CGMS-52-NOAA-WP-04
29 March 2024

Prepared by: NOAA
Agenda Item 7.7
Discussed at WGI

Subject	**Operational DCS status report + status of implementation of best practices (NOAA)**
In response to CGMS action/recommendation	Not Applicable
HLPP reference	Not Applicable
Executive Summary	**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 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.**
Action/Recommendation proposed	**Continue to coordinate with CGMS Workgroup I to progress the Enhanced Data Collection Platform (EDCP) initiative and bring radio frequency interference (RFI) issues to the attention of spectrum regulators.**

1 INTRODUCTION

The GOES DCS is an environmental data relay system that supports the collection of over 978,000 messages per day from over 32,000 active Data Collection Platforms (DCPs) through the Western Hemisphere. The GOES DCS Program has 672 user agency agreements representing 42 countries. DCPs collect environmental data, transmit this information to a GOES East or West satellite. The data is then rebroadcast from the satellite(s) to terrestrial receive facilities. Environmental data is then distributed using the DCS Administrative and Data Distribution System (DADDS) or forwarded to other distribution points such as the Global Telecommunication System (GTS). The DADDS is the central IT management tool for GOES DCS users, DCPs, and spectrum assignments.

2 GOES DCS STATUS

2.1 SYSTEM RELIABILITY AND GROWTH

GOES DCS continues to see annual growth at approximately 2% per year. Figure 1 depicts the number of registered DCPs since 1970.

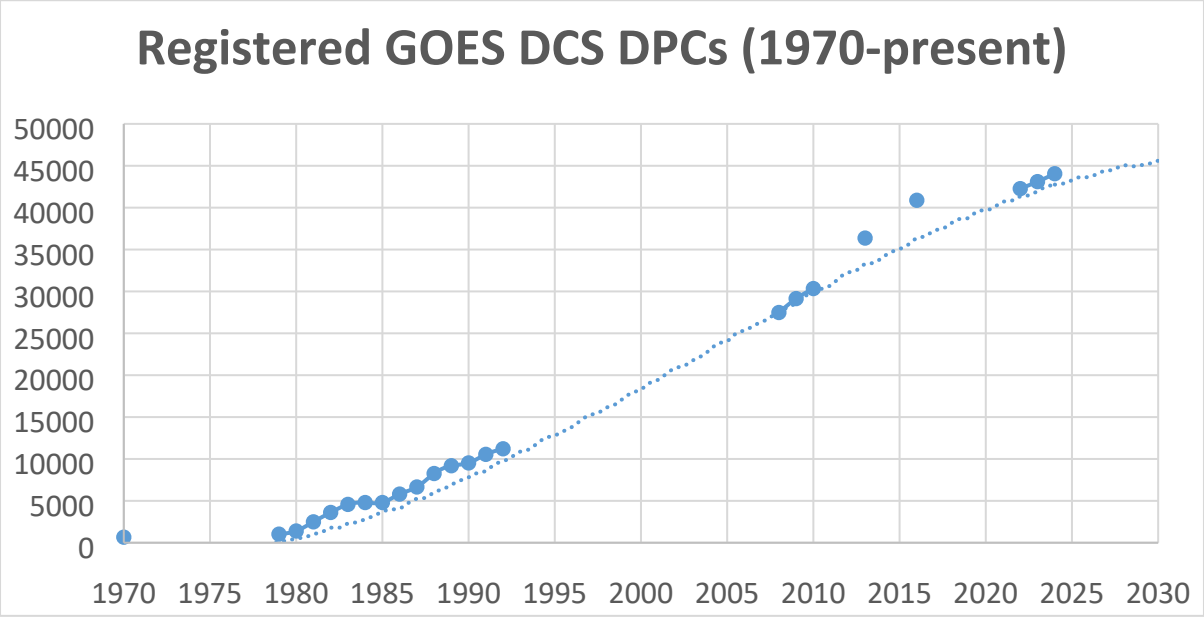

Figure 1 - GOES DCS DCP Growth Since 1970

While the original purpose of GOES DCS was to provide data to NOAA, the use of the DCS has grown into a complex network of data gathering for a multitude of environmental purposes throughout the western hemisphere. In some cases, the system has become an important component for redundancy, complementing other capabilities like commercial satellite services, and for critical operational decisions. The following include a few examples:

- fire prediction and firefighting,
- seismic alerting and tsunami warning,

- avalanche warning,
- water level monitoring and flood alerting,
- navigable waterway management,
- climate research, and;
- system and technology testing.

