HRIT/EMWIN

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GOES Data Collection System

Joint Satellite Conference DCS Training

Boston, Massachusetts

October 2019

HRIT/EMWIN Training Topics

-HRIT/EMWIN Background Information

-GOES Constellation

-HRIT/EMWIN Ground System Overview

-HRIT/EMWIN Production Overview

-DCS on HRIT Performance

-PDA DCS Specific HRIT/EMWIN Release Issues & Schedule

-NOAASIS Website and Quarterly User Group Meetings

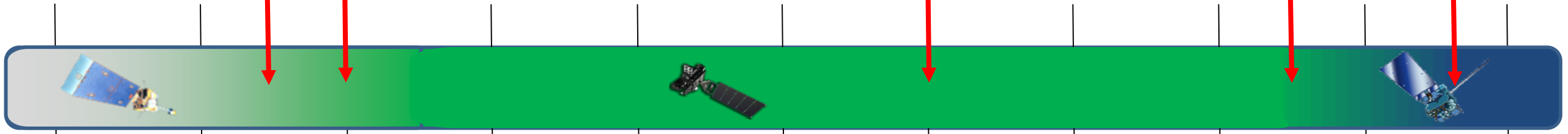
Historical Transition Overview

WEFAX transition to LRIT started with GOES East, then GOES West two years later

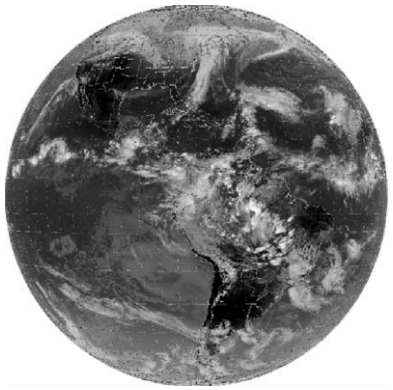
LRGS DCS Data added to LRIT Broadcast

DADDS DCS Data added to LRIT Broadcast

HRIT transition started with GOES-16 declared operational in June 2017, then complete with GOES-17 declared operational in February 2019. DADDS alone feeds the HRIT broadcast.

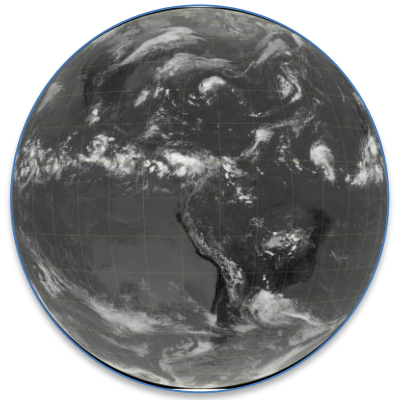


2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020



16km resolution IR Image off of WEFAX every 3 hours with end-to-end latency of 90 minutes

4km resolution IR Image off of LRIT every 3 hours with end-to-end latency of 31 minutes

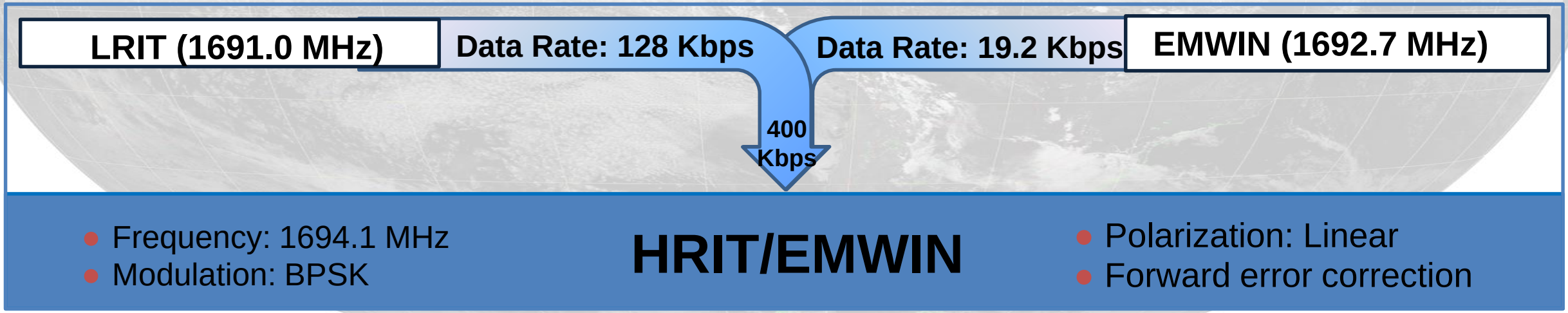


2km resolution IR Image off of HRIT every 30 minutes with a latency of 3 minutes

High Rate Information Transmission (HRIT)

What is HRIT/EMWIN?

- The High Rate Information Transmission/Emergency Manager Weather Information Network's (HRIT/EMWIN) is available only on the GOES-R series satellites and is the follow up to both the separate LRIT and EMWIN broadcasts onboard the GOES-NOP satellites.
- HRIT/EMWIN's objective is to continue the previous broadcast services of LRIT and EMWIN at a significantly higher data capacity. This is accomplished by combining the two services into a single service with a data relay capacity of 400Kbps.
- HRIT/EMWIN provides more imagery channel selection with greater resolution at a more frequent rate than previous LRIT broadcasts.



