

# Minutes of the 35<sup>th</sup> SOHO SWT Meeting

Goddard Space Flight Center, Greenbelt, Maryland

24 March 2003

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# 1 Agree Agenda and Actions Revision

B. Fleck welcomed the attendees (see Annex 1). There were no changes to the agenda (see Annex 2). He announced several people will be leaving soon, both at GSFC and in Europe: P. Wenzel and H. Schweitzer will be retiring, M. Chaloupy and H. Boithias will be returning to Europe. Ton van Overbeek will replace H. Schweitzer on 1 May 2003. A replacement for M. Chaloupy will start working in July.

## 1.1 Action Items

### **Action 35-1:**

On PIs: Write an informal plan to address hardware problems in the future.

## 1.2. Actions Revision

### **Action 34-1: Closed(except CELIAS)**

On PIs: Input for contingency turn-on scripts to be given to SOCs, with time estimates, including need for NRT.

### **Action 34-2: Closed(except CELIAS part)**

On SOCs: Make a master turn-on plan based on contingency turn-on scripts and time estimates.

### **Action 33-4: Closed (SH,EIT,CELIAS,UVCS,GOLF)/Open (all other)**

On S. Haugan/PIs: A template web page with links to instrument/data file information to be constructed, and filled out by instruments.

### **Action 32-4: Closed (LS)/Open (European archives)**

On L. Sanchez/European archive administrators: Provide monthly usage statistics for archive sites.

### **Action 32-5: Closed (dropped)**

On L. Sanchez: An input field to search for flare locations covered by archive observations will be added.

# 2 Spacecraft Status

H. Schweitzer and M. Verdant presented the spacecraft status (see Annex 3).

### **3 Ground System Status**

B. Dutilly presented the ground systems (see Annex 4).

R. Harrison asked when we would stop getting CD's; the answer is after the data on 1 February comes (*4 February was quoted incorrectly at the meeting*). The CDRs were produced in mid-March.

### **4 SOC Report**

S. Haugan presented the SOC report (see Annex 5).

J.-P. Delaboudiniere asked whether the orbit could be changed to observe the Venus transit. *Note added after meeting: This was investigated, but since the period of the halo orbit is pretty much insensitive to changes in the size of the orbit, extreme manoeuvres (weeks of thruster firings) would be required. A swing-by and gravity assist of the moon was even discussed (though very briefly!).*

### **5 Status of Instruments + Instrument Teams:**

#### **5.1. GOLF (A. Gabriel)**

GOLF is performing nominally. Last September/October observations were changed from red to blue wing. First attempt at Goddard, but more commanding was needed from MEDOC later. No g modes have been found, but the detection limit has been lowered.

#### **5.2. VIRGO (C. Fröhlich)**

VIRGO is nominal. Degradation is slow and the instrument still has many years of operations left before reaching sensitivity limits. VIRGO data has appeared in 56 papers, covering irradiance time series, radiometry plots, p mode characteristics, g mode searches, comparisons between the two detectors and with ACRIM.

#### **5.3. MDI (R. Bush)**

MDI is nominal and working well. No CCD flat field changes except related to focus changes. Drift in focus point has now moved it almost to the design point. The front window degrades by about 2% per year. The exposure time is being increased to compensate, but no problems on the horizon. Shutter jitter causes added noise to magnetograms. The optics package temperature has been adjusted, reducing shutter jitter. MDI is taking lots of data, and has many requests for collaborations. See also Annex 6-1.

## 5.4. SUMER (W. Curdt)

SUMER is nominal, and the team has funding for more than 3 years. The web based data archive is well accepted. Both detectors are still within their calibrated lifetimes. A “fresh pixel mode” will be implemented when main detector parts are gone. SUMER is willing to collaborate and will even go on disk with good justification. A new flat field implementation includes shift vectors, so flat fields are not needed as often as before. A bit flip detection program for submode 6 is being worked on to prevent errors after long periods of inactivity. SUMER data has appeared in 681 papers. Most notably, SUMER has discovered the phenomenon of Doppler oscillations in (very) hot loops. For more details, see Annex 6-2.

## 5.5. CDS (A. Fludra)

CDS continues to operate in a near nominal mode. We have but one problem which is placing a minimal restriction on science activities using the GIS.

GIS: This instrument behaves nominally. No recalibration or changes to High Voltages have been necessary in the past 18 months.

NIS: This instrument behaves nominally. No adjustments have been necessary in the past two years, though we continue to monitor closely critical parameters, e.g., HV to the MCP.

Electronics: Behave Nominally

Mechanisms: The OPS, and mirror behave nominally, showing no signs of wear. The doors open/close satisfactorily. The Slit mechanism has shown a problem when used in a rastering mode, where movement appears to become 'sticky' when entering a certain but short range. It does free itself and catch up as movement exits this area. Thus a restriction on the range of movements when rastering the slit has been imposed. This applies to all slit numbers. The change of slit numbers is not affected by this problem. The restriction applies only to using GIS rasters and does not affect the amount of science that can be done. It simply restricts the raster size permitted in the N-S direction, but that can be compensated for by using additional OPS movements.

Thermal: We continue to see a slow, steady increase in the temperatures of the Front Bulkhead and the Side Frame +Y (Top), which in turn leads to seasonally raised temperatures at the Telescope mount and within parts of the Optical Bench. However analysis of the science data shows that the NIS wavelength calibration remains within tolerances. Interestingly we do see abrupt changes during major SOHO & CDS activities, which remain unexplained, but are still within wavelength calibration tolerances. see <http://solg2.bnsc.rl.ac.uk/newsletter/issue8/latest.html>

Onboard S/W: No issues, No new patches required.

Ground system: No issues. Upgrades to operating system will be required during 2003, in order to maintain satisfactory system security. (OSF 4.0F to OSF 5.1A) This will be tested in full at RAL prior to installing at GSFC. (estimate late 2003) This should then be all that is necessary through to 2007. Reason: V4.0F no longer supported, hence no new security patches released.

Data processing: Due to ongoing problems with the production of the SOHO Final Attitude Data files (since September 2002 !) we have been unable to produce the CDS final fits data files. No time estimate is available as to when the production problems will be resolved. In order to make the final 'telemetry data' available to the scientists we are continuing to re-process using final data, thus filling missing data gaps, but we are not flagging the fits files at 'Final'. Once the attitude data does become available we shall instigate a full re-processing of all the data received since September 2002. - though this will take some considerable time (many months).

## 5.6. EIT (J.-P. Delaboudiniere)

EIT is nominal, and there is little additional degradation. Funding of the team in Europe is difficult, but only affecting equipment, not salaries, so far. A calibration rocket is scheduled for August, the rocket will be calibrated during May 12-25.

