Payload & Data Rate for Option-A

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Requirements for S/C System Design

- Sojourn time >40 days (TBD) for a solar latitude of >30 deg (TBD)
  - Target of max. latitude : ~40 deg (higher is better, of course)
  - Need to define these numbers clearly from evaluation through helioseismic model calculations
- Distance to the Sun in the final orbit: 1.0 AU
  - Minimum distance to the sun is 0.7 AU from the thermal-design point of view
  - Maximum distance to the sun is not defined because of a possibility of ballistic orbits by Jupiter swing-by
- Use 7 deg tilt angle of the solar rotation axis to the ecliptic plane

- Duration of cruise phase to the final orbit: ~5 years
  - Need 40-days (TBD) observations near perihelion/aphelion points in the cruise phase
- Payload weight: 130 kg
- Data recording rate: >100 kbps ave.
- Mission life:

  cruise phase N_0~5 yr + N_1 yr + extended duration N_2 yr (total ~N_3 yr)

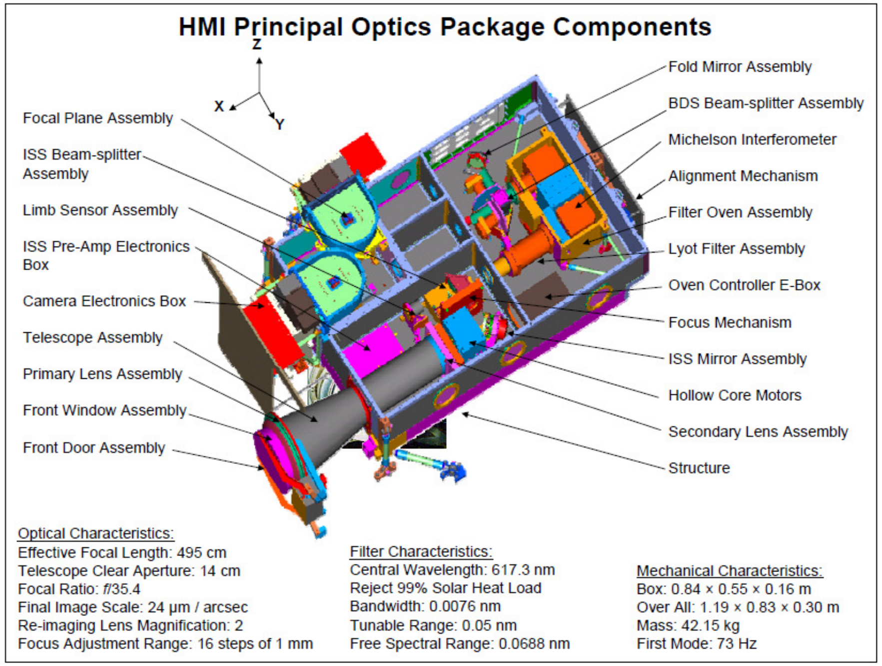
Visible-light Magnetic-field and Doppler imager

- Full-disk imager like SOHO MDI or SDO HMI
  ~1" spatial resolution [MDI: 55 kg, HMI: ~70 kg]
- Will require multiple wavebands for the first mapping of polar regions
- Need on-board processing to reduce the amount of data

- Vector magnetic fields mandatory?
  [probably yes, but uncertain]

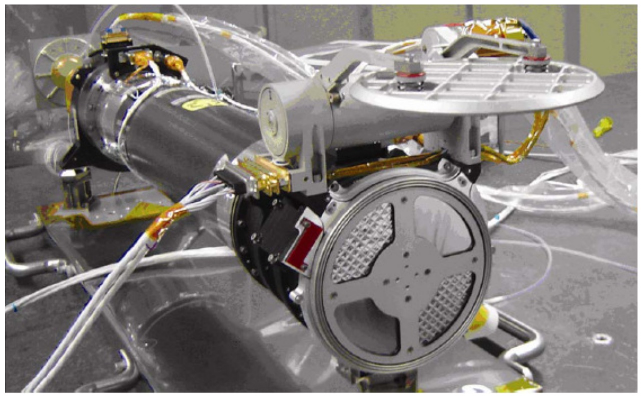
- Lighter option possible?