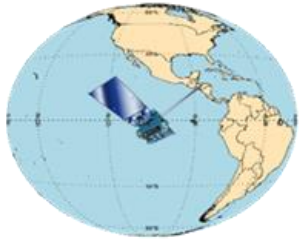
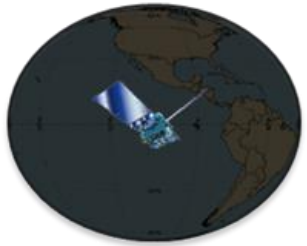
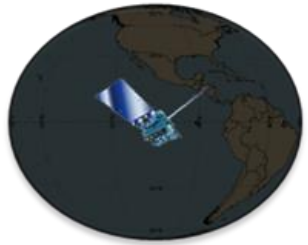
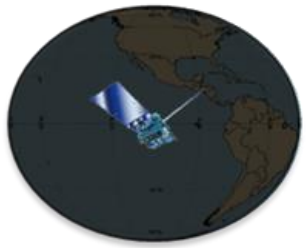
Description of the Broadcast

Characteristic	HRIT/EMWIN Broadcast Specifications
Platform	Operational East and West GOES-R Series Satellites
Operating Frequency Range	L-band
Center Frequency	1694.1 MHz
Data Rate	400 kilobits per second (Kbps)
Symbol Rate	927,000 symbols per second (sps)
Modulation	BPSK
Polarization	Linear – Vertical offset
Antenna System	At 5 degree elevation, the minimum antenna is 1.2 meter. At 10 degrees or more, the minimum size is 1.0 meter

How to Receive HRIT/EMWIN

- To receive HRIT/EMWIN, a user can purchase the necessary equipment (antenna, cabling, receiver, computer, and software) from commercial companies for unlimited access. A manufacturer's list is available at: https://www.noaasis.noaa.gov/GOES/manu_list.html
  - Previous compatible 1.0+ meter LRIT antennas, cabling and majority of LNB downconverters can be reused for HRIT/EMWIN
  - All LRIT 1691.0 MHz receivers will not work without modification or new 1694.1 MHz HRIT/EMWIN compatible receivers will need to be obtained
- The transmission format; "The Coordination Group for Meteorological Satellites LRIT/HRIT Global Specification" can be downloaded from: https://www.cgms-info.org/documents/cgms-lrit-hrit-global-specification-(v2-8-of-30-oct-2013).pdf
- The NOAASIS Web Site provides program and technical information at: https://www.noaasis.noaa.gov/GOES/HRIT/hrit.html
- A free software-based solution is described at the HRIT/EMWIN prototype receiver links and specifications webpage: https://www.goes-r.gov/users/hrit-links.html
- There is no fee, registration or license requirement required by NOAA to receive the products on HRIT/EMWIN

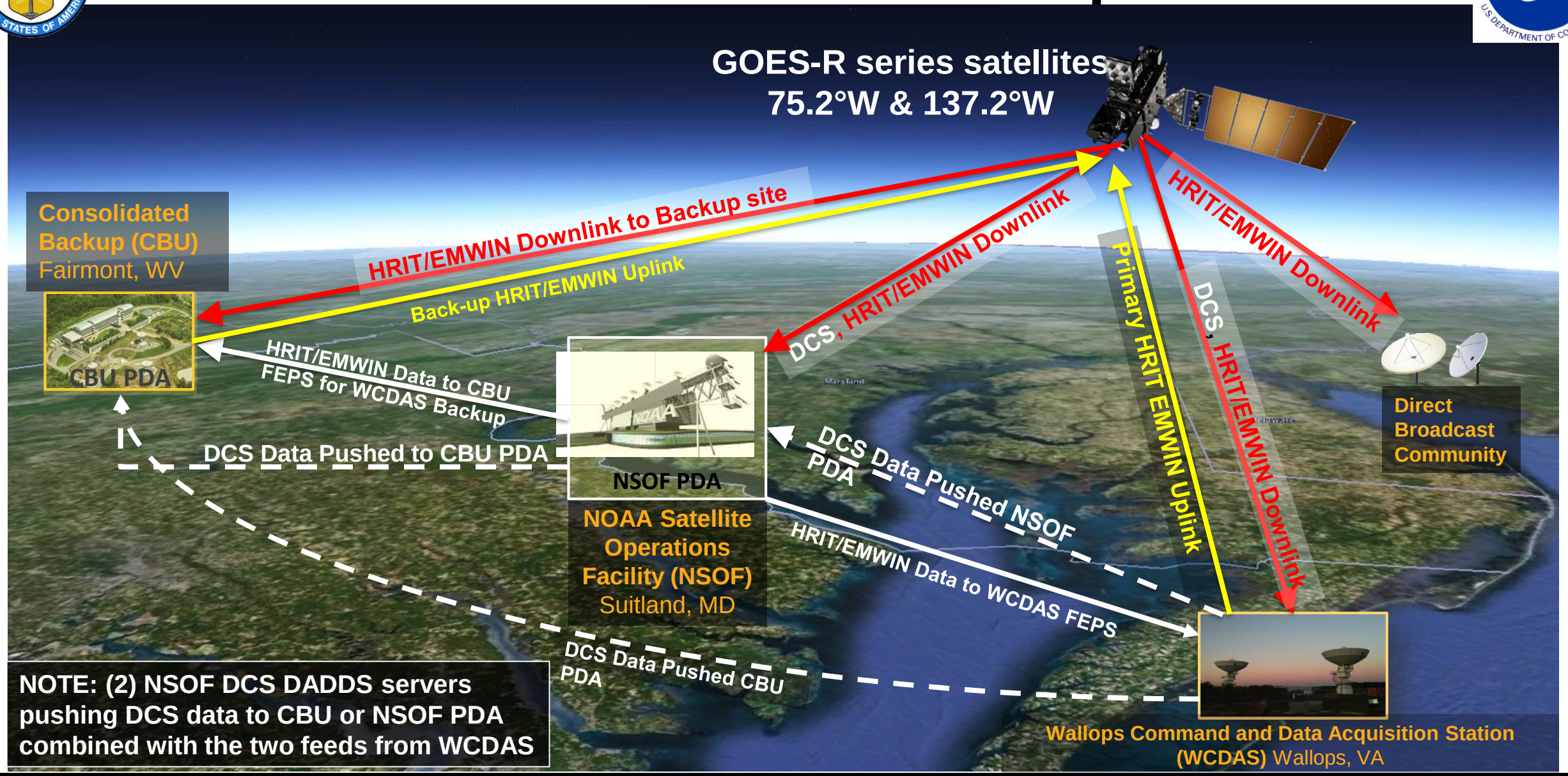
GOES Constellation Current and Future Status

