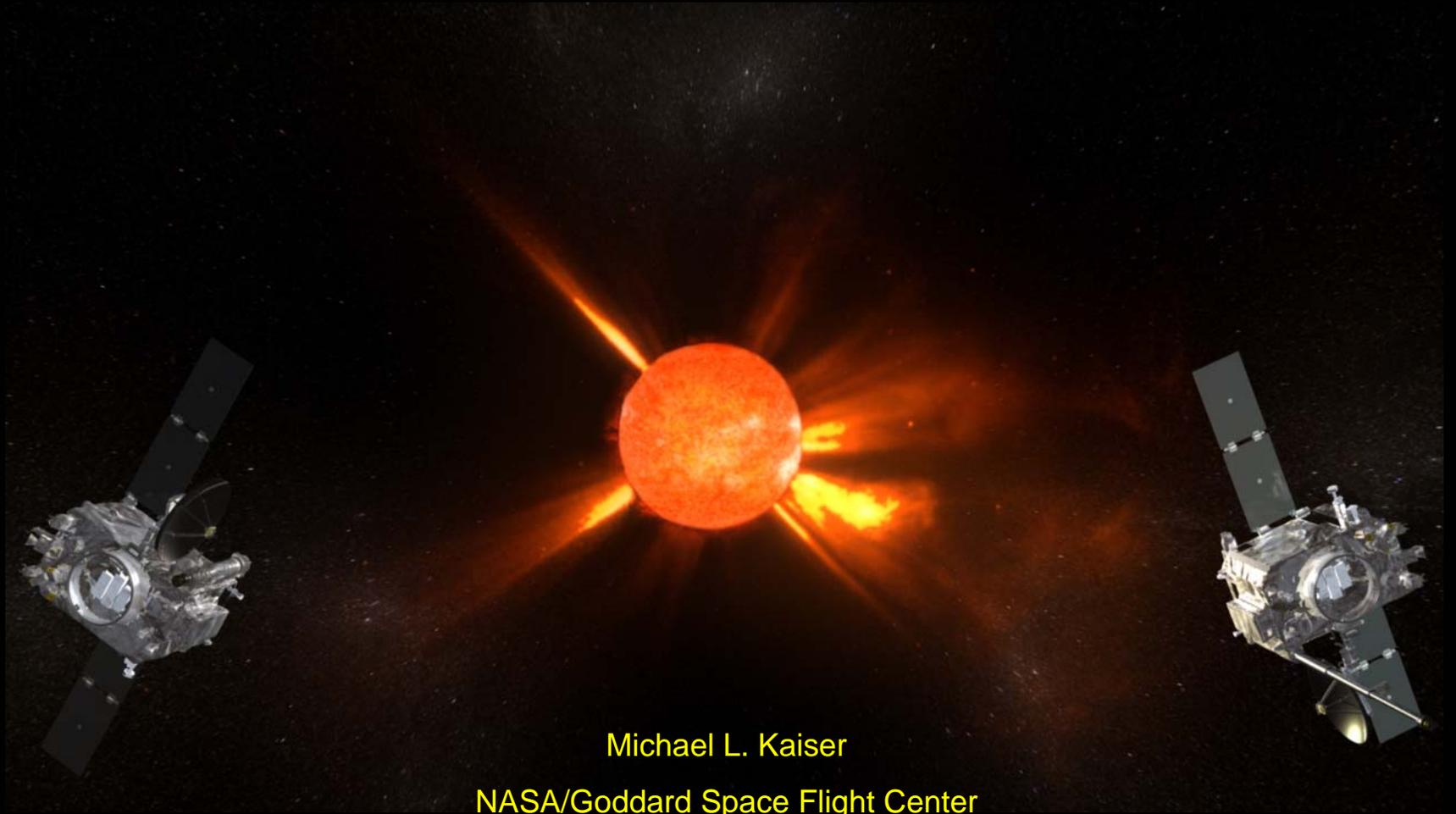


The STEREO Mission



Michael L. Kaiser

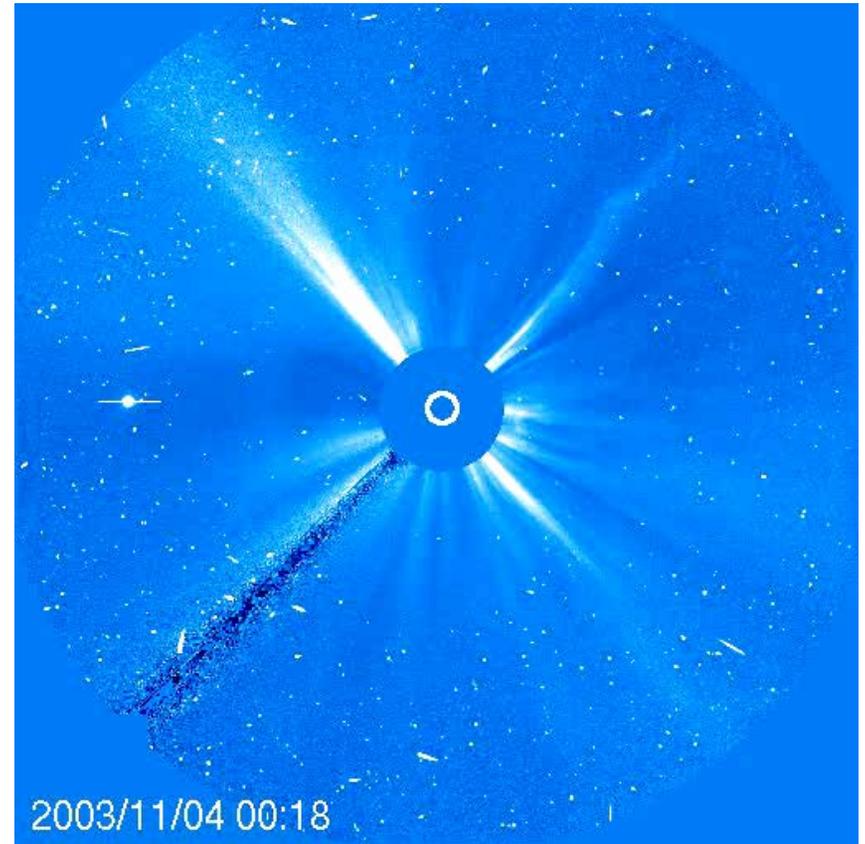
NASA/Goddard Space Flight Center

Greenbelt, MD USA 20771

Project Scientist

Science Objectives

1. Understand the causes and mechanisms of Coronal Mass Ejection (CME) initiation
2. Characterize the propagation of CMEs through the heliosphere
3. Discover the mechanisms and sites of energetic particle acceleration in the low corona and the interplanetary medium
4. Develop a 3D time-dependent model of the magnetic topology, temperature, density, and velocity structure of the ambient solar wind



Level 1 Science Requirements

SCIENTIFIC OBJECTIVE		MEASUREMENT REQUIREMENT	
1	Understand the causes and mechanisms of CME initiation	A.	Determine the CME initiation time to an accuracy of order 10 [120] minutes
		B.	Determine the location of CME initiation to within +/- 5 [30] degrees of solar latitude and longitude
2	Characterize the propagation of CMEs through the heliosphere	C1.	Determine the evolution of the CME mass distribution and the longitudinal extent to an accuracy of +/- 5 [30] degrees as it propagates in the low corona
		C2.	Determine the evolution of the CME mass distribution and the longitudinal extent to an accuracy of +/- 5 [30] degrees as it propagates in the upper corona
		C3.	Determine the evolution of the CME mass distribution and the longitudinal extent to an accuracy of +/- 5 [30] degrees as it propagates in the IPM.
		D1.	Determine the CME and MHD shock speeds accurate to +/- 10 [30]% as it propagates from the low corona
		D2.	Determine the CME and MHD shock speeds accurate to +/- 10 [30]% as it propagates from the upper corona
		D3.	Determine the CME and MHD shock speeds accurate to +/- 10 [30]% as it propagates in the IPM
		E1.	Determine the direction of CME and MHD shock propagation to within +/- 5 [30] degrees of latitude and longitude as the CME evolves from the low corona to 1 AU
		E2.	Determine the direction of CME and MHD shock propagation to within +/- 5 [30] degrees of latitude and longitude as the CME evolves in the upper corona
		E3.	Determine the direction of CME and MHD shock propagation to within +/- 5 [30] degrees of latitude and longitude as the CME evolves in the IPM