2.2. System Challenges, Limitations, and Modernization

Growth of GOES DCS in terms of users and DCPs presents new challenges. In most cases users must physically visit DCPs to perform configuration changes and maintenance. Many DCPs are located in remote or difficult to access locations. The result is that any change to the DCS infrastructure can have far reaching implications to many users who all face different constraints. Additionally, other components of the GOES DCS have not progressed with technology. The system was not designed to address the growing IT security requirements and emerging threats like RFI.

2.2.1 GOES DCS DCP Communication Changes and Protocols

The GOES DCS program started implementing a new Certification Standard for DCPs in June of 2009 in order to add 300 and 1200 baud data rates to the system. The widespread impact of this change included hardware changes that necessitated a seven-year transition period to mitigate the impact to users. This standard will be effective on May 31, 2026.

Current DCS communication only provides for ASCII and Pseudobinary protocols. However, there are techniques and technologies that can decrease message transmission times or allow more data to be sent in existing time slots. NOAA has developed three new protocols. Two protocols compact the existing ASCII and Pseudobinary protocols and the third implements a pure binary protocol. Preliminary testing has shown message lengths may be reduced from 25%-50%, depending on the selected protocol. These enhancements are also intended to be compatible with existing DCPs and could be implemented without significant impact to DCS users as optional software upgrades. NOAA is currently testing these protocols with external interfaces to ensure that downstream data distribution is not affected or can be adapted to accept this new capability. NOAA will be engaging GOES DCS users on this topic at the annual Technical Working Group (TWG) in April 2024 and plans to start implementing the protocols in 2025.

These protocols initiatives are complementary to and may directly support the CGMS Workgroup I (DCS) Enhanced DCP (EDCP) Standard. The DCS Program is investigating methods to fund elements of the EDCP Standard that are out of scope of existing contracted work. The current GOES DCS protocol project and the EDCP Standard are intended to be software or firmware changes that would avoid wide-spread hardware changes that may not be achievable within the diverse GOES DCS user group.

1. 2.2.2 DCS DADDS IT Modernization

In September of 2023 NOAA awarded a contract to Systems Integration and Development, LLC to modernize the current DADDS IT system. This system is used to manage user accounts, DCP data, monitor system components, and access message data. The new system will include these functionalities in a cloud-compatible form and will include additional capabilities to improve user experience, manage platforms and users accounts more efficiently, reduce spectrum management complexity, and enable streaming data services.

2. 2.2.3 DCS Commanding (DCPC)

The GOES DCS Program has not operationally used the forward link Ultra High Frequency (UHF) transponder function of GOES for a long period of time. In 2023 the DCS program conducted an end-to-end test that demonstrated remote confirmation changes on a test DCP. During this test DADDS was used to send various commands to the DCP in order to obtain a DCP “are you there” response, disable the transmitter, re-enable the transmitter, and change channels. This was the first time DCP configuration changes have been conducted using the GOES DCS transponder. The DCS program is now proceeding with additional DADD updates and working with the GOES program to develop a DCP reference design to share with DCP manufacturers. NOAA GOES DCS has set a goal to have significant user commitment to this capability in 2025.

3. 2.2.4 Radio Frequency Interference (RFI)

The GOES DCS is subject to harmful RFI on a daily basis. This RFI is from a combination of sources. Figure 2 depicts the width of the DCS UHF spectrum as a waterfall over a brief span of time. The most recent transmissions are at the top and the oldest at the bottom. The frequency range is represented horizontally. The well-defined lines in the diagram represent DCS messages. The left half of the waterfall shows a fairly normal DCS spectrum. The right half of the figure shows a variety of different signals that are not DCS messages and represent various interference events.