	GOES-West	Tandem GOES-West	Standby	GOES-East
	GOES-17 137.2° West	GOES-15 128° West	GOES-14 105° West	GOES-16 75.2° West
Current – Dec 31, 2019	 HRIT/EMWIN Active	 LRIT Disabled EMWIN Active	 LRIT Disabled EMWIN Active	 HRIT/EMWIN Active
Plan for Jan 2020	GOES-West GOES-17 137.2° West  HRIT/EMWIN Active	Storage GOES-15 128° West  LRIT Disabled EMWIN Disabled *Dec 31, 2019*	Standby GOES-14 105° West  LRIT Disabled EMWIN Disabled *Dec 31, 2019*	GOES-East GOES-16 75.2° West  HRIT/EMWIN Active

Ground Production and Uplink Systems

Characteristic	HRIT/EMWIN System Configuration
Input Streams All Go Through the Product Dissemination & Access (PDA) Systems	1. Imagery – PDA NSOF, Suitland, MD or WBU Fairmont, WV 2. EMWIN – NWS "Gateway" College Park, MD or Boulder, CO **3. DCS – DADDS NSOF, Suitland, MD or DADDS Wallops, VA** 4. NHC Products – Acquired over the internet at this time
PDA / HRIT-EMWIN Broadcast Stream Production	**Primary – Satellite Operations Facility (NSOF) in Suitland, MD** **Backup – Consolidated Backup Facility (CBU) in Fairmont, WV** **-Both can feed uplink antenna systems at Wallops, WV and the CBU**
Uplink Antenna Systems	**Primary – Command & Data Acquisition Station (WCDAS)** **Wallops Island, VA** **Backup – Consolidated Backup Facility (CBU) in Fairmont, WV** **-Both can uplink HRIT/EMWIN to GOES-R Series Satellites**
Downlink and Data Monitoring	**-Front End Processors linked to GOES-R antennas at WCDAS/CBU have both transmit and receive capability. Received files are relayed back to PDA's for transmit-receipt & checksum validation** **-Anomaly warning messages are generated to help desk & operators** **-VSAT stations are online at the NSOF for troubleshooting**
User Input on Broadcast Quality	-Input from users/manufacturers in the field is highly desired

GOES DCS to HRIT/EMWIN Operations



HRIT/EMWIN Bandwidth Management

A Product Group Name	Guaranteed Bandwidth	Maximum Bandwidth	Group Order Rank
EMWIN	8%	15%	1
DCS	**5%**	**10%**	**2**
Imagery	72%	100%	3

