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The Current Status of the GOES LRIT Service

NOAA-WP-35 provides the status of the Low Rate Information Transmission (LRIT) on the GOES I-M and N-P spacecraft. The LRIT broadcast is operational on both GOES-east and GOES-west spacecrafts.

NOAA continues to concentrate its efforts on upgrading system reliability and monitoring activities. NOAA began the expansion of the product suite through additional imagery products and environmental products. NOAA continues to work with users and vendors to assess the quality and reliability of the LRIT service.

NOAA will continue to re-evaluate the system architecture and to upgrade the hardware and software in LRIT domains. Future development of the LRIT system will be defined through increased utilization and community outreach activities. NOAA will continue to work on the provision of a combined HRIT/EMWIN broadcast on the upcoming GOES-R series of satellites.

The Current Status of the GOES LRIT Service

1. Introduction

The United States operates a Low Rate Information Transition (LRIT) broadcast from both the East and West Geo-stationary Operational Environmental Satellites (GOES) spacecraft. LRIT services will be operational from the GOES-O/P spacecraft when they are put into service. On the future GOES-R series of satellites, the LRIT service will be combined with the US National Weather Service's Emergency Manager's Weather Information Network (EMWIN) service into an High Rate Information Transmission of 400 Kilobits per second.

2. System Configuration

The processing of data and the subsequent transmission of the LRIT products was designed to be more robust and flexible than the previous WEFAX analog service. This flexibility extends to the data ingestors, the product processors, and the transmission and reception portions of the system.

The LRIT system ingestors (in Suitland, Maryland) continually process a GOES GVAR data stream. As this equipment is configurable; it provides the operator the ability to specify the segmentation level of each product for processing and transmission. The ingestors also permit the configuration of parameters i.e., the region of coverage, the data resolution, and the channel(s), to be processed. Additionally, Rapid Scan Operations (RSO) data are ingested and can be made available to the LRIT Product Processor (LPP) system. The flexibility of the data ingestors enhances the overall robustness of the LRIT system.

The CGMS LRIT Global Specification defines a reference model with multiple layers. The model is generally consistent with both the Consultative Committee for Space Data System (CCSDS) and the International Standards Organization's (ISO) Open Systems Interconnect (OSI) reference model. The LRIT system is essentially a unidirectional flow of data from a transmission side (uplink) to a reception side (downlink). The model used for the NOAA LRIT implementation includes seven layers consisting of the: 1) Application Layer, 2) Presentation Layer, 3) Session Layer, 4) Transport Layer, 5) Network Layer, 6) Data Link Layer and the 7) Physical Layer.

On the transmission side, data is processed into LRIT files in the Application and Presentation Layers, which correspond to the LRIT Product Processor. Performed in layers 3 through 7, LRIT Communications Processing is concerned with sending LRIT files from the transmission side to the reception side.

The LRIT Product Processor (LPP) system adds flexibility and robustness to the LRIT system. A configurable system, the LPP's primary purpose is to create LRIT product files from various input sources, such as the GOES data from the data ingestors. It is in the LPP that product priority is determined and assigned. Not only is the LRIT data assigned a transmission priority, it is also given a processing priority.

The distinction between the two relates to where the priorities are implemented. The processing priority's significance is in the LPP; whereas the transmission priority is significant in the communications processing. Processing priority represents the amount of CPU capacity a given process receives relative to the other processes concurrently being performed. Transmission priority represents the priority an LRIT product file receives in the communications processing system. This priority allows for higher priority data to supersede lower priority data currently being transmitted. Such priority processing permits data that is deemed more urgent the opportunity to be transmitted quickly, thus reducing the latency for higher priority data.

3. LRIT Capabilities

The LRIT broadcast is a consolidated mode of data dissemination that includes the combination of 1) GOES imagery data, 2) National Weather Service Environmental products, 3) the US National Weather Service's Emergency Manager's Weather Information Network (EMWIN) and 4) information from the GOES Data Collection System (DCS).

