THE CURRENT STATUS OF THE GOES LRIT SERVICE

1.0 Background

In response to Coordination Group for Meteorological Satellites (CGMS) recommendations for digital meteorological satellite broadcasts, the National Oceanic and Atmospheric Administration (NOAA) has replaced the Weather Facsimile (WEFAX) broadcast with a Low Rate Information Transmission (LRIT) digital service. NOAA uses its LRIT broadcast system to disseminate Geostationary Operational Environmental Satellite (GOES) data, GOES Data Collection System (DCS), the National Weather Service's Emergency Managers Weather Information Network (EMWIN) and other meteorological products to users using the 1691 Megahertz GOES L band down-link frequency. NOAA's LRIT system is based on the CGMS LRIT/HRIT Global Specification (CGMS Document Number CGMS 03, Issue: 2.6, dated 12 August 1999).

2.0 System Architecture, Descriptions, Designs and Specifications

The architecture of the LRIT system is presented in Figure 1 and consists of five processing domains interconnected by various communications media and one ground receive system domain. The NOAA LRIT implementation is based on the LRIT global specifications endorsed by the CGMS. The detailed LRIT specifications of both the European [i.e., European Organization for the Exploitation of Meteorological Satellite (EUMETSAT)] and Japanese Meteorological Agency were reviewed and considered to maximize the interoperability between the systems.

2.1 Summary of Domains 1 through 6.

Figure 1, on page 2, presents a high level functional flow for LRIT Domains 1 through 5.

Domain 1 (Advanced Front End Processor - AFEP) receives the GOES Variable format (GVAR) data and clock data through an antennae system from the Command and Data Acquisition (CDA) Station at Wallops, Virginia. The AFEP parses the data and delivers the relevant visible and infrared images to the main processor. The LRIT Domain 1 processor within the AFEP creates the Level 1A meteorological imagery products in a McIDAS area file format for distribution.

The Domain 1 processor builds partial image files or segments from a fixed number of scan lines in each image. This subdivision of the full image reduces the size of transmitted files, reduces latency, and provides a means for a Domain 6 ground receiver workstation user to build an image even if some data are corrupted during transmission.
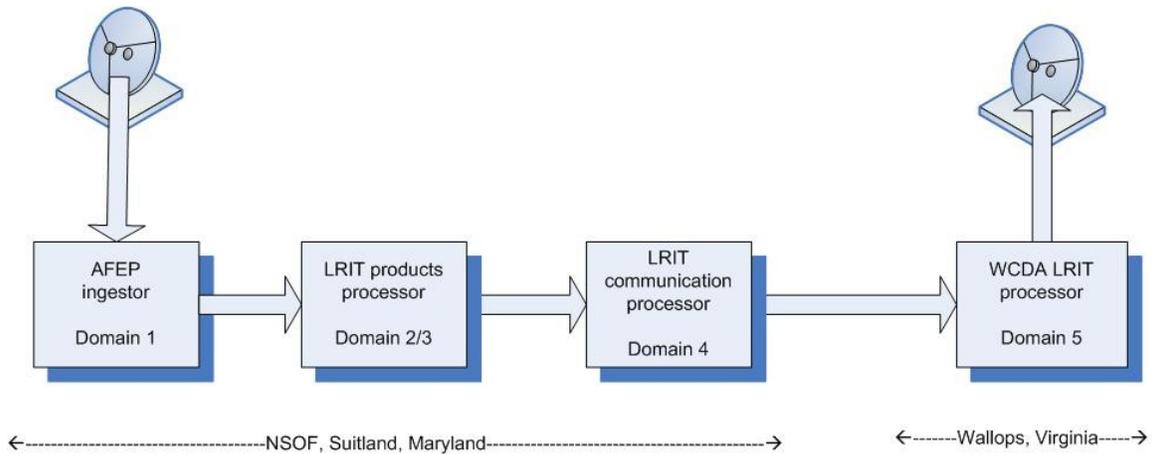
Figure 1 High level functional flows for Domain 1 through 5.