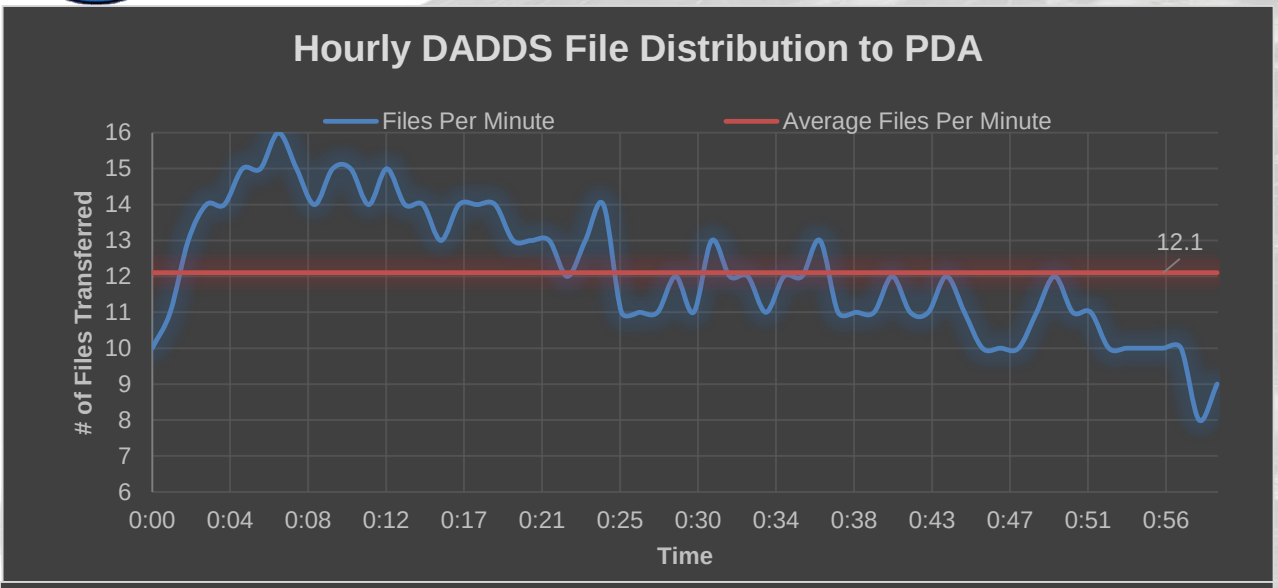
- HRIT has “subscriptions” to various products within the Product Distribution and Access (PDA) system
- When each of the subscriptions gets pulled for HRIT dissemination based on their availability or when they’re scheduled, they move over to HRIT’s Broadcast Management system where the subscriptions get labeled under a group listing and pushed to the dissemination queue for FEP uplink.
- HRIT separates subscriptions into three different groups and prioritizes each product on how its configured into the system.
  - DCS data group is the second highest priority behind EMWIN data

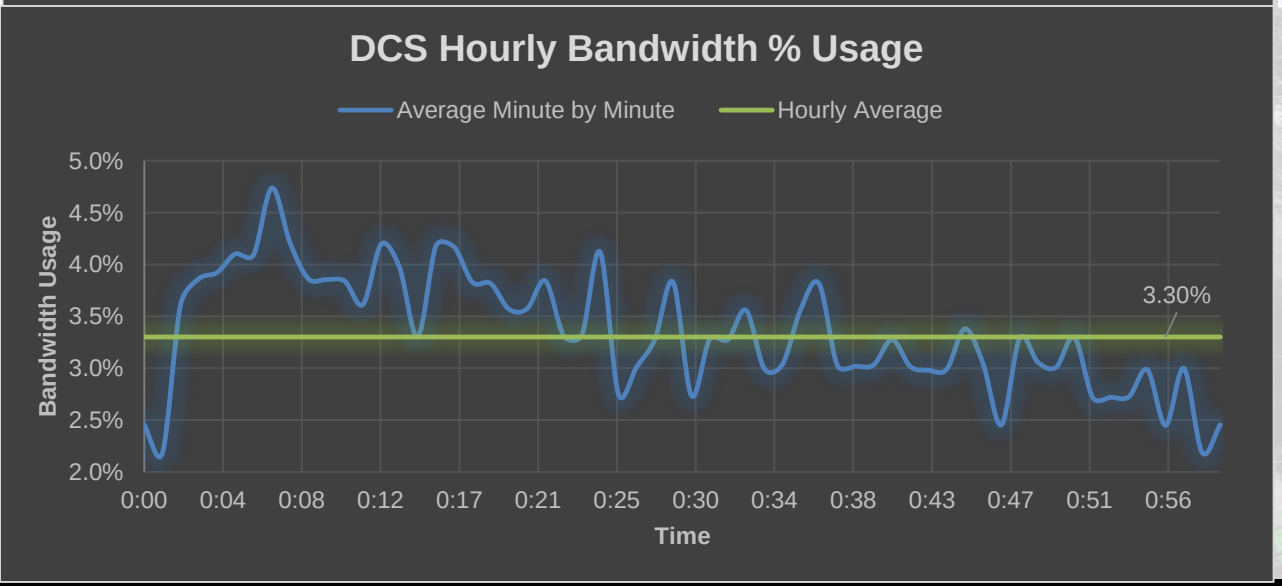
HRIT/EMWIN Virtual Channel ID and Group Listing

