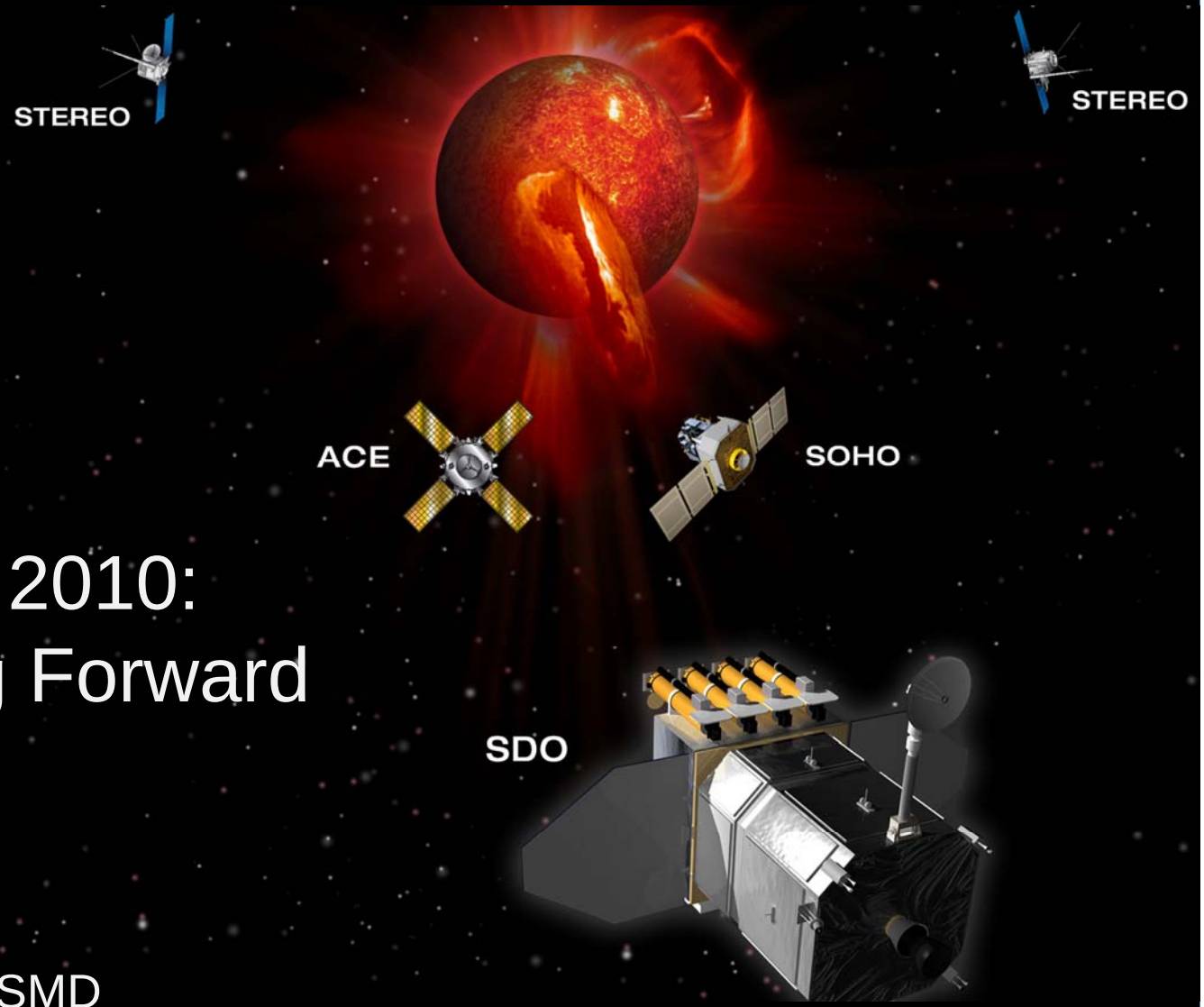
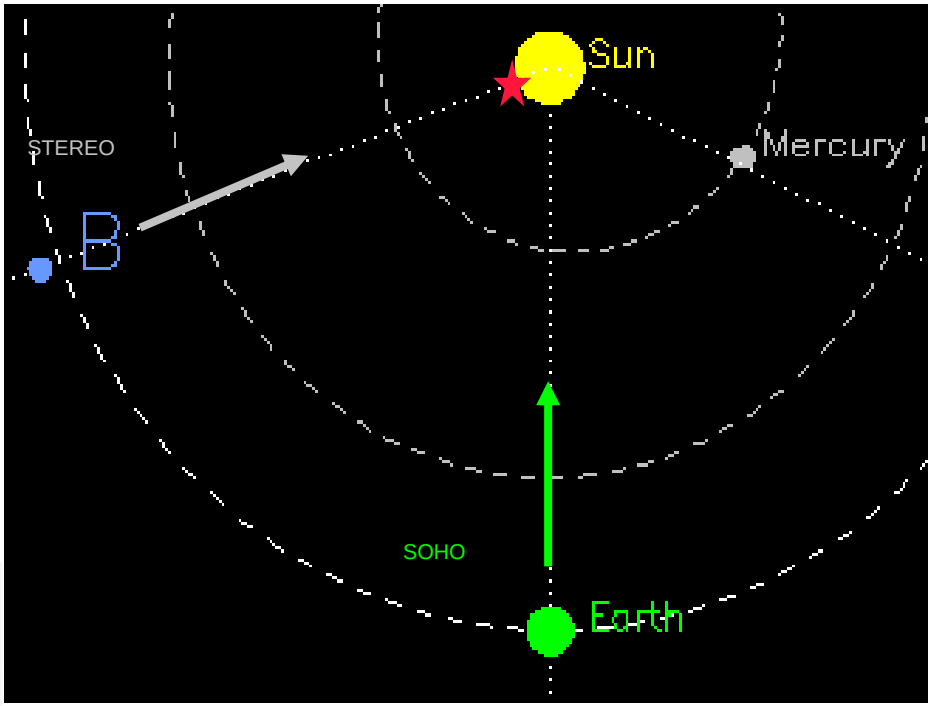
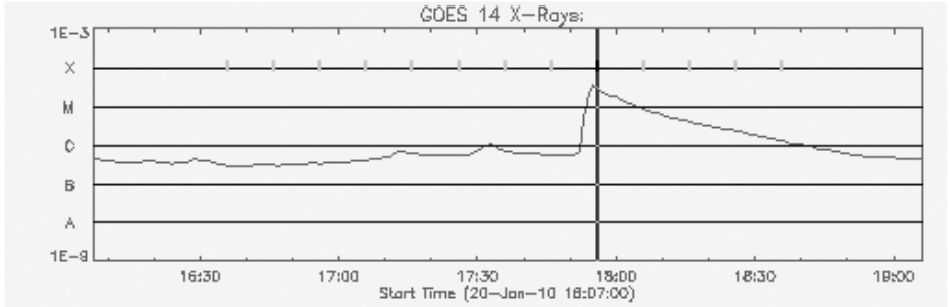
NASA SWx in 2010: A Year Moving Forward

