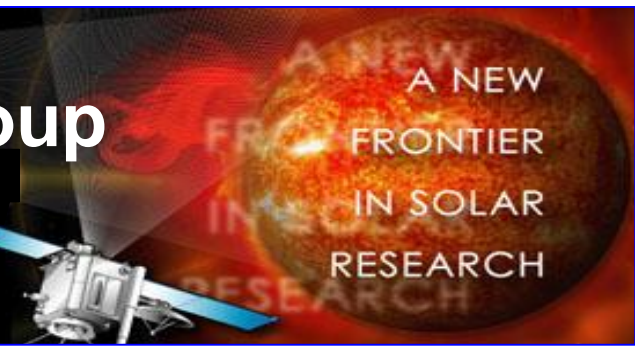




Science Working Group

March 24th, 2010

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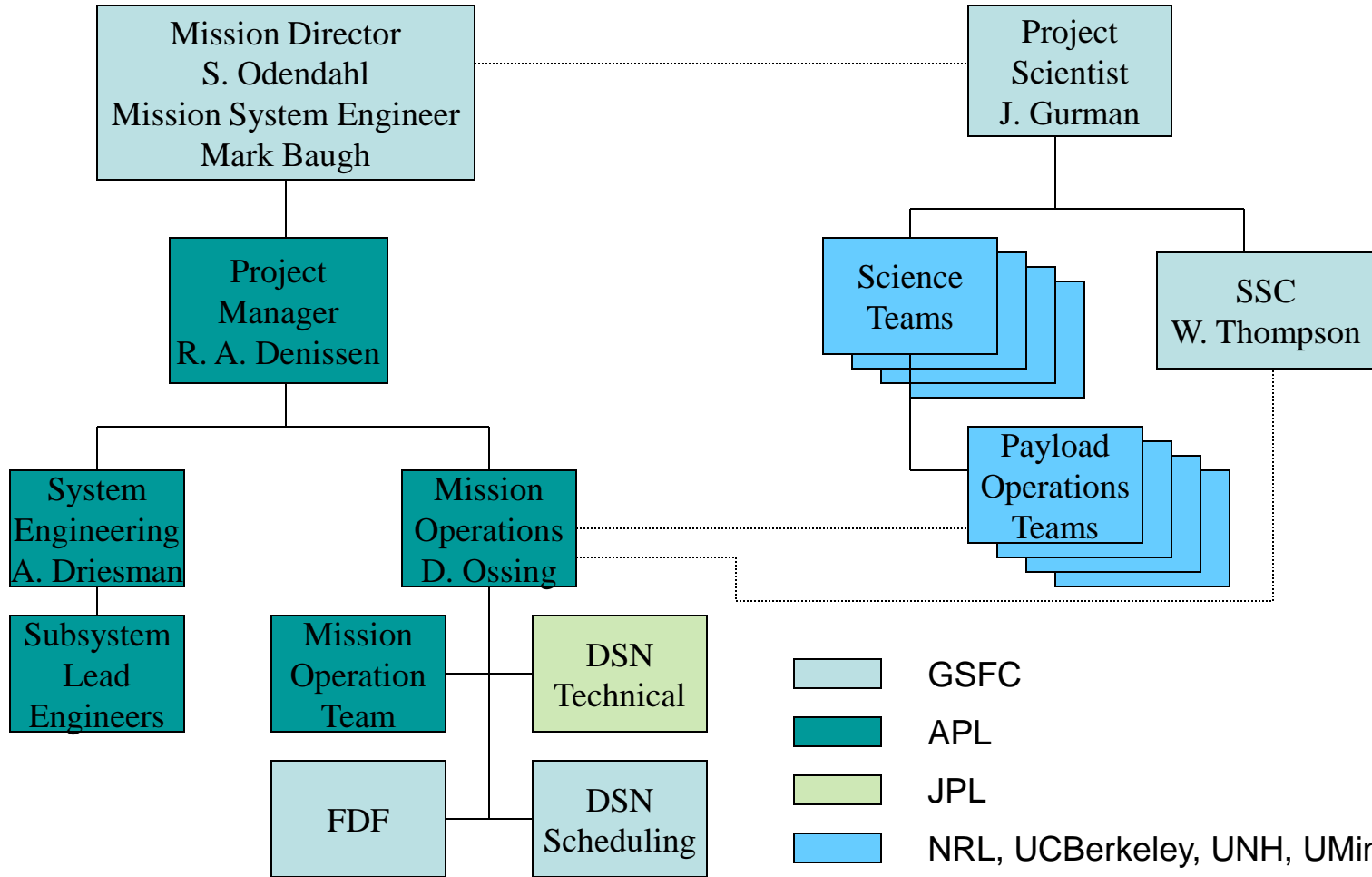
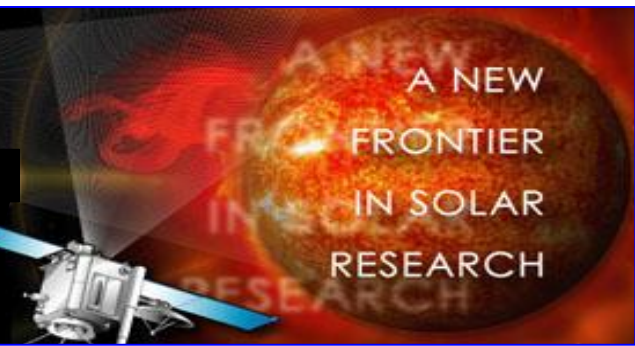
STEREO Project

