Future of NOAA's Direct Readout And Direct Broadcast Services

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1. Introduction

The National Oceanic and Atmospheric Administration (NOAA) is in the process of transitioning its current direct broadcast services to the most up-to-date digital formats. The new Global Specifications for Low Rate Information Transmission (LRIT) and the Advance High Rate Picture Transmission (AHRPT) digital formats are intended to improve the quality, quantity, and availability of meteorological data from direct broadcast meteorological satellites.

The transition of the NOAA direct readout services is taking place across several spacecraft constellations. This will encompass many years of development, coordination and implementation. Replacement of the analog Weather Facsimile (WEFAX) with the new digital LRIT, in 2005, started a transition period that will culminate with the implementation of the GOES Re-Broadcast (GRB) service on the GOES-R spacecraft constellation. NOAA's current direct broadcast services will change dramatically in data rate, data content, frequency allocation and field terminal configurations.

2. Current Broadcast Services

The current direct readout services are derived from satellite sensor data from NOAA's GOES and POES systems. NOAA's geostationary (i.e., GOES) direct readout services include Low Rate Information Transmission (LRIT) and GOES VARiable (GVAR) broadcasts. The polar orbiting (i.e., POES) direct readout services include the analog Automated Picture Transmission (APT) and digital High-Rate Picture Transmission (HRPT) transmissions.

LRIT

LRIT is a communications transponder service provided through the GOES spacecraft. This low-rate digital service involves the retransmission of low-resolution geostationary data, polar-orbiter satellite imagery and other meteorological data through the GOES satellites to relatively low cost receiving units within receiving range of the satellite. The low-resolution geostationary and polar satellite images are produced at the NOAA Environmental Satellite Processing Center (ESPC) facility in Suitland, Maryland. This GOES imagery is created from the retransmitted GVAR data received at the facility. The ESPC ingests these retransmitted GVAR data streams through a Front End Processor. Based on an automated schedule, the data is divided up into sub areas, reduced in spatial resolution, if necessary, and enhanced according to predefined look-up tables. The resultant LRIT products and imagery (IR and visible) are referred to as sectors which are spatial subsets of the full earth disc corresponding to an area of interest to weather forecasters. The generated sectors are then sent from the ESPC as digital product via dedicated telephone lines to the Wallops CDA station for transmission through the GOES spacecraft.

On the current on-orbit spacecraft suite (GOES 10/11/12/13) and the planned launch missions of GOES O/P, the LRIT service will continue to support a 128 kbps service. In the GOES-R era, LRIT or HRIT will provide a 455 kbps broadcast service. The

LRIT service complies with the CGMS Global Specification for LRIT/HRIT (i.e., CGMS Document Number CGMS 03, Issue 2.6, dated August 12, 1999).

GVAR

With its two operational satellites, the GOES system views North, Central, and South America and their neighbouring ocean environments including the central and eastern portions of the Pacific Ocean and the central and western portions of the Atlantic Ocean. NOAA acquires raw data from its two primary instruments used to carry out the main mission. The Imager is a multi-channel instrument that senses radiant energy and reflected solar energy from the Earth's surface and atmosphere. The Sounder is a multi-channel instrument that provides data through vertical atmospheric temperature and moisture profiles, surface and cloud top temperatures, and ozone distribution. These instruments scan the Earth according to the sector commanded. Raw data from these instruments is down-linked to the ground to be processed into GVAR formatted data. The GVAR data is up-linked to its corresponding GOES satellite, together with auxiliary data inputs from additional ground equipment, for global re-broadcast to users.

The GVAR data format is primarily used to transmit Imager and Sounder meteorological data. Other functions of GVAR data include transmission of calibration data, satellite navigation data, administrative and operational text messages. The GVAR format was developed because the AAA format used for the early spin-stabilized GOES spacecraft would severely limit the capabilities of the Imager and Sounder for the new three-axis stabilized spacecraft platform. The AAA format used a fixed-length transmission. The GVAR format supports variable scan line lengths. The last GVAR mission will be supported by GOES-P scheduled for launch in October 2009.