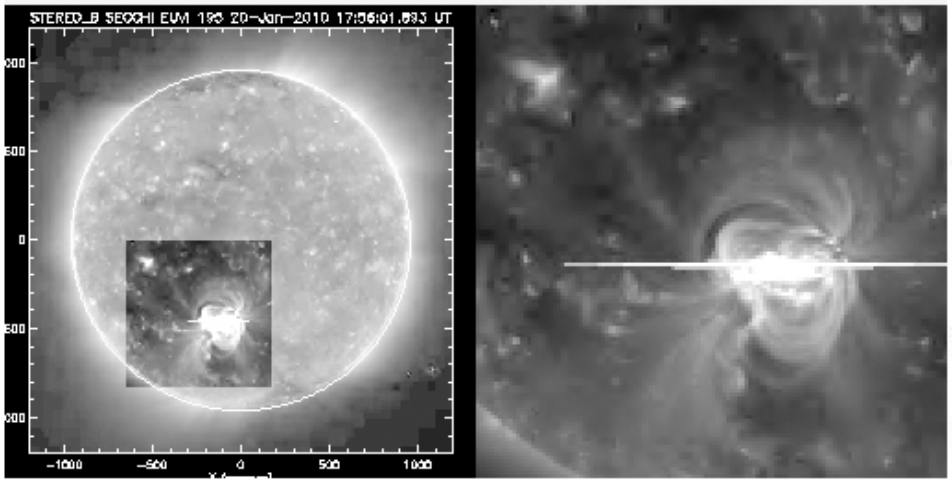


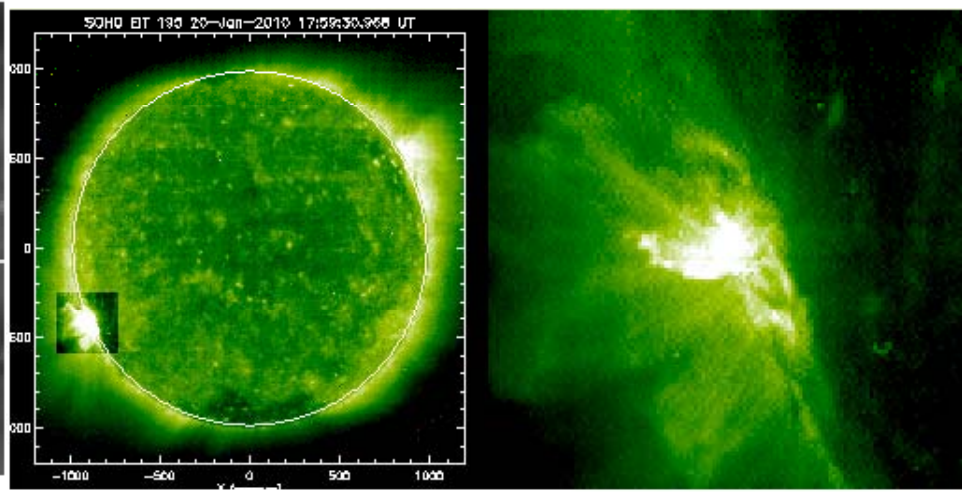
R. Fisher
Heliophysics Division, SMD
NASA HQ

At the Beginning of the New Cycle, STEREO augments ACE and SOHO









The SDO Spacecraft

Launched on an Atlas V EELV

