Interface Control Document
Between
the Solar and Heliospheric Observatory (SOHO)
Experimenters Operations Facility (EOF)
Core System (ECS)
and the SOHO Instrumenters

Revision 1

October 1995

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ABSTRACT

locument describes the interface between the International Solar-Terrestrial Physics (ISTP) Solar and Heliospheric vatory (SOHO) Experimenters' Operations Facility (EOF) Core System (ECS) and the SOHO Instrumenters. Section ides an introduction to this document. Section 2 presents an overview of the interface. Section 3 defines the format of ıta exchanged over the interface. Section 4 defines the communications protocols and lower level layers of the ace.

ords: Experimenters' Operations Facility (EOF)
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PREFACE

s the first revision of the Interface Control Document (ICD) between the SOHO ECS and the SOHO Instrumenters.

nterface between the ECS and the instrumenters for the commanding functions is widely based on a proposal oped by Dr Van Ballegooijen, following an action item from the November 1991 Science Operations Working Group G) splinter meeting. A preliminary outline of the ICD was presented to the instrumenters during the May 1992 er meeting. A draft version of the document was produced in July 1992 and discussed at the September 1992 SOWG ng. The review copy (April 1993) was presented at the June 1993 SOWG meeting and at the ECS Critical Design w. The final approved version is dated January 1994. Integration testing with the instrument teams and several l system tests have shown that modifications to the ICD were necessary and those are incorporated in the present on of the document. Revision 1 provides a final definition of the data to be exchanged in support of the mission ing functions. It also includes a revised file naming convention (see appendix A) for better compatibility with the) archive.

CD is under the configuration management of the Mission Operations Division (MOD) Configuration Control Board . Proposed changes to this document shall be submitted to the MOD CCB, along with supportive material justifying ange. Changes shall be made by document change notice (DCN) or by complete revision.

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SECTION 1. INTRODUCTION

1.1 PURPOSE AND SCOPE

This Interface Control Document (ICD) defines the interface between the Solar and Heliospheric Observatory (SOHO) Instrumenters and the Experimenters' Operations Facility (EOF) Core System (ECS). This interface supports three main data exchanges: instrument commanding data from the instrumenters, telemetry distribution to the instrumenters, and exchange of other mission related data.

The interface between the ECS and the SOHO instrumenters is described within the framework of the Open System Interconnection (OSI) model, a seven-layer reference model developed by the International Organization for Standardization (ISO). Section 2 of this ICD provides an overview of the interface between the ECS and the instrumenters. Section 3 defines the interface at the application layer level. Section 4 defines the lower levels of the OSI model: presentation layer, session layer, transport layer, network layer, data link layer and physical layer.

1.2 BACKGROUND

The SOHO mission is part of the International Solar-Terrestrial Physics (ISTP) program. The SOHO EOF is part of the NASA Goddard Space Flight Center (GSFC) ground system and serves as the focal point for instrument operations, mission planning, and science data analysis related to the operations.

The EOF is comprised of two main elements:

1) The ECS which includes hardware and software to support the three primary ECS functions described above. Two specialized workstations are part of the ECS: the Science Operations Coordinator (SOC) workstation and the Project Scientist workstation.

2) The Instrumenters WorkStations (IWS) which include hardware and software provided by the individual instrument teams and are dedicated to the operation of a given instrument and its science analysis for planning purpose.

The instrumenters may be located as follows:

1) The resident instrumenters are located at the EOF where they have data processing equipment, referred to as the IWSs.

2) The "remote" instrumenters are located outside of the EOF. They may have some support equipment at the EOF, or they may communicate with the ECS via another instrument's IWS or via a dedicated ECS workstation, namely, the SOC workstation. The remote instrumenters may also use the telephone or facsimile to communicate with the Flight Operations Team (FOT) or with an EOF resident team member and request changes in their instrument status.

3) Instrumenters may be located at the Analysis Facility at GSFC. At the present time, instrumenters at the Analysis Facility will have the same privileges as remote instrumenters. However, the EOF design does not preclude the fact that some of the equipment located at the Analysis Facility could be treated as resident IWSs, provided the following:
   - Security requirements are met: this includes having a dedicated line between the two facilities, and ensuring adequate physical security at the Analysis Facility.
   - ECS capacity: Telemetry could be distributed in real-time to workstations in the Analysis Facility provided this can be supported by the current ECS hardware/software architecture.

4) Instrumenters may also be located at the Multi-Experiment Data Operation Centre (MEDOC) in Orsay, France. The present document treats MEDOC as an IWS that would not have near-real-

time commanding authority. Thus, MEDOC can receive real-time telemetry and archived telemetry files. If conditions change concerning the functionality of this interface, it will be described and defined in a separate document.

The ECS provides the communications between the instrumenters and other elements of the SOHO ground system as illustrated at a conceptual level in Figure 1.1. The physical configuration of the EOF is defined in section 4. ECS receives and stores telemetry data. ECS makes that telemetry data available to the instrumenters for processing on their own equipment and defining future instrument commands. The instrumenters use their interface with ECS to send these commands to their instruments both in real-time and on a delayed transmission basis. Near-real time commanding and reception of real-time telemetry is only available to the EOF resident instrumenters (i.e., IWSs).

1.3 REFERENCES

1. Commanding at the SOHO Experiment Operations Facility, Dr Van Ballegooijen, memorandum, Action Item from SOWG Splinter Meeting, November 1991.

2. SOHO Science Operations Plan, Issue 1.1, June 1993.

3. SOHO Experimenters' Operations Facility (EOF) Core System (ECS) Functional Requirements Document, NASA, April 1992.

4. CCS External Interfaces Specification Document, MATRA, July 1991.

5. Telemetry and Telecommand Handbook, MATRA, March 1991.

6. CCS Protocol Implementation, SS-AN-003-91, March 24, 1992.

7. SOHO Experimenters' Operations Facility (EOF) Core System (ECS) System Requirements Document, NASA 514-4SRD/0492, February 1993.

8. Interface Control Document between the International Solar-Terrestrial Physics (ISTP) SOHO Command Management System (CMS) and the ECS, NASA 514-4ICD/0293, July 1994.

9. Interface Control Document between the Sensor Data Processing Facility (SDPF) and SOHO Consumers, Revision 1, NASA 560-203.97, February 1995.