Ron Denissen – APL Project Manager
Andy Driesman – APL Mission System Engineer



STEREO Phase E Organization Chart

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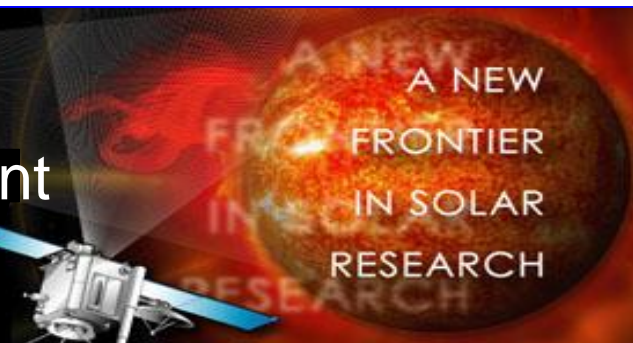
- GSFC
- APL
- JPL
- NRL, UC Berkeley, UNH, UMinn





Program Assessment

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Technical

Schedule

Programmatic

Nov	Dec	Jan
G	G	G

Nov	Dec	Jan
G	G	G

Nov	Dec	Jan
G	G	G

Nov	Dec	Jan
G	G	G

❖ Technical

- Both Observatories operational. Completed the prime science mission successfully and are now in our first extended mission.

❖ Schedule

- Routine operations – HGA and instrument cals, momentum dumps.

❖ Resources

- Extended mission proposal has been accepted and APL is under contract until the end of September 2010.

❖ Programmatic

- No issues at this time.

G No current problem
All commitments can be met

Y Major problem
Identified solution
Commitment is in jeopardy

R Major problem
No identified solution
Commitment cannot be met



Program Status

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❖ Operations

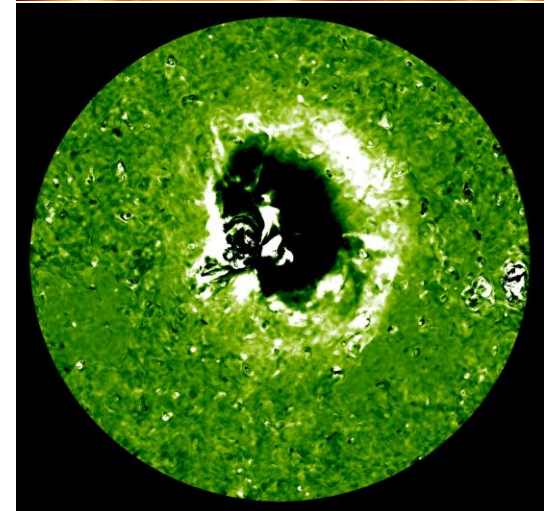
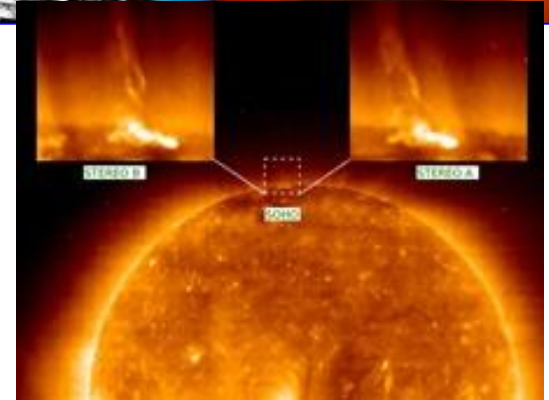
- *Began automated unattended tracks April 30,2007*
- *Operations team is 6 full time staff. Total manpower is approximately 11 MM/M*
- *Downlink rates: SCA - 360 Kbps; SCB - 240Kbps.*
- *Mission operations center collecting greater than 5 Gbits per day in support of the science mission.*

❖ Special Observatory Events

- *>100 instrument calibration events and roll events*
- *22 High Gain Antenna Calibrations*
- *50 Momentum Dumps (~every 6 weeks on both spacecraft)*

❖ Science

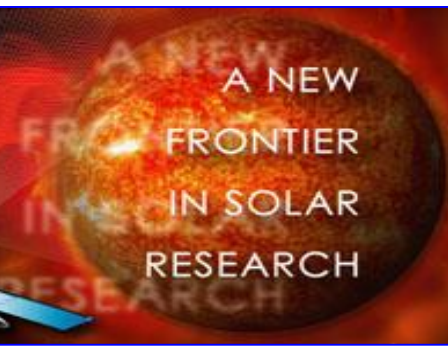
- *Over 250 CMEs observed.*
- *Full 3-D reconstruction on about 2 dozen.*





DSN Interface Changes

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2010

- ❖ Apr - 240 kbps Rate Change – **AHEAD** (7 hr tracks)
- ❖ Aug - DSN DCD Transition – replaces CDR
- ❖ Sep - SLE TLM Implementation
- ❖ Sep - 160 kbps Rate Change (both S/C, 8 hr tracks)
- ❖ Nov - 120 kbps Rate Change – **BEHIND**