SDO placed into an inclined geosynchronous orbit ~36,000 km (21,000 mi) over New Mexico for a 5-year mission

The total mass of the spacecraft at launch is 3200 kg (payload 270 kg; fuel 1400 kg).

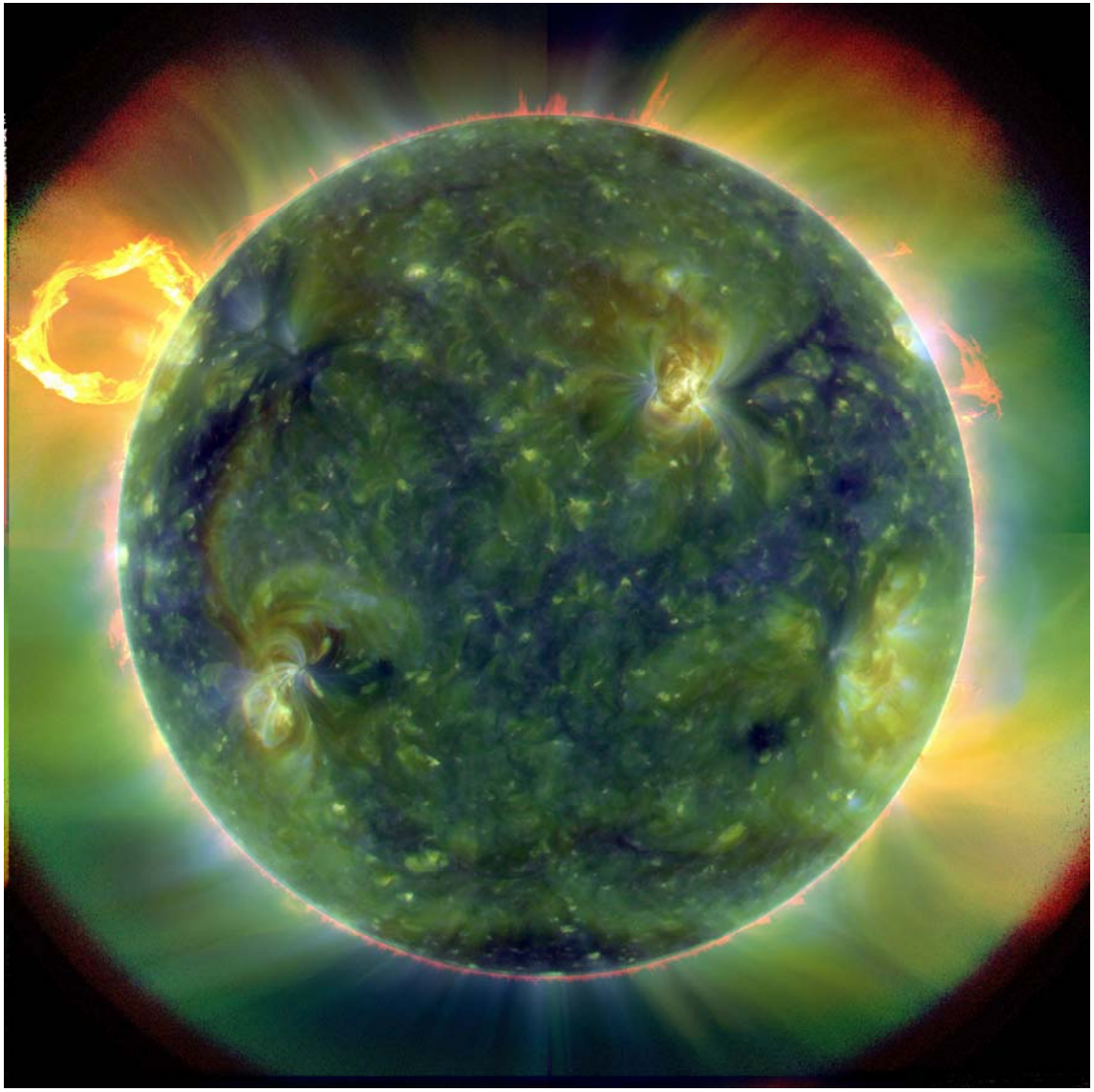
Its overall length along the sun-pointing axis is 4.5 m, and each side is 2.2 m.

