2020 Spring GOES DCS Technical Working Group (TWG) 125th Meeting
Tuesday, May 5th, 2020
(Virtual Via Webex and Teleconference)

Opening Remarks/ Introductions – LySanias Broyles (STIWG Chair and U.S. Army Corps of Engineer, Rock Island District) and Richard Antoine (NESDIS/OSPO/SPSD/Direct Services Branch)

Richard Antoine opened the meeting at 09:30.

DCS Update: 100 BPS Discontinuation, CS2 Status (Richard Antoine (NESDIS/OSPO/SPSD/ Direct Services Branch)

Richard began by noting that we now have 659 SUAs and 2,134 registered users. Also noted was that the 100 BPS DCPs are no longer supported as of last January 21, 2020. There has also been an enhancement to DAMS-NT that should result in a better service to users by adding enhanced message statistics and that the site surveys needed to install a backup pilot at the CBU in Fairmont, WB have been accomplished.

Letecia Reeves then went over the chart below showing the status of all the DCPs in the system.

DCP Status	100 Baud	300 Baud	1200 Baud	Totals
Active DCPs	0	29,304	520	29,824
Inactive DCPs	0	7,347	604	7,951
Unused DCPs	0	2,400	214	2,614
Totals	0	39,051	1,338	40,389

Note: Statistics do not include the parked channel (-1).

Letecia then discussed the factors that determine the status of the DCP. The status levels are in column one, on the left in the table above. They factors are listed in bullet form below:

- A: System received data transmissions w/in 2 days.
- D: No data transmission received in 2 days.
- U: No data transmissions ever received from ID assigned to specific channel and timeslot.

She also noted that no active 100 BPS transmitters are left as they are not supported as of this last January 2020. She also briefed that there are now many more CS2 transmitters. A graphic showing the numbers of CS2 transmitters is below.

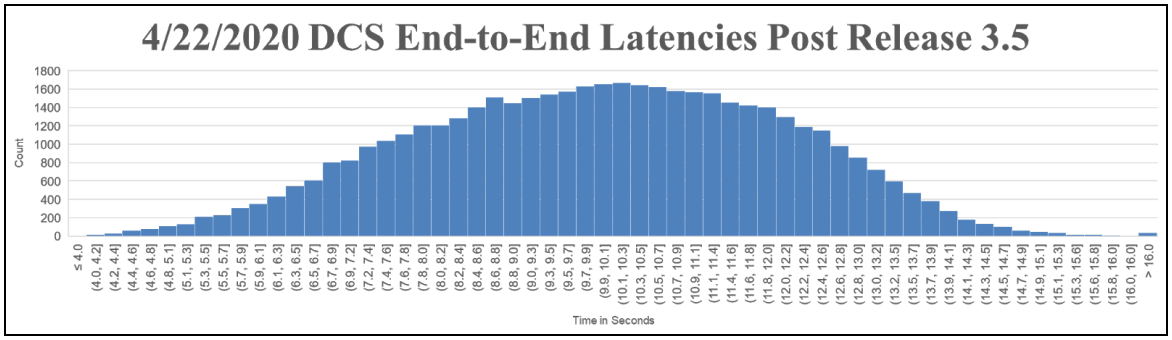
	300 Baud	1200 Baud	Totals
CS2 Transmitters	15,676	168	15,844

CS2 Transmitters by Baud Rate

Letecia also discussed the continued progress on CS2 transition with nearly 2000 more CS2 platforms transmitting since last April. She noted that 50% of all active platforms are now CS2 and that we now have 5 CS2 1200 baud channels. The users are doing so well with the transition that there has been enough bandwidth room created for 2 new 1200 baud channels. She noted that CS1 1200 baud transmitters will not work on the new 1200 baud channels. She also noted that users will have to contact her for new assignments if they want to install new CS2 transmitters. She noted that it is important for all to remember that the CS2 Transition Deadline is May 31, 2026.

A new initiative that was proposed at the last Spring's meeting was to have a "PDT Week" where users would be encouraged and assisted to update their PDT records. It is important to have the metadata within the DADDS kept up to date. Once each quarter, the DCS Program will dedicate a week to this task. During this week Users can contact us to ask questions or request assistance with creating and uploading a batch file. We will also contact some users, probably beginning with users that are attendees to this meeting. The first quarterly PDT Week will be June 8-11, 2020.

Seth Clevenstine, NOAA HRIT/EMWIN Manager, had briefed in previous years that there were some latency spikes for DCS within the LRIT and HRIT broadcasts. A NESDIS Product Dissemination and Access (PDA) update was accomplished recently that makes the latency less than 10 seconds end-to-end for the vast majority of the DCS data. Only 5 or 6 files spiked over 30 seconds over a 24-hour period. Two graphics below show statistics from 2018, 2019, and 2020 for DCS over HRIT transmissions.