NOTES

- The four science objectives are split into 17 Level 1 measurement requirements
- Some measurements (C, D, E) are defined for three heliospheric regions, low and upper corona, and interplanetary medium (IPM)

Level 1 Science Requirements (2)

SCIENTIFIC OBJECTIVE		MEASUREMENT REQUIREMENT	
3	Discover the mechanisms and sites of energetic particle acceleration in the low corona and the interplanetary medium	F.	Develop distribution functions to an accuracy of $\pm 10\%$ for electrons and/or ions with energies typical of solar energetic particle populations
		G.	Location of particle acceleration in the low corona to within 300,000 km [500,000 km] in radius and in interplanetary space to within 20 degrees [40 degrees] in total longitude
4	Develop a 3D time-dependent model of the magnetic topology, temperature, density, and velocity structure of the ambient solar wind	H.	Obtain a time series of the solar wind temperature accurate to ± 10 [30]% at two points separated in solar longitude
		I.	Obtain a time series of the solar wind density accurate to ± 10 [30] at two points separated in solar longitude
		J.	Obtain a time series of the solar wind speed accurate to ± 10 [30]% at two points separated in solar longitude
		K.	Measure global magnetic field topology near the ecliptic by determining the magnetic field direction to ± 10 degrees.

STEREO INSTRUMENTS

•**SECCHI**- Remote Sensing Package that will track Coronal Mass Ejections (CMEs) from the Sun to the Earth. PI – Russ Howard, Naval Research Lab

- Two White Light Coronagraphs (**COR1,COR2**)- COR1 explores 1.4 – 4 R_{sun}. COR2 explores 2 – 15 R_{sun}
- Extreme Ultra Violet Imager (**EUVI**)- Observes chromosphere and inner corona
- Heliospheric Imager (**HI1, HI2**)- Observes Coronal Mass Ejections from the Sun to the Earth (12 – 300 R_{sun})

•**IMPACT**- will sample the 3-D distribution of solar wind plasma electrons, the characteristics of the energetic particle ions and electrons, and the local magnetic field. PI – Janet Luhmann, UC Berkeley