The span of the extended solar panels is 6.25 m.

Total available power is 1450 W from 6.5 m^2 of solar arrays (efficiency of 16%).

The high-gain antennas rotate once each orbit to follow the Earth.

AIA Data Analysis



Three images taken in March 2010 by AIA on SDO make up this false-color image. Images in Fe IX-X 171 Å (blue), Fe XII 195 Å (green) and Fe XV 211 Å (red) were combined into one that reveals solar features unique to each wavelength. He II 304 is shown in yellow.

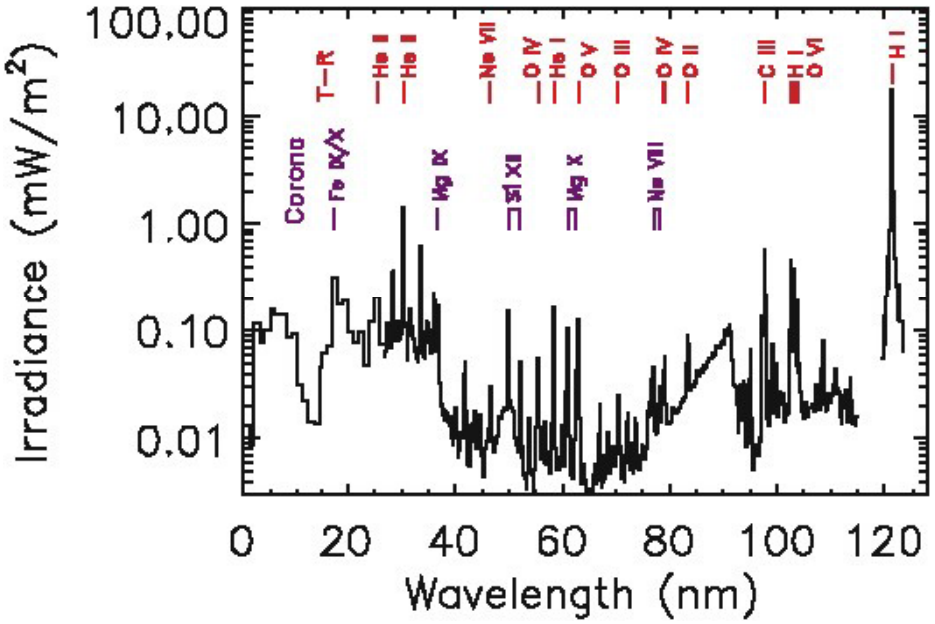
The magnetic structures in the corona are clearly traced in these images. AIA data is designed to measure the temperature of the plasma as well as its shape.