Transmission Counts with Latency Over Time

DCS End-to-End Latency 12/18/2018		DCS End-to-End Latency 11/11/2019		DCS End-to-End Latency 04/22/2020	
Mean	21.41062	Mean	12.62271	Mean	**9.960817**
Median	17	Median	11.167	Median	**10.003**
Mode	16	Mode	12.085	Mode	**10.309**
Standard Deviation	27.14868	Standard Deviation	15.52087	Standard Deviation	**2.194221**
Minimum	8	Minimum	4.491	Minimum	**3.971**
Maximum	686	Maximum	360.65	Maximum	**62.622**
File % > 30-60 sec	2.80%	File % > 30-60 sec	0.57%	File % > 30-60 sec	**0.04%**
Files % 60-120 sec	1.11%	Files % 60-120 sec	0.42%	Files % 60-120 sec	**0.00%**
Files % 120-300 sec	0.79%	Files % 120-300 sec	0.50%	Files % 120-300 sec	**0.00%**
Files % > 300 sec	0.27%	Files % > 300 sec	0.04%	Files % > 300 sec	**0.00%**
Total % Latent >30 sec	6.60%	Total % Latent >30 sec	1.53%	Total % Latent >30 sec	**0.04%**

DCS Over HRIT End-to-End Latency Statistics from 2018, 2019 and 2020

These presentations can be found at: on the NOAASIS Web Site at: https://noaasis.noaa.gov/GOES/GOES_DCS/twg_meeting.html.

Wallops CDA Update - Travis Thornton and Matt Sullivan (Wallops Command and Data Acquisition Station)

Matt Sullivan introduced himself as a GOES DCS point of contact at WCDAS. He gave an overview of the GOES constellation and noted which are the operational East and West satellites; GOES-16 and GOES-17 respectively. He noted that GOES-13 will be renamed DOD-1 and, after acceptance by the USAF, is now located over the Indian Ocean. GOES-14 and 15 are in storage locations. Matt also noted that with the transition to GOES-R Series satellites becoming operational, the L-band downlink frequency for DCS changed from a range of 1694.30 to 1694.70 MHz to 1679.70 to 1680.10 MHz. Matt then briefed the GOES-R frequency plan. He noted that the frequency chart has a date from 2011. He noted that the radiosonde frequency band has changed from what it was on this chart.

He also briefed that the primary GOES antenna site is WCDAS and that there are two backup sites. The CBU site in West Virginia is a full backup site with one exception being a DCS receive ground system. The actual backup receive system is located at the NSOF in Suitland, MD. He noted that there are tentative plans to move that capability to the CBU in late 2020 or in

2021. He noted that there are 3 GOES-R antennas at CBU and another 3 at WCDAS. There are another 3 that support legacy GOES but that they are in the process of being updated for GOES-R.

Matt then briefed that WCDAS supports 4 main DCS disseminations: National Weather Service Telecommunications Gateway (NWSTG), Local Readout Ground Station (LRGS), High Rate Information Transition from GOES (HRIT/EMWIN) and the DCS Administration and Data Distribution System (DADDS). Matt noted that the NWSTG has a dedicated line from DADDS to the NWS gateway for redistribution. There is a dual feed; one from WCDAS and one from the NSOF. This feed can be switched in case of operational need. One thing to note is that the end customers for this are mostly unknown.

He noted that NOAA has 4 LRGS servers. There are two at WCDAS and two at the NSOF. The messages are received from both the DAMS-NT systems and they back each other up over the network. Users can monitor the status of the LRGS's via a web interface. There are also 3 other LRGS's that are maintained by the USGS at EDDS in Sioux Falls, SD. Matt showed a summary page for a LRGS. He noted that this is available from the DCS (1-4) web pages. There is a link on the home page.

Matt then briefed the HRIT dissemination. He noted that HRIT is a composite service containing EMWIN, imagery and products as well as the DCS feed. The HRIT transponder is located on the GOES-R satellites. It replaced the legacy LRIT broadcast.

Matt also went over the DADDS dissemination. DADDS has 4 web pages (https://dcsx.noaa.gov with the x being 1, 2, 3 or 4). He showed that there is a wealth of DCS information on the DCS web sites. There is both current and historical information. This included the information from all the TWG conferences. Users can also download their data from the DADDS.

Matt also briefed that there are DCP test channels for use by users. Users can use these when they are setting up DCPs etc. He also briefed the ARM or IM messages that provide quality information that is included in each message as a single character. Matt showed how you can access your messages on DADDS and where the ARM or IM codes are. These are also used by technicians for troubleshooting. The codes are included below.

- 'G' : Good Message - also transmitted with all messages except '?' and 'M'.
- '?' : Parity Error(s).
- 'A' : Correctable address
- 'N' : PDT Incomplete
- 'T' : Overlapping time error. A message was outside of, but overlapping its window.
- 'U' : Non-overlapping time error. Message completely out of its defined window.
- 'W' : Wrong channel
- 'M' : A self-timed message was not received at all, received on wrong channel, not completely inside a window or an overlapping window.
- 'B' : Non-correctable : Available on the DADDS Website message data. Messages with bad addresses are not disseminated.

