Operational DCS status report + Status of Implementation of Best Practices (NOAA)

Presented to CGMS-52 Working Group I session, agenda item 7.7

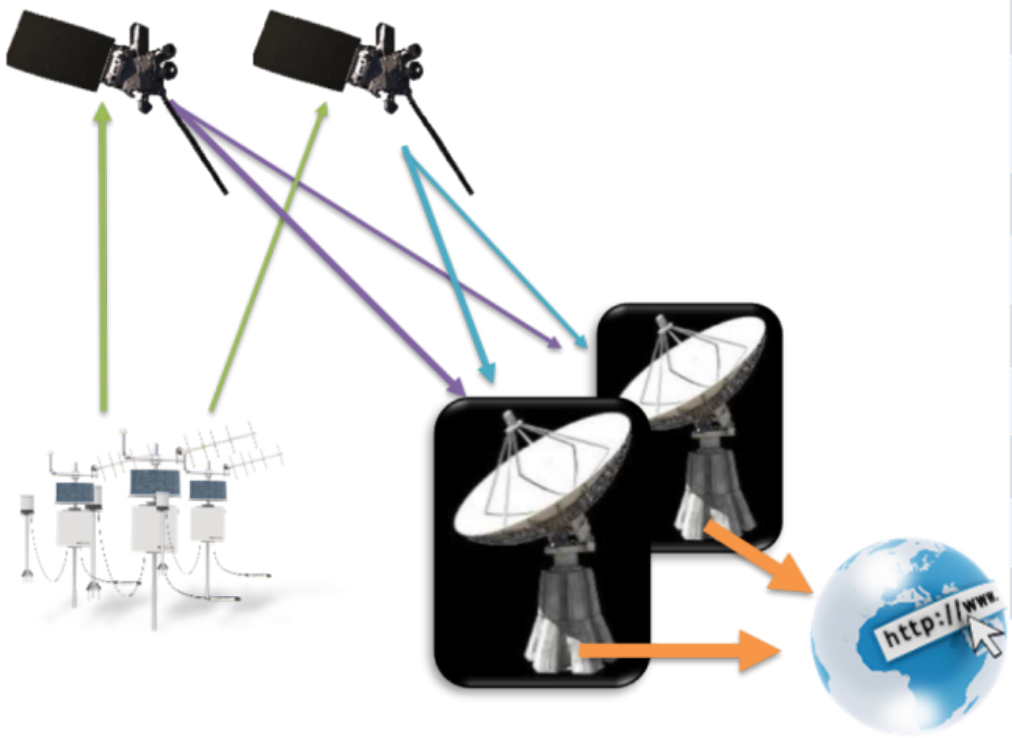
CGMS-52-NOAA-WP04

Executive summary of the WP

The GOES DCS is an environmental data relay system that supports the collection of over 978,000 message per day from over 32,000 active Data Collection Platforms (DCPs) located throughout the Western Hemisphere. The GOES DCS Program has 672 different user agency agreements representing 42 countries. DCP platforms collect environmental data and transmit this information to a GOES East or West satellite. The satellites then rebroadcast this data to terrestrial receive facilities maintained by NOAA or users' own facility. NOAA collects the complete range of DCS data, distributes it using the DCS Administrative and Data Distribution System (DADDS) or to other distribution interfaces. The DADDS is the central management for GOES DCS and provides user, DCP, and spectrum management tools.

The NOAA GOES DCS continues to be a highly reliable and highly utilized. The system continues to grow and fulfils many critical roles for many users, including use of environmental data to act to protect life, property, and the environment. The growth of system usage, advance of technology, IT security requirements and external radio frequency interference provide both opportunities and challenges. NOAA GOES DCS is replacing DADDS, modernizing DCP communication technologies, and restoring a DCP Command link in order to make GOES DCS a more modern, efficient, and flexible system.