SDO HMI



X-ray / EUV Telescope

- G.I. X-Ray Telescope :
  - Difficult to achieve a high-spatial resolution by a limited instrument mass.
  - Hinode XRT 46 kg, Yohkoh SXT: 24 kg
  - Worthwhile for a low-resolution imaging? Probably no.
- EUV telescope:
  - STEREO EUVI: 7.7 kg excluding electronics
  - Scanning-spectrograph may become a substitute for dynamic events in a small FOV?



STEREO EUVI

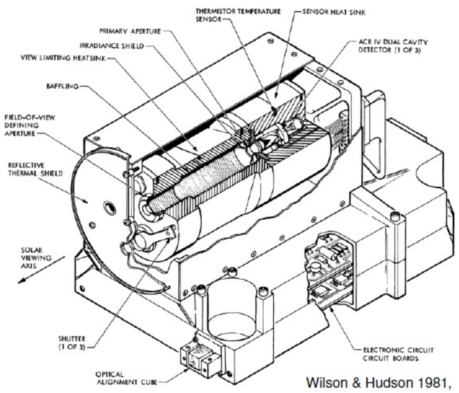
EUV Imaging Spectrograph

- Possible to make an imaging spectrograph of a similar performance by half-scale size of EIS
- Optics is similar to that of the UV/EUV spectrograph in Option-B (Plan-B)
- A better sensitivity (by a factor of 4-10) than EIS/SUMER will be possible with a similar spatial resolution. This is quite a new instrument.
- Similar spectrograph is proposed as SPICE in Solar Orbiter.
- Become a substitute for a small-FOV imager: partially Yes

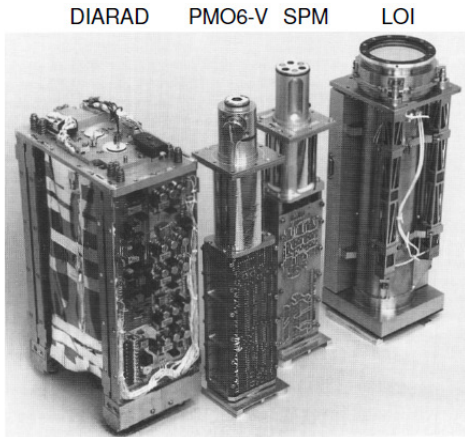
- Shimizu san will report its optics in the next presentation.

TSI monitor

- Space Heritage (not in Japan)



ACRIM/SMM



VIRGO/SOHO

TIM/SORCE

- Require multiple cavities for self-calibration
- mass ~10 kg (ACRIM, TIM);

  Need light-weight solution
- Data recording rate << 1kbps (negligible)

Heliospheric Imager

- STEREO-HI: sufficient sensitivity

  Parker-spiral structures in solar wind may be detected as density inhomogeneity

- Zodiacal light distribution

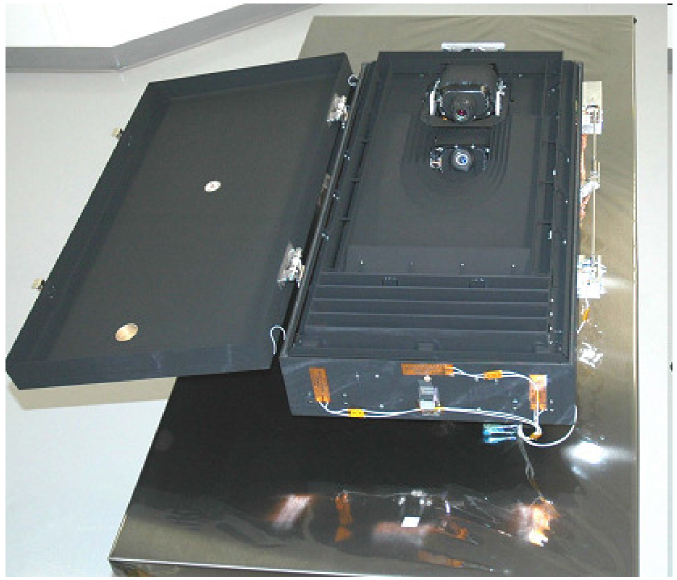
  will be obtained when looking

  at opposite side to the ecliptic plane

- Data size becomes small by

  on-board integration.

