He stated that more research will be done to address this question for the user community.
2. GOES-R program will post GRB Downlink and Equipment Specifications on its website in February 2012, once the specifications are finalized.

Response: Mr. Mandt said that he hears the users when they say they need to know exactly what they will need to prepare for GOES-R. Mr. Mandt said that the GOES-R program needs to look at what they can do for the GVAR users to ease the transition.

3. Can a brochure be put together for emergency managers about changes in EMWIN for users like the NHC so they can teach their emergency managers and help them become educated sooner?

Response: Good idea. GOES-R program will investigate the possibility of generating a brochure for the emergency managers. Further, Mr. Mandt suggested that the GVAR alternative questions and the types of educational materials the user would like to see are difficult questions at the present time, but there is a need for dialogue. It was brought to the attention of the conference that at the monthly meetings, the topic could be expanded (it's in the training area) and that could start this dialogue each month.

Recommendations:

- Work with GEONETCast users to determine coordination and what subset of data they would want to receive from the larger GRB data stream.
- Look for expanded opportunities to get information to Brazil and consider a presentation at the 2012 WMO meeting in Rio de Janeiro to present more information.
- Conferences need to have people to translate data presented at conferences, not just the speaker translation, for international members attending meetings and conferences to help users receive training and education at these meetings. It was specifically asked that key information be translated into Spanish.
- Simulator Testing: A suggestion was made requesting that GOES-R test things that already go wrong using the simulator for a better test. For example, one person asked if there was a way to simulate noise as part of the testing since noise is a problem. Another suggestion was to add testing in simulation to learn more about various products if operational times are delayed. Another user said that GOES-R should ask more users for input on simulators also. A suggestion to create simulated data over South America was also made. The algorithm working group (AWG) has proxy data sets that could be made available for simulator testing.
- COMET monthly sessions with foreign users could be planned so the international users could start asking questions and providing feedback. Outreach and more information on how international users in various countries will be trained are important for the users to know.

Breakout Group #2: Transition from POES to NPP/JPSS: APT, HRPT, IPOPP, LRD, HRD

Moderator: Marlin O. Perkins
Subject Matter Experts: Gary McWilliams, John Furguson, John Overton

The Low Rate Data Breakout Group was chaired by Mr. Marlin O. Perkins, NOAA. The intended goal of the sessions was to provide feedback to NASA for the generation of requirement documents to Ball Aerospace (BATC) for the LRD on JPSS-1 no later than April 15, 2011 to identify the aspects that affect the spacecraft design. Since NASA captured the RF link characteristics and data format in the ICD, NOAA needed a final review of the LRD characteristics before they were presented to BATC. Mr. Perkins informed the group about the need for mission support data (MSD). Currently, this data is not supported in the HRPT transmission. If we need to provide this, we need to provide BATC an estimate of the data volume the spacecraft would need to accept and store, and how it would be managed with the other data in the downlink. Mr. Perkins asked, "How can we decide whether or not we need to provide this capability?" The majority of the LRD user community should have access to network/Internet data to provide mission support data. Currently, there are several vendors that provide two-line element (TLE) data. Also, the Internet provides the capability to get additional datasets to generate the end products. Otherwise, making the mission support data available in the LRD data stream will degrade the performance. It was recommended that the LRD users get this information before going out in the field. The spacecraft will not provide MSD in LRD downlink. Most users agreed that they were comfortable receiving the MSD over the Internet or via other means.

The use of the programmable broadcast has created some misunderstanding about the operations of the LRD service. Mr. Perkins suggested the programmable feature be used to replace channels that failed during operation and to maintain a constant data rate. The ground segment will maintain an APID prioritization table. If the data stream content is <4 Mbps, the spacecraft will provide fill. If data stream content is >4 Mbps, the spacecraft will drop APIDs based on a prioritization table until content <=4 Mbps.

Mr. Perkins touched on the antenna size and wanted to know if we should specify the size as a requirement. The current consideration is 1m vs. 1.8m. This decision may drive the hardware implementation. NOAA will specify 1.8m antenna with G/T = 6 dB/K in the L1 supplement and LRD IRD. Reducing the aperture size of the antenna would require more power and require a change to the satellite bus. A 1m antenna is capable of acquiring the LRD signal at an elevation above 10 degrees.

The bandwidth/data rate is a critical component that will define the characteristics of the LRD service. We need to identify a reasonable estimate of what these need to be as they drive the hardware/software implementation. According to BATC, we can get 3 dB margin with 4 Mbps rate for 1.8m antenna and use SSPAs. Mr. Perkins expressed his concern about the 6 MHz bandwidth and the possible interference it may cause to other meteorological satellites operating in this frequency band. Also, there was concern about interference from the current 4G users above 1710 MHz. It was suggested the LRD be move further way from 1707 MHz, where it would be less likely to encounter interference.

There were a number of issues on the content of the LRD service. NOAA and NASA proposed a set of channels that represented the AVHRR data stream. The data content was defined by a daylight and nighttime potion of the orbit. To meet the data rate requirement, the equivalent AVHRR channels for the LRD are represented by moderate resolution channels from the VIIRS (daylight) and the CrIS, ATMS, OMPS, and CERES (nighttime). Mr. David Smith, Raytheon, questioned whether the VIIRS channel selection should be based on maintaining continuity with the AVHRR channels. He suggests that we take a fresh look at the VIIRS products and then decide on the products to select.

Several of the participants said the LRD is a subset of the HRD. Given the antenna size (1.8m), it would be practical for all the HRPT users to convert to the HRD service. Therefore, it would not be necessary for NOAA to support an L-band service in the future. A recommendation was made to evaluate whether X-band is not preferable to L-band. The other possibility is to have a ground system capable of receiving both L- and X- band service. Many participants, especially from Europe, are more in favor of using the IMAP software compared to the IPOPP for their HRD service. They prefer IMAP because it is more compatible with a variety of operating environments. Several felt that IMAP should be the recommended software package. Most participants were interested in having a functional software package available by the NPP launch date.

In conclusion, the LRD capability for JPSS-1 is an objective (goal), but is required for JPSS-2. JPSS-1 LRD link characteristics are 1707 MHz with 6 MHz BW, 4 Mbps data rate and 3 dB to a 1.8m antenna with a G/T of +6 dB/K. Mission Support Data will not be provided in the LRD downlink. It is suggested that users obtain this data via network/Internet and NOAA conduct a final analysis for the ideal channel combination for LRD.

<u>Breakout #2 Recommendations:</u>

- NOAA more fully engage users to give them more time to evaluate LRD options/needs
- Do not include mission support data in LRD downlink
- Drop requirement for spacecraft to service 1.0m receive dish
- LRD Downlink Frequency
    - Explore possibility of dropping center downlink (1707 MHz) frequency below 1690 MHz to avoid future interference with mobile cellular industry
    - In short-term move center downlink frequency below 1707 MHz to avoid current 4G interference
- Candidate LRD Content
    - Use the day and nighttime (Mr. Tom Schott) AVHRR baseline channels for LRD initial specifications
    - Conduct a final analysis of ideal channel combination for LRD
- Investigate a format similar to level-1b for the LRD rather than EDRs
- HRD Processing Packages
    - Users prefer NOAA support IMAP vs. IPOPP software
    - Users need access to software and source code at NPP launch date
    - Users need consistency between local and global processing software
    - Users need user support for HRD processing software
- Look at X-Band service only
    - More fully evaluate pros/cons & costs/benefits of both X-Band & L-Band

- Investigate reducing the data content of LRD to ensure users can use the existing 1-meter dish and decrease the bandwidth to 4 MHz.

Breakout Group #3: Satellite Services (LRIT, EMWIN, GOES DCS, GVAR, Argos, GEONETCast, RANET)

Moderator: Paul Seymour
Subject Matter Experts: Kay Metcalf, Jim Heil, Edward Young, Scott Rogerson, Natalia Donoho, Letecia Reeves, Matthew Seybold

A total of 30 attendees participated in the two breakout groups. The primary topics discussed were DCS, EMWIN, LRIT, and RAPIDCast Pilot Program. The main focus of the first session was on DCS. Discussions centered on transitions to new transmitters and how to inform users of the changes and on the new DADDS system and needed improvements. The main focus of the second session was on LRIT, EMWIN, and the private individual user (PIU) community of weather satellites.

Session One - Questions, Issues, Recommendations, Conclusions

1. Describe the transition process for narrow band transmitters
    a. Overview of satellite system
    b. Currently, there are only two manufacturers certified to produce the narrow band transmitters. We expect others to participate in the future.
    c. Ground system is ready, but need to make a configuration change for the demodulators.
    d. Changes have to be made in the frame sync.
    e. System transition status – Ms. Metcalf checked with vendors. New version on one side, leave old version for other side.
    f. Action – Need to more clearly define transition plan to the narrow band transmitters.
2. The manufacturer of ground systems was asked for a quote on making the full change. It was highlighted that Microcom is also the contractor for the EDDM.
3. **Question:** What is the timeframe for updating the software at our USGS site?
   Response: This is estimated to be within one month, without a government shutdown.
4. **Question:** How long before 100 baud transmitters will not work any longer.
   Response: According the DCS Program Manager, the life expectancy of the 100 baud transmitter is expected to cease around May, 2013. At that time all demodulators are changed to 300 baud and data will not come through on 100 baud transmitters. Mr. Jim Heil, NWS, provided comments on the funding initiative for upper Colorado River Upgrade. He stated, "The NWS brought in all 100 baud transmitters that needed to be upgraded."
5. **Question:** Mr. Edward Young, NWS Pacific region asked, "The tide tool software ingests sea level data and plots sea level stations and sea level change per station. Now that DCS is in LRIT, how do you pull those data out of LRIT to export into the tide tool software?
    a. Need to describe the process. Action – Conversations need to occur between LRIT manager and PTWC internally.
    b. In current LRIT stream for DCS there are no quality monitoring flags. Data format updates need to be considered before the process is formalized. Action – Look at updating the DCS stream into LRIT (with modern quality indicators [which are currently available in DCS system], reliable delivery mechanisms, latency, etc.).
    c. Action – Add Rapid Cast to STIWG/TWG next month.

d. Increase reliability of LRIT service. Domain 5 needs to be replaced next, but reliability of those has been good. Non-standard dissemination over Internet out of Wallops to NSOF. To make LRIT into a delivery system for DCS, requirements (latency, etc.) need to be established. Once EMWIN is available at COOP site, LRIT will also benefit.
e. Mr. Paul Seymour – LRGs in DCS have issues, but LRIT is pretty reliable at this point.

6. Recommendation: Mr. Paul Seymour / Mr. Emile Bergeron – increase options/functionality for users in DADDS. (Last time transmitted, user code on the message grid, upon submission of batch files – can a response message come more quickly – current delay of 1 day, database image output frequency of production is not known – in the past it was once/day).
7. Mr. Rolin Meyer – LRIT installed at NOS/CO-OPS facilities in Chesapeake, VA recently and will be installed in Seattle, WA within 1-2 months.
8. Action: Need report of plan for changes coming in near/extended future. Unknown which GOES Incident Reports (GIRs) are going to be worked on next. Uncertain which will be approved in change management first, as well as when.
9. NTIA asserts no impact on GOES services. Unclear whether there actually is a potential for interference.
10. How do we do a better job of informing changes and defining methodology, using mechanisms including WMO? There needs to be better coordination and documentation of changes.

Session Two - Questions, Issues, Recommendations, Conclusions

1. **Question:** Mr. Sean Burns – What efforts are occurring in consolidating numerous data flows?
    a. Terrestrial dissemination systems will consolidate to the PDA – GAS, NDE (CLASS is not part of PDA).
    b. User registrations are voluntary, so they are not entirely known.
    c. Ms. Kay Metcalf – perhaps we could look at describing all of the outlets, so that they are all accessible from the same place even if the data flows are separate. Might include information to who the data are being served and why.
    d. If the name of the SDRC were changed, there might be broader participation.
    e. Currently NOAA seems committed to multiple transmissions from constellations.
2. **Question:** Mr. Dave Cawley – Would the LRIT include both EMWIN and DCS?
   Response: Current LRIT has copies of both. GOES-R HRIT will also have copies and perform dissemination.
3. **Question:** Mr. Dave Cawley – Why aren't the GERBER files (plan for printing circuit boards) for the prototype HRIT/EMWIN file available?
   Response: They were developed as part of GOES-R contract. A prototype software receiver was developed to handle "all of these" and shared with industry.
4. **Question:** Did NOAA pay for the IPs?
   Response: GOES-R will provide a response.
5. **Question:** Is it the same circuit board?
   Response: Aerospace will provide a response.
    a. **Action** – NOAA investigate possibilities for making the GERBER files available? If not by NOAA, who can make them available? Availability would be to general public.

6. **Question:** Can NOAA/EUMETSAT look at jointly sharing Central and South American, and Caribbean customers?
   Response: NOAA will explore methods to share customer information with EUMETSAT to improve the availability and usage of satellite data from both constellations.
7. **Question:** Are any users receiving the EMWIN 19.2?
   Response: Yes, this is known because of recent training session in Caribbean and also in the Pacific. Number of users in U.S. is not known.

Breakout #3 Recommendations

- DCS Transition Plan to new transmitters needs to be clearly defined.
- Increase options/functionality for users in DADDS. (Last time transmitted, group code [user ID] on the message grid, upon submission of batch files – can a response message come more quickly – current delay of 1 day, database image output frequency of production is not known – in the past it was once/day).
- Investigate use of LRIT and or RAPIDCast pilot program for delivery of tide data to the Pacific Region.
- Look at updating the DCS stream into LRIT (with modern quality indicators [which are currently available in DCS system], reliable delivery mechanisms, latency, etc.).
- Add Rapid Cast to agenda of STIWG/TWG next month.
- Make the GERBER (plan for printing circuit boards) files available. If not by NOAA, who can make them available? Availability would be to general public.
- What efforts are occurring in consolidating NOAA's numerous data flows?
- Can we look at jointly sharing Central American, South American, and Caribbean DCS customers, between EUMETSAT and NOAA?
- More clearly define and communicate the transition plan or process for narrow band transmitters.
    - Overview of satellite system
    - Getting manufacturers certified
    - Changes to ground system specifically to make a configuration change for the demodulators.
    - Change in frame sync
- Address the issue regarding timeframe for updating the software at our USGS site in 1 month.
- Now that DCS is in LRIT, how can that data be extracted from the LRIT stream for export into the software?
    - NOAA GOES DCS and LRIT programs need to coordinate internally and with the PTWC
    - NOAA should provide a description of the process
    - Look at updating the DCS stream into LRIT (with modern quality indicators [which are currently available in DCS system], reliable delivery mechanisms, latency, etc.).
    - Action – Add Rapid Cast to STIWG/TWG next month.
    - Evaluate the reliability of the LRIT service in relation to the possibility of LRIT being an official dissemination method for GOES DCS.
- Increase options/functionality for users in DADDS.
    - Last time transmitted

    - User code on the message grid
    - Upon submission of batch file, can a response message come more quickly (current delay of 1 day)?
    - Database image output frequency of production is not known (in the past it was once/day)
- Need report of plan for changes coming in both the near and extended future.
    - Example: It is unknown which GOES Incident Reports (GIRs) are going to be worked on next.
    - Uncertain which will be approved in change management first, as well as when.
- Assess what the potential for interference with GOES Services is vis-à-vis the upcoming L-band frequency changes.
- Do a better job of informing changes and defining methodology, using mechanisms including WMO. (There needs to be better coordination and documentation of changes.)
- Will the GOES-R HRIT/EMWIN service include both EMWIN and DCS?