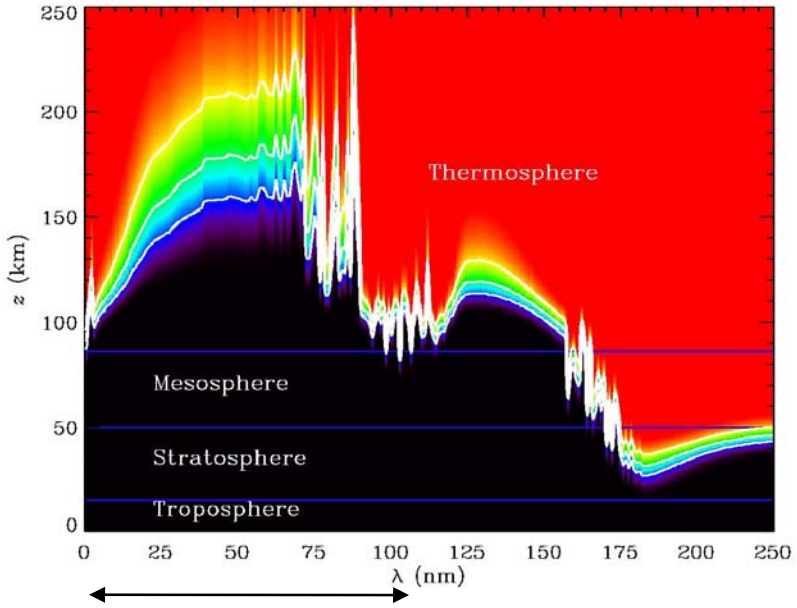
EVE Data & Research

- One spectrum every 10 seconds
- Driver of real-time models of the upper atmosphere of the Earth and other planets
- Identify sources of EUV irradiance (with AIA)
- Predict the EUV irradiance (with HMI)

Below (left): Example EVE spectrum. Some of the lines are identified and where the lines are formed in the solar atmosphere is noted at the top.

(right) Absorption of radiation as it enters the Earth's atmosphere. Red areas are altitudes that do not absorb a wavelength, black means complete absorption. All of the radiation measured by EVE is absorbed above 75 km, most above 100 km.





EVE

SDO Media Day,
June 2009

SDO Operations

- Mission Operations Center for SDO is at NASA's Goddard Space Flight Center.
  - Maintain its inclined geosynchronous orbit
  - Keep SDO pointing at the Sun
  - Keep the data flowing
  - Handle the two eclipse seasons.
- Communications with the spacecraft are via two radio dishes at NASA's White Sands Complex in New Mexico.
- Science teams plan operations with the MOC and analyze the data.
- Operations Philosophy
  - Few modes: turn it on and let the data flow!
  - Images are sent to the ground for processing
  - Data is made available soon after downlink; people can use the data in near-real-time
  - Campaigns and collaborations are coordinated when convenient, but the data is always available

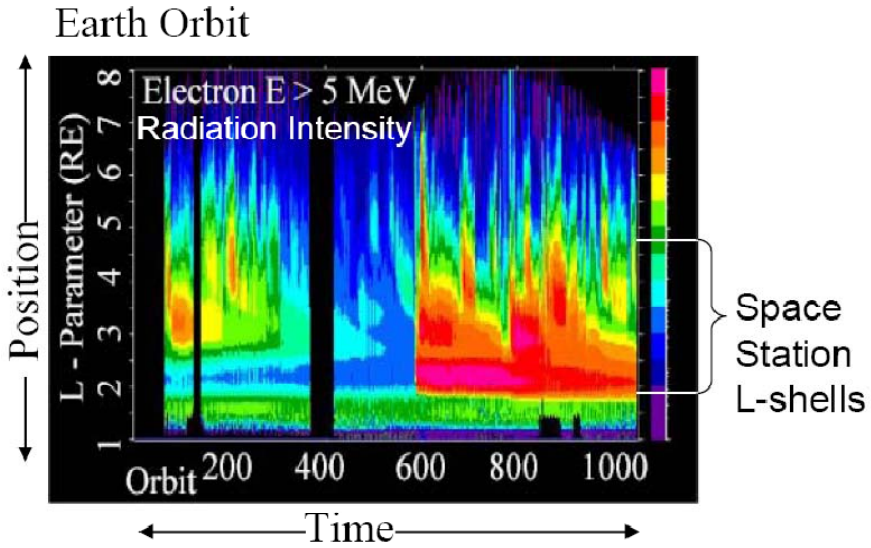
MOC in Building 14

SDO antenna in New Mexico (LRO antenna is behind SDO2).