- 'I' : Invalid address. Available on the DADDS Website message data. Messages invalid addresses are not disseminated.

Matt showed a set of contacts for WCDAS. He noted there is 24-hour technical support at WCDAS. The contact information is shown below.

- Wallops Help Desk: 757-824-7450, wdcs@noaa.gov
  - 24/7 Technical Support for DCS, LRGS, DADDS, HRIT
- Travis Thornton: 757-824-7316, joseph.t.thornton@noaa.gov
  - WCDAS Operations Shift Supervisor
  - DCS Operations Team Lead
- Matthew Sullivan: 757-824-7360, matt.g.sullivan@noaa.gov
  - DCS RF Systems Specialist
  - WCDAS Frequency Spectrum Manager

This presentation can be found at: on the NOAASIS Web Site at: https://noaasis.noaa.gov/GOES/GOES_DCS/twg_meeting.html.

STIWG Report - LySanias Broyles (STIWG Chair and U.S. Army Corps of Engineer, Rock Island District)

LySanias Broyles gave an overview of the 2019 meetings. He noted that in recent years there has been a mid-year intersessional meeting in the Fall. The Fall meetings are useful to keep us on track with projects and actions. LySanias briefed that there is a relatively new working group on Random Channel Coordination to go along with the DCS Preservation and the OpenDCS Standardization working group. This group will develop rules and standards to guide the use of the random channels.

On the OpenDCS effort, he noted that there are support agreements in place. These MOAs and MOUs will be used to fund updates to the OpenDCS software. Another activity is the Radio Frequency Interference Analysis and Mitigation activity. The community is awaiting publication of the SPRES report. One result of this is to identify or baseline the spectrum environment at sites. What they would like to do is to compare SPRES with other studies that have been accomplished. This information can be used in consultations with the FCC.

The effort to use 2-way communication is progressing. This will allow users to command their DCPs remotely. This mitigates the need to make so many trips to these sites. The STIWG is advocating the continued development of this capability. He then briefed that they are working on processing the full set of HRIT data. One thing that has been an issue is the Rice Compression Algorithm. It is a universal format, but one issue has been the lack of documentation. The STIWG is talking with both Microcom and Cove to provide a cross-platform solution. We are hoping to have a solution by the Fall meeting.

LySanias also noted that a presentation was developed that was a comprehensive brief on GOES DCS that can be used to inform agencies on the need for DCS. It is well known that most

agencies and the public do not understand how important and useful the DCS data can be. He also went over a list of on-going activities including the CS2 migration that is providing additional bands that can support more frequent transmissions. It was also noted that the STIWG is working with NOAA on the DADDS upgrade project. A new effort is to investigate whether DCPs should transmit their location and possibly radio data, which is important to making the PDT information and more importantly location information accurate.

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User Reports – Significant Events

User 1 - USACE - LySanias Broyles (STIWG Chair and U.S. Army Corps of Engineer, Rock Island District)

LySanias gave a "user" presentation on the use of DCS by USACE. He showed the map of the USACE regions and then a map of plots of the CONUS DCP deployments. He noted the USACE is going through a DRGS modernization process. They have done a spectrum analysis of many of their sites and are going through mitigation for interference. He noted they have 7 DRGS sites. The DRGS sites are listed here:

- Rock Island, IL – GOES East/West – Scheduled to begin ~Aug 2020
- St. Louis, MO (East) – Site visit and EME analysis complete
- Vicksburg, MS (East) – Site visit and EME analysis complete
- Columbia, MS (East) – Site visit and EME analysis complete
- Cincinnati, OH (East) – Site visit and EME analysis complete
- Omaha, NE (East) – Phase 1 projected to begin ~Summer/Fall 2020
- Sacramento, CA (West) – Phase 1 complete

He noted that one obstacle is that some of these sites have limited access at the present time due to the COVID-19 epidemic. USACE is doing new site surveys noting that some of the stations are 30+ years old. They are implementing new Microcom DRGS systems in-order-to have a homogeneous network. They are working to link all the various DRGS and HRIT sites so they have redundancy and resiliency. They are doing interference monitoring to understand where inference is coming from and what can be mitigated.

He briefed that they monitor water quantity primarily using DCPs. They have had a very abnormal winter. He noted that instead of sustained bitter cold snaps, they got higher temperatures and rain this year. Then there were short times of freezing that produced a deep frost layer. This caused a long flood season duration with several top ten crests. He showed a photo of Rock Island during a crest noting there was 80 days of high crest. LySanias then showed a list of the top 10 flood crests along the Mississippi River. The thing to note was that the height of the crest was not the major issue, but it was the duration of the flood event. The new record set in 2019 was 96 days where the previous record was 35 days.