Breakout Group #4: Frequency Issues: 1675 -1695 MHz, 1695 -1710 MHz

Moderator: Mark Mulholland
Subject-Matter-Experts: Cynthia Hampton, Jerome Lafeuille, Ivan Navarro, Joaquin Gonzalez

The frequency break-out sessions addressed goals and objectives of the panel discussion and continued much of the dialogue. Participants discussed exclusion zones and recommended that NOAA advocate adding exclusion zones around non-governmental HRPT receiving stations that directly support NOAA operations. Among these were the University of Wisconsin, Madison; and the Louisiana State University. The facilitator noted that the LSU site would be protected by the exclusion zone which will be in place for the New Orleans area. NOAA took an action to discuss adding additional exclusion zones around Madison, WI, and other similar sites.

Participants discussed possible ways to minimize interference with HRPT broadcasts. Some participants discussed moving antennas or adding additional antennas to provide multiple feeds. This discussion led to a desire to be able to share ideas and solutions among DRO users.

Finally, participants expressed a desire to update the user databases managed by the WMO, which have been neglected following the departure of the individual responsible for maintaining them. NOAA agreed to discuss the best way to reactivate an accurate database of voluntary registrants.

Breakout #4 Recommendations:

- NOAA to work with NTIA to consider adding non-government site exclusion zones for those locations directly supporting 24/7 NOAA operations.

- NOAA to discuss reactivating, updating, and maintaining the voluntary user registration database.

- Users were encouraged to propose and create low-cost informal messaging web sites where users could exchange ideas, common problems and solutions, and discuss interference mitigation techniques. NOAA suggested that the private or non-profit sectors would be in a better position to quickly establish and maintain such a web site.

2011 NOAA Satellite Direct Readout Conference:
Real-time Access for Real-time Applications
April 4 - 8, 2011 Miami, Florida
Conference Report
Session 9: User Services and Impacts

9.1 Session Introduction

Edward Young, Jr., Deputy Director National Weather Service, Pacific Region

9.2 Breakout Group reports

Breakout Group #1 – Transitioning From GOES to GOES-R

Dr. Satya Kalluri presented the report from Breakout Group #1, Transitioning from GOES to GOES-R. The purpose of the breakout was to determine what resources the users would need for a smooth transition from legacy GOES to GOES-R receipt and exploitation as GOES-R provides significant improvements in quality of data compared to legacy GOES systems. The Key Issues and Recommendations were:

- Participants included various stake holders
  - International users
  - U.S. users from academia, industry and federal government agencies such as the NWS
- What are the options for countries/users that cannot update their system from GVAR to GRB?
  - Option 1: As a stopgap, use HRIT/EMWIN
  - Option 2: Use Internet distribution (GAS) if your Internet pipes can support
  - Option 3: GEONETCast
- Data reduction – Can users get a smaller subset of the full stream GOES-R data stream
  - Subset by region
  - Explore data reduction options such as compression
- Training – Identify resources and approaches to train South American users
  - Provide translations of training material in other foreign language
  - Extend the proving ground concept to include foreign users
  - Participate in WMO conference in 2012 in Rio and extend outreach within South American countries
- Antenna upgrades and equipment needs
  - Provide signal specification to users in 2012
  - Provide notional geographic coverage maps/antenna size
  - Explore a prototype GVAR/GRB receiver – backward compatibility
  - Develop SW to unpack GRB feed for Direct Readout Users

Breakout Group #2 – Transition from POES to NPP/JPSS

Mr. Marlin Perkins presented the report from Breakout Group #2, Transition from POES to NPP/JPSS. The main topics discussed were: Mission Support Data, Bandwidth, Data Rate, Programmable Broadcast, Antenna Size, Frequency, LRD Content, VIIRS M Channels, HRD Processing Software, and IPOPP vs. IMAP. An important point raised was the criticality of engaging customers/users.

The major recommendations were:

- NOAA should more fully engage users to give them more time to evaluate LRD options/needs
- Do not include mission support data in LRD downlink
- Drop requirement for spacecraft to service 1.0m receive dish
- LRD Downlink Frequency
  - Explore possibility of dropping center downlink (1707 MHz) frequency below 1690 MHz to avoid future interference with mobile cellular industry
  - In short-term move center downlink frequency below 1707 MHz to avoid current 4G interference
- Candidate LRD Content
  - Use the day and nighttime (Mr. Tom Schott) AVHRR baseline channels for LRD initial specifications
  - Conduct a final analysis of ideal channel combination for LRD
- HRD Processing Packages
  - Users would prefer that NOAA support IMAP vs. IPOPP software
  - Users need access to software and source code at NPP launch date
  - Users need consistency between local and global processing software
  - Users need user support for HRD processing software
  - Look at X-Band service only
  - More fully evaluate pros/cons & costs/benefits of both X-Band & L-Band

Breakout Group #3 – Satellite Services

Mr. Paul Seymour presented the report from Breakout Group #3, Satellite Services. The primary services discussed were: LRIT, EMWIN, GOES DCS, GVAR, Argos, GEONETCast, RANET, and the RAPIDCast Pilot Program. The main focus of the first session was on DCS. Discussions centered on transitions to new transmitters and how to inform users of the changes and on the new DADDS system and needed improvements. The main focus of the second session was on LRIT, EMWIN, and the private individual user (PIU) community of weather satellites.

The Major Recommendations were:

1. DCS Transition Plan for new transmitters needs to be clearly defined.
2. Increase options/functionality for users in DADDS. (Last time transmitted, group code [user ID] on the message grid, upon submission of batch files – can a response message come more quickly – current delay of 1 day, database image output frequency of production is not known – in the past it was once/day.)

3. Investigate use of LRIT and or RAPIDCast pilot program for delivery of tide data to the Pacific Region.
4. Look at updating the DCS stream into LRIT (with modern quality indicators [which are currently available in DCS system], reliable delivery mechanisms, latency, etc.).
5. Add Rapid Cast to agenda of STIWG/TWG next month.
6. Make the GERBER (plan for printing circuit boards) files available. If not by NOAA, who can make them available? Availability would be to general public.
7. What efforts are occurring in consolidating NOAA's numerous data flows?
8. Can we look at jointly sharing Central American, South American, and Caribbean DCS customers, between EUMETSAT and NOAA?

Breakout Group #4 – Frequency Issues

Mr. Mark Mulholland presented the report from Breakout Group #4, Frequency Issues. The group made several assumptions including:

- Assume that sharing of 1695-1710 MHz will happen
- Assume that there will be a desire to proliferate U.S. decision throughout the world as the future international standard
- Remain engaged in public debate – FCC notice, legislative communications, etc.

Key issues discussed were:

- Some non-U.S. Government HRPT sites outside exclusion zones directly support U.S. Government:
    - University of Wisconsin
    - University of Oklahoma
    - Louisiana State University
- Exclusion zones may not work
    - Theoretical calculations based on accepted standards
    - Keeps out base stations (cell towers) but not cell phones
    - Transmission characteristics of future cell phones not known
- Enhanced communication among worldwide L-Band community needed
    - Official – for policy issues, guidance, etc.
    - Informal – for technical issues and general information sharing

The recommendations and actions were:

- NOAA to work with NTIA to advocate additional exclusion zones
    - Current U.S. law and NTIA rules do not allow exclusion zones for non-U.S. government sites
    - Compelling argument required
- L-Band user community should collaborate on innovative approaches
    - Use of dispersed antennas -- "hot back-up"
    - Antenna placement
    - Government and intergovernmental bodies should facilitate
- NOAA, together with WMO and national meteorological organizations, should facilitate enhanced communication among L-Band user community

- Update, re-activate, and maintain WMO user database
- Establish informal network, user forum, etc., for unconstrained user communication

9.3 Facilitated Discussion: Where Do We Go from Here?

Moderators: Kathy Kelly, Director, Office of Satellite Products and Operations and Edward Young, Jr., Deputy Director National Weather Service, Pacific Region

Ms. Kathy Kelly led an interactive discussion with the audience. She asked what issues, opportunities, questions, recommendations and comments need to be brought up before the conference reaches a conclusion. To facilitate this discussion, Mr. Dane Clark had prepared a list of questions and recommendations raised during the first four days of the conference from the plenary sessions, special sessions, demonstrations, posters, breakout sessions, and the survey. The following questions and answers and participant recommendations were used to compile the final conference recommendations:

Questions and comments:

1. What kind of training is needed to use the new NOAA satellites? What resources are available for training?
    a. Response – Resources are being developed to train in the use of these new data types. The training would include the NWS and would be made widely available with opportunities to learn how to use the data.
2. Comment from Ms. Jennifer Lewis (NWS International Activities) – regarding training. We need to translate more COMET modules into Spanish. Other resources must be sought. Please include Spanish translations as part of the initial contracts. If there are Central/South American partners who could help, please work with NOAA.
3. A group from Region III and Region IV came together to discuss requirements. This group was involved in trying to identify the primary satellite requirements for managing met services for forecasting.
4. To prepare for GOES-R, engage participants and develop training needs for real-time applications in a monthly focus group.

Training recommendations:

1. Assess the training needs for GOES-R and JPSS. Use RA III, RA IV and RA V requirements team to help map timeliness for developing country partners for equipment need and training needs.
2. Translate these training modules utilizing the translation resources from the recipient countries.
3. Engage participants in more real-time and frequent training such as monthly chat groups.
4. Need more training in RA V in satellite data interpretation and assimilation.
5. Utilize the Visit-View groups to inform the users of coming changes in available training resources.
6. Share the results of the weather forecast test bed project in Oklahoma City – that is, share new forecast models with WMO partners.
7. Need methods for user readiness – communicate opportunities. Provide schedule and time frame for users to be ready for the new systems.

8. Need clearer understanding of how training (and new equipment as well) will cover the new systems and the transitions from the old to the new.
9. Send out images with known errors to help in the testing and training regimes.

10. Need international points of contact in International offices. (Mr. Eric Madsen and Ms. Jennifer Lewis are U.S. POCs.)
11. NOAA NWS Pacific Region needs to facilitate RA V training – especially satellites and products.

Other participant recommendations:

1. Explore use of research satellites for use in operations.
    a. Dr. Steve Goodman comment – GOES-R PG is teaming up with NWS Weather Operations PG (Kansas City). There will be a test bed of sorts available there.
2. Include NCEP's OPC in the GOES-R Proving Ground – DONE. It's in the plan now.
3. Survey GOES-R users for need of Option 2 products.
    a. Dr. Steve Goodman commented that both options have been executed. Option 1 addressed latency. Option 2 addressed bringing in new non-continuity products. Question remains – when will those new Option 2 products be available upon launch even if they are not operationally supported immediately after launch? Ms. Kathy Kelly commented – Opportunities for Users to comment and provide suggestions on what would be most useful to them. This would go well beyond the testing of ingest.
    b. Ms. Jennifer Lewis (NWS International Affairs) comment: Many of the users (e.g., Pacific remote regions) are not entirely on-board with existing services, using GVAR and HRIT. Would NOAA be able to provide mapping to prepare these folks from the existing capacity to the next level of enhancements? This would be a recipe for training, equipment, time frame / time scale for the transition. What steps would prepare users for 2015 operations?
    c. Mr. Jerome Lafeuille (WMO) comment: Wants to reiterate that support for each RA is not necessarily comparable. Some RAs need more support than they've previously received in order to bring the support levels for all RAs to an equal level.
4. Assess the pros and cons of adding 2 additional VIIRS M-band channels.
    a. Mr. Marlin Perkins commented – They want to add two additional medium resolution channels to VIIRS. Dr. Patrick Coronado will talk to Dr. Mitch Goldberg about that addition. The channels are already on the instrument and the request is to add them to the Candidate LRD data scenarios. Dr. Goldberg had a concern about the fire channel (channel 13). It sounds like it is already in there and we simply need to get a LRD on JPSS.
5. NOAA needs better search capability in "reaching the correct NOAA office."
    a. Sounds like we need to improve / clarify Points of Contact. Mr. Eric Madsen offered himself to the international community as a primary conduit. Of course, the Help Desk should also be contacted.

6. NOAA needs to offer both low and high levels for data in catalogs and directories. There are limited formats. Formats are non-standard.
    a. Dr. Jack Beven commented – Also it would be nice to pull smaller sets of data and smaller domains of imagery in many cases.

7. User would like to see sample GVAR data for GOES-14.
    a. Go to CLASS to see these or also to Wisconsin CIMSS. Specific requests might go to Mr. Tim Schmit. GOES-14 is in storage currently, so real-time data are not available. At the end of the year GOES-14 will enter operations. There will be a transition period when both satellites are broadcasting (GOES-11 and GOES-14).
    b. Ms. Kay Metcalf comment - The NOAA Visualization Lab also has a lot of low-resolution images. Also, NCDC archives everything and has additional processing capabilities that may not be available through CLASS.
8. Need AVHRR/POES data on NOAAPort (have been asking for 4 years).
    a. This will be an action for OSPO.
    b. The bandwidth connection between Suitland and Silver Spring is too small.
9. The NOAA website needs to be improved – it is dated and quality of imagery is lacking.
    a. Action for OSPO webmasters.
    b. Dr. Jack Beven comment – NASA Marshall Space Flight Center has the best, most flexible site for viewing imagery.
10. NOAA products needed for YouTube, Wiki, Facebook, media, and education.
    a. Action for OSPO User Services.
11. New products via the web like: NWP, satellite loops, forecasts, forecast discussions, radar mosaics, Proving Ground products.
    a. Action for OSPO webmasters and User Services.
    b. Mr. James Gurka – GOES-R web site (www.goes-r.gov) has links to Proving Ground where products are available.
12. Need EMWIN to offer the Caribbean products. They would be happy to cooperate with NOAA to make this possible.
13. DCS needs a budget to fund a backup capability at EROS.
    a. Ms. Kay Metcalf – we do, but USGS is funding it; will discuss off line.
14. For GOES-R and JPSS, please consider capabilities of RA IV countries with limited resources. Could NOAA Pacific HQ facilitate the improvement of capacity building for obtaining satellite data?
    a. Dr. Jack Beven comment – NWS holds an annual training course to RA IV countries (max 25 people per session). The curriculum is already pretty full, but it might be a good template for adding satellite training.
    b. Need TPC to work with other Regions to exchange curricula for applications in other regions that have tropical cyclones.

9.4 Develop/Prioritize Conference Recommendations

Edward Young, Jr., Deputy Director, National Weather Service, Pacific Region
David Benner, NOAA Satellite and Information Service

Mr. Dave Benner listed the top 3-4 recommendations from the Satellite Services, POES, GOES-R, and Frequency Breakout Groups.

Recommendations from the Satellite Services breakout sessions

- The DCS transition plan to new transmitters needs to be clearly defined and communicated.
- Update DCS stream into LRIT.
- Make GERBER files available.

Recommendations from the POES breakout sessions

- Deveolp candidate LRD Content for JPSS-2.
- Investigate alternative for the LRD Downlink Frequency and future use of the L-band service on JPSS-2 and beyond.
- HRD Processing Packages system from GVAR to GRB

Recommendations from the GOES-R breakout sessions

- What are the options for countries/users that cannot update their system from GVAR to RGB?
- Data reduction – Can users get a smaller subset of the full stream GOES-R data stream?
- Training – Identify resources and approaches to train international users.
- Antenna upgrades and equipment needs.

Recommendations from the Frequency breakout sessions

- NOAA to work with NTIA to advocate for additional exclusion zones.
- L-Band user community should collaborate on innovations approaches.
- NOAA together with WMO should facilitate enhanced communication among L-Band user community.

