HRIT/EMWIN Status

GOES DCS Technical Working Group Meeting

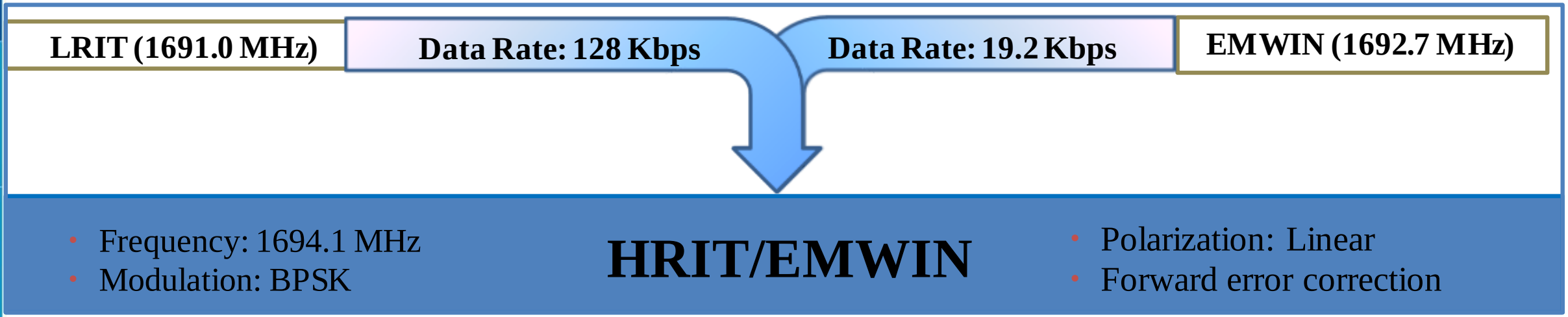
May 10th, 2022

Ian Avruch – HRIT/EMWIN Program Manager

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

HRIT/EMWIN Bandwidth Management

- HRIT "subscribes" to various products within the Product Distribution and Access (PDA) system. One being DCS data.
- 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 is the second highest priority behind EMWIN data

PDA Product Group Name	Guaranteed Bandwidth	Maximum Bandwidth	Group Order Rank
EMWIN	8%	50%	1
DCS	**5%**	**20%**	**2**
Imagery	87%	100%	3

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	Unavailable
6	GOES-15 IR Imagery		X	30 - 180	LRIT	4 km	Unavailable
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	Cloud Moisture Imagery Band 13	X	X	30	HRIT/LRIT	2 km	Active and available
14	Cloud Moisture Imagery Band 14	X	X	30	HRIT/LRIT	2 km	Active and available
15	Cloud Moisture Imagery 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	Available
21	EMWIN - Graphics	X	X	Variable	Graphic (e.g. GIF, JPEG)	N/A	Available
22	EMWIN - Other	X	X	Variable	Text and Graphic	N/A	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	Not Available	Not Available	Variable	HRIT/LRIT	2-10 km	Active and Available
30	**DCS Admin**	**X**	**X**	**Continuous**	**Text**	**N/A**	**Active and available**
32	**DCS Data**	**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

EMWIN Text Product Examples

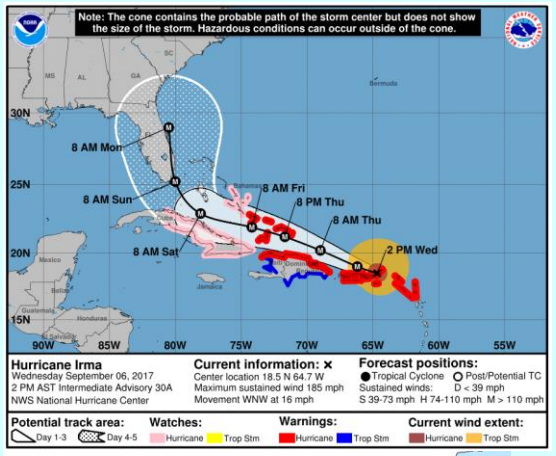
- Watches, Warning & Alerts, including:
  - Tsunami
  - Tornado
  - Flood
  - Severe Storms
- Forecasts
- Observations
- Climate Data
- Sever Weather Programs:
  - RA-IV Hurricane Operations Plan
  - Tsunami Warning Program

- All Non-Weather Emergency Alerts, including:
  - Avalanche Warning
  - Child Abduction Emergency
  - Civil Emergency Message
  - Earthquake Warning
  - Radiological Hazard Warning
  - Volcano Warning