He briefed the USACE's 2019 USACE DCP Summary. He noted that there are still a few line-of-site platforms in the Western District, but they are converting to GOES.

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Open DCS Suite Software Discussion - LySanias Broyles (STIWG Chair and U.S. Army Corps of Engineer, Rock Island District)

LySanias began this presentation on the DCS OpenDCS Software Suite by noting that this project was started several years ago to get all the uses on the same software but primarily to share funding and collaborate on updates and enhancements to the software. The open standardization group has accomplished a baseline software and an executable plan to unify existing OpenDCS variants and capabilities into a single platform.

Historically, it was determined that some agencies had developed their own enhancements which other users did not know about or did not have access to. The STIWG initiated the project by doing a survey. It was discovered that most agencies use the Cove version but that the NOS uses the Sutron version that had an enhancement for the PORTS project. The first iteration of the OpenDCS baseline will incorporate the NOS PUFFF application functionality into the Cove Software. This will then become the standard OpenDCS software version and future enhancements will be incorporated into this version. Using the OpenDCS software agreements, agencies will be able to share and fund enhancements so that all users will be able to take advantage of the improvements. He noted that some improvements may be unique to some agencies while others will be more widely applicable.

LySanias noted that USACE has interagency MOUs with each STIWG agency. They now have language to allow for the exchange of funds. USACE will become the clearinghouse for OpenDCS support and improvements. It was noted that this is a way to expedite getting the projects funded and the work completed but will not be a vetting procedure for what is done. He noted that this is not a subscription service but will be pay as you go for funding projects and improvements.

This presentation can be found at: on the NOAASIS Web Site at: https://noaasis.noaa.gov/GOES/GOES_DCS/twg_meeting.html.

Spectrum Update/ FCC Auction - Dave Lubar (Alion)

Dave Lubar presented a talk on Radio Frequency Interference where he outlined some of the challenges this presents to DCS users.

This presentation can be found at: on the NOAASIS Web Site at: https://noaasis.noaa.gov/GOES/GOES_DCS/twg_meeting.html.

Radio Frequency Interference Monitoring System (RFIMS) - Dr. Pouyan Amirshahi (RFIMS Chief Scientist, Aerospace Corporation/RFIMS Program)

Dr. Pouyan Amirshahi gave a presentation on the Radio Frequency Interference Monitoring System (RFIMS) project. Pouyan presented a short history of the FCC auctions to give context to the goals of the project and went over the NOAA L-band environment. He noted that one of the auctions was for 1695-1710 which are adjacent to the GOES-R bands. The purpose of the RFIMS project is to monitor the full spectrum from 1670 – 1755 MHz b spectrum.

He noted that there was already interference from the AWS-1 band to the polar downlink. He then showed a graphic showing data loss lines on an image noting that there will probably be out of band interference in the GRB and HRIT signal when the cell phone companies begin to use the band near 1695MHz. He also stated that the AWS-1 cell users must coordinate with the government on the location of their towers in relation to the government protection zones that were established. He also showed a diagram of the protection zone for WCDAS. It is a 30km zone.

Pouyan noted that the RFIMS project has 4 core functions. They are Detect, Classify, Identify and Notify and are described in bulletized form below.

- Detect - The system will detect, in real-time, interference "events" at levels at or above -10 dB Interference-to-Noise Ratio (INR) during NOAA's earth station downlink reception.
- Classify - The system will classify, in real-time, the nature of RF interference. Where "classify" is the discrimination between 1695 – 1710 MHz LTE UE uplink signals and all other radio frequency interference (RFI) such as background impulsive noise and out-of-band emissions from other RF sources.
- Identify - If the system determines the RFI is related to 1695 – 1710 MHz LTE UE uplink signal interference, then the system will identify the source(s) of interference in real-time
- Notify - The system will notify NOAA operators, and the wireless carriers responsible for the interference

He noted that the RFIMS needed an extremely capable antenna. Two solutions were developed. One is an antenna located on a tower and the other is a portable system that can be carried on a truck. There is a picture below of both solutions in the presentation.

RFIMS Stationary and Mobile Antenna Configurations

Pouyan then went over the operations of the RFIMS. RFIMS has one antenna beam that always looks at the horizon. There is also a scanning beam that can focus on an event location. The system also includes a spectrogram, a RFIMS Analysis Tool and a user interface. The primary system will be located at the Table Mountain facility that is a radio quiet zone equipped with antennas and receivers that are normally found at NOAA's ground stations including POES, Metop, and GRB. HRIT and DCS antenna receive systems will soon be acquired. There will also be an LTE network that can be used to develop test interference signals. This site will be used for extensive testing and validation of the RFIMS system.

Paul Campbell asked a question on how weather conditions affect radio interference. Pouyan answered that it has been known that ducting has an effect. This has not been correlated yet. This study is a possibility at Table Mountain but not planned.

He also noted that it is planned that the portable solution will be located at WCDAS in February 2021, depending on the pandemic staffing response. He also noted that users can request to have a specific interference scenario tested at Table Mountain.