Questions and discussion:

Satellite Services:

Responses/Discussion: Mr. Paul Seymour provided responses to questions/comments. GOES-R commissioned a receiver card (EDIS) to make forward and backward compatible for EMWIN/HRIT.

Question: Who is to release them?

Response: Ask GOES-R to look at the 3 options and make recommendations.

Question: Could there be a regional subset for EMWIN/LRIT data also similar to the regional subset request for GOES-R GRB?

Response: Mr. Paul Seymour said he will add this to his recommendations for subgroup request for future follow up.

POES:

No additional discussion.

GOES-R:

Discussion/Suggestions: Under data reduction recommendation, explore subsets by region. Expand training materials and language specific communications beyond South American to include other international users. Provide antenna upgrade specification as soon as specifications are available.

Frequency:

No additional comments or questions.

9.5 Session Wrap-up and Final Discussion

Edward Young, Jr., Deputy Director, National Weather Service, Pacific Region

Mr. Ed Young thanked everyone for contributing to the conference recommendations. Since this was the first year that formal conference recommendations have been formulated at the conference, he asked that all participants look these over after returning home and encouraged any additional information, ideas and questions to be sent to NOAA using the conference contact e-mail.

3 Closing Remarks

Ms. Kathy Kelly thanked all of the participants in NOAA's 2011 Direct Readout Conference including Mr. Marlin Perkins, Chair of the Organizing Committee and his committee members for an outstanding job designing and executing the conference. The purpose of the conference was twofold; first, to supply the user with the information needed in order to maintain current data and product reception systems and prepare for our future systems. Second, to hear user feedback regarding our systems, both current and future, in order for us to better supply the data and information needed. After five days of presentations, demonstrations, discussions, break-out groups, coffee breaks and talks, she hoped everyone agreed we had done these. She next outlined a review of what had been accomplished during the week.

Monday started with a review of the actions from the 2008 conference. Some items are closed, some are in process of being closed and others have yet to start. We will continue to work on the 2008 open actions and will add the actions and recommendations from this conference and will report out on our progress at the next Direct Readout Conference.

Also on Monday we heard high-level reviews of NOAA's satellite program, the National Weather Service's new strategic plan, NASA's direct readout services and the WMO's space program. We also had a panel on the use of satellites in disaster response and mitigation, hearing from USGS, the National Hurricane Center, WMO, and the NWS Pacific Region.

Tuesday started with a Keynote address from a representative for the President of RA III and heard the perspective of our users in South America. The rest of the morning was spent going over current NOAA GOES satellites and systems. We also heard from our international partners on how they are using GOES-12 and 13 data. At lunch we had a panel discussion on the use of satellite data in numerical modeling.

Tuesday afternoon was GOES-R. We heard about the satellite, instruments, ground systems, rebroadcast options, and what is developing in the various GOES-R proving grounds. We were able to answer many of your questions regarding this exciting new generation of NOAA geostationary satellites. Tuesday evening there was a demonstration of the new HRIT/EMWIN prototype system.

Wednesday started out with a Keynote address from Dr. Sri Harijono, the President of WMO RA V, who gave us the perspective of our users in the southwest pacific region. Ms. Kelly thanked Dr. Harijono and her staff for making the long journey from Indonesia to participate in the conference.

Current polar-orbiting satellite systems were the topic of the morning. There were presentations on NOAA's and EUMETSAT's current systems as well as CONAE's SAC-D/ Aquarius mission. There were also presentations on how POES data is being applied in Peru and the new MyOceans effort. The second half of the morning was dedicated to updates on the progress of the new generation of NOAA POES satellites, JPSS.

The topics for the afternoon were training resources of NOAA's cooperative institutes, the WMO and the WMO Centre of Excellence in Barbados. Late in the afternoon, we held our largest poster session yet with over 50 posters covering a wide range of interesting topics. We had a number of international posters this year, too. Wednesday evening there were question and answer sessions on JPSS and GOES-R, both of which produced lively discussions.

Thursday began with a Keynote address from the representative of the President of WMO RA IV, who gave us the perspective of the users in North and Central America and the Caribbean. We then heard about the applications of data in Chile, for nighttime lights, new data collection platforms, and new software packages. The morning ended with a lively panel discussion on frequency re-allocation and the future of the L-Band.

The afternoon began with presentations on alternative distribution and communications systems and ended with break out groups. She emphasized the important of these breakout sessions to NOAA and thanked everyone for their active participation, questions, comments and suggestions. Thursday ended with the conference dinner and presentation from Bryan Norcross from the Weather Channel.

Friday, we have heard the report outs from the breakout groups, had a facilitated discussion on where we go from here and developed a prioritized list of recommendations from the conference. Ms. Kelly indicated that she would be taking these recommendations back and sharing them with fellow NOAA managers and NOAA's senior leadership. The recommendations are important and they will be thoroughly reviewed and discussed. As we did at the start of this conference, at the next conference we will report back to you on them.

4 List of 2011 Actions and Recommendations

2011 SDRO Actions and Recommendations					
Customer Support/Information Access					
Actionee	Action	Description	Action feedback/closing document	Deadline	Status
GOES-R/JPSS	SDRO 2011-1	Provide information on changes to NOAA broadcast systems that will be necessary for GOES-R and JPSS.		NSC 2013	OPEN
GOES-R/JPSS	SDRO 2011-2	Investigate methods to provide real-time satellite data to RA IV countries through low cost methods, since only a small percentage of the RA IV countries have direct readout ground stations.		NSC 2013	OPEN
NWS COMET	SDRO 2011-3	Explore training modules to acquire and use satellite data in real-time, for improved forecasting.		NSC 2013	OPEN
STAR, CIMSS	SDRO 2011-4	Explore uses of research satellite data for operations (list best practice organizations).		NSC 2013	OPEN
OSPO	SDRO 2011-5	Investigate improving data access in RA V to real-time satellite data, other than through GVAR/GRB.		NSC 2013	OPEN
NESDIS IIA, NWS IIA	SDRO 2011-6	NOAA should consider updating its website including better and easy accessibility to satellite data.		NSC 2013	OPEN
NWS COMET	SDRO 2011-7	Investigate the resources needed to get users the processing needed for new data sets and/or provide training to determine the minimum data sets to meet local mission requirements.		NSC 2013	OPEN
NESDIS IIA, OSPO, GOES-R, JPSS	SDRO 2011-8	Consider additional mechanisms including the WMO to inform users about upcoming satellite changes and defining methodology that affect future operations.		NSC 2013	OPEN
Outreach – User Conferences/Meetings					
Actionee	Action	Description	Action feedback/closing document	Deadline	Status
OSPO	SDRO 2011-9	For future surveys, consider including questions about the quality and usefulness of the SDRC in addition to data products and services related issues.		NSC 2013	OPEN

NESDIS IIA	SDRO 2011-10	Investigate methods to expand opportunities for getting information to Brazil. NOAA should consider offering presentations at the 2012 WMO meeting in Rio de Janeiro.		NSC 2013	OPEN
NESDIS IIA, NWS IIA	SDRO 2011-11	Consider having official translators present at conferences, (not just the speaker translation) to help users receive training and education at these meetings. It was specifically asked that key information be translated into Spanish. (a request at every SDRC).		NSC 2013	OPEN
Re-broadcast Services: LRIT, DCS, Argos, EMWIN, NOAAPORT, RANET					
Actionee	Action	Description	Action feedback/closing document	Deadline	Status
OSPO	SDRO 2011-12	Clearly define the DCS transition plan for new transmitters.		NSC 2013	OPEN
OSPO	SDRO 2011-13	Update the DCS stream into the LRIT broadcast.		NSC 2013	OPEN
OSPO	SDRO 200-14	Make GERBER files available (plan for printing circuit boards).		NSC 2013	OPEN
NWS	SDRO 2011-15	Consider offering Caribbean products on EMWIN.		NSC 2013	OPEN
NWS Pacific Region	SDRO 2011-16	Investigate the EMWIN broadcast's ability to provide sub-channels to Pacific users.		NSC 2013	OPEN
OSPO	SDRO 2011-17	Publicize the products that are currently available through GEONETCast Americas, and strengthen the system.		NSC 2013	OPEN
NOAA IIA	SDRO 2011-18	Investigate a permanent solution to the possible end of the EUMETCast broadcast.		NSC 2013	OPEN
NWS	SDRO 2011-19	Address the need for AVHRR data on NOAAPort (ongoing request).		NSC 2013	OPEN
NWS Pacific Region	SDR) 2011-20	Assess use of RANET Chatty Beetles by Met Offices.		NSC 2013	OPEN
GOES-R, OSPO	SDRO 2011-21	Work with GEONETCast users to coordinate what subset of data they want to receive from the larger GRB data stream.		NSC 2013	OPEN

OSPO	SDRO 2011-22	Increase the options and functionality for users in DADDS.		NSC 2013	OPEN
OSPO, NWS Pacific Region	SDRO 2011-23	Investigate the use of LRIT and/or the RAPIDCast pilot program for delivery of tide data to the Pacific Region.		NSC 2013	OPEN
OSPO	SDRO 2011-24	Clearly define and communicate the DCS transition plan or process for narrow band transmitters.		NSC 2013	OPEN
OSPO	SDRO 2011-25	Improve the process to have DCS manufacturers certified.		NSC 2013	OPEN
OSPO	SDRO 2011-26	Investigate the need to change the DCS ground system, specifically to make a configuration change for the demodulators.		NSC 2013	OPEN
OSPO	SDRO 2011-27	Investigate the need to change the DCS frame sync.		NSC 2013	OPEN
OSPO	SDRO 2011-28	NOAA is encouraged to make and/or clarify these additional DCS changes: • Include last time transmitted • Put the user code on the message grid • Upon submission of batch file, speed up response message (there is a current delay of 1 day) • Database image output frequency of production is not known (in the past it was once/day) • Users need a report of the planned changes for near and extended future • Clarify the priority for working on GOES Incident Reports (GIRs) • For change management, clarify the order of approvals and when		NSC 2013	OPEN
GOES-R, OSPO	SDRO 2011-29	Assess the potential for interference with GOES Services in light of the upcoming L-band frequency changes.		NSC 2013	OPEN
OSPO	SDRO 2011-30	Provide the resource requirements needed to get ready for new EMWIN on GOES-15.		NSC 2013	OPEN
OSPO	SDRO 2011-31	Investigate user access for non-NOAA data as well.		NSC 2013	OPEN

OSPO	SDRO 2011-32	Investigate and provide procedures to get unique data sets to specific users.		NSC 2013	OPEN
OSPO	SDRO 2011-33	Clarify OSPO's processes for determining user needs/requirements compared to capabilities (with due respect for fiscal & other limitations) – especially in light of new capabilities.		NSC 2013	
OSPO	SDRO 2011-34	Investigate ways to consolidate NOAA's numerous data flows.		NSC 2013	OPEN
OSPO	SDRO 2011-35	Investigate making the SS file systems smaller for easier use.		NSC 2013	OPEN
OSPO	SDRO 2011-36	Provide information on extracting DCS data from the LRIT stream.		NSC 2013	OPEN
OSPO	SDRO 2011-37	NOAA GOES DCS and LRIT programs to consider the need to coordinate internally and with the PTWC.	NOAA GOES DCS and LRIT programs are coordinating closely with the PTWC in planning the future of DCS rebroadcast (DCSRB) on LRIT and HRIT	NSC 2013	CLOSED
OSPO	SDRO 2011-38	Evaluate the reliability of the LRIT service in relation to the possibility of LRIT being an official dissemination method for GOES DCS.		NSC 2013	OPEN
OSPO, NWS Pacific Region, OSD	SDRO 2011-39	Investigate whether the inter-operable digital HF networks and VHF re-broadcast should be expanded? If so, what resources are needed?		NSC 2013	OPEN
Re-broadcast Services Related to – HRIT/EMWIN Software Defined Radio Prototype Receiver for Transition to GOES-R					
Actionee	Action	Description	Action feedback/closing document	Deadline	Status
GOES-R, OSD	SDRO 2011-40	Investigate the options for countries/users that cannot update their system from GVAR to GRB? Note: GOES-R commissioned a receiver card (EDIS) to make forward and backward compatible for EMWIN/HRIT. The GOES-R program will look at 3 options and make recommendations.		NSC 2013	OPEN
GOES-R, OSPO	SDRO 2011-41	Investigate whether users can get a smaller subset of the full stream GOES-R data stream (need to examine, by regions).		NSC 2013	OPEN

GOES-R, OSPO	SDRO 2011-42	NOAA will be encouraged to investigate a regional subset for EMWIN/LRIT data also similar to the regional subset request for GOES-R GRB.		NSC 2013	OPEN
GOES-R, NWS COMET	SDRO 2011-43	The GOES-R Program is encouraged to identify resources and approaches to train international users.		NSC 2013	OPEN
GOES-R	SDRO 2011-44	Provide GOES-R antenna upgrade specifications and equipment needs as soon as details are available.		NSC 2013	OPEN
GOES-R, OSPO, NWS COMET	SDRO 2011-45	NOAA is encouraged to develop GOES-R training material in Spanish.		NSC 2013	OPEN
GOES-R	SDRO 2011-46	Make GOES-R test products available for GOES-R level 2 products for research.		NSC 2013	OPEN
GOES-R	SDRO 2011-47	Develop the ability to input GOES-R test data into product processing systems to test before operational.		NSC 2013	OPEN
OSPO	SDRO 2011-48	Develop samples of GVAR data for GOES-15.		NSC 2013	OPEN
GOES-R, CIMSS	SDRO 2011-49	Produce simulated GOES-R test data sets.		NSC 2013	OPEN
Direct Readout: Current and Future, Geostationary and Polar, Satellite Systems Including GRB, LRD and HRD					
Actionee	Action	Description	Action feedback/closing document	Deadline	Status
OSPO, JPSS	SDRO 2011-50	Provide information on candidate LRD Content.		NSC 2013	OPEN
JPSS, OSD	SDRO 2011-51	Provide more up-to-date information on the LRD Downlink Frequency.		NSC 2013	OPEN
JPSS	SDRO 2011-52	Provide additional information on the HRD Processing Packages.		NSC 2013	OPEN
GOES-R	SDRO 2011-53	Provide information on the transition of GVAR to GRB.		NSC 2013	OPEN
OSPO, JPSS	SDRO 2011-54	Routinely engage users with additional data and information to give them more time to evaluate LRD options/needs.		NSC 2013	OPEN

JPSS	SDRO 2011-55	NOAA is encouraged not to include mission support data in LRD downlink.		NSC 2013	OPEN
JPSS	SDRO 2011-56	NOAA is encouraged to drop the requirement for the JPSS spacecraft to service 1.0 meter receive antennas.		NSC 2013	OPEN
OSPO	SDRO 2011-57	Explore the possibility of a replacement for the WEFAX System that is 1) low cost, 2) uses a small antenna and is analogue based without the need for specialized technology.	NOAA transitioned from WEFAX to LRIT in 2006. NOAA does not plan to support an analogue service on any of its spacecrafts, geostationary or polar-orbiting, in the future.	4-Apr-11	CLOSED
GOES-R	SDRO 2011-58	Provide information on the antenna size need for GOES-R considering the new location of the spacecrafts.		NSC 2013	OPEN
GOES-R	SDRO 2011-59	GOES-R program to consider posting GRB Downlink and Equipment Specifications on its website once the specifications are finalized.		NSC 2013	OPEN
GOES-R, NWS COMET, NESDIS Outreach Office	SDRO 2011-60	Provide outreach information on the transition from GVAR to GOES-R.		NSC 2013	OPEN
OSPO, GOES-R, NWS	SDRO 2011-61	Consider a brochure be put together for emergency managers about changes in EMWIN for users like the NHC so they can teach their emergency managers and help them become educated sooner.		NSC 2013	OPEN
GOES-R	SDRO 2011-62	Provide a dialogue or venue to consider a GVAR alternative and the types of educational materials the user would like to see.		NSC 2013	OPEN
GOES-R, OSPO	SDRO 2011-63	Work with GEONETCast users to determine coordination and what subset of data they would want to receive from the larger GRB data stream.		NSC 2013	OPEN
GOES-R	SDRO 2011-64	Provide additional tests of real-time anomalies using the GOES-R simulator for better test results. GOES-R should acquire more users for input on simulators (e.g., create simulated data over South America).		NSC 2013	OPEN

