STEREO Science Center Status Report

William Thompson
NASA Goddard Space Flight Center

STEREO SWG
3-5 February 2009
Pasadena, California

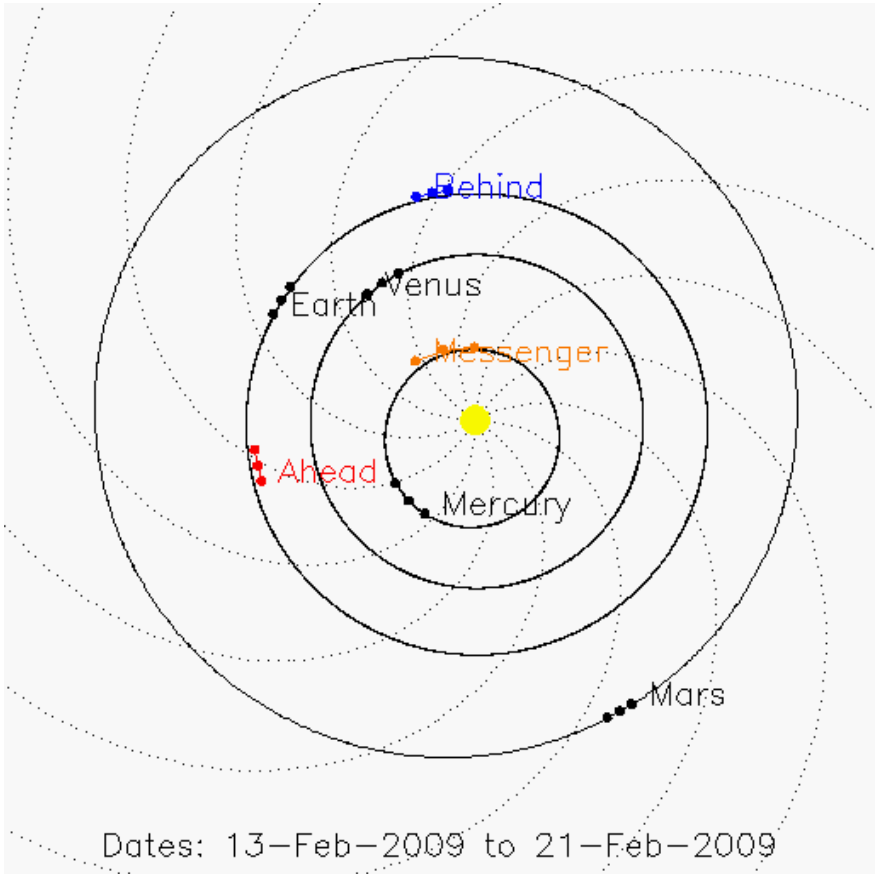
Recent Science Events

- Whole Heliospheric Interval
  - March 20 – April 16
  - Multi-mission campaign to observe the Sun and heliosphere over a complete solar rotation
- SUMER observing period, June 20-30
- Total Solar Eclipse, August 1
  - Passed through arctic, Russia, China
- MESSENGER fly-by of Mercury, Oct 6

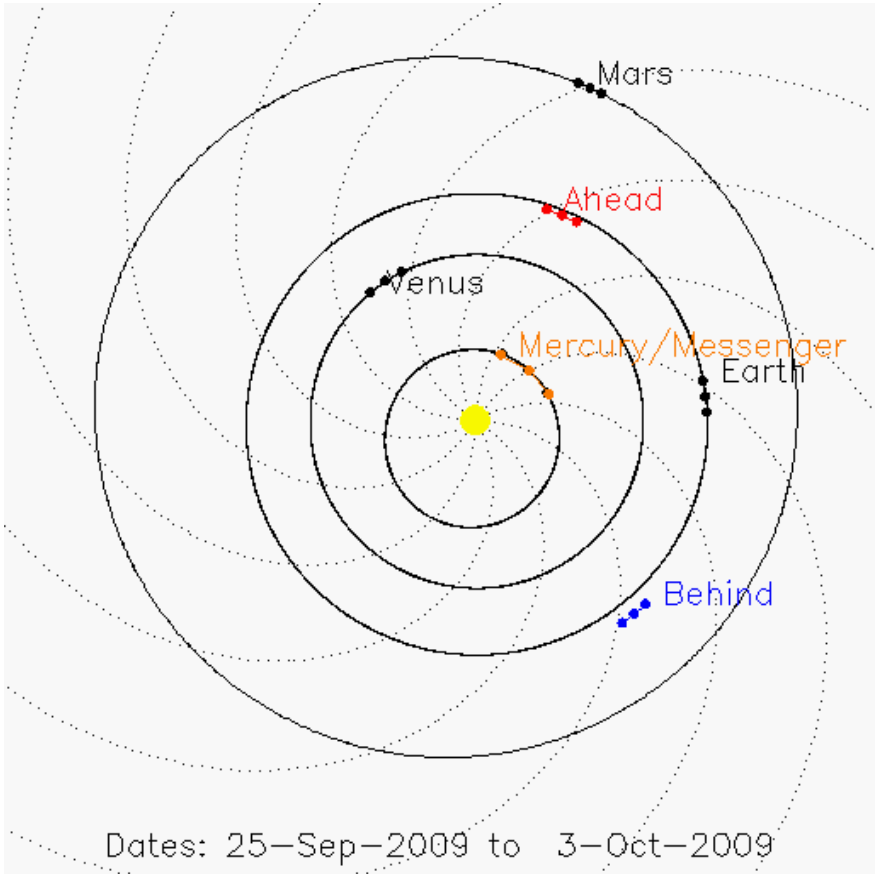
Upcoming Science Opportunities

- 2009
  - DAWN fly-by of Mars, Feb 17, 2009
  - Herschel sounding rocket launch, ICAL14
    - February/March
  - SUMER campaign, April 15-29
  - SUMI sounding rocket launch, April 16
  - Sunrise 5-day balloon flight, June 1 – July 10
  - Total solar eclipse, July 22, China
  - Messenger fly-by of Mercury, September 29
    - Behind in quadrature with Mercury
  - STEREO-Behind at L5, September-November
    - Interest as test for possible future SWx mission
    - Ahead at L4 about the same time
  - SUMER campaign, Nov 1 – Dec 15