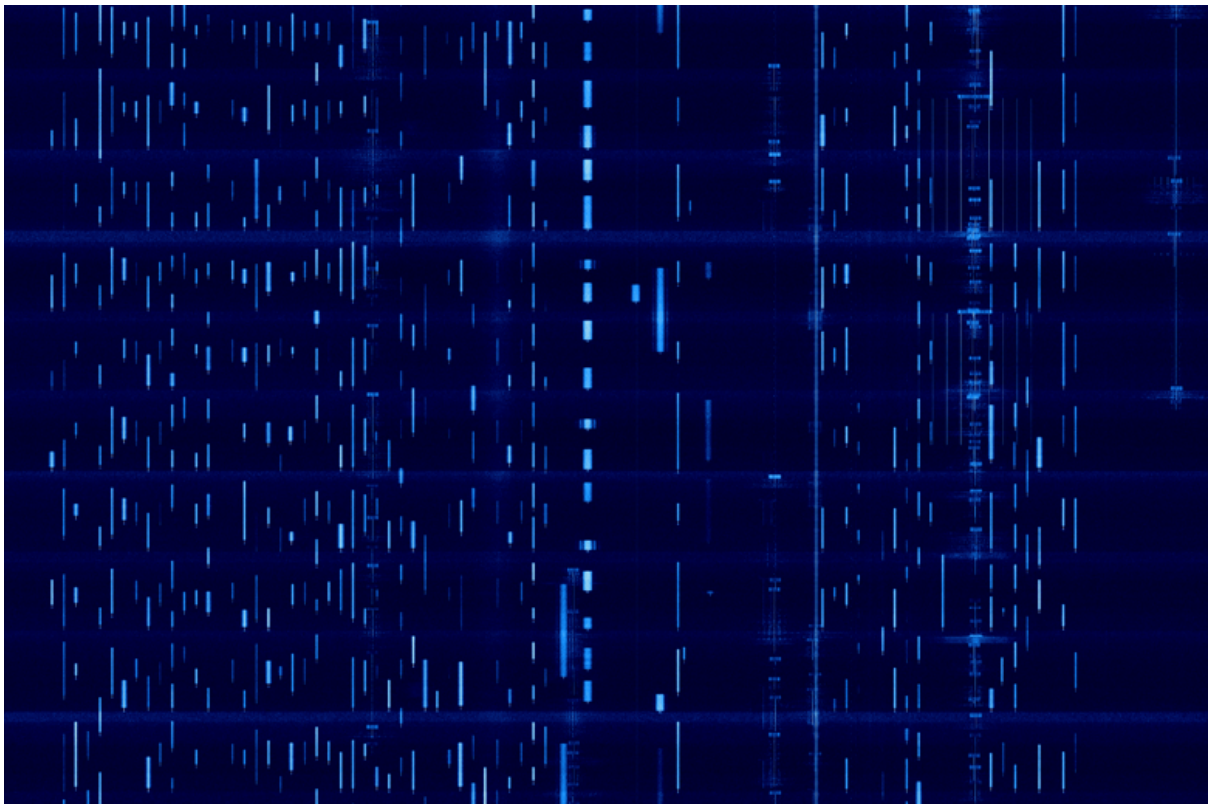

Figure 2 - DCS Spectrum Analyzer Waterfall

The GOES DCS program has implemented a number of mitigations to recover or avoid RFI but has not been able to locate and remove RFI sources. Some current mitigations include the following:

- Recovery of DCP signal received by demodulating message received at the other GOES satellite.
- Offering users the option of changing broadcast times or frequencies.
- Submitting an RFI report to the International Telecommunications Union (ITU)

The GOES DCS Program is also working on other system improvements that offer potential to mitigate RFI:

- DADDS software improvements to look at message data at both NOAA ground stations to select the best message from all data.
- Message protocols (previously mentioned) that reduce the time of transmission, avoiding RFI, or more robust protocols like the EDCP Standard, which would be less susceptible to RFI.
- Limiting testing of GOES-17, which is current in storage, in a central location that may avoid RFI due to longitudinal positioning.
- DCPC (previously mentioned) would allow users to dynamically respond to RFI impact and configure DCPs to avoid RFI. DCPC would also provide the ability to disable a DCP transmitter to troubleshooting overlaying signals.

3 IMPLEMENTATION OF BEST PRACTICES

NOAA GOES DCS has many current practices that mirror CGMS DCS best practices although there are some differences. Those differences in best practice and actual practice are in CGMS DCS best practices for Data Access 2, 6, and 8; and, in CGMS best practices for DCP Transmitter (TX) Certification Process numbers 1, 2, and 6.