GOES DCS Overview

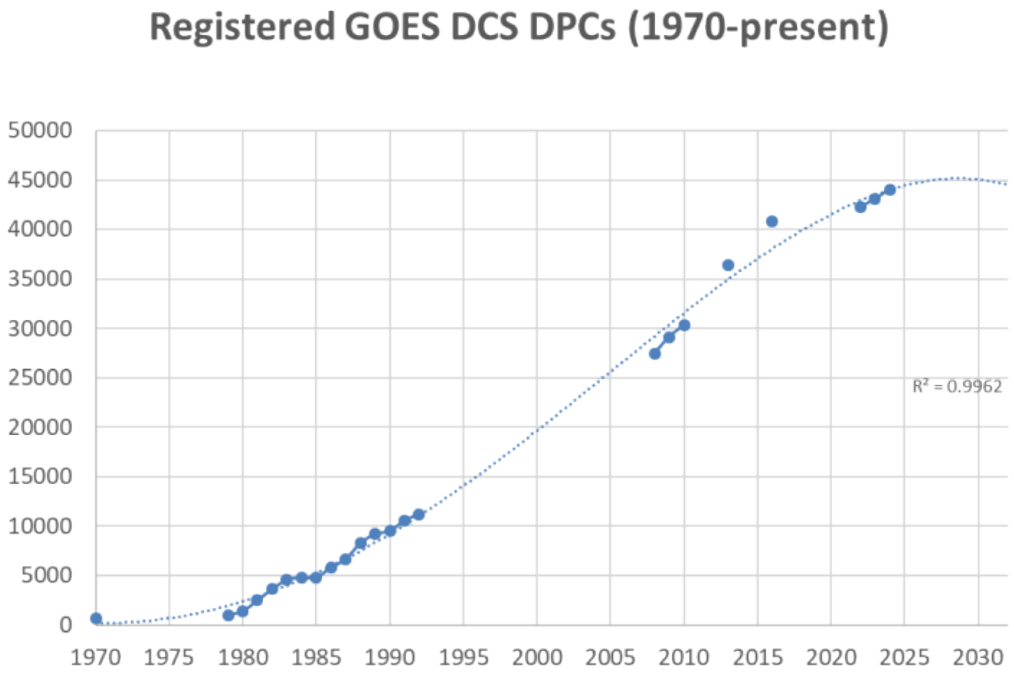


Satellites:	GOES East – 89.5°W GOES West – 137°W GOES 17 – 104.7°W (storage*)
Data Collection Platforms:	32,700+ active 43,000+ registered
DCS DCP Uplink:	401-402 MHz
DCS DCP Downlink:	468 MHz
GOES Downlink:	1679.7 - 1680.1 MHz
Agency Agreements:	728
Countries Participating:	42

***GOES-17 Auxiliary Comms for DCS is operational for testing as an RFI mitigation**

GOES DCS System Growth

- System Growth is ~2% year
- DCS Certification Standard (CS2) requires hardware changes. Users may elect to choose other services.
- International demand signal is high
- New applications in offshore environmental monitoring may cause additional growth



DCS System Use and Example 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

GOES DCS System Challenges and Limitations

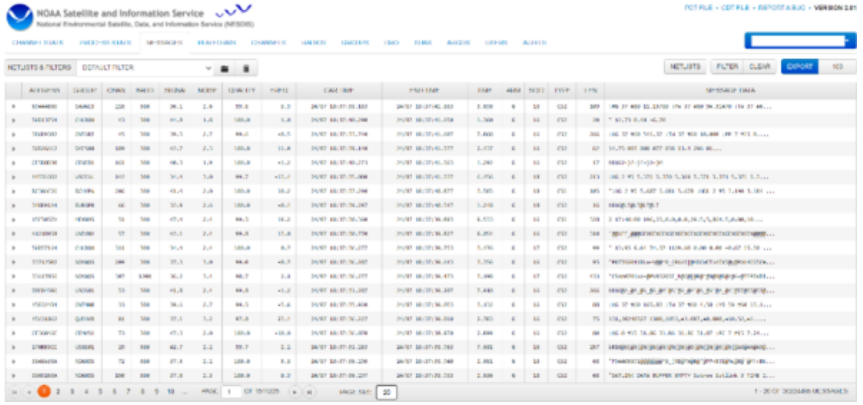
- Widespread and Geographically Diverse Users & DCPs
  - Impact to change can be complex to assess
  - Certification Standard change required a 7-year transition
  - Result is a *bias against change* and the DCS hasn't fundamentally changed to keep with technology or address emerging threats
- However, challenges create opportunities