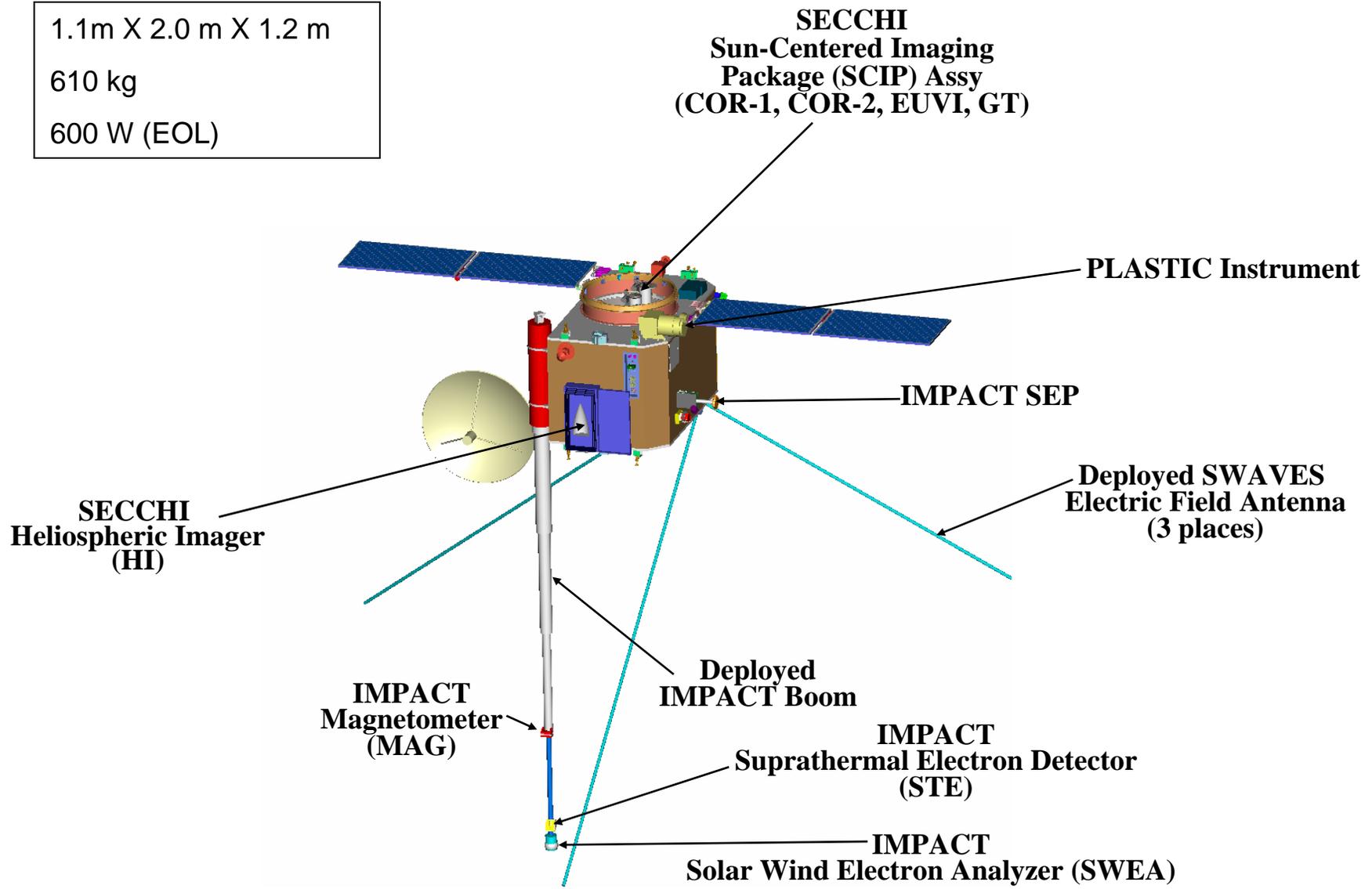
- Solar Wind Experiment (**SWEA**)- Measures ~0-3 keV electrons with wide angle coverage
- Suprathermal Electron Telescope (**STE**)- Measures electrons from 2-100 keV with wide angle coverage
- Magnetometer Experiment (**MAG**)- Measures the vector magnetic field at 65,536 nT and 500 nT ranges
- Solar Energetic Particle Experiment (**SEP**) Suite
 - Measures electrons from 0.02-6 MeV
 - Measures protons from 0.02 – 100 MeV
 - Measures helium ions from 0.03 – 100 MeV/nucleon
 - Measures heavier ions from 0.03 – 40 MeV/nucleon

•**PLASTIC**- will provide the plasma characteristics of protons, alpha particles, and heavy ion. Provide composition measurements of heavy ions and characterizes the CME plasma PI – Toni Galvin, UNH