## 5.7. UVCS (J. Kohl)

UVCS is nominal. Changes in overall system responsivity have been observed (e.g., radiometric responsivity is currently at 60% of original value for the vignettted aperture that is used for observations at 2.5 R<sub>sun</sub> and are being accurately tracked using observations of stars (see Gardner et al. 2002).

O VI detector:

There has been no significant decrease in efficiency in the O VI detector. Detector efficiency loss is carefully tracked with an increase in high voltage of 5 engineering units that is carried out when the loss approaches 5%. The period between such increases depends on the accumulated Ly-alpha dose and at current rates is more than 1.2 years. An increase from 210 to 215 is expected soon, and a maximum high voltage of 250 allows seven increases beyond 215.

Ly-alpha detector:

This detector has been turned off since November 1998 because it draws about 50% of the maximum current and has regions of elevated background. The detector is still operational and is treated as a back-up detector for Ly-alpha observations.

See also Annex 6-3 for the UVCS Data Policy and science highlights.

## 5.8. LASCO (R. Howard)

LASCO is nominal. Improved calibration statistics show a loss of 0.6% loss per year in C3 – this will be factored into the calibration. Similar analysis will be applied to C2 in coming weeks. The camera offset voltages have increased over the mission, and a temperature increase of 0.5 degrees has been seen in the cold finger temperatures. LASCO now has a few more dark pixels, but no loss in charge transfer efficiency has been seen. There is some concern about whether the GSE operating system needs to be upgraded. They now have a better handle on the F corona. The comet NEAT observations showed an interaction between a CME and the dust tail.

## 5.9. CELIAS (F. Ipavich)

CELIAS is nominal – no change in the instrument, except for a DPU patch to increase bit rate for the proton monitor (which performs better than ACE during big events). They are tracking parameters versus the solar cycle, and could see a “double hump” during solar maximum.

## 5.10. SWAN (J.-L. Bertaux)

SWAN is nominal. The H cell on one sensor is not absorbing, but photometry is still possible. The sensitivity decreased a bit on the –Z sensor, not on the other one. The mechanisms are performing well. SWAN has observed 40 comets. They now have someone in France to help out, but they have not yet looked into documentation of the data.

## 5.11. COSTEP (H. Kunow)

COSTEP is nominal. LION can still be used with calibration for large events, but not for small energies. One EPHIN detector was lost in 1996 but no problems since then. Manpower is a bigger problem: Ulysses & SOHO contract decreases, and there will be many changes. R. Mueller-Mellin is working on getting data ready for the archive. Documentation for the data is not being worked on.

# 6 NASA SEC Senior Review Proposal

J. Gurman chaired a discussion about the proposal.

# 7 Status of SOHO Archives

L. Sanchez-Duarte presented the status of the SOHO Archives (Annex 7).

B. Fleck pointed out that many instruments had not completed the web pages on data analysis: MDI's page is being worked on, CDS has the information but needs to organize it and update it, COSTEP – H. Kunow will try to do this, LASCO – will do it, SWAN – J.-L. Bertaux will try to do it, VIRGO – has some things done, SUMER – has D. Zarro's page and German pages but they should be linked, and VMS/UNIX worlds should be merged (2 people working on it).

## **8 Ground System Equipment updates**

J. Gurman presented concerns over the aging GSE (Annex 8; **Action 35-1**).

## **9 PR and Outreach Activities**

B. Fleck summarized recent PR and Outreach Activities (see Annex 9).

## **10 Workshops and Meetings**

B. Fleck presented upcoming meetings. See <http://soho.nascom.nasa.gov/meetings/>.

## **11 AOB**

The possibility of having a teleconference with everyone before the senior review was discussed.



# Annex 1: List of Participants

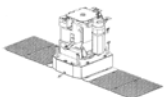
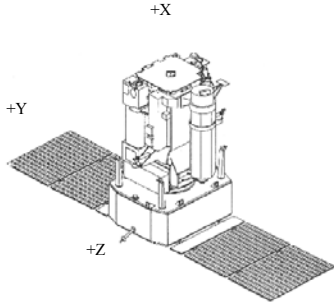
## Attendees SOHO SWT-34

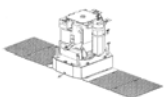
Name	Institute/Experiment	Email address
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Zamkoff, E.	L3 Communications/SOC	zamkoff@socopl1.nascom.nasa.gov

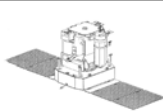
## **Annex 2: Agenda**

- 09:00**    **Agree Agenda and Actions Revision (BF)**
- 09:10**    **Spacecraft Status (MV)**
- 09:30**    **Ground System Status (RD)**
- 09:45**    **SOC report (SOCs)**
- 10:00**    **Status of Instruments + Instrument  
Teams (PIs)**
  
- 12:00**    **Lunch**
  
- 13:30**    **NASA SEC Senior Review Proposal (JG)**
- 15:30**    **Status of SOHO archives (LS)**
  - data availability
  - documentation
  - SPDAC updates
- 16:30**    **Analysis software and documentation  
(BF)**
- 17:00**    **Ground System Equipment updates (JG)**
- 17:15**    **PR and Outreach Activities (BF)**
- 17:30**    **Workshops and Meetings (BF)**
- 17:45**    **AOB**
- 18:00**    **Adjourn**
  
- 18:15**    **Joint dinner at Sir Walter Raleigh**

## **Annex 3: Spacecraft Status**

	<b>SOHO Spacecraft Status SWT-35</b>	<b>GSFC March 24, 2003</b>
<p style="text-align: center;"><b>CONTENTS:</b></p> <ul style="list-style-type: none"> <li>• <b>Spacecraft Subsystem Status</b></li> <li>• <b>Solar arrays degradation</b></li> <li>• <b>SSR Single Event Flag counts</b></li> <li>• <b>Remaining Fuel</b></li> </ul> <div style="text-align: center;">  </div> <p style="text-align: left;"> <b>H.Boithias,M.Chaloupy,H.Schweitzer, M.Verdant@GSFC</b> </p> <p style="text-align: right;">1</p>		