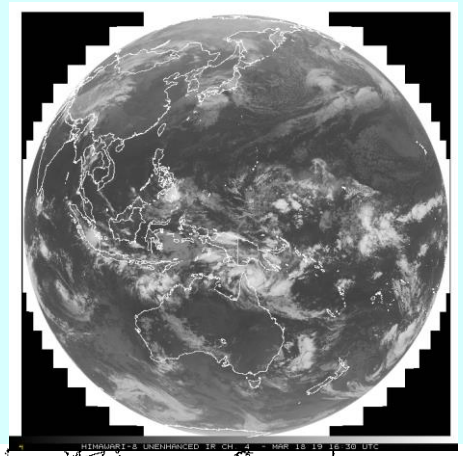
Source: R. Gillespie, 7 April 2022

EMWIN Image Product Examples

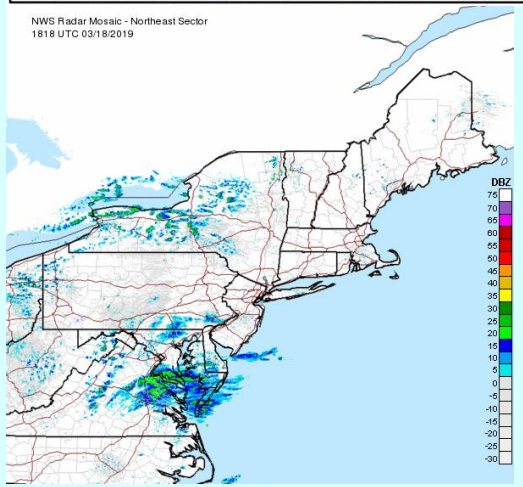
Hurricane Forecast Tracts



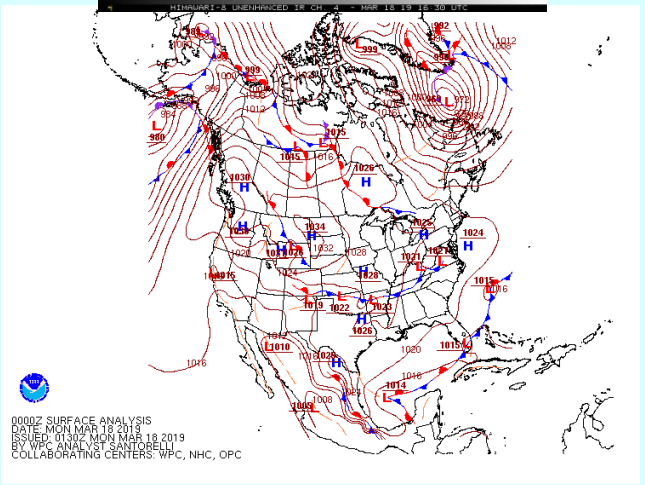
Satellite Imagery



Radar Mosaic Products



