



GOES Data Collection System (DCS)

Overview and Planned Upgrades

National Environmental Satellite,
Data, and Information Service

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William “Skip” Dronen, NOAA GOES DCS Program
Manager

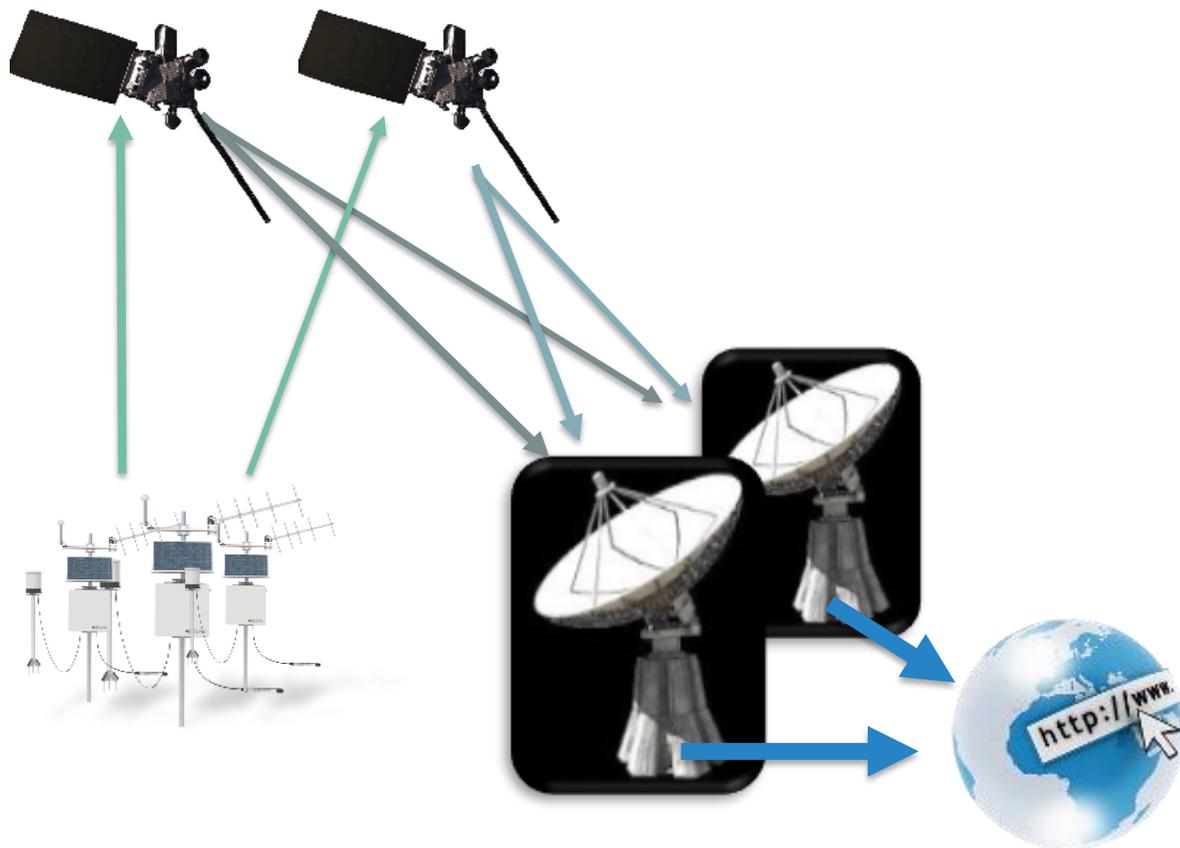


GOES DCS Update - Agenda

- Overview
 - DCS Growth
 - DCS Users and Uses
- GOES DCS Issues
 - CS1 to CS2 Transition
 - Radio Frequency Interference
- GOES DCS Projects
 - Replacement DADDS
 - Latitude/Longitude and more
 - Communication Protocols
 - DCP Commanding (DCPC) –aka Two-way Comms
 - GOES-17 Test