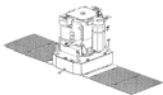
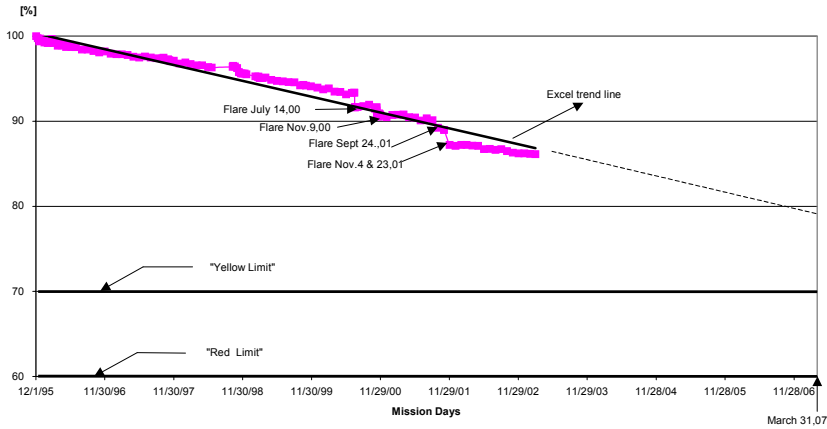
	<b>SOHO Spacecraft Status SWT-35</b>	<b>GSFC March 24, 2003</b>
<p style="text-align: center;"><b><u>Spacecraft status</u></b></p> <ul style="list-style-type: none"> <li>• <b>Spacecraft is nominal.</b> There was no ESR for more than one year (the last one was Feb.5, 2002).</li> <li>• <b>Power subsystem: nominal performance;</b> the last major proton event, seen by the solar array, was Nov.2001; the degradation since is less than during the first 2 years. Present current margin: 13.3A</li> <li>• <b>Data handling and attitude control: nominal performance;</b></li> <li>• <b>Propulsion: Thruster performed nominally during the 3 maneuvers,</b> performed since the last SWT. Remaining fuel: about 120 kg. Next maneuver is tentatively planned for mid June 2003. Propellant branch B is now activated every other week to directly read the pressure, rather than rely on temperature monitoring.</li> <li>• <b>Thermal: all spacecraft temperatures are within limits. PLM temps average increased 0.5° during 2 years. Switching off the X-panel heaters Nov.2001 decreased the average temps by 0.5°.</b></li> </ul> <p style="text-align: right;">1</p>		



# SOHO Spacecraft Status SWT-35

GSFC  
March 24, 2003

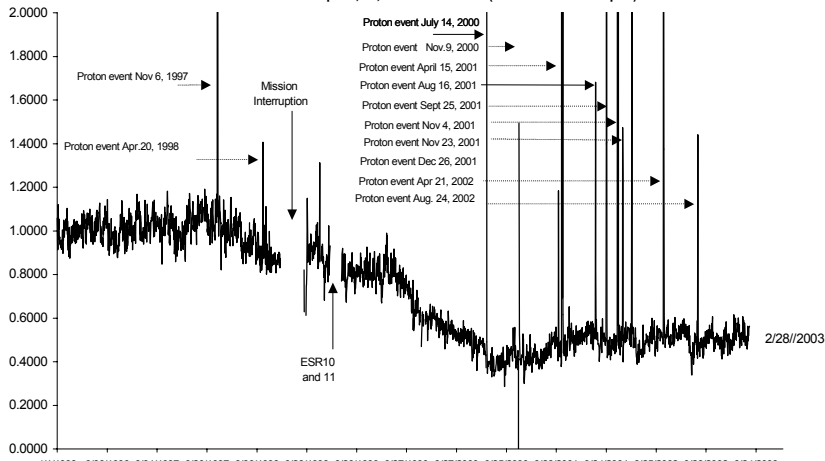
SOHO S.A. Degradation, based on average of Section Currents PISW1 and PISW2.

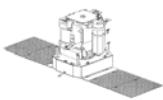


# SOHO Spacecraft Status SWT-35

GSFC  
March 24, 2003

SOHO SSR Single Event Upsets, parameter DKSSCSEF (events/minutes/2G-bit)  
Note: since Sept.13, 00, the MU 15 is OFF (corrected for in the plot)

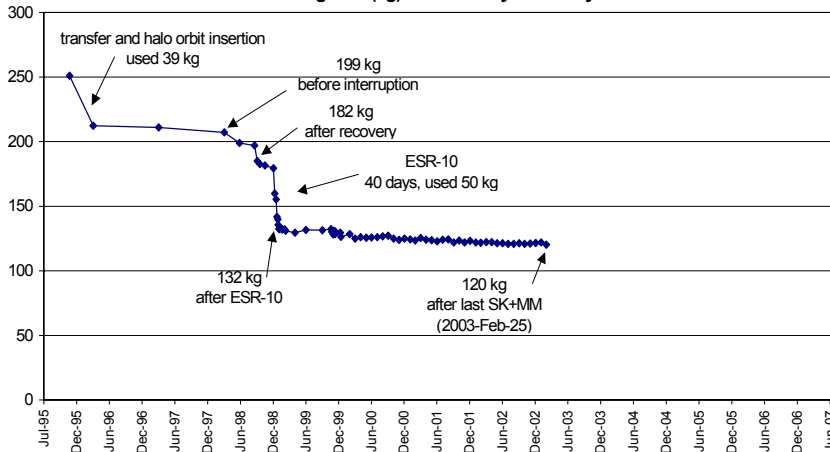




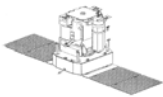
# SOHO Spacecraft Status SWT-35

GSFC  
March 24, 2003

Remaining Fuel (kg) estimated by PVT analysis

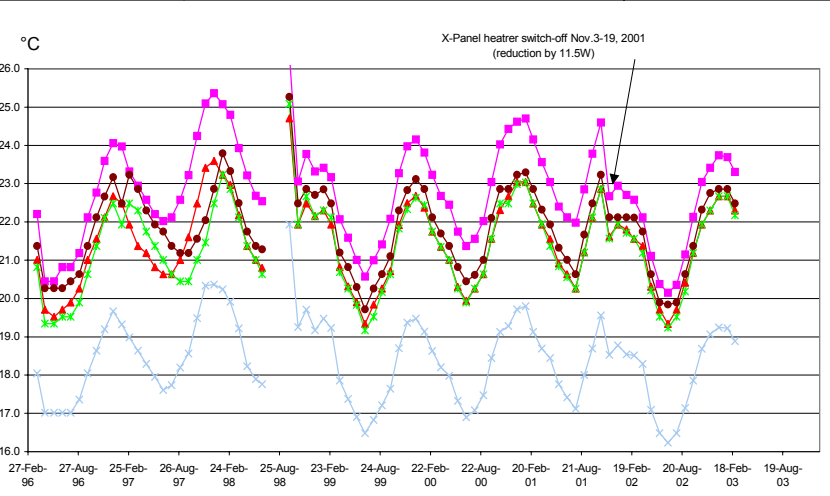


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# SOHO Spacecraft Status SWT-35

GSFC  
March 24, 2003



6

## **Annex 4: Ground System Status**



## SOHO Mission Operations Center Status

Ground System Status

SOHO

- SOHO Simulator
  - the operational system is using release 7.03
  - another release needed to clean up remaining discrepancies
  - continued increase of simulator fidelity over previous system
  - simulator used to test operational products and for FOT training. Crews have successfully gone through ESR to CRP recovery training using new simulator
  - all maneuver and special activities are tested on the simulator prior to the special activity

