

12.17 NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)  
IMPLEMENTATION OF LOW-RATE INFORMATION TRANSMISSION (LRIT) SERVICES

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1. NOAA AND LRIT BACKGROUND

NOAA's National Environmental Satellite Data Information Service (NESDIS) currently uses Weather Facsimile (WEFAX), an analog meteorological broadcast service, to disseminate Geostationary Operational Environmental Satellite (GOES), Polar Orbiting Environmental Satellite (POES) and foreign satellite meteorological data to direct broadcast users via the GOES L-band down-link frequency. In response to the World Meteorological Organization's (WMO) recommendations for digital meteorological satellite broadcasts, the follow-on series, GOES NOPQ, will replace WEFAX with a new digital service called Low-Rate Information Transmission (LRIT).

Since the transmission formats of WEFAX and LRIT are incompatible, the current WEFAX users will need to upgrade or replace their existing WEFAX stations to receive the new LRIT products. The development of relatively inexpensive ground stations for receiving NOAA LRIT transmissions is a major goal of NOAA's WEFAX-LRIT transition plan.

2. EVOLUTION OF LRIT REQUIREMENTS AND SPECIFICATION

During the 1990's the Coordination Group for Meteorological Satellites (CGMS) met periodically to discuss, coordinate and develop a plan and specification (i.e., CGMS LRIT/HRIT Global Specification, Doc. No. CGMS 03) for the dissemination of digital data to LRIT user stations. This data is intended to include rasterized image data mapped to the surface of the Earth as well as other types of graphical information, alphanumeric data or binary data.

This CGMS Global Specification defines multiple levels of a specific data format that is generally consistent with both the Consultive Committee for Space Data Systems (CCSDS) and the International Standards Organization's (ISO) Open Systems Interconnect (OSI) reference model.

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NOAA and other world meteorological agencies have proceeded to develop subsequent, more detailed system specifications for the purpose of designing and implementing their specific LRIT systems. NOAA is currently completing its LRIT system specifications for the LRIT ground systems (e.g., LRIT data generation and transmission) and the LRIT user stations (e.g., LRIT receive stations).

3. NOAA WEFAX AND LRIT PRODUCTS

The NOAA LRIT data will evolve from the current WEFAX product suite. It will take advantage of the new digital format to provide more data as well as greater flexibility.

3.1 Current WEFAX Service and Products

The current NOAA WEFAX service is a 24/7 continuous operation on two GOES spacecraft, GOES East and West. Each product takes 4 minutes to transmit except the National Weather Service (NWS) Chart products, which take 5 minutes. Table 1 given below shows the current typical product suite for each spacecraft.

TABLE 1

GOES EAST WEFAX	GOES WEST WEFAX
135 GOES products	132 GOES products
44 NOAA Polar products	44 NOAA Polar products
2 TBUS 3 msg files	2 TBUS 3 msg files
67 Meteosat products	7 Meteosat products
59 NWS Chart products	58 NWS Chart products
	40 GMS products

3.2 LRIT Service and Product Considerations for Initial Operational Capability (IOC)

Geostationary satellite data is the primary WEFAX product. Current GOES products on WEFAX consist of large areas of coverage, such as full disk and northern hemisphere in low resolution (16 km), and smaller areas of coverage in higher resolution (8 km quadrants, 4 km

CONUS) derived from the same GOES Variable (GVAR) ingest. The current limitations of the product processing system cause dissemination delays of 15 minutes to over an hour. The current LRIT dissemination plan under consideration is to broadcast data segments or small chunks of near real-time GOES data that cover large geographic areas (e.g., full disc, northern hemisphere) in high resolution (e.g., 4 km) and allow the individual user to select their own areas of interest (i.e., sectors). The general advantage of this method is to provide more timely (i.e., lower latency) data distribution with greater product flexibility. NOAA plans to make available a limited amount of user station software that provides basic image and text display capabilities, but will rely on value added companies to develop and offer supplementary software that generates more advanced or sophisticated value added products or capabilities.

Additional products being considered for LRIT broadcasts include: 1) Emergency Managers Weather Information Network (EMWIN) data and 2) GOES Data Collection System (DCS) data. EMWIN data provides severe storm and other weather related warnings, and the DCS provides observational data from terrestrial platforms that generally monitor terrestrial environments and conditions.

The Japanese Geostationary Meteorological Satellite, GMS, and European Meteosat Second Generation, MSG, satellite systems will also broadcast similar LRIT data. There may be some limitation on the specific Japanese and European LRIT data that are permitted to be included in the NOAA LRIT broadcasts. Both the European and Japanese LRIT broadcasts are expected to begin sometime after 2002.

### **3.3 Transition Phase**

During the planned transition phase (6 to 18 months), when the GOES transponder may be time shared with both the existing WEFAX service and the new LRIT service, a limited suite of products will be made available on both WEFAX and LRIT. GOES data, being the primary product of WEFAX, will be given first priority. Polar WEFAX products, currently considered the least useful due to its severe latency, will generally be given lower priority. NWS charts, GMS and Meteosat data will be scheduled as time permits. NOAA will continue to accommodate specific user needs during this transition period whenever possible.

### **3.4 Service and Products Considerations for Final Operational Capability (FOC)**

The FOC increase in data rate from 64 kbps to 128 kbps will allow the product suite to be greatly expanded. This increased data rate may enable additional data (e.g., data from NMC models, GOES Rapid Scan, larger quantities of Polar data or possibly more foreign satellite data) to be included. The determination of what is included will be based on what is learned during IOC from user requests. Some of the candidate FOC capabilities currently being considered include:

- 1) Higher resolution data (e.g., 1 km resolution)
- 2) More frequent updates (i.e., lower latency)
- 3) Additional ocean data (e.g., winds, currents, sea state, sea surface temperature)
- 4) Additional polar data from both US and foreign sources
- 5) Significant environmental events (e.g., fires, floods, storms)

## **4. LRIT IMPLEMENTATION PLANS**

NOAA is currently planning to begin its new LRIT broadcast by the end of 2002, with LRIT test broadcasts scheduled to begin 3 to 6 months earlier. Regular LRIT broadcasts will actually begin before the new GOES NOPQ series of satellites becomes operational in 2003 or later. This will be achieved by using the current series of satellites, GOES I-M, for LRIT broadcasts. The actual recommended design and specification of the LRIT user station, however, is based on the lower Effective Isotropic Radiated Power (EIRP) of the GOES NOPQ series. The preliminary determination of the primary parameters of the LRIT user stations are as follows:

- 1) L-Band operation
- 2) Binary Phase Shift Keying (BPSK) modulation
- 3) IOC data rate of 64 kbps, FOC data rate of 128 kbps
- 4) Gain over Temperature (G/T) of -0.3 dBi/K with a 1 to 2 meter antenna
- 5) Forward Error Correction (FEC) using Reed-Solomon/Convolutional

The cost of an LRIT user station has always been a primary concern for NOAA. The cost is currently projected to be under \$5,000.00 and could even be considerably less than \$5,000.00. Development of prototype stations has already begun and is projected to be completed in early 2002.

The development of the Reed-Solomon/Convolutional coding and decoding software will be a primary focus of this development. Initial testing to validate the coding gain of this FEC has been successfully completed.

#### *References:*

CGMS, 1999: CGMS LRIT/HRIT Global Specification, Doc. No. CGMS 03.