CGMS-51-NOAA-WP-03
24 April 2023

Prepared by: NOAA
Agenda Item 8.5
Discussed at WGI

Subject	**GOES DCS STATUS AND BEST PRACTICE IMPLEMENTATION**
In response to CGMS action/recommendation	**Not Applicable**
HLPP reference	
Executive Summary	**The GOES DCS is an environmental data relay system that supports the collection of over 900,000 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 61 countries. DCP platforms collect environmental data, transmit this information to a GOES East or West satellite. The satellites then rebroadcast this data to terrestrial receive facilities maintained by NOAA or a user's 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 take action to protect life, property, and the environment. However, the growth of system usage has not had an accompanying maturation in the DCS system itself. Specific challenges include spectrum management and radio frequency interference (RFI). NOAA plans to replace the current version of DADDS, modernize DCP communication technologies, and restore 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 standardize Data Collection Platform specifications and bring radio frequency interference (RFI) issues to the attention of spectrum regulators.**

1 INTRODUCTION

The GOES DCS is an environmental data relay system supports the collection of over 900,000 message 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 61 countries. DCP platforms 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. The DADDS is the central management for GOES DCS, providing user, DCP, and spectrum management tools.

2 GOES DCS STATUS

2.1 System Reliability and Growth

GOES DCS remains a highly reliable and popular environmental data relay system. Figure 1 represents DCP growth since the inception of NOAA's data collection system.

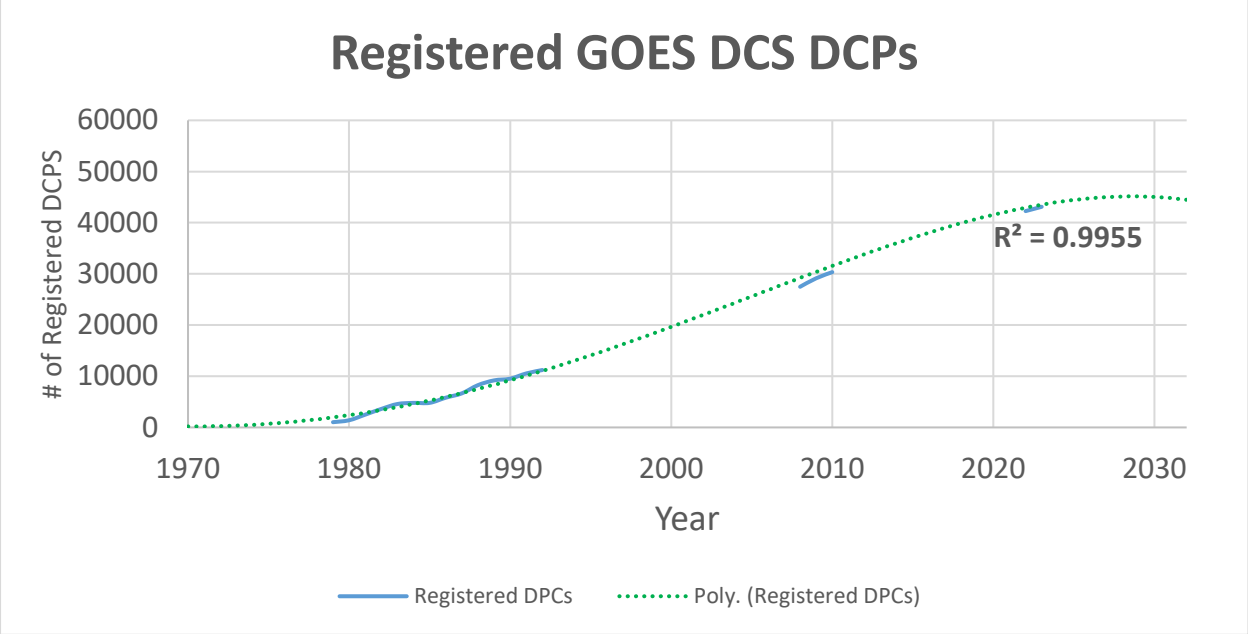

Figure 1 – GOES DCS DCP Growth Chart

The GOES DCS has been highly reliable (>99.99%) for a sustained period time. Many agencies the collect operational environmental data for critical decision-making use GOES DCS as their primary method of collection. Some of the critical uses of the system include fire prediction, firefighting, seismic alerts, tsunami warning, avalanche warning, flood control, climate research, and navigable waterway management.

2.2 System Challenges and Limitations

By its very nature, 33,000+ DCPs geographical dispersed through the hemisphere make system and spectrum management a challenge. GOES DCS system changes impacting a DCP configuration may take years to implement due to the need for each user to visit each DCP location. For example, NOAA implemented Certification Standard 2 (CS2) in June of 2009 but provided a significant lead time for users to transition to the new standard prior to May 31, 2026. This long lead time provided the opportunity for a widespread DCP changeover as users replaced and recapitalized their systems.

Additionally, system changes that affect a DCP need to consider the downstream affect to demodulation and IT data distribution systems. While NOAA maintains geographically redundant receive and distribution system there are almost 100 independent antenna receive locations throughout the western hemisphere. NOAA is investigating DCP communication protocol changes to deploy compact ASCII and Pseudo-binary message formats in order to obtain 20%-50% reduction in message size. Complementary to that is an effort to employ an Open Binary standard for to reduce message size and support the restoration of a DCP Commanding capability. Prior to implementation of these capabilities, NOAA must carefully consider the backward compatibility of existing systems and what affect these protocols may have on traditional users, as well as fully understanding the impact may have on other distribution interfaces like the U.S. National Weather Service Telecommunications Gateway (NWSTG).