This presentation can be found at: on the NOAASIS Web Site at: https://noaasis.noaa.gov/GOES/GOES_DCS/twg_meeting.html.

Small Sat Concept Validation Update - Beau Backus (NOAA/NESDIS Spectrum Management- Management and Continuity Operations Branch)

Beau Backus gave a presentation on the Small-Sat project. He noted that there is increasing use of the 400 MHz band for uplink to satellites. Normally, the uplink will not interfere with the downlink of DCS. However, the small-sats are using omnidirectional antennas that propagate in

a horizontal manner. This aggregated energy from a constellation of satellites will eventually result in an increased source of RFI to the DCS system over time. The idea is to have small-sats transmit within the DCS architecture, since this is low data rate transmission.

The TechEdSat 10 mission will host our payload to test DCS in orbit. Microcom has been developing a board to mimic a DCS in space and account for the Doppler Effect. This will test the ability for a small-sat to transfer data to the user on the ground. Beau noted that this will only work when we are in sight of one of the GOES-R satellites. It will do a test transmission on GOES-West until it sees GOES-East. If we want to do more then we would wait until we can only see GOES-East. He noted that the test will last a week. TechEdSat 10 is currently located on the International Space Station and the ejection will be on July 2nd, 2020. There will be tests with the Doppler correction and possibly without the correction. Aerospace has built a ground site in El Segundo to support the test.

TechEdSat-11 tests will be used to test with all the international satellites so there will be global coverage. When we are not doing Doppler correction, we need to be able to use random channels. This way, it will not cause any harm to a terrestrial user. They will need to be able to select between the 300 and 100 baud rates. A possible launch date for TechEdSat-11 will be in early 2021. Potential future work would be two-way communication using GOES and the use of higher data rates. He noted that NASA is proposing to use the DCS network for the monitoring of the surface of Mars.

In conclusion, it was noted that the 401-402 MHz band is desired for use by the small-sat community. NOAA is working with them to use the DCS system. This cooperative approach could also be used by the international DCS community to expand the availability of DCS satellite use of the international DCS bands globally. It does not seem that there are insurmountable difficulties. The work over the near future is a proof of concept. If successful, we would need to develop rules and guidelines along with best practices. We expect to be through validation after July 14th.

This presentation can be found at: on the NOAASIS Web Site at: https://noaasis.noaa.gov/GOES/GOES_DCS/twg_meeting.html.

Two-Way Update - Brett Betsill (Microcom Design, Inc.)

Brett Betsill gave an overview of the progress involved in establishing two-way communications for the DCS DCPs. Due to the highly technical subject matter involved in this presentation, Microcom Design provided a summary of the update and the status of the Two-Way modulator and demodulator. Their summary is presented as written by Microcom below.

> "The topics covered in the presentation were the modulator hardware and software, the Over-the-Air BER testing, the hop synchronization and the unforeseen satellite movement.

The presentation began by showing a photograph of the modulator installed at WCDA while it was creating the hopping Two-Way signal to GOES East. Remote desktop software was able to be used to reliably connect to the Two-Way modulator at WCDA from Microcom's offices in Hunt Valley. The default status of the Two-Way modulator when not testing is to synthesize a 72.8 MHz carrier signal which is uplinked to GOES East, this correlates to the DCPI 468.8 MHz downlink signal.

In the next slides Microcom covered the features added to the Modulator PC program needed for testing. Those additions included an adjustable power level which will be used to reliably and repeatedly adjust the output power of the Two-Way modulator in 0.1 dB steps so that good BER data can be taken. Channel adjustment was added to enable the ability to quickly verify proper frequency output. A 10MHz OCXO lock algorithm was added to ensure accurate frequency synthesization. Four modulation modes were added to ensure the correct bit rate and filters were being used by viewing the output on a spectrum analyzer. The ability to remotely program the firmware in the modulator was also added in case there were any firmware features that needed to be added. The last software addition covered was the hop timing adjustment which is used to adjust the hopping time in 10 nano-second steps to accurately align the hop time.

A screen capture of the GOES East Two-Way signal was shown. This signal was captured using a 468 MHz cross Yagi receive antenna pointed at GOES East. In the screen shot both the GOES East and West signals can be seen with the GOES East signal being 25 dB stronger.

The next four slides showed animations of the path the hopping signal takes from WCDA to Microcom. The first and second slides depict the light speed induced delay in the hopping signal as it travels to and from the satellite. The goal of these slides was to clarify the need to advance the hopping signal. The third and fourth slides showed a representation of the spectrum with the LRM channels and the Two-Way signal hopping through its eight interstitial frequencies.

Microcom then presented the unforeseen complications delaying the BER measurements. These complications included a strong interfering emitter, temporary transition of GOES operations from WCDA to CBU, satellite transponder AGC and satellite movement.

