

STEREO Spring 08 SWG

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The logo for Applied Physics Laboratory (APL) at Johns Hopkins University, consisting of the letters 'APL' in a bold, sans-serif font.

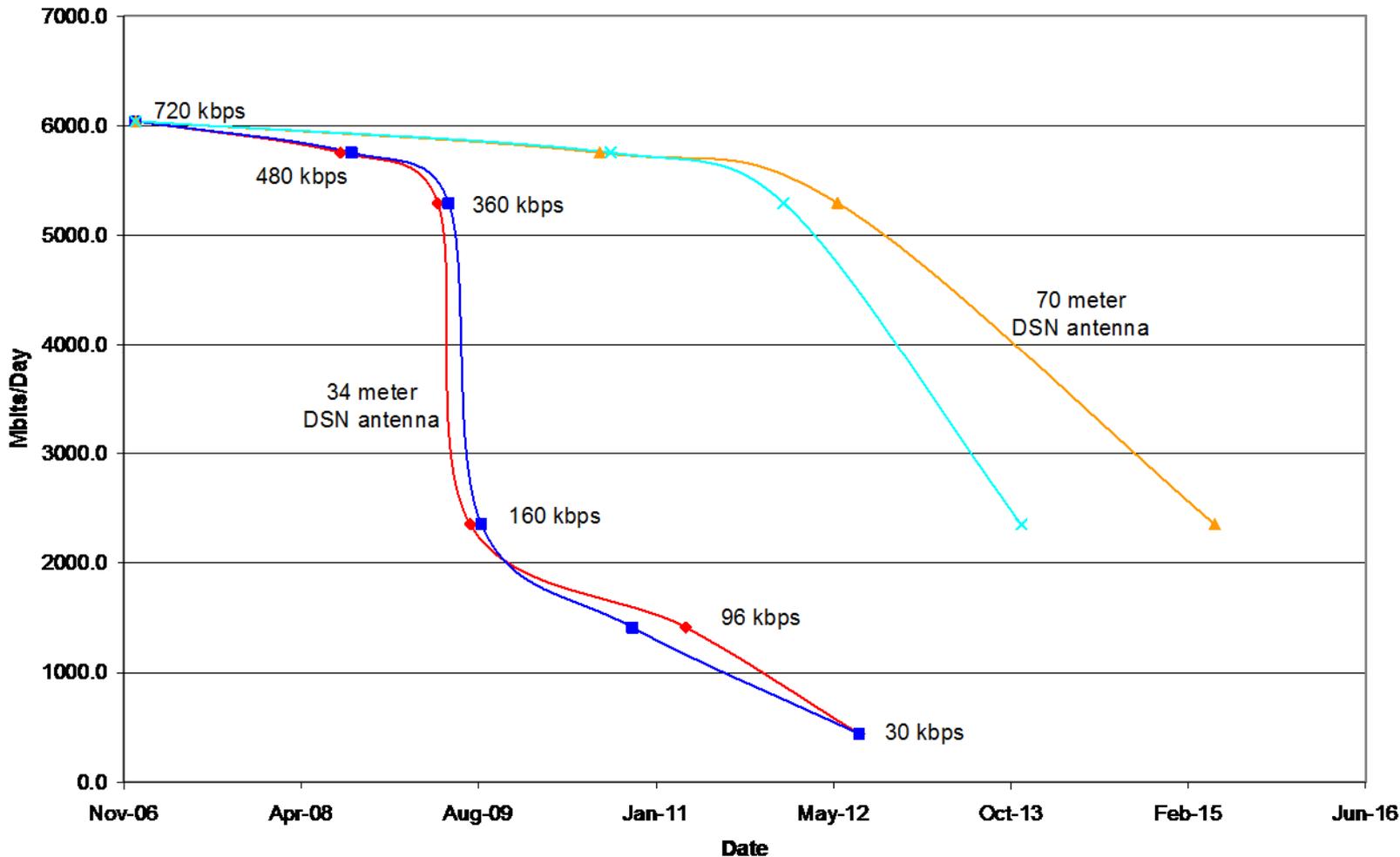
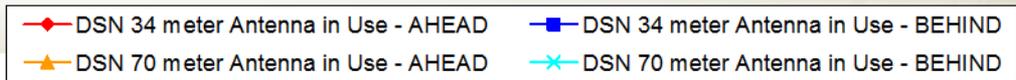
The Johns Hopkins University
APPLIED PHYSICS LABORATORY

