STEREO MOC Status Report
Time Period: 2017:128 – 2017:134

STEREO Ahead (STA) Status:

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

   - On day 130, during the DSS-14 support, turbo decoder lock was lost briefly at 2234z. This anomaly resulted in the loss of 457 frames of real-time telemetry and SSR data. See DR #N110585 for more information.

   - On day 132, during the DSS-43 support, turbo decoder lock was lost briefly at 0621z. This anomaly resulted in the loss of five frames of SSR data.

   - On day 133, during the DSS-43 support, turbo decoder lock was lost intermittently between 0525z and 0709z. This anomaly resulted in the loss of 52 frames of real-time telemetry and SSR data.

   - On day 134, during the DSS-63 support, turbo decoder lock was lost briefly at 0725z and again at 0756z. This anomaly resulted in the loss of 1194 frames of real-time telemetry and SSR data. See DR #N110586 for more information.

2. The following spacecraft/instrument events occurred during this week. The Ahead observatory operated nominally during this week.

   - On day 133, the Ahead observatory was used to phase calibrate the 12th uplink array, using DSS-24, 25, and 26 for 1.9 hours, to support the array use for STEREO Behind battery recovery. An approximate 12 dB gain in uplink AGC was observed in the spacecraft transponder data. No SSR playback was conducted as the phasing of the transmitters would have caused periodic dropped frames.

   - On day 134, the Ahead observatory was used again to phase calibrate the 13th uplink array, using DSS-24, 25, and 26 for 1.9 hours, to support the array use for STEREO Behind transmitter carrier recovery. An approximate 12 dB gain in uplink AGC was observed in the spacecraft transponder data.

No SSR playback was conducted as the phasing of the transmitters would have caused periodic dropped frames.

- The average daily science data return for Ahead was 6.3 Gbits during this week.

STEREO Behind (STB) Status:

1. Detailed status of the recovery activities this week to restore operations is listed below.

   - On day 133, the 12th uplink array for STEREO Behind recovery was conducted using DSS-24, 25, and 26 for a duration of 2.8 hours. The uplink array was phase calibrated to provide approximate 12 dB gain, as compared to a single 34m station, using the Ahead observatory first for 1.9 hours then the arrayed stations were switched to point to the Behind observatory. The configuration consisted of three 34m stations at the Goldstone complex using the 80 kW and two 20 kW transmitters repeating a 4 kHz frequency acquisition sequence with the MOC sending 20 critical commands after each sweep. 300 commands were sent for battery recovery.

   - On day 134, the 13th uplink array for STEREO Behind recovery was conducted using DSS-24, 25, and 26 for a duration of 3.7 hours. The uplink array was phase calibrated to provide approximate 12 dB gain, as compared to a single 34m station, using the Ahead observatory first for 1.9 hours then the arrayed stations were switched to point to the Behind observatory. The configuration consisted of three 34m stations at the Goldstone complex using the 80 kW and two 20 kW transmitters repeating a 4 kHz frequency acquisition sequence with the MOC sending 20 critical commands after each sweep. 400 commands were sent for carrier recovery. The DSN 70m station DSS-14 monitored the downlink along with the radio science receiver team, however, no downlink signal was detected.

2. The Behind loss of communication anomaly occurred on October 1, 2014. Post superior solar conjunction, recovery operations resumed on November 30, 2015. By implementing the NASA Failure Review Board recommendations, the first recovery attempt began with carrier detection by the DSN on August 21st, through September 23, 2016. At a spacecraft range of ~2 AU, the observatory was found to be rotating slowly about its

principal axis of inertia for which the uncontrolled attitude allowed some solar array input and continuous uplink and downlink communications on the LGA at emergency data rates. Over the next 22 continuous days, significant obstacles to recovery were overcome with a collaborative effort of the JHU/APL engineering team, NASA GSFC, DSN, FDF, SSMO scheduling, and Mission Operations teams. This consisted of:

- Reliably commanding a rotating spacecraft with uncontrolled attitude at a distance of 2 AU
- How to power on the spacecraft that was never designed to be off without collapsing the battery voltage
- Acquiring telemetry at 35 bps from a spacecraft that is rotating with an uncontrolled attitude
- Warming a frozen propulsion subsystem with a degraded battery and limited solar array input with an uncontrolled attitude
- Configuring, loading, and verifying EA, C&DH, and G&C parameters and macros with very limited telemetry
- Conducting an autonomous momentum dump in the blind and transitioning to C&DH standby mode and successfully receiving telemetry on the HGA indicating star tracker lock and decreasing system momentum.

However, system momentum level remained above the threshold for re-establishing attitude control with the reaction wheels. Due to the uncontrolled attitude, communication degraded and the last detection of the carrier was on September 23rd.

Behind Observatory Status – From the last telemetry received on September 18th and the telemetry assessment review held on February 24th, main bus voltage is low, 3 out of 11 battery cells are bypassed, attitude remains uncontrolled, rotating about its principal axis of maximum moment of inertia. While likely all ~42 kg of hydrazine remains and is frozen, both pressure transducers are not functioning. EA mode is enabled and autonomy is disabled. The battery charge rate is C/10. RF is configured for the +Z LGA at emergency data rates and the range of the expected best lock frequency is known. Necessary macro sequences have been tested to allow the peak power tracker in C&DH standby mode to protect the battery. These macro sequences will be loaded to EEPROM when the communications supports longer commands.

Monthly recovery efforts consist of attempting to power on the transmitter for 30 minutes. If no carrier signal is detected,

battery recovery operations will commence which consist of repeatedly sweeping a 4 kHz uplink range and sending commands for IEM switched power and PDU 1553 interface bus off. The next recovery tracks are on June 9th, 10th, and 11th.

Recovery planning continues with weekly discussions to refine the plan and procedures for the next recovery attempt this Fall by incorporating recommendations from the BEHIND telemetry assessment review and lessons learned. The next recovery planning meeting is on Thursday, May 18th at 9 AM EDT.