DAWN fly-by of Mars 17 February 2009



Messenger fly-by of Mercury 29 September 2009



Proposed HI L4/L5 Campaign

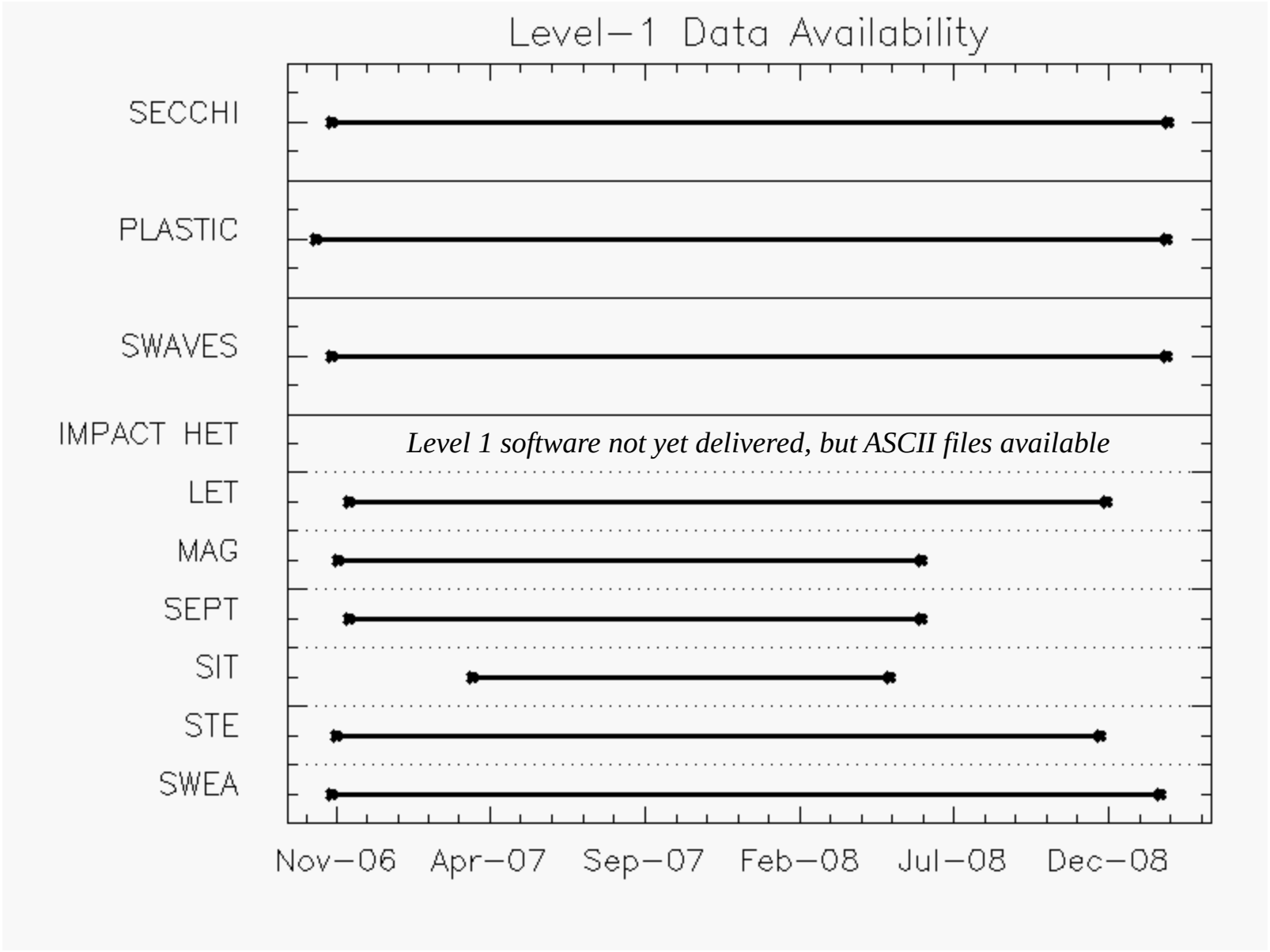
- Expect dust enhancements (which could be spread quite widely) and even some rocky objects.
- Monthly rolls of the spacecraft by 180 degrees - from ***NOW*** - to allow HI to view the L4/L5 regions as we approach. Six hours once a month, taking 'synoptic' image sequences, i.e. no modification to cadences, exposures...
- Periods of 180 rolls (quarter of a day each) to monitor dust impacts as we pass through the 'cloud' - to be done during October and November. Frequency TBD.
- Synoptic operations for the rest of the passage utilizing current imaging schemes to extract any dust or rocky object imaging.

