5. THE CDS OPERATIONS PLAN

"It is true, I never assisted the Sun materially in his rising, but, doubt not, it was of the last importance only to be present at it" - Henry David Thoreau.

5.1 General Information

The centre for operations for the coronal instruments on board SOHO is the Experiment Operations Facility (EOF) at the NASA/Goddard Space Flight Center, Greenbelt, USA. At the EOF, each experiment team will run a dedicated Instrument Work Station (IWS) from which experiment commanding, telemetry receipt and handling, and instrument health monitoring will be performed. Access to the EOF and to the CDS IWS will be very limited! Operations planning will be performed at the EOF.

In addition to the EOF, and also at Goddard, there will be an Experiment Analysis Facility (EAF) which will be the scientific heart of the mission. At the EAF, the experiment teams will run their scientific programmes and the general scientific community may come to "use" SOHO. The EAF is the interface to the scientific user. Again, each experiment team will maintain equipment and a presence at the EAF.

In summary, at the EOF/EAF, the following CDS activities take place:

- Planning of scientific operations, calibration operations and engineering activities
- Command generation and uplinking
- Telemetry/Data receipt, processing and archiving
- Data cataloguing and distribution
- Monitoring of instrument health and associated troubleshooting
- Development of on board and ground software as necessary
- Monitoring of science data for calibration purposes
- Basic Data Analysis - (quick look checks and for planning purposes)
- Data analysis and interpretation

Clearly such activities require a mixture of scientific, software and engineering effort.

Limited activities will occur outside the EOF/EAF. For example, an archive will be maintained at RAL along with facilities to support UK researchers who are unable to

get to Goddard; an archive and operations planning facility is planned at Orsay, France - the so-called MEDOC (Multi Experiment Data and Operations Centre). Some CDS Co-Investigators may well build up CDS facilities of their own.

There will be a principal operations day, usually covered by a real-time contact period of 8 hours during Goddard daylight hours. On top of this there are three periods of real-time contact of duration 1.3 hours each. For two months per year we have a full 24 hour real-time contact.

5.2 The CDS Science Planning and Exploitation Committee (SPEC)

There has to be a central group which provides the scientific direction for CDS, which acts as the interface to the scientific community and which provides the interface to ESA/NASA. Of course, ultimate responsibility for running CDS must lie with the Principal Investigator - but there is no point in running a dictatorship!

The CDS Science Planning and Exploitation Committee (SPEC) will oversee the *scientific* running of CDS, i.e. it will not be concerned with hardware and engineering issues, unless they impact the scientific operation. This group consists of the following:

- The Principal Investigator
- The CDS Project Scientist
- 2-3 Co-Investigators - elected by the Co-Investigator/Associated Science team on a 6 month to yearly basis.

Given such a small group, day to day discussion and planning may be done largely by e-mail, telephone and fax, though occasional meetings will be required.

The CDS SPEC will perform the following duties:

- **Co-ordinate Observation Requests:** Co-ordinate requests for observations using CDS - both internal (from Co-Investigators and Associated Scientsits) and external (from Guest Investigators and Collaborators) - ***i.e. Requests for Observations Should be Sent to this Committee c/o the PI.***

- **Produce Long Term Science Strategies:** Devise long term strategies and monthly plans for CDS operations, including high level negotiations with collaborating instruments, other spacecraft, ground based observatories and the SOHO Project (e.g. for special operations such as spacecraft roll).

- **Co-ordinate EOF Visits:** Due to the large number of Co-Investigators, Associated Scientists and potential Guest Investigators and Collaborators, all visits to the EOF should be managed by the SPEC - ***i.e. Requests for Visits to the EOF should be cleared with the Committee.***

- **Manage the Data Exploitation:** Data exploitation will be subject to a co-ordination scheme (see below) which must ensure that many people are not looking at the same data-sets and that research topics are covered efficiently. The SPEC should be responsible for the running of that scheme. When an observation is selected the SPEC will assign a person responsible for overseeing the exploitation (usually the proposer). A written short report must be submitted to the SPEC by this person within 6 months of an observation summarising progress in the exploitation of the data.