2



# SOHO Flight Operations Status

Ground System Status

SOHO

- Flight Operations continues to be strengthened through focused workshops, increased check and balances between Observatory Engineer's and crew members, and training.
- Flight Operations Team is fully staffed.
- Certification of console positions are on-going
  - the command analyst positions have all been certified
  - spacecraft analyst positions certifications are in progress

3

# SOHO Flight Operations Status

Ground System Status

SOHO

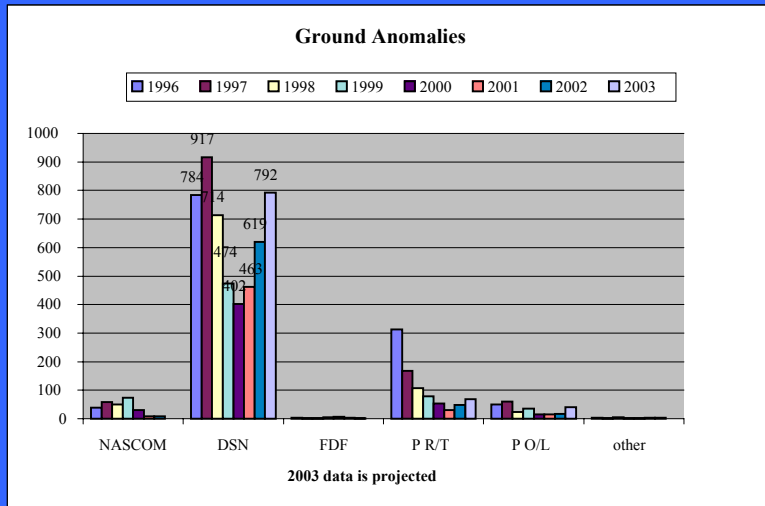
- Ground anomalies with the DSN has continued to rise but corrective action is being taken in conjunction with JPL/DSN
  - continue to have face to face meetings with JPL/DSN personnel to help resolve anomalies

4

# Ground Anomalies 1996-2003

Ground System Status

SOHO

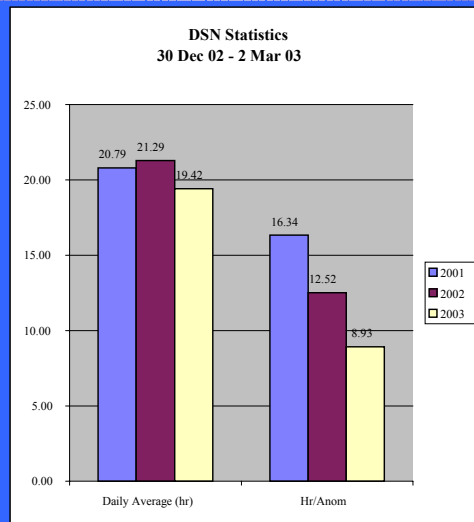


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# DSN Statistics 2001-2003

Ground System Status

SOHO



6

## **Annex 5: SOC Report**

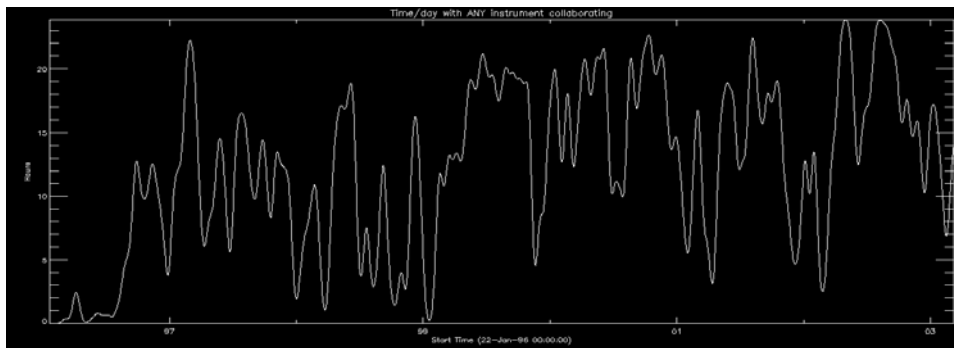
## Meeting formats changed

- Shorter daily & weekly meetings
  - Inputs from planners/operators before meetings
  - Focus on changes from normal/earlier information
- SPWG meetings by email & web (mostly)
  - Big gain in time (down to 5 minutes)
  - Better, more thoroughly researched by representatives
  - Somewhat increased workload on SOCs
- Feedback so far has been positive

## Joint Observation Statistics I

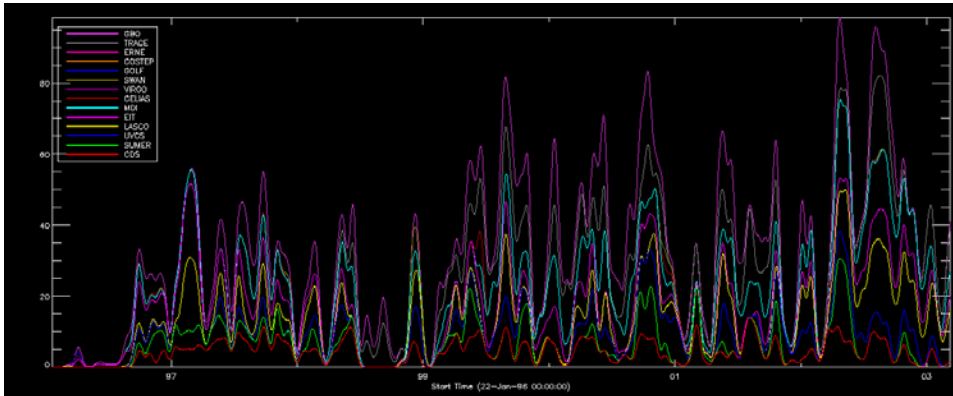
To what extent is SOHO coordinated?

- |                    |                    |
|--------------------|--------------------|
| • 1996: 3.9 h/day  | • 2000: 17.3 h/day |
| • 1997: 12.0 h/day | • 2001: 12.9 h/day |
| • 1998: 8.5 h/day  | • 2002: 16.2 h/day |
| • 1999: 14.2 h/day | • 2003: 12.7 h/day |



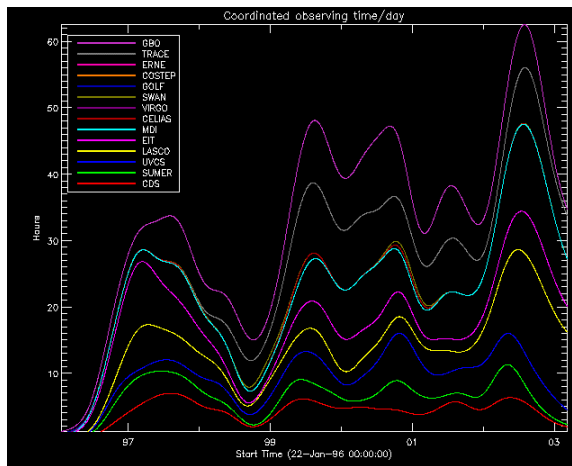
# Joint Observation Statistics II

Who is collaborating, and with whom?