Topics

- **Future Data Rates**
- **Spacecraft Anomaly Status (Star Tracker and IMU)**

Data Capture in the Extended Mission

STEREO Daily Downlink Volume, Jan 07 through Dec 2015



Spacecraft B Star Tracker Anomaly Description

- **10:10Z (DOY355:2007), Star Tracker resets.**
 - **Following the reset, the spacecraft acted autonomously to promote the star tracker from standby mode to autonomous attitude determination (AAD) mode.**
- **10:10Z – 14:10Z, Spacecraft commands ST to attempt promotion to AAD mode every 25 seconds.**
 - **The star tracker never succeeds in determining a correct attitude and tracking known stars.**
- **14:10Z, spacecraft autonomously suspended use of the star tracker. Switches to Low Gain Antennas and reduces data rate.**
- **22:41Z Ground Command to reset ST.**
 - **Fails to correct problem.**
- **22:55Z Ground Command to power cycle ST.**
 - **Fails to correct problem.**
- **04:23Z (DOY356) After obtaining what telemetry was available, the operations team suspended ST usage to prevent autonomy from placing the spacecraft on low-gain antennas and in a slow roll due to the absence of inertial attitude knowledge.**
- **13:46Z Star tracker usage re-enabled, again without success.**
- **16:54Z (DOT357) ST achieved an attitude solution and maintained track through the contact.**
- **DOY357 – DOY 361 Usage disabled out of contact in case of a recurrence of problems.**
- **DOY361 Usage permanently re-enabled.**
 - **Since then, there have been no further problems with the star tracker on either spacecraft.**

ST Root Cause Investigation

- In conjunction with Galileo (the ST manufacturer) various theories as to what cause the anomaly have been and continue to be investigated.
- No conclusions have yet to be reached.

Spacecraft B Star Tracker Anomaly Mitigation

- Improved IMU drift rate biasing
 - Allows Spacecraft to propagate better using IMU rates. Increases time on HGA.
- Processes put into place to determine spacecraft roll from HGA beam form.
- Developing algorithm to calculate orbit normal using IMU rates while locked on to Sun using Guide Telescope (or Sun Sensors)
 - Performance on GT likely to be sufficient to point HGA within a day or two. Sun sensors will take longer.

IMU Anomaly Summary

- **The x-axis gyro on spacecraft A has been declared unusable.**
- **Spacecraft performance has been tested using Star Tracker and GT rates.**
- **Y and Z axis performance is close to nominal.**
- **X-axis performance remains in spec but is not**