2. 3.1 DCS Best Practice for Data Access (BP.02) - DCS on the WMO GTS

All DCS data is made available on the National Weather Service Telecommunication Gateway. This data is also available for the Global Telecommunication System. NOAA GOES DCS has not been able to confirm any user on the GTS has requested access to this data.

3. 3.2 DCS Best Practice for Data Access (BP.06) – Online Data Archive

The GOES DCS system stores all message data on DADDS for 30 days allowing users the opportunity for download. Additionally, the NOAA Wallops Command and Data Acquisition Site (WCDAS) provides a data distribution service where DCS data is available for 90 days. NOAA does not actively adjust message storage based on user need or long-term access.

4. 3.3. DCS Best Practice for Data Access (BP.08) – User Notifications

The GOES DCS system stores all message data on DADDS for 30 days allowing users the opportunity for download. Additionally, the NOAA Wallops Command and Data Acquisition Site (WCDAS) provides a data distribution service where DCS data is available for 90 days. NOAA does not actively adjust message storage based on user need or long-term access.

5. 3.4 DCS Best Practice for DCP Transmitter Certification (BP.01) – Minimizing Manufacturer Cost

Certification of a manufacturer of DCP is a rare event and the government certifier travels to the manufacturer's location. In one way that minimizes the manufacturer's costs because it simplifies travel to a single individual. However, certification costs are not an issue that has been brought to the attention of the GOES DCS Program.

6. 3.5 DCS Best Practice for DCP Transmitter Certification (BP.02) – Online Registration for Manufacturer Certification

Certification of a manufacturer of DCP is a rare event. The process to begin certification is as simple as contacting the NOAA radio frequency engineer that will

conduct the certification. This information is published on DADDS. GOES DCS also publicly publishes the current list of all approved manufacturers.

7. 3.6 DCS Best Practice for DCP Transmitter Certification (BP.06) – Contingency Time in the Testing Schedule

Certification of a manufacturer of DCP is a rare event and there are not prescribed timelines for the certification process.

Table 1 shows a detailed list of all CGMS DCS best practices compared to NOAA GOES DCS practices.

CGMS Agency Best Practices in support to DCP Data Access		
BP #	Best Practice	NOAA Practice
BP.01	Satellite Operators offering DCS should make all the DCS data available via the Internet on a DCS Web Service.	NOAA provides DCS data via the internet using the DCS Administration and Data Distribution System (DADDS) web interface. Additionally, NOAA supports Data Distribution System (DDS) servers that users' may access using their own software.
BP.02	Satellite Operators offering DCS should make all the DCS data globally available on the WMO GTS.	NOAA GOES DCS data can be provided to the WMO GTS via the U.S. National Weather Service (NWS) Telecommunication Gateway.
BP.03	Satellite Operators offering DCS should ensure their DCS Web Service makes all DCS data within their system available to a valid registered user	Registered Users for GOES DCS can access any message data on the system, subject to the thirty (30) day storage limit of the DCS Administration and Data Distribution Systems (DADDS).
BP.04	The Satellite Operators offering DCS should ensure high DCS data availability and put in place mechanisms to be able to detect and recover problems with the service with minimum delays.	NOAA GOES DCS is highly reliable through the use of two geographically separated antenna locations as well as dual redundancy within each component of the system infrastructure. Additionally, NOAA has a twenty-four-hour watch that monitors the GOES DCS system.
BP.05	The Satellite Operators offering DCS should ensure DCS data are made available on	DCS data is typically available within 2 seconds of receipt at a NOAA antenna downlink location.

