STEREO MOC Status Report
Time Period: 2015:320 - 2015:326

STEREO Ahead (STA) Status:

1. The following Ground System anomalies/events occurred during this reporting period:

   - On day 321, during the DSS-63 support, turbo decoder lock was lost at 0946z. This anomaly resulted in the loss of one frame of SSR data.

   - On day 321, during the ESA DSS-84 support, initial telemetry acquisition was 5 minutes delayed due to an incorrect downlink rate configuration. Later in the support, the command bind was lost at 2032z. After the station switched command servers, the MOC was able to rebind successfully to the command link at 2215z. This resulted in postponing the IMPACT SWEA high voltage ramping to the next day.

   - On day 322, during the DSS-43 support, the telemetry bind was lost at 2235z due to a network anomaly at JPL. The MOC successfully rebound to the telemetry server at 2239z. This resulted in the loss of 4 minutes of real-time telemetry. See DR# N110143 for more information.

   - On day 323, the 4th uplink array test for STEREO using DSS-26 and 25 was successfully conducted by the DSN. The new configuration tested consisted of two 34m stations utilizing the 80 kW transmitter on DSS-26 and the 20 kW transmitter on DSS-25 with the HGA main lobe, riding along a one degree offset, with the MOC sending no-op commands. An approximately 3 dBm increase in received signal power was demonstrated when the DSS-25 uplink was phased to the DSS-26 uplink at the spacecraft with all 20 no-op commands being received correctly using the 7.8125 bps uplink rate.

   - On day 324, during the DSS-63 support, turbo decoder lock was lost intermittently between 0941z and 1053z. This anomaly resulted in the loss of 12 frames of SSR data.

   - On day 324, during the DSS-43 support, at BOT, telemetry lock was lost intermittently from 2010z and 2014z. This anomaly resulted in the loss of 1184 frames of real-time

and SECCHI and spacecraft SSR data. See DR# C111529 for more information.

- On day 325, a Return-To-Service (RTS) engineering demo was conducted with DSS-55. The purpose was to validate X-band tracking performance after the completion of the depot level maintenance. All test objectives were met successfully. Tracking, telemetry, and command data from this support was non-committed.

2. The following spacecraft/instrument events occurred during this week. The Ahead observatory operated nominally during this week resuming operations on the HGA main lobe riding along a one degree offset to prevent overheating of the HGA feed assembly which was at 119 degrees C with the HGA angle at 7.1 degrees and increasing, with respect to the spacecraft-Sun line. After 15 months of side lobe and superior solar conjunction operations, on day 321, November 17th, nominal daily science operations resumed.

   - On day 320, during the DSS-63 support, after verifying that all in-situ science data recorded since the start of side lobe operations in August 2014 was received by the MOC, the SSR was successfully reconfigured for nominal science operations by loading DHS release 1.1.11 to C&DH RAM. The real-time telemetry queue for SECCHI housekeeping data was operating as expected.

   - On day 321, during the DSS-63 support, the MOC finished configuring the Ahead spacecraft bus for returning to nominal science operations by loading MOps Macro release 1.1.28 to C&DH RAM at 1054z. After 454 days of side lobe and solar conjunction operations on the Ahead observatory, daily SSR playback, commanding, and tracking operations have resumed. The space weather broadcast has resumed transmitting SECCHI images and the small amount of spacecraft housekeeping data has been removed.

   - On day 321, during the ESA DSS-84 support, the IMPACT SWEA and STE instruments were powered on at 1808z, after being off for 15 months due to very limited telemetry bandwidth.

   - On day 322, during the DSS-43 support, the real-time telemetry table was switched to RTDFD #23 at 2043z to provide IMPACT science APIDs to monitor SWEA high voltage ramp-up and STE reconfiguration. The IMPACT team

successfully completed bringing up SWEA and STE to their respective science configurations.

- On day 323, the SWAVES SSR science partition (#13) filled at 1241z for 11.7 hours.

- Processing status of the in-situ instrument space weather data recorded during the 15 months of side lobe operations:

  This week, the following days were processed with the associated data products available on the MOC STEREO Data Server and GSFC SSC websites:

  Day 2014-331 through day 2015-245
  (November 27th, 2014 through September 2, 2015)

- The average daily science data return for Ahead, with the HGA on the main lobe riding along a one degree offset, was 2.9 Gbits during this week.