GOES DCS Overview



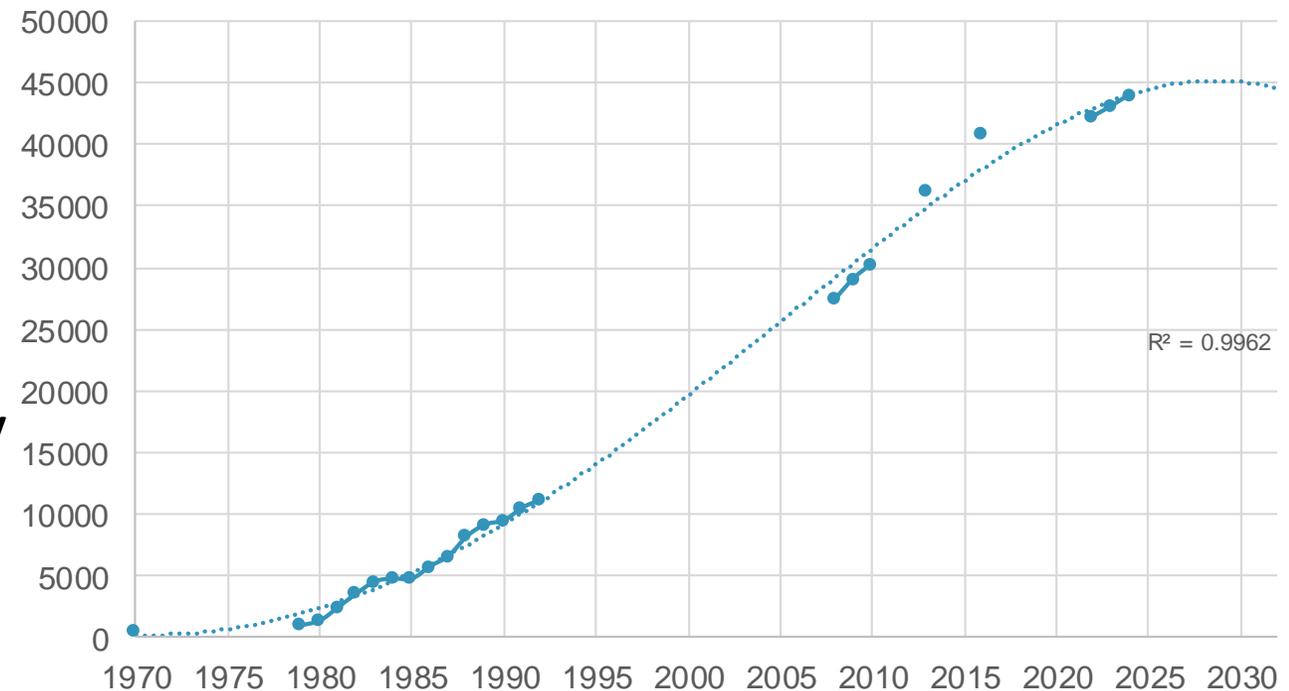
Satellites:	GOES East – 89.5°W GOES West – 137°W GOES 17 – 104.7°W (storage*)
Data Collection Platforms:	32,700+ active 43,000+ registered
DCS DCP Uplink:	401-402 MHz
DCS DCP Downlink:	468 MHz
GOES Downlink:	1679.7 - 1680.1 MHz
Agency Agreements:	728
Countries Participating:	42
*GOES-17 Auxiliary Comms for DCS is operational for testing as an RFI mitigation	



GOES DCS Overview - DCS Growth

- System Growth is ~2% year
- DCS Certification Standard (CS2) may affect growth
- International demand signal is still high
- New applications in offshore environmental monitoring may cause additional growth

Registered GOES DCS DPCs (1970-present)



GOES DCS Overview - DCS Uses and Users

- Fire Prediction and Firefighting
- Seismic Alerting and Tsunami Warning
- Avalanche Warning
- Water Level Monitoring and Flood Alerting
- Navigable Waterway Management (River, Canals and Locks)
- Water Retention & Allocation
- Climate Research
- System Technology and Testing