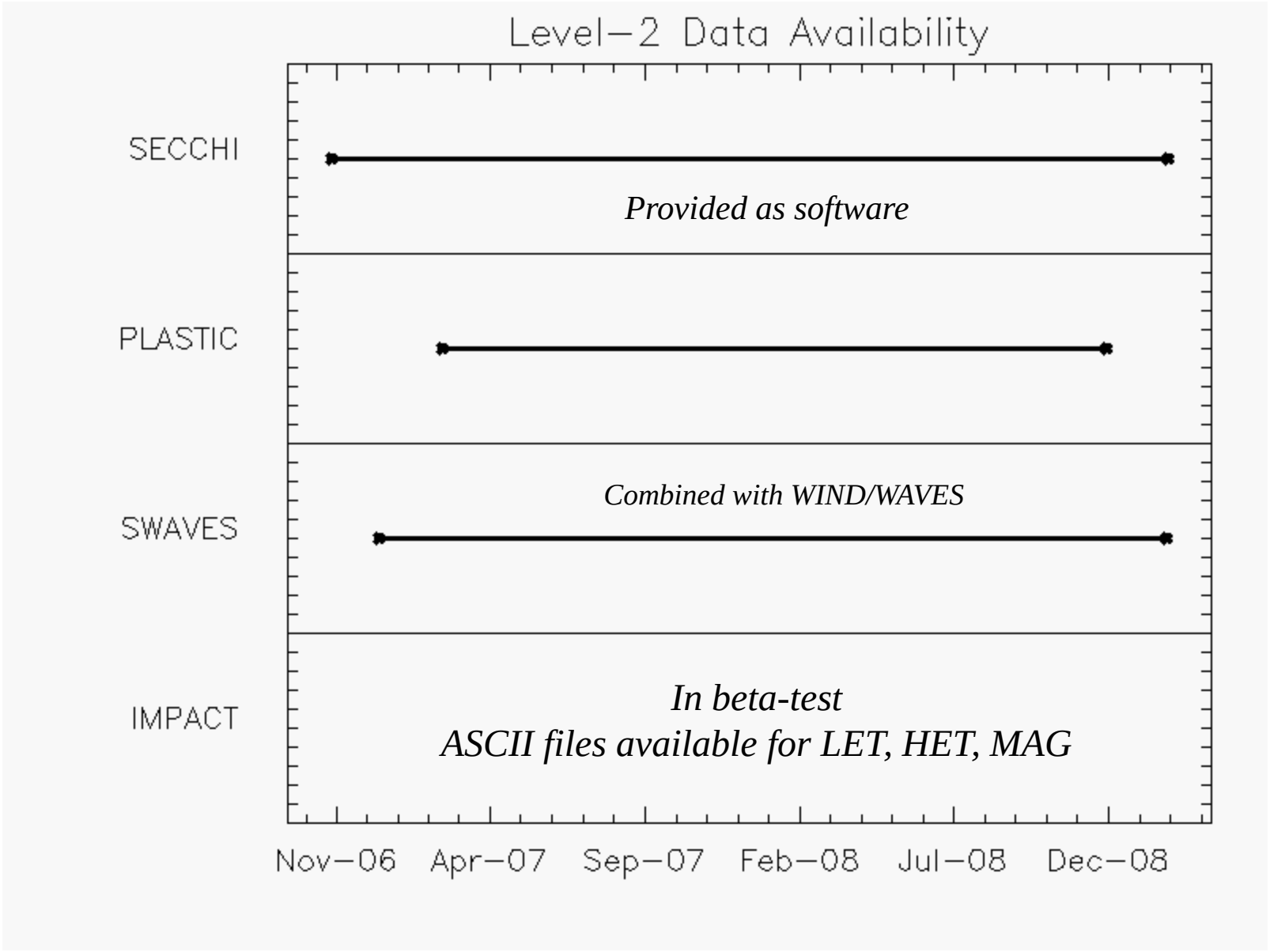
Much Farther Ahead

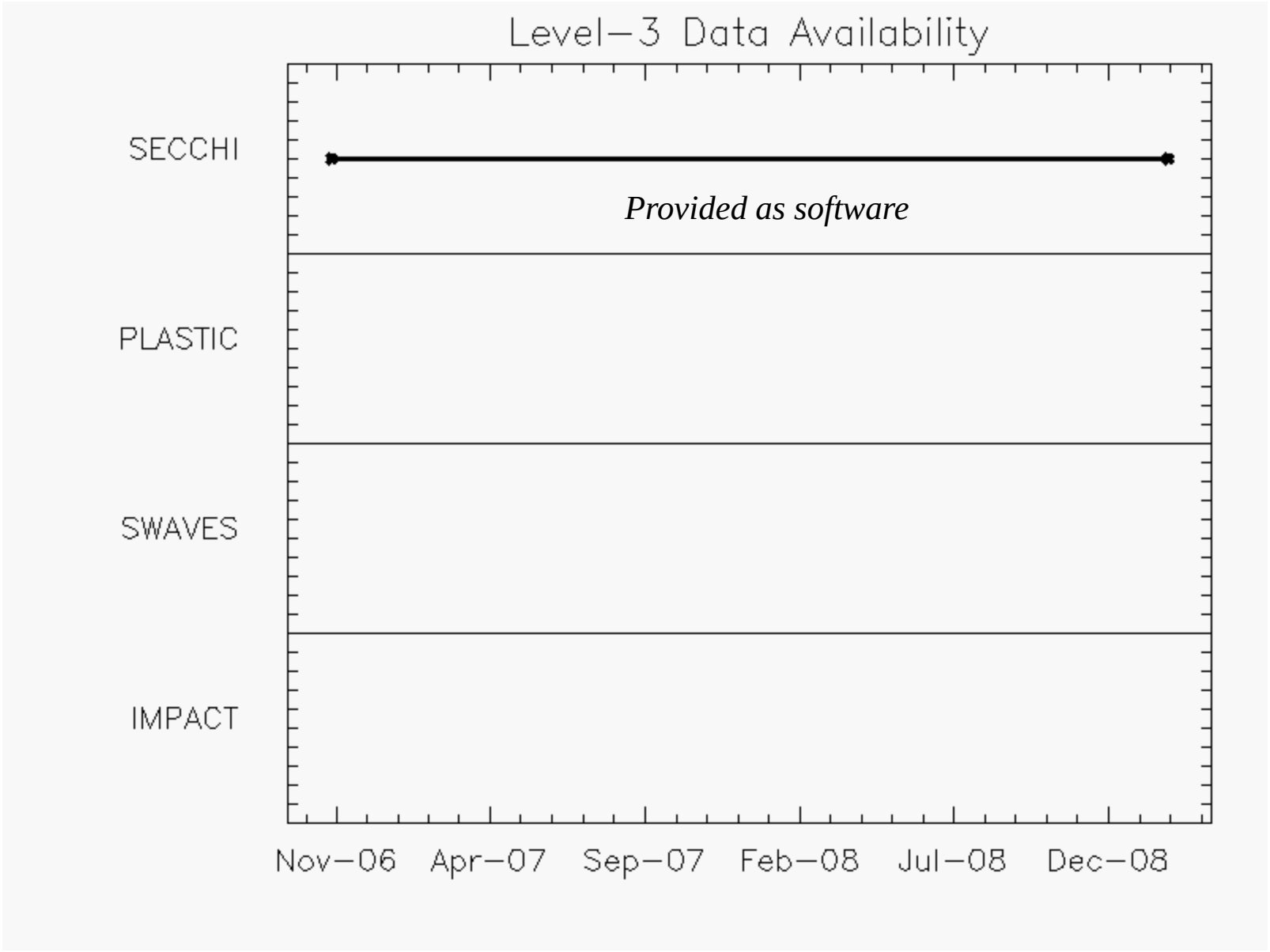
- 2010
  - Total solar eclipse, July 11, South Pacific
- 2011
  - Messenger Mercury orbital insertion, March 18
  - DAWN arrives at Vesta, August
- 2012
  - DAWN leaves Vesta, May
- 2014
  - MAVEN arrives at Mars, September
- 2015
  - DAWN arrives at Ceres
  - STEREO goes behind Sun (3°)
    - Ahead, Feb 17–Aug 2
    - Behind, Jan 10–Apr 12, Jul 23–Nov 10

Data Availability

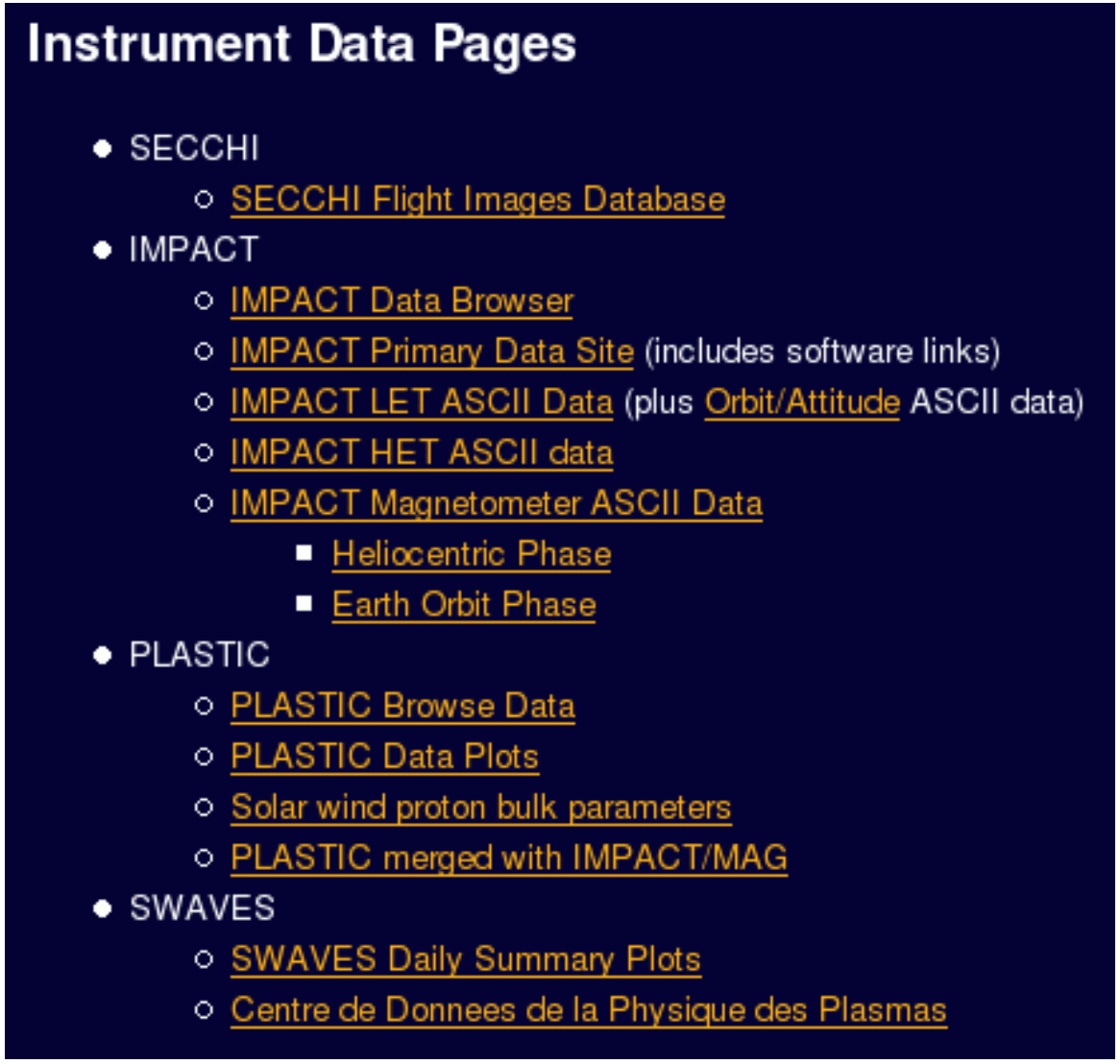
- Following plots show data archived within SSC for various data levels.
- Instrument resource pages now available for all instruments.
  - Alex Young has put together alternative pages for IMPACT, PLASTIC, and SECCHI, based on the SOHO model.
- Data available through Virtual Solar Observatory, but customized interface is still not available
  - Much data available through individual instrument data pages
- Currently, there is a problem retrieving SECCHI data from NRL site
  - IDL routine **SECCHI_VSO_INGEST** will retrieve data