VCID #	Product Name	GOES-16 Availability	GOES-17 Availability	Period -Min	Format	Resolution	Product Source Information
0	Admin Text	X	X	60	Text Messages	N/A	Active and available
1	Mesoscale Imagery	X	X	15	HRIT/LRIT	0.5km Band 2, 2km for bands 7 and 13	Active and available
2	Cloud Moisture Imagery Band 2	X	X	30	HRIT/LRIT	2 km	Active and available
5	GOES-15 WV Imagery		X	30 - 180	LRIT	4 km	Available until Jan 2020
6	GOES-15 IR Imagery		X	30 - 180	LRIT	4 km	Available until Jan 2020
7	Cloud Moisture Imagery Band 7	X	X	30	HRIT/LRIT	2 km	Active and available
8	Cloud Moisture Imagery Band 8	X	X	30	HRIT/LRIT	2 km	Active and available
9	Cloud Moisture Imagery Band 9	X	X	30	HRIT/LRIT	2 km	Active and available
13	CMI Band 13	X	X	30	HRIT/LRIT	2 km	Active and available
14	CMI Band 14	X	X	30	HRIT/LRIT	2 km	Active and available
15	CMI Band 15	X	X	30	HRIT/LRIT	2 km	Active and available
16	G16 CMI Band 13		X	60	HRIT/LRIT	4 km	Active and available
17	G17 CMI Band 13	X		60	HRIT/LRIT	4 km	Active and available
20	EMWIN - Priority	X	X	Variable	Text	N/A	Active and available
21	EMWIN - Graphics	X	X	Variable	Graphic (e.g. GIF, JPEG)	N/A	Active and available
22	EMWIN - Other	X	X	Variable	Text and Graphic	N/A	Active and available
23	NWS Products	X	X	Variable	Graphic	N/A	Active and available
24	NHC Maritime Graphics Products	X	X	Variable	Graphic (e.g. GIF, JPEG)	N/A	Active and available
25	GOES-R/S Level II Products	X	X	Variable	HRIT/LRIT	2-10 km	Active and available
30	**DCS Admin**	**X**	**X**	**Continuous**	**Text**	**N/A**	**Active and available**
32	**DCS Data New Format**	**X**	**X**	**Continuous**	**Formatted Text**	**N/A**	**Active and available**
60	Himawari-8		X	60	LRIT	4 km	Active and available

Group Legend
- EMWIN
- DCS
- Imagery

DCS Statistics

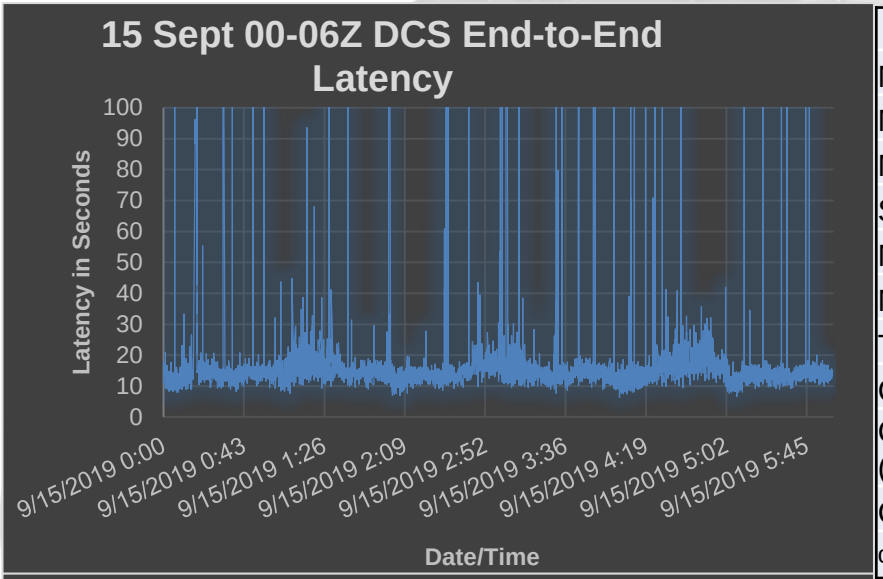




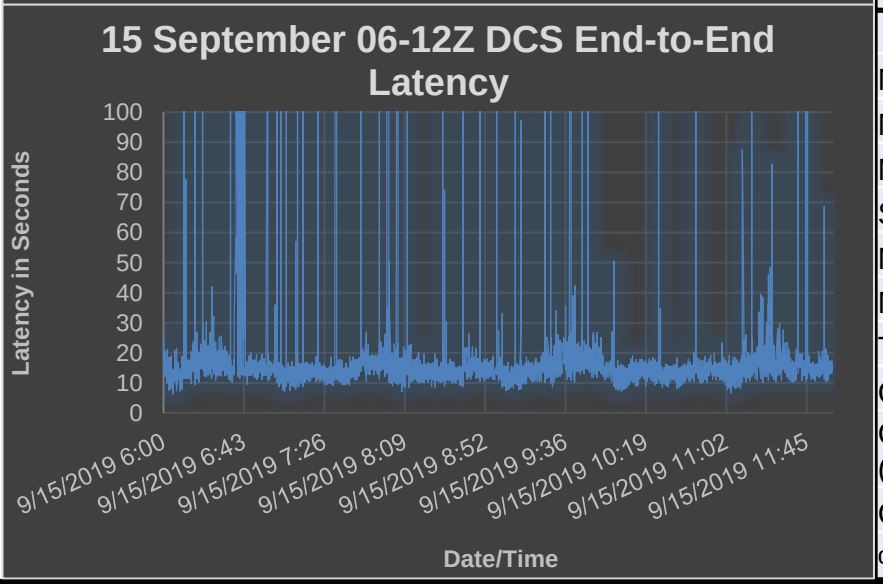
Average File Size	8.2 KB
Daily Amount Data Transferred	143.8 MB
Daily DCS File Count	~17400
File Distribution Frequency	~5 seconds
Average HRIT Bandwidth Usage	3.30%