United States	US	22420	Uruguay	UY	14
Canada	CA	4596	Guyana	GY	10
Brazil	BR	1522	Bahamas	BS	9
Chile	CL	781	Barbados	BB	6
Mexico	MX	766	St. Vincent and the Grenadines	VC	6
Colombia	CO	709	U.S. Virgin Islands	VI	5
Peru	PE	496	Guatemala	GT	4
Country Unknown	ZZ	357	Antigua and Barbuda	AG	3
Puerto Rico	PR	185	Trinidad and Tobago	TT	3
Panama	PA	143	Martinique	MQ	2
Venezuela	VE	115	Bermuda	BM	2
Nicaragua	NI	95	Antarctica	AQ	2
Honduras	HN	73	Marshall Islands	MH	2
Argentina	AR	72	Wake Island	WK	2
Ecuador	EC	44	Jamaica	JM	1
Dominica	DM	41	Haiti	HT	1
Suriname	SR	37	Turks and Caicos Islands	TC	1
Belize	BZ	31	Guam	GU	1
Grenada	GD	29	Guadeloupe	GP	1
El Salvador	SV	24	Costa Rica	CR	1
Bolivia	BO	21	South Georgia	GS	1
St. Lucia	LC	16	Portugal	PT	1
French Polynesia	PF	15	Anguilla	AI	1
Dominican Republic	DO	14	Micronesia, Federated States of	FM	1
			American Samoa	AS	1
			Kiribati	KI	1
			Cayman Islands	KY	1





GOES DCS Issues – CS1 to CS2

- NOAA published Communication Standard 2 in June 2009
- Transition period ends May 31, 2026
- There will be no waiver
- NOAA will cease demodulating CS1
- Operators that continue to use CS1 will be outside the **legal** framework for GOES DCS access

<https://dcs2.noaa.gov/documents/Certification%20Standard%20V2.pdf>



GOES DCS Issues - Radiofrequency Interference (RFI)

- GOES DCS is impacted by a number of interfering RF effects in the UHF Uplink
 - Ionospheric Scintillation – magnified during peak solar cycle / solar events
 - NOAA Space Weather Center does not model or forecast the effect. Does anyone?
 - “Scintillation is a strong function of local time, season, geomagnetic activity, and solar cycle but it also influenced by waves propagating from the lower atmosphere.” (<https://www.swpc.noaa.gov/phenomena/ionospheric-scintillation>)

