



# *SOHO and STEREO Health and Future Plans*



*J.B. Gurman*

US Project Scientist for *SOHO*  
*STEREO Project Scientist*

671/Laboratory for Solar Physics,  
Heliophysics Division



# Overview



1. *SOHO* status and plans
2. STEREO status and plans

TL;DR:

*SOHO* is good for at least another two years

STEREO will not be much help for forecasting over the next ~ 16 months

....but it won't be useless, either



# SOHO: Status (I)



- Spacecraft
  - All spacecraft subsystems that survived the offpointing of 1998 are still operational, except for:
    - Sun sensors: surface flaking (?) led to false positive offpoint indication
    - High Gain Antenna (HGA) east-west gymbal mechanism failed in 2003



# SOHO: Status (II)



- Spacecraft (continued)
  - Consumables
    - Hydrazine propellant for maneuvers: 114 kg
      - Enough for 100 - 200 years
  - Solar array lifetime
    - Current at ~ 77% of immediate post-launch value
    - ESA study assuming much higher solar activity than we have seen this cycle indicates we will be operational at least through the end of CY2018 (failure will be rapid once it becomes noticeable)



# SOHO: Status (III)



- Instruments
  - Partial failures during 1998 offpointing and thermal excursions: LASCO C1 piezoelectric wavelength tuning
  - Quiesced: MDI (helioseismology), CDS, SUMER (spectroscopy)
  - End of life: UVCS (coronal spectroscopy)



# SOHO: Status (IV)



- Other instruments (continued)
  - Aside from throughput degradation over nearly 19 years of operation
    - EIT (EUV coronal imaging): 2 x 4 wavelength images per day → use SDO AIA instead
    - CELIAS operational (for at least one more year)
    - COSTEP: EPHIN noise levels affected by secular increase in heating of front of spacecraft
    - ERNE: Detector leakage current growing at rate of ~ 20%/year, again due to secular heating increase
    - SWAN: H cells lost their gas by 2007, otherwise OK



# SOHO: Status (V)



- LASCO
  - C3 coronagraph continues ~ 0.5% throughput degradation per year
  - Some elements of ground system aging



# *SOHO: Future Plans*



- Future plans
  - The pacing consumable is, as always, funding
  - 2015 will see a novel situation: *SOHO* will be reviewed programmatically by HQ, but not by the Senior Review
    - No science funding since FY08
  - Approved for extension by ESA through CY2016
    - Extension through CY2018 under review





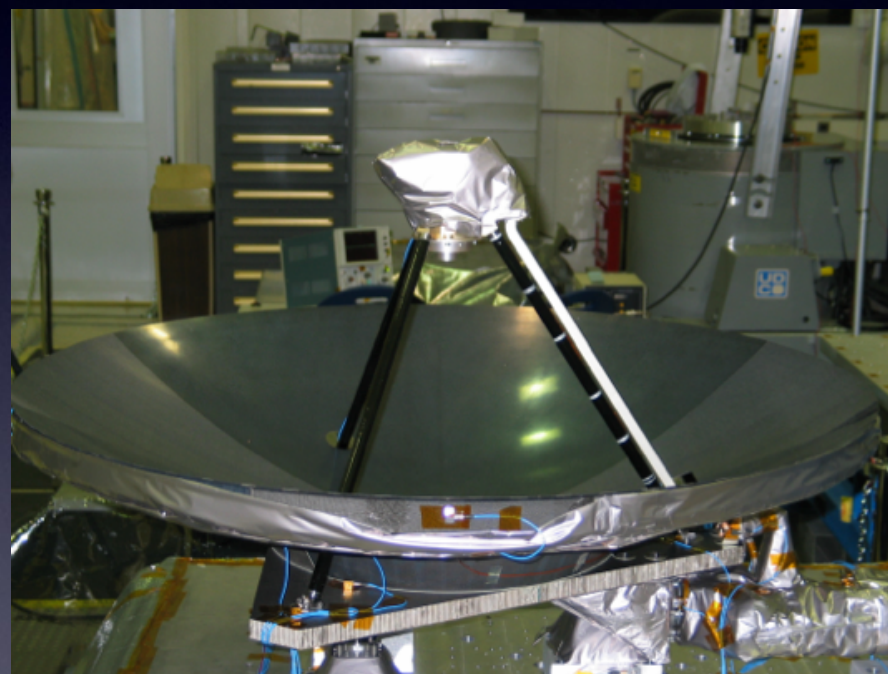
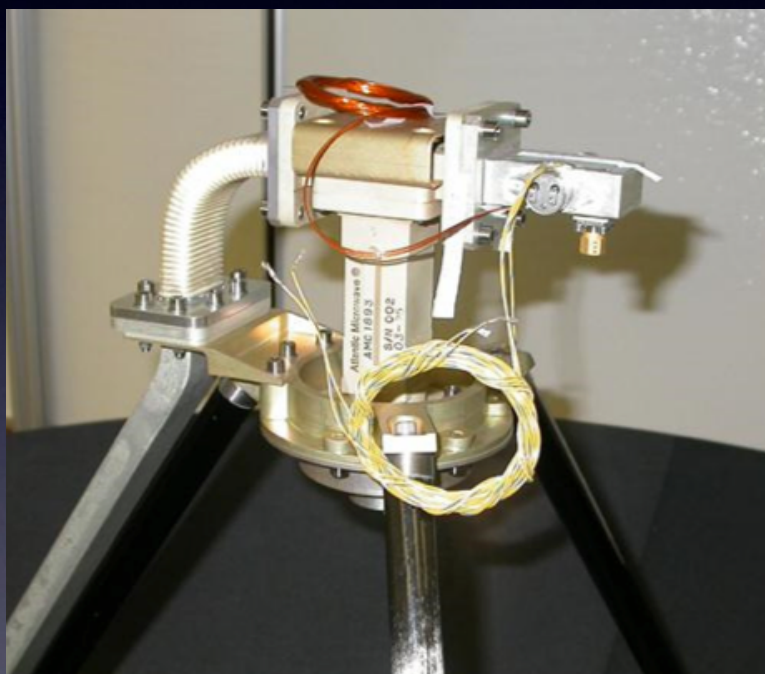
# *STEREO: Status (I)*