Level–1 Data Availability
SECCHI
PLASTIC
SWAVES
IMPACT HET
Level 1 software not yet delivered, but ASCII files available
LET
MAG
SEPT
SIT
STE
SWEA
Nov–06
Apr–07
Sep–07
Feb–08
Jul–08
Dec–08


Level–2 Data Availability
SECCHI
Provided as software
PLASTIC
SWAVES
Combined with WIND/WAVES
IMPACT
In beta-test
ASCII files available for LET, HET, MAG
Nov–06
Apr–07
Sep–07
Feb–08
Jul–08
Dec–08


Level–3 Data Availability
SECCHI
PLASTIC
SWAVES
IMPACT
Provided as software
Nov–06
Apr–07
Sep–07
Feb–08
Jul–08
Dec–08

Instrument Data Pages



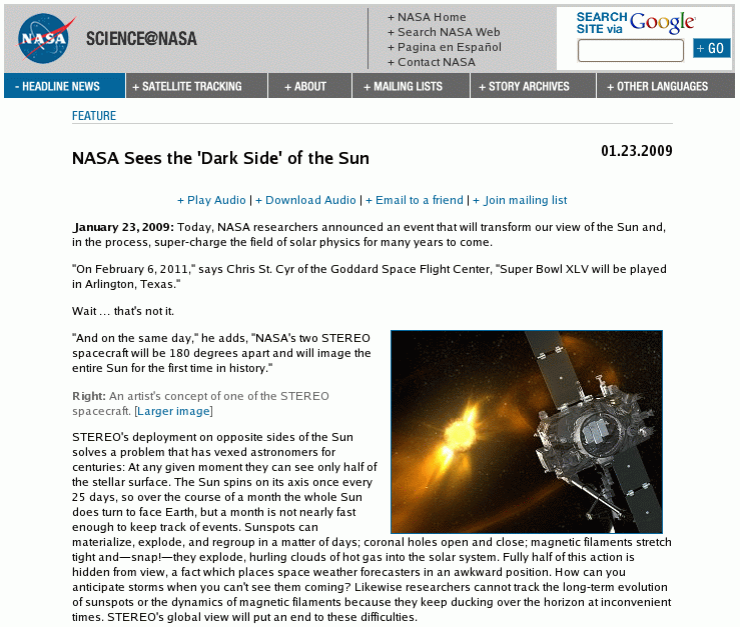
- Split off list of instrument data pages as a separate page
- Lists all data pages currently known
- Need to know what data should be archived within SSC

Beacon Status

- Receive beacon telemetry from England and Japan on a regular basis.
  - French station in Toulouse has been down since June because of mechanical problems
    - No word yet on when it will be back up
  - Not certain about continued funding for station in England
  - NOAA examining link margins for extended mission
    - Switch from Convolutional to Turbo encoding
    - Possibly changing the modulation index
  - Some possible additional stations have come to light from article in Science@NASA and spaceweather.com.
- Plan for real-time ASCII files. *(Need software from IMPACT team.)*

Beacon Volunteers

- A story in Science@NASA mentioned that we're looking for antennas to bring down the beacon telemetry
- A number of amateur groups and companies have volunteered antennas.



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FEATURE

NASA Sees the 'Dark Side' of the Sun

01.23.2009

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January 23, 2009: Today, NASA researchers announced an event that will transform our view of the Sun and, in the process, super-charge the field of solar physics for many years to come.

"On February 6, 2011," says Chris St. Cyr of the Goddard Space Flight Center, "Super Bowl XLV will be played in Arlington, Texas."

Wait ... that's not it.

"And on the same day," he adds, "NASA's two STEREO spacecraft will be 180 degrees apart and will image the entire Sun for the first time in history."