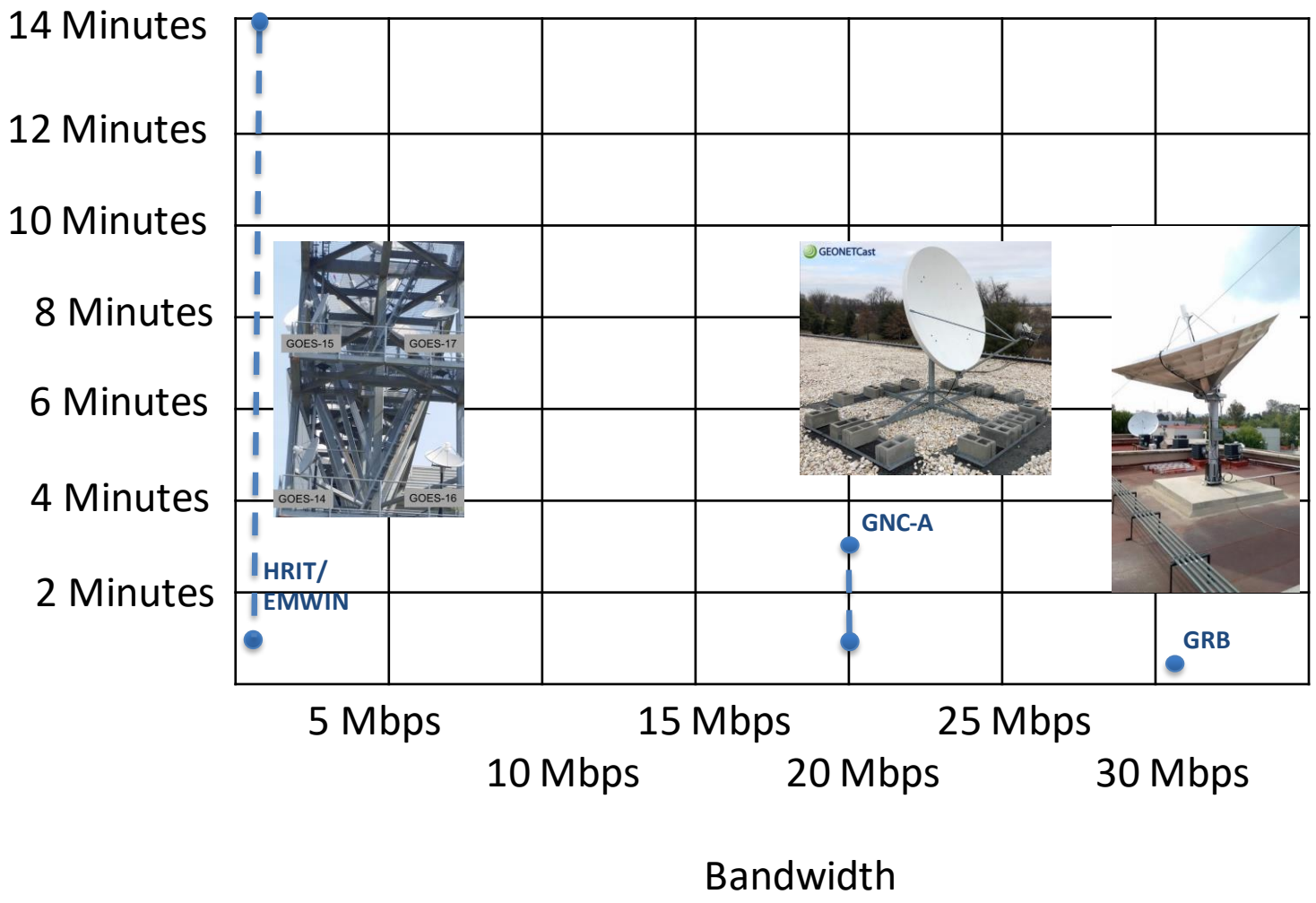
Surface Analysis



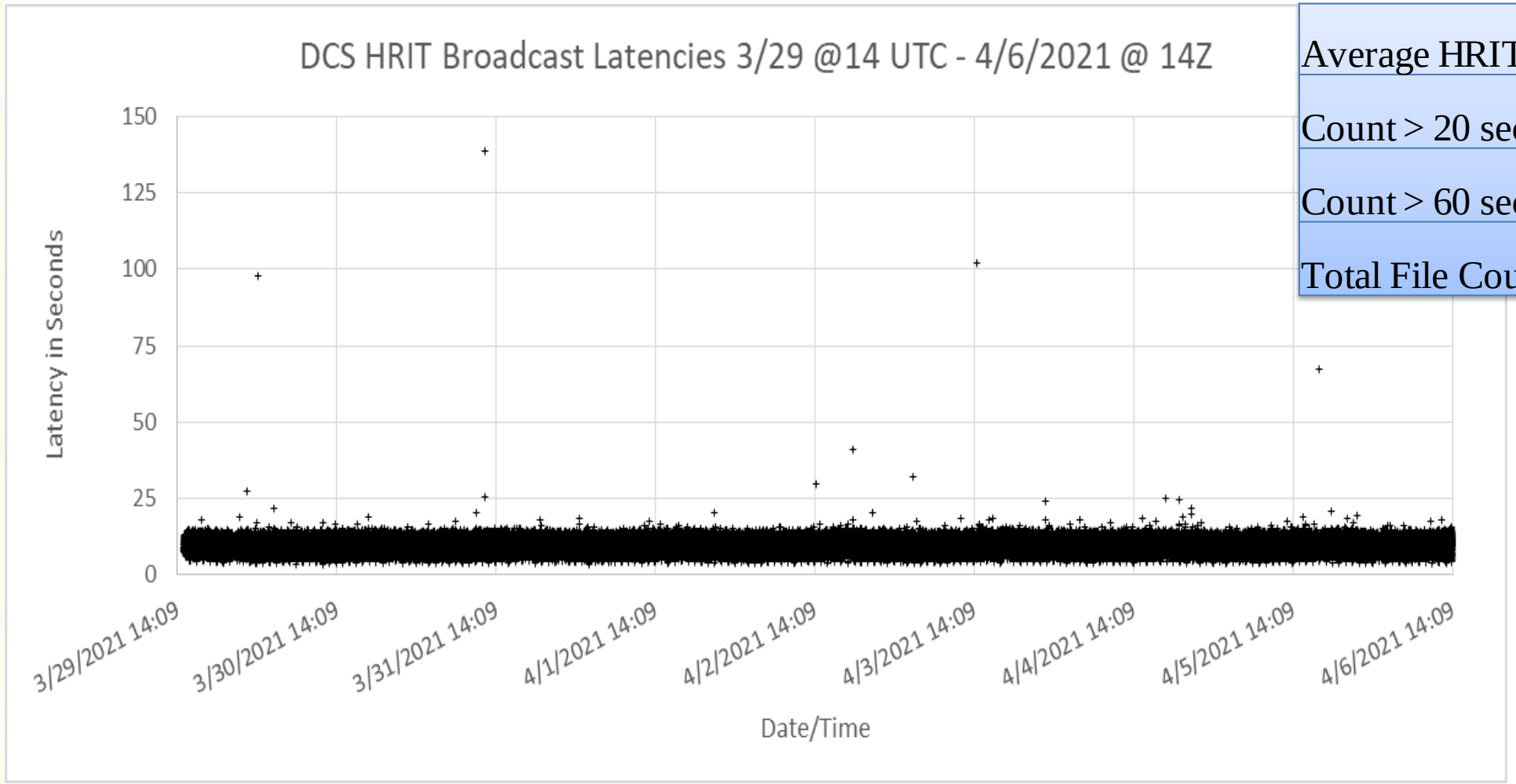
Source: R. Gillespie, 7 April 2022

Imagery Rebroadcast Bandwidth vs Latency

Data Latency
(From L1b generation to receipt by receive station), note GNC-A & HRIT/EMWIN use L2 CMI Data