NWS COMET	SDRO 2011-65	Consider planning COMET monthly sessions with foreign users so they can start asking questions and providing feedback.		NSC 2013	OPEN
NWS COMET, NESDIS IIA	SDRO 2011-66	Provide information on how international users in various countries will be trained.		NSC 2013	OPEN
OSPO, JPSS	SDRO 2011-67	Investigate moving the LRD center downlink frequency below 1707 MHz to avoid current 4G interference.		NSC 2013	OPEN
OSPO, JPSS	SDRO 2011-68	Investigate the possibility of dropping center downlink (1707 MHz) frequency below1690 MHz to avoid future interference with mobile cellular industry.		NSC 2013	OPEN
OSPO, JPSS	SDRO 2011-69	Consider using the day and nighttime (Mr. Tom Schott) AVHRR baseline channels for LRD initial content specifications and conduct a final analysis of ideal channel combination for LRD.		NSC 2013	OPEN
OSPO, JPSS	SDRO 2011-70	Investigate a format similar to level-1b for the LRD rather than EDRs.		NSC 2013	OPEN
OSPO, JPSS	SDRO 2011-71	Investigate use of the IMAP software to support NPP immediately after launch.		NSC 2013	OPEN
OSPO,JPSS	SDRO 2011-72	Investigate the use of an X-Band service only and more fully evaluate pros/cons & costs/benefits of both X-Band & L-Band.		NSC 2013	OPEN
OSPO, JPSS	SDRO 2011-73	Investigate reducing the data content of LRD to ensure users can use the existing 1-meter dish and decrease the bandwidth to 4 MHz.		NSC 2013	OPEN
Spectral Issues					
Actionee	Action	Description	Action feedback/closing document	Deadline	Status
OSD	SDRO 2011-74	Work with NTIA on Spectrum-change issues and report on the exclusion zones. Since the current law does not allow for non-USG facilities to have exclusion zones, a compelling argument needs to be formulated.		NSC 2013	OPEN

OSD	SDRO 2011-75	Develop an interactive L-Band user website, related to Spectrum-change, to facilitate the exchange of ideas to collaborate and develop innovative approaches to deal with interference that could arise if spacing between frequencies is reduced to DCS and other GOES ready devices.		NSC 2013	OPEN
OSD	SDRO 2011-76	With the help of the WMO, facilitate better communications with the L-band user community, related to the Spectrum-change issue.		NSC 2013	OPEN
OSD	SDRO 2011-77	Work with NTIA to consider adding non-government site exclusion zones for those locations directly supporting 24/7 NOAA operations.		NSC 2013	OPEN
OSD	SDRO 2011-78	Consider reactivating, updating, and maintaining the voluntary user registration database.		NSC 2013	OPEN
OSD	SDRO 2011-79	Investigate sources for operating and maintaining a low-cost informal messaging website.		NSC 2013	OPEN
Training					
Actionee	Action	Description	Action feedback/closing document	Deadline	Status
NWS COMET/NESDIS IIA	SDRO 2011-80	Plan COMET monthly sessions with foreign users so the international users can start asking questions and providing feedback. Develop Outreach and more information on how international users in various countries will be trained.		NSC 2013	OPEN

COMET, GOES-R, JPSS, NESDIS IIA	SDRO 2011-81	Assess the training needs for GOES-R and JPSS. Use an RA III, RA IV and RA V requirements team to help map timeliness for developing country partners for equipment need and training needs. Translate these training modules utilizing the translation resources from the recipient countries.		NSC 2013	OPEN
NESDIS IIA, NWS COMET	SDRO 2011-82	NOAA is encouraged to engage participants in more real-time and frequent training such as monthly chat groups.		NSC 2013	OPEN
NWS Pacific Region, NWS COMET	SDRO 2011-83	Consider more RA V training in satellite data interpretation and assimilation by the NOAA NWS Pacific Region.		NSC 2013	OPEN
NWS COMET	SDRO 2011-84	Utilize the Visit-View groups to inform the users of coming changes in available training resources.		NSC 2013	OPEN
NWS COMET	SDRO 2011-85	Share the results of the weather forecast test bed project in Oklahoma City – that is, share new forecast model with WMO partners.		NSC 2013	OPEN
OSPO	SDRO 2011-86	Develop methods for user readiness and communicate opportunities. Provide the schedule and time-frame for users to be prepared for the new systems.		NSC 2013	OPEN
NWS COMET, GOES-R, JPSS, NESDIS IIA	SDRO 2011-87	Provide a clearer understanding of how training (and new equipment as well) will cover the new systems and the transitions from the old to the new.		NSC 2013	
NWS COMET	SDRO 2011-88	Provide images with known errors to help in the testing and training regimes.		NSC 2013	
Satellite Data Access					
Actionee	Action	Description	Action feedback/closing document	Deadline	Status
NCDC CLASS	SDRO 2011-89	Provide both low and high levels for data in catalogs and directories. Currently there are limited formats offered and the formats are non-standard.		NSC 2013	OPEN

OSPO	SDRO 2011-90	Since MTSAT-3 will not have a downlink option for users, NOAA should investigate alternatives for users to acquire the data.		NSC 2013	OPEN
NWS, OSPO	SDRO 2011-91	Investigate improving access to GTS.		NSC 2013	OPEN
OSD, OSPO	SDRO 2011-92	Investigate methods to improve communications and coordination between Met Services and Space Agencies.		NSC 2013	OPEN
OSPO	SDRO 2011-93	Investigate options to restore the ATP system or develop an APT-like system that utilizes an Omni-antenna.		NSC 2013	OPEN
User Questions					
Actionee	Action	Description	Action feedback/closing document	Deadline	Status
NOAA	SDRO 2011-94	Can NOAA look at jointly sharing Central American, South American, and Caribbean DCS customers, between EUMETSAT and NOAA?	NOAA is interested in pursuing this and will work with EUMETSAT as their new DCS is developed.	NSC 2013	CLOSED
NOAA	SDRO 2011-95	How long will it be before the 100 baud DCS transmitters will no longer work?	NOAA expects the last 100 baud transmitter to be retired on May 31, 2013.	NSC 2013	CLOSED
NOAA	SDRO 2011-96	Who are the NOAA International Office's points of contact?	Mr. Eric Madsen and Ms. Jennifer Lewis are U.S. POC's.	NSC 2013	CLOSED

5 Participants Survey

2011 DRO Conference Survey Questions (45 RESPONDENTS)

Product/Service Satisfaction (xx%) = approx % of responses for that question

	DISSATISFIED	***NOT SATISFIED***	***NO OPINION***	***SATISFIED***	***EXTREMELY SATISFIED***	***N \ A***
Question1			1 (2%)	30 (68%)	12 (27%)	1 (2%)
Question2				29 (64%)	14 (31%)	2 (4%)
Question3				27 (64%)	8 (19%)	7 (17%)
Question4			2 (4%)	10 (23%)	29 (64%)	4 (10%)
Question5			2 (4%)	17 (38%)	23 (51%)	3 (7%)
Question6			2 (4%)	26 (60%)	14 (33%)	1 (2%)
Question7			1 (2%)	23 (52%)	12 (27%)	8 (18%)
Question8			2 (4%)	23 (52%)	11 (25%)	8 (18%)
Question9		2 (4%)	5 (11%)	19 (42%)	11 (25%)	8 (18%)
Question10		1 (2%)		24 (57%)	13 (31%)	4 (10%)
Question11		3 (7%)	1 (2%)	23 (52%)	10 (23%)	7 (17%)
Question12		3 (7%)	3 (7%)	26 (59%)	5 (11%)	7 (17%)
Question13		1 (2%)	2 (4%)	19 (47%)	12 (29%)	7 (17%)
Question14				22 (51%)	16 (37%)	5 (11%)
Question15			3 (7%)	12 (28%)	16 (36%)	13 (30%)
Question16			2 (4%)	17 (40%)	11 (28%)	13 (30%)

Question 1. Quality of the product or service received
Question 2. Quality of data received
Question 3. Timeliness of response to request
Question 4. Courtesy of staff who dealt with you
Question 5. Expertise of staff in dealing with your needs
Question 6. Degree that product/service met your needs
Question 7. Clarity and accuracy of responses from staff to your questions prior to receipt
Question 8. Clarity and accuracy of responses from staff to your questions after receipt
Question 9. Ease in reaching correct NOAA office to deal with your request
Question 10. Format of data received
Question 11. Documentation of data received
Question 12. Descriptions of data in catalogs and directories
Question 13. Accessibility of data desired
Question 14. Overall satisfaction with service received
Question 15. Overall satisfaction compared with services/data obtained from private sector
Question 16. Overall satisfaction compared with services/data obtained from other Federal agencies

2011 DRO Conference Survey Questions (45 RESPONDENTS)
Product/Service Use Part B

Question 1a: What product/service did you obtain?

26	GOES Direct Readout/GVAR
13	POES Direct Readout/HRPT
15	GOES Data Collection System (DCS)
6	POES Data Collection System (DCS, a.k.a. Argos)
8	Low Resolution Information Transmission (LRIT)
12	Emergency Manager's Weather Information Network (EMWIN)
15	NOAA produced product/data
8	Other:
	GEONETCast, DOMSAT, MODIS, Terra, Aqua, DWSS, Internet

Question 1b: Through what medium did you receive the information?

28	Direct Readout
4	Digital Media
2	Paper Media
1	Film Media
23	Internet (FTP,ADDE, etc.)
13	Web page
1	Other:
	SAB, STAR, e-mails, visits, CLASS, NOAAPORT, Internet

Question 2: How did you find out about the product/service?

31	NOAA Web Page
2	Other Web Page
11	Conference
11	NOAA Brochure
1	Other Printed Material
12	Other
	AMS, SDRC (3), Service providers

Question 3: What is your affiliation?

3	Individual
0	Student/teacher K-12
1	University student
5	University Faculty/staff
1	Other Research Institution
8	Business/Industry
11	NOAA
5	Other Federal Government
0	News Media
9	State/Local Government
7	Other:
	Met Services from different countries

Question 4: How frequently do you request products/services from NOAA?

26	Frequently (> once a month)
7	Regularly (>twice a year)
8	Infrequently (once a year)
1	First time user
1	Never used a NOAA product or service

Question 5: Do you have suggestions as to how NOAA can improve its products or services?

More conferences, training, user surveys
Include OPC in Proving Ground
More NOAAPort data with POES and foreign sat data: restore APT
Need Survey on SDRC success: better archive data: reduce data costs for Cen. America
Improve NOAA GOES web page - better imagery: fly ocean color satellite
Need easier access on NOAA web page, YouTube, wiki, FB, Media Edu.

Question 6: What new products/services/ would you like to see offered?

Include more products from non-NOAA satellites, include sat products from Cen. America
Need better GOES Soundings
Need AVHRR data on NOAAPort
Need EMWIN for the Caribbean
Need RSS of all text products

Question 7: What media/format would you like to see data provided in?

25	Direct Broadcast
26	Online (Web)
19	FTP
7	CD-ROM
2	Other Digital Media
3	Paper
3	Other

Question 8:
Will you use our products/services again?

42	Yes
0	No

Question 9: What will be the primary use of the product/service?

25	Scientific Research
9	Business
1	Legal
13	Education
4	Personal
11	Other: Operations (2), NOAA

6 Conclusion

The 2011 Satellite Direct Readout Conference was another opportunity for NOAA, as well as the international community, to interface with one another to foster global data exchange and scientific collaboration. Participants unanimously agreed that the conference was a success. Both NOAA managers and participants took away a large volume of information that will benefit them and their organizations in preparing for satellite service transitions and new technologies. The conference further helped identify common needs and areas for possible future cooperation as well as opening up idea-sharing for action planning. There was general agreement that improved communications and information sharing among countries is an area that NOAA and the user community need to continue to address.

This year's conference was especially important, considering the restructuring of the National Polar-orbiting Operational Environmental Satellite System (NPOESS) program and subsequent creation of the Joint Polar-orbiting Satellite System (JPSS) as the follow-on civilian polar satellite program. NOAA made available details on the NPOESS Preparatory Platform (NPP), now an operational component of JPSS and future JPSS platforms, JPSS direct readout services, high rate data (HRD) X-band broadcast and low rate data (LRD) L-band broadcast. NOAA presented new information on the next generation GOES-R ground system development and direct readout services. In addition, NOAA provided an update on the proposal by the National Telecommunication and Information Administration (NTIA) to re-allocate and share the 1675-1710 MHz frequency band with broadband Internet and cell phone services. As many of the attendees were aware, these frequencies are currently used by many earth observation satellites to transmit satellite telemetry and environmental observation to users. These data and observations provide critical information to decision-makers for the protection of life and property through improved accuracy in environmental forecasts and warnings.

An important element of this Direct Readout Conference was the tremendous international participation generated. This was one of the key strengths of the conference and provided a unique opportunity to bring together the users of environmental satellite data from around the world to work together. It is this spirit of international cooperation that enabled several important projects to become a reality. NOAA highlighted its efforts for supporting the international communities by passing out a spreadsheet showing the responses to the recommendations from the 2008 conference. This spreadsheet represented a combined effort from all the line offices to demonstrate NOAA's ongoing support for the international community. NOAA also called attention to the major accomplishments from the 2008 recommendations. These included: 1) continued support over the Caribbean Sea, Central and South Americas, 2) assist in the acquisition of GEONETCast Americas receive stations to help in the exchange of data, 3) outreach on the transition from GOES-N/O/P to GOES-R, 4) provide the HRIT/EMWIN Software Defined Receiver information for GOES-R, 5) provide users access to the NPP software for data access called the International Polar Orbiter Processing Package (IPOPP) and 6) proceed with DCS upgrades in technology and capacity. NOAA will carefully examine the recommendations gathered during the 2011 conference and will report back to the user community.