Radiation Belt Storm Probes
Second Mission in NASA's Living With a Star Program

- Objective: Provide understanding, ideally to the point of predictability, of how populations of relativistic electrons and penetrating ions in space form or change in response to variable inputs of energy from the Sun.
  - Two identically-instrumented spacecraft that cover the radiation belts from 600 km perigee to 5.8 R_E apogee with a 9 hour period and lap each other 4-5 times/year for space-time separation
- Impacts:

1. Understand fundamental particle radiation processes operating throughout the universe.
2. Understand Earth's radiation belts and related regions that pose hazards to human and robotic explorers.



Mission confirmed: December 2008
CDR completed: December 1-3, 2009
Launch date: May 18, 2012

RBSP

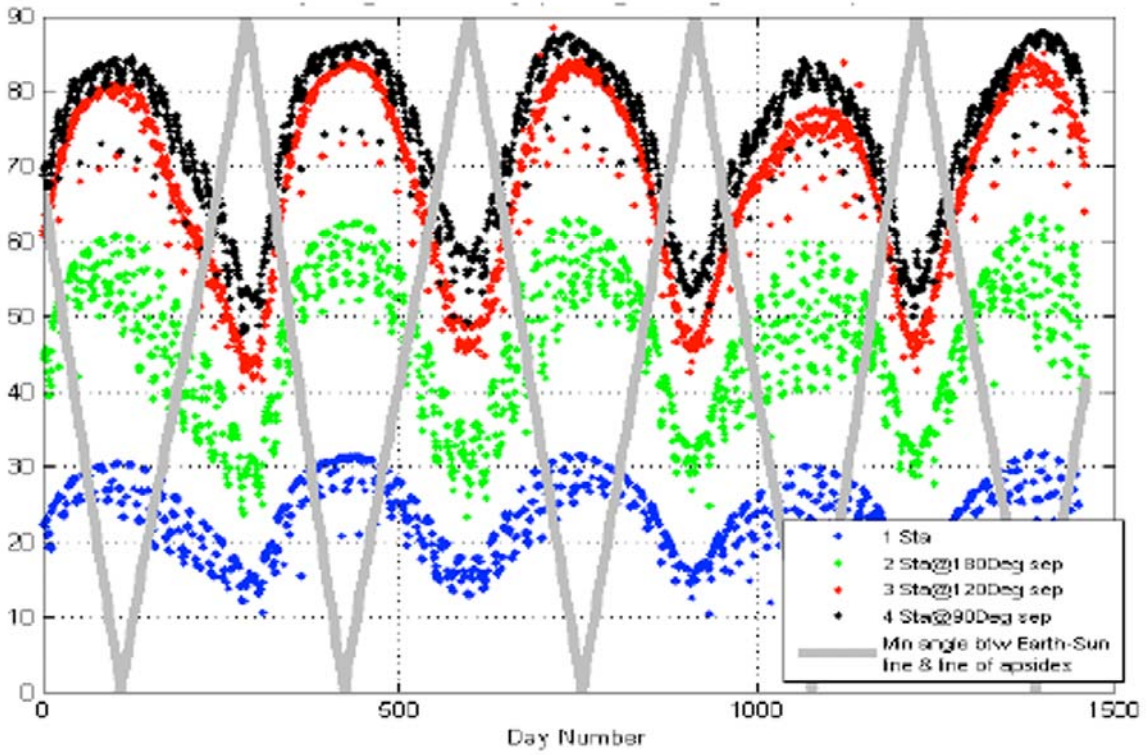
Flight Structures Completed Dynamic Load Testing