The GOES GVAR data and the National Weather Service products form the baseline product suite of the LRIT broadcast and have the highest priority whereas support for the other improvements depends on available data transport capacities after the highest priority LRIT needs are addressed. The baseline products include the following:

GOES Infrared full disk
GOES Water vapor full disk
GOES Visible full disk
GOES Infrared northern hemisphere
GOES Water vapor northern hemisphere
GOES Visible northern hemisphere
GOES Infrared continental U. S.
GOES Water vapor continental U. S
GOES Visible continental U. S.
GOES Infrared southern hemisphere
GOES Water vapor southern hemisphere
GOES Visible southern hemisphere
GOES Rapid Scan
Various National Weather Service charts
Various administrative ASCII messages

The EMWIN (Emergency Managers Weather Information) data is now included in the LRIT data stream. The basic, or native, data formats of the LRIT system and the EMWIN system are not immediately compatible. The former is a file based system and the latter is serial data.

The EMWIN data, in its current implementation, is a 9600 baud, serial, RS-232 data stream. To include the EMWIN data in the LRIT data stream, one second chunks of the serial EMWIN data are converted to small files. The EMWIN serial data contains start and stop bits which are necessary for the serial protocol but are simply added overhead for the LRIT file. These are removed leaving only the 8 bit ASCII

characters to be transmitted in the EMWIN file within LRIT. These files are identified uniquely within the LRIT data stream as are all other files in LRIT.

At the LRIT receiver end, these files are received and stored as are all LRIT files. Software within the receiver reads the ASCII character data from the EMWIN files, adds the start and stop bits back in and makes the newly serialized data available to any of the EMWIN data display programs or to an outgoing serial port on the receiver.

NOAA has also integrated the GOES Data Collection System (DCS) data into the LRIT broadcast. The GOES DCS data has been enhanced so that all of the data files being transmitted to the SES Americom spacecraft (i.e., the US domestic satellite service, DOMSAT) is ported to a computer at the Wallops Command and Data Acquisition (WCDA) Facility. Software has been designed to build a file of the GOES DCS data based on three criteria. First, there can be a parameter based on time; second, their size of the file can be based on the number of messages; third, the number of bytes can be the determining factor. The criteria are selectable.

When the file is built at the WCDA, it is tagged with a “date/time group” name. This is useful in determining the confirmation of the file transfer. The DCS files are transmitted to the Environmental Satellite Processing Center (ESPC) facilities in Suitland, Md. At this point the files are incorporated in the Low Resolution Information Transfer (LRIT) data stream.

This completed stream is then re-transmitted to the WCDA station where it is up-linked to the GOES spacecraft. When it reaches the spacecraft it is transmitted to the entire hemisphere through a transponder. This service allows any DCS customer who can transmit to the spacecraft – to receive from the spacecraft.

The WCDA facility has the capability to receive the LRIT data. Here a comparison is made with the data that was originally transmitted. This is where the naming convention becomes a useful tool in the quality monitoring of the GOES DCS data in the LI broadcast. If a file is transmitted and not received, then an automatic retransmission is generated.

In addition, the WCDA has commissioned software that is open-source and Government-owned that will select the GOES DCS data from the total LRIT stream to allow users to display the DCS data in its original format. This software is available to all manufacturers that would like to use it. To obtain a copy of this software, please visit our website at http://www.noaasis.noaa.gov/LRIT/.

4. Summary

NOAA’s LRIT service is operational on both the GOES-East and GOES-West spacecrafts. It will be available on the GOES O-P satellites when they are brought into service. On the future GOES-R series of satellites, LRIT will transition to a combined HRIT/EMWIN Service. Our short range plans include the restoration and expansion of the product suite and adding imagery from other polar and geo-stationary satellites. NOAA will also concentrate on outreach to the user community

and working to expand its LRIT's use. NOAA has also concentrated its efforts on upgrading system reliability and monitoring activities.