10. Deleted

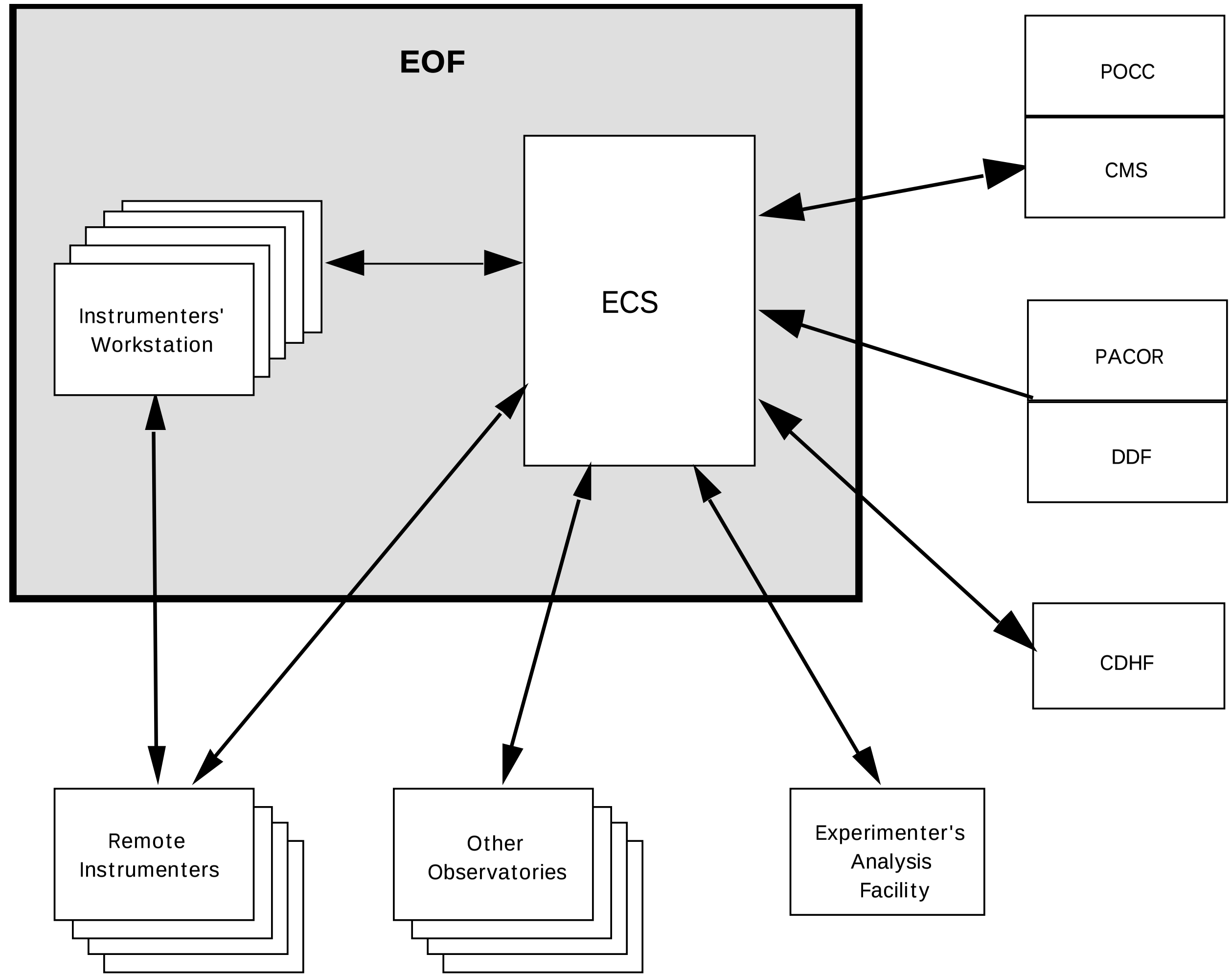


Figure 1.1. ECS/IWSs Context Diagram

11. Interface Control Document between the International Solar-Terrestrial Physics (ISTP) Program Central Data Handling Facility (CDHF) and the ISTP SOHO Experimenters' Operations Facility (EOF), NASA, 560-1ICD/1093, August 1994.

12. SOHO Experimenters' Operations Facility (EOF) Core System (ECS) Detailed Design Specification, NASA 514-4DDS/0293, Review Copy, June 1993.

13. SOHO Experimenters' Operations Facility (EOF) Core System (ECS) Software Users' Guide, NASA, April 1995.

14. Data Format Control Document for the International Solar-Terrestrial Physics (ISTP) Program SOHO Project Data Base, Revision 1, NASA, 511-4DFC/0292, September 1994.

1.4 GLOSSARY

As-Planned Database. Information provided by the instrumenters to the ECS describing the science activities scheduled for a given day or week. This information will be based on the template provided by the ECS Activity Plan (EAP) which shows Deep Space network (DSN) contact times, FOT-dedicated commanding times, and other related activities. The information provided by the instrumenters will be in the form of ASCII files and it will be electronically transferred to the ECS.

As-Run Database. Information provided by the instrumenters describing the science programs executed. The detailed format and content of the data provided by the instrumenters will be defined separately from this document. The design and implementation of the Database is the responsibility of a designated group of instrumenters. ECS is only responsible for providing the commercial Relational Database Management System package that will be used to support these functions and the hardware on which it will run. Information related to the As-Run data base will be provided to the ECS in an ASCII file format for inclusion into the Summary data files sent to the CDHF, for later distribution to the instrumenters' teams.

Critical Command. A command which is flagged as critical in the Project Database (PDB). Operationally, the uplink of a critical command requires the intervention of an FOT operator within the Payload Operations Control Center (POCC).

Delayed Commands. A group of commands originating from EOF-resident or remote instrumenters destined to be uplinked by the FOT within a specified time window during the next operational day or later.

Instrument Command. A command addressed to a given instrument. Most instruments have a processor which will act upon that command once it receives it. When an instrument command is received by the spacecraft, it is immediately routed to the instrument. The command may be an actual command to perform a specific function. That function may be executed as soon as received by the instrument processor or it may be stored within the instrument processor memory for execution at a later predefined time (this depends on the capabilities of the instrument processor itself). The command may also be data to be stored in the processor memory. Each instrument team is responsible for the management of their instrument processor memory. Note that the VIRGO instrument has a particular design and will require a special command handling.

Instrumenter WorkStation (IWS). Hardware and software provided by the individual instrument teams, physically located in the EOF. During real-time passes, they may support the commanding of a given set of instruments or perform their science analysis for planning purposes. The commanding IWSs are the only authorized source of near-real-time commands. A given instrument may only be commanded by a single IWS at a given time.

Large Instrument Tables. Instrument command groups which do not need to be uplinked in a time critical manner. This includes large amounts of commanding data which could block the commanding channel for a long period of time. To avoid this, the instrumenters must package the commanding data into "chunks" no larger than 0.5 Kbytes, which corresponds approximately to 10 seconds of uplink time. These "chunks" will be uplinked using the CMS background queue.

Macros. The spacecraft has an on-board macro capability. However, this capability is not available for use by the instrumenters through the EOF.

Near-Real-time (NRT) Commands. A group of commands originating from an IWS that will be routed through the POCC for uplink and arrive at the spacecraft within 60 seconds. Near-real-time commanding is only available to the IWSs during the "throughput mode", that is when there is a contact with the spacecraft and near-real-time commanding is enabled by POCC, CMS and the ECS. Only instrument OBDH block commands are allowed in NRT. However, certain instrument OBDH block commands are not allowed to be sent by an IWS as an NRT command. The commands "not allowed in NRT" are identified as such in the Project Data Base. They include but are not limited to the critical commands. The commands "not allowed in NRT" can be used in RPRs and RCRs and in delayed command files.