STEREO Behind (STB) Status:

1. The following Ground System anomalies/events occurred during this reporting period:

   - None.

2. Detailed status of the recovery activities to restore operations from the Behind loss of communication anomaly, which occurred on day 2014-274, are listed below.

   - The Behind observatory entered superior solar conjunction at the 2.0 degree SPE angle on day 022. Recovery efforts resumed post solar conjunction on day 124, May 4th through day 178, June 27th, as the spacecraft had cleared solar interference for LGA communications. The Failure Review Board recommendations were implemented consisting of battery state of charge recovery and powering on the downlink carrier. The Green Bank Radio Telescope and the Arecibo Observatory also observed the carrier recovery tracks. To date, no downlink signal has been detected from the Behind observatory since the anomaly occurred. Due to Behind's retrograde motion causing it to re-enter the region of solar interference, recovery operations have been suspended and will resume on November 30th. The Green Bank

Radio Telescope and the Arecibo Observatory will also observe the carrier recovery tracks depending on availability.

- The Failure Review Board's recommended faster frequency segmented acquisition sequence was tested with the Ahead observatory on day 272, September 29th. All 18 one kHz frequency steps were tested twice. While stepping down through the 1 kHz segments, on segment #9 going down in frequency, the transponder locked to the BLF and accepted 9 no-op commands as expected. An interesting finding, but not unexpected, was that the transponder continued to follow the moving carrier and accept all commands sent for the remaining 27 segments.

- Testing of the DSN uplink arraying capability using the Ahead observatory continued on day 323, November 19th, with the 4th uplink array test successfully conducted for STEREO using DSS-26 and 25. The new configuration tested consisted of two 34m stations utilizing the 80 kW transmitter on DSS-26 and the 20 kW transmitter on DSS-25 with the HGA main lobe, riding along a one degree offset, with the MOC sending no-op commands. An approximately 3 dBm increase in received signal power was demonstrated when the DSS-25 uplink was phased to the DSS-26 uplink at the spacecraft with all 20 no-op commands being received correctly using the 7.8125 bps uplink rate. The 5th uplink array test is scheduled for January 14th, testing the use of three 34m station using the 80 kW and two 20 kW transmitters with the HGA main lobe. When the uplink array capability is ready, it will be used to increase the spacecraft received signal power to assist with Behind recovery commanding.

- With time the spacecraft range improves RF communications and the ability for other assets to acquire data on Behind. While the STEREO RF link was not designed to be closed beyond 2 AU, as the Earth range is now decreasing, the LGA uplink margin returns to nominal, 6 dB for the 7.8 bps rate, in March 2016 and the LGA downlink margin returns to nominal, 3 dB for the 12 bps rate, in December 2016.

Significant findings to date:

1. Analysis of the three DSN extracted telemetry frames from the carrier signal just before the planned observatory reset/anomaly occurred on day 2014-274, October 1st, showed

nominal performance of the spacecraft, i.e., no anomalies, IMU off, and the star tracker providing an attitude solution.

2. Post reset, from the very limited telemetry, three packets, extracted from the carrier signal by the DSN, the X-axis gyro on IMU-A had failed. Unfortunately, this telemetry contained only G&C anomaly data and no spacecraft summary data, i.e., the state of the RF, G&C, fault protection and other subsystems is not known at the time of the anomaly. With a failed IMU and the star tracker being off-line for an undetermined duration, the sun sensors will keep the observatory pointed at the Sun, though the G&C will not have any roll knowledge, and cannot roll the observatory as part of the safing configuration to re-establish communications on the LGAs. From analysis of this telemetry and initial G&C simulations, it is highly suspected that the observatory is rotating about the principal axis of inertia due to an autonomous momentum dump initiated by biased gyro data flagged good by the IMU, but this has not yet been confirmed.

3. At least two anomalies occurred post reset, the star tracker not promoting to AAD mode and the X-axis gyro failure. Unfortunately, due to the number of possible combinations, the STEREO fault protection system is not designed for simultaneous failures.

Once communications are restored and the anomaly resolved, the Behind observatory will be returned to nominal science data collection as soon as it is safely possible.