- **Monitor Publications:** All publications involving CDS and CDS data must be approved by the SPEC prior to submission to a journal. The SPEC will maintain a list of all CDS publications. Publications will be subject to a publication policy (see below).

- **Publicity/CDS Bulletins:** The CDS SPEC will be responsible for the production and distribution of publicity material, including the CDS Bulletin and press releases.

The operations team at the EOF/EAF will be concerned with the day to day running of CDS, with the fine details and implementation of observations, but the strategy and monthly plans, and the management of the scientific community will reside with the CDS SPEC.

5.3 CDS At the EOF/EAF

The CDS IWS facility resides in a dedicated room in building 6 at Goddard. The room is adjacent to the operations planning area, the other SOHO experiment rooms, and the spacecraft control facility. This facility, the EOF, has restricted access. The CDS EAF facility resides in the basement of building 26, along with similar facilities for the other experiments.

The CDS IWS facilities are managed and maintained by the CDS Ground System Support Manager, Jeff Payne (RAL).

During the main 8 hour operations period, we require the following CDS staff at the EOF/EAF, with the duties as listed:

- **Operations Scientist:** To monitor the receipt of science data
  To participate in SOHO planning meetings
  To run CDS planning meetings as necessary
  To interface with in-coming CDS users
  To construct observing sequences

- **Operations Engineer:** To oversee memory loads and commanding
  To monitor instrument health
  To participate in CDS planning meetings

To construct engineering sequences when necessary
To interface with the Flight Operations Team (FOT)
To maintain the CDS IWS

- **Data Technician(s):** To perform data handling activities at EAF
To assist in science data monitoring

CDS will be run 24 hours per day. However, we do not anticipate a 24 hour presence at the EOF/EAF. During non-Goddard working hours, a member of the CDS team will be on call in case of problems.

In-coming scientists will interact mainly with the CDS Operations Scientist who will help in the construction of observing sequences and operations planning. Normally, such visitors will reside at the EAF.

5.4 CDS At RAL

A CDS data archive will be maintained at RAL and access to the data will be provided either from a dedicated facility or through a general SOHO archive. Facilities at RAL will be limited; the focus of CDS operations and science will be at Goddard. However, we anticipate the presence of at least one CDS scientist at any point in time and a dedicated workstation facility.

5.5 Operation Planning

CDS operations will be planned by the SPEC and the CDS team at the EOF. We anticipate several tiers of regular planning meetings to ensure efficient operations. They should follow the framework given in Table 5.1.

Table 5.1: The CDS Planning Scenario

Meeting	Period Planned For	Activities
SOHO Quarterly SWT Meeting	Quarter starting in a month's time	General SOHO Plan
CDS Monthly SPEC Session	Month starting in months time	- Produce strategy for coming month - Co-ordinate EOF/EAF manning and visits - Interface with other experiments, satellites or ESA/NASA as necessary
SOHO Monthly Planning Meeting	Month starting in 2 weeks time	- Schedule the month including timing of specific programmes (e.g. JOPs) and supporting observations
CDS Monthly Planning Meeting	Month starting in 2 weeks time	- Follow up on SOHO monthly meeting to schedule CDS operations

SOHO Weekly Planning Meeting	Week starting in 3 days time	- Polish detailed plan. Confirm telemetry and flag requirements.
CDS Weekly Planning Meeting	Week starting in 3 days time	- Follow up to SOHO meeting - finalise CDS operation as much as possible for week.
SOHO Daily Planning Meeting	For current/following day	- Final target choices to be made

Let us consider this planning cycle in some detail.

At the SWT meeting, one could imagine a SOHO-wide decision to concentrate on a coronal hole campaign for a particular period, accompanied by a request to perform a detailed intercalibration activity due to the launch of a calibration rocket.