On-line/off-line Availability. Within the EOF, "on-line" information may be accessed electronically, without human intervention. "Off-line" information is stored on a medium that requires human intervention before access, for example, mounting a tape or disk.

Operational Day and Operational Week. An operational day is the 24-hour period starting at 00:00 GMT. An operational week is the 7-day period starting on a fixed day of the week at 00:00 GMT.

Predefined Command Sequence (PCS). A list of command mnemonics resident in the POCC, identified by a unique name known to both the FOT and the instrumenters. It may contain instrument commands and/or approved spacecraft commands, but critical commands are not allowed. It contains no time-tags or delay factors. The definition and maintenance of a PCS takes place between the instrumenters and the FOT (possibly via E-mail) and does not involve the ECS.

Project Data Base (PDB). The PDB consists of a series of data sets defining commands, telemetry, page displays, procedures, etc... The FOT is responsible for its maintenance and redistribution. Changes to the PDB require approval by the Change Control Board and are implemented under the control of the FOT.

Quicklook Data. This term refers to data created expeditiously by PACOR, post-pass. In this document, it is primarily used to refer to files containing tape recorder dumps, forward-ordered, organized by APID and by time.

Real-time Telemetry. Telemetry data delivered to ECS by PACOR with minimal delay and immediately distributed to the instrumenters. It includes housekeeping (VC0), science (VC1), and MDI-M (VC2) packets.

Telemetry Archive Data. The telemetry data archived by ECS. It consists of all VC0, VC1 and VC2 packets received as real-time telemetry, tape recorder dumps quicklook data (VC4), or retransmission from PACOR of real-time telemetry in the case of a failure in the real-time transmission. The telemetry archive data is stored by ECS on-line for 7 days and off-line for 21 days. It can be retrieved by the instrumenters via file transfer.

Remote Command Request (RCR). Electronic request originating from a IWS and destined to the POCC. It is used to request the execution of a PCS which is already approved by the FOT and stored in the POCC. RCRs are primarily intended to allow the instrumenters to make use of spacecraft commands needed by the instrumenters.

Remote Instrumenter. This term refers to the hardware and software provided by individual instrument teams, physically located outside of the EOF. They are not allowed to perform near-real-time commanding from their remote sites and they cannot receive real-time telemetry.

Remote Procedure Request (RPR). Electronic request originating from a IWS and destined to the POCC, used to request that the FOT operator execute a Systems Test and Operations Language (STOL) procedure which is already approved and stored in the POCC under the control of the FOT. STOL is the high level interactive command language that will be used in the POCC. RPRs are primarily intended to allow the instrumenters to make use of spacecraft commands as well as critical commands.

Spacecraft Command. A command addressed to a spacecraft subsystem, not including the payload instruments. As a general rule, the FOT is responsible for all spacecraft commands and the instrumenters are not allowed to generate these commands. However, some spacecraft commands may affect an instrument operation or invoke functions in which associated instrument commands need to be sent. The following is a non-exhaustive list of such spacecraft commands, the execution of which will need to be coordinated with the FOT (see the RPR and RCR definitions):

- Pulse commands,
- On-Board Time (OBT) update commands,
- Instrument power on / off,
- Select primary / redundant electronics,
- Non-operational heaters on / off,
- Select mode of inter-instrument data exchange,
- Program inter-instrument data exchange,
- Select telemetry sub-mode, etc...

1.5 ACRONYMS

AIV	Assembly, Integration and Validation
APID	Application Process Identification
CCS	Central Checkout System
CDF	Common Data Format
CDHF	Central Data Handling Facility
CDS	Coronal Diagnostic Spectrometer
CELIAS	Charge, Element and Isotope Analysis System
CEPAC	COSTEP-ERNE Particle Analysis Collaboration
CMS	Command Management System
COSTEP	Comprehensive SupraThermal and Energetic Particle Analyzer
DDF	Data Distribution Facility
DFCD	Data Format Control Document
DSN	Deep Space Network
EAP	ECS Activity Plan
ECS	EOF Core System
EGSE	Experiment Ground Support Equipment
EIT	Extreme-ultraviolet Imaging Telescope
EOF	Experimenters' Operations Facility
ERNE	Energetic and Relativistic Nuclei and Electron experiment
ESA	European Space Agency
FDDI	Fiber Distributed Data Interface
FITS	Flexible Image Transport System
FOT	Flight Operations Team
FTP	File Transfer Protocol
GMT	Greenwich Mean Time
GOLF	Global Oscillations at Low Frequencies
GSFC	Goddard Space Flight Center
HK	Housekeeping
IAP	Instrumenter Input to the Activity Plan
ICD	Interface Control Document
IDL	Interactive Data Language
IP	Internet Protocol
IPD	Information Processing Division
ISO	International Organization for Standardization
ISTP	International Solar-Terrestrial Physics
IWS	Instrumenter WorkStation
LASCO	Large Angle Spectrometric Coronagraph
LOBT	Local On-Board Time
MDI-H	Michelson Doppler Imager-Helioseismology
MDI-M	Michelson Doppler Imager-Magnetogram
MEDOC	Multi-Experiment Data Operation Centre
MO&DSD	Mission Operations and Data Systems Directorate

MODNET	MO&DSD Operational Development Network
NASA	National Aeronautics and Space Administration
NRT	Near-Real-Time
NSI	NASA Science Internet
NTP	Network Time Protocol
OBDH	On-Board Data Handling
OBT	On-Board Time
ODB	Operational Data Base
OSI	Open System Interconnection
PACOR	Packet Processor
PCS	Predefined Command Sequence
PDB	Project Data Base
PI	Principal Investigator
POCC	Payload Operations Control Center
Q&A	Quality and Accounting
RCR	Remote Command Request
RDBMS	Relational DataBase Management System
RFC	Request for Comment
RPR	Remote Procedure Request
R-S	Reed-Solomon
S/C	Spacecraft
SDB	System Data Base
SDPF	Sensor Data Processing Facility
SFDU	Standard Formatted Data Unit
SMOCC	SOHO Mission Operations Control Center
SMTP	Simple Mail Transfer Protocol
SOC	Science Operations Coordinator
SOHO	Solar and Heliospheric Observatory
SOWG	Science Operations Working Group
STOL	Systems Test and Operations Language
SUMER	Solar Ultraviolet Measurements of Emitted Radiation
SWAN	Solar Wind Anisotropies
TCP	Transmission Control Protocol
TELNET	Remote Login over TCP/IP Network
TM	Telemetry
TPOCC	Transportable Payload Operations Control Center
UDP	User Datagram Protocol
UTC	Coordinated Universal Time
UVCS	Ultraviolet Coronagraph Spectrometer
VC	Virtual Channel
VIRGO	Variability of Solar Radiance and Gravity Oscillations

SECTION 2. INTERFACE OVERVIEW

2.1 DATA EXCHANGED

The subsections below provide a description of the various data items exchanged over the interface between the ECS and the instrumenters. Several modes of data transfer will be used:

1) Data stream: transfer data in real-time over sockets.
2) File transfer: transfer large and less time-sensitive data using File Transfer Protocol (FTP).
3) Remote graphic displays: graphical interface to interactive ECS processes via X.11.
4) Mail services: address text messages to a specific user to be read later using Simple Mail Transfer Protocol (SMTP).