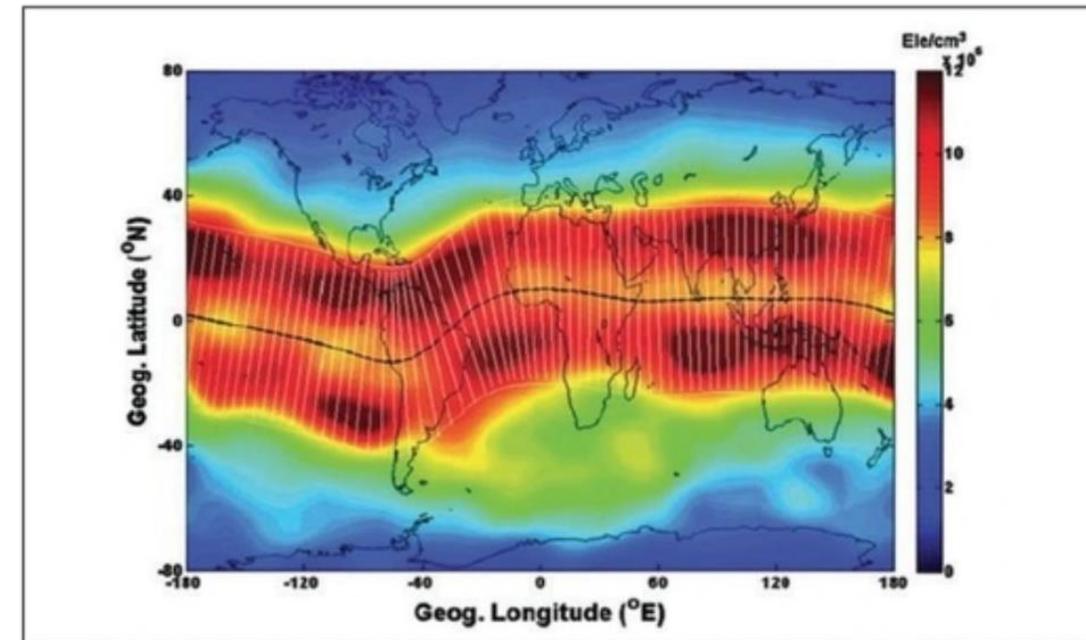
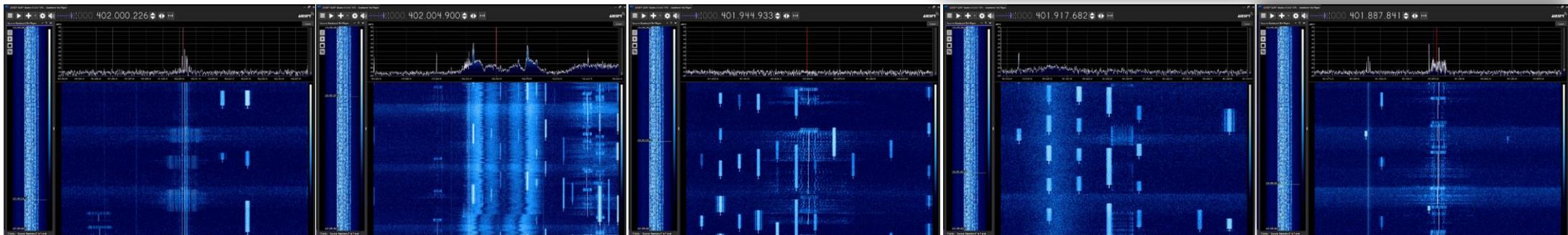
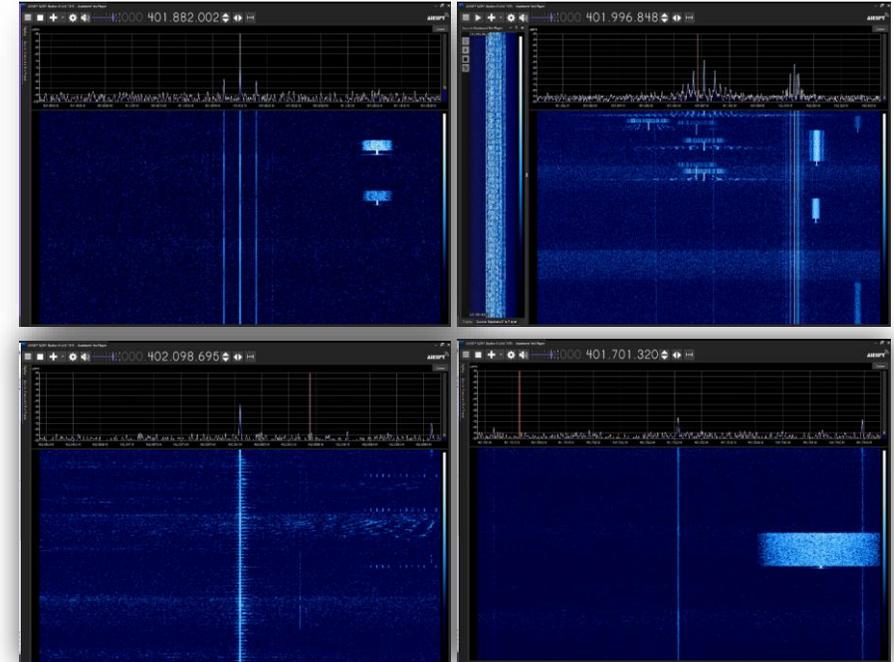


FIGURE 1 Geographical Regions of the Ionosphere (from M. C. Ortega Caldeira, C. R. Tanajura Caldeira, et al., “Evaluation of the GNSS Positioning Performance Under Influence of the Ionospheric Scintillation,” Bulletin of Geodetic Sciences, Vol. 26, No. 3, 2020.)

GOES DCS Issues – L Band and UHF

- The GOES L-band downlink is not a source of DCS RF at present
- GOES UHF uplink are being affected on a daily basis



Spectrum Analyzer Waterfall Plots developed by Matt Taylor (Microcom) for DCS Unwanted Emission Reports (DUERs)



GOES DCS Issues – What do to about RFI?

- Identify a Persistent Problem
 - Easier said than done...
 - User input
 - System Monitoring (primarily increases in Parity Errors)
- Mitigate
 - Use of Spare Demodulators (39)
 - User voluntary assignment changes
 - Cross Ingest from both NOAA downlink sites for “best message” in DADDS
 - Alternate Satellite Data Paths
 - GOES-17 – In Progress
 - Commercial LEO/MEO/GEO
 - Identify other possible mitigation techniques or capabilities
 - Satellite functions are essentially fixed for GOES and GeoXO



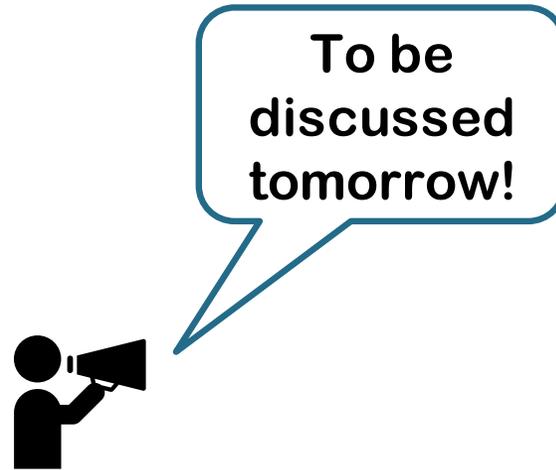
GOES DCS Issues – What do to about RFI?