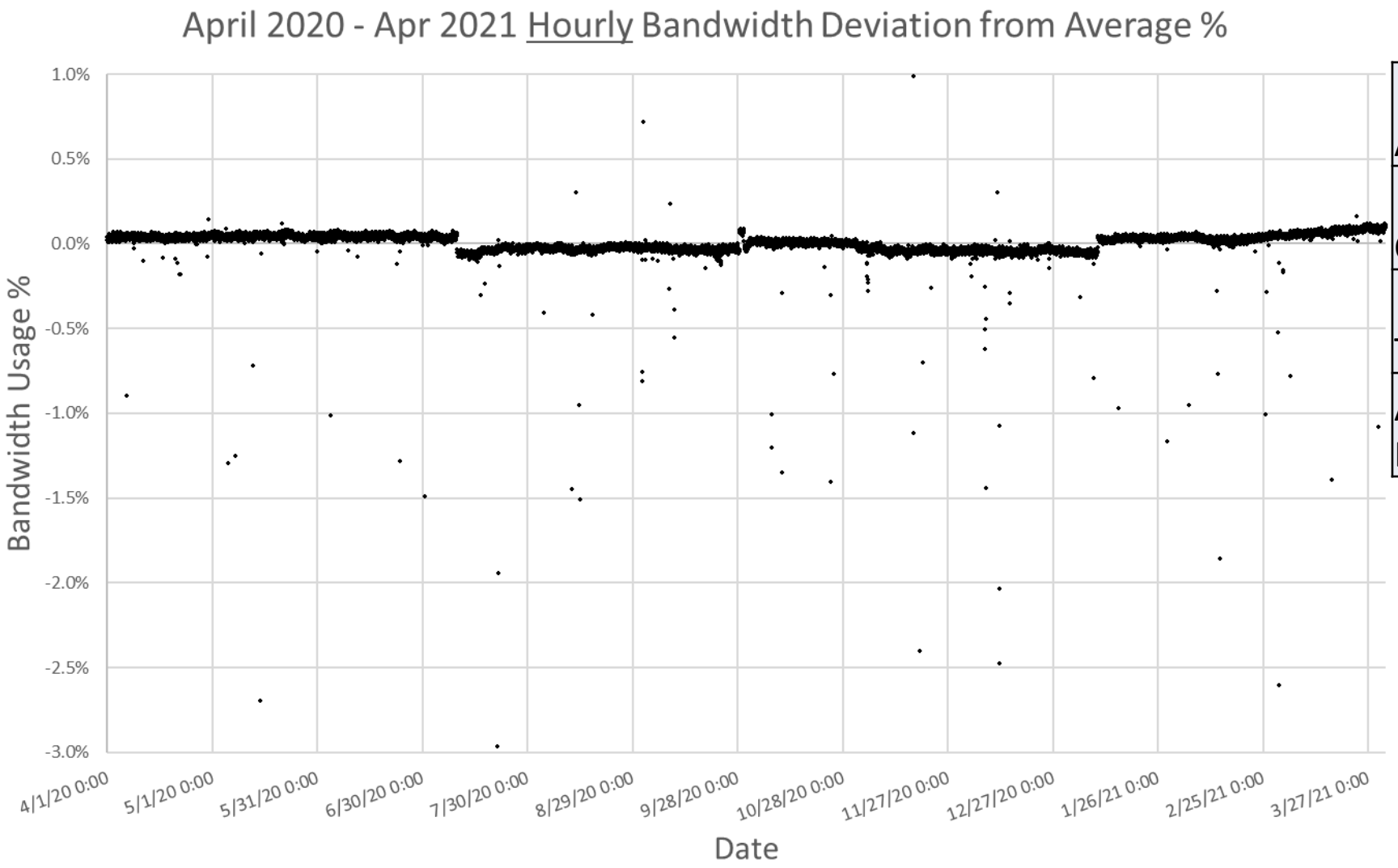
DCS Broadcast Latencies



Average HRIT Latency (s)	9.604798
Count > 20 seconds	18
Count > 60 seconds	4
Total File Count	147300

- DCS end-to-end latency is measured from DADDS timestamp to broadcast receipt. DADDS adds latency in gaining the necessary messages to make 8 KB file size.