Table 2.1 provides a list of the main types of data exchanged between the ECS and the instrumenters and, for each type, it identifies the mode of data transfer used.

Table 2.1. Data exchanged over the ECS/instrumenters interface

DATA TRANSFERRED:	DIRECTION	TRANSFER MODE
Session Control messages	Bidirectional ECS / IWSs	Data stream
Near-real-time commanding data	IWSs to ECS	Data stream
Commanding status messages	ECS to IWSs	Data stream
Informational messages	Bidirectional ECS / IWSs	Data stream / Mail services
Commanding and telemetry status windows	ECS to IWSs	X.11 remote graphic display
Delayed commanding data	Instrumenters to ECS	File transfer
Background-queue commanding data	Instrumenters to ECS	File transfer
Delayed command validation reports	ECS to Instrumenters	File transfer
Background-queue cmd validation reports	ECS to Instrumenters	File transfer
Real-time telemetry data	ECS to IWSs	Data stream
Real-time TLM distribution control messages	ECS to IWSs	Data stream
Quicklook / Archived TLM data	ECS to Instrumenters	File transfer
Activity plan	ECS to Instrumenters	File transfer
Instrumenter input to activity plan	Instrumenters to ECS	File transfer
Summary data	ECS to Instrumenters	File transfer
Instrumenters input to the Summary Data	Instrumenters to ECS	File transfer
Orbit and attitude data	ECS to Instrumenters	File transfer
Command history data	ECS to Instrumenters	File transfer
Time correlation log	ECS to Instrumenters	File transfer
SOHO Daily Report	ECS to Instrumenters	File transfer
As-Run Database	Instrumenters to ECS	File transfer
Synoptic data	ECS to Instrumenters	File transfer
Project data base	ECS to Instrumenters	File transfer
Project data base update requests	Instrumenters to ECS	Mail services
Time services	ECS to Instrumenters	Data stream

2.2 COMMANDING PROCESS OVERVIEW

There are two primary commanding modes differentiated by the delay between the time the commands are transmitted by the instrumenters and the time they are uplinked: the near-real-time commanding mode and the delayed commanding mode. In both modes, all instrument commands are routed to the instruments as soon as they are received by the spacecraft, since the instrumenters may not use the spacecraft time-tagged buffer. The actual execution of a command once it is received by an instrument processor is not relevant to this classification.

A third commanding mode is defined to accommodate the case where instrumenters need to utilize spacecraft commands or critical commands: the FOT-coordinated commanding mode. The instrumenters must coordinate the issuance of these commands with the FOT operator who will send the commands requested by the instrumenters. This commanding mode may also be utilized in case of contingency. A particular case of this commanding mode will be used to command the VIRGO instrument.

The commands are submitted either in binary or in mnemonic format by the instrumenters who have the basic responsibility of command validation. The role of the ECS is limited to verifying that the commands originate from an authorized source, and does not include a check against the command definitions in the PDB. This check is done by the CMS. However, commands that will be submitted in the binary format will not be checked against the PDB. In particular, critical commands cannot be flagged. The instrumenters have the choice of disallowing commanding in binary format and they may do so by contacting the SOC. From then on and until the request is revoked by the originating instrumenter, ECS will reject commands in binary format for that instrument.

2.2.1 NEAR-REAL-TIME COMMANDING

The near-real-time commanding data is submitted by the IWS to the ECS as a series of "messages", the functional protocol being, as much as possible, similar to the protocol used with the Central Checkout System (CCS) in the Assembly, Integration and Validation (AIV) environment. Modifications have been necessary to support the operational environment.

2.2.1.1 Throughput Mode

The overall ground system requirement for this mode is that commands generated by an instrumenter in the EOF will be received by the spacecraft within 60 seconds. More specifically, ECS shall make a single near-real-time command available for transmission to the SMOCC within 10 seconds of reception from an IWS. This mode is only available to the instrumenters who are resident in the EOF. Its primary goal is science monitoring and control of experiments as dictated by changes in solar activities. Thus, full processor reloads would normally not be done in this mode, although the uplink of large loads might be negotiated among the experiment teams resident at the EOF.

The throughput mode may be interrupted or ended in three different ways:

1) Pause: In order to allow POCC or FOT activities to take place, the throughput mode is temporarily interrupted. At that time, ECS stops accepting near-real-time commands from the instrumenters but all near-real-time command queues in ECS and in the SMOCC are maintained. When the throughput mode resumes, near-real-time commanding resumes without any data loss.

2) Stop gracefully. This is the normal ending for the throughput mode. SMOCC sends a warning that the throughput mode will be ended shortly. All the near-real-time commanding data in the ECS queues and in the SMOCC queues are processed, uplinked and acknowledged before the throughput mode is ended.

3) Stop immediate. In cases of emergency, SMOCC will terminate the throughput mode without a warning. In this case, all the near-real-time commanding queues in the SMOCC and in the ECS will be flushed.

If an error is detected in a near-real-time command group, both the ECS and SMOCC will reject all near-real-time command groups addressed to the same instrument following the group where the error was found. The originating IWS must submit an Instrument Reset message. Commanding will resume after proper reception by ECS and SMOCC of the Instrument Reset message. All near-real-time command groups for the same instrument between the group in error and the reset message will be discarded by ECS and the CMS. The operation of the throughput mode for the other instruments is not affected by this process.

2.2.1.2 Reserved-time Commanding

This mode allows one or more instrumenter teams to have exclusive use of the throughput mode during a reserved period of time. At least one operational day in advance, an instrumenter requests a reserved time slot, and indicates the command volume expected. The request may be included in the planning process, it is negotiated among the EOF instrument teams, and if accepted, the requested time window is reserved for that instrument. The SOC will manually control the start and end of a reserved-time session. This mode can be used when an instrument requires a larger amount of commands or when the command uplink needs to be timed in a very precise manner.

2.2.2 DELAYED COMMANDING

In this mode, the commanding data will be uplinked to the spacecraft by the FOT within a time window specified by the instrumenter. The delayed commanding mode applies to individual command groups which need to be uplinked during a rather precise time window. It is available to all instrumenters, EOF resident or not.

A command group is submitted in a file, the header of which specifies the desired uplink window. Under normal operational conditions, the file should be submitted to the EOF at least 8 hours be fore the start of the operational day during which the commands will be uplinked. When received by ECS, the command group is submitted to the CMS for validation. CMS will return a command validation report which will be transmitted back to the originating instrumenter. If the group is valid and the requested uplink time does not create any scheduling conflict, it will be uplinked by the FOT during the specified window.