Another management challenge pertains to the fragmented way NOAA's spectrum is now divided under the CS2. User transition to the new standard has created gaps that offer potential to more efficiently assign broadcast times, increase reporting times, or increase transmission time. However, due to limitations with DADDS as a management tool, it is not simple process for a spectrum manager to develop an efficient DCP reassignment or reconfiguration plan. Furthermore, even if a strategy was developed, implementing the strategy would take an exceedingly long time due to the requirement for each user to visit the DCP for manual reprogramming. NOAA is pursuing remedies to these challenges by developing a new version of DADDS to provide DCS Program personnel a more capable management tool. NOAA is also restoring a forward link capability to use the existing GOES two-way transponders to send DCP Commands. These new tools will allow the GOES DCS Program personnel and DCS users to make spectrum changes in hours or days as opposed years.

Lastly, the most recent challenge to GOES DCS, and one that has widespread negative impact across the GOES DCS User Community, is Radio Frequency Interference (RFI). 2022 and 2023 have been a particularly challenging year due to naturally occurring and human caused RFI. A phenomenon called Ionospheric Scintillation that corresponds to the sun's solar cycle is present this year and has negatively impacted users, particularly those in Central and South America. But the most significant interferer, and the most significant interference has probably seen in NOAA data collection history, started occurring in June of 2022. A UHF voice

broadcast radio system began appearing on GOES DCS frequencies. This interference affected the GOES DCS pilot signals, which effectively disrupted the entire system. While the error rate was only approximately 5% of the system, those affected included users that utilize DCS data for tsunami warnings and firefighting. Figure 2 presents an example of the voice interference (horizontal green section) on the steady pilot frequency (thin vertical red line).

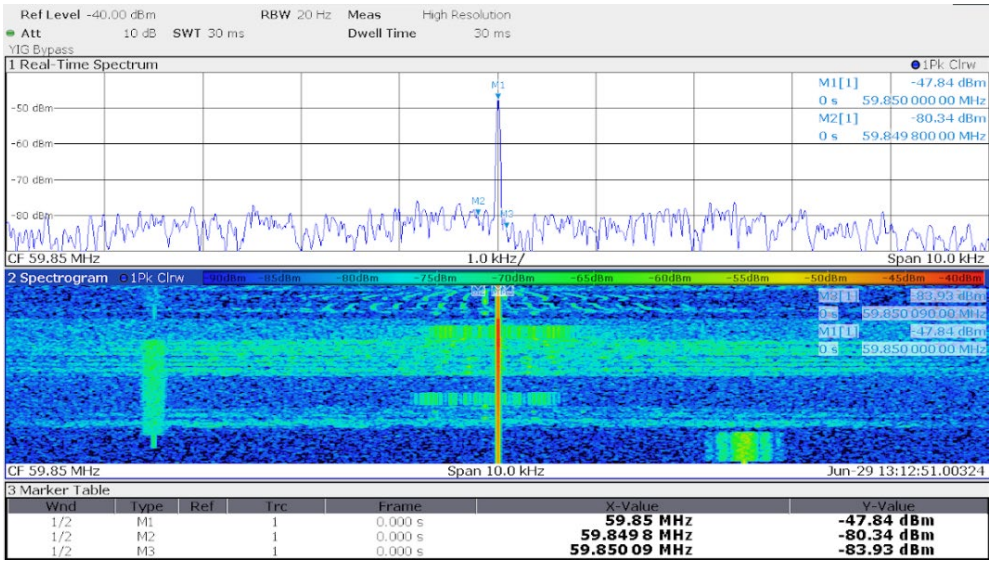

Figure 2 – Spectrum Analyzer Capture of Voice Interference on the GOES DCS Pilot Frequency

The combination of pre-existing interferers and the inability to rapidly command DCP frequency changes make RFI mitigation a challenge. This interference continues to affect GOES DCS and NOAA is currently coordinating with other government agencies to isolate the source of interference.

The growing number of satellite or terrestrial transmitters along with potential of mandated spectrum sharing represent additional RFI risks to GOES DCS. These risks make deploying a DCP command capability that will allow remote DCP configuration changes for frequency, time, or power (for example) a critical tool for the future.

3 IMPLEMENTATION OF BEST PRACTICES

NOAA GOES DCS had 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.

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.

3.2 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.

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

Due to redundancy of the GEOS DCS no service outages have resulted in the loss of data. However, “all user” e-mail notifications are sent during satellite transitions that require user action, unusual periods of RFI, or other activities that impact users. Additionally, public notices are posted to the DADDS public facing website. However, clarifying user notices with first like “first notice” and “final notice” or applying a tracking system to notices would offer an improvement over the current system and is a best practice the GOES DCS program will pursue.

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.

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.

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 the DCS Web Service as soon as possible.	DCS data is typically available within 2 seconds of receipt at a NOAA antenna downlink location.
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	The DCS Administration and Data Distribution Systems (DADDS) provides the ability for users to develop custom

	possibility for tailoring DCS data retrieval.	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 record 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 DCS Data Access documentation, accessible through the DCS Web Service.	NOAA GOES DCS documentation is posted on a publicly available web page.
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 agency 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 1 – 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 continues to be a highly reliable and highly utilized for environmental data relay in the western hemisphere. The system continues to grow and users from dozens of countries use the system for a variety of important applications, to include the protection of life, property, and the environment. However, the growth of system usage has not had an accompanying maturation in the DCS system to address new challenges such as spectrum management and RFI mitigation. NOAA's plans to replace the current version of DADDS and restore a DCP Command link are technologies that will foster this needed maturation and make GOES DCS a more modern, efficient, and flexible system.