- The Product Distribution and Access (PDA) system has met its 30-day average requirement of 99.44% availability over the past year in exception of one month.
  - Generally PDA software releases and database patching are impactful where outages occur.
    - HRIT has mitigated these significant outages by using the CBU backup site

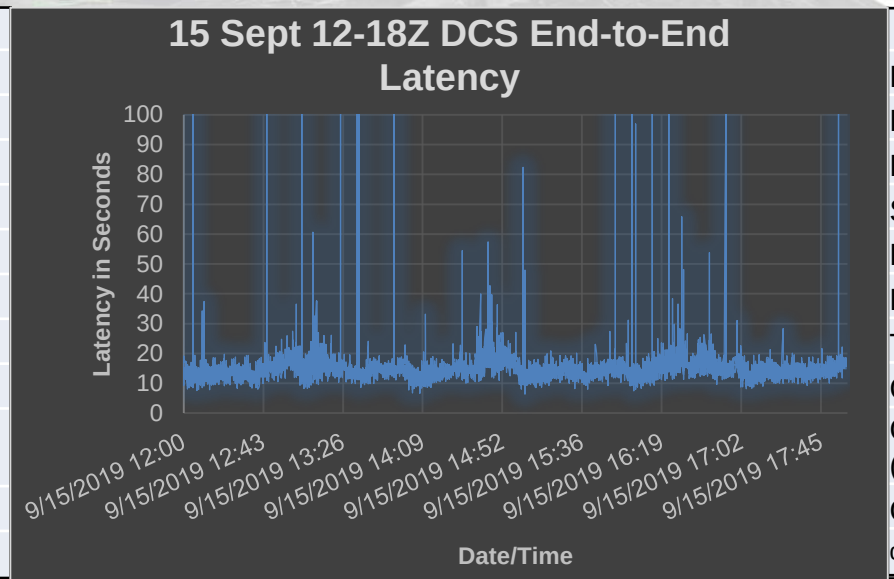
Recent DCS Latency Performance



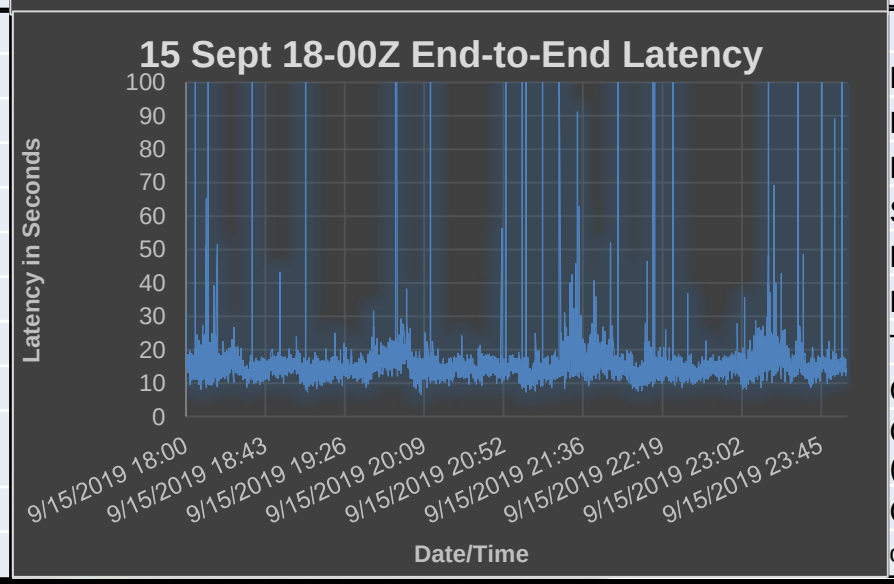
15th Sept 00-06Z	
Mean (seconds)	18.47
Median	14.29
Mode	14.11
Standard Deviation	0.57
Minimum	6.44
Maximum	743.57
Total Count	4364
Count 60-120 (sec)	32
Count 120-300 (sec)	18
Count >300 (sec)	19
% > 60 seconds	1.58%



15th Sept 06-12Z	
Mean (seconds)	18.89
Median	14.49
Mode	13.61
Standard Deviation	0.54
Minimum	6.34
Maximum	599.74
Total Count	4344
Count 60-120 (sec)	19
Count 120-300 (sec)	39
Count >300 (sec)	20
% > 60 seconds	1.80%



15th Sept 12-18Z	
Mean (seconds)	15.49
Median	14.45
Mode	15.01
Standard Deviation	0.16
Minimum	6.71
Maximum	282.58
Total Count	4372
Count 60-120 (sec)	6
Count 120-300 (sec)	13
Count >300 (sec)	0
% > 60 seconds	0.43%



15th Sept 18-00Z	
Mean (seconds)	16.19
Median	14.71
Mode	12.24
Standard Deviation	0.21
Minimum	6.83
Maximum	386.16
Total Count	4379
Count 60-120 (sec)	10
Count 120-300 (sec)	15
Count >300 (sec)	2
% > 60 seconds	0.62%

HRIT/EMWIN DCS Specific PDA Updates

PDA Release 3.3 (completed in May 2019)

✔ ENTR 4263 – "Fast Track" data.
- This fix will give HRIT data the highest priority within the shared PDA system, helping to reduce latency times.