GOES DCS System Opportunities

- 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
  - Proposing to DCS users in April 2024
  - Protocols are developed and in testing.
- CGMS Enhanced DCP Standard

GOES DCS System Opportunities

- DCS DADDS IT Modernization – Replacement DADDS (RDADDS) Project
  - Initial Development on NOAA's Common Cloud Framework
  - Containerized products for flexibility in deployment
  - Improve upon existing system
- IT security
- Improved Performance Measurements
- Streaming Data Service
  - Replacement DADDS delivery 2026



GOES DCS System Opportunities

- DCS DCP Commanding (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, Chang Channel
- DCPC Protocol Set
  - Notional Concept of Operations
- DCPs are programmed to "listen" following scheduled or unscheduled broadc
- 255 Possible Commands
- Industry will be provided with a Reference Design

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/manufacturer specific.**	?
0x1F	Future		?

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– “Ping” with acknowledge, Disable transmitter Enable Transmitter, Change DCP Channel

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- DCS DCP Commanding (DCPC)
  - System Security (unwanted/accidental commands)
    - Second DCP Command ID is private (retained using same authentication of current system)
    - Frequency Hopping Spread Spectrum Pattern. Unique to each GOES and mutually exclusive.
    - Reed Solomon Error Correction, 256bit
  - DCP Commanding has been official added to the GeoXO Baseline

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GOES DCS System Opportunities

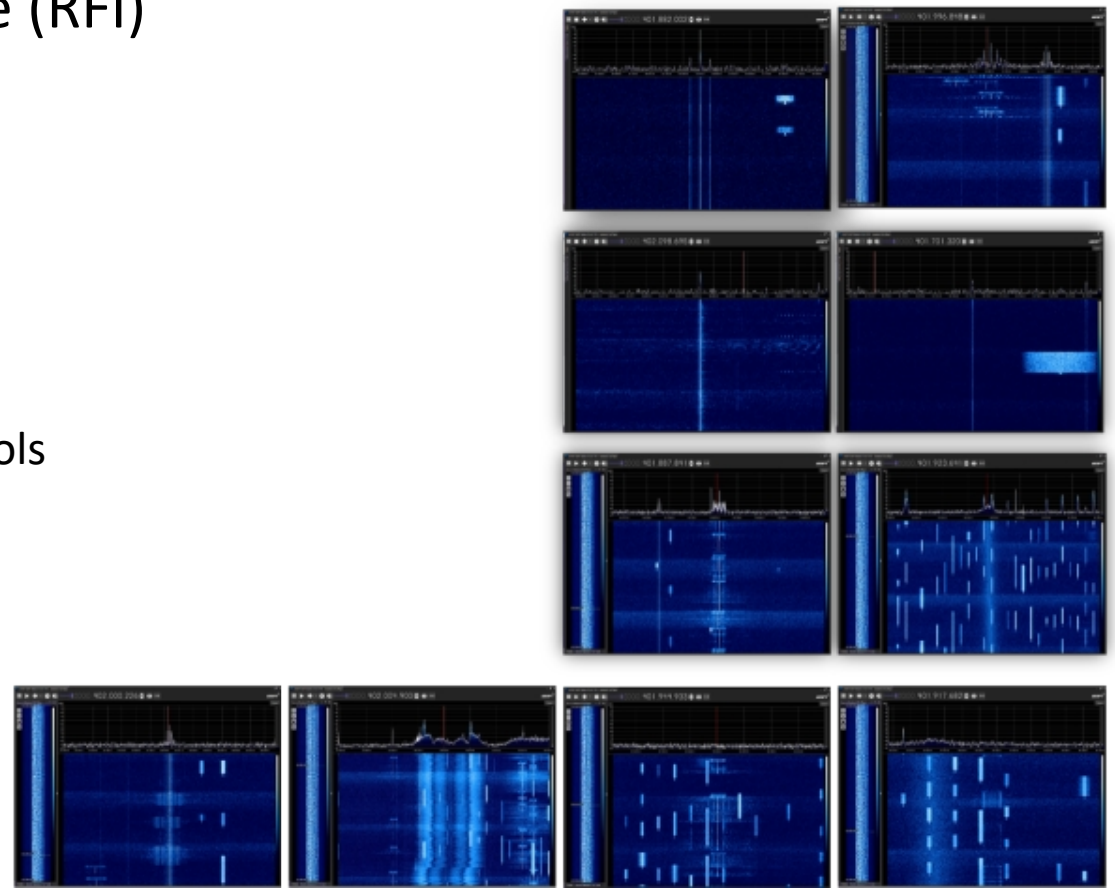
DCS Radio Frequency Interference (RFI)