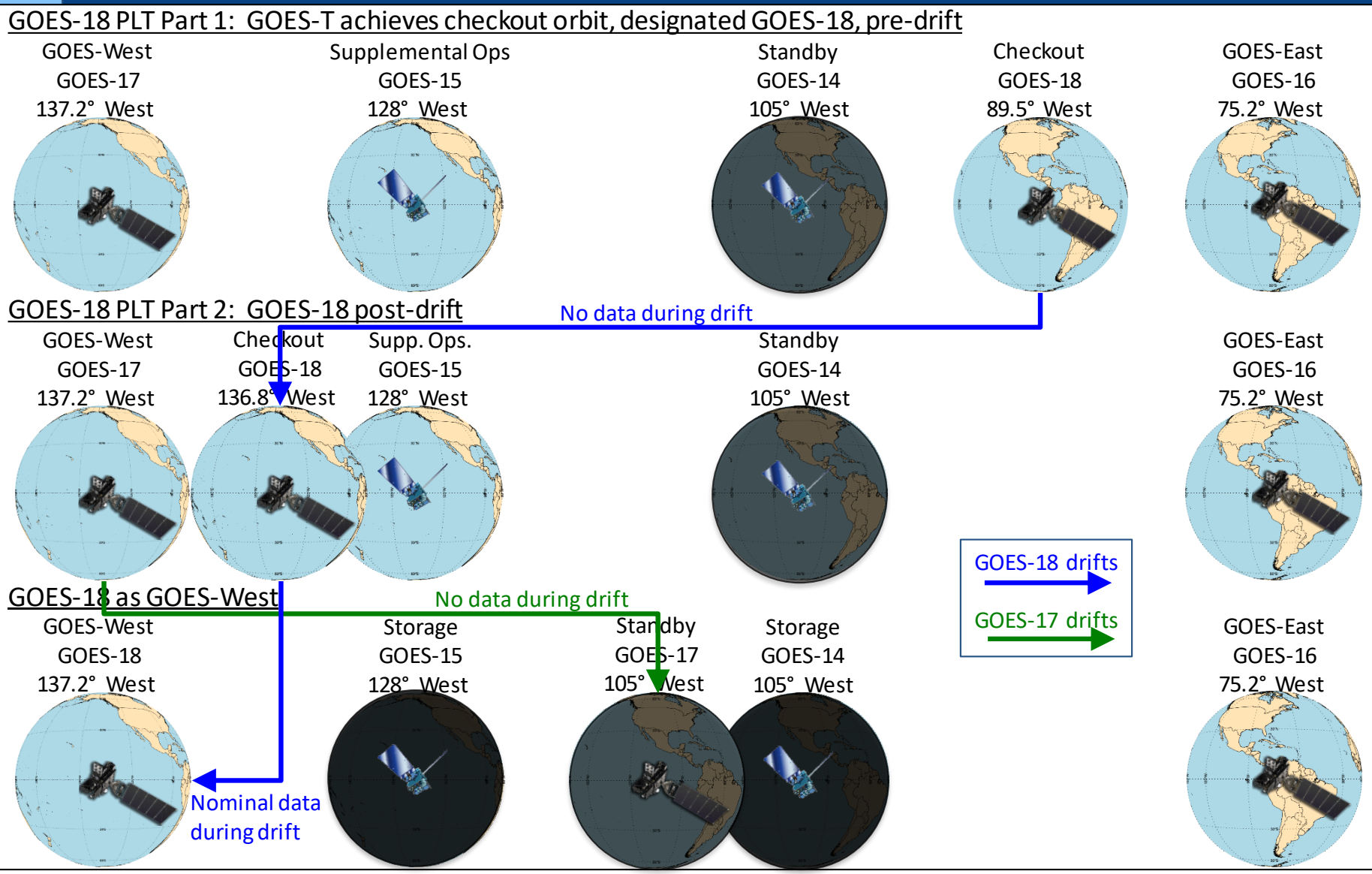
DCS on HRIT Availability Estimate



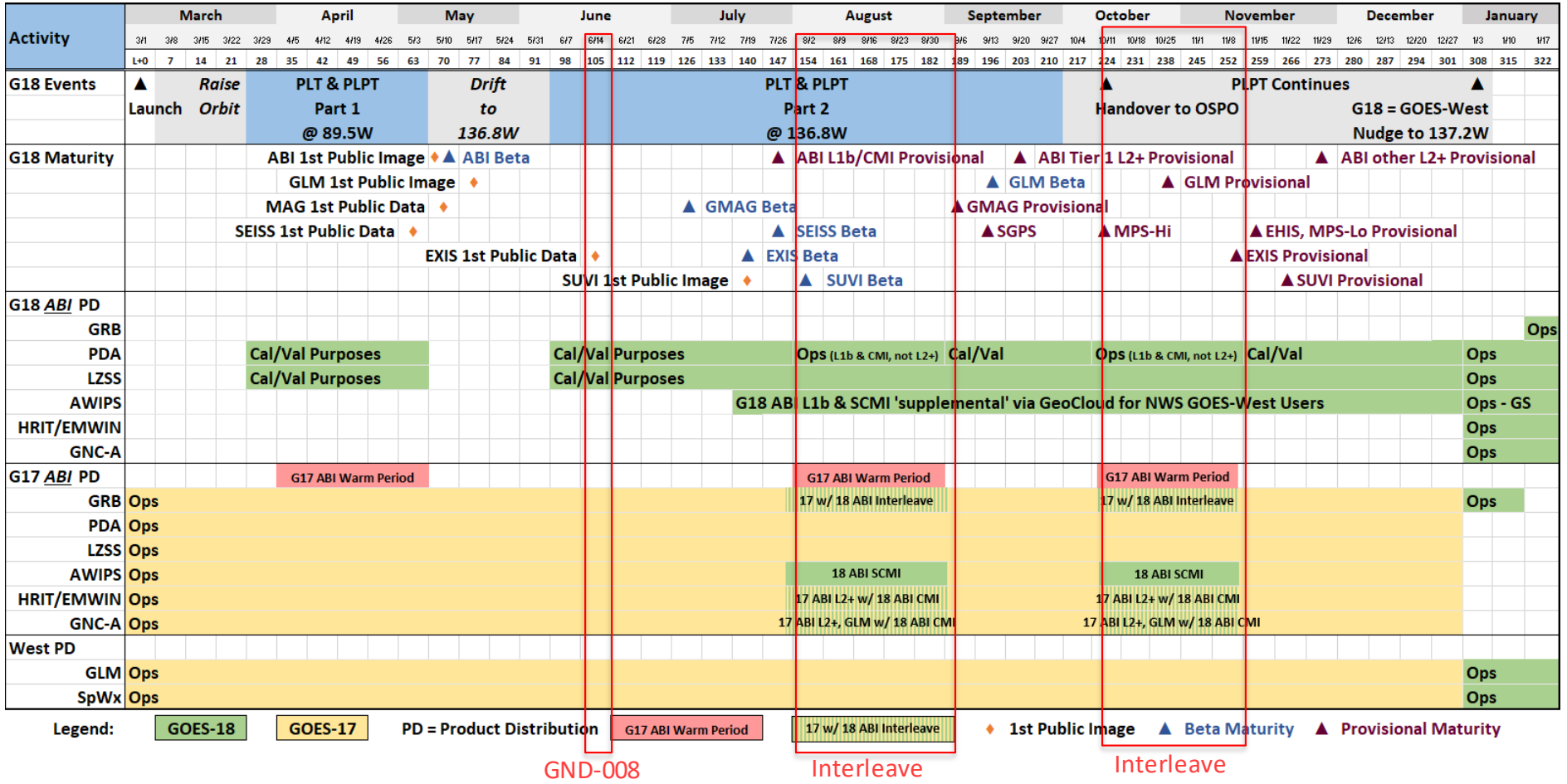
Average Bandwidth %	3.33%
Count < 95% Received	42
Total Counted Hours	8760
Availability >95% Expected	**0.995205**

- DCS file availability on HRIT is a bit higher than 99.5% as anything upstream will affect these %
  - PDA Anomalies
  - HRIT uplink site failovers
  - DADDS DRGS missing data

GOES Constellation



GOES-18 T2O Overview



Planning a 'split' Post Launch Test phase, beginning at 89.5°W and then drifting to 136.8°W in order to have early use of the GOES-18 Imager in the West location to mitigate the GOES-17 Imager thermal anomaly

PLTs of Interleave vs Nominal Interleave

	G18 PLT Test "GND-006"	G18 PLT Test "GND-009"	G18 PLT Test "GND-008"	Nominal Interleave
Description	Test of GRB interleave logic early during G18 PLT	Pre-drift test of Interleave	Post-drift test of Interleave	Early ops access to G18 ABI data as a mitigation for G17 ABI saturated images
Duration	2 hours	30 minutes	2-4 hours	36 days
Dates	May 9, 2022 prior to drift	~May 11, 2022 prior to drift after test "GND-006"	June 15, 2022 prior to Interleave	1st: August 1 – September 6, 2022 2nd: October 15 – November 11, 2022
