STEREO MOC Status Report
Time Period: 2018:260 – 2018:266

STEREO Ahead (STA) Status:

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

   - On day 260, during the DSS-14 support, the initial receipt of monitor data was delayed for 30 minutes. Also, the station was unable to conduct pre-pass ranging calibrations. A post pass ranging calibration was conducted. These anomalies resulted in the loss of 30 minutes of monitor data. All SSR data was received. See DRs# G119400 and G119401 for more information.

   - On day 266, during the DSS-65 support, no monitor data was received for the duration of the support due to a software issue at the Madrid complex. This anomaly resulted in the loss of 3 hours of monitor data. All SSR data was received. See DR# M110833 for more information.

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

   - On day 259, fine pointing was lost intermittently (~78 times) beginning at 2333z through 260-2200z. This occurred when wheel #2 passed through zero speed and remained below the wheel speed avoidance (WSA) bandwidth (+ and - 30.70 rads/sec). Fine pointing stabilized after wheel #2 remained above the WSA bandwidth. G&C is investigating possible mitigations include shortening the WSA computation time and increasing the filter bandwidth to speed convergence.

   - On day 266, the IMPACT IDPU/MAG high power consumption autonomy rule (#64) fired at 11:17:33z. This powered off all of IMPACT and PLASTIC instruments. This is 2nd occurrence on the Ahead spacecraft with last occurrence in September of 2011. On day 267, the IMPACT IDPU/MAG and SWEA/STE power services were turned on at 1822z and 1909z respectively.

- The average daily science data return for Ahead was 4.4 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 264, during a 2.5 hour 1 kHz battery recovery support with DSS-14, 189 commands were transmitted for battery state of charge recovery. Due to the duration of the support, only 21 of the 36 frequency segments were commanded.

   - On day 265, during a 4 hour 1 kHz carrier recovery support with DSS-14, 440 commands were sent for transmitter carrier recovery. No carrier was detected by the DSN station. 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 266, during a 4 hour 1 kHz carrier recovery support with DSS-14, 440 commands were sent for transmitter carrier recovery. No carrier was detected by the DSN station. 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.

2. Four years after the initial loss of communications anomaly with 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 at: 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 command 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
- Close latch valves after each thrusting operation
- Refined autonomous momentum dump to re-establish 3-axis attitude control
  - Use IMUA as it will leave solar arrays Sun pointing
  - Power wheels on after momentum dump