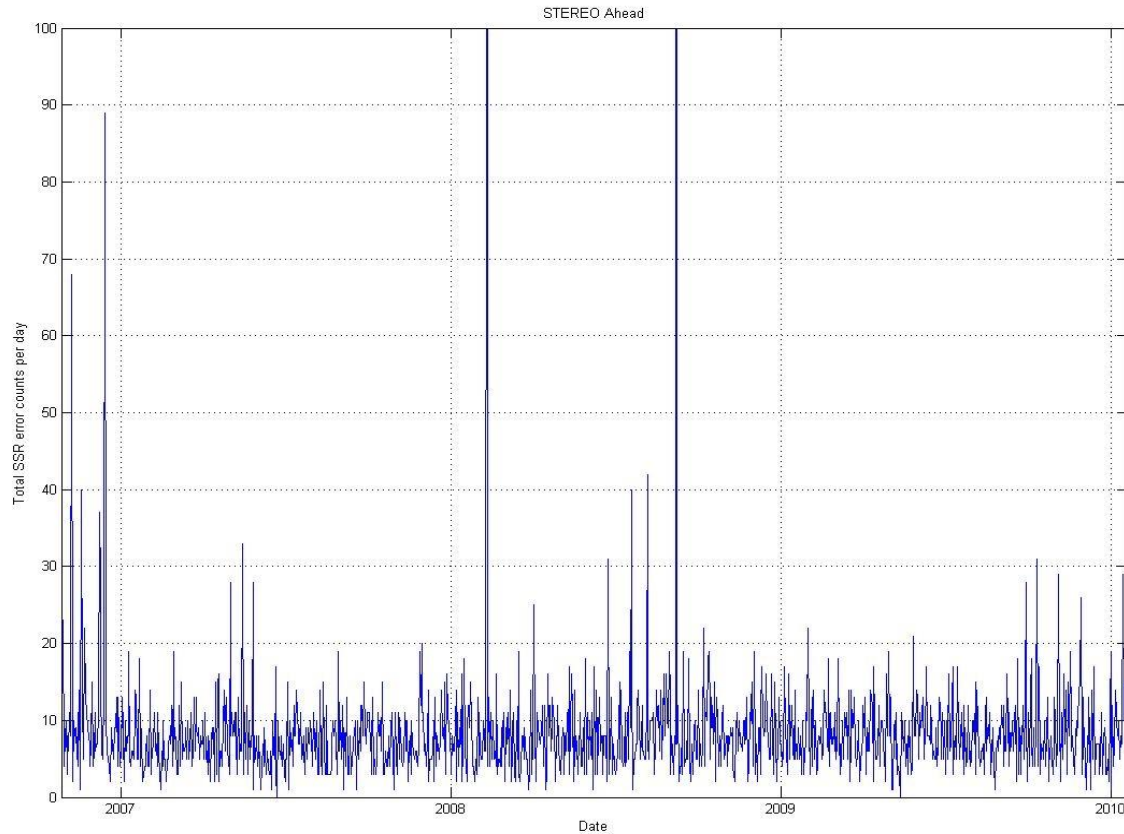
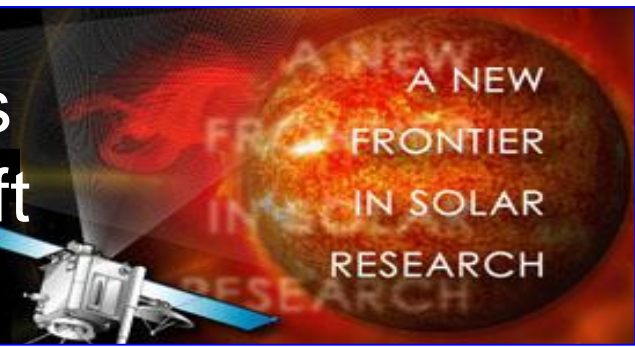
2011

- ❖ Jan – DSN Service Scheduling Software Implementation
- ❖ Apr - 120 kbps Rate Change – **AHEAD**
- ❖ Jul - Update DSN Schedule File Format
- ❖ Sep - 96 kbps Rate Change (both S/C)



SSR Error Counts AHEAD Spacecraft

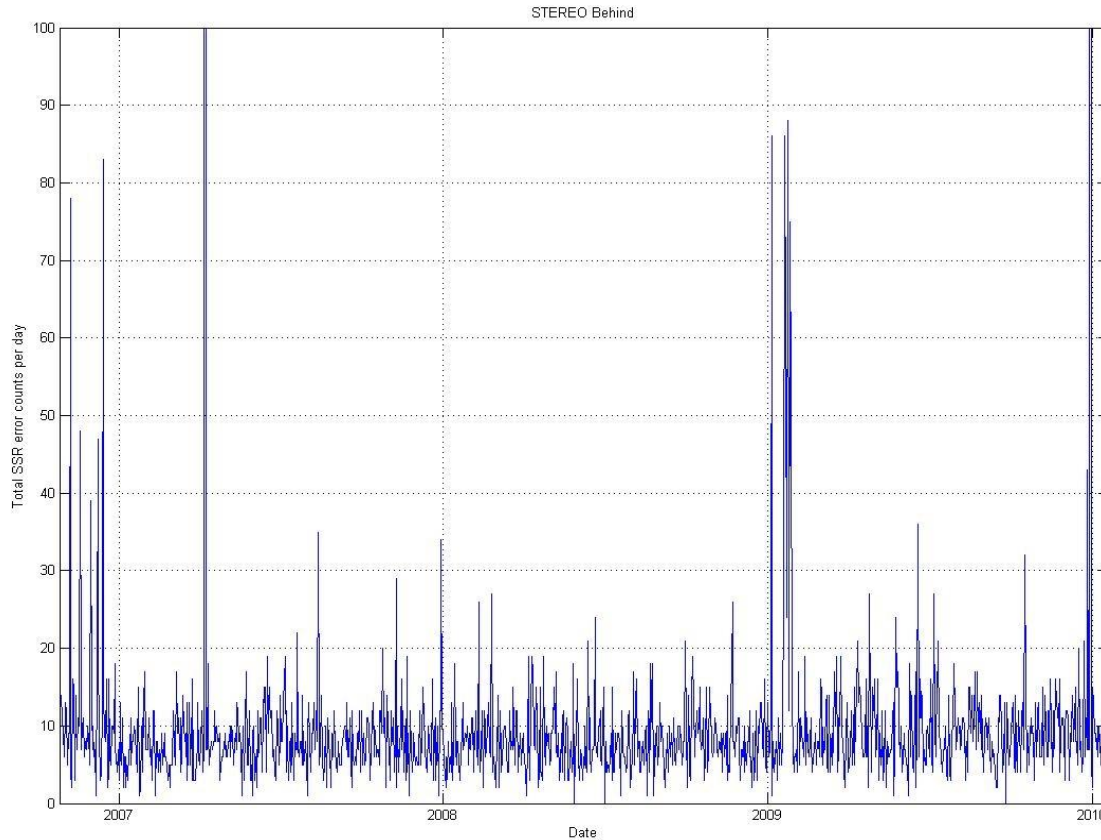
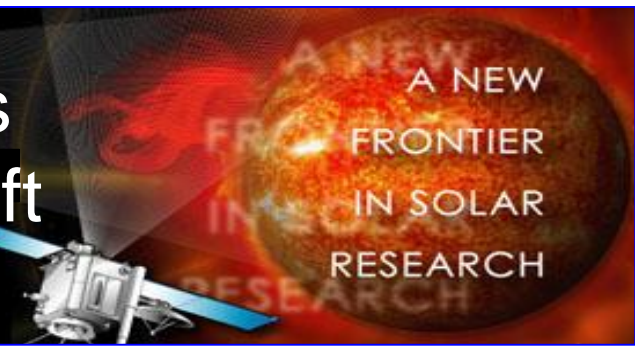
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SSR Error Counts BEHIND Spacecraft