- A strong interfering emitter was detected and measured to be +65 dB stronger than the Two-Way signal. This signal was strong enough to damage the first version of the RF front end amplification and caused delays when the front end was modified to tolerate strong interfering signals. The improved RF front end was then demonstrated to be able to mix down the Two-Way signal with 25 dB SNR with a spectrum screen shot.
- The signal strength of the Two-Way signal will need to be decreased to allow for BER measurements to be made at different levels. This was accomplished during the previous testing by increasing the noise floor to decrease the SNR and was dismissed as a test method because it will not accurately simulate real world situations where DCRPs are located at the edge of the GOES illuminated area. On March 6th the inability to adjust the power level coming from the satellite was discovered. Two potential solutions were discussed: first a secondary carrier could be added which would keep the AGC active

while testing the Two-Way signal or second the satellite could be placed in fixed gain mode. Both potential solutions were thwarted by the ongoing pandemic which halted any further investigations.

- On March 6th it was also discovered the satellite movement was impacting Two-Way reception. Testing showed that the Two-Way hopping signal requires alignment accuracy better than 0.5 micro-seconds, or else the phase noise of the signal will be increased by the miss-alignment. 0.5 micro-seconds equates to a satellite movement of 300 meters. Unfortunately GOES-East moves 12000 meters per day. If this movement is un-tracked by the modulator or demodulator it will cause increased phase in the Two-Way signal noise due to hop misalignment and eventually it will cause the demodulator to break lock. This drift must be tracked out in order for the system to function. The satellite movement was also found to cause a 7 Hz shift Doppler shift in the 468.8 MHz signal over 24 hours. The next slide showed a graph with two curves, the time variation and Doppler frequency variation. The time variation showed the satellites movement causes 80 micro-seconds of travel time variation over a 24-hour period. The Doppler variation showed a corresponding frequency variation of 7 Hz over the same 24-hour period. Since the satellite movement is approximately sinusoidal the delay can currently be tracked out over one day by entering a set of pre-calculated terms into the demodulator. Unfortunately, the satellite movement is not exactly sinusoidal and any satellite movement due to station keeping maneuvers will alter the travel time delay so a method for detecting an offset in timing will need to be developed. This satellite movement tracking will require further investigation in order to find a robust solution."

This presentation can be found at: on the NOAASIS Web Site at: https://noaasis.noaa.gov/GOES/GOES_DCS/twg_meeting.html.

Manufacturers' Remarks

Manufacturer 1 – Microcom Design and Microcom Environmental (Perry West)

Perry West gave a presentation on Microcom Design and Microcom Environmental. He highlighted their XPress system noting that this is Microcom's feature product. He also briefed that Xpress is an extremely cost-effective solution as it is contained in an enclosed package that eliminates the need for a gage house and instrument enclosure and that optional mounting solutions are available. Some of the XPress system characteristics are listed below:

- GTX-2.0 Satellite Data Transmitter & Logger
- UB6 Satellite Transmit Antenna
- 5 Watt Solar Panel
- GPS Antenna
- Internal Battery Pack
- Solar Regulator
- Lightweight
- IP66 Enclosure
- Mounting & Solar Panel options available

- Extremely cost-effective

Perry also noted that Microcom offers the DAMS-NT DigiTrak DRGS systems and a DigiRIT HRIT System.

Points of contact for Microcom are listed below.

This presentation can be found at: on the NOAASIS Web Site at: https://noaasis.noaa.gov/GOES/GOES_DCS/twg_meeting.html.

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Manufacturer 2 – OTT HydroMet (Sutron) (Chris Buchner)

Chris Buchner from OTT HydroMet gave a presentation highlighting their family of data loggers; specifically, their new Satlink3 Lite product.

Chris showed a graphic with their family of their "data loggers." Satlink 3 lite is a new product. This system is targeted for simple stations and applications. A list of characteristics is listed below:

- Built-in Internal memory (no SD card required)
- 3 year Warranty
- 32 Measurements
- Dual Independent SDI-12 Ports
- Tipping Bucket Input
- Supports WiFi
- Uses Link Comm, no learning curve

He noted that this is a very low-cost system that can use either a Yagi or GOES antenna.

A comparison between the Sutron Satlink3 and the Satlink 3 Lite capabilities is contained in a graphic below:

Advanced Selection Guide

SUTRON SatLink3 vs SUTRON SatLink3 Lite

Feature	SatLink 3	SatLink 3 Lite
Uses geostationary/meteorological satellites for transmitting data.	✓	✓
Connectivity via SDI-12 sensors and a dedicated Tipping Bucket and Modbus Slave.	✓	✓
Compatible with SUTRON LinkComm software to configure stations and view/process data.	✓	✓
Can support additional telemetry methods Cellular or IRIIDUM satellite via plug in modules, which allow for near real-time data transmission.	✓	X
Can support data redundancy as well as two-way communication (remote site access and configuration) via plug in modules.	✓	X
Capable of future upgrades or expansions on telemetry or measurement types for long-term, ever changing monitoring needs.	✓	X
Supports customization through Python scripting.	✓	X
Supports multiple analog and digital channels, Modbus Master and Slave interfaces.	✓	X

Chris Buchner's contact information is below.