This conference represents the fourth time in the last decade that NOAA has hosted an international satellite conference in Miami. As NOAA approaches the significant changes expected in its satellite programs over the next decade, this continued need for interaction with Direct Readout users is paramount. NOAA remains dedicated to working with all its users and continuing and developing new national and international partnerships. The information presented at the 2011 conference was extremely important for all agencies and organizations that provide and use real-time satellite information to issue environmental forecasts and warnings and make informed decisions to mitigate the effects of man-made and natural disasters. Since the launch of the first meteorological satellite, "real-time access" has led to "real-time applications" that translated into improved environmental forecasts and warnings that continue to save lives and minimize property damage. Ongoing Direct Readout Conferences are a critical part of that effort and reflect NOAA's ongoing commitment to prepare the user community for these changes. The next satellite conference is being planned for April of 2013, again in Miami, Florida. This expanded conference will be a week-long event, as NOAA invites government, university, private users, manufacturers, and national and international producers and users of Direct Readout, GOES/POES and GOES-R/JPSS satellite data to attend the first annual "NOAA Satellite Conference." The 2013 conference will be a combination of the GOES-R User's Conference and Satellite Direct Readout Conference. Also, it will include participation from the NASA/NOAA NPP and JPSS programs, STAR, NWS Training facilities, NWS and NESDIS International and Interagency Affairs Offices as well as information on the NESDIS Outreach and Education programs. The 2013 NOAA Satellite Conference will provide additional information on the status of the current operational satellites, products and services, and future systems. The conference will offer interactive and international involvement with emphasis on the users and how to use the data. As this date approaches and you have any questions or suggestions, please contact Scott.Rogerson@noaa.gov. In the meantime, please visit: http://satelliteconferences.noaa.gov/miami2013/

7 Acknowledgements

The conference organizing committee would like to express its appreciation to the sponsors who supported and made this conference possible. First, we would like to thank the NOAA participants, including the National Weather Service, the Satellite and Information Service (NESDIS) and its Office of System Development (OSD), Office of Satellite and Product Operations (OSPO), Office of International and Interagency Affairs (IIA), the Joint Polar-orbiting Satellite System (JPSS) Program and the GOES-R Program. To the National Aeronautics and Space Administration (NASA) and the U.S. Geological Survey, we offer our sincere thanks for your support and participation. For the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) and the World Meteorological Organization (WMO), we offer our gratitude for your participation and for your support in assisting us in presenting a broader perspective of the future to a worldwide audience.
We would also like to thank all of the other presenters for their contributions, particularly the many international partners who provided briefings and posters and participated in dialog sessions. In fact, we appreciate all of our international participants who have traveled from abroad to participate.

Playing an important leadership role in the success of the conference were our session chairs: Kathy Kelly, Dave Benner, Tim Schmit, Tony Mostek, Patrick Coronado, Gary Davis, Greg Mandt, Steve Goodman, Scott Rogerson, Edward Young, Jr. and Marlin O. Perkins. For their hard work and perseverance, we would like to acknowledge the support of the panel moderators: Timothy Stryker, Dr. Jack Beven and Mark Mulholland. With gratitude and appreciation we recognize the guidance of the breakout group moderators: Greg Mandt, Marlin O. Perkins, Mark Mulholland and Paul Seymour. Let us not forget the diligence and dedication of the discussion group leaders: Patrick Coronado and Satya Kalluri.

We'd also like to thank the Aerospace Corporation for the EMWIN/LRIT demo on Tuesday night and Bryan Norcross, The Weather Channel, for being our banquet speaker. Special thanks go to our international partners: WMO Space Programme, WMO Region Assocations III, IV and V, European Organisation for the Exploitation of Meteorological Satellites, Centre National d'Études Spatiales (CNES), National Institute for Space Research (INPE), Comision Nacional de Actividades Espaciales (CONAE) and Environment Canada. For conference support, thanks to the National Weather Service, the GOES-R Program, the JPSS Program, the Office of Systems Development and the National Hurricane Center.

Finally, we wish to offer our gratitude to the many people on our Organizing Committee and our support staff, who provided their time and dedication to ensure that this conference was a success. We offer our appreciation to the session chairpersons for organizing interesting and exciting sessions, to all of our speakers and poster presenters who willingly shared their knowledge and experiences with us, and to the exhibitors for their outstanding exhibits. We also appreciated the excellent facilities and services provided by the Hilton Miami Airport hotel staff and by our Translation and Audio-Visual Support contractor, Seven Languages, Inc. Most of all, we wish to express our appreciation to those who participated, giving their time, attention, interest, and feedback to help us provide a smooth transition to new technologies over the next decade.

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Dane Clark - Short and Associates, Inc.
Charlotte Jenkins - Short and Associates, Inc.
Marc Pulliam - I. M. Systems Group
Valerie Randall - Science Systems and Applications, Inc.

Additional Support:
Heidi Rowe - BPX Technologies, Inc.

Appendix I – Conference Agenda

Monday, April 4, 2011 (1:00 p.m. – 3:40 p.m.)
Session 1: Welcome and Keynote Addresses
Co-Chairs: Kathy Kelly and Marlin O. Perkins

Presentation	Time	Session or Event
	8:00 a.m. – 1:00 p.m.	Registration
1.1	1:00 p.m. – 1:15 p.m.	Welcome and Logistics Marlin O. Perkins, NOAA Satellite and Information Service
1.2	1:15 p.m. – 1:35 p.m.	Conference Opening Remarks and Introductions Kathy Kelly, Director, Office of Satellite Products and Operations, NOAA Satellite and Information Service
1.3	1:35 p.m. – 2:00 p.m.	NOAA Satellite Program Charles S. Baker, Deputy Assistant Administrator, NOAA Satellite and Information Services
1.4	2:00 p.m. – 2:25 p.m.	National Weather Service Welcome Edward Johnson, Director, Strategic Planning and Policy Office, NOAA National Weather Service
1.5	2:25 p.m. – 2:50 p.m.	National Aeronautics and Space Administration Welcome Patrick Coronado, NASA Direct Readout Laboratory
1.6	2:50 p.m. – 3:15 p.m.	World Meteorological Organization (WMO) Space Program Jerome Lafeuille, Chief, Space-based Observing Division, World Meteorological Organization (WMO) Observing and Information Systems Department
1.7	3:15 p.m. – 3:40 p.m.	The International Charter for Space and Major Disasters: Monitoring and Management Support for Disaster Response Timothy Stryker, Executive Officer, Committee on Earth Observation Satellites, U. S. Geological Survey
	3:40 p.m. – 4:00 p.m.	Break: Refreshments in Exhibits Area

Monday, April 4, 2011 (4:00 p.m. – 5:30 p.m.)
Session 2: Panel Discussion: Use of Satellites in Disaster Response and Mitigation
Co-Chairs: Kathy Kelly and Marlin O. Perkins

Presentation	Time	Session or Event
2.1	4:00 p.m. – 5:15 p.m.	Panel: Use of Satellites in Disaster Response and Mitigation Moderator: Timothy Stryker, Executive Officer, Committee on Earth Observation Satellites, U. S. Geological Survey Panel Members: William Read, Director, National Hurricane Center Jerome Lafeuille, Chief, Space-based Observing Division, WMO Alejandro Muñoz, Jefe Subdepartamento Pronósticos, Dirección Meteorológica de Chile Edward Young, Deputy Director, National Weather Service, Pacific Region
2.2	5:15 p.m. – 5:30 p.m.	Panel Discussion Summary and Conclusions Timothy Stryker, Executive Officer, Committee on Earth Observation Satellites, U. S. Geological Survey
	6:00 p.m. – 8:00 p.m.	Conference "Icebreaker" – Hilton Miami Airport Hotel: Pool Area

Tuesday, April 5, 2011 (8:30 a.m. – 12:45 p.m.)
Session 3: Current Geostationary Satellite Systems
Co-Chairs: Kathy Kelly and Greg Mandt

Presentation	Time	Session or Event
	8:00 a.m. – 8:30 a.m.	Registration/Coffee
3.1	8:30 a.m. – 8:35 a.m.	Introduction Kathy Kelly, Director, Office of Satellite Products and Operations, NOAA Satellite and Information Service
3.2	8:35 a.m. – 9:00 a.m.	Keynote: The Perspective of WMO RA III Alejandro Muñoz, Jefe Subdepartamento Pronósticos, Dirección Meteorológica de Chile, representing Myrna Araneda, Director, Dirección Meteorológica de Chile, and President, WMO RA III (South America).
3.3	9:00 a.m. – 9:15 a.m.	NOAA Geostationary Operational Environmental Satellite (GOES) Overview Cynthia Hampton, NOAA Satellite and Information Service
3.4	9:15 a.m. – 9:30 a.m.	Status of the Current GOES Services (Low Rate Information Transmission and the Emergency Managers Weather and Information Network) Paul Seymour, NOAA Satellite and Information Service
3.5	9:30 a.m. – 9:45 a.m.	Access to Real-time Satellite Products from Mobile Devices and Desktop Browsers Through a Web Map Service Dave Santek, Space Science and Engineering Center (SSEC)
3.6	9:45 a.m. – 10:00 a.m.	Current Status and Planned Activities of SSEC/UW-Madison Direct Broadcast Processing Packages, Real-time Data Processing and Near Real-time Applications Allen Huang, Cooperative Institute for Meteorological Satellite Studies (CIMSS), Space Science and Engineering Center (SSEC)
	10:00 a.m. – 10:30 a.m.	Break: Refreshments in Exhibits Area
3.7	10:30 a.m. – 10:45 a.m.	INPE Applications of the Geostationary Operational Environmental Satellite - 12 (GOES-12) Data Carlos Frederico Angelis, Instituto Nacional de Pesquisas Espaciais (INPE), Brazi
3.8	10:45 a.m. – 11:00 a.m.	CONAE Applications of the Geostationary Operational Environmental Satellite - 12 (GOES-12) Data

		Dr. Sandra Torrusio, Servicio Meteorológico Nacional, Argentina
3.9	11:00 a.m. – 11:15 a.m.	Costa Rica Applications of the Geostationary Operational Environmental Satellite - 13 (GOES-13) Data Werner Stolz, Costa Rican Meteorological Service
	11:15 a.m. – 11:30 a.m.	Pickup Box Lunches
3.10	11:30 a.m. – 12:45 p.m.	Panel Discussion: Current and Future Use of Satellite Data in Numerical Models Moderator: Jack Beven, National Weather Service Panel Members: Mike Manore, Environment Canada Carlos Frederico Angelis, Instituto Nacional de Pesquisas Espaciais (INPE), Brazil Dr. Gloria Pujol, Servicio Meteorológico Nacional, Argentina

Tuesday, April 5, 2011 (1:00 p.m. – 6:30 p.m.)
Session 4: Future Geostationary Satellite Systems
Co-Chairs: Greg Mandt and Steve Goodman

Presentation	Time	Session or Event
4.1	1:00 p.m. – 1:10 p.m.	Introduction Steve Goodman, Senior Scientist, NOAA GOES-R Program
4.2	1:10 p.m. – 1:25 p.m.	European Organization for the Exploitation of Meteorological Satellites (EUMETSAT): Geostationary Satellite Systems Joaquin Gonzalez, Head of System Engineering Support Division, EUMETSAT
4.3	1:25 p.m. – 1:45 p.m.	GOES-R Overview Greg Mandt, System Program Director, NOAA GOES-R Program
4.4	1:45 p.m. - 2:00 p.m.	The Advanced Baseline Imager (ABI) on the GOES-R series Tim Schmit, NOAA Satellite and Information Service
4.5	2:00 p.m. – 2:15 p.m.	High Impact Weather Forecasts and Warnings with the GOES-R Geostationary Lightning Mapper (GLM) Steve Goodman, Senior Scientist, NOAA GOES-R Program
4.6	2:15 p.m. – 2:30 p.m.	Information on the GOES-R User Readiness Planning Dr. Kathleen S. Fontaine, National Aeronautics and Space Administration
4.7	2:30 p.m. – 2:45 p.m.	GOES-R Rebroadcast Services Satya Kalluri, Andrew Royle and Randall Race, NOAA GOES-R Program
4.8	2:45 p.m. – 3:00 p.m.	NOAA Report on the Development of the GOES-R Access Subsystem (GAS) and Future Products Reginald Lawrence, NOAA Satellite and Information Service
	3:00 p.m. – 3:30 p.m.	Break: Refreshments in Exhibits Area

4.9	3:30 p.m. – 3:45 p.m.	GOES-R Proving Ground: Demonstrating New Products to Ensure User Readiness James Gurka, Physical Scientist, NOAA GOES-R Program
4.10	3:45 p.m. – 4:00 p.m.	Cooperative Institute for Research in the Atmosphere Proving Ground Activities Bernadette Connell, Cooperative Institute for Research in the Atmosphere (CIRA)
4.11	4:00 p.m. – 4:15 p.m.	Cooperative Institute for Meteorological Satellite Studies GOES-R Proving Ground Participation Wayne Feltz, Cooperative Institute for Meteorological Satellite Studies (CIMSS)
4.12	4:15 p.m. – 4:30 p.m.	NASA Short-term Prediction Research and Transition (SPoRT) GOES-R Proving Ground Activities Dr. Andrew Molthan, Principal Investigator, SPoRT Program, NASA
4.13	4:30 p.m. – 4:45 p.m.	National Hurricane Center Testbed Activities Jack Beven, NOAA National Weather Service
4.14	4:45 p.m. – 5:00 p.m.	Storm Prediction Center Chris Siewert, Oklahoma University, Storm Prediction Center
4.15	5:00 p.m. – 5:15 p.m.	University of Wisconsin Direct Broadcast Experiences and Plans Kathleen Strabala, Cooperative Institute for Meteorological Satellite Studies (CIMSS)
4.16	5:30 p.m. – 6:30 p.m.	HRIT/EMWIN Prototype Demonstration Craig Keeler, NOAA GOES-R Program, and Paul Seymour, NOAA Satellite and Information Service

Wednesday, April 6, 2011 (8:30 a.m. – 12:05 p.m.)
Session 5: Current and Future Polar-orbiting Satellite Systems
Co-Chairs: Gary Davis and Patrick Coronado

Presentation	Time	Session or Event
	8:00 a.m. – 8:30 a.m.	Registration/Coffee
5.1	8:30 a.m. – 8:35 a.m.	Introduction Gary Davis, Director, Office of Systems Development, NOAA Satellite and Information Service
5.2	8:35 a.m. – 9:00 a.m.	Keynote: Status of Utilization of Geostationary and Polar-orbiting Satellite Data in WMO Region Association (RA) V Dr. Sri W. B. Harijono, Director General, Agency for Meteorology, Climatology and Geophysics (BMKG), Indonesia, and President, WMO RA V (South-West Pacific)
5.3	9:00 a.m. – 9:15 a.m.	Polar-orbiting Operational Environmental Satellite (POES) Program Overview Cynthia Hampton, NOAA Satellite and Information Service
5.4	9:15 a.m. – 9:30 a.m.	Argos Data Collection System Scott Rogerson, NOAA Satellite and Information Service
5.5	9:30 a.m. – 9:45 a.m.	European Organization for the Exploitation of Meteorological Satellites (EUMETSAT): Polar-orbiting Satellite Systems Sean Burns, EUMETSAT
5.6	9:45 a.m. – 10:00 a.m.	Analysis of Extreme Rainfall in Cusco in Summer 2010 Jorge Chira La Rosa, Director, Oficina General de Operaciones Tecnicas, Servicio Nacional de Meteorología e Horología, Peru
5.7	10:00 a.m. – 10:15 a.m.	My Ocean Frédérique Blanc, CLS France
	10:15 a.m. – 1035 a.m.	Break: Refreshments in Exhibits Area

5.8	10:35 a.m. – 10:50 a.m.	NPOESS Preparatory Project - Joint Polar-orbiting Satellite System Program Overview Gary Davis, Director, Office of Systems Development, NOAA Satellite and Information Service
5.9	10:50 a.m. – 11:05 a.m.	Overview of the Defense Weather Satellite System (DWSS) and Planned Activities of DMSP at McMurdo Capt. Harvey S. Gaber, Ground System Chief, Defense Weather Systems Directorate, USAF
5.10	11:05 a.m. – 11:20 a.m.	Status of the National Aeronautics and Space Administration (NASA) Earth Observing System (EOS) and NPOESS Preparatory Project (NPP) Direct Readout Mission Patrick Coronado, NASA Direct Readout Laboratory
5.11	11:20 a.m. – 11:35 a.m.	NPOESS Preparatory Project - Joint Polar-orbiting Satellite System Product Overview Heather Kilcoyne, NOAA Satellite and Information Service
5.12	11:35 a.m. – 11:50 a.m.	Advances in Imagers from AVHRR to VIIRS Lihang Zhou, NOAA Satellite and Information Service
5.13	11:50 a.m. – 12:05 p.m. .	Observation of Our Planet, and of the Argentine Territory via the SAC-C/D Aquarius Missions Dr. Sandra Torrusio, Servicio Meteorológico Nacional, Argentina
	12:05 p.m. – 1:30 p.m.	Lunch