APT

The APT service provides a reduced resolution data stream from the AVHRR instrument. Any two of the AVHRR channels can be chosen by ground command for processing and ultimate output to the APT transmitter. A visible channel is used to provide visible APT imagery during daylight, and one IR channel is used constantly (day and night). A second IR channel can be scheduled to replace the visible channel during the night time portion of the orbit. The analogue APT signal is transmitted continuously and can be received in real time by relatively unsophisticated, inexpensive ground station equipment while the satellite is within radio range. The characteristics of the transmitted signal remain unchanged in the NOAA KLM satellite series from those in the TIROS-N series (NOAA 8 through NOAA 14), while there is a minor change in the data format to account for the modified channel 3 on the AVHRR/3 instrument beginning with NOAA-K.

With the launch and operation of the METOP1, the morning (AM) Automatic Picture Transmission (APT) service is replaced with Low Rate Picture Transmission (LRPT) broadcast. Since the failure of the LRPT transponder, NOAA will continue to support both the morning (AM) and the afternoon (PM) polar-orbiting missions with its APT service. The last of the APT missions will be supported by NOAA-N' scheduled for launch in March 2009.

HRPT

The High Rate Picture Transmission (HRPT) service installed on the NOAA satellites has for some two decades been the main source of high quality data from polar orbiting meteorological satellites at major user stations throughout the world. The data stream not only contains full resolution images in digital format from the AVHRR instrument but also the atmospheric information from the suite of sounding instruments.

Through a HRPT terminal, an environmental user can acquire data from three or more consecutive overpasses twice each day from each satellite, giving high resolution data coverage of a region extending to about 1500 km radius from the user station. The imagery gives a snapshot of the meteorological conditions and can also be used for many land and ocean applications, while the sounding data gives detailed atmospheric data that may be processed and used in regional Numerical Weather Prediction (NWP) models. The NOAA HRPT system provides data from all NOAA-K, L, M, N, and N' spacecraft instruments at a transmission rate of 665,400 BPS. All information necessary to calibrate the instrument outputs is also included in the data stream. The real-time transmissions in S-band (at around 1700 MHz) include the digitized unprocessed output of the following sensors:

Advanced Very High Resolution Radiometer/3 (AVHRR/3)

The AVHRR/3 with its 1.1 km resolution dominates the data rate of the HRPT broadcast. Five spectral channels out of a possible range of six are transmitted in full resolution at any one time, together with relevant calibration data. Channels 3A and 3B cannot be transmitted at the same time. The selection is made by the Satellite Operations Command Center (SOCC) via telemetry control. The onboard processor also generates Global Area Coverage (GAC) and Local Area Coverage (LAC) formats from the original AVHRR data. These data are stored onboard and downloaded separately from the real-time data stream transmitted by HRPT.

Atmospheric Sounding Instruments

The atmospheric sounders on the NOAA-K, L, M, N, and N' spacecraft comprise the suite of instruments known as the Advanced TIROS Operational Vertical Sounder (ATOVS). This includes the Advanced Microwave Sounding Unit-A (AMSU-A) for atmospheric temperature profiles, the Advanced Microwave Sounding Unit-B (AMSU-B) for atmospheric humidity profiles and the High Resolution Infrared Radiation Sounder/3 (HIRS/3) for atmospheric sounding in cloud-free regions. Data from all three of these TOVS instruments are included at full resolution in the HRPT broadcast. On NOAA-N and NOAA-N', data from the Microwave Humidity Sounder (MHS) provided by EUMETSAT will replace AMSU-B data. The Solar Back scattered Ultraviolet (SBUV) instrument measures atmospheric ozone: its data are also transmitted by HRPT

The HRPT data stream also contains data from the Solar Environment Monitor (SEM) and the ARGOS Data Collection System (DCS). It should be noted that a new version of HRPT is to be implemented on the Metop spacecraft, operated by EUMETSAT, will not be compatible with the NOAA HRPT system. The last of the HRPT missions will be supported by NOAA-N' scheduled for launch in March 2009.

3. Future Direct Readout Services

As future environmental satellites improve their monitor and observing capabilities, they will produce far more data than the current satellite series. The geostationary and polar-orbiting environmental satellite constellations will employ new downlink frequency allocations, larger bandwidths, and faster data rates. Environmental data users must employ new field terminal receivers unique to that particular broadcast service.