Status As Of: 5/3/10

RBSP Beacon Mode GS Coverage

DRAFT

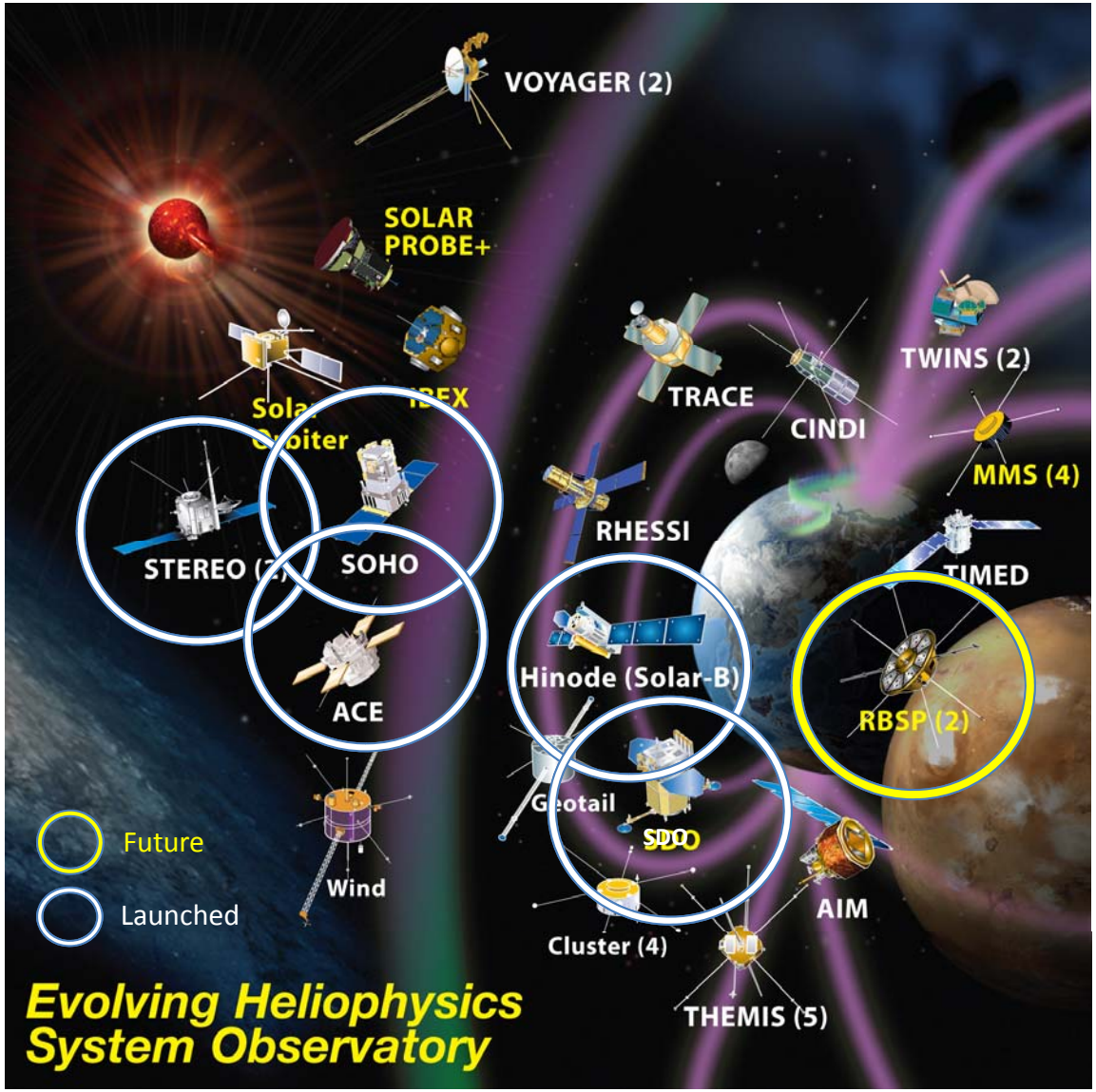
Figure 5: Average Contact Time per Day (%)
Min. Angle Between Earth-Sun Line & Line of Apsides (deg)



Assumptions:

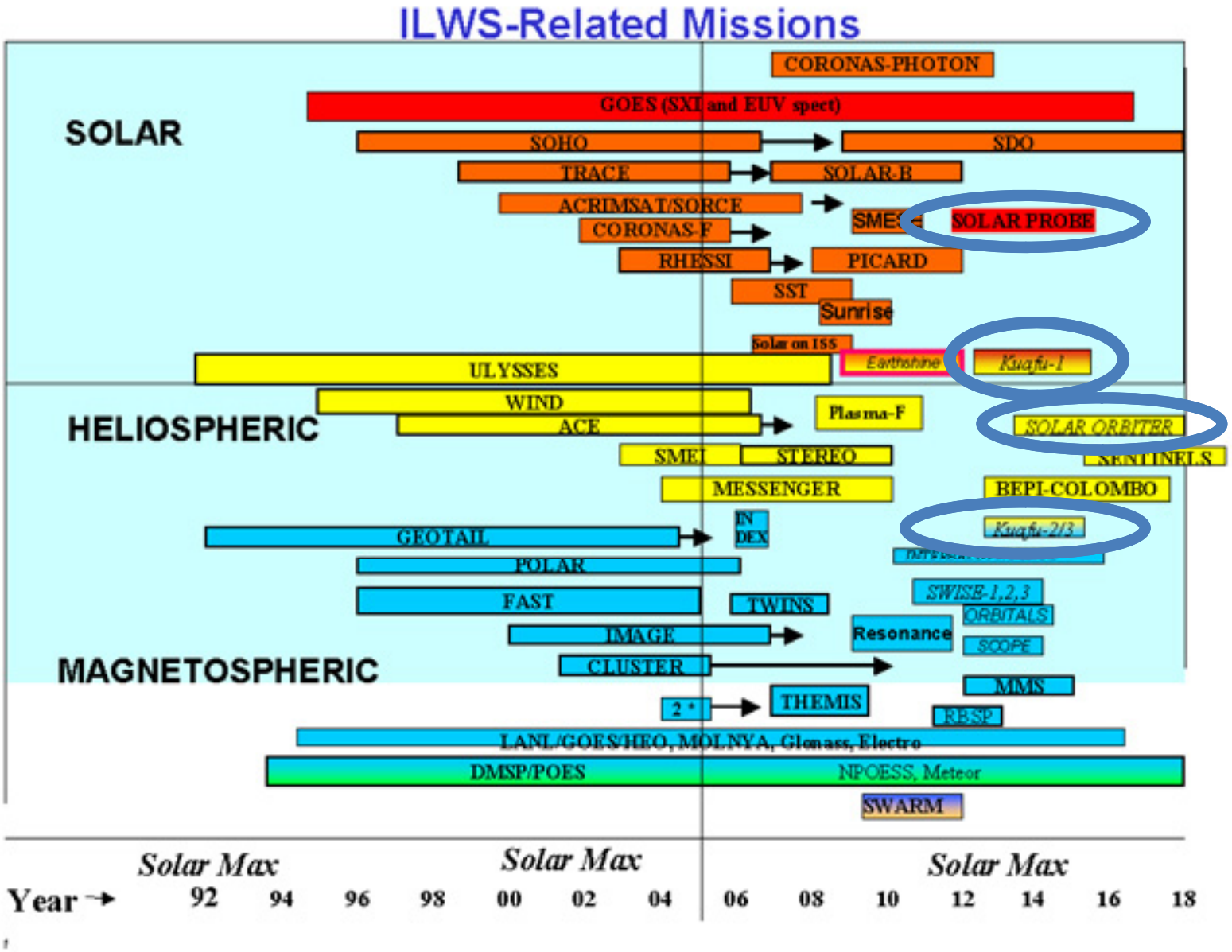
- **Visibility averaged over 3 day increments**
- **Two 70° half angle antennas**
- **Generic ground stations assumed at 35° N latitude**

2010-2015 NASA Heliophysics Program
Knowledge and Utility for Space Weather



Space Weather Assets

- $3.4B in spacecraft assets in Heliophysics observatory system
- Heliophysics space weather data bases available via the internet for worldwide use (e.g., Korea, USAF, NOAA)
- NASA space weather theories and models available on the internet 24/7
- NASA situational awareness software and displays now available via internet


ILWS-Related Missions
SOLAR
HELIOSPHERIC
MAGNETOSPHERIC
CORONAS-PHOTON
GOES (SXI and EUV spect)
SOHO
SDO
TRACE
SOLAR-B
ACRIMSAT/SORCE
SOLAR PROBE
CORONAS-F
RHESSI
PICARD
SST
Sunrise
Solar on ISS
Earthshine
Kuafu-1
ULYSSES
WIND
ACE
Plasma-F
SOLAR ORBITER
SMEI
STEREO
SENTINELS
MESSENGER
BEPI-COLOMBO
IN DEX
GEOTAIL
Kuafu-2/3
POLAR
FAST
TWINS
SWISE-1,2,3
ORBITALS
IMAGE
Resonance
SCOPE
CLUSTER
MMS
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THEMIS
RESP
LANL/GOES/HEO, MOLNYA, Glonass, Electro
DMSP/POES
NPOESS, Meteor
SWARM
Solar Max
Solar Max
Solar Max
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