- Remove
 - Obtain detailed signal characteristics and behavior
 - Aside from system monitoring via DADDS and current support, NOAA does not have a persistent satellite based RFI detection capability
 - Locate
 - If a DCP is a source is the culprit DCS can directly liaison with the user
 - Interagency support has been obtained on a limited basis
 - Coordinate
 - Submit RFI Reports to the NTIA or ITU (via the NTIA)



GOES DCS Projects – Lat/Long & More

- Latitude/Longitude and more
- Communication Protocols
- DCP Commanding (DCPC) –aka Two-way Comms
- GOES-17 Test



To be
discussed
tomorrow!

GOES DCS Projects – Comms Protocols

- Communication Protocols
 - Various compaction schemes for ASCII and Pseudobinary plus an “open” binary protocol
 - Compactions are IT transparent. Applied at DCP encode and removed at demodulation. Users at data distribution should see now difference.
 - Open Binary needs to be tested on the distribution side.
 - Compactions and Open Binary offer 25-50% message reductions
 - Protocols are developed and in testing
- CGMS Enhanced DCP Standard
 - Software/Firmware only
 - Based on comprehensive stuff of worldwide DCS protocols and what offers the best for ‘robustness’.



**To be
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tomorrow!**

https://www.noaasis.noaa.gov/GOES/GOES_DCS/gdcs_pf.html



GOES DCS Projects - DCPC

- NOAA has committed to restoring DCP Commanding on GOES
 - Successful End-to-End Demonstration in 2023
 - DCS DADDS was used to sent remote commands to lab DCP via GOES
 - “Ping” with acknowledge, Disable transmitter Enable Transmitter, Change DCP Channel
 - Notional Concept of Operations
 - DCPs are programmed to “listen” following scheduled or unscheduled broadcasts.
 - 255 Possible Commands
 - Industry will be provided with a Reference Design

Demo Tomorrow!