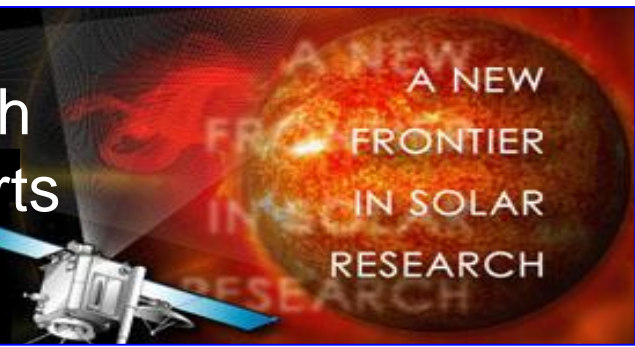
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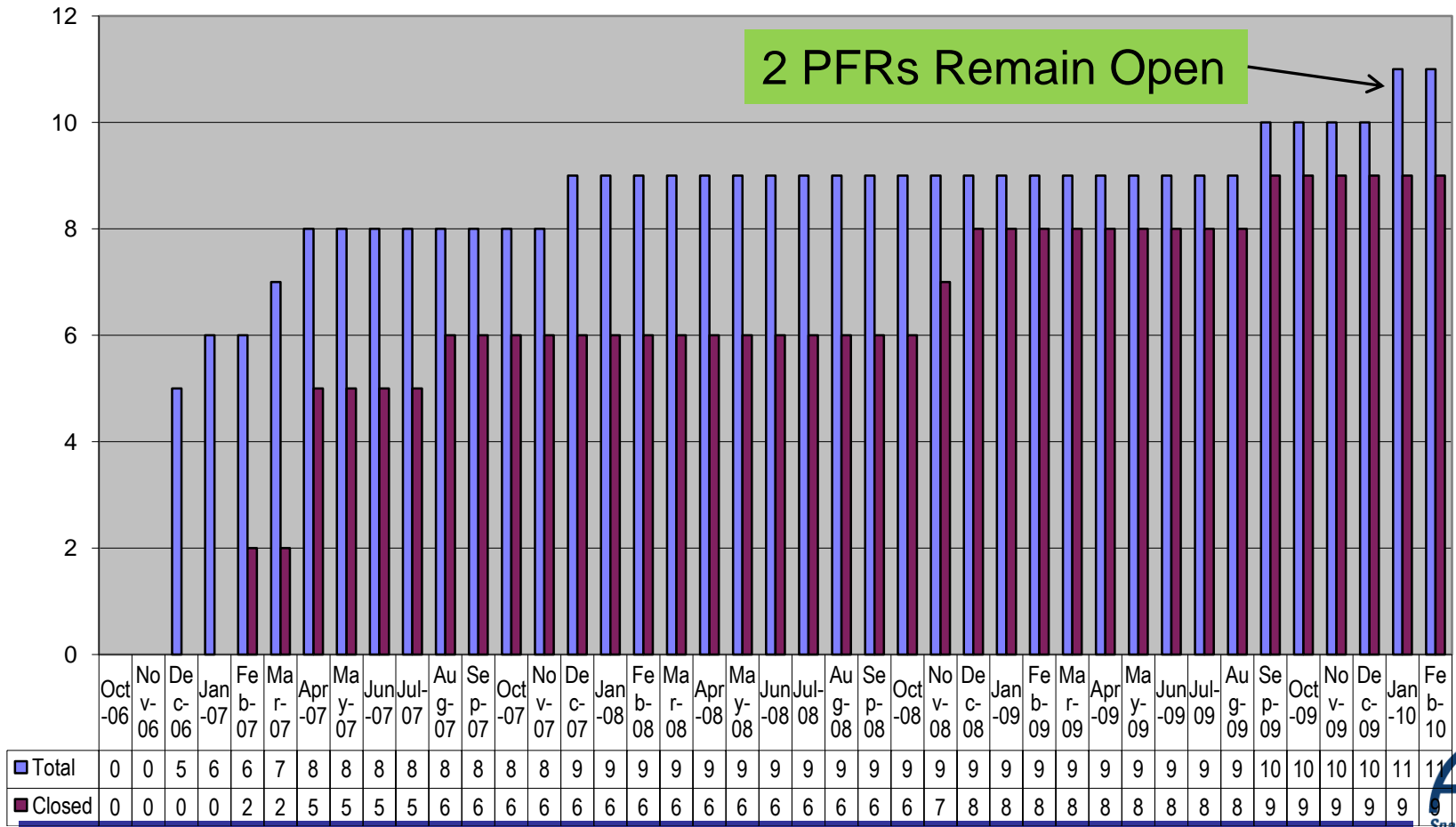