Subsequently, the CDS SPEC would produce a strategy which is consistent with this, selecting several coronal hole studies which have been submitted. Of course, the standard synoptic, calibration and monitoring activities will be continued throughout the month being planned for, and there will be time for other scientific activities. The SPEC would communicate with the relevant authorities to plan the calibration activities around the rocket flight. This would involve the use of existing JOPs which would be selected. The outcome of the SPEC meeting would be a list of CDS Studies, in various forms of development, and a general outline for activities.

At the SOHO monthly meeting, the SPEC plan would be presented as the CDS input, and modified in accordance with the meeting. The output would most likely be specific timings for the JOPs and for the coronal hole studies/campaign.

The CDS monthly meeting would follow almost immediately and start to finalise the CDS details for this plan. This would include finalising and checking the designs of the Studies to be used. The weekly SOHO and CDS meetings can be used to polish the details of the parts of the plan for the following week, and the daily planning meeting can be used to confirm pointing in cases where this is necessary.

A CDS day would be made up of regular synoptic and monitoring/calibration activities plus the science studies. One might expect the operation to include some 4-6 different CDS observation sequences. Table 5.3 shows a "typical" day.

Table 5.3: A "Typical" CDS Day

00:00 - 04:30	Synoptic scan of central meridian
04:30 - 06:30	High Velocity Event Study
06:30 - 07:00	EIT High Telemetry Rate - no CDS operation
07:00 - 14:00	High Velocity Event Study
14:00 - 24:00	Flow Distribution Study

Details of specific studies are given in the next section.

The specific details of the CDS calibration and monitoring activities are discussed in a later section. However, these activities involve the running of studies in the same way as scientific studies. The scheduling of these studies will be subject to a regular pattern. The analysis of the observations from these studies will be the responsibility of the PI team at RAL and will be overseen by Barry Kent.

5.6 MEDOC

The MEDOC (Multi-Experiment Data Operations Centre for SOHO) is designed to meet the needs of European SOHO Investigators who wish to work together on data analysis and the preparation of joint observations using SOHO instruments and European ground-based observatories. This European Centre complements the SOHO EOF and EAF facilities. In normal operational mode, the MEDOC central workstations obtain and distribute to instrument-dedicated workstations, the telemetry from the EOF. MEDOC will be able to work in other modes such as joint planning together with European observatories or instrument commanding. Moreover, MEDOC is one of the European archiving centres for SOHO approved by ESA.

MEDOC facilities, located in the IAS building at Orsay, France, will include operation and analysis rooms, an efficient internal network, a dedicated conference room and team-dedicated rooms. The three main functions of MEDOC will be:

- Data Acquisition - MEDOC receives all telemetry and assocated files from the EOF through a dedicated line through CNES (Toulouse) (128 kb/s). It distributes data to the experiment workstations (e.g. CDS) located in Orsay, according to their data requests.
- Planning - MEDOC will provide planning and commanding capabilities for investigators who wish to work together in Europe, for instance, during campaigns of co-ordinated observations with European observatories. During these special operations - to be approved by the SOHO Science Working Team - interfaces with the spacecraft, US users and US archive will be maintained by the EOF.
- Archiving - A mission archive will be kept at Osay where most data will be accessible “on-line” through the MEDOC network. A long-term archive will be installed within the CNES Archiving Facility in Toulouse. The MEDOC archive will be a mirror copy of the US SOHO archive with Mosaic-type access. The archive will contain all data of different levels, from raw (level 0) to fully calibrated and sorted (level 1,2). It will maintain the integrity of the data and data access more than 10 years after the end of the mission. The user will access the data through the SOHO catalogue. Network access will be available for European users located in their institutes.

MEDOC is primarily intended for coronal instrument teams such as SUMER and CDS, which need to tightly control the status of their instruments. It will work very much as an extension of the EOF and, during campaigns when instrument campaigns

are run from MEDOC, it will support regular planning meetings, the preparation of new observing programmes and the construction of instrument sequences through the running of planning software. The resulting plans would be transmitted to the EOF for checking and implementation.