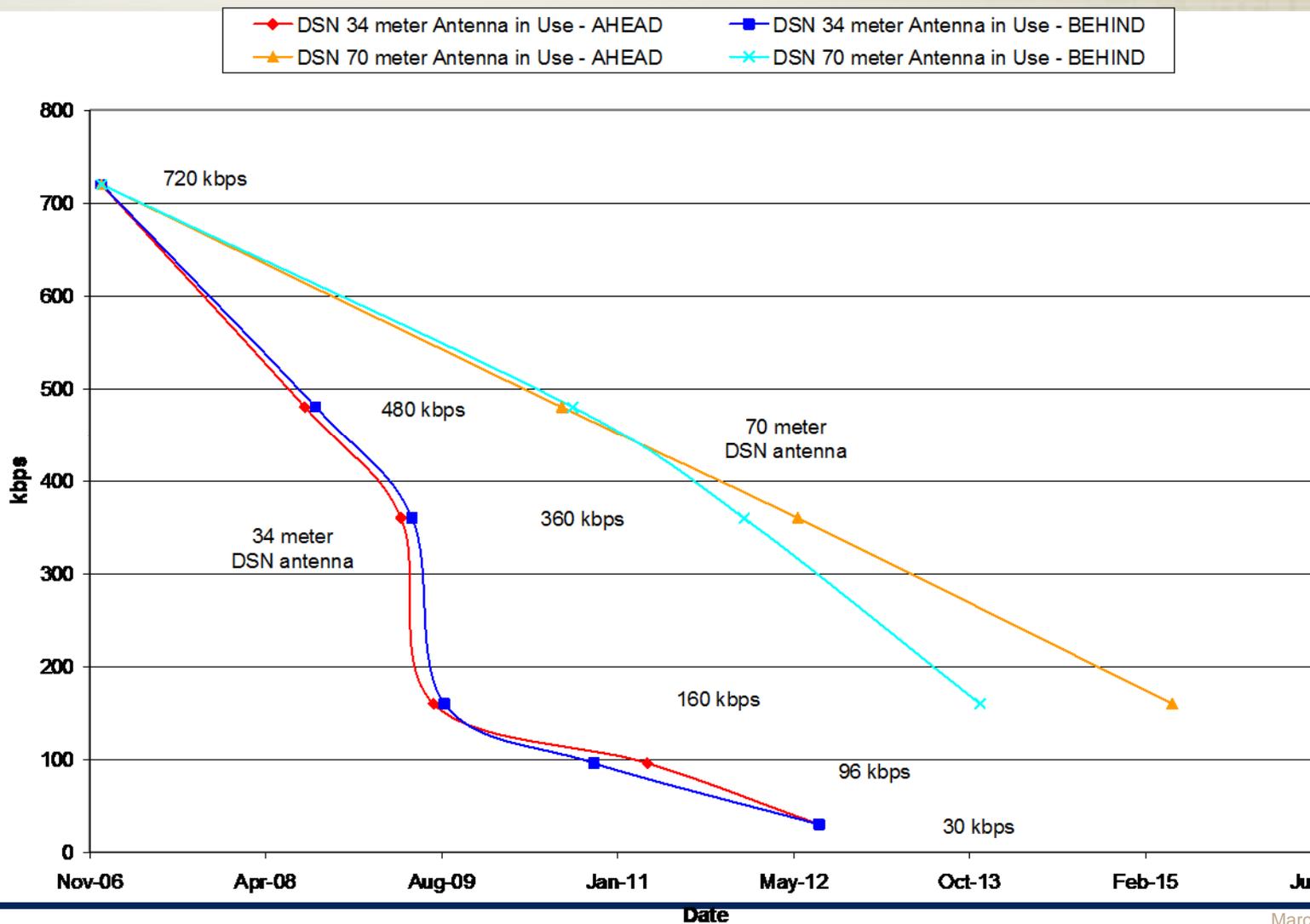
BACKUP

Assumptions for Data Capture

- 720, 480, & 360 kbps record rates based on Obs. CDR.
- Average daily volume is presented which includes S/C housekeeping. We typically do much better than this.
- Downlink volume assumes down linking all that is recorded using the average record rate.
- 12 Kbps Real-time Data for All Instruments
- Record rates and downlink volumes include current space weather allocations.
- 10 deg elev, 95% weather, nominal attitude, ignores PFD restr.
- 2 dB downlink margin, ranging on for 633bps to 720Kbps

Data Rate vs. Time

STEREO Downlink Rates, Jan 2007 through Dec 2015



ST Anomaly Detailed Timeline

DOY	Time (Z)	Event
355	10:09:52	Telemetry indicates ST message missing
355	10:10:00	Telemetry indicates ST in INI mode
355	10:10:03	Rule 62 fired, promote ST to standby mode
355	10:10:15	Rule 63 fired, failed to promote ST to AAD, fired every 25 seconds
355	14:09:54	Rule 28 fired, suspended ST usage, switch to LGA
355	16:33:38	Dumped ST APID 114
355	21:19:47	ST diagnostic read failed, SA=15 WC=32
355	21:41:49	Enable use of ST
355	22:22:01	Changed G&C TLM schedule to include APID 114
355	22:41:16	Ground command to reset ST
355	22:48:54	ST diagnostic read failed, SA=15 WC=32
355	22:55:52	Ground command to power cycle ST
355	22:58:18	Rule 26 fired, reset ST, no effect with ST off
355	23:03:36	ST diagnostic read failed, SA=15 WC=32
356	4:23:24	Suspended ST usage
356	13:46:25	Enabled use of ST
356	16:43:51	Suspended ST usage
357	19:54:01	Enabled use of ST
357	19:54:14	Rule 63 fired, ST achieves AAD mode
357	22:25:20	Suspended ST usage
358	16:05:00	Enabled use of ST
358	19:08:31	Suspended ST usage
359	14:24:48	Enabled use of ST
359	17:25:50	Suspended ST usage
360	13:30:23	Enabled use of ST
360	16:27:51	Suspended ST usage
361	16:42:46	Enabled use of ST