Wednesday, April 6, 2011, (1:30 p.m. – 6:45 p.m.)
Session 6: Training Resources and Posters
Co-Chairs: Tony Mostek and Tim Schmit

Presentation	Time	Session or Event
6.1	1:30 p.m. – 1:45 p.m.	Introduction Anthony Mostek, NOAA/NWS – Training Division
6.2	1:45 p.m. – 2:00 p.m.	Cooperative Institute for Meteorological Satellite Studies (CIMSS) VISITview Scott Bachmeier, CIMSS
6.3	2:00 p.m. – 2:15 p.m.	COMET Program: Satellite Meteorology Training Resources for the Atmospheric Science Community Tim Spangler, University Corporation for Atmospheric Research (UCAR) Cooperative Program for Operational Meteorology, Education, and Training (COMET®)
6.4	2:15 p.m. – 2:30 p.m.	Satellite Training Activities: Cooperative Institute for Research in the Atmosphere (CIRA) Bernadette Connell, CIRA
6.5	2:30 p.m. – 2:45 p.m.	Training in the Satellite Proving Ground Anthony Mostek, NOAA/NWS – Office of Climate, Weather, and Water, Weather Services (OCWWS) Training Division
6.6	2:45 p.m. – 3:00 p.m.	WMO Virtual Laboratory for Training in Satellite Meteorology Jerome Lafeuille, Chief of Space-based Observing Division, World Meteorological Organization (WMO) Observing and Information Systems Department
6.7	3:00 p.m. – 3:15 p.m.	Satellite Training at the Caribbean Institute for Meteorology and Hydrology Kathy-Ann Caesar, Department of Meteorology, Barbados Center of Excellence
6.8	3:15 p.m. – 3:30 p.m.	Monitoring Urban Night-Time Lights Carlos Cotlier, Facultad de Ciencias Exactas, Ingeniería y Agrimensura, Centro de Sensores Remotos, Universidad Nacional de Rosario, Argentina

6.9	3:30 p.m. – 3:45 p.m.	Satellite Demonstration and Education at the National Research Laboratory (NRL) Thomas Lee, National Research Laboratory
6.10	3:45 p.m. – 4:15 p.m.	Poster Session Overview Tim Schmit, NOAA Satellite and Information Service
6.11	4:15 p.m. – 5:30 p.m.	Poster Session
6.12	5:15 p.m. – 6:00 p.m.	JPSS L-band Discussion with the HRPT Users: Questions and Answers Patrick Coronado, NASA Direct Readout Laboratory
6.13	6:00 p.m. – 6:45 p.m.	GOES-R Discussion with the Users: Questions and Answers James Gurka and Satya Kalluri, NOAA GOES-R Program

Thursday, April 7, 2011 (8:30 a.m. – 12:30 p.m.)
Session 7: User Applications
Co-Chairs: Kathy Kelly and David Benner

Presentation	Time	Session or Event
	8:00 a.m. – 8:30 a.m.	Registration/Coffee
7.1	8:30 a.m. – 8:35 a.m.	Introduction David Benner, NOAA Satellite and Information Service
7.2	8:35 a.m. – 9:00 a.m.	Keynote: Perspective of WMO RA IV Trevor Basden, Senior Deputy Director, Bahamas Department of Meteorology representing Arthur Rolle, Director, Bahamas Department of Meteorology, and President, WMO RA IV
7.3	9:00 a.m. – 9:15 a.m.	The LSU Earth Scan Laboratory: A History of Research to Real-time Operations Dr. Nan D. Walker, Director Earth Scan laboratory, Louisiana State University
7.4	9:15 a.m. – 9:30 a.m.	Applications of Satellite Data (Chile) Alejandro Muñoz, Jefe Subdepartamento Pronósticos, Dirección Meteorológica de Chile
7.5	9:30 a.m. – 9:45 a.m.	Development of a New High Rate Data Collection Platform (DCP) Sean Burns, EUMETSAT
7.6	9:45 a.m. – 10:00 a.m.	Real Time Access for Private Individual Users of Weather Satellites Dave Cawley, United Kingdom
7.7	10:00 a.m. – 10:15 a.m.	Processing and evaluating NPP Direct Readout Data using the AAPP Software Package Nigel Atkinson, Meteorological Office, United Kingdom
7.8	10:15 a.m. – 10:30 a.m.	Online and Real Time Monitoring of Volcanic Eruption in Ecuador Using NOAA APT Ghulam Jaffer, Graz University of Technology, Graz, Austria
	10:30 a.m. – 11:00 a.m.	Break : Refreshments in Exhibits Area

7.9	11:00 a.m. – 11:20 a.m.	Frequency Re-Allocation Overview
		Mark Mulholland, NOAA Satellite and Information Service
7.10	11:20 a.m. – 12:30 p.m.	Panel Discussion: Frequency Re-Allocation and the Future of the L-band
		Moderator: Mark Mulholland, NOAA Satellite and Information Service
		Panel Members: Eddie Davidson, National Telecommunications and Information Administration (NTIA)
		Cynthia Hampton, NOAA Satellite and Information Service
		Jerome Lafeuille, Chief, Space-based Observing Division, WMO
		David Bradley, Environment Canada
		Karen Dubey, Seaspace Corporation
		Dr. Nan D. Walker, Earth Scan Laboratory, Louisiana State University
	12:30 p.m. – 1:30 p.m.	Lunch

Thursday, April 7, 2011 (1:30 p.m. – 5:15 p.m.)
Session 8: Communications and Breakout Groups
Co-Chairs: David Benner and Scott Rogerson

Presentation	Time	Session or Event
8.1	1:30 p.m. – 1:35 p.m.	Introduction David Benner, NOAA Satellite and Information Service
8.2	1:35 p.m. – 1:50 p.m.	GEONETCast and GEONETCast Americas Paul Seymour, NOAA Satellite and Information Service
8.3	1:50 p.m. – 2:05 p.m.	RANET Program Overview Kelly Sponberg, Program Manager, IEPAS / RANET, Joint Office of Science Support, University Corporation for Atmospheric Research
8.4	2:05 p.m. – 2:20 p.m.	The Role of the Polar Communications and Weather Mission for Canada Mike Manore, Project Coordinator, Space-Based Monitoring, Meteorological Services of Canada
8.5	2:20 p.m. – 2:50 p.m.	International Satellite Communications System (ISCS) and NOAAport Activities Robert Gillespie and Scott Christensen, NOAA National Weather Service
8.6	2:50 p.m. – 3:05 p.m.	User Services for NESDIS Satellite Products and Services Matthew Seybold, NOAA Satellite and Information Service
8.7	3:05 p.m. – 3:20 p.m.	McIDAS-V: Advances in data analysis and visualization for satellite data and products Dave Santek, Space Science and Engineering Center (SSEC)
8.8	3:20 p.m. – 3:25 p.m.	Breakout Group Instructions Scott Rogerson, NOAA Satellite and Information Service
	3:25 p.m. – 3:45 p.m.	Break: Refreshments in Exhibits Area

8.9	3:45 p.m. – 4:35 p.m.	Breakout Groups: Session A Transition from GOES to GOES-R: GRB, GAS Moderator: Greg Mandt Subject-Matter-Experts: Tim Schmit, Reggie Lawrence, Craig Keeler, Satya Kalluri Transition from POES to NPP/JPSS: APT, HRPT, IPOPP, LRD, HRD Moderator: Gary Davis Subject-Matter-Experts: Marlin O. Perkins, Patrick Coronado Satellite Services: LRIT, EMWIN, GOES DCS, GVAR, Argos, GEONETCast, RANET Moderator: Paul Seymour Subject-Matter-Experts: Kay Metcalf, Matthew Seybold, Natalia Donoho, Letecia Reeves, James Heil, Edward Young, Scott Rogerson Frequency Issues: 1675 -1695 MHz, 1695 - 1710 MHz Moderator: Mark Mulholland Subject-Matter-Experts: Cynthia Hampton, Jerome Lafeuille, Ivan Navarro, Joaquin Gonzalez
	4:40 p.m. – 5:30 p.m.	Breakout Groups: Session B Same as Session A
	6:30 p.m. – 8:30 p.m.	Conference Banquet – Hilton Miami Airport Hotel – Cove Ballroom "The Decline of the American Emergency Communications System: How Technology Makes Communicating with the Public More Difficult" Speaker: Bryan Norcross, The Weather Channel, Inc.

Friday, April 8, 2011 (8:30 a.m. – 12:00 p.m.)
Session 9: User Services and Impacts
Co-Chairs: Kathy Kelly and Edward Young

Presentation	Time	Session or Event
	8:00 a.m. – 8:30 a.m.	Registration/Coffee
9.1	8:30 a.m. – 8:40 a.m.	Introduction
		Edward Young, Deputy Director National Weather Service, Pacific Region
9.2	8:40 a.m. – 9:30 a.m.	Breakout Group reports
9.3	9:30 a.m. – 10:30 a.m.	Facilitated Discussion: Where Do We Go From here?
		Moderators: Kathy Kelly, Director, Office of Satellite Products and Operations and
		Edward Young, Deputy Director National Weather Service, Pacific Region
	10:30 a.m. – 10:45 a.m.	Break: Refreshments
9.4	10:45 a.m. – 11:45 a.m.	Develop/Prioritize Conference Recommendations
		Edward Young, Deputy Director, National Weather Service, Pacific Region
		David Benner, NOAA Satellite and Information Service
9.5	11:45 a.m. – 11:50 a.m.	Session Wrap-up and Final Discussion
		Edward Young, Deputy Director, National Weather Service, Pacific Region
9.6	11:50 a.m. – 12:00 p.m.	Closing Remarks
		Kathy Kelly, Director, Office Satellite Products and Operations, NOAA Satellite and Information Service
		Conference Closes
	1:30 p.m. – 3:30 p.m.	Tour of the National Hurricane Center

Appendix II – Conference Attendees

Country	Attendee	Organization	Position
Antigua & Barbuda	Braithwaite, George	Antigua & Barbuda Govt	Deputy Director
Argentina	Cotlier, Carlos	Universidad Nacional de Rosario	
	Pujol, Gloria	Servicio Meteorólogico Nacional, Argentina	Researcher
	Torrusio, Sandra Edith	Servicio Meteorólogico Nacional, Argentina	Principal Investigator
Australia	Hodge, Bryan	Bureau of Meteorology	Manager
Bahamas	Basden, Trevor	Bahamas Department of Meteorology	Senior Deputy Director
	Gibson, Gregory	Bahamas Department of Meteorology	Electronic Technician
Barbados	Caesar, Kathy-Ann	Caribbean Institute for Meteorology and Hydrology, Barbados	Meteorologist
Belize	Thompson, Roy	Belize Meteorological Service	Electronic Technician
Bolivia	Imaña, Edgar	SENAMHI-Bolivia	
	Ontiveros, Miguel	National Service of Meteorology and Hydrology	Director

Brazil	Angelis, Carlos	INPE/CPTEC	
	Belassiano, Marcelo	FURNAS	Meteorologist
	Junior, Jurandir Zullo	Cepagri/ Unicamp-CNPq	
Canada	Bergeron, Paul-Emile	Environment Canada	System Monitoring Tech
	Bradley, David	Environment Canada	
	Cawley, Dave	Timestep	Director
Chile	Charpentier H., Gina	Dirección Meteorológica de Chile	Meteorologist
	Muñoz, Alejandro	Dirección Meteorológica de Chile	Deputy Director
	Narbona, Javier Naranjo	Min of Public Works	Chief, Hydrology
Colombia	Gonzalez, P. Harold O.	CVC	Ingeniero Sistemas
	Muñoz, Gustavo	Empresas Publicas	Engineer
Costa Rica	Quiros, Evelyn	ICE	Meteorologist
	Sanchez, Rodolfo	Instituto Meteorologico	Jefe T.I.
	Stolz, Werner	Costa Rican Meteorological Institute	Chief, Synoptic Meteorology
Dominican Republic	Severino, Orlando	Oficina Nacional de Meterologia	
Ecuador	Palacios, Juan	Hydrometeorological Institute	
France	Blanc, Frederique	Collecte Localisation Satellites (CLS France)	

	Brunel, Pascal	Meteo France	Deputy, R&D
	Roquet, Herve	Meteo-France	Head of R&D Division
Germany	Burns, Sean	EUMETSAT	Systems Operations Manager
	Gonzalez, Joaquin	EUMETSAT	Head, System Engineering Support Division
Guatemala	Osoy, Mario	INSIVUMEH	Climatology
Honduras	Sevilla, Nelson	SMN/Honduras	Communication System
Indonesia	Adriyanto, Riris	Indonesian Agency for Meteorology, Climatology & Geophysics	Chief, Satellite Data Management Sub Division
	Harijono, Sri W.B.	Agency for Meteorology, Climatology and Geophysics (BMKG), Indonesia & President WMO RA V	Director General
	Sopahulewakan, Ardhasena	Indonesian Agency for Meteorology, Climatology & Geophysics	Staff
	Widada, Sulistya	Indonesian Agency for Meteorology, Climatology & Geophysics	Deputy Director General

Mexico	Hidalgo, Jorge Zalvala	Universidad Nacional Autónoma de México	
Norway	Groenass, Einar	Kongsberg Spacetec	Marketing Director
Panama	Espinosa, Jorge A.	Panama Canal Authority	Manager
	Aguilar, Emmanuel	ETESA Hidro-meteorología	Supervisor
Peru	La Rosa, Jorge Chira	Servicio Nacional de Meteorologia e Hidrología de Peru	Director
Puerto Rico	Ramírez, Nazorio	University of Puerto Rico	Professor
Russia	Gershenzon, Olga	R&D Center ScanEx	
Suriname	Becker, Cornelis	Meteorological Servcice	Director
Switzerland	LaFeuille, Jerome	World Meterological Organization, Space Programme Office	Chief, Observing and Information Systems Department
Uruguay	Cuello, Beatriz	Direccion Nacional de Meteorologia	Technical Secretary
Venezuela	Hernandez, Luis Afonso Fernandez	INAMEH	Manager Technical Assistance

USA	Aarup, Thorkild	Inter-governmental Oceanographic Commission	Senior Programme Specialist
	Allegretti, Phil	Vaisala, Inc	
	Andrews, Ron	Northrop Grumman/DWSS	System Engineer
	Atkinson, Nigel	Meteorological Office	Senior Scientist
	Austin, James	Raytheon Corporation	Systems Engineer
	Baker, Charlie	NOAA/NESDIS/SIS	Deputy Assistant Administrator
	Baptiste, Eric	SeaSpace Corporation	Director, Civil Space & Special Projects
	Bedard, Mike	Harris Corporation	Manager, Business Development
	Benner, David	NOAA/NESDIS/OSPO/SIS	Division Chief
	Betsill, Dani	Microcom Design, Inc	President
	Beven, Jack	NOAA-National Hurricane Center	Senior Hurricane Specialist
	Bloom, Hal	Earth Resources Technology	
	Bories, Cristina	Harris Corporation	L1, L2 Processing
	Brown, Curtis	Harris Corporation	Environmental Systems Engineer
	Carr, James		
	Christensen, Scott	NOAA/NWS	IT Project Manager Enterprise System
	Clark, Dane	Short & Associates Inc	Consultant