–Various Sources

–Mitigations:

- Employ spare demodulators
- Improve “best message” processing
- Employ more effective or robust protocols
- Explore alternate data sources
- ITU Reporting

–Modernization will help



CGMS DCS Best Practices and GOES DCS Practices – DCS Data Access

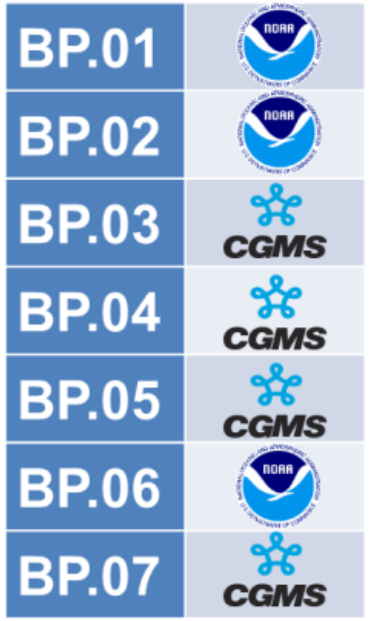
BP.01	CGMS
BP.02	NOAA
BP.03	CGMS
BP.04	CGMS
BP.05	CGMS
BP.06	NOAA
BP.07	CGMS
BP.08	NOAA
BP.09	CGMS
BP.10	CGMS

Practices Generally Aligned

Differing NOAA Practices

- BP.02 – NOAA National Weather Service Telecommunication Gateway (NWSTG) has capability to distribute on the Global Telecommunication System (GTS). One international user.
- BP.06 – NOAA stores user data for 30 days. Scaling storage and long-term storage is up to the user.
- BP.08 – NOAA uses web notices and all-user e-mails to communicate outages, which are rare. Replacement DADDS may have improved issue tracking and user communication.

CGMS DCS Best Practices and GOES DCS Practices – DCS Data Access



Practices Generally Aligned NOAA Practices

- BP.01 – DCP certifications are very rare. Government rep conducts personal visit to the manufacturer.
- BP.02 – DCP certifications are very rare. Manufacturers contact the NOAA Radio Frequency Engineer directly. All procedures, standards, and approved manufacturers are published on a public webpage.
- BP.06 – DCP certifications are very rare, there is currently not a timeline requirement for the certification process.

Key issues of relevance to CGMS:

- ☐ Enhanced DCP Standard (EDCP)
- ☐ Radiofrequency Interference (RFI)

To be considered by CGMS:

- ☐ The GOES DCS Program recommends continued coordination with CGMS Workgroup I to standardize Data Collection Platform specifications and bring radio frequency interference (RFI) issues to the attention of spectrum regulators.