STEREO MOC Status Report
Time Period: 2018:036 - 2018:042

STEREO Ahead (STA) Status:

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

   - On day 038, during the DSS-35 support, turbo decoder lock was lost briefly at 0427z. This anomaly resulted in the loss of 4 frames of SSR data.

   - On day 038, during the DSS-55 support, turbo decoder lock was lost briefly at 1236z. This anomaly resulted in the loss of 3 frames of SSR data.

   - On day 039, during the DSS-55 support, telemetry lock became intermittent at 1508z through the EOT due to receiver anomaly at the station. SSR pointers were repositioned during the next track to minimize data loss. This anomaly resulted in the loss of 74 minutes of tracking data. All SSR data was received. See DR #M110463 for more information.

   - On day 039, during the DSS-25 support, turbo decoder lock was lost intermittently at 2150z through 040-0040z as the HEMT receiver was in use as maser receiver was declared red. This anomaly resulted in the loss of 17 frames of real-time telemetry and SSR data.

   - On day 040, during the pre-calibration for the DSS-14 support, DSN was unable to perform range calibrations. The station delay was set to zero. Later in the support, turbo decoder lock was lost briefly at 1709z. These anomalies resulted in the loss of 10 frames of real-time telemetry and SSR data. See DR #G118920 for more information.

   - On day 041, during the DSS-25 support, turbo decoder lock was lost intermittently at 2012z through 042-0122z as the HEMT receiver was in use as maser receiver was declared red. This anomaly resulted in the loss of 35 frames of real-time telemetry and SSR data. See DR #G118925 for more information.

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

   - The average daily science data return for Ahead was 7.0 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 036, during a 2.4 hour 4 kHz carrier recovery support with DSS-63, 200 commands were transmitted during the support. No carrier was detected by either the DSN station or the radio science receiver team after attempting to power on the TWTA for 30 minutes. Transitioned to battery recovery operations for the remainder of the support which consists of repeatedly sweeping a 4 kHz uplink range and sending commands for IEM switched power and PDU 1553 interface bus off.

   - On day 038, during a 2.5 hour 4 kHz carrier recovery support with DSS-14, 260 commands were transmitted during the support. No carrier was detected by either the DSN station or the radio science receiver team after attempting to power on the TWTA for 30 minutes. Transitioned to battery recovery operations for the remainder of the support which consists of repeatedly sweeping a 4 kHz uplink range and sending commands for IEM switched power and PDU 1553 interface bus off.

   - On day 040, during a 3.9 hour 1 kHz carrier recovery support with DSS-63, 440 commands were sent for transmitter carrier recovery. No carrier was detected by either the DSN station or the radio science receiver team. Due to the duration of the support and the increased commands for each step, only 22 of the 36 frequency segments were commanded. Three commands must be received sequentially to power on the transmitter.

   - On day 042, during a 3 hour 4 kHz battery recovery search pattern support with DSS-14, 306 commands were transmitted during the support. All 7 points on the pattern were covered twice. Only 6 of 20 commands at the initial step 1

location on the pattern were transmitted due to an issue with the transmitter. See DR #G118929 for more information.

2. The Behind loss of communication anomaly occurred on October 1, 2014 from simultaneous failures of the star tracker and the IMU. 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 23, 2016.

   Behind Observatory Status – From the last telemetry received on September 18, 2016 and the telemetry assessment review held on February 24, 2017, 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 (BLF) 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.

After 2.5 months of daily recovery efforts that began on August 21, 2017, to date the downlink signal has not been detected by the DSN block V receivers or the RSR team. With significant support of the DSN, two different acquisition sequences are being utilized weekly to re-establish communications with STEREO Behind using a 70m track:

1. 4 kHz Sweep – consists of repeatedly sweeping a 4 kHz uplink frequency range for which the BLF was found during the first recovery attempt. Commands are sent to power on the transmitter for 30 minutes. If no carrier signal is detected, the transmitter is powered off and battery recovery commands are sent consisting power off the IEM switched power and PDU 1553 interface bus. This acquisition sequence is used 3 times each week.

2. 4 kHz Sweep with Search Pattern – The DSN created a diamond shaped search pattern with 7 steps of 0.037 deg, dwelling 10 min & 49 sec/step. There are two diamond patterns of 4 steps to cover the area of the estimated ephemeris error. The starting point is offset 0.02 deg for 100% uplink optimization. Repeating each diamond pattern accounts for the 30 minute RTLT. This search pattern acquisition sequence is used twice weekly during 3 hour supports, sending battery recovery commands at each step during the first day and on the second day, sending carrier recovery commands at each step.