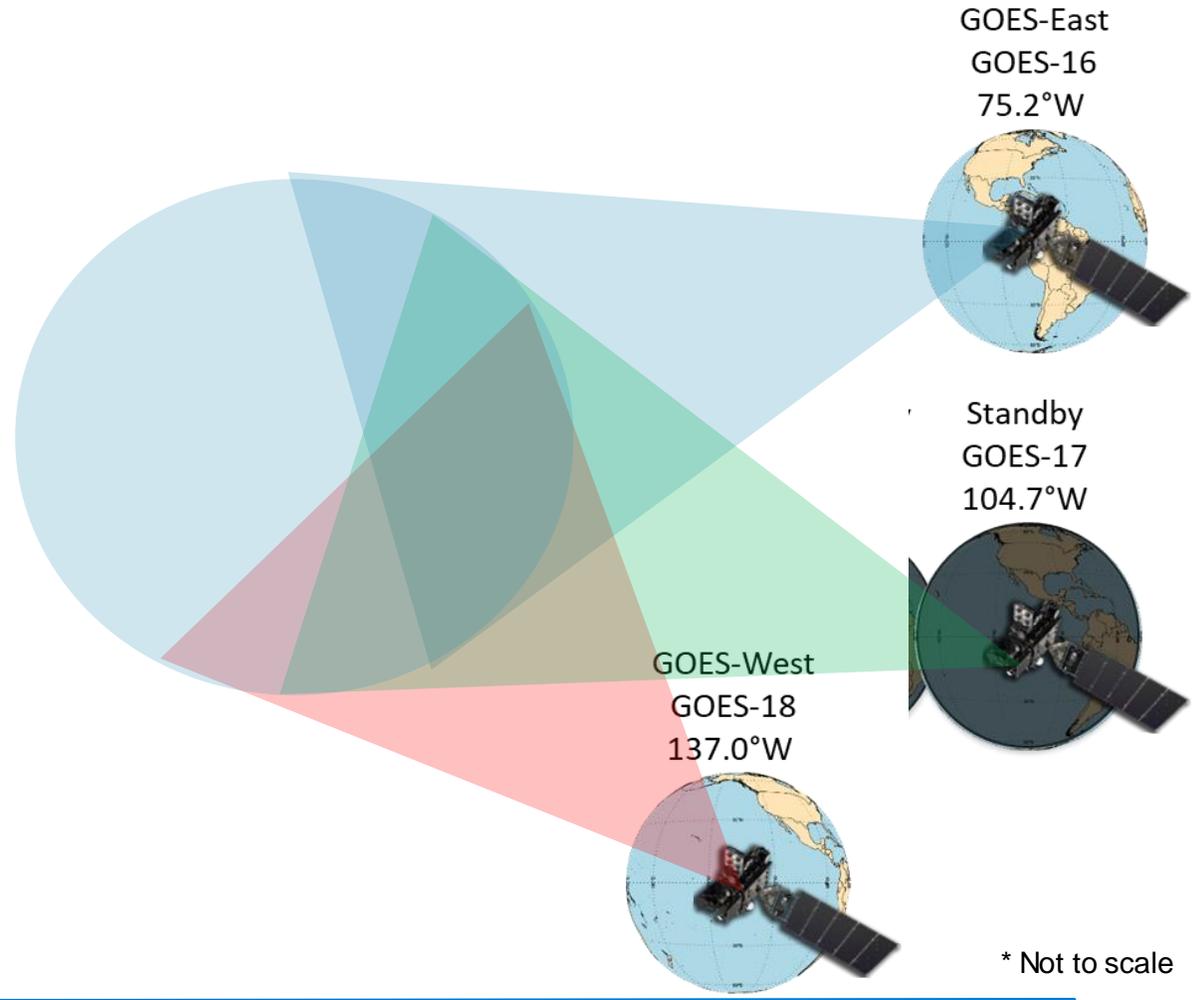
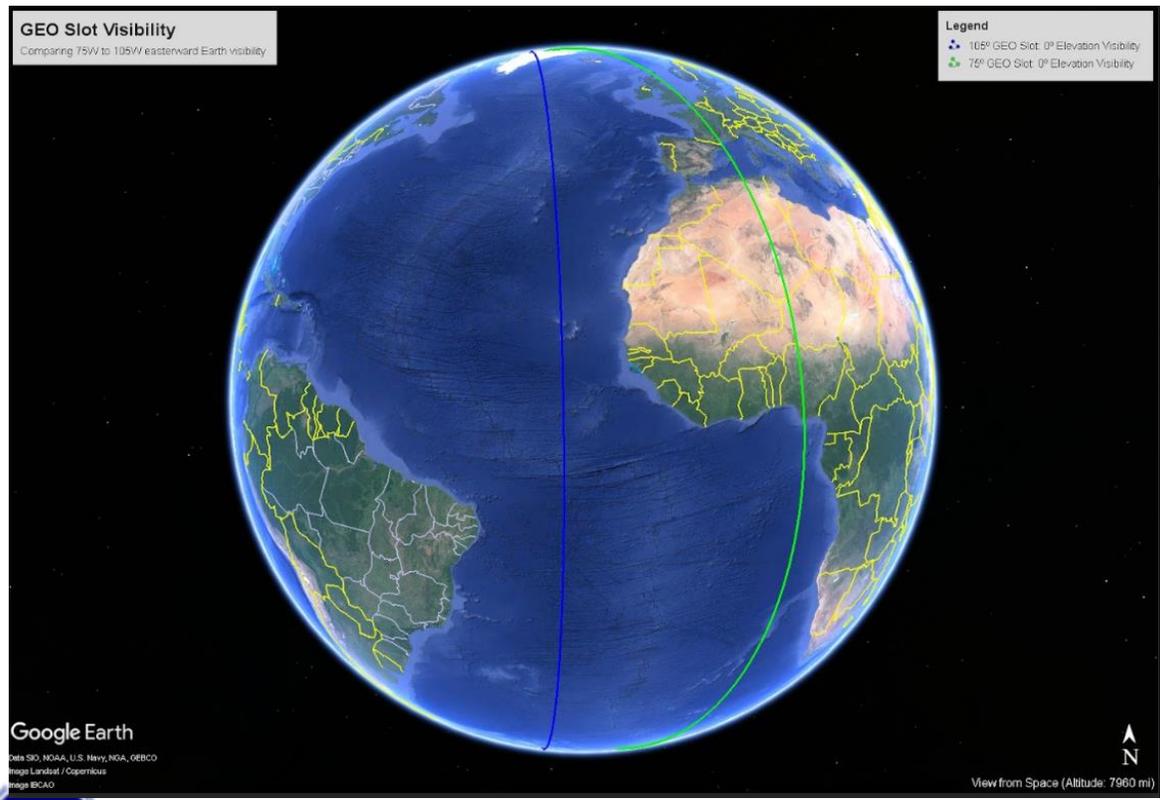