	the DCS Web Service as soon as possible.	
BP.06	The Satellite Operators offering DCS should provide an on-line DCS data archive, which is sized according to user's applications requirements and expandable to cope with evolving user needs.	NOAA GOES DCS stores user message data for thirty days in order to provide sufficient time for access. The responsibility of data storage is left to the user of data. NOAA does not archive, nor has plans to archive, any user message data.
BP.07	The Satellite Operators offering DCS should ensure their DCS Web Services offer the possibility for tailoring DCS data retrieval.	The DCS Administration and Data Distribution Systems (DADDS) provides the ability for users to develop custom lists of Data Collection Platform data for export.
BP.08	The Satellite Operators offering DCS should put in place mechanisms to notify the DCS Data Users of any service changes and issues, which impact the access to DCS data (e.g. delays, outages). The information provided in the notification should be as detailed as possible, including the extent of the impact, expected duration of the impact, etc. Updates to the notifications should be issued regularly and a final notification should be sent to confirm return to nominal service.	The NOAA GOES DCS program issues all user notification through an e-mail system that references the user provided points of contact. The DCS program has recently issued notices for manufacturer's maintenance updates, program outreach activities, and radio frequency interference.
BP.09	The Satellite Operators offering DCS should ensure their DCS Web Services allows easy maintenance of up-to-date records of the DCP Operator's contact information by the users.	The DCS Administration and Data Distribution Systems (DADDS) provides users an internet-based web interface to update account information.
BP.10	The Satellite Operators offering DCS should provide the DCS Users with a full set of	NOAA GOES DCS documentation is posted on a publicly available web page.

	DCS Data Access documentation, accessible through the DCS Web Service.	
CGMS Agency Best Practices in support to DCP Transmitter (TX) Certification Process		
BP#	Best Practice	NOAA Practice
BP.01	The certification process should be implemented in such a way to minimize the costs to the manufacturer.	As per the GOES Data Collection System Radio Set (DCPRS) Certification Standards Version 2.0 Memorandum: "All responsibility for obtaining NESDIS certification rests with the manufacturer and/or builder of the equipment. Certification testing is performed by the manufacturer with a NESDIS witness present. All test results are then compiled in a report and forwarded to NESDIS. Testing is to be conducted at the manufacturer's facility. The set-up and demonstration of the manufacturer's equipment is the responsibility of the manufacturer. The salary, travel, per diem and any other expenses/costs for the NESDIS representative to verify and certify this testing and the subsequent test results are to be paid by the certification requester (manufacturer/builder)."
BP.02	The manufacturer should be able to register for the certification process online. This process should be as automated as possible.	There are very few manufacturer certification activities for GOES DCS. The process to certify a DCP is posted on the GOES DCS webpage along with a point of contact to support the process.
BP.03	Manufacturers should submit their DCP test plan for approval to the relevant satellite agency and following approval conduct factory testing and provide results back to the agency.	NOAA has a defined process per Certification Standard 2 as follows: The manufacturer submits a DCP certification test plan for review by the DCS Certification Officer and other relevant DCS program office personnel.

		Following approval of the test plan, a NESDIS witness (currently the DCS Certification Officer) travels to the manufacturer's facility to witness the certification testing and ensure that the DCP under consideration meets all requirements as defined in the DCPRS Certification Standards Version 2.0. A final test report including all data captured during the NESDIS witnessed testing is created by the manufacturer and submitted for review by the DCS Certification Officer and other relevant DCS program office personnel. Upon acceptance of the final test report, a certification number is issued and a certificate signed by the OSGS Director is provided to the manufacturer. All certification test data is entered into the OSGS and WCDAS technical library DADDS Radio database is updated to reflect the newly certified DCP.
BP.04	Where feasible, preliminary over-the-air testing from the manufacturer's premises should be performed following successful factory testing.	Over-the-air testing is performed during the NESDIS-witnessed factory testing. This is done using a DCS Certification test set maintained by NESDIS and loaned to the manufacturer for the duration of the testing period.
BP.05	Manufacturers and agencies should ensure that the message encoding is correct during the different test steps, this may include a blind test.	Message encoding is verified during factory testing.
BP.06	Ensure adequate contingency time is built into the testing schedule.	There are no documented time limits for acceptance testing.

Table 2 – CGMS Best Practices and NOAA Practices

4 ACTIONS AND/OR RECOMMENDATIONS FOR CONSIDERATION BY CGMS WORKING GROUP I

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.

5 CONCLUSION

The NOAA GOES DCS is a highly utilized environmental data relay system in the western hemisphere. The system continues to grow and users from dozens of countries rely on the DCS for a variety of important applications, to include the protection of life, property, and the environment. However, the growth of system usage and emerging challenges over time provide the opportunity for system improvement in several areas. NOAA is currently replacing the DADDS IT system, mitigating RFI, and implementing several system enhancements intended to improve GOES DCS to make it a more modern, efficient, and flexible system.