The LRIT product processor (Domain 2/3) creates the files that will be broadcast over the GOES East and West broadcasts. The Domain 2 and 3 reside on a single server and are referred to as LRIT Domain 2/3. Currently, products processed within the LRIT Domain 2/3 include GOES imagery segments received from Domain 1; GOES DCS files received over the internet from the Wallops CDA; environmental products pulled from NOAA locations including tropical storm information from a NOAA web sites; and text administrative messages inserted by NOAA personnel into the Domain 2/3. Header records, metadata and images data are converted into LRIT format and transmission priority is set LRIT products processor and sent to Domain 4 for further processing and delivery to the Domain 5 at the Wallops CDA.

The LRIT Domain 4 Communication Processor is an Intel-based, high-reliability server running the Linux operating system. The Communication Processor receives files from Domain 2/3 and generates a compressed LRIT data stream of virtual channel data units (VCDU). Also added to the stream is an EMWIN stream. EMWIN information is a bit-stream that is then converted to a simple file encapsulation. The entire LRIT data stream is then sent by Domain 4 to the LRIT Domain 5 at the Wallops CDA. Figure 2, on page 3, presents high level functional flow for Domain 4 and 5.
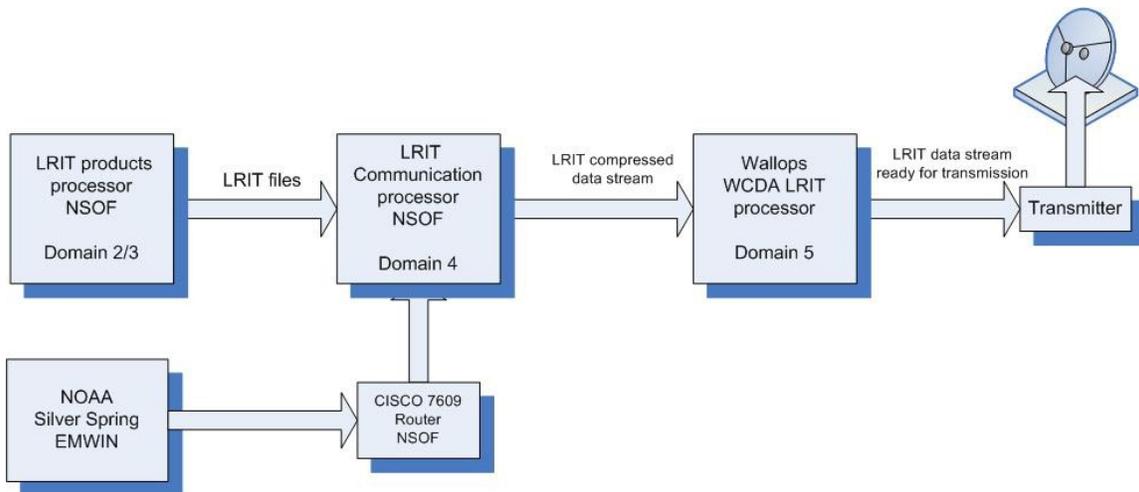
Figure 2 High level functional flows for Domain 4 and 5.

The Domain 5 is a Commercial Off-The-Shelf AVTEC Programmable Telemetry Processor. Domain 5 maintains a constant uplink rate (IOC=146.942 kbps, FOC=293.884 kbps) to supply the transmitter with LRIT data stream. The Domain 5 servers provide the physical layer processing. Domain 5 adds Reed-Solomon coding, interleaving, randomization and convolutional coding of the serialized data stream. LRIT Domain 5 also buffers the data stream and maintains a constant data rate through the use of added fill data bits. Domain 5 also adds a clock signal to the transmit modulators.