Connell, Bernadette	NOAA-Cooperative Institute for Research in the Atmosphere	Research Scientist
Corbett, Michael	GOES-R Program	Assistant Systems Program Director
Coronado, Patrick	NASA/Direct Readout Laboratory	Director
Culver, Ben	Stevens Water Monitoring Systems, Inc.	
Davis, Gary	NOAA/NESDIS/OSD/SIS	Director
De Cima, Anna	SeaSpace Corporation	
Dittberner, Gerald	Harris Corporation	Senior System Engineer
Donoho, Natalia	NOAA/NESDIS/OSPO-Satellite Products and Services Division	User Services Coordinator
Dubey, Karen	SeaSpace Corporation	Technology Development Specialist
Feltz, Wayne	CIMSS/SSEC-Univ. of Wisconsin	
Finocchio, Peter	AER, Inc.	
Fogle, Rick	Orbital Systems	Partner
Fontaine, Kathleen	NASA/GSFC	GEOSS Liaison
Furgerson, John	JPSS Program	Dep. Data Products
Gaber, Harvey	USAF/DWSD	Ground Systems Chief
Gerth, Jordan	CIMSS/SSEC-Univ. of Wisconsin	Research Assistant
Gillespie, Robert	NOAA/NWS	PM - ISCS
Goldberg, Mitch	NOAA/STAR	
Goodman, Steven	NOAA/NESDIS/GOES-R Program	Senior Scientist

Grant, Kerry	Raytheon Corporation	
Green, Russell	Northern Video Graphics, Inc	
Gschwendtner, Capt. Werner	DWSS Program	Senior Engineer
Guberek, Michael	Global Imaging	Technical Director
Guiffrida, Anthony	AER, Inc.	
Gumley, Liam	CIMSS/SSEC-Univ. of Wisconsin	Senior Scientist
Gurka, Jim	NOAA/NESDIS/GOES-R Program	Ground System Division
Hampton, Cynthia	NOAA/NESDIS/SIS	Senior Engineer
Hansen, Dennis	Harris Corporation	
Hauser, Robert	Air Force Weather Agency	Deputy Chief
Heil, Jim	NOAA/NWS/OCWWS	Senior Meteorologist
Heinrichs, Thomas	University of Alaska Fairbanks	Associate Director
Hellstern, Brandt	Waterlog/YSI Inc	US & Latin America Sales Manager
Higginbotham, Devon	Raytheon	
Hodge, Hoover	HQ Air Force Special Operations Command	meteorologist
Holloway, Fred	Stevens Water Monitoring Systems, Inc.	
Huang, Allen	CIMSS/SSEC-Univ. of Wisconsin	Senior Scientist
Jackson, Nina	NOAA/NESDIS	Communication Specialist
Jamilkowski, Michael	Raytheon	JPSS Customer Liaison

Jenkins, Charlotte	Short & Associates Inc	Director of Organizational Change
Johnson, Edward	NOAA/NWS/ SPPO	Director
Jordan, Karen	Northrop Grumman/DWSS	Engineer
Kalluri, Satya	NOAA/NESDIS/GOES-R Program	Senior Scientist
Keeler, Craig	NOAA/NESDIS/GOES-R Program	Senior Engineer
Kelly, Kathleen	NOAA/NESDIS/OSPO/SIS	Director
Kennelly, Ted		
Kilcoyne, Heather	NOAA/NESDIS/ JPSS Program	
Lawrence, Reginald	NOAA/NESDIS/Satellite and Information Service	GORE-R GAS Program Manager
Lee, Thomas	Naval Research Lab	meteorologist
Lewis, Jennifer	NOAA/National Weather Service	International Analyst
Leyva, Salim	NOAA/NWS/NCEP/National Hurricane Center	Sup IT Specialist
Madsen, Eric	NOAA/NESDIS International and Interagency Affairs	Senior International Relations Specialist
Maloney, Mike	Sutron Corporation	Vice President
Mandt, Greg	NOAA/NESDIS/GOES-R Program	Program Director
Marley, Stephen	Harris Corporation	Enterprise Architect
McMurdy, Michelle	ADNET Systems Inc NASA/GSFC	Communication Specialist
McNeil, Julie	GOES-R Program	Systems Engineer
McQuivey, Raul	Sutron Corporation	President

McWilliams, Gary	JPSS Program Office	Army User Liaison
Medina, Joe	Dept of Water Resources CA	Telecomm Engineer
Medina, Martin	NOAA/NESDIS/ IIAO	
Melfi, Davide	Italian Air Force Met Service	
Metcalf, Kay	NOAA/NESDIS	GOES DCS Program Manager
Meyer, Rolin	NOAA	Chief, Pacific Operations Branch
Misciasci Jr., Frank	Harris Corporation	Senior Executive Account Manager
Molthan, Andrew	NASA MSFC	Research meteorologist
Mostek, Tony	NOAA/NWS/OCWWS	Branch Chief
Mozer, Kathryn	Short & Associates Inc	
Mulholland, Mark	NOAA/NESDIS/SIS	Chief Systems Engineer
Navarro, Ivan	NOAA/NWS/OOS	Branch Chief
Nelson, Mike	Design Analysis/YSI	Engineer
Nguyen, Louis	NASA Langley	Research Computer Engineer
Norcross, Bryan	The Weather Channel	Senior Broadcast meteorologist
Ojeda, Manuel	Morcom International	President
Overton, John	NOAA/JPSS	Customer Liaison
Padar, Stephen		End user

Palikonda, Rabindra	NASA/Langley Research Center	Senior Research Scientist
Pardee, Richard	USGS/Water Mission Area Hydrologic Instrumentation Facility	WMA Radio Liaison Officer GOES PASS DB MGR
Pemble, Rick	Harris Corporation	Senior Principal Engineer
Pepper, William	Harris Corporation	Principal Investigator
Perkins, Marlin	NOAA/NESDIS/OSPO	Direct Readout Program Manager
Pirone, Maria	Harris Corporation	Senior Account Manager
Preble, Duane	Microcom Design, Inc	Senior Engineer
Race, Randall	NOAA/NESDIS/GOES-R Program	PG Engineer
Reed, Bonnie	NOAA/NWS/OST	
Reeves, Letecia	NOAA/NESDIS/OSPO	GOES DCS Coordinator
Reynolds, Richard	NOAA/NESDIS/GOES-R Program	Consultant
Riley, Shawn	Baron Services	Forecast Development meteorologist
Robaidek, Jerrold	CIMSS/SSEC-Univ. of Wisconsin	
Robeson, Deborah	Harris Corporation	Program Manager
Robinson, Kris	Space Dynamics Lab	Systems Engineer
Rodriguez, Santos	NOAA/NWS/ OOS	Senior Engineer
Rogerson, Scott	NOAA/NESDIS/OSPO	Argos Program Manager
Santek, David	CIMSS/SSEC-Univ. of Wisconsin	Scientist

Schaffer, Becky	CIMSS/SSEC-Univ. of Wisconsin	McIDAS Program Mgr
Schmit, Tim	NOAA/NESDIS	Senior meteorologist
Schulz, Colin	NOAA Contractor	Communications Consultant
Seybold, Matthew	NOAA/NESDIS/OSPO	User Services Coordinator
Seymour, Paul	NOAA/NESDIS/OSPO	Direct Broadcast Program Manager
Shanks, Adam	Vaisala, Inc	
Shin, Hae-Yong	SeaSpace Corporation	Chief Technology Officer
Siewert, Christopher	Oklahoma University, Storm Prediction Center	Proving Ground Liaison
Singer, Mike	Harris Corporation	
Smith, David	Raytheon	Engineering Fellow
Soto, Ted	Sutron Corporation	Sales Manager
Spangler, Timothy	UCAR/COMET Program	Director
Sponberg, Kelly	University Corporation for Atmospheric Research	Program Manager
Standridge, Jason	NOAA	Electrical Engineer
Stedronsky, Rich	IPS MeteoStar	Sales/Marketing
Strabala, Kathleen	CIMSS/SSEC-Univ. of Wisconsin	
Stryker, Tim	US Geological Survey, Committee on Earth Observation Satellites	Executive Officer
Sutherlun, Jacob	NOAA/NESDIS/International Affairs	International Affairs Specialist

Terry, Shawn	Aquila Systems	
Thorpe, Ray	Harris Corporation	
Tuggle, George	ADNET Systems Inc	Multimedia Specialist
Ulrich, Kevin	California State University	Research Assistant
Vande Castle, John		
Vila, Daniel	DSA/CPTEC/ INPE	
Walker, Nan	Louisiana State University/Department of Oceanography and Coastal Sciences	Associate Professor
Wagner, Robert	NOAA	
Weber, Jeff	UCAR/Unidata	Project Manager
Wiemann, James	AVTEG	Assistant Chief Combat Division
Wooldridge, Charles	NOAA/NESDIS/IIAO	
Young, Jr. Edward	NOAA/NWS/Pacific Region	Deputy Regional Director
Zakar, David		
Zhou, Lihang	NOAA/NESDIS/STAR	
Zullo, Jurandir	UNICAMP	Researcher

Appendix III – List of Exhibitors and Vendors

2011 SDRC Exhibitor List

1. **SeaSpace Corporation (Karen Dubey, Eric Baptiste, Hae-Yong Shin & Anna De Cima)**
   1300 Gregg Street
   Poway, CA 92064
   Phone: 858-746-1143 Fax: 858-746-1143
   Email: kdubey@seaspace.com
   Email: adecima@seaspace.com
   Email: ebaptiste@seaspace.com
   Email: hshin@seaspace.com

2. **Sutron Corporation (Ted Soto, Dr. Raul McQuivey & Mike Maloney)**
   2400 Davis Drive
   Sterling, VA 20164
   Phone: 703-406-2800 Fax: 703-406-2801
   Email: tsoto@sutron.com
   Email: rmcquivey@sutron.com
   Email: mmaloney@sutron.com

3. **CIMSS/SSEC (Jordan Gerth)**
   1225 W. Dayton Street
   Madison, WI 53706
   Phone: 608-263-4942 Fax: 608-262-5974
   Email: jordang@ssec.wisc.edu

4. **Waterlog YSI Incorporated (Brandt Hellstern)**
   75 West 100 South
   Logan, UT 84321
   Phone: 435-753-2215 Fax: 435-753-7669
   Email: bhellstern@waterlog.com

5. **IPS MeteoStar, Inc. (Richard Stedronsky & Hank Fallek)**
   99 Inverness Drive East, Suite 130
   Englewood, CO 80112
   Phone: 303-242-5002 ext 336
   Email: sted@meteostar.com
   Email: hfallek@meteostar.com

6. **Microcom Design. Inc. (Dani Betsill)**
   10948 Beaver Dam Road, Suite C
   Hunt Valley, MD 21030
   Phone: 410-967-4580 Fax: 410-771-0018
   Email: boyx3@aol.com

7. **Global Imaging (Michael Guberek)**
   201 Lomas Santa Fe Drive, Suite 380
   Solana Beach, CA 92075
   Phone: 858-481-5750 Fax: 858-481-5794
   Email: mguberek@globalimaging.com

8. **Orbital Systems, Ltd. (Carl Schoeneberger)**
   3807 Carbon Road
   Irving, TX 75038
   Phone: 972-915-3669 ext 124 Fax: 972-915-3699
   Email: carl.s@orbitalsystems.com

9. **Northern Video Graphics, Inc (Russell Green)**
   1745 Wellesley Avenue
   Saint Paul, MN 55105
   Phone: 651-698-2187
   Email: nvg@nvgweather.com

10. **NOAA GEONETCast/GEONETCast Americas (Paul Seymour)**
    NOAA/NSOF
    4321 Suitland Road
    Suitland, MD 20746
    Phone: 301-817-4521 Fax: 301-817-4569
    Email: Paul.Seymour@noaa.gov

11. **NOAA HRIT/EMWIN (Paul Seymour)**
    NOAA/NSOF
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    Suitland, MD 20746
    Phone: 301-817-4521 Fax: 301-817-4569
    Email: Paul.Seymour@noaa.gov

12. **NOAA (Nina Jackson)**
    1335 East West Highway, 8th Floor
    Silver Spring, MD 20910
    Phone: 301-713-2087
    Email: Nina.Jackson@noaa.gov

    a) NESDIS
    b) National Hurricane Center (NHC)
    c) GOES-R
    d) RANET

13. **Vaisala, Inc (Adam Shanks & Phil Allegretti))**
    10690 E. Calle Nopalito
    Tucson, AZ 85748

Email: adam.shanks@vaisala.com
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14. Stevens Water Monitoring Systems, Inc. (Fred Holloway & Ben Culver)
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Phone: 503-445-8000
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Email: bculver@stevenswater.com

15. Aquila Systems (Shawn Terry)
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Oakdale, CT 06370
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Email: info@aquilasys.com

16. Kongsberg Spacetec (Frank Øynes)
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17. Harris Corporation (Maria Pirone)
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Appendix IV – Acronym List

A

AAPP	ATOVS and AVHRR Pre-processing Package
ABBA	Automated Biomass Burning Algorithm
ABI	Advanced Baseline Imager
ABS	Advanced Baseline Sounder
ADT	Automated Dvorak Technique
AFWA	Air Force Weather Agency
AIRS	Atmospheric Infrared Sounder
AMV	Atmospheric Motion Vectors
AMS	American Meteorological Society
AMSR	Advanced Microwave Scanning Radiometer
AMSR-E	Advanced Microwave Scanning Radiometer - EOS
AMSU	Advanced Microwave Sounding Unit
AMSU-A	Advanced Microwave Sounding Unit-A
AMW	Atmospheric Motion Vectors
AOD	Aerosol Optical Depth
APT	Automatic Picture Transmission
ARP	Application Related Products
ASAR	Advanced Synthetic Aperture Radar
ASCAT	Advanced Scatterometer
ASOS	Automated Surface Observing System
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
ATMS	Advanced Technology Microwave Sounder
ATOVS	Advanced TIROS Operational Vertical Sounder
AVHRR	Advanced Very High Resolution Radiometer
AWIPS	Advanced Weather Information Display System
AWC	Aviation Weather Center
AWG	Algorithm Working Group

B

BoR	Bureau of Reclamation
BMKG	Agency for Meteorology Climatology and Geophysics (Indonesia)
BRDF	Bidirectional Reflectance Distribution Function

C

CAFFG	Central American Flash Flood Guidance
Cal/Val	Calibration & Validation
CARMEN-1	ICARE (Influence of Space Radiation on Advanced Components) and SODAD (Système orbital pour la détection active des débris)
CCRI	Climate Change Research Initiative
CCRS	Canada Center for Remote Sensing