# Joint Observation Statistics III

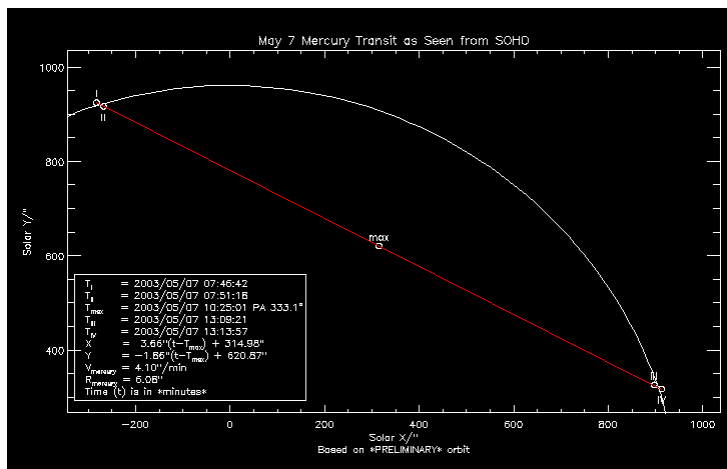
Trends?



# Mercury ('03) & Venus ('04) Transits

- Mercury, May 7, 2003
  - 696 arc-sec from disk center
  - 5 ½ hour transit, 4.1 arc-sec/minute
  - Expect <1 arc-sec precision at any given time
- Venus, June 8, 2004
  - Coronal transit, 187 arc-sec off-limb
  - Roughly 4 arc-sec/minute

## Mercury Transit



## “Contingency Turn-on” Plans

- Originated by FOT
- First request January 28, 2002
- ESR-18 February 5, 2002
- Instrument plans/scripts/TSTOLs
- Question about redundant instrument systems
  - Low priority due to low probability, uncertainty regarding instrument status & probable manpower scenarios when actually needed.

## Contingency Turn-on Sequence

- Reasonable workdays (6h effective time)
- Science priorities, impact of gaps, space weather commitments & operational constraints
- Support personnel in Europe, Goddard, Stanford
- **Ad hoc**: Start time, station & personnel availability, planned collaborations & calibrations, doors open/closed.

## Contingency Turn-on Sequence

- VIRGO/GOLF\*/MDI\* (1+.5+3 hrs)
- SWAN/LASCO+EIT/CDS\* (1-4+2+2 hrs)
- CEPAC/UVCS\* (1+5 hrs)
- CELIAS\* (9 hrs)
- SUMER\* - Submode 5! (3 hrs)
  
- \* NRT needed later for normal ops



## **Annex 6-1: MDI**

### MDI Instrument Status

- After seven years of operation and 70 million images, MDI is basically working very well.
- After on-board computations, it has delivered about eleven million raw data images to the ground.
- There is no detected change in the CCD flat field except for variations with focus change.
- The drift in central wavelength of the Michelson's has nearly stopped.
- The drift in best focus position has moved the nominal focus setting back almost to the design point. Shortly after launch it was at the limit of the adjustment range. This drift has also apparently stopped.

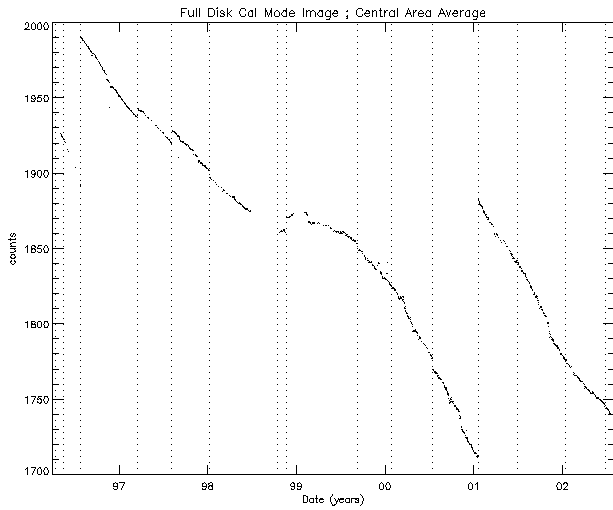
MDI Status - SWT-35

1

- There is an expected degradation in total light throughput likely due to changes in the front window.
- The reduction in transmission to March 2003 was about **XXX%** which corresponds to about **XXX%** per year.
- The throughput is (will be) plotted at [http://soi.stanford.edu/results/2003 MDI sr review/fd\\_ice\\_central\\_mean.gif](http://soi.stanford.edu/results/2003_MDI_sr_review/fd_ice_central_mean.gif)
- The jumps in early 2001 and 2003 correspond to changes in the full disk exposure time from 150ms to 165ms and presently to 180ms.

MDI Status - SWT-35

2



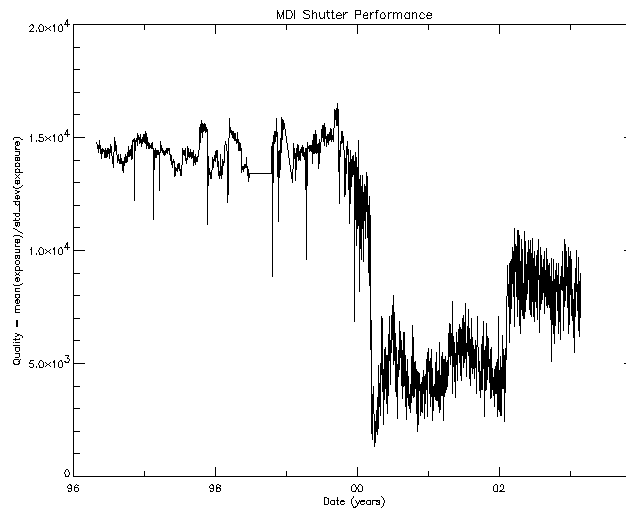
MDI Status - SWT-35

3

- In March 2000 the MDI shutter began to show a drop in exposure uniformity.
- For the 165 ms this corresponded to a jitter from one frame to the next of about 40 microseconds.
- The pre-launch specification was 40 microseconds.
- Since the prior senior review the shutter has not degraded further. In fact its performance improved when we reduced the optics package temperature.
- The plots at <http://mdisas.nascom.nasa.gov/shutter> show the trends.