CMD Code	Short Description	Long Description	R/O
0x00	Fill	Data has no meaning; it is used as a fill between commands	R
0x01	Ping	Requests a response from the platform to check if it is still active.	R
0x02	Software Reset	DCP must execute software reset after acknowledgement.	R
0x03	Hardware Reset	DCP should execute a hard reset after acknowledgement.	O
0x04	Disable Timed	Disable Self-Timed transmissions until specified date/time	R
0x05	Enable Timed	Enable Self-Timed transmissions (use after indefinite disable).	R
0x06	Disable Random	Disable Random transmissions until specified date/time	R
0x07	Enable Random	Enable Random transmissions (use after indefinite disable).	R
0x08	Enb/Dis DCP	Enable/Disable the DCP (if supported).	O
0x09	Failsafe Reset	Reset transmitter failsafe.	R
0x0A	Transmitter Status	Send DCP transmitter status and key performance metrics.	R
0x0B	Receiver Status	Send DCPC receiver status and key performance metrics.	R
0x0C	Set Platform ID	Set 32-Bit DCP Address	R
0x0D	Receiver Listen	Set DCPC receiver listen (aka power up) mode/times.	R
0x0E	Force GPS Sync	Force a GPS Sync and report result.	R
0x0F	Lat/Lon/TxID	Initiate a Lat/Lon/TxID Report Sequence	O
0x10	Resend Timed Tx	Resend a Self-Timed Message on Specified Channel	O
0x11	Future		?
thru	Future	NOTE: Some of these could be system/manufacture specific.	?
0x1F	Future		?