CDR	Climate Data Record
CEO	Coasts, Estuaries, and Oceans
CEOS	Committee on Earth Observation Satellites
CERES	Clouds and the Earth's Radiant Energy System
CDA	Command and Data Acquisition
CGMS	Committee on Geostationary Meteorological Satellites
CHAMP	Challenging Mini Satellite Payload
CHARTS	Compact Hydrographic Airborne Rapid Total Survey
CICS	Cooperative Institute for Climate Studies
CIMSS	Cooperative Institute for Meteorological Satellite Studies
CIRA	Cooperative Institute for Research in the Atmosphere
CLASS	Comprehensive Large Array-data Stewardship System
CLAVR	Clouds from AVHRR
CLS	Collecte Localisation Satellites
CMA	Chinese Meteorological Agency
CMC	Canadian Meteorology Center
CMDL	Climate Monitoring and Diagnostics Laboratory
CMIS	Conically Scanning Microwave Image/Sounder
CNES	French Space Agency
C/NOFS	Communication/Navigation Outage Forecasting System
CoE	Centres of Excellence
COMET	Cooperative Program for Operational Meteorology
CONAE	Comision Nacional de Actividades Espaciales
CONUS	Continental United States
COOP	Continuity of Operations
CORL	Consolidated Observations Requirements List
CoRP	Cooperative Research Program
COSMIC	Constellation Observing Satellites for Meteorology, Ionosphere, and Climate
CPC	Climate Prediction Center
CrIS	Cross-track Infrared Sounder (NPOESS)
CRAD	Climate Research and Applications Division
CSA	Canadian Space Agency
CSIR	Council for Scientific and Industrial Research
CSU	Colorado State University
CW/OW	CoastWatch/OceanWatch

D

DAAC	Distributed Active Archives Center
DAO	Data Assimilation Office
DADDS	DCS Advanced Data Distribution System
DAPS	DCS Automated Processing System
DB	Direct Broadcast
DBPAS	Direct Broadcast Processing and Application System
DBCRAS	Direct Broadcast Cooperative Institute for Meterological Satellite Studies (CIMSS) Regional Assimilation System
DCPC	Data Collection or Production Centres

DCPI	Data Collection Platform/Interrogate
DCPR	Data Collection Platform/Receive
DCS	Data Collection System
DHS	Department of Homeland Security
DMSP	Defense Meteorological Satellite Program
DOC	Department of Commerce
DoD	Department of Defense
DRL	Direct Readout Laboratory (NASA)
DRO	Direct Readout
DRR	Disaster Risk Reduction
DVB-S	Digital Video Broadcasting - Satellite
DWL	Doppler Wind Lidar
DWSD	Defense Weather Systems Directorate
DWSS	Defense Weather Satellite System

E

EDC	EROS Data Center
EDR	Environmental Data Record
eGVAR/GRB	emulated GVAR/Goes Rebroadcast (GOES R)
EMWIN	Emergency Manager's Weather Information Network
EOS	Earth Observation System/Satellite
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
EPS	EUMETSAT Polar System
ERB	Earth Radiation Budget
ERBS	Earth Radiation Budget Sensor
EROS	Earth Resources Observation System
ERS	European Remote Sensing
ESA	European Space Agency
ESPDS	Environmental Satellite Processing and Distribution System
ESPC	Environmental Satellite Processing Center
ESRO	European Space Research Organization
EU	European Union
EUMETCast	European Meteorological Satellite Rebroadcast
EUMETSAT	European organization for the Exploitation of Meteorological Satellites
EXIS	Extreme Ultraviolet and X-ray Irradiance Sensors
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FNMOC	Fleet Numerical Meteorology and Oceanography Center
FSOF	Fairbanks Alaska Satellite Operations Facility
FSU	Florida State University
FTP	File Transfer Protocol

G

GAS	GOES-R Access Subsystem
GDAS	Global Data Assimilation System

GDR	Geophysical Data Record
GEO	Group on Earth Observations
Geo	Geosynchronous Earth Orbit
GEONETCast	Geostationary Satellite Rebroadcast (not an acronym)
GEOSAR	Geostationary Search and Rescue
GEOSS	Global Environment Observation System of Systems
GEST	Goddard Earth Sciences and Technology Center
GFS	Global Forecasting System
GIS	Geographical Information System
GLM	GOES Lightning Mapper
GMSRA	GOES Multi-Spectral Rainfall Algorithm
GMES	Global Monitoring for Environment and Security
GNC-A	GEONETCast Americas
GOES	Geostationary Operational Environmental Satellite
GOES-R	Geostationary Operational Environmental Satellite - R
GOES-R3	GOES-R Risk Reduction
GOME	Global Ozone Monitoring Experiment
GOME-2	Global Ozone Monitoring Experiment
GOOS	Global Ocean Observing System
GOS	Global Observing System
GMS	Geostationary Meteorological Satellite
GRAS	GPS Radio Atmospheric Sounder
GRB	GOES Rebroadcast Service
GRIB/BUFR	Gridded Binary/Binary Universal For the Representation of meteorological data
GS	Ground System
GSC	Geological Survey of Canada
GSFC	Goddard Space Flight Center
GSICS	Global Space-Based Inter-Calibration System
GSIP	GOES Surface and Insolation Project
GSLR	Global Sea Level Rise
GTS	Global Telecommunications System
GUC	GOES User Conference
GRB	GOES ReBroadcast
GVAR	GOES VARiable Format
GVI	Global Vegetation Index
GVF	Global Vegetation Fraction
GOES	Geostationary Operational Environmental Satellite

H

HF	High Frequency
HES	Hyperspectral Environmental Suite
HIE	Hurricane Intensity Estimator
HIRS	High-Resolution Infrared Radiation Sounder
HIRDLS	High Resolution Dynamics Limb Sounder
HPC	Hydrometeorological Prediction Center
HRD	High Rate Data

HRIT	High Rate Information Transmission
HRPT	High Rate Picture Transmission
HSC	High Sensitivity Camera
HWT	Hazardous Weather Testbed

I

IAPP	International ATOVS Processing Package
IASI	Infrared Atmospheric Sounding Interferometer
ICD	Interface Control Document
IDEA-I	Infusing satellite Data into Environmental Applications International
IDCS	International data Collection System
IGDDS	Integrated Global Data Dissemination Service
IGOS	Integrated Global Observing Strategy
IIA	Interagency and International Affairs
IJPS	Initial Joint Polar System
IMAPP	International MODIS/AIRS Processing Package
IMN	National Meteorological Institute (Costa Rica)
InSAR	Interferometric SAR
INPE/CPTEC	National Institute for Space Research (Brazil)/Centro De Previsao de Tempo e Estudos Climaticos (Center For the Provision of Time and Climate Studies)
INSAT	Indian National Satellite
IOOS	Integrated Ocean Observing System
IORD	Integrated Operational Requirements Document
IP	Intermediate Products
IPCC	Intergovernmental Panel on Climate Change
IPO	Integrated Program Office
IPOPP	International Polar Orbiter Processing Package
IR	Infrared
IRS	InfraRed Sounder
IT	Information Technology
ITCZ	Inter-Tropical Convergence Zone
ITPP	International TOVS Processing Package
ITT	Information Technology Team (new name for TST)
JAXA	Japan Aerospace Exploration Agency
JCSDA	Joint Center for Satellite Data Assimilation
JPEG	Joint Photographic Experts Group
JPL	Jet Propulsion Laboratory
JTWC	Joint Typhoon Warning Center
JMA	Japanese Meteorological Agency
JPL	Jet Propulsion Laboratory
JPSS	Joint Polar-orbiting Satellite System

L

LEO	Low-Earth Orbit
LI	Lightning Imaging Sensor

LMA	Lightning Mapping Array
LRD	Low Rate Data
LRGS	Local Readout Ground System (DCS)
LRIT	Low Rate Information Transmission
LTAN	Local Time Ascending Node

M

MAS	MODIS Airborne Simulator
McIDAS	Man computer Interactive Data Access System
MERIS	Medium Resolution Imaging Spectrometer
METEOSAT	Meteorological Satellite (European Geostationary Meteorological Satellite)
METOP	Meteorological Operations Platform
MHS	Microwave Humidity Sounder
MHz	Megahertz
MIS	Microwave Imager/Sounder
MISR	Multi-angle Imaging SpectroRadiometer
MIRS	Microwave Integrated Retrieval System
MLS	Microwave Limb Sounder
MODIS	Moderate Resolution Imaging Spectro-Radiometer
MOPITT	Measurements of Pollution in the Troposphere
MOU/MOA	Memorandums of Understanding and Agreement
MSC/EC	Meteorological Service of Canada/Environment Canada
MSG	METEOSAT Second Generation
MSG-S	METEOSAT Second Generation - S
MSMR	Multi-frequency Scanning Microwave Radiometer
MSU	Microwave Sounding Unit
MTG	METEOSAT Third Generation
MTSAT	Multifunctional Transport Satellite (Japanese geostationary)
MW	Microwave

N

NASA	National Aeronautics and Space Administration
NASDA	National Space Development Agency of Japan
NAST-I	National Polar-orbiting Operational Environmental Satellite System Airborne Sounder Testbed - Interferometer
NAVOCEANO	Naval Oceanographic Office
NCAR	National Center for Atmospheric Research
NCDC	National Climatic Data Center
NCEP	National Centers for Environmental Prediction
NCAR	National Center for Atmospheric Research
NDE	NPOESS Data Exploitation
NDVI	Normalized Difference Vegetation Index
NESDIS	National Environmental Satellite, Data, and Information Service
NEXRAD	Next Generation Weather Radar
NGA	National Geospatial Agency

NGDC	National Geophysical Data Center
NHC	National Hurricane Center
NIC	NOAA National Ice Center
NIMA	National Imagery and Mapping Agency
NIST	National Institute of Science and Technology
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOAASIS	NOAA Satellite Information System
NODC	National Oceanographic Data Center
NOS	National Ocean Service
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NPP	NPOESS Preparatory Program
NSC	NOAA Satellite Conference
NRC	National Research Council
NRCS	Normalized Radar Cross-Section
NRL	Naval Research Laboratory
NRT	Near-Real-Time
NSF	National Science Foundation
NSOF	NOAA Satellite Operations Facility
NSSL	National Severe Storms Laboratory
NTIA	National Telecommunications and Information Administration
NWP	National Weather Prediction
NWS	National Weather Service

O

OAR	Office of Oceanic and Atmospheric Research
OCM	Ocean Color Monitor
OCONUS	Outside the Continental United States
OH	Office of Hydrology
OLR	Outgoing Longwave Radiation
OLS	Optical Linescan System
OMI	Ozone Monitoring Instrument
OMPS	Ozone Mapping and Profiler Suite
OPC	Ocean Prediction Center
OPDB	Operational Products Development Branch
OPT	Ozone Processing Team
ORA	Office of Research and Applications
ORI	Orographic Rain Index
OSCAR	Ocean Surface Current Analysis Real-time
OSD	Office of Systems Development
OSO	Office of Satellite Operations
OSPO	Office of Satellite and Product Operations
OSDPD	Office of Satellite Data Processing and Distribution

P

PEACESAT	Pan-Pacific Education and Communication Experiments by Satellite
PAW	PDA Animated Weather
PD	Product Distribution
PDA	Personal Digital Assistant
PDA	Product Distribution and Access
PFEL	Pacific Fisheries Environmental Laboratory
PG	Proving Ground
PMEL	Pacific Marine Environmental Laboratory
POC	Point-of-Contact
POES	Polar-orbiting Operational Environmental Satellites
POP	Product Oversight Panel
PPBES	Project, Planning, Budgeting and Execution System
PRiMO	Pacific Risk Management Ohana

Q

QPE	Quantitative Precipitation Estimates
QPF	Quantitative Precipitation Forecasts
QPSK	Quadra Phase Shift Key
Quikscat	Quick Scatterometer

R

RA	Regional Associations
RADS	Radar Altimetry Database System
RAMMB	Regional and Mesoscale Meteorology Branch
RAMSDIS	Regional and Mesoscale Meteorology Team Advanced Meteorological Satellite Demonstration and Interpretation System
RANET	Radio and Internet for the Communication of Hydro-Meteorological and Climate Related Information
RARS	Regional ATOVS Retransmission Services Project
RDR	Raw Data Record
R&D	Research and Development
RFI	Radio Frequency Interference
RGB	Red-Greeb-Blue
RIG	Remote Imaging Group
RII	Rapid Intensity Index
ROSA	Radio Occultation Sounder for Atmosphere
RPP	Research Project Plan
RPS	Radar-Polarimetric Satellite
RSO	Rapid Scan Operation

S

SAC-D	Satellite de Aplicaciones Centificas - D
SAL	Saharan Air Layer
SAR	Synthetic Aperture Radar
SARP	Search and Rescue Processor

SARSAT	Search and Rescue Satellite Aided Tracking
SBN	Satellite Broadcast Network
SBUV/2	Solar Backscatter Ultraviolet Spectral Radiometer, MOD 2
SDRO	Satellite Direct Readout
SDRC	Satellite Direct Readout Conference
SEISS	Space Environment In-Situ Suite
SEM	Space Environment Monitor
SEM-N	Space Environment Monitor-Next
SERVIR	Spanish for "To Serve" - a Regional Visualization and Monitoring System for the Latin America and the Caribbean region
SEVIRI	Spinning Enhanced Visible & InfraRed Imager
SHyMet	Satellite Hydrology and Meteorology
SOCC	Satellite Operations Control Center
SOCD	Satellite Oceanography and Climatology Division
SPC	Storm Prediction Center
SDR	Sensor Data Record
SRSO	Super-Rapid Scan Operations
SPORT	Short-term Prediction Research and Transition
SPSD	Satellite products and Services Division (of NOAA)
SSEC	Space Science and Engineering Center
SSM/I	Special Sensor Microwave Imager
SSMIS	Special Sensor Microwave Imager/Sounder
SSULI	Special Sensor Ultraviolet Limb Imager
SSUSI	Special Sensor Ultraviolet Spectrographic Imager
SSS	Sea Surface Salinity
SST	Sea Surface Temperature
STAR	Center for Satellite Applications and Research
SUVI	Solar Ultraviolet Imager
SWIR	Short Wavelength Infrared
SXI	Solar X-ray Imager

T

TAFB	Tropical Analysis and Forecast Branch
TCFP	Tropical Cyclone Formation Probability
TCHP	Tropical Cyclone Heat Potential
TES	Tropospheric Emission Spectrometer
TIROS	Television and Infrared Observation Satellite
TIROS N	Television InfraRed Observation Satellite - N
TOMS	Total Ozone Mapping Spectrometer
TOPEX	Topography Ocean Experiment (A Sensor)
TOVS	TIROS Operational Vertical Sounder
TRMM	Tropical Rainfall Measuring Mission

U

UCAR	University Corporation for Atmospheric Research
UKMO	United Kingdom Meteorological Office

UMBC	University of Maryland, Baltimore County
UHF	Ultra High Frequency
UN	United Nations
UNITAR	UN Institute for Training and Research
UNOOSA	UN Office of Outer Space Affairs
USAF	United States Air Force
USAID	United States Agency for International Development
UCAR	University Corporation for Atmospheric Research
USCG	United States Coast Guard
USD	United States Dollar
USDA	United States Department of Agriculture
USFS	United States Forest Service
USGEO	United States Group on Earth Observations
USGS	United States Geological Survey
USGCRP	United States Carbon Cycle Science Plan
USP	Universidade de São Paulo
USWRP	United States Weather Research Program
UVN	Ultra-violet Visible Near-infrared (UVN) Sounder
UTC	Universal Time Coordinated

V

VCI	Vegetation Condition Index
VHF	Very High Frequency
VIIRS	Visible/Infrared Imager/Radiometer Suite
VIRS	Visible Infrared Scanner
VIS	Visual Imaging System
VISIT	Virtual Institute for Satellite Integration Training
VISSR	Visible and Infrared Spin-Scan Radiometer
VNIR	Visible and Near Infra-Red

W

WAN	Wide Area Network
WES	Weather Event Simulator
WES	Warning Event Simulator
WF_ABBA	Wildfire Automated Biomass Burning Algorithm
WFO	Weather Forecast Office
WMO	World Meteorological Organization
WRF	Weather Research & Forecasting