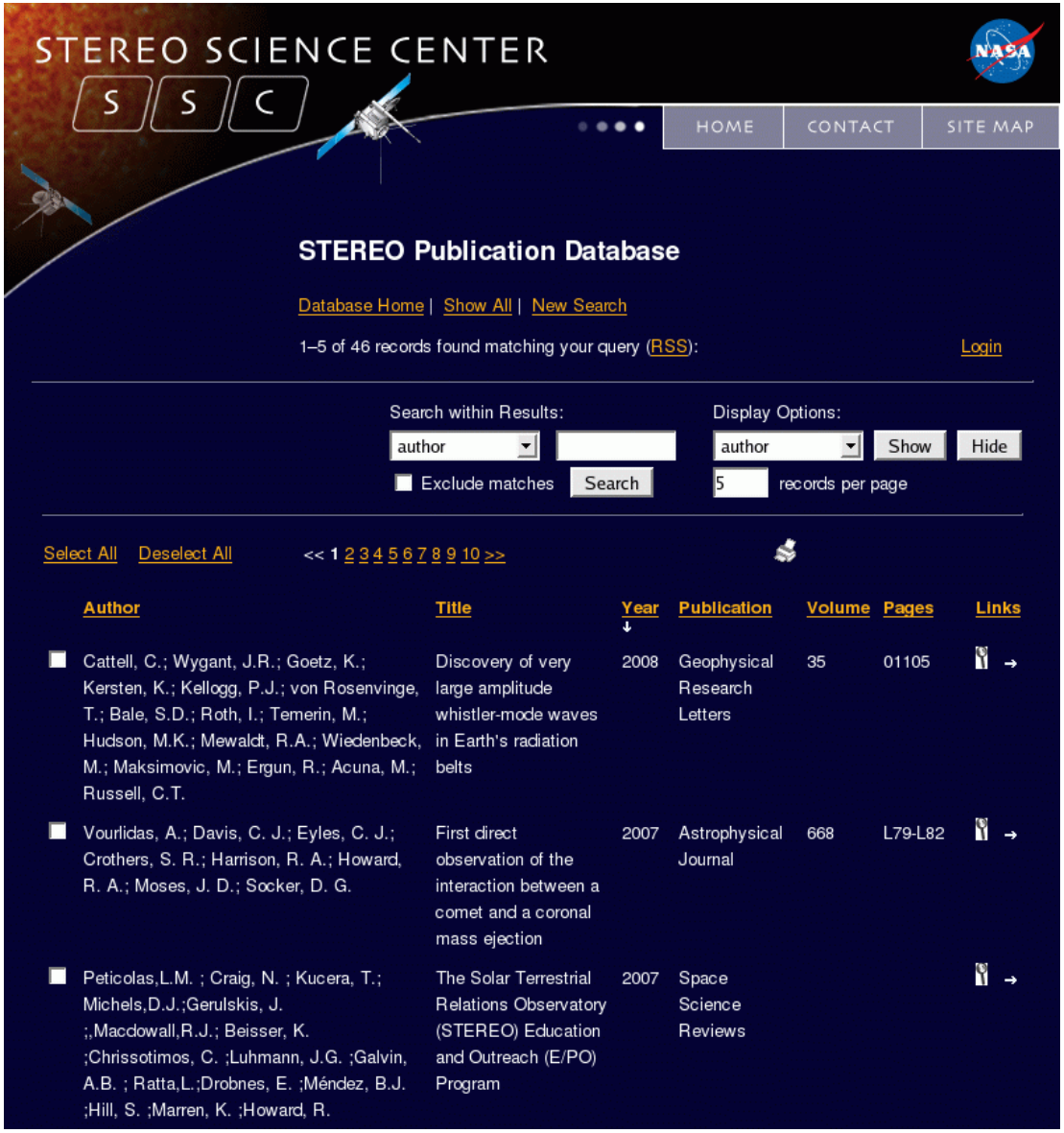
Right: An artist's concept of one of the STEREO spacecraft. [Larger image]

STEREO's deployment on opposite sides of the Sun solves a problem that has vexed astronomers for centuries: At any given moment they can see only half of the stellar surface. The Sun spins on its axis once every 25 days, so over the course of a month the whole Sun does turn to face Earth, but a month is not nearly fast enough to keep track of events. Sunspots can materialize, explode, and regroup in a matter of days; coronal holes open and close; magnetic filaments stretch tight and—snap!—they explode, hurling clouds of hot gas into the solar system. Fully half of this action is hidden from view, a fact which places space weather forecasters in an awkward position. How can you anticipate storms when you can't see them coming? Likewise researchers cannot track the long-term evolution of sunspots or the dynamics of magnetic filaments because they keep ducking over the horizon at inconvenient times. STEREO's global view will put an end to these difficulties.