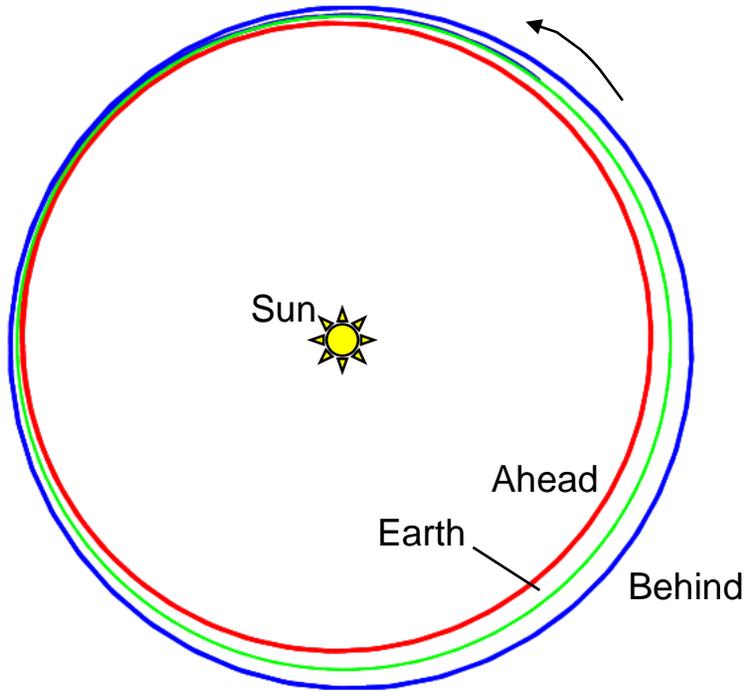
•**SWAVES**- in-situ as well as remote sensing instrument. Tracks CME Driven Shocks from the Corona to the Earth. PI – J-L Bougeret, Paris Observatory

STEREO-B (BEHIND) OBSERVATORY

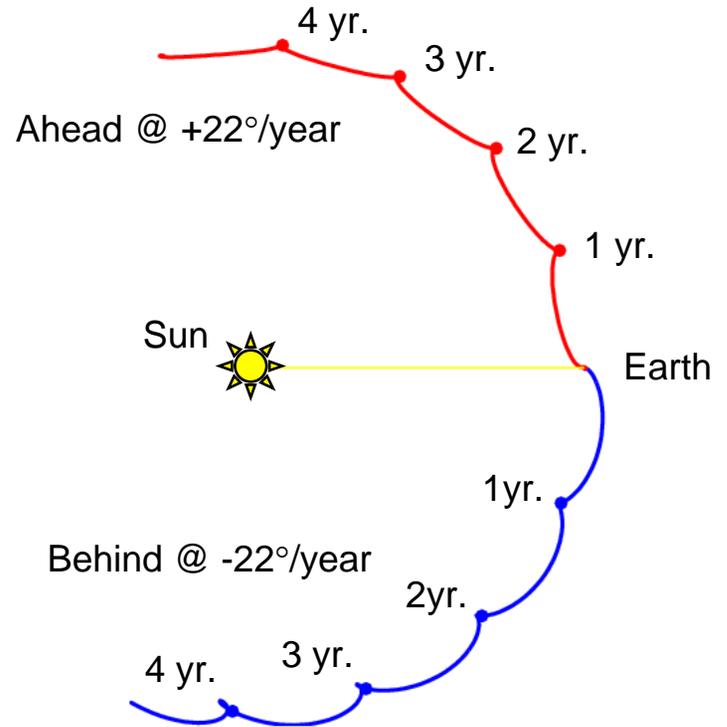
1.1m X 2.0 m X 1.2 m
610 kg
600 W (EOL)