GOES DCS Projects – GOES 17 Test

- GOES-17 is centrally located between GOES East and West

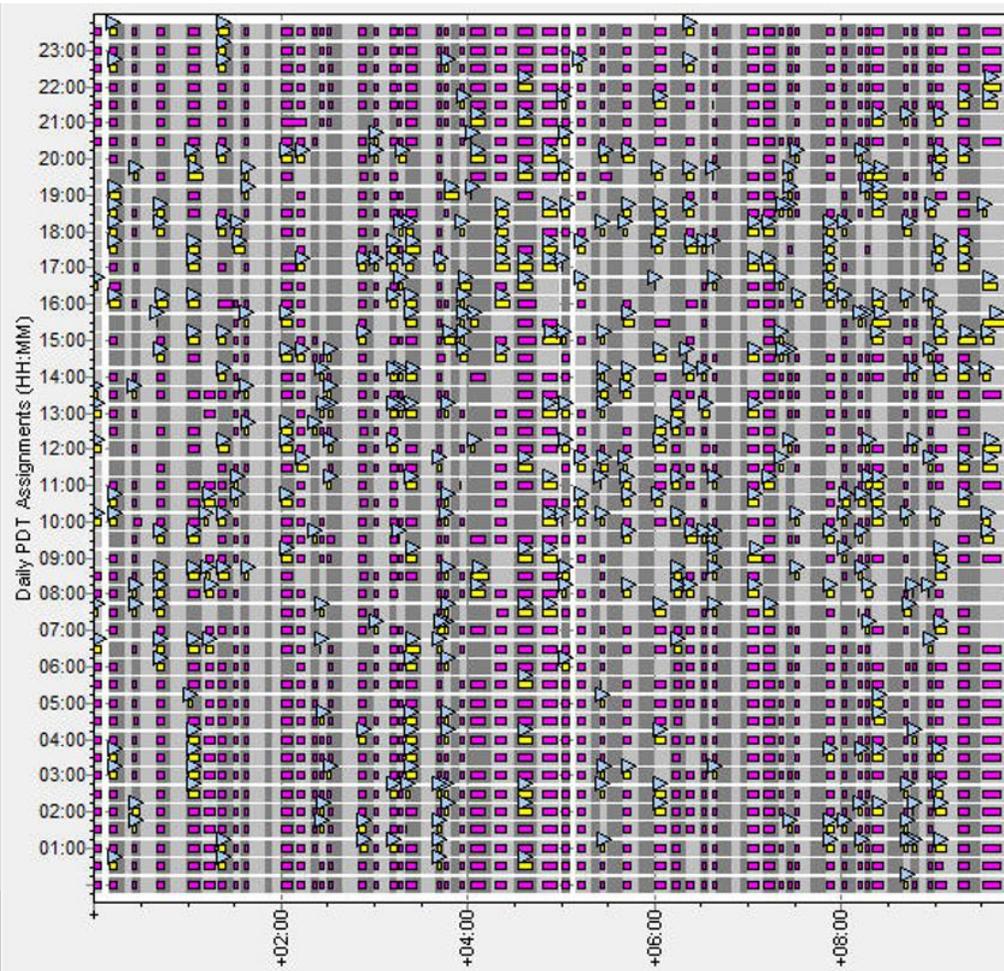




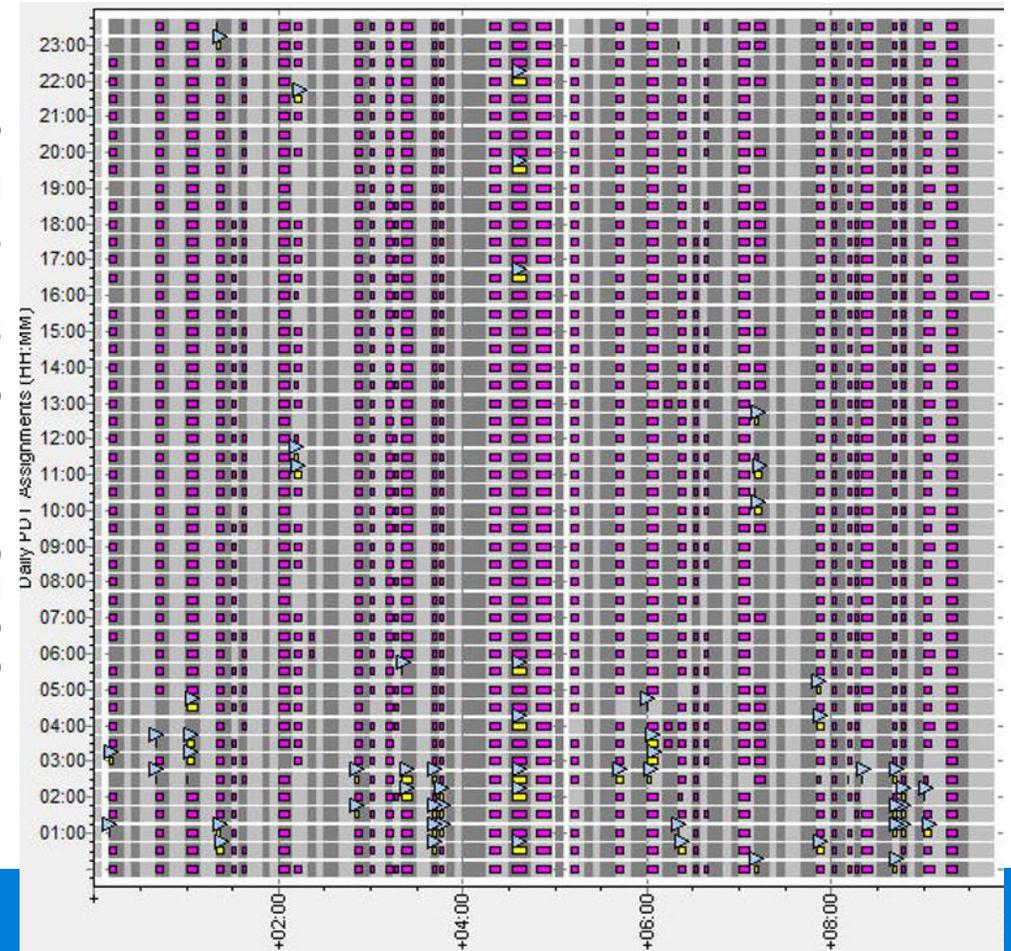
GOES DCS Projects – GOES 17 Test

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GOES East - Channel 215



GOES 17 - Channel 215





Questions?