  STEREO-HI: ~1kbps

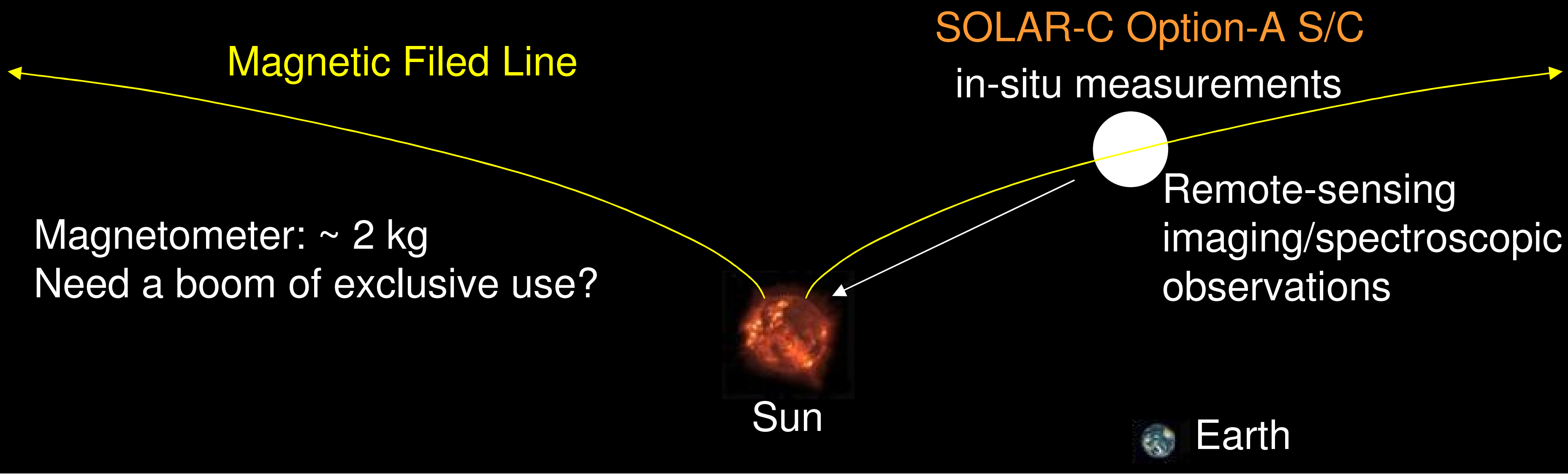


STEREO-HI 13.4 kg

Visible-light range

in-situ measurements?

- Have not discussed with heliophysics group
- Wind velocity, magnetic field, cosmic rays
  - B-field measurement will not be possible in SEP-option orbit (by use of permanent magnet)
- Gain/advantage from Ulysses?
  - ans. Periodic fast scan in the 11-yr activity cycle



Option-A model payload mass crude allocation

including electronics package

- Doppler/Magnetic field imager like HMI: 70 kg
  (MDI: 55 kg)
- Imaging Spectrometer like SPICE : 30 kg
- X-ray/EUV imager : 15 kg
- TSI monitor : 5 kg
- Electronics like Hinode MDP? : α

$120 + \alpha$ kg

Options

- Heliospheric imager : 10 kg
- In-situ instruments and others : 10 kg

Contamination monitor may be required near the aperture of telescopes for the use of ion engine systems.

Requirement for average data recording rate

- Data Recording Rate: ~100 kbps (Total)
- Estimation for a model case (very preliminary)
  - Helioseismology/B-field observations ~ 50kbps
    - Global helioseismology
      - 256×256(pixels) ×16(bit/pixel) ×0.4(comp.)/60(s)/1024(kbps/bps) = 6.8 kbps ave.
      - without on-board processing: 6.8 × number of λ positions

      - Study on compression not enough
      - Higher compression used in Hinode
    - Local helioseismology
      - 1024 ×1024 ×16 ×0.4 /60(s)/1024 = 109 kbps ave.
    - Magnetic (B) field
      - 1024 ×1024 ×16 ×0.4 /3600(s)/1024 ×4(pol.state) = 7.3 kbps
      - 512 ×512 ×16 ×0.4 /60(s)/1024 ×2(pol.state) = 54 kbps
  - EUV imaging spectroscopy ~20 kbps ave.
  - EUV/X-ray imaging ~20 kbps ave.
  - TSI monitor: <1 kbps, negligible
  - Heliospheric imager ~ 1kbps by on-board summing
  - Others: probably negligible