STEREO Post Launch Problem Failure Reports (PFRs)

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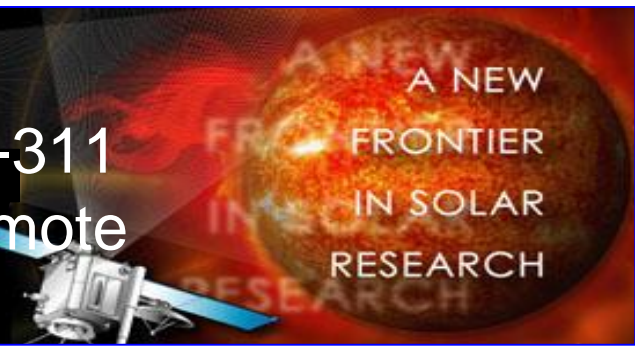
STEREO Cumulative Total and Closed Post-Launch PFRs as of 28 February 2010





Open PFR#1:PFR ST-P-311 Ahead ST Failure to Promote

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❖ What we know:

- *DOY 2010-027, 07:56z, Star Tracker dropped into INIT Mode and would not promote back to Autonomous Attitude Determination (AAD) Mode.*
- *Almost identical to event on Behind 2007-355, 10:10z*
- *Events lasted 0D 12Hr on Ahead and 2D 9Hr on Behind.*
- *In both cases ST promoted back to AAD mode w/o cause.*

❖ Problem if not mitigated:

- *Spacecraft cannot ascertain absolute knowledge of attitude*
 - Potential for HGA to drift off of Earth.
 - Potential for difficulty re-acquiring GT lock (if it is lost)
 - Spacecraft fails to meet its science roll pointing requirement.

❖ What we suspect:

- *A diffuse object (e.g.: Nebulae) in the ST FOV combined with low spacecraft rates are causing issues with transitioning between ST sub-windows.*

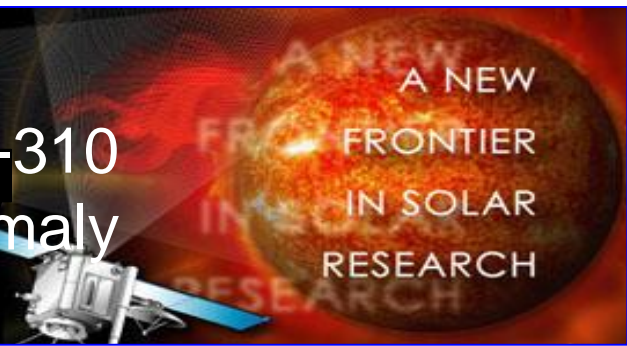
❖ Mitigation:

- *Plan in place to roll the ST FOV into a new part of the sky. This should force the ST to promote.*
- *Can use knowledge of HGA beam pattern to ascertain roll position allowing MOPS to manually keep the HGA on the Earth*



Open PFR #2:PFR ST-P-310 Ahead Roll Pointing Anomaly

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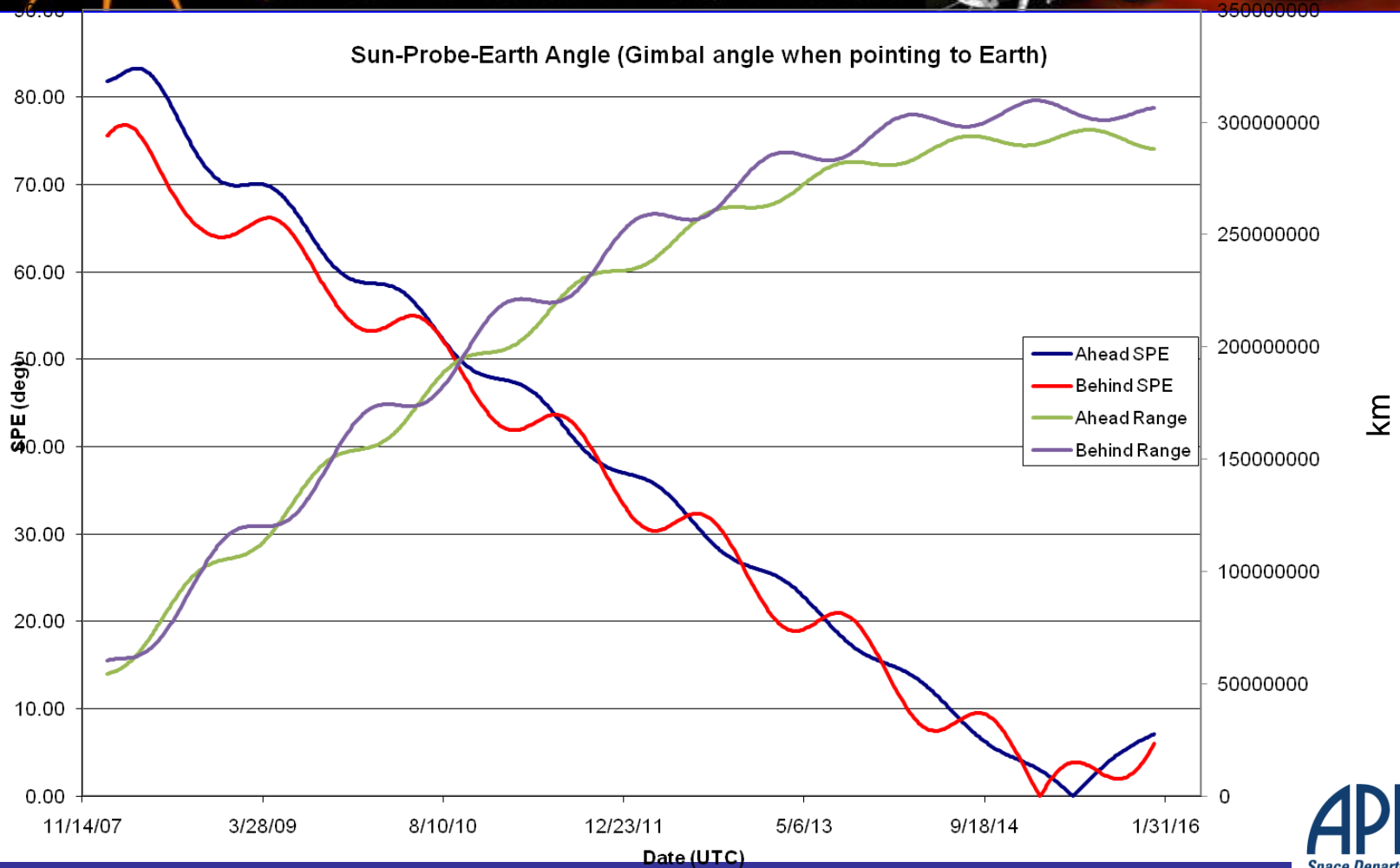