NPOESS

Over the last nine years, NOAA has been developing the National Polar-orbiting Operational Environmental Satellite System (NPOESS). With a planned delivery of the first operational satellite in 2013, NOAA will begin launching NPOESS spacecraft into two orbital planes (0530, and 1330 equatorial nodal crossing times) to provide a single, national system capable of satisfying both civil and national security requirements for space-based, remotely sensed environmental data. The advanced visible and infrared imagers, and microwave sounders that are being developed for NPOESS will deliver higher spatial and temporal resolution data to meet user validated requirements for 55 atmospheric, oceanic, terrestrial, and solar-geophysical parameters enabling more accurate short-term weather forecasts and severe storm warnings, as well as serving the data continuity requirements for improved global climate change assessment and prediction. Early flight-testing of instruments is planned to reduce development risk and to demonstrate and validate global imaging and sounding instruments, algorithms, and pre-operational ground processing systems prior to delivery of the first NPOESS spacecraft.

The Integrated Program Office (IPO) is developed a Memorandum of Agreement (MOA) with the NOAA, DOD and NASA on the issue of Field Terminal interoperability and funding. Under this MOA, the IPO proposes providing two direct data links to Field Terminal users, one for High Rate Data (HRD) in X-band at 20 Megabits per second (Mbps), and one for Low Rate Data (LRD) in L-band at 3.5 Mbps. The IPO plans to demonstrate prototype NPOESS HRD and LRD terminals as a guide to users in modifying or replacing their existing terminals, and will distribute non-proprietary HRD and LRD versions of Field Terminal Interface Data Processor Segment (IDPS) software. Under the proposed MOA, individual agencies are expected to fund, procure, and manage their own Field Terminals to satisfy their user needs and to support the NPOESS Field Terminal Registry.

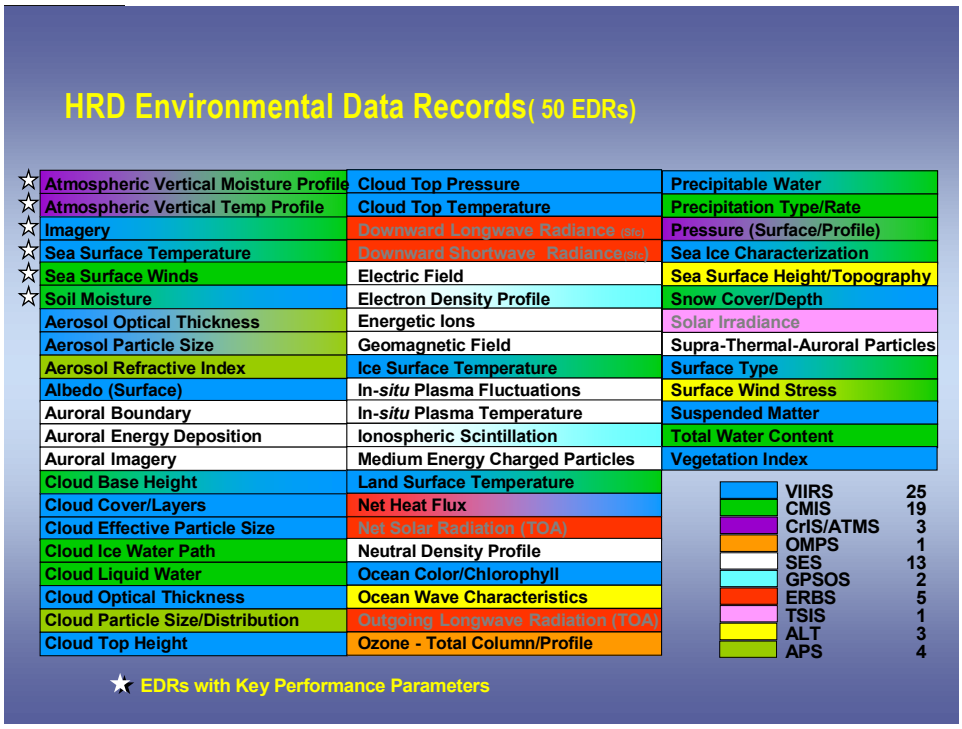
NPOESS spacecraft will simultaneously broadcast two types of real-time data to suitably equipped ground stations. These direct broadcast/real-time ground stations (or field terminals) will be capable of processing NPOESS RDRs into EDRs by utilizing IDPS software appropriate for the type of field terminal.