Mission Orbit



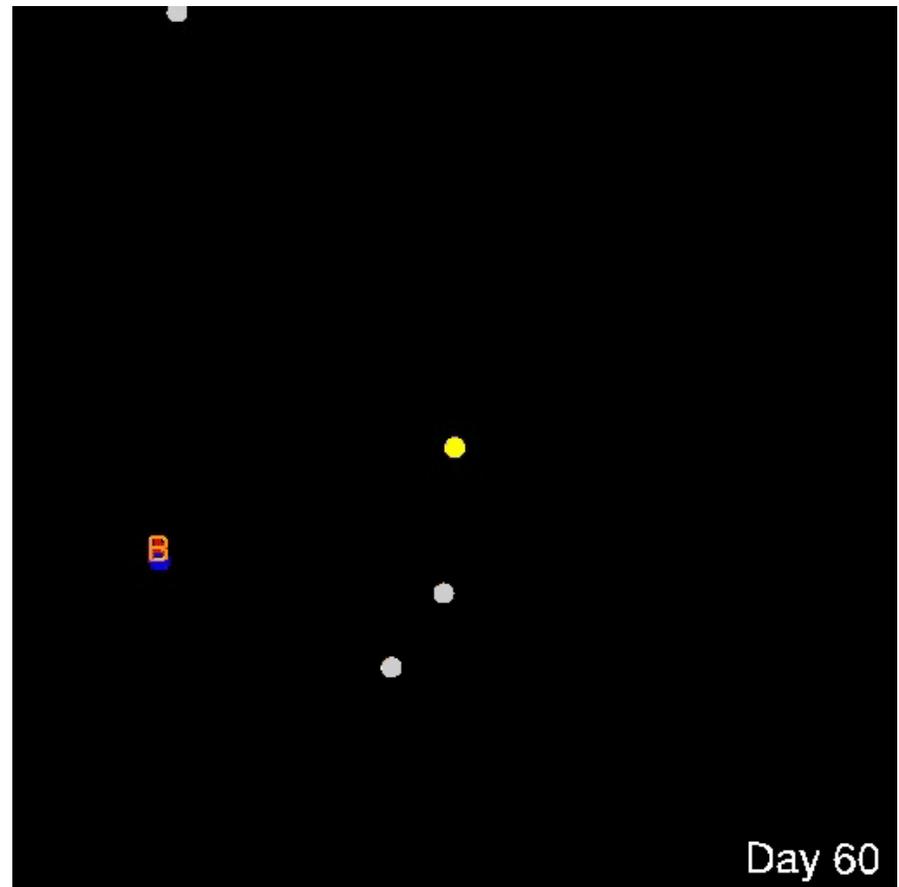
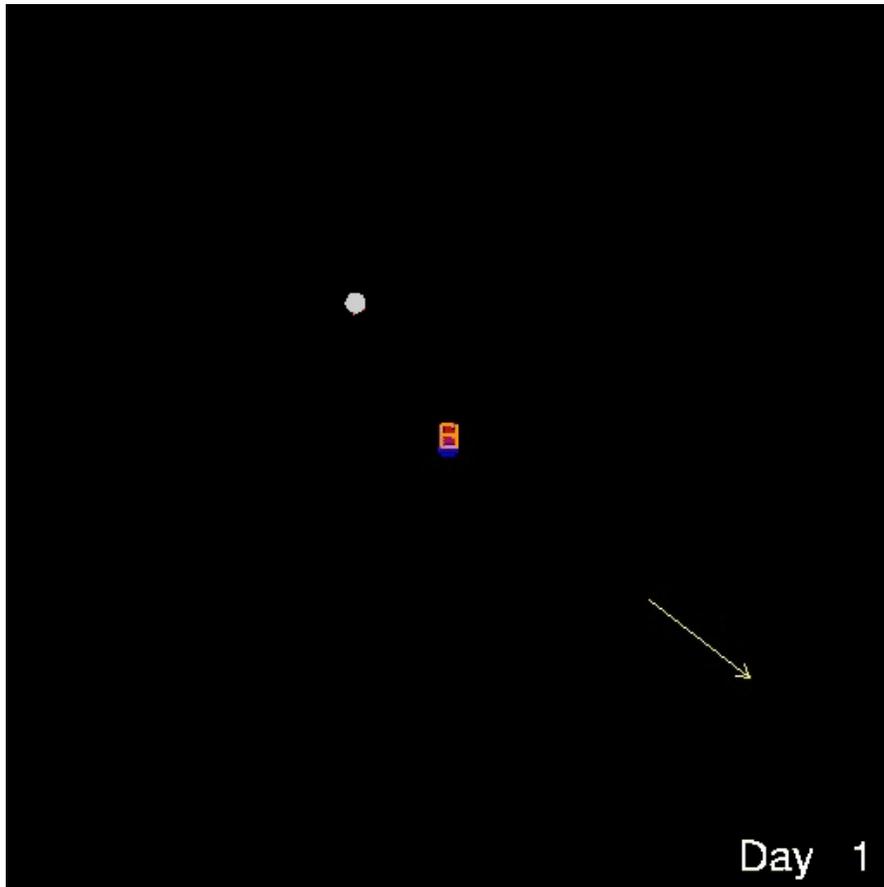
Heliocentric Inertial Coordinates
(Ecliptic Plane Projection)



Geocentric Solar Ecliptic Coordinates
Fixed Earth-Sun Line
(Ecliptic Plane Projection)

STEREO

Getting there is half the fun



<http://stereo.gsfc.nasa.gov>

3-D VIEW OF THE SUN AND HELIOSPHERE

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STEREO SOLAR TERRITORIAL RELATIONS OBSERVATORY

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STEREO will use stereoscopic (3-D) vision to construct a global picture of the Sun and its influences.