- ❖ What we know:
 - DOY 2009-253, 1615z. Roll pointing became intermittently unstable causing the spacecraft to lose HGA communications.
 - Problem is associated with bug in G&C version 3.2.6
- ❖ Problem if not mitigated:
 - Spacecraft randomly loses roll stability causing spacecraft to miss-point the HGA
 - Spacecraft fails to meet its roll pointing science requirement.
- ❖ What we highly suspect:
 - The bug is isolated to new functionality that allows the use of GT data to update quaternion that relates the inertial frame to the gyro frame.
 - This functionality was an enhancement.
- ❖ Mitigation:
 - At 1907z, commands were sent to the spacecraft to disable this functionality.
 - Functionality was also disabled on Spacecraft B.
 - Problem has not appeared since

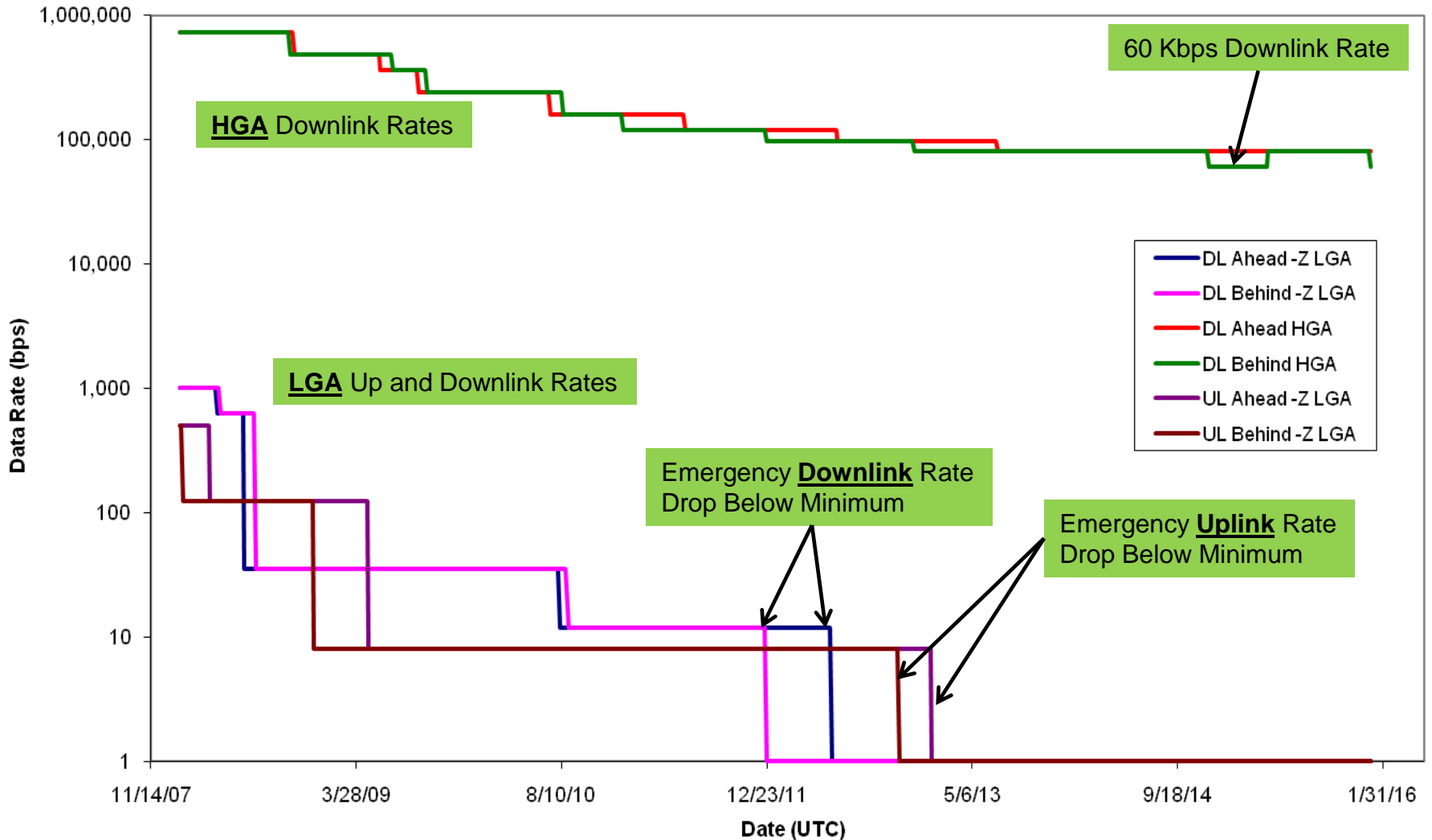


Telemetry Rates: Sun-Probe- Earth Angle and Range

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Data Rate Capability with 34m DSN
 10 deg elev, 95% weather, nominal attitude, ignores PFD restr.
 2 dB downlink margin, ranging on for 633bps to 720Kbps
 3 dB downlink margin, ranging off for 12bps and 35bps
 6 dB uplink margin (HGA supports 2K throughput)