MDI Status - SWT-35

4



MDI Status - SWT-35

5

- The shutter noise affects the helioseismology ONLY for degree  $l < 4$  and adds noise to the zero level of the magnetic field.
- The magnetic field zero is corrected by analysis of the data (see Liu et al, 2002).
- If further degradation were to begin we can reduce the shutter usage with some loss of science opportunity.
- Since the shutter has not degraded below a part in 4000 we do not presently plan to change the observing sequence.
- In summary, with the possible exception of the shutter jitter, there is no known limit to MDI's useful life within the SOHO expected fuel life.

MDI Status - SWT-35

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### MDI Data Processing

- As of March 1, 2003 the MDI data processing system had archived 2.2 million datasets containing 118 Terabytes of raw and processed data. This data resides on 436 high-density tape cartridges.
- 192 thousand datasets, 12 Terabytes, contain the calibrated level 1.5 science data. 79 thousand datasets, 24 Terabytes, contain higher level science products.
- The MDI data center has responded to 13579 individual online requests for data amounting to about 12.4 Terabytes.
- Data exports in the two years ending March 1, 2003 included 6610 requests totaling 6.764 Terabytes.
- Most requests are for multiple datasets. Requests for MDI data processed through the SOHO archives at GSFC and the remote SOHO archives in Europe are not included in this total.
- Data export requests plots are shown at <http://soi.stanford.edu/production/cumulative.html>

MDI Status - SWT-35

7



## **Annex 6-2: SUMER**

# SUMER Status Report

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- SUMER project
  - ➔ funds for 'Solar Cycle Mission'
- SUMER instrument
  - ➔ operated in 7 campaigns
- SUMER science
  - ➔ Statistical information

GSFC, 24 Mar 03

W. Curdt, SUMER

## SUMER Project

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- Funds to operate SUMER for >3 years to come
- SUMER technical team is small, but existent
- Web-based data archive well accepted
- SUMER retains resources for NG missions
  - ➔ joint observations
  - ➔ cross-calibration

GSFC, 24 Mar 03

W. Curdt, SUMER



# SUMER Instrument



- Both detectors still within calibrated lifetime
  - ➔ checkout in cw 15
  - ➔ will implement the 'fresh pixel mode'

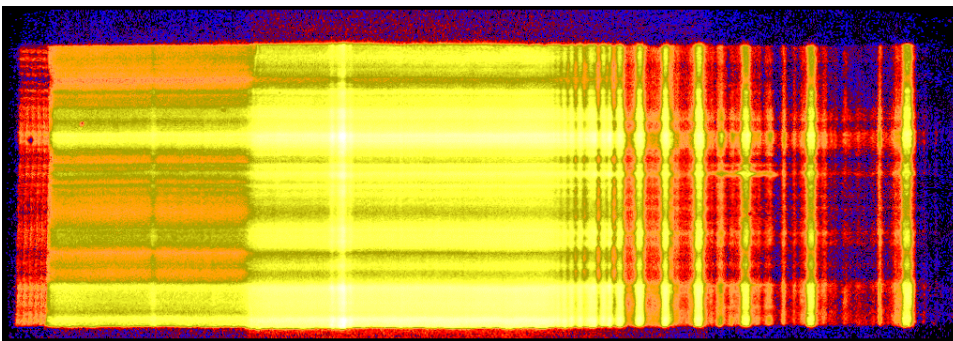
GSFC, 24 Mar 03

W. Curdt, SUMER

# SUMER Instrument



- Both detectors still within calibrated lifetime
  - ➔ checkout in cw 15
  - ➔ will implement the 'fresh pixel mode'



# SUMER Instrument



- Both detectors still within calibrated lifetime
  - ➔ checkout in cw 15
  - ➔ will implement the 'fresh pixel mode'
  - ➔ will implement submode 6 'bit flip detection'
  - ➔ new flatfield procedure
- Need efficient use of what's left
  - ➔ NOAA SXI could be very helpful for context

GSFC, 24 Mar 03

W. Curdt, SUMER

# SUMER Science



- Statistical information
  - ➔ 681 SUMER related papers (371) / 552 authors
    - ➔ morphology: chromosphere, coronal hole, spicules, ...
    - ➔ plasma diagnostics, temperature, abundance, FIP
    - ➔ transient events, jets, explosive events, flows, flares
    - ➔ oscillations, waves
    - ➔ spectroscopy, atomic physics, line ID, wavelengths
    - ➔ radiometry, calibration, radiance
  - ➔ rate unchanged at a high level

GSFC, 24 Mar 03

W. Curdt, SUMER

# SUMER Science



- Off-limb observations  $\Rightarrow$  coronal science
- Science nugget: Doppler oscillations in hot coronal loops
- Web page summarizing flare obs results so far

Fe XIX

[www.linmpi.mpg.de/~curdt/JOP104\\_review.html](http://www.linmpi.mpg.de/~curdt/JOP104_review.html)



GSFC, 24 Mar 03

W. Curdt, SUMER

**Review of recent papers resulting on spectroscopic studies based on JOP 104 SUMER observations (Status 21 Feb 03)**

**Atomic Physics and Spectroscopy:**

- (1) Precision measurements of the first resonance transition of He-like Ne IX, Na X, Mg XI, and Si XIII.;  
Curd et al. (2000), Phys. Rev. A 62, 022502: [\[pdf\]](#)
- (2) A list of flare lines in the SUMER spectral range has been compiled, identifications and measured wavelengths are given : [\[html\]](#); the list is taken from Feldmann et al. (2000), ApJ 544, 508: [\[pdf\]](#)
- (3) A study of the Fe XX emission lines in the SUMER spectral range; Kucera et al. (2000), ApJ 538, 424: [\[pdf\]](#)
- (4) Bremsstrahlung and related diagnostic methods in flaring plasmas; Feldmann et al. (2003), submitted to ApJ: [\[pdf\]](#)

**Flare observations:**

- (1) About the explosive start of the M8 flare on May 9, 1999; Innes et al. (2001), ApJ 549, L249: [\[pdf\]](#)
- (2) Spectroscopic signatures of a flare observed by SUMER; Dammasch et al. (2001), IAU Symposium 203, 264: [\[pdf\]](#)
- (3) The IAU paper and this ApJ Letter: First communications on hot loop oscillations; Kliem et al. (2002), ApJ 568, L61: [\[pdf\]](#)
- (4) Correlated hot and cool plasma dynamics; Kliem et al. (2002), Yokoh 10th Annivers. Mtg, COSPAR Coll. S. 13,271: [\[pdf\]](#)
- (5) Initial features of the April 21, 2002 monster flare; Wang et al. (2002), ESA SP-505, 607: [\[pdf\]](#)
- (6) Multi-wavelength observations at the onset of the April 21, 2002 monster flare; Kliem et al. (2003), submitted to ApJ:
- (7) About the downflow observed during the April 21, 2002 monster flare; Innes et al. (2003), submitted to A&A:
- (8) Mass motions and plasma properties observed during the M8 flare on May 9, 1999; Landi et al. (2003), ApJ 582, 506: [\[pdf\]](#)