The LRIT Domain 6 user terminal is implemented using the lowest risk approach, while maintaining the NOAA low cost goal. A typical user station consists of four main components as illustrated in Figure 3 below. The 1.8-meter antenna is a parabolic dish antenna with no auto tracking. The downlink signal is received at
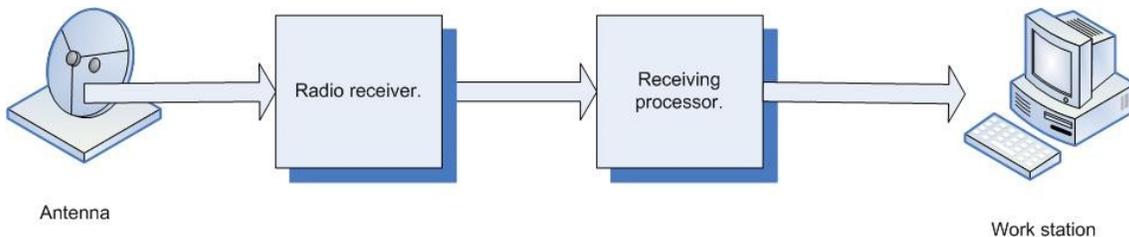

Figure 3 LRIT user station system.

1691 Megahertz (MHz). The signal may be filtered to reduce adjacent channel interference and/or amplified by a low-noise amplifier. Then it is down-converted to the Radio receiver IF frequency. The IF amplifiers have an IF bandwidth capable of receiving a 293 kbps symbol stream. The IF signal is then demodulated in the Receiving processor demodulator and the base band output to the Receiving processor is a serial bit stream. Domain 6 Work station receives this data stream, groups file segments, extracts and concatenates them and finally displays or stores the outputs.

3.0 Current Product Suite

The NOAA LRIT schedules are shown below in tables 1 and 2.

Product Name	Format	Source	Schedule	Reference
GOES East	Imagery: 1. Visible. 2. Infrared. 3. Water Vapor.	LRIT System	GOES Schedule	http://www.oso.noaa.gov/goes/schd-sector/index.htm
GOES West	Imagery: 1. Visible. 2. Infrared. 3. Water Vapor.	LRIT System	GOES Schedule	http://www.oso.noaa.gov/goes/schd-sector/index.htm
Tropical Storm Products	Graphic	NOAA/NWS Hurricane Center	Hourly	http://www.nhc.noaa.gov/tafb_latest/
EMWIN	Text	National Weather Service	As Received	http://www.weather.gov/emwin/index.htm
DCS	Text	NOAA/NESDIS/OSO	As Received	http://www.noaasis.noaa.gov/DCS/
Meteosat (MSG)	Graphic	NOAA/NESDIS/OSDPD	Hourly	http://www.osdpd.noaa.gov/ml/info/index.html
MTSAT	Graphic	NOAA/NESDIS/OSDPD	Hourly	http://www.osdpd.noaa.gov/ml/info/index.html
Administrative Text Message	Text	LRIT System Administrators	Hourly or As Needed	N/A

Table 1: NOAA GOES East LRIT Content Table (Updated 092109)

Product Name	Format	Source	Schedule	Reference
GOES West	Imagery: 1. Visible 2. Infrared 3. Water Vapor	LRIT System	GOES Schedule	http://www.oso.noaa.gov/goes/schd-sector/index.htm
GOES East	Imagery: Infrared	LRIT System	GOES Schedule	http://www.oso.noaa.gov/goes/schd-sector/index.htm
Tropical Storm Products	Graphic	NOAA/NWS Hurricane Center	Hourly	http://www.nhc.noaa.gov/tafb_latest/
EMWIN	Text	National Weather Service	As Received	http://www.weather.gov/emwin/index.htm
DCS	Text	NOAA/NESDIS/OSO	As Received	http://www.noaasis.noaa.gov/DCS/
Meteosat (MSG)	Graphic	NOAA/NESDIS/OSDPD	Hourly	http://www.osdpd.noaa.gov/ml/info/index.html
MTSAT	Graphic	NOAA/NESDIS/OSDPD	Hourly	http://www.osdpd.noaa.gov/ml/info/index.html
Administrative Text Message	Text	LRIT System Administrators	Hourly or As Needed	N/A

Table 2: NOAA GOES West LRIT Content Table (Updated 092109)