This presentation can be found at: on the NOAASIS Web Site at: https://noaasis.noaa.gov/GOES/GOES_DCS/twg_meeting.html.

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OTT HydroMet Corp.
can be reached at chris.buchner@otthydromet.com

Review Action Items – Richard Antoine and LySanias Broyles

Richard Antoine then led a discussion on the action items from the previous meetings and their status.

- 123-1 Inform Seth that there is no DCS User Objection to canceling Virtual Channel 31 and to continue using VC 32 for the New HRIT DCS File Format
    - Status: Complete and closed
- 123-2 (122-1): NOAA to investigate request from Bahamas Met Service to maintain 5-10 years of GOES DCS data on website. See Pages 01-02
    - Status: Complete and closed. It was determined that this request would not be fulfilled.
- 123-3 (122-2): Investigate how to make configuration files available in the USACE DCP Monitor system.
    - Status: This action is In Progress

- 123-4 (122-3): As WCDAS puts WMO headers on 89% of messages and sends them to the NWSTG, consider putting WMO headers on all the messages; or assess whether we should be doing this at all by seeing if there are user requirements for this. This needs clarification or a statement of need then NOAA will scope the task. See Pages 01-02.
    - Status: This action is In Progress and needs follow-up with Matt Sullivan of WCDAS.
- 123-5 (122-6): Provide the location, exact latitude and longitude for all Federal and non-Federal stations (including foreign) for DRGS, LRIT, HRIT/EMWIN to the NOAA SPRES Contractor Shared Spectrum Company so that they have a correct and comprehensive list of receiving stations. Send to Dr. Todd Martin at tmartin@sharedspectrum.com and please copy beau.backus@noaa.gov. Please provide within the next 30-60 days along with a point of contact with email and phone for your organization. See Page 13. See Pages 01-02
    - Status: Complete and closed as it has become overcome by other events.
- 123-6 (122-8): DCS Program to prepare some vehicle for getting user input on the DCPI two-way communication project. See Pages 01-02
    - Status: This action is In Progress. Letecia Reeves will include this in a questionnaire within the next month or so.
- 123-7 (122-9): DCS Program manager to prepare a briefing for OSPO and NESDIS Management on estimates on the costs to bring the DCPI two-way communication project to completion for GOES-R Series and the next generation of satellites. NOAA and Microcom are in progress of executing a project plan. See Pages 01-02.
    - Status: This action is In Progress and will be addressed again after the PMR to take place in June 2020)
- 123-8 (122-10): NOAA to investigate back-up (remote) pilot options including reuse of Goddard equipment or a new system for the CBU. Short term project complete; long term solution in progress. See Pages 01-02.
    - Status: This action is in progress under a contract work assignment. It should be completed in the contract year OY#4.
- 123-9 (122-12): Work with the HRIT/EMWIN Program Manager to plan for up to 10% DCS usage on HRIT/EMWIN. See Pages 01-02.
    - Status: This is complete and closed. Currently DCS is allowed up to 8% of the bandwidth, with 4% of it guaranteed. DCS never clips past 3.4% of the bandwidth each hour.

Next Meeting and Adjourn – Richard Antoine

This was the end of the STIWG meeting.

See Appendix I for the action items, Appendix II for the meeting agenda and Appendix III for meeting attendees.

All presentations can be found at: on the NOAASIS Web Site at: https://noaasis.noaa.gov/GOES/GOES_DCS/twg_meeting.html.

LySanias and Richard noted that the next TWG and STIWG will be held virtually on or about December 7th in a virtual format.

Appendix I: May 5, 2020 125th TWG (Virtual) Actions

There were no new actions noted at this meeting.

Appendix II: May 5, 2020 125th TWG (Virtual) Agenda

0900 Check-In/ Conference Call line/ WebEx
0930 Opening Remarks/ Introductions online
0945 DCS Update (100 BPS Discontinuation, CS2 Status) (Antoine/Reeves)
0945 HRIT (Seth Clevenstine)
1000 Wallops Update (Travis T/ Matt S)
1015 STIWG Report (LySanias B)
1030 User Reports - Significant Events
1100 Open DCS Suite Software Discussion (LySanias B)
1130 Spectrum Update/ FCC Auction (Dave Lubar/ Alion Survey update/etc.)
1200 Radio Frequency Interference Monitoring System (RFIMS) (Dr. Pouyan Amirshahi)

1230 Lunch

1330 Small Sat Concept Validation Update (Beau Backus)
1400 Two-Way Update (Brett Betsill)
1430 Manufacturers Remarks
1530 Review Action Items
1600 Adjourn for the day!