**Loop oscillations:**

- (1) SOHO 11 proceedings paper on SUMER loop oscillations; Wang et al. (2002) ESA SP 508, 465: [\[pdf\]](#)
- (2) Doppler Oscillations in SUMER flare lines; Wang et al. (2002) ApJ 574, L101: [\[pdf\]](#)
- (3) On the wave mode and the damping of hot loop oscillations; Ofman & Wang (2002), ApJ 580, L85: [\[pdf\]](#)
- (4) Hot loop oscillations as seen by SUMER: What are they?; Wang et al. (2002), ESA SP-505, 199: [\[pdf\]](#)
- (5) Statistical analysis of Doppler oscillation events observed by SUMER; Curdt et al. (2002), ESA SP 506-581: [\[pdf\]](#)
- (6) 54 examples and statistics of SUMER loop oscillations proving the standing wave model; Wang et al., A&A 2003 (subm.);
- (7) Doppler oscillations of active region loops: steps towards coronal seismology; Curdt et al. (2003),  
Hvar Observatory Bulletin, submitted: [\[pdf\]](#)
- (8) SUMER loop oscillations modelled as slow-mode standing axial waves; Wang et al., A&A (submitted):

## **Annex 6-3: UVCS Data Policy and Science Highlights**

## UVCS/SOHO Data Policy

The following is the data access and publication policy for the SOHO Ultraviolet Coronagraph Spectrometer Investigation.

### I. Purpose and Statement of Data Policy

The purpose of the UVCS/SOHO data policy is to enable research in an orderly and efficient fashion while enabling the widest accessibility to the data at the earliest reasonable date. The UVCS/SOHO data policy is a UVCS implementation plan for the SOHO data access policy.

### II. Access to UVCS Data

All UVCS data and data products are made available to the scientific community and the general/public within less than three months. There are no restrictions on the use of the data.

All UVCS Co-I's, Lead Observers and Guest Investigators will have immediate access to UVCS quick look data for purposes of planning future observations and investigations.

### IV. Types of UVCS Data

Within the UVCS project there are several well defined levels of processed data.

The data, as output from the UVCS instrument and delivered to the UVCS project by NASA, is called level 0 data. Level 0 data is not useful for any purpose except processing into level-1 data.

Level-1 data is processed raw data which has been decompressed and repacked into data files in a logical form representative of the data products as delivered by the UVCS instrument. Level-1 data is stored in a standard external storage protocol (FITS files). Examples of Level-1 data are the following:

1. **Spectral Data Files:** These are FITS files containing uncalibrated detector count data (counts per pixel), as well as instrument configuration and exposure timing data. Each Exposure Sequence produces one Spectral Data File per detector. Each file includes a header that contains a brief, standard description for use by investigators.
2. **Visible Light Data Files:** These are FITS files containing the time series of count rates from the White Light Channel, along with pointing information and information on the polarizer and neutral density filter. Each VL Data File contains the data corresponding to one exposure sequence. Each file includes a header that contains a brief, standard description for use by investigators.

Calibration Data Files contain the following: a) Parameter files (ascii) for pointing, spatial, wavelength and radiometric calibrations, and b) Flat field and dark count data (FITS).

Data analysis software allows the user to perform calibrations and obtain spectra that are wavelength calibrated and converted to photons  $\text{cm}^{-2} \text{s}^{-1} \text{sr}^{-1} \text{nm}^{-1}$ . Calibrated pointing information can also be derived using this software. The software allows the user to write out processed spectral data files and processed visible light data files. Temporary processed spectral and visible light data files are produced at the EOF to be used as Quick Look data for observation planning. Processed data files are examples of level-2 data.

In addition, the UVCS program produces level-3 data which has undergone a higher level of processing. For example, image data files, including synoptic maps, are FITS files such as HI Ly-alpha maps of the corona that are provided as part of the Summary Data. There are also Data Catalogs to permit users to select observations based on pointing, observation date, type of feature observed, or other criteria. They also include references to Mission Log Files, which record the observing sequences and other commands sent to the instrument. Most level-3 data will be produced by scientists in the course of analyzing the data using software and data that is publicly available.

Summary data is quick-processed Level-3 data which is available at the SOHO Experiment Operations Facility at GSFC within a few hours of receipt by the UVCS operators workstation. These data are suitable for observation planning purposes.

The following table describes the goals for availability of the various types of data according to its purpose.

<b>Data Type</b>	<b>Available to PI, Co-PI's, G-I's, A S's, and other members of Science Working Teams</b>	<b>Available to all</b>
Final Spectral and Visible Light Data Files	< 3 months	< 3 months
Calibration Files	Immediately	Immediately
Catalogs	Immediately	Immediately
Summary Data	Immediately	Immediately

## UVCS Science Highlights

Plasma Properties of Coronal Holes over the Solar Cycle: UVCS has been used to measure the heating and acceleration of the fast solar wind in a variety of large coronal holes from 1996 to 2003 (Miralles et al. 2001, 2002; Poletto et al. 2002).

A pattern is beginning to emerge, in that coronal holes with lower densities at a given heliocentric height tend to exhibit faster ion outflow and higher ion temperatures (Kohl et al. 2001). However, all of the coronal holes observed by both UVCS and in situ instruments were found to have roughly similar outflow speeds in interplanetary space. Thus, the densities and ion temperatures measured in the extended corona seem to be indicators of the solar wind acceleration as a function of heliocentric height.

This information has been useful in gaining further insight into identifying the processes that generate the fast solar wind, but only a subset of the full range of plasma properties has been probed.

Theory Impact on Other Fields: Ion Cyclotron Resonance: The surprisingly extreme plasma conditions observed by UVCS in coronal holes have guided theorists to discard some candidate physical processes and further investigate others (see, e.g., Cranmer 2002). Hollweg and Isenberg (2002) state in a review paper that "We have seen that the information provided by UVCS has been pivotal in defining how research has proceeded during the past few years." Indeed, the UVCS results and subsequent theoretical investigations have been cited increasingly in literature devoted to other plasma environments, such as the Earth's aurora (Gavrishchaka et al. 2000), and they have guided new investigations in pure plasma physics (e.g., Mizuta and Hoshino 2001; Chen et al. 2001).

Preferential Ion Heating and Temperature Anisotropies: The analysis of UVCS data has led to evidence that the fast and slow wind share the same physical processes. Frazin et al. (2003) determined that O<sup>5+</sup> ions in the bright edges---or "legs"---of equatorial streamers have significantly higher kinetic temperatures than hydrogen and exhibit anisotropic velocity distributions with  $T(\text{perp}) > T(\text{parallel})$ , much like coronal holes. Joint theoretical studies of physical processes such as ion cyclotron resonance that apply to both the fast and slow solar wind are ongoing (e.g., Chen and Hu 2001).