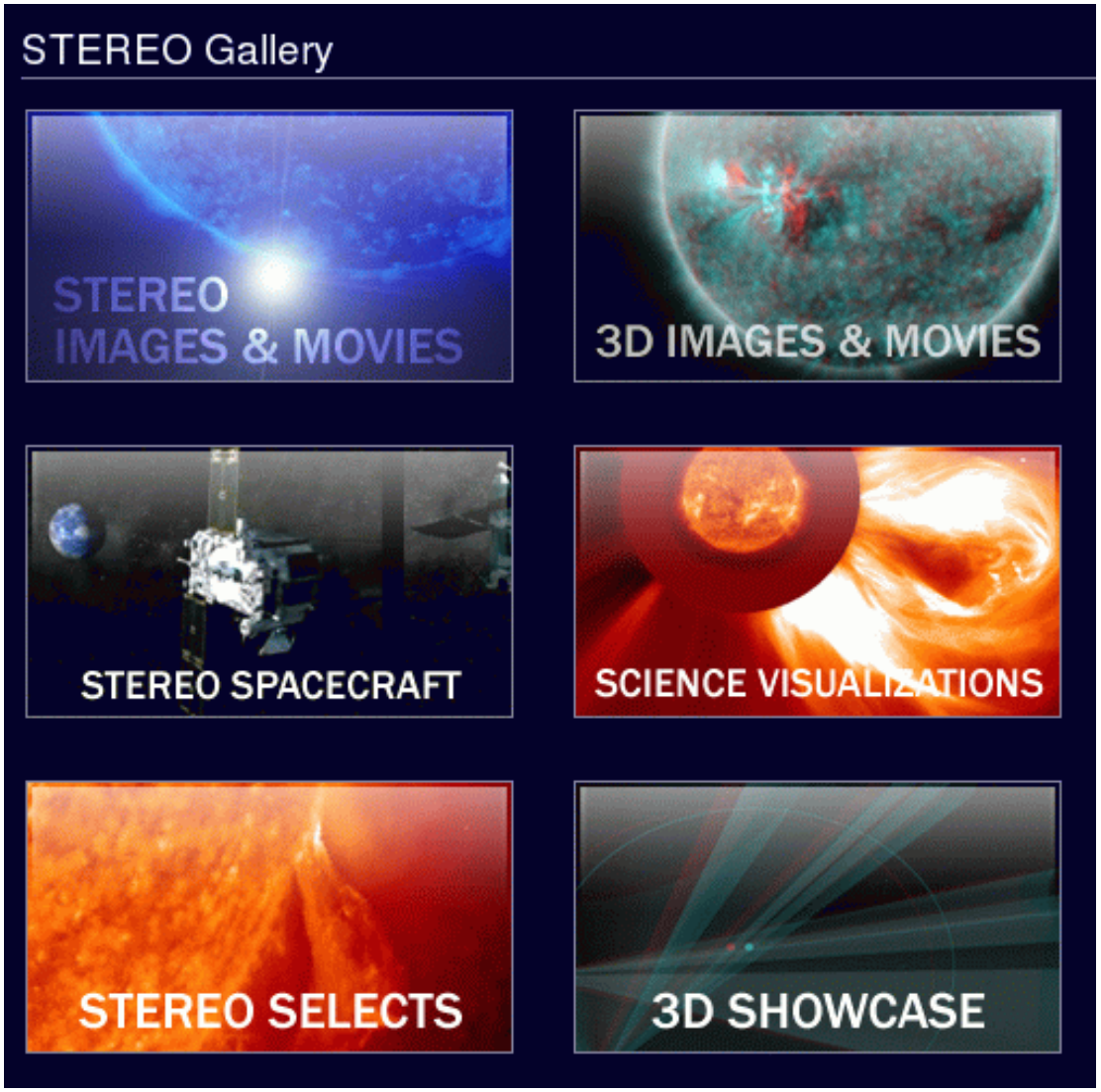
- Some possible stations that may come out of this effort:
  - Jamesburg Moon Bounce Team, 30 meters, California
  - AMSAT-DL, 20 meters, Germany
  - Amateur 9 and 7 meter dishes, Germany
  - CTO – CSS Robotics, 10 meters (?), Michigan

Science Publication Database

- The STEREO publication database is now online.
- Contains published papers *only*.
- Links to online versions of the papers from the publishers
- Send new entries to C.Alex.Young @nasa.gov



Gallery

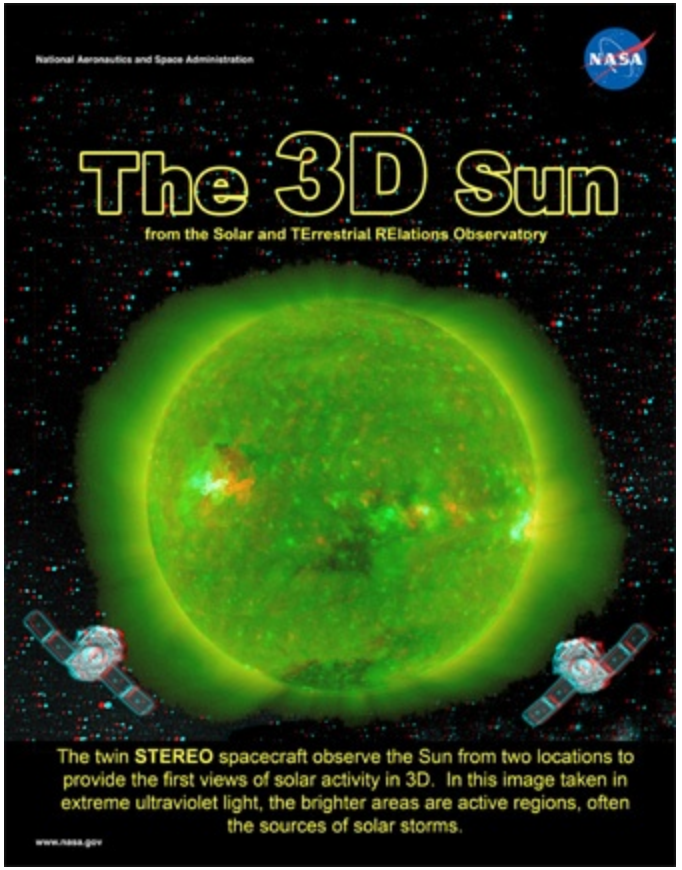


- A lot of work has been done on the STEREO gallery
- We encourage everybody to send us your best stuff
- Should also inform us of upcoming press releases

i.e. Mike, Rani

Outreach to Informal Educators

- Astronomy clubs, amateur astronomy efforts (including star parties), science centers, NASA IYA student ambassadors
- Over 100 boxes/packets sent out
- Materials often re-distributed to teachers and presenters in schools, scouts, etc.