GRB Content	G18 GRB at 89.5° West: • G16 ABI L1b • G17 GLM L2+, Space Wx L1b G16 GRB at 75.2° West: G16 L1b G17 GRB at 137.2° West: G17 L1b	G18 GRB at 89.5° West: • N/A G16 GRB at 75.2° West: G16 L1b G17 GRB at 137.2° West: • G18 ABI L1b (from 89.5° West)* • G17 GLM L2, Space Wx L1b • ~1 hour post-test impact to GRB user's trending of G17 ABI L2+ products (e.g., CSPP Geo products)	G18 GRB at 136.8° West: • N/A G16 GRB at 75.2° West: G16 L1b G17 GRB at 137.2° West: • G18 ABI L1b (from 136.8° West) • G17 GLM L2, Space Wx L1b	G18 GRB at 136.8° West: • N/A G16 GRB at 75.2° West: G16 L1b G17 GRB at 137.2° West: • G18 ABI L1b (from 136.8° West) • G17 GLM L2, Space Wx L1b
PDA Content	Nominal G16/17 G18 L1b and L2 products will not be distributed to PDA	• Potential G17 GLM, Space Wx metadata inaccuracies • All other G16/17/18 data nominal	Nominal G16/17/18	Nominal G16/17/18
AWIPS NCF Content	Nominal G16/17 SCMI		G18 ABI SCMI Nominal G16	G18 ABI SCMI Nominal G16
LZSS Content	Nominal G16/17 The G18 GRB interleave products will not go to LZSS	*G18 ABI L1b mapped to 89.5°W but delivered via G17 GRB at 137.2°W	Nominal G16/17/18	Nominal G16/17/18