✔ ENTR 4155 – HRIT Packet Format Error reported by Microcom. This fix is specific to the HRIT file packetization in regards to fill packets.

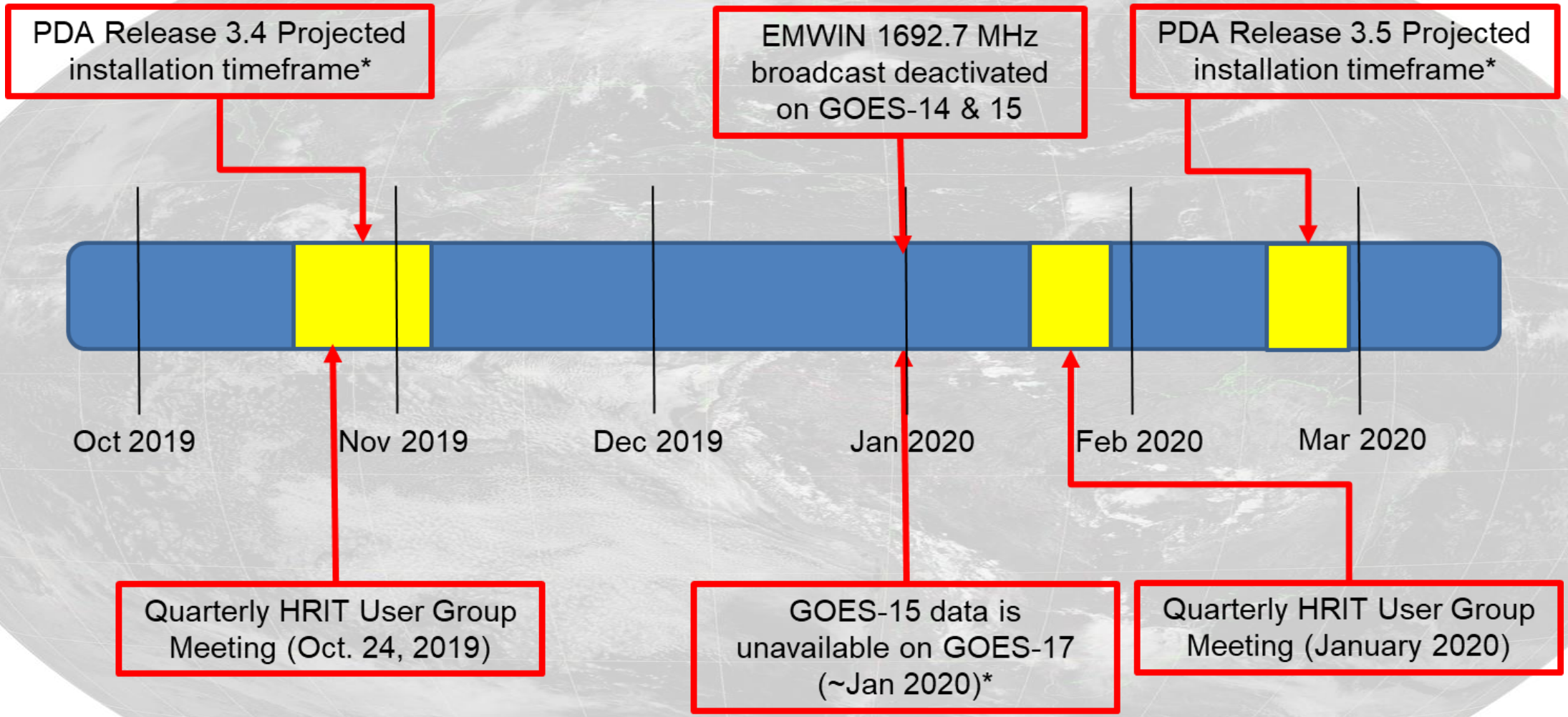
PDA Release 3.4

- ENTR 5298 – Upgrade to Java 8 for PDA/HRIT systems
  - Upgrading Java will fix the latency spikes observed in DCS/EMWIN data

PDA Release 3.5

- ENTR 5551 – Removing HRIT from shared PDA pathways
  - Gives HRIT the ability to bypass a large majority of PDA pathways while performing its own "tailoring" instead of sharing resources with other PDA products

