

STEREO MOC Status Report  
Time Period: 2015:299 - 2015:305

STEREO Ahead (STA) Status:

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

- On day 300, during the support with DSS-15, the transmitter tripped off-line at 2052z due to a high voltage arc. The transmitter was reset and placed on-line again at 2113z. This anomaly resulted in the loss of 21 minutes of commanding and 3 frames of real-time data during the transition from one-way to two-way. See DR# G116670 for more information.

2. The following spacecraft/instrument events occurred during this week. The Ahead observatory operated nominally during this week on the 1<sup>st</sup> side lobe of the HGA to prevent overheating of the HGA feed assembly which was at 108 degrees C and decreasing with the HGA angle at 9.1 degrees and increasing, with respect to the spacecraft-Sun line. The observatory will return to the HGA main lobe, riding along a one degree offset, on day 314, November 10<sup>th</sup>. The 15 months of in-situ instruments science data on the SSR will be played back twice and NOAA antenna partners can once again close the RF link on the space weather broadcast. On day 321, November 17<sup>th</sup>, instruments will begin reconfiguration for resuming nominal daily science data return.

- Day 299 marked the 9<sup>th</sup> year anniversary of the STEREO launch.
- This week, data for the following days was played back from the C&DH routine SSR partition playback:

2015-297-08:32:12z through 2015-304-09:58:10z

Specifically, this partition contains spacecraft bus data for science analysis and instrument status, i.e., attitude history, instrument thermal interface temperatures, heater performance, etc., which are used to create the attitude history and converted spacecraft housekeeping data products.

The following days have not played back yet:

071 through 133 = 63 days (inclusive)  
146 through 231 = 86 days (inclusive)  
Total = 149 days

As it is predicted that this partition will be overwritten on or about November 12<sup>th</sup>, the read pointer will be repositioned back to where the playback left off, DOY 071-0942z on day 307, November 3<sup>rd</sup>.

Once the HGA returns to the main lobe on day 314, November 10<sup>th</sup>, the in-situ instruments space weather science SSR data, along with the spacecraft housekeeping data, will be downlinked twice and verified before the SSR is reconfigured on day 320, November 16<sup>th</sup> in preparations for resuming nominal daily science operations.

- The average daily science data return for Ahead, while operating on the 1<sup>st</sup> side lobe of the HGA, was 82 Mbits 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 4<sup>th</sup> through day 178, June 27<sup>th</sup>, 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 30<sup>th</sup>.

- The Failure Review Board's recommended faster frequency segmented acquisition sequence was tested with the Ahead observatory on day 272, September 29<sup>th</sup>. 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 resumed on day 281, October 8<sup>th</sup>, with the 3<sup>rd</sup> uplink array test successfully conducted for STEREO using DSS-24 and 25. This test consisted of two 34m stations, each with a 20 kW transmitter using the HGA 1<sup>st</sup> side lobe with the Ahead observatory with the MOC sending no-op commands. An approximately 6 dBm increase in received signal power was demonstrated, as compared to one 34m uplink, at the spacecraft with all 30 no-op commands being received correctly using the 7.8125 bps uplink rate. The 4<sup>th</sup> uplink array test is scheduled for day 323, November 19<sup>th</sup>, testing the phasing of 80 kW and 20 kW transmitters on 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 1<sup>st</sup>, 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.