- Spacecraft
  - At least one ring laser gyro in the primary inertial management unit (IMU) on each spacecraft is gone
  - Remaining IMU being used as a finite-lifetime consumable
  - Current control law uses SECCHI guide telescope plus spacecraft star tracker as nominal attitude control system



# STEREO: HGA Feed





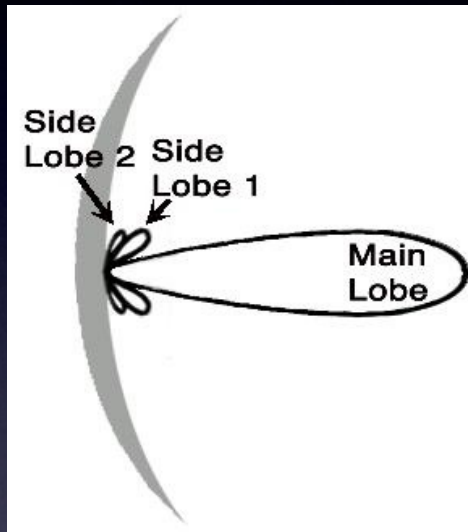
# STEREO: Status (II)



- High-gain antennas (HGAs)
  - Designed for a 2-year prime mission
  - Thermal requirements for superior conjunction ops ( $\sim L + 8$  years) evidently not considered during design phase
  - Antenna feed temperatures began rising rapidly in late Q2 of this calendar year
  - Led to rapid development of a plan for sidelobe operations
    - Including limited science ops



# STEREO: Sidelobe Ops (I)



Separation and width of sidelobes is exaggerated for visibility. Sidelobe 1, for instance, is only  $0.2^\circ$  wide.

- Sidelobe 1 signal strength is down  $\sim 20$  dB from main lobe, and much narrower
- Science data rates practical with 70 m antenna (*vice* 120 - 160 kbps on main lobe with 34 m antenna):
  - Sidelobe 1: 7.4 kbps
  - Sidelobe 2: 1.7 kbps
  - For comparison, current space weather beacon mode data rate: 630 bps



# STEREO: Sidelobe Ops (IIa)



- Schedule:
  - Ahead
    - Sidelobe 1: 2014 August 19 - 2014 November 9
    - Sidelobe 2: 2014 November 10 - 2015 March 21
    - Superior conjunction (**instruments off**): 2015 March 22 - 2015 July 13
    - Sidelobe 2: 2015 July 14 - 2015 September 23
    - Sidelobe 1: 2015 September 24 - 2015 December 30
    - Back to main lobe: 2015 December 31



# STEREO: Sidelobe Ops (IIb)



- Behind
  - Sidelobe 1: 2014 December 1 - 2015 January 5
  - Sidelobe 2: 2015 January 6 - 2015 January 19
  - Superior conjunction (**instruments off**): 2015 January 20 - 2015 March 29
  - Sidelobe 2: 2015 March 30 - 2015 April 24; 2015 July 8 - 2015 November 19
  - Sidelobe 1: 2015 April 25 - 2015 July 7; 2015 November 20 - 2016 January 4
  - Back to main lobe: 2016 January 5



# STEREO: Things to Note



- There will *only be 8 - 9 days of no coverage*; aside from that overlap of superior conjunction outages, at least one spacecraft will be returning science data at a reduced rate throughout the period (now - early 2016 January)
- Behind instruments will be off the air 2014 September 29 - October 5/6 for a test of superior conjunction ops
- All instrument teams will probably want to recommission their instruments on return to main lobe ops in early 2016, so it may be days to weeks before normal data products are available



# STEREO: Sidelobe Ops (III)



- Space weather prediction utility of sidelobe ops will be limited
- Only ~ 2 hours per day per spacecraft of downlink
- But:
  - EUVI images @ 15 minute cadence should reveal if a significant, farside event has occurred in the last few hours
  - Regular IMPACT, PLASTIC, and S/WAVES beacon mode data will be stored on board until downlink after the end of sidelobe ops (~ 2016 January) and then read out – science will still be possible on events during the outage
  - Looking for more bandwidth
- Details of science products:
  - [http://stereo-ssc.nascom.nasa.gov/solar\\_conjunction\\_science.shtml](http://stereo-ssc.nascom.nasa.gov/solar_conjunction_science.shtml)





# *STEREO: Future Plans*



- Senior Review of Heliophysics missions coming up
  - Expect proposals to be due in early 2015 March
  - Presentations probably in late 2014 April
- We'll have the challenge of convincing the review panel that:
  - it costs as least as much money to operate two spacecraft in new modes of operation for up to 17 months as it did to operate them in nominal mode
  - there will be valuable science opportunities even in the depths of the superior conjunction phase of the mission