HRIT/EMWIN Event Timeline

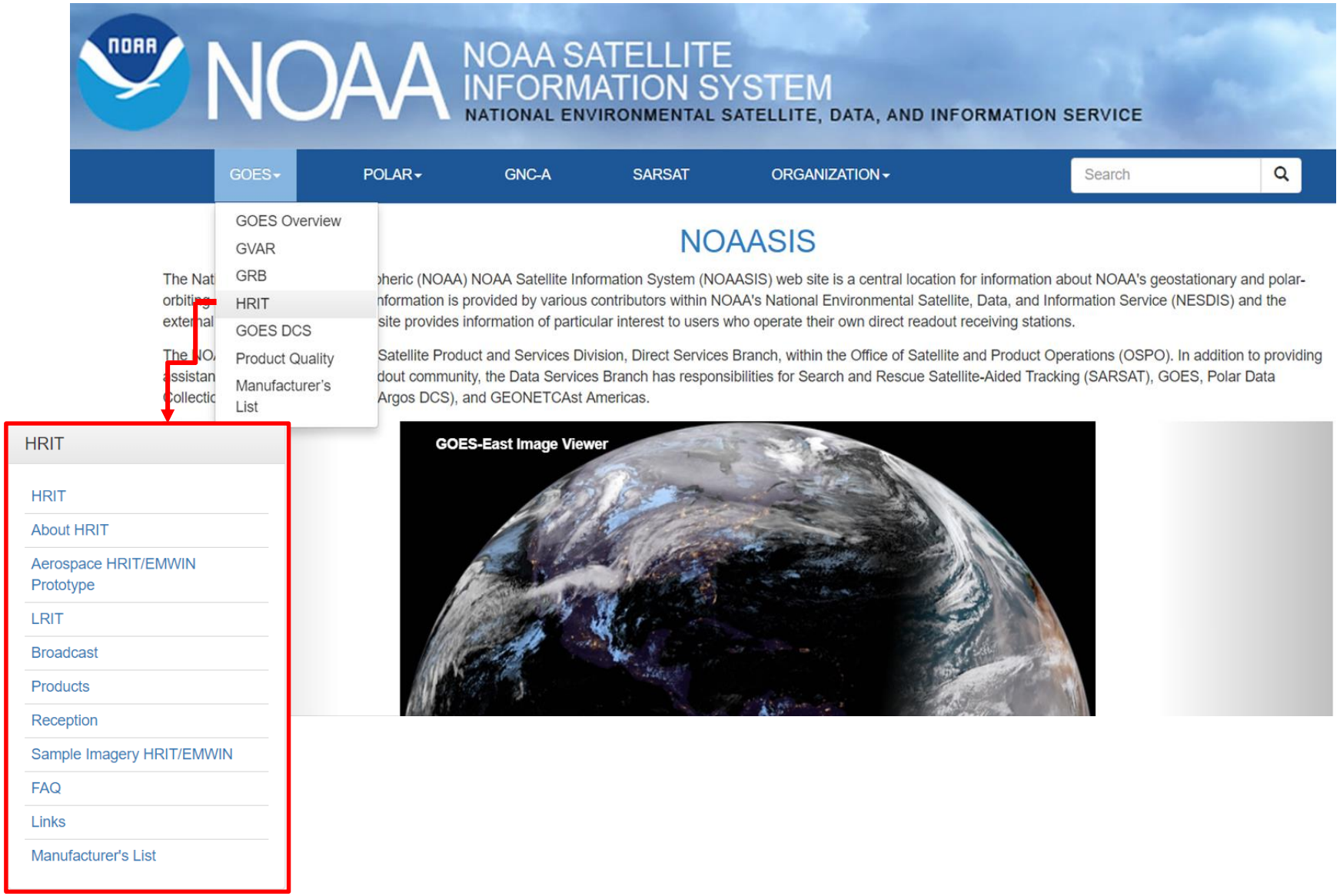


Dates are subject to change, these are just projections from the current ongoing development work taking place in October 2019

HRIT/EMWIN User Group

- NESDIS holds Quarterly HRIT User Group Meetings aimed at the following:
  - Providing the latest news and status on the HRIT/EMWIN broadcasts
  - Providing the latest status of upcoming GOES schedules
  - Information exchange, user feedback on broadcast content
  - User/Manufacturer Readiness for new product content or change.
  - Other topics as they arise
- Next planned meeting is October 24, 2019 at 1900 UTC.
  - Please contact seth.clevenstine@noaa.gov to be added to the HRIT User Group roster

New NOAASIS Website



- Went live on July 25th.
- The HRIT section includes information on the broadcast, products, reception, sample imagery, frequently asked questions and links to other affiliated organizations with NOAA (both internal and external)
- Any issues or comments for inclusion, feedback is welcome!

Contact Information

HRIT/EMWIN Broadcasts	EMWIN Product Information
Seth Clevenstine HRIT/EMWIN Program Manager Direct Services Branch Satellite Products and Services Division Office of Satellite and Product Operations NOAA NESDIS NOAA Satellite Operations Facility (NSOF) Suitland, MD Cubicle #1653 Email: Seth.Clevenstine@noaa.gov Tel: 301-817-4558	Robert Gillespie EMWIN Program Manager National Weather Service Office of Dissemination NOAA NWS 1325 East West Highway Silver Spring, MD 20910 Email: Robert.Gillespie@noaa.gov Tel: 301-427-9693