The width of the requested uplink window should be on the order of one hour. This would avoid scheduling conflicts and too frequent interruptions of the throughput mode since the uplink of delayed commands necessitates pausing the throughput mode for near-real-time commands. There also will be times outside of the throughput mode reserved for payload-related activities by the FOT; these time windows will be specified in the ECS activity plan and should be used as much as possible for the uplink of delayed commands. CMS cannot ensure the ordering of individual command groups that would have the same or overlapping uplink windows. In order to avoid sequencing problems, the following is suggested: for a given instrument, all delayed command groups should have non-overlapping uplink windows. As long as the maximum number of commands contained in a single file does not exceed the allowed limit, a single larger group should be used instead of several smaller groups with the same requested uplink window.

ECS is informed of a successful uplink via an informational message generated in the POCC. This informational message is forwarded to the IWS commanding this instrument if a NRT session is open at that time. In order to accommodate remote instrumenters, ECS will also send the same message via E-mail to two addresses agreed upon between the instrument team and the ECS.

2.2.3 BACKGROUND-QUEUE COMMANDING

This mode is primarily intended to deal with large command groups which do not need to be uplinked in a time-critical manner. In particular, this mode will be used for large amounts of commanding data (e.g., large table loads) which could block the commanding link for a long period of time. To avoid this, the instrumenters must package the commanding data into "chunks" no larger than 0.5 Kbytes. Just like for delayed commanding, ECS submits the command groups to the CMS which returns a command validation report that will be transmitted back to the originating instrumenter. If no errors were found, the command groups are put in the SMOCC "background queue". The individual groups are uplinked in the order submitted by the instrumenter, by interleaving them into the real-time command stream as soon as some space becomes available. However, ECS and SMOCC understand that there is no need to uplink the individual chunks in any specific order. Background-queue commands have the lowest priority among all commanding data. The originating instrumenter may optionally specify an uplink window. If not specified, the chunks are uplinked whenever possible without a time limit. If specified, CMS would reject all the chunks that could not be uplinked during the requested uplink window. It is recommended that the width of the requested uplink window be at least on the order of one week.

Note that for both delayed and background-queue commands, once the validation report has been received and until uplink confirmation, there is no electronic method for an instrumenter to determine the status of the submitted file. This information may be requested from the FOT through the SOC.

2.2.4 FOT-COORDINATED COMMANDING MODE

This mode allows the instrumenters to request the execution of spacecraft commands or critical commands. This is implemented using either a Remote Command Request (RCR) or a Remote Procedure Request (RPR). When originating from an IWS, these requests are received by the ECS and forwarded to the FOT via the SMOCC in a format similar to the NRT command messages. These requests identify the originating instrumenter and contain the name of a Predefined Command Sequence (PCS) in the case of an RCR, or the name of a STOL procedure in the case of an RPR. The PCSs and STOL procedures are defined directly between the instrumenters and the FOT. The FOT maintains a list of PCSs and STOL procedures that have been approved and can be invoked in RCRs or RPRs respectively. The throughput mode can be set to either allow RCRs or not. If RCRs are disallowed, ECS will reject them. If RCRs are allowed, ECS forwards them to the CMS / POCC. If an instrumenter's RCR is valid, the PCS will be automatically executed in the POCC and incorporated into the uplink transmission. Critical commands are not allowed via RCRs. If an instrumenters' RPR is valid, the FOT operator will initiate its execution. The throughput mode will have to be paused during the execution of an RPR. ECS will always acknowledge the receipt of an RCR or RPR via a NRT response message. For RPRs, the originating IWS will receive an informational message containing text defined in conjunction with the FOT as part of the procedure itself (last line of the procedure).

This mode of commanding may only be used by EOF-resident instrumenters while the near-real-time throughput mode is enabled. For remote instrumenters, it will require communication with the SOC (E-mail or fax) to request the intervention the FOT operator.

2.2.5 COMMANDING PRIORITY SCHEME

The ECS has a requirement to prioritize the commanding data it receives from the instrumenters. To that effect, different levels of priority are implemented at the instrument level.

Near-Real-Time Commanding
Two priority levels apply:

1) High Priority. This level is intended for emergency situations. It may only be granted by the SOC for near-real-time commands originating from a given instrument or a given set of instruments. It may even be a single-user mode where all commanding activities for all other instruments are stopped.

2) Normal Priority. This is the normal level of priority for near-real-time commanding. However, ECS provides several levels within the normal priority (instruments can be prioritized on an individual basis). These levels will be negotiated by the instrument teams during the daily planning meeting, but they can be changed at any time by the SOC. This will allow the instrumenters to control, and modify when needed, the allocation of relative priorities regarding near-real-time commanding.

Delayed and Background-Queue Commanding

All delayed commanding data is assigned a lower priority for transmission to the SMOCC. Within the SMOCC, delayed commands are guaranteed an uplink time. Background-queue commands are assigned the lowest priority level and are only transmitted when the uplink channel is free.

2.3 TELEMETRY DISTRIBUTION

ECS receives, archives and distributes real-time telemetry data (house-keeping, science and MDI-M data) to the resident instrumenters. ECS receives and archives tape recorder playback data.

2.3.1 REAL-TIME TELEMETRY DISTRIBUTION

The real-time telemetry data is comprised of housekeeping and science data (VC0 and VC1), as well as MDI-M data (VC2). ECS receives that data from the Information Processing Division (IPD) Packet Processor (PACOR) as a stream of packets identified by an Application Process Identifier (APID). ECS distributes these packets in real-time to the IWSs.

During a given real-time pass, the IWSs request the APIDs they wish to receive, each APID being requested individually. An IWS may request more than one APID for simultaneous distribution (for example, housekeeping and science from different sources). A given IWS is not limited to telemetry from the instrument it primarily controls, and it may request telemetry from other instruments. The maximum number of APIDs that may be requested simultaneously depends on the system capacity and utilization: if during the pass, the requests for telemetry distribution exceed the system capacity, the instrumenters will have to negotiate and modify the distribution scheme.
The IWSs receive the telemetry packets they requested in individual messages, one packet per message. PACOR provides quality and accounting information associated with each packet. The instrumenters may select to either receive or not receive this information on a session basis. Under normal conditions, ECS will stop distributing the telemetry to a given IWS either following an interrupt-packet-transfer message from that IWS, or at the end of the real-time pass.

2.3.2 ARCHIVED TELEMETRY DATA

The telemetry data archived within ECS consists of all VC0, VC1 and VC2 packets received either as real-time telemetry or as quicklook data, including the tape recorder dumps and retransmissions of real-time telemetry in the case of a transmission loss. The archived telemetry data are sorted by APID and by time: each file contains approximately 2 hours worth of data for a single APID. The tape recorder dump data are available to the instrumenters at ECS within approximately 2 hours of downlink. The telemetry data are kept on-line for 7 days and off-line for 21 days.