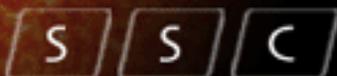
Its objective is to obtain the necessary measurements and observations to develop an understanding of the fundamental nature and origin of coronal mass ejections - the most energetic eruptions on the Sun and primary cause of major geomagnetic storms.

3-D view of the Sun...Understand CMEs...3-D view of the Sun...Understand CMEs...3-D vi

Last Revised: Thu Jul 8 10:21:40 2004
Responsible NASA Official: [Michael L. Kaiser](#)
[NASA IT Security Banner & Privacy Statement](#)
Feedback and comments: [webmaster](#)

http://stereo-ssc.nascom.nasa.gov

STEREO SCIENCE CENTER



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SITE MAP

News

June 9, 2004: Both the [STEREO](#) and [Science Center](#) websites are now operational. The first website is intended to be the main entry point for the public, while the second is targeted to the STEREO team and users of STEREO data. Included in the Science Center site is the password-protected [intranet](#) site.

June 4, 2004: The STEREO A & B spacecraft have been successfully shipped to Aerojet to have their propulsion systems installed.

May 28, 2004: Both A and B spacecraft successfully completed the structural loads test in a stacked configuration with the flight separation system.

Last Revised: Thursday, 10-Jun-2004 18:17:01 EDT
Responsible NASA Official: [Michael L. Kaiser](#)
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STEREO Space Weather Data Products

Beacon (space weather) data – available ‘immediately’

- SECCHI: 7 256 X 256 images every hour
- IMPACT: 1 min aves of **B**, 1 min aves solar wind moments and selected SEP fluxes
- PLASTIC: 1 minute resolution selected moments and fluxes
- SWAVES: 1 minute summaries of selected frequencies

Highest resolution data – available 24-48 hrs

- SECCHI: 2048 X 2048 images
- IMPACT: fluxes (10s sec), moments (few sec) and B (<1 sec)
- PLASTIC: fluxes and moments 1 min resolution
- SWAVES: intensities from all frequencies (~320) every 15 sec

Other data products – available TBD

- Key parameters
- Catalogs and event tables
- Movies

STEREO SCIENCE CENTER



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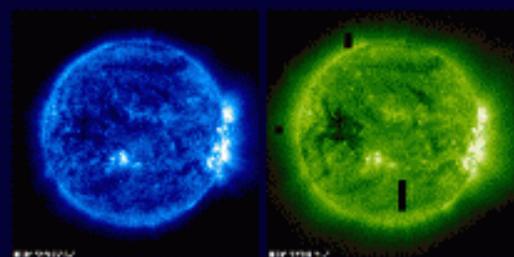
operations