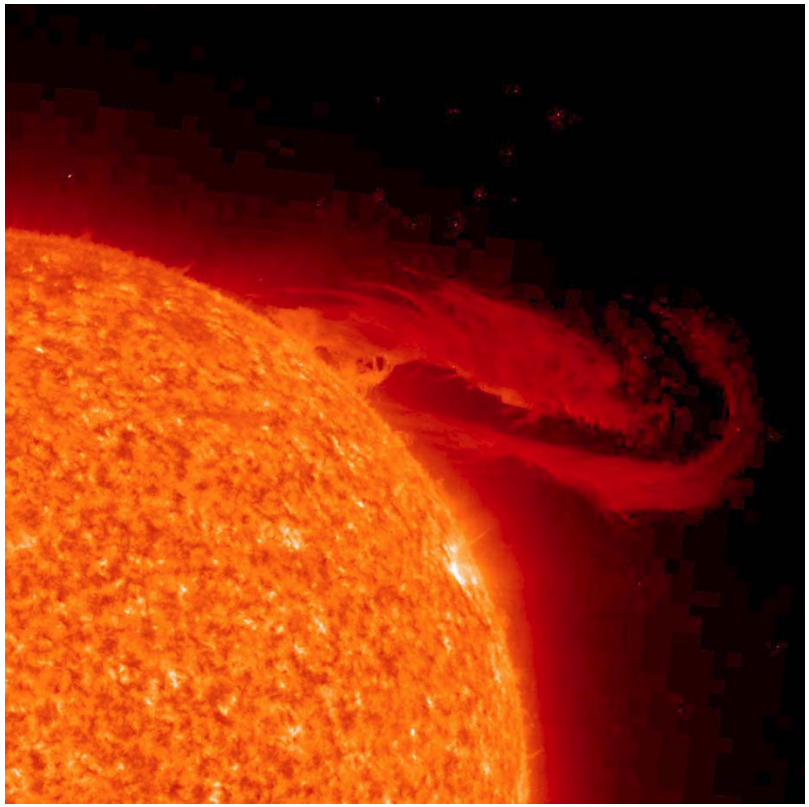


Supported Events

- Booths manned and materials distributed at Goddard at Annapolis Day, AARP Convention, ASTC Conf., Goddard Open House, Natl. Science Teachers Association Conf., Pa. Science Teachers Association Conf., and NASA at the Smithsonian Air and Space Museum

Digital Presence

- STEREO movies and images grab the attention of the public though NASA portal, APOD, STEREO galleries.
- SOHO Pick of the Week, often featuring STEREO, goes to 200 kiosks via ViewSpace and 30 sites through the American Museum of Natural History's AstroBulletins.



Telemetry Rate Changes

Date Ahead	Date Behind	Downlink (kbps)	Pass duration (hrs)	Daily volume (Gbits)
Jan 2007	Jan 2007	720	4	5
Oct 2008	Sep 2008	480	5	5
May 2009	June 2009	360	6	5
Aug 2009	Sep 2009	240	7	4
May 2010	Dec 2009	160	8	2.7
Apr 2011	Nov 2010	120	8	2.1
Sep 2011	Sep 2011	96	8	1.7
Aug 2012	Aug 2012	30	10	0.6

Extended Mission Strategy

- Space weather beacon telemetry will be unaffected.
  - SECCHI SWx telemetry will *not* be stored on the SSR.
- Spacecraft housekeeping rates will drop proportionally to the overall rate.
- Instruments will only put housekeeping data in the realtime stream, with science data written to the SSR.
  - SECCHI already does this. The SECCHI housekeeping rate will drop from the current 3.6 kbps to 2.2 kbps. This will drop again to 1.2 kbps when the overall rate drops to 96 kbps.
  - Optional realtime modes for special instrument operations
- All instruments, including the *in situ* instruments, will lower their science rates.

Table 1.8: Realtime telemetry allocations during the extended science mission, in kbps. The rates marked *"full"* will vary depending on the total telemetry rate available—see Table 1.10.

	IMPACT	PLASTIC	SWAVES	SECCHI
Nominal	0.108	0.558	0.072	2.2[a]
IMPACT-prime	*full*	0.558	0.072	2.2[a]
PLASTIC-prime	0.108	*full*	0.072	2.2[a]
SWAVES-prime	0.108	0.558	*full*	2.2[a]
All-full-rate	*full*	*full*	*full*	2.2[a]
SECCHI-emergency	0.108	0.558	0.072	16.0

[a]Will drop to 1.2 kbps for rates of 96 kbps and below.

Table 1.10: Instrument telemetry allocations during the extended mission, for various total spacecraft telemetry rates. Both daily data volumes in megabits and average SSR write rates in kilobits per second are listed. The latter values for the in-situ instruments are used for the *"full"* values in Table 1.8.

Rate	IMPACT		PLASTIC		SWAVES		SECCHI	
(kbps)	Mbits	kbps	Mbits	kbps	Mbits	kbps	Mbits	kbps
240	276	3.27	276	3.27	172.8	2.074	2998	35.53
160	202	2.39	213	2.52	124.0	1.632	1925	22.82
120	185	2.19	180	2.13	107.5	1.414	1369	16.23
96	166	1.96	171	2.03	99.2	1.305	1032	12.23

SECCHI Operations Changes

- Currently, the SSR write pointers aren't moved until the end of the pass.
  - With the much longer pass durations, the concern is that the buffer will reach capacity before the pointers are moved.
  - May request that the pointers also be moved at pass midpoint.
- Currently, both the synoptic (SSR1) and special event (SSR2) partitions are read out simultaneously.
  - Priority is to ensure that SSR1 emptied every pass.
  - If SSR2 is read out while still being written (i.e. no event trigger), then images are corrupted, wasting telemetry bandwidth.
  - Request better scheme for prioritizing SSR1 versus SSR2.
    - Different DFDs depending on NRL requests?
    - Read out SSR1 first, and then SSR2?