The current field terminals used throughout NOAA, DOD, and the worldwide civilian community will not be capable of receiving NPOESS data in their current configurations. For example, the planned LRD frequency and data rate are substantially higher than the current Automatic Picture Transmission (APT) transmissions. OSDPD is working with users to ensure that the IPO's proposals

address all user requirements and that an integrated test strategy is developed to evaluate end-to-end interoperability.

High Rate Data (HRD)

The NPOESS HRD broadcast will be a complete, full resolution data set containing all sensor data and auxiliary data necessary to generate all NPOESS EDRs and is intended to support users at regional hubs. The HRD broadcast will be transmitted at X-band frequencies, at a data rate of about 20 Mbps, and will require a bandwidth of nearly 50 MHz, with a receive antenna aperture not to exceed 2.0 meters in diameter. The IPO has reviewed alternative spectrum availability and has determined that the WARC-97 EESS X-band allocation at 7750-7850 MHz is suitable for this application.



Low Rate Data (LRD)

The NPOESS LRD broadcast will be a subset of the full NPOESS sensor data set and is intended for NOAA and worldwide users of field terminals (land and ship-based, fixed and mobile environmental data receivers operated by DoD users and surface receivers operated by other federal agencies, worldwide weather services, and other international users). Some data compression (Lossy or Lossless) may be employed for the LRD link. The LRD L-band broadcast will provide data at a rate of about 4.0 Mbps (nominally 3.88 Mbps) at 1702.5/1706.5 MHz with full CCSDS convolutional coding, Viterbi decoding, and Reed Solomon encoding/decoding into a tracking receive antenna aperture not to exceed 1.0 meter diameter. The LRD broadcast will be available on two selectable channels to accommodate multiple NPOESS spacecraft in the same orbit during life-cycle replacement. The NPOESS LRD broadcast parameters (frequency, bandwidth, data rate, and data content) have been selected to satisfy NOAA requirements for low-rate, real-time direct broadcast, as well as be closely compatible with the broadcast parameters for the Advanced High Resolution Picture Transmission (AHRPT) format that has been accepted and approved by the Coordinating Group on Meteorological Satellites (CGMS) and will be

used on the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) Metop spacecraft.

The NPOESS LRD service will include data required to satisfy the U.S. user-specified highest priority EDRs for real-time broadcast. These EDRs are listed in priority order in the following table:

	High Priority EDRs, In Priority Order from Highest to Lowest
1	Imagery Threshold Attributes: • 0.8 km horizontal spatial resolution (HSR) worst case across scan for at least one visible • and one IR band. • Day/night band at night with 2.7 km HSR • Provide Day and Night capability for the Field Terminal User** to: -Interpret High, Mid, and Low Cloud Types -Detect all Fog Types (Valley, Coast, etc.) -Distinguish Between Snow & Clouds -Detect Coastal Water Mass Features (coastal fronts, eddies, river plumes, etc.) -Detect Dust/Aerosol/Haze/Smoke ** The users intend to primarily exploit the LRD Imagery by manual methods (Interpretation, Detection, and Distinction) of inspection of processed images.
2	Atmospheric Vertical Temperature Profile (Surface to 100 mb only) Measurement Accuracy Threshold Attributes: • Surface to 700 mb: 2.5K/1 km • 700 mb to 300 mb: 1.5 K/1 km • 300 mb to 100 mb: 1.5K/3km. Measurement Accuracy attribute applies to clear and cloudy conditions.
3	Atmospheric Vertical Moisture Profile (Surface to100 mb only)
4	Global Sea Surface Winds (Speed and Direction)
5	Cloud Base Height
6	Cloud Cover/Layers
7	Pressure (Surface/Profile
8	Sea Surface Temperature (SST)

Fifteen additional lower priority EDRs will also be included in the LRD broadcast. While the eight high priority EDRs will be produced at the LRD “objective” level of performance, including data latency of two minutes for imagery EDR processing and 15 minutes or less for the other EDRs, these lower priority EDRs will be produced between threshold and objective levels with less stringent latency requirements.