The archived telemetry data are organized among several system directories and specific naming conventions are used. That data may be retrieved by the instrumenters via file transfer. To access the data, the instrumenters utilize the telemetry file naming conventions and search the system directory. They may also submit to the SOC a request to receive the telemetry data for a given set of APIDs and ECS will automatically send the requested data via FTP as soon as the files are available.

2.4 MISSION SUPPORT DATA

2.4.1 SUMMARY DATA

These data provide a synopsis of solar conditions and SOHO science programs. They include three classes of data: images from the imaging instruments, parameters from non-imaging instruments, and a list of observation programs which is information extracted from the As-run database. Table 2.2 describes the various components of the summary data.

Table 2.2. SOHO Summary Data.

Instrument	Images	Key Parameters	Observation Program
GOLF		X	X
VIRGO		X	X
MDI	X		X
SUMER	X		X
CDS	X		X
EIT	X		X
UVCS	X		X
LASCO	X		X
SWAN		X	X
CELIAS		X (CDHF)	X
CEPAC		X (CDHF)	X

MDI, EIT, UVCS and LASCO are expected to provide ECS with daily images. SUMER and CDS are also expected to provide images, but possibly not on a daily basis. Key parameters will be calculated for CELIAS and CEPAC by CDHF, and will be kept on-line in that facility. Parameters are expected to be provided to the SOC in the ECS by GOLF, VIRGO, and SWAN. A daily observation program report will be compiled by the SOC based on input from the instrumenters (see As-run database).

The average size of the instrumenter input to the summary data is 20 Mbytes per day. ECS stores these data (images, instrumenter-generated parameters, and observation program report) for on-line access by the instrumenters for 28 days. Input to the summary data is submitted to ECS by the individual instrumenters. Under the control of the SOC, it is merged and stored in the ECS where the instrumenters can access it. Once all the instrumenter input has been received and approved, the SOC transmits the daily summary data to CDHF.

2.4.2 PREDICTIVE AND DEFINITIVE ORBIT DATA

The orbit data describes the translational motion of the spacecraft relative to an inertial reference system. Definitive orbit refers to the measured past translational motion of the spacecraft; predictive orbit refers to the calculated future translational motion of the spacecraft. That data consists of a series of state vectors describing the position and velocity of the spacecraft at 10-minute intervals. The orbital data is generated weekly or biweekly by FDF, sent electronically to CDHF and forwarded to EOF. The definitive data describes the previous week (7 days), and the predicted data refers to the upcoming 5 weeks (42 days). ECS stores 5 weeks of predictive and 28 days of definitive orbit data on-line. With 10-minute intervals between data points, the average daily volume of orbit data is on the order of 1.0 MB.

2.4.3 DEFINITIVE ATTITUDE DATA

Definitive attitude data describes the past rotational motion and pointing stability of the spacecraft relative to an inertial reference system. It contains pitch and yaw offsets from Sun-center, and roll angle offset from the projection of the Sun north pole.

Two attitude products are available in the EOF:

- the "full-time resolution" data contains pitch and yaw values at 10 samples per seconds and roll values at one sample per second.
- the "definitive attitude" data contains pitch, yaw and roll values averaged over 10-minute intervals.

The attitude data is generated by CDHF and forwarded to the EOF. ECS stores 28 days of attitude data.

2.4.4 COMMAND HISTORY

This data is provided by the SMOCC and contains a time-ordered list of POCC activities and all the command groups uplinked to the spacecraft during a given operational day. This is a fixed-format report, where each entry contains a time field and a description of the activity. Instrument commanding activities are keyed by instrument name and command group ID uniquely identifying each command group. CMS will append to that report activities that are specific to the CMS, such as the background queue processing.

2.4.5 SYNOPTIC DATA

This data is comprised of images and science reports obtained from other missions and other observatories. It is presently estimated that ECS would receive approximately 50 Mbytes per day of solar-related data for planning purpose. It is obtained by the SOC, and stored for 7 days within the ECS, for access by the instrumenters.

2.4.6 TIME CORRELATION LOG

This information describes the on-board clock drift rates and resets. This data is created from information received from the SMOCC in the command history report. It will be kept within the ECS in a data set containing the times and description of procedures run in the POCC affecting the spacecraft clock.

2.4.7 PROJECT DATA BASE

The PDB is maintained by the POCC. ECS will obtain the original version of the PDB from the POCC. Later on, when new versions of the PDB are issued, the POCC distributes the entire updated PDB to the interested entities.

The POCC provides the PDB to the ECS via tape or possibly electronically, as a series of ASCII files. ECS will make these files available for the instrumenters to retrieve them via file transfer. These files are in the format provided by the POCC, that is the format defined in the Data Format Control Document (DFCD) which is produced by the POCC (reference 14). ECS does not modify or reformat them. An E-mail message will inform the instrumenters of the reception of a new PDB.

2.4.8 PROJECT DATA BASE UPDATE REQUESTS

When instrumenters need to request an update to the existing PDB (for example modification of command or telemetry parameter definitions), they must send an E-mail message to the FOT operator describing the desired change. FOT will approve or reject this request. If accepted, it will be incorporated into the operational data base which is the POCC working copy of the PDB. Recreating an operational data base is usually a cumbersome process and is done infrequently. Changes to the PDB require approval by the Configuration Control Board and there may be a rather long delay between the time a PDB update is requested by an instrumenter and the time it is actually implemented.

2.4.9 SOHO DAILY REPORT

FOT sends this report to ECS via E-mail, typically within 24 hours of the operational day being reported. It gives a high level status of the spacecraft and each instrument (ON / OFF) for that day. The report provides descriptions and times of anomalies or contingencies in the spacecraft or any instrument. The SOHO Daily Report contains the times of any unrecoverable data gaps. It will be stored in one file per operational day, each file being uniquely named for that calendar day. It will remain available on-line in the EOF for the most recent 30 days. It is also transmitted electronically to CDHF where it is stored on-line for 30 days for access by remote instrumenters and other interested researchers. The SOHO Daily Report will be included by DDF in the distribution data on hard media.

2.4.10 TIME SERVICES

The ECS will obtain the Universal Time using the Network Time Protocol (NTP). The ECS system clocks will be synchronized to that time to allow for uniform time tagging. Using the appropriate utilities on their own systems, the instrumenters will be able to access that time service and synchronize their own system clocks.

2.4.11 DISPLAYS

Two main types of displays are made available to the instrumenters:

1) Commanding Status and Telemetry Distribution Monitoring displays. These displays are primarily designed and implemented to support the SOC with ECS monitoring functions. They are made available to the EOF-resident instrument teams that have X.11 capabilities. ECS will make available to the instrumenters ANSI C code to support these displays on their workstations. The format and general content of these displays are provided in Appendix B.

2) POCC Telemetry Displays. Two POCC terminals will be located in the EOF. POCC telemetry pages will be displayed on these terminals for viewing by the instrumenters within the EOF.

