

STEREO MOC Status Report
Time Period: 2018:288 - 2018:294

STEREO Ahead (STA) Status:

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

- On day 289, the DSS-43 support was downlink only as the transmitter was unavailable for the duration of the support due to a failed X-Band waveguide cooling system. This anomaly resulted in the loss of 1.75 hours of commanding and two-way tracking data. All the SSR data was received. See DR# C113704 for more information.
- On day 290, the DSS-43 support was downlink only again as the transmitter continued to be unavailable. To prevent a soft command loss timeout and load instrument commands, ESA Malargüe (DSS-84) was available to provide the uplink during the DSS-43 support. This anomaly resulted in the loss of 2 hours of two-way tracking data. All the SSR data was received. See DR# C113708 for more information.
- On day 292, the second acceptance test of the CCSDS SLE bluebook version 4 software update between the Ahead MOC with ESA, using DSS-83 (Cebreros) was conducted. SLE binds were unsuccessful and further testing is scheduled next week.

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

- On day 292, fine pointing was lost intermittently beginning at 0335z through 0635z. The wheel speed avoidance algorithm failed to find a solution which resulted in two reaction wheels operating at low speeds for three hours. These transients can occur with no gyro operations and are not indicative of any problem with the spacecraft G&C.
- On day 294, the SWAVES SSR science partitions reached 100% full at 2153z for 49 minutes.
- The average daily science data return for Ahead was 4.3 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 288, during a 3 hour 4 kHz battery recovery search pattern support with DSS-14, 320 commands were transmitted during the support. All 7 points on the pattern were covered twice.
 - On day 289, during a 3 hour 4 kHz carrier recovery search pattern support with DSS-63, 320 commands were transmitted during the support for carrier recovery. No carrier was detected by the DSN station. All 7 points on the pattern were covered twice. Three commands must be received sequentially to power on the transmitter.
 - On day 290, during a 3 hour 4 kHz carrier recovery search pattern support with DSS-63, 320 commands were transmitted during the support for carrier recovery. No carrier was detected by the DSN station. All 7 points on the pattern were covered twice. Three commands must be received sequentially to power on the transmitter. This was the last scheduled recovery support.
2. Four years after the initial loss of communications anomaly with the Behind observatory, NASA has directed to cease periodic recovery operations with the last support on October 17, 2018.
3. Detailed history and status of the recovery activities are listed below. Additional information can be found by copying and pasting the link below in a web browser:

https://stereo-ssc.nascom.nasa.gov/behind_status.shtml

- 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.

- To re-establish a power positive, 3-axis control of the observatory, system momentum had to be reduced to a level that would allow the reaction wheels to resume attitude control. Significant obstacles that were overcome included reliably commanding the uncontrolled rotating spacecraft at a distance of 2 AU, powering on the spacecraft that was never designed to be off without collapsing the battery voltage, and warming a frozen propulsion subsystem with a degraded battery and limited solar array input. An autonomous momentum dump in the blind was conducted and telemetry on the HGA indicated 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 telemetry received was on September 18, 2016 with final carrier detection on September 23, 2016.
- From the 283 telemetry packets received during the recovery attempt, an assessment review held on February 24, 2017. It was concluded that the Behind observatory status was as follows: main bus voltage is low, 3 out of 11 battery cells are bypassed, and 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. After all commanded thruster firing had terminated the angle between the angular momentum vector and sun vector steadily increased at ~0.03 deg/min. This tends to further support the hypothesis that something was being expelled.
- In July 2017, with collaboration with GSFC, the recovery plan was revised and 61 procedures were developed and tested. Significant improvements include:
 - Using the -Z LGA as it provides 2 dB more than +Z LGA
 - Recovering in C&DH standby mode to better protect the battery
 - Minimize fault protection usage

- o Close latch valves after each thrusting operation
- o Refined autonomous momentum dump to re-establish 3-axis attitude control
 - o Use IMUA as it will leave solar arrays Sun pointing
 - o Power wheels on after momentum dump