	Lower Priority EDRs (no particular order)
	Aerosol Optical Thickness
	Albedo
	Cloud Effective Particle Size
	Cloud Liquid Water

	Cloud Optical Thickness
	Cloud Top Height
	Cloud Top Temperature
	Land Surface Temperature
	Ocean Wave Characteristics – Significant Wave Height
	Precipitation Type/Rate
	Precipitable Water
	Snow Cover/Depth
	Soil Moisture (Surface)
	Suspended Matter
	Total Water Content

GOES-R

NOAA has initiated a program to introduce new advanced improved performance imager and sounder sensors to GOES satellites in year 2014. The new imager has been named the Advanced Baseline Imager (ABI) and the sounder the Advanced Baseline Sounder (ABS). The ABI will have between 8-12 bands, with strong hopes for the 12 bands based on earlier NOAA engineering studies. The .59-.69 micron visible resolution band will be improved to 0.5KM with all other bands being 2km. The new imager scanning rate will be significantly increased to provide 4 full discs per hour plus 12 CONUS scans.

The ABS will be a Michelson Interferometer providing a greater number of vertical layers and improved temperature and moisture accuracy. In addition the ABS will have a scanning rate approximately 4 times faster than the current sounder. This ABS scanning rate will in one hour cover not only CONUS but all of South America and a large open ocean area. in the Atlantic and in the Pacific beyond Hawaii.

The ABI and ABS from their increased capabilities will have a significantly higher data rate. The current processed rate of about 2.1Mbps will be somewhere in the range of 12-17Mbps. This will require significant changes to the GOES spacecraft communication system, some changes to the processed data sites, and the introduction of new data formatting. Because of the large data rate the GVAR format will no longer be used.

The GOES I-N series (currently GOES 8-13) imager and sounder raw data downlink is 2.6 Mbps. The corresponding entire Level 1b data stream, 2.11 Mbps, is uplinked to the GOES I-N series satellite for broadcast as GVAR data. GVAR data is broadcast in L-band (1685.7 MHz), with binary phase shift keyed (BPSK) modulation.

The GOES-R instrument raw data downlink (includes imager, sounder, lightning mapper, and two space environmental instrument suites) is expected to be approximately 70 Mbps. The corresponding entire Level 1b data stream may be in the order of 40 Mbps. The goal is to downlink the entire Level 1b data stream as GOES Re-Broadcast (GRB) data. This data stream exceeds the bandwidth capacity of the current GVAR implementation.

The GOES-R Program Office (GPO) has developed a Government Reference Architecture that provides a workable solution to the GOES-R GRB requirements.

The final design could be significantly different based on the results of the GOES-R Program Definition and Risk Reduction acquisition activity. To minimize the impact on the user, the GRB is expected to continue to be transmitted in L-band, but use an expanded bandwidth (1682 MHz -1695 MHz). Emergency Managers Weather Information Network (EMWIN), Low Rate Information Transmission (LRIT) and Data Collection Platform Report (DCPR) will then be operated in the 1695 MHz to 1698 MHz range (see Figure 1).

Service	Current Frequency Spectrum	Current Data Rate	Future Frequency Spectrum	Future Data Rate
GVAR/GRB	1685.7	2.11 MHz	1690.2 MHz	<40 Mbps
LRIT	1691 MHz	128 kbps	1696.4 MHz	256 kbps
EMWIN	1692.7 MHz	9.6 kbps	1695.7 MHz	56 kbps
DCS/DCPR	1694.5 MHz	100/300/ 1200 bps	1697.65 MHz	1.2 kbps

Figure 1 - Impact on Transmission Frequencies/Data Rates for GOES-R

Understanding that the entire data downlink may not be of interest to every user, the GRB is expected to be formatted to allow data of interest to be filtered out of the data stream. In addition to the traditional direct broadcast mode, GRB is expected to be distributed via terrestrial networks to authorized users in a “push/pull” mode as the GFUL data service, so that some users with less stringent data continuity requirements can opt not to invest in new/updated Earth station receive systems. File sizes of all products are expected to be targeted for moderate line-rate web porting to support users with multi-megabit or Giga-bit connectivity. A key feature in the GPO transition plan is the planned development of a GVAR-like processed data stream containing selected products from GOES-R ABI, but relayed through the existing GOES-N/P series spacecraft. This service will allow legacy GVAR users to transition more gradually to the new receive and processing systems required for GRB. However, operation of the GOES-R GVAR-like service is planned as a stop-gap measure and is not expected to continue indefinitely. Finally, the GPO plans to develop a prototype GRB ground receive system as a proof of concept prototype. The design for this prototype is expected to be made available to the user community.