Current Sheets: Models of CMEs rely heavily on reconnection in current sheets, either trailing beneath the ejected magnetic flux rope or creating the flux rope in the first place (e.g., Lin and Forbes 2000; Antiochos et al. 1999). UVCS has observed current sheets in the wakes of two CMEs (Ciaravella et al. 2000; Ko et al. 2003). They appear as geometrically narrow features in the high temperature emission lines of [Fe XVIII] and [Ca XIV]. These observations test the overall energetics predicted by the idea that the current sheets power the post-flare arcades observed in X-rays and EIT images.

Helical Structure: The approximate conservation of magnetic helicity is a powerful tool for the analysis of laboratory plasmas, and it may determine the evolution of CMEs as they travel through interplanetary space (Kumar and Rust 1996).



Doppler shift measurements with UVCS, CDS, and SUMER provide the velocity signatures to show that the structures are indeed helical and, more importantly, to determine whether the structures are unwinding or merely stretching out. The combination of velocity and imaging information provides a picture of the 3D structure of the CME material (Ciaravella et al. 1997) and in several cases shows the structure to be rotating (Pike and Mason 2002; Ciaravella et al. 2000). The Doppler shifts also determine the chirality (handedness) of the helix for comparison with that of the pre-CME prominence. In one case this worked out as expected (Ciaravella et al. 2000), but in the September 12, 2000 event the chirality is reversed.



## **Annex 7: Status of the SOHO Archives**



## Status of the SOHO Archive

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### ➤ Main developments since SWT 33:

- ❑ Replaced CDS and SUMER data sets after identifying a problem with the tables that hold study (program) information.
  - We can now deal with CDS instrument reboots gracefully.
- ❑ Recent data sets ingested:
  - CELIAS: Level 2 proton monitor.
  - ERNE: Level 2 data.
  - GOLF: Recovery to September 2002.
  - SWAN: Recovery to present day.
- ❑ Very soon: Add VIRGO level 2 and CELIAS/SEM averaged data.
- ❑ First transfers of data to the European archives over the network (used to be done with tapes). Evaluation still pending, but first impressions are positive.



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## Status of the SOHO Archive

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### ➤ Main developments since SWT 33 (continued):

- ❑ We have developed a new bibliography database and search interface, accessible from the SOHO web pages.
- ❑ Upgraded some of the hardware used at GSFC.



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## Data Deposited with the Archive

Instrument	No. Files	Gbytes	Latest Data
CDS	157350	233	Mar 2003
CELIAS	62466	98	Dec 2002
COSTEP	16423	42	Jan 2002
EIT	237158	386	Feb 2003
ERNE	7876	11	Jun 2001
GOLF	2214	2	Jun 2002
LASCO	353501	484	Jan 2003
MDI	40785	86	Mar 2003
<i>Remote</i>	<i>1932324</i>	<i>9790</i>	
SUMER	92037	141	Dec 2002
SWAN	5494	4	Jan 2003
UVCS	64034	65	Feb 2003
VIRGO	12809	2	Mar 2003
<b>Total</b>	<b>1052147</b>	<b>1554</b>	<i>(Ex Remote MDI)</i>

*Includes only data accessible via the archive user interface.*



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## LZ & Ancillary Data Processing

- **CDHF was decommissioned on September 30, 2002:**
  - ❑ We took over the tasks of producing the ancillary data sets and distributing definitive LZ telemetry.
  - ❑ LZ TLM is received from SOHO DPS and archived. PIs teams can retrieve it (HTTP, FTP) or it can be automatically pushed to PI institutions via FTP upon its reception from SOHO DPS.
  - ❑ The spacecraft mode data set was added to the ancillary data collection.
- **Orbit data sets:**
  - ❑ Being processed in a timely manner upon reception of FDF predicts.
  - ❑ Predictive orbit is now available for at least 42 and at most 70 days ahead, updated every 4 weeks (used to be at most 42 days).



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# LZ & Ancillary Data Processing

## ➤ Attitude data sets:

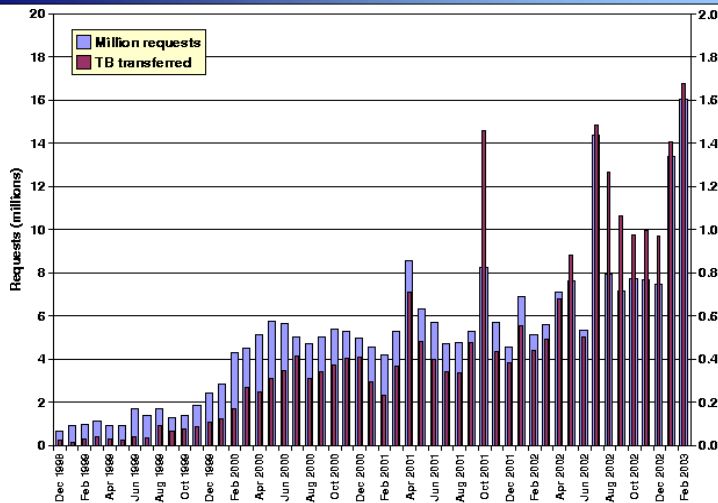
- ❑ Up to date definitive and full time resolution data sets are not available.
- ❑ Impact: CDS and LASCO cannot complete full processing of LZ TLM.
- ❑ The CDHF software delivered last year (81,000 lines) did not include all necessary routines.
- ❑ Additional software obtained in January (36,000 lines of database routines) was enough to compile in February an executable of the application used at CDHF for attitude production.
- ❑ However, it was found that CDHF was modifying the format of the AOCS TLM before processing it into the attitude products.
- ❑ The complete CDHF software suite (400,000+ lines) has been obtained in March. The support programs for reformatting the AOCS TLM have been already identified, modified and compiled.
- ❑ Barring further unforeseen problems, attitude data processing will resume by the end of April, once the new software is integrated into the existing system.



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# SOHO WWW Traffic



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## **Annex 8: GSE updates**

## GSE aging: I. Hardware

- Most Investigator WorkStation (IWS) hardware in the EOF was put into operation ~ 10 years ago
- Several of these pieces of hardware have begun to fail
- In many cases, the hardware is no longer available, or only as refurbished units from third parties

2003 March 24

SOHO SWT 35

*J.B. Gurman*

## GSE aging: II. OSes

- IT security is a major concern, and we are asked to apply patches to prevent known vulnerabilities
- Some of the “platforms” are no longer supported: no patches
- Some of the PI team software may not function under newer operating systems (OSes)



## GSE aging: III. Action

- We hope to operate for 4 - 5 more years
- These problems will only grow more severe with time (retirements, obsolescence)
- Resources are obviously a problem for some teams
- Request that each PI team should produce an *informal* plan to address this issue by 2003 December 1 (send to Joe)