2.5 PLANNING PROCESS OVERVIEW

The planning process enables the instrumenters to incorporate their science activities with pre-existing constraints such as DSN contacts or commanding time slots reserved by the FOT for special spacecraft activities. Planning can be done on a quarterly, monthly, weekly or daily basis. The long term planning is mainly based on science programs, whereas the shorter term planning is more detailed and incorporates DSN schedules and FOT planned activities.

In order to initially set-up the planning process, a set of activities needs to be defined. The definition of activities also includes specifying associated priorities and scheduling strategies. For the shorter term planning (monthly or less), the instrumenters are expected to submit their activity requests to ECS who merges them. ECS identifies and resolves conflicts when possible. If conflicts remain, the instrumenters are notified, and they should modify and resubmit their requests. This process is repeated until all conflicts are solved. The final conflict-free plan is referred to as the schedule.

2.5.1 ECS ACTIVITY PLAN

The ECS Activity Plan (EAP) consists of a list of activity requests or notifications. The following is provided to the instrumenters as part of the activity plan:

1) DSN Contacts. This provides DSN contact start and end times, and the associated ground station. This information is incorporated into the activity plan as soon as the ECS receives it from the SMOCC. Each transmission covers one week of confirmed schedule and up to 3 weeks of forecast and FDF predicts schedule. Long-term predictions may be incorporated if and when available. This information is transmitted by the SMOCC every week on a fixed day, 3 days before the start of the confirmed week.

2) FOT-controlled Events. This indicates the start and end times of events and activities controlled by the FOT. For instance, it includes time windows for planned near-real-time commanding and time windows reserved by the FOT for special activities such as spacecraft commanding, maneuvers and instrument maintenance. It also provides start and end times for events such as tape recorder dumps, MDI-M transmission to the EOF and planned telemetry modes.

3) Reserved Times for Activities Coordinated with Other Observatories. This indicates the start and stop times of science programs and special campaign activities.

2.5.2 INSTRUMENTERS INPUT TO THE ACTIVITY PLAN

The Instrumenters Input to the Activity Plan (IAP) consists of a list of statements, each statement defining a specific activity request or notification. These statements may be classified as follows.

1) Science Plan and Program Notifications. The Science Plan entries describe the planned science plans, their goals and objectives. They specify the first level of science planning information, i.e. the overall plan as developed during the monthly or weekly science planning meetings and refined during the daily meetings. The Science Program entries describe the specific programs that each instrument team would run to satisfy the scientific objectives of the corresponding Science Plan: for each Plan entry, there will be a sequence of Program entries that represent the details of the Science Plan.

2) Notification for Special Activities. This is used to indicate when an instrument will perform an activity that may affect the operation of other instruments. This will include requests for near-real-time commanding for a specified period of time, requests for a reserved time slot for near-real-time commanding for a given instrument, or uplink window for a group of delayed commands. It may also include notifications of planned execution of STOL procedures and maneuvers that may cause vibrations and affect the overall pointing stability of the spacecraft.

3) Instrument Mode Change Notifications. Examples of possible requests are:

- Change in telemetry sub-modes
- Change in the inter-instrument flag configuration
- Change in instrument mode of operation (specific to each instrument).

Specific requests may be defined by the instrument teams for activities which are of interest to or affect the operation of other instruments.

2.5.3 AS-RUN DATABASE

This information is provided by the instrumenters to the ECS. It describes the science programs that were actually executed on the previous day. It is electronically transferred to the ECS as ASCII files and the SOC is responsible for incorporating it into the Summary Data that will be sent to the CDHF for later distribution to the instrument teams. The design and implementation of the As-run database are not the responsibility of the ECS development task and further details on the nature and format of that data are not included in this ICD.

SECTION 3 - DATA FORMAT SPECIFICATION

3.1 GENERAL DATA FORMAT SPECIFICATION

3.1.1 ECS MESSAGES

This section describes various messages exchanged between the ECS and the instrumenters as data streams over sockets.

3.1.1.1 General Format of an ECS Message.

A message exchanged over the ECS/IWS interface consists of a 4-byte standard header followed by a data field of variable length as illustrated in Table 3.1.

Table 3.1. General ECS Message Format.

Field	Bytes	Description
Type/Message ID	2	Standard Header
Length	2	
User data dependent on the message type.	variable	Data field

The standard header is comprised of a 2-byte "type field" followed by a 2-byte length field.

(1) The 2-byte type field is defined as:
first byte is
X'01' for messages to control a communication session
X'02' for messages related to telemetry distribution
X'03' for messages related to telecommanding
X'04' for informational messages
second byte identifies the messages within these 4 categories.

(2) The 2-byte length field contains the length in bytes of the message that follows, excluding the 4-byte standard header.

The data field is specific to each type of message and is of variable length.

3.1.1.2 ECS Messages Description.

As much as possible, the ECS/instrumenters functional protocol was kept similar to the protocol implemented between CCS and the Experiment Ground Support Equipment (EGSE) in the AIV environment. Modifications were necessary to apply the AIV protocol to the operational environment, mainly to support the commanding functions. Also, a bi-directional Informational message has been added. Table 3.2. defines the messages used within the EOF.

Table 3.2. ECS Messages.

Message Name	Direction	Standard Header		Data Field	
		Type	Length	Bytes	Description
Session Init	ECS to IWS	X'0101'	X'0004'	Int 4	Endian check block data
Session Init Response	IWS to ECS	X'0102'	X'0015'	ASCII 16 Int 1 Int 4	ORIG_ID Endian check result Endian check block data
Session End	ECS to IWS	X'0103'	X'0001'	Int 1	Reason code
NRT Command	IWS to ECS	X'0301'	var	Int 2 ASCII 6 ASCII var	Request ID Instrument name Command data
Response to NRT Command	ECS to IWS	X'0302'	var	Int 2 ASCII 6 Int 2 Int 2 ASCII var	Request ID Instrument name Response code Reason code Response to command (text)
NRT Command Authority Request	IWS to ECS	X'0303'	X'000A'	Int 2 ASCII 6 Int 2	Request ID Instrument name Request code
NRT Authority Status	ECS to IWS	X'0304'	var	Int 2 ASCII 6 Int 2 ASCII var	Request ID Instrument name Status code Status description (text)
Remote Command Request	IWS to ECS	X'0305'	var	Int 2 ASCII 6 ASCII 20 ASCII var	Request ID Instrument name PCS name Instructions/Comments
Remote Procedure Request	IWS to ECS	X'0306'	var	Int 2 ASCII 6 ASCII 20 ASCII var	Request ID Instrument name STOL Procedure name Instructions/Comments
TM Packet Distribution Request	IWS to ECS	X'0201'	var: X'0005' or X'0006'	Int 1 Int 2 Int 2 Int 1	Spacecraft ID APID Request ID Optional: Q&A capsule Flag
TM Packet Distribution Response	ECS to IWS	X'0202'	X'0004'	Int 2 Int 1 Int 1	Request ID corresponding to Request Response Code Reason Code
Start of TM Packet Distribution	ECS to IWS	X'0203'	X'0005'	Int 1 Int 2 Int 2	Spacecraft ID APID Request ID
Telemetry Packet	ECS to IWS	X'0204'	var	Int 2 Binary 6 bytes	Request ID TM source packet Q&A capsule
Interrupt TM packet transfer	IWS to ECS	X'0205'	X'0002'	Int 2	Request ID
End of TM Packet Transfer	ECS to IWS	X'0206'	X'0003'	Int 2 Int 1	Request ID Status code
Informational Message	ECS to IWS IWS to ECS	X'0400'	var	ASCII var	Free form text