The GRB transmission format has not been defined; however, the intent is to take advantage of standard formats and technologies. The GVAR data transmission format was developed to allow full use of the capabilities of the advanced, three-axis stabilized spacecraft while retaining as much commonality as possible with receiving equipment in use from earlier spin-stabilized GOES spacecraft. The GVAR format is based on the operational visible and infrared spin scan radiometer atmospheric sounder (VAS) mode AAA format, which consisted of a repeating sequence of 12 fixed- length equal size blocks. The transmission of these blocks was synchronized with the spin rate of the earlier GOES spacecraft, that is, one complete 12 block sequence per satellite rotation.

4. Service Transition

NOAA's Direct Readout and Direct Broadcast services are manage by the Office of Satellite Data Processing and Distribution. The Direct Services Branch (DSB) is responsible for administering the processing and procedures required to meet the environmental user needs and expectations. Planning and coordination of the data content, data quality, transmission schedules and, interface with the users and manufacturers are critical to the efficient performance of these services. Over the next seven (7) years, direct readout and direct broadcast services will changes significantly as the future spacecraft constellations become operational.

Transition to the new data formats and adjusting for the increased data volume are concerns that DSB will provide continued support to current and future direct users. DSB will spearhead activities to addressing the new technology for data reception as well as alternative methods for data distribution. Future planning enable DSB to coordinate the demise of the legacy services while preparing the user community for the new direct services.

Service Management
Several of the direct readout communities will not be supported on future NOAA environmental satellites. These groups of people will either upgrade to a new service or find an alternative method to acquire the data they need to support their mission. To improve customer relations and provide up-to-date information about the applications of the direct services, DSB will continue to support those services that are not a part of the future satellite constellations. Also, DSB will provide practical information on how to obtain the services they should need.

Transition Activities
A summary of the DSB service transition activities are listed below:

METOP
LRPT service is not available, NOAA'S APT-am mission was re-instated to support global user. The AHRPT format requires upgrades to existing HRPT field terminals or the purchase new station. DSB will continue to provide updates and insight on the status of the LRPT/AHRPT services. Technical specifications to transition a HRPT station to AHRPT terminal will be available via the NOAASIS website by mid-2009.

NOAA's POES Constellation
The APT transmission was changed in the 137.1 – 137.937 MHz frequency band for NOAA-18 and NOAA-N' spacecraft. HRPT transmission remains unchanged. DSB will continue to monitor the quality of the transmission and provide the user communities any information on the status of the services in a timely manner. Working with the user communities, DSB will coordinate user requirements and concerns for the future of APT/HRPT as well as impacts of new services. DSB will make available all information pertaining to system modifications required to acquire any new or additional service. DSB will maintain an active database of DRO users, plan periodic user group meetings and convene bi-annual users' conferences.

NOAA's NPOESS Constellation
The APT service will not be available on the NPOESS spacecraft and the HRPT is replaced with the Low Rate Data (LRD) broadcast. An environmental user desiring

this service will require a new L-band field terminal. The new High data Rate (HRD) service requires a new X-band field terminal for the reception of the full NPOESS transmission. DSB will continue to work with the IPO to ensure the DRO user requirements for LRD and HRD are fully met. In coordination with the DRO user communities, DSB will ensure the environmental receive stations (i.e., field terminals) are reliable and affordable. DSB will develop and maintain a Field terminal Registry Office to support the distribution and maintenance of encryption keys. DSB will coordinate with the APT/HRPT users the future impacts of new LRD/HRD services.