Unique test/interleave configurations are indicated in blue
Anomalous Data Quality is indicated in red

Ver: 4/6/22 M. Seybold (amended I.Avruch)

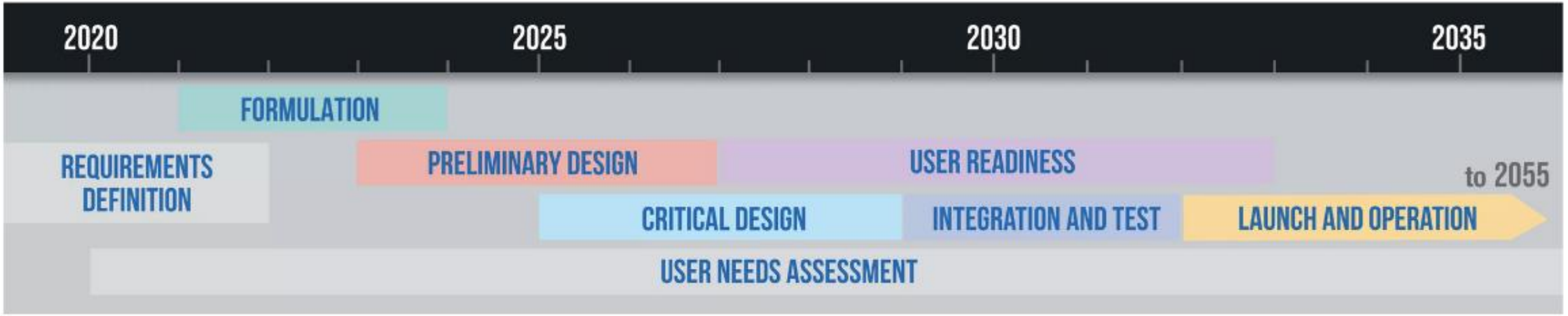
GeoXO Program

- **NOAA's Geostationary Extended Observations (GeoXO)** satellite system is the next generation mission that will advance Earth observations from geostationary orbit.
- **GeoXO** will supply vital information to address major environmental challenges of the future in support of U.S. weather, ocean, and climate.
- The GeoXO mission will continue and expand observations provided by the **GOES-R Series** as NOAA's next generation of geostationary satellites.
- NOAA is working to ensure these critical observations are in place by the early 2030s, as the GOES-R Series nears the end of its operational lifetime.
- **GeoXO Program Formally Initiated Nov. 9, 2021**

Source: C. Keeler, 7 April 2022

GeoXO Timeline

- NOAA assessing user needs and potential observational capabilities.
- Key decisions made in 2021 led GeoXO Program initiation.
- GeoXO requirements definition and pilot studies underway will lead to the preliminary design of the spacecraft and instruments.
- In critical design stage, NOAA will provide data to users on new capabilities.
- The first GeoXO launch is planned for the early 2030s to maintain and advance NOAA's critical geostationary observations through 2055.