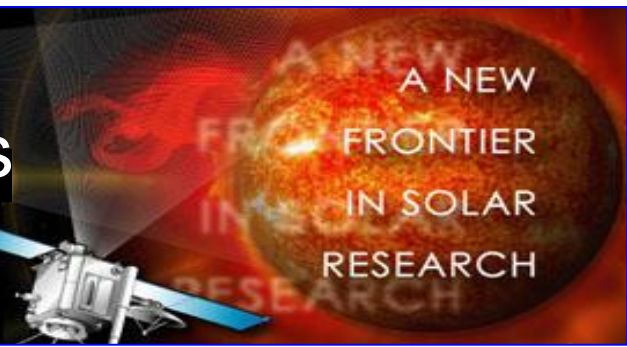


Dublin SWG, 24 March 2010



Potential Solutions

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❖ HGA Downlink:

- *~60 Kbps downlink rate (not standard) will be tested and added to the array of selectable downlinks.*

❖ LGA Down and Uplinks

- *Used in the event of a spacecraft emergency.*
- *Options:*
 - Configure spacecraft for “EA Bypass”.
 - *In the event of an emergency, request “70m and 34m arrayed” tracks.*
 - Narrow tracking (Doppler) loop BW on DSN Receivers.

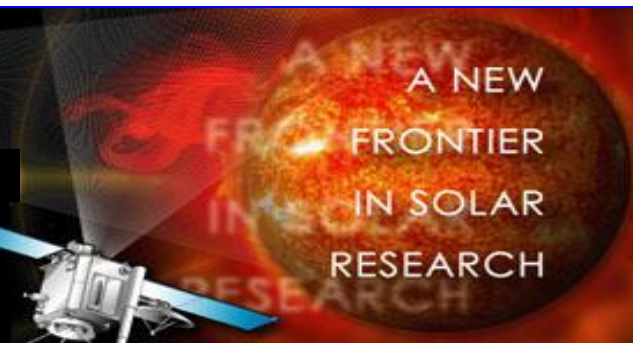
❖ Next question:

- *Solar Conjunction*

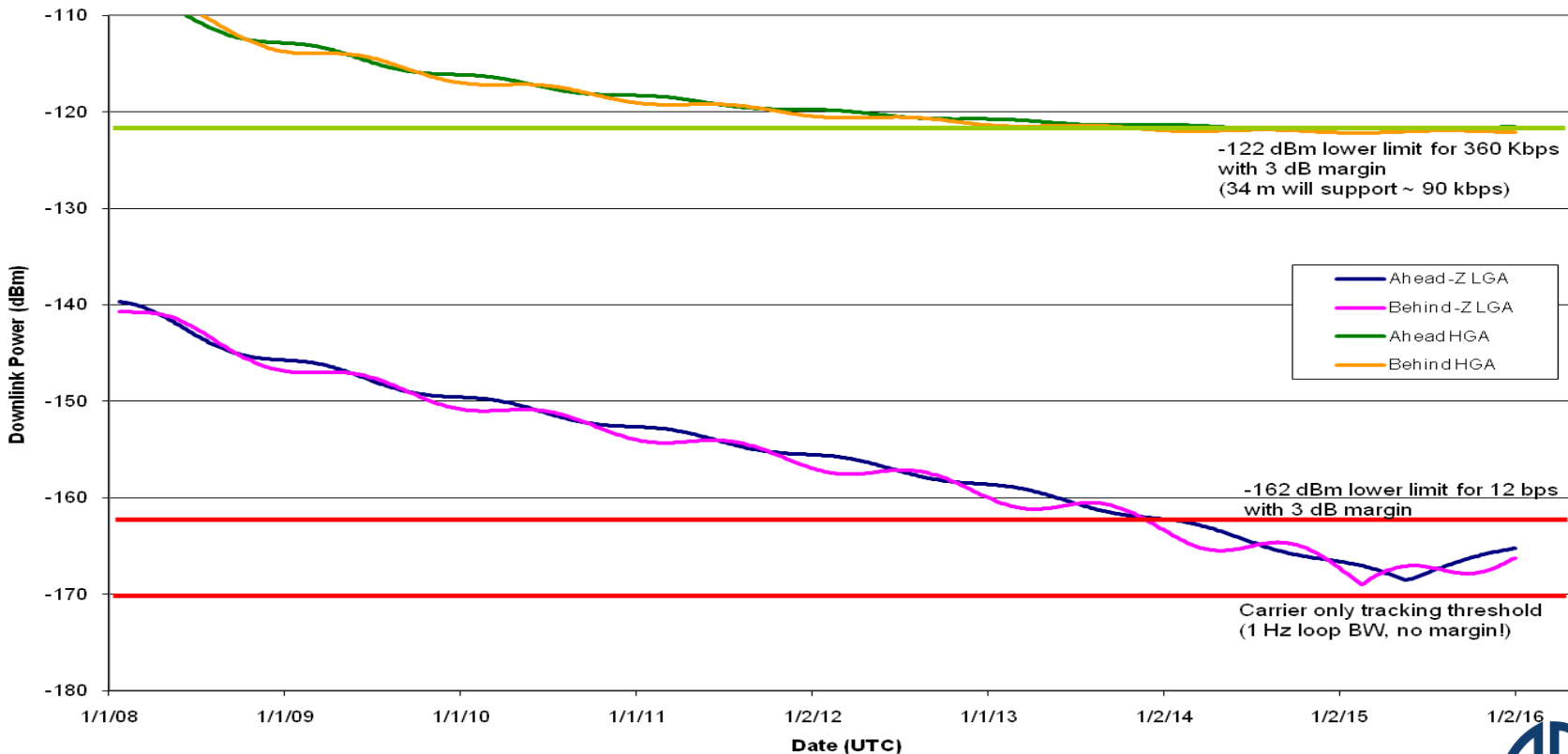


Downlink Power

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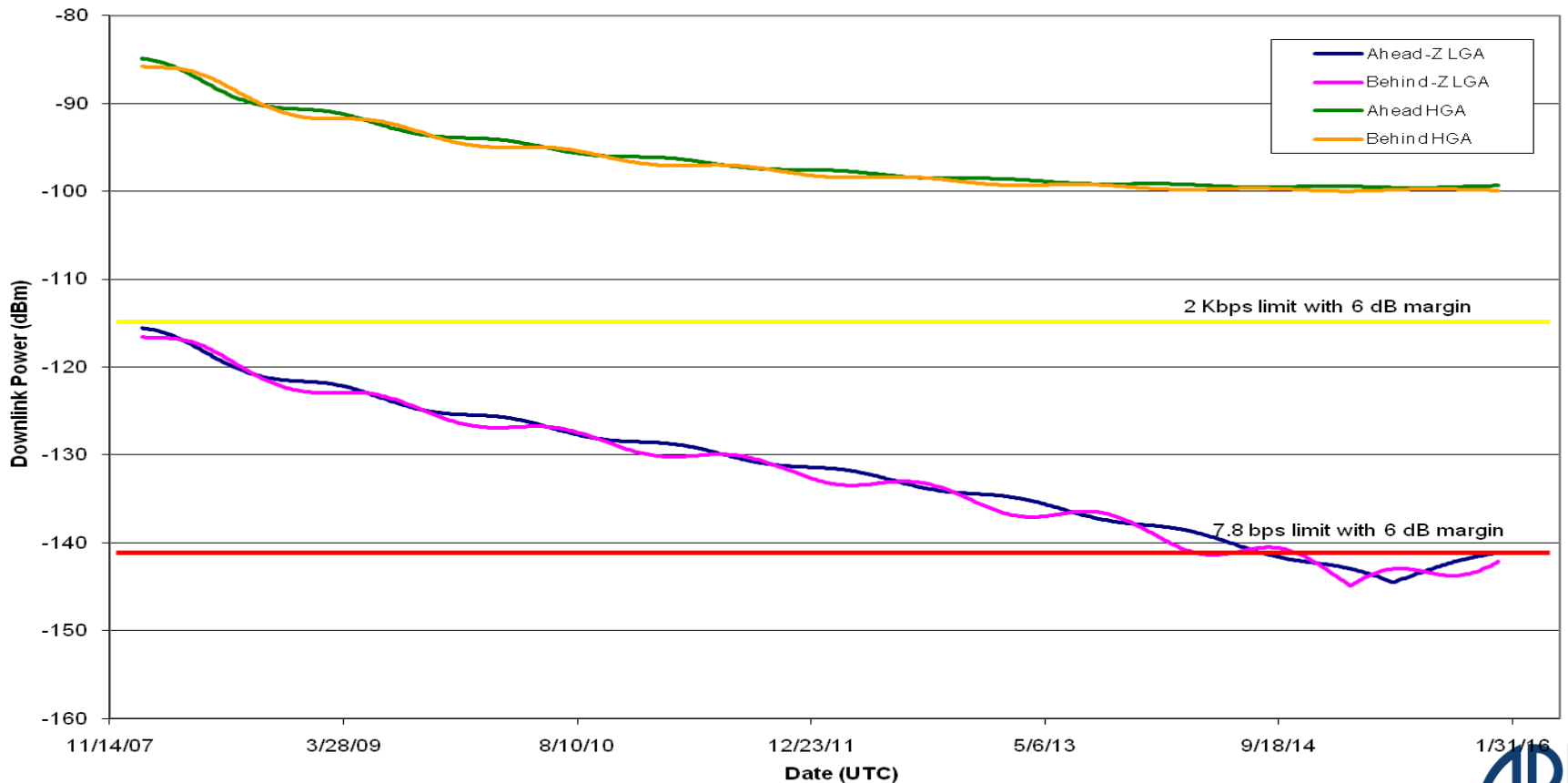


**Total Downlink Received Power to 70m DSN
(10 deg elev, 95% weather)
DL carrier is 4.1 or 9.8 dB lower**





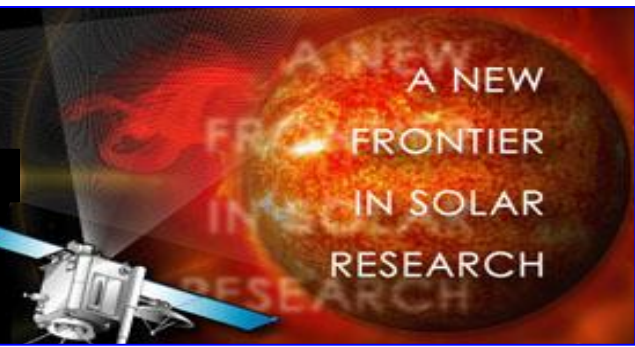
Total Uplink Received Power from 70m DSN with 10 deg elev, 95% weather, 20 KW uplink





Program Summary

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- ❖ Began extended mission January 22nd, 2009
- ❖ The observatories are in operational mode and about 135 degrees apart.
- ❖ APL Team activities:
 - *Guidance interaction and star tracker anomaly investigation*
 - *SLE Telemetry testing*
 - *Internet Security*
- ❖ Continuing to collect science data, averaging about 5 Gbits/day.
- ❖ Supporting science team any way necessary.

Let us know how we can help