Appendix III: May 5, 2020 125th TWG (Virtual) Attendees

Allegretti, Phillip	Vaisala
Amirshahi, Pouyan	NOAA OSGS/Aerospace Corp
Anderson, Quentin	Tennessee Valley Authority
Antoine, Richard	NOAA/NESDIS/OSPO/SPSD
Argast, Tim	Northwest Hydraulic Consultants
Backus, Beau	NOAA
Beers, Thomas	USDA NRCS Snow Survey
Bejarano Estrada, Stefany	SENAMHI
Belanger, Francis	Evolugen - Brookfield Renewable
Bell, Brian	USACE Seattle District
Bestill, Brett	Microcom Design, Inc.
Breitkreutz, Patrick	Department of Natural Resources

Broyles, LySanias	USACE
Buchner, Chris	OTT Hydromet Corp.
Burke, Megan	USACE-NAE
Campbell, Paul	Environment and Climate Change Canada
Ceanfaglione, Matt	Microcom Design/Microcom Environmental
Chira, Jorge	Meteorological and Hidrological Service
Chodkiewicz, Scott	U.S. Army Corps of Engineers - Mobile District
Clevenstine, Seth	NOAA/NESDIS/OSPO/SPSD
Cortez, Adrian	USIBWC
Couture, Sylvain	MINISTRY OF ENVIR.QUEBEC
Crawford, Charles	Texas Water Development Board
Dagenais, Henri	Saskatchewan Public Safety Agency
De Dominicis, Shayne	Manitoba Hydro
Denholm, Ann	U.S. Army Corps of Engineers, Northwestern Division, Missouri River Basin Water Management
DeWitt, Jan	USACE
Diamond, Howard	NOAA's Air Resources Laboratory
Dopp, Justin	Bureau of Land Management
Dormuth, Darryl	Water Security Agency, Province of Saskatchewan
Dorsey, Warren	SME- NOAA/NESDIS/OSGS/PETD
Edwards, Richard	USGS-NJ
Ellis, Nicholas	California Department of Water Resources
Forste, Jerry	NWS-CRH
Fraley, Tracy	USACE
Gagnon, Simon-Pierre	Quebec Ministry of Environment (MELCC)
Gomez Ramos, Octovio	National Sea Level Monitoring Service of the Geophysics Institute of the National Autonomous University of Mexico (UNAM)
Gray, Jesse	BLM/NIFC
Greenberg, Brandi	Alion Science & Technology
Hall, Mark	ARL/NOAA
Herbert, Bruce	Signal Engineering Inc
Hoffmeister, Dirk	University of Cologne, Germany
Holcomb, Nathan	NOAA-NOS
Hyde, Leona	Government of Newfoundland Labrador
Jackson, Brian	National Weather Service Office of Dissemination
Jarlenski, Lauren	NOAA/ NDBC
Keating, Linnea	U.S. Forest Service
Keeler, Craig	GOES-R Program Systems Engineering

Keenan, Jack	USACE
Kissock, Stephan	US Army Corps of Engineers
Koehnke, Ruth	USACE, Portland District
Kopp, Brian	The Semaphore Group,Inc.
Krug, Warren	NOAA/NOS/CO-OPS
Larson, Eric	USDA-NRCS Snow Survey
LeBlanc, Lex	NDBC
Lee, Lee	US Army Corps of Engineers-LA District
Loseman, Wade	Ott Hydromet
Lubar, David	The Aerospace Corporation
Maloney, Michael	Cove Software LLC
Marotto, Ron	County of Ventura
Medina, Joe	California Department of Water Resources
Moore, Zachary	Minnesota DNR
Morris, Kara	Oregon Water Resources Department
Nelson, Michael	Campbell Scientific Inc
Nikolova, Karolina	EUMETSAT
Opishinski, Tom	Interactive Oceanographics
Pardee, Richard	USGS water mission area
Parsons, Randolf	Government of Newfoundland and Labrador
Poveda, Luis	MAE-SENAGUA
Ramage, Dan	NERRS/CDMO
Randall, Valerie	NOAA/SSAI
Redding, Chris	Not Available
Reeves, Letecia	NOAA/NESDIS/OSPO/SPSD
Rele, Bhushan	Alion Science and Technology
Robertson, Carrie	MN Department of Natural Resources
Romero Casas, Edgar	SMN CONAGUA
Schwitalla, Dan	USGS-DOI
Seymour, Paul	SID/NOAA
Simmer, Steve	U.S. Army Corps of Engineers
Smiley, Bruce	BC Hydro
Smith, Eric	USACE
Stuart, Joe	USACE
Sullivan, Matthew	NOAA
Swofford, Robert	BLM/NIFC
Ustare, August	Hydrologica Environmental
West, Perry	Microcom Design/Microcom Environmental
Whaley, Philip	NOAA/Systems Engineer/Perspecta
Yazzie, Jeremy	Environmental Protection Agency
Yeadon, Steven	The National Data Buoy Center

Zarikoff, Brad	FTS Inc.