Source: C. Keeler, 7 April 2022

Recommended GeoXO Constellation

GEO-West
Vis/IR Imager
Lightning Mapper
Ocean Color

GEO-Central
IR Sounder
Atmospheric Composition
Partner Payload

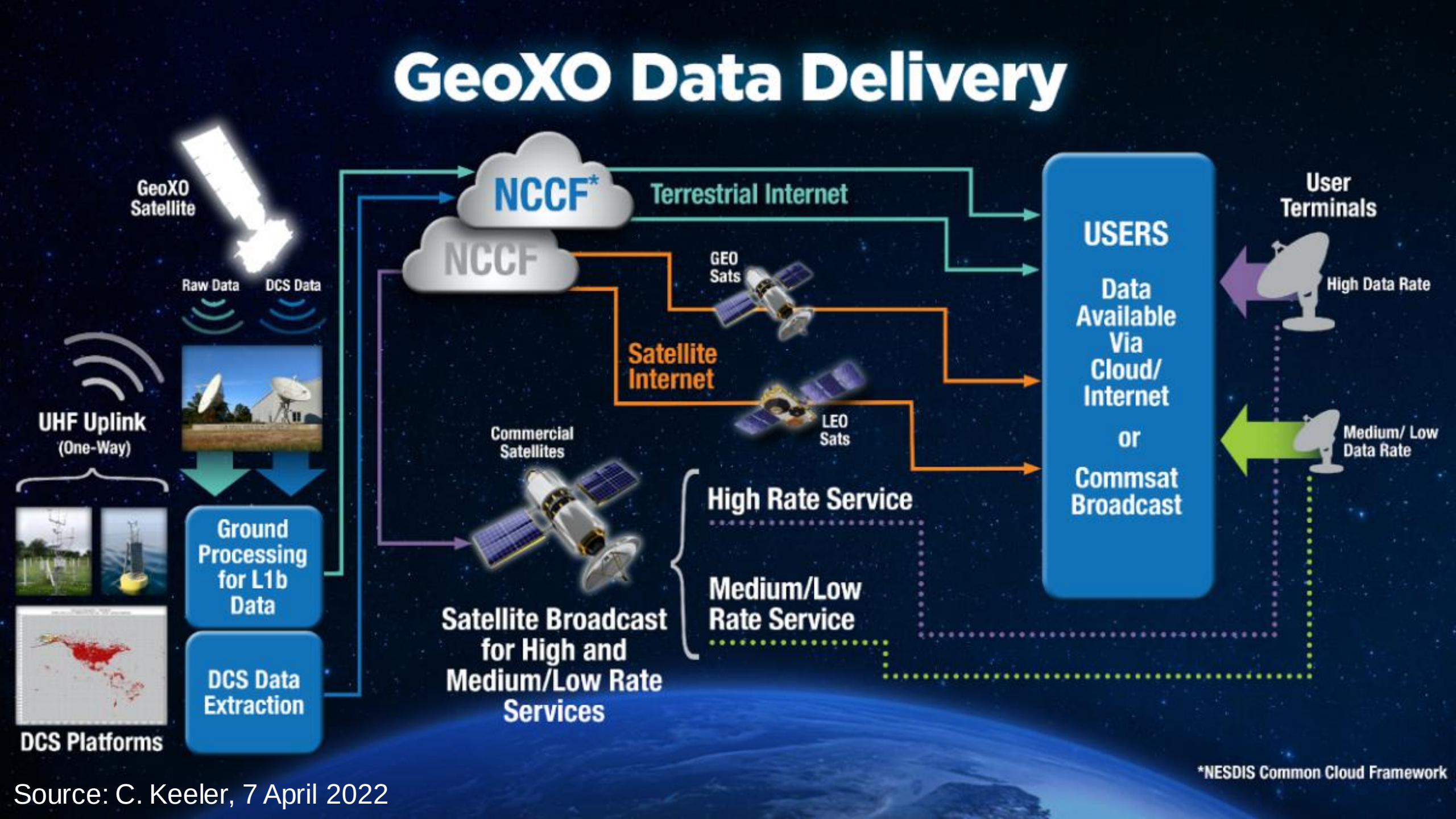
GEO-East
Vis/IR Imager
Lightning Mapper
Ocean Color

HRIT/EMWIN Direct Broadcast Services via Commercial Satellite

DCS data relay planned for GOES-East and West satellites

Source: C. Keeler, 7 April 2022

GeoXO Data Delivery



Source: C. Keeler, 7 April 2022

HRIT & GeoXO User Outreach

GeoXO Plans and HRIT

- The requirements for GeoXO stemming from HRIT/EMWIN and DCS will be set in the near future, likely by August 2022
- Shifting the HRIT/EMWIN broadcast to commercial satellite providers is contemplated.
- Users' needs and continuity of service are explicit factors in the decision.
- In forming requirements for GeoXO & HRIT/EMWIN, it's most helpful to have from users their requirements and use cases. What are your performance metrics, and what is the impact of under-performance?
  - Is the historical (GOES DCS) latency (10s) & availability (99.5%) an appropriate goal?
  - Will terrestrial internet and/or Ku-band satellite serve your location (e.g., geography, weather)?
  - Value of the capability to receive meteo and hydro data, imagery, and DCS in the same broadcast at remote sites.
  - Are there security concerns of direct NOAA broadcast for critical infrastructure
- What are the potential benefits of change?
  - mitigate interference associated with L-band AWS-3 Spectrum Sharing.
  - Lower-cost receive stations

- We will hold several webex meetings to collect your input.
  - Tuesday, 17 May 2022 14:00-15:00 EDT (18:00-19:00 UTC)
  - Thursday, 19 May 2022 14:30-15:30 EDT (18:30-19:30 UTC)

Feel free to contact the HRIT/EMWIN Program Manager Ian Avruch (ian.avruch@noaa.gov) to receive the webex links when available, and to share your use cases and requirements, which will be shared with the GeoXO team.

Points of Contact

https://noaasis.noaa.gov/ORGANIZATION/contacts.html

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