NOAA's GOES Constellation

GOES ReBroadcast (GRB) will be a new service that requires a new X-band field terminal. GOES ReBroadcast – Lite (GRB-Lite) service will be a transitional replacement for the GOES VARiable (GVAR) service. If this service is available, DSB will provide the GVAR user community the necessary specifications to modify their existing terminals to acquire the GRB-Lite transmission. DSB will continue to provide updates and insight on the status of the GRB and GRB-Lite services. Technical specifications for the GRB/GRB-Lite field terminals will be posted to the NOAASIS website when available. DSB will maintain an active database of DRO users, plan periodic user group meetings and convene bi-annual users' conferences.

User Interface

1The OSDPD requires improvements in the ESPC to provide better user coordination on data acquisition, dissemination alternatives, and product and service quality as well customer interface. These improvements include the development of reliable user friendly interfaces for the distribution of the environmental services to the general public. Improvements in understanding user needs, developing better problem solving techniques and learning how the services are being used will enable OSDPD to interact with the customer more effectively. Using new technologies to monitor the acquisition, display and quality of the OSDPD services will promote a closer relationship with the user community. Effective and efficient management of the direct readout services and customer relations will ensure quality benefits to the user communities. The direct services will be of use to more organizations and can be supported domestically as well as internationally.

Customer service support in OSDPD includes the development, maintenance and operation of IT systems that support mission critical activities of the NOAA environmental satellite services. This support includes but not limited to the following functions: reviewing and managing customer system use requests, diagnosing and resolving problems in response to customer feedback in a professional and timely manner, assisting in the development and maintenance of a user database for tracking requests, reporting on problematic trends and daily system status, assisting in the management and allocation of system resources, assisting in the development and generation of reports on system performance, providing customer training as required, providing recommendations for system improvements and monitoring approved systems changes and assisting in ensuring the application of IT security policies in the delivery of customer support services. ESPC1 maintains a technical file(s) on system enhancement and applications in use, http://noaasis.noaa.gov. In addition, ESPC maintains a partial list of satellite equipment manufacturers on its NOAASIS web site at: http://noaasis.noaa.gov/NOAASIS/ml/manulst.html. The list contains HRPT, APT, GVAR and WEFAX equipment manufacturers and dealers of complete meteorological satellite receiving systems, system components, and

system integrators. In the future, this list will also include NPOESS High Data Rate (HRD) and Low Data Rate (LRD) equipment manufacturers. To provide through and complete solutions to customer problems, DSB will continue to improve customer support and decrease response time to customer inquiries and engage in customer focus groups to determine improvements in service quality.

5. Conclusion

The transition of the NOAA direct readout services is taking place across several spacecraft constellations. This will encompass many years of development, coordination and implementation. Replacement of the analog Weather Facsimile (WEFAX) with the new digital LRIT, in 2005, started a transition period that will culminate with the implementation of the GOES Re-Broadcast (GRB) service on the GOES-R spacecraft constellation. NOAA's current direct broadcast services will change dramatically in data rate, data content, frequency allocation and field terminal configurations. The geostationary and polar-orbiting environmental satellite constellations will employ new downlink frequency allocations, larger bandwidths, and faster data rates. Environmental data users must employ new field terminals unique to that particular broadcast service. The Direct Services Branch (DSB) is the NOAA customer interface for all environmental services. A summary of the spacecraft effects and field terminal changes are listed below:

METOP Constellation

- Low Rate Picture Transmission (LRPT): Automatic Picture Transmission (APT) Service replaced the failed LRPT, requires no modifications
- Advance High Rate Picture Transmission (AHRPT): New format requires upgrades to existing HRPT field terminals or purchase new station

NOAA's POES Constellation

- Automated Picture Transmission (APT) – Frequency change in the 137.1 – 137.937 MHz frequency band
- HRPT Service remains unchanged

NOAA's NPOESS Constellation

- Automatic Picture Transmission (APT) service is not available
- High Rate Picture Transmission (HRPT) is replaced with the Low Rate Data (LRD) broadcast, requires new L-band field terminal
- High data Rate (HRD) service requires a new X-band field terminal

NOAA's GOES Constellation

- GOES ReBroadcast – Lite (GRB-Lite) broadcast will be a transitional replacement for GOES VARiable (GVAR) service. If the service is available, DSB will provide the technical specification requirements to modify the current GVAR terminals
- GOES ReBroadcast (GRB) will require a new X-band field terminal