COMMUNITY

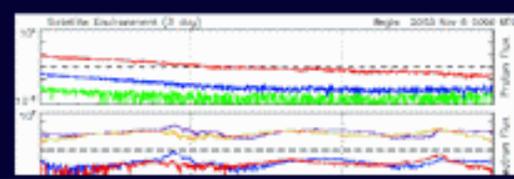
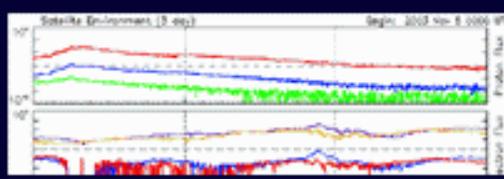
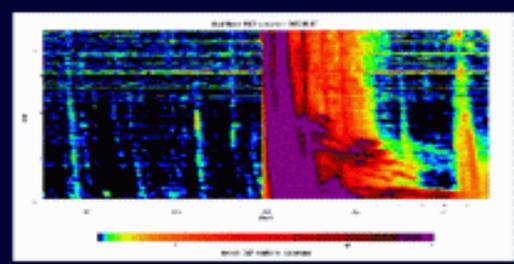
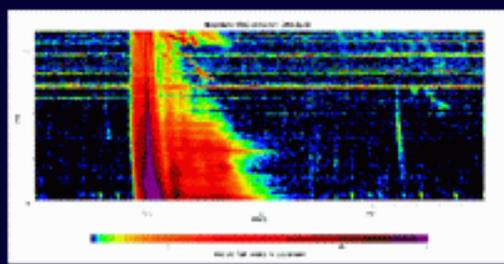
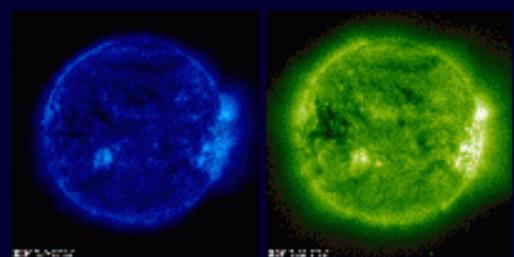
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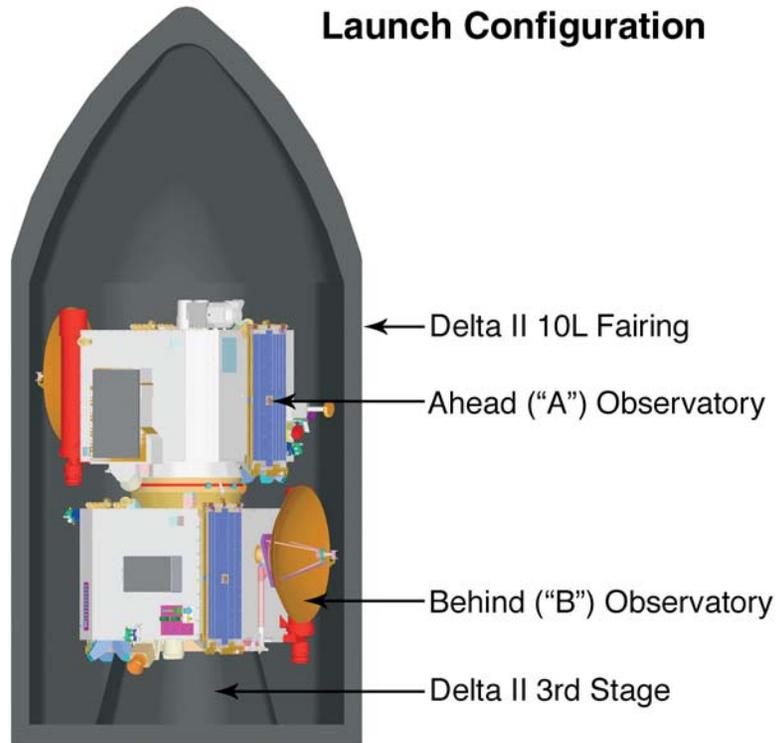
STEREO A



STEREO B

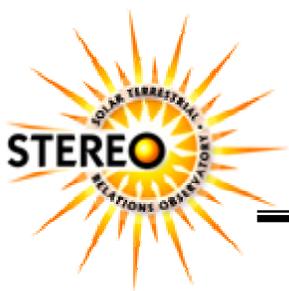


Launch Configuration



Current status

- Spacecraft finished vibration testing at APL
- Spacecraft arrived at Goddard last Wednesday
- Acoustic testing today
- Thermal vacuum testing, followed by EMC Dec-Feb
- Ship to Cape ~March
- Launch in either early or late May



Observatory Vibration Test



May, 2006



Produced by Johns-Hopkins Applied Physics Laboratory

Launch + ~90 days → Aug/Sept. 2005



Produced by NASA/Goddard Space Flight Center