3.1.2 ECS FILES

Files exchanged between the ECS and the instrumenters have a standard transfer format consisting of a file header followed by a file body. The file header uses keywords to provide information about the file and is in the general format "KEYWORD = value". Each Keyword is followed by '=' and each record is ended by a New Line (X'0A'). The file body contains ASCII character data that is specific to each type of data contained in the file. See Appendix B for examples of file formats.

3.1.2.1 System Directory Organization for Files

The ECS files are organized among various system directories, one directory being provided for each type of file, and sub-directories being provided as needed in each case. The ECS main system directories for the data exchanged with the instrumenters are listed and described in Appendix B.

3.1.2.2 File Naming Conventions

Each file is referenced by a unique name representative of the type of data it contains. Several file naming schemes are necessary in the EOF to better describe the data contained within each file or to satisfy already existing naming conventions with other ECS external interfaces. The specific conventions are described in Appendix A.

3.1.2.3 File Header Format

All file headers described in this document have the same general format: a series of records of ASCII characters, each record being of the form "KEYWORD = value", the last character being a New Line (NL).

3.1.3 TIME FIELD FORMAT

All time fields, unless specified otherwise in individual cases, will contain both the date and time in a single 19 character format as follows:

YYYY/MM/DD HH:MM:SS
where:
YYYY/MM/DD is the date:
YYYY represents the year (for example 1995)
MM represents the month (01 for January to 12 for December)
DD represents the day of the month (01 to 31)
HH:MM:SS is the time:
HH represents the hours (00 to 23)
MM represents the minutes (00 to 59)
SS represents the seconds (00 to 59)
The date and time fields are separated by an ASCII blank.

Except where specifically mentioned otherwise, all times mentioned in this document are in reference to GMT.

3.1.4 INSTRUMENT NAME FIELD FORMAT

Unless specified otherwise, all fields specifying the Instrument name are 6 ASCII characters in length, and must be one of the following, left-justified and padded with ASCII blanks if necessary:

CDS
CELIAS
CEPAC
EIT
GOLF
LASCO
MDI
SUMER
SWAN
UVCS
VIRGO

3.2 COMMANDING DATA SPECIFICATION

3.2.1 OBDH BLOCK COMMAND

The routing and formatting of the command data from the instrumenters to the spacecraft is illustrated in figure 3.1. The basic unit of command input provided by an instrumenter is an OBDH block command as illustrated in figure 3.2. Each OBDH block command consists of a series of 16-bit words of data as follows:

- one word representing the block header
- up to 30 words of data
- one word containing the checksum of the preceding words (header and data).

The block header is 16 bits long and of the form:

XXYYYYZZZZZLLLLL

where:

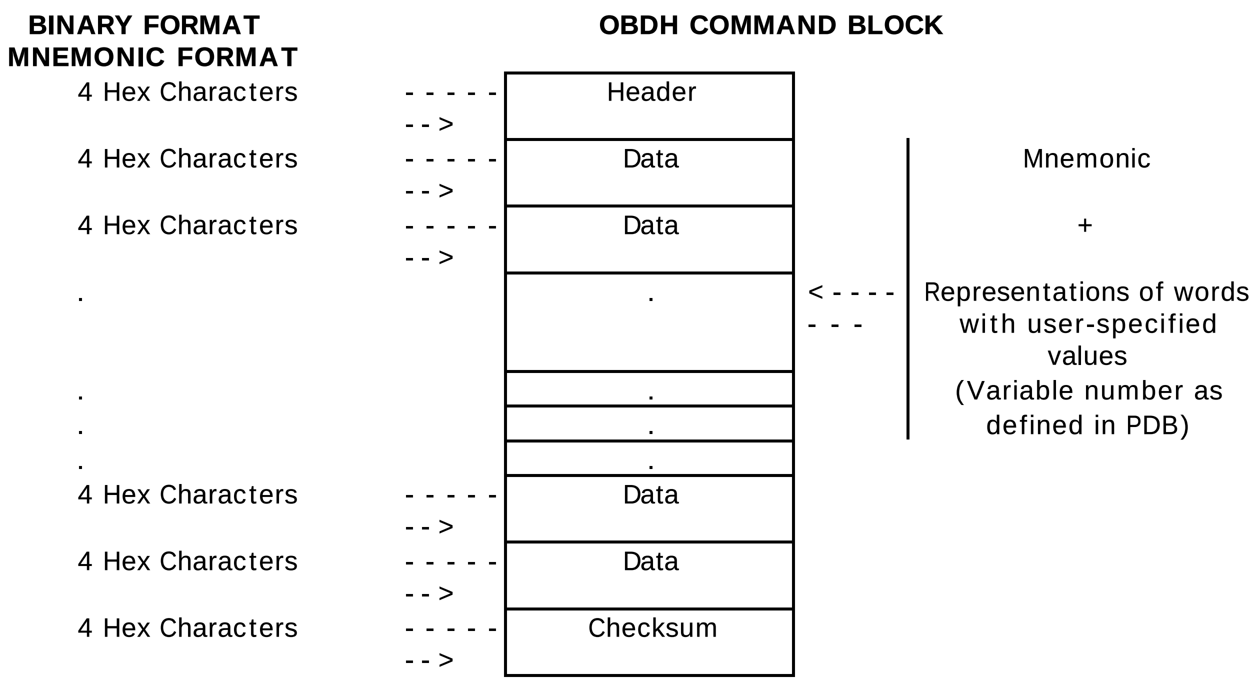
XX	bits 0 and 1	Reserved	
YYYY	bits 2 through 5	Destination address	
		0100 for CDS	0101 for CELIAS
		0110 for CEPAC	0111 for EIT
		1000 for GOLF	1001 for LASCO
		1010 for MDI	1011 for SUMER
		1100 for SWAN	1101 for UVCS
		1110 for VIRGO	
ZZZZZ	bits 6 through 10	Command identifier	
LLLLL	bits 11 through 15	Block length (1 to 31): number of 16-bit words in the block, excluding the checksum.	

3.2.2 INSTRUMENT COMMAND INPUT

The method and format for submitting instrument commands described in this section are based on the following understanding:

Figure 3.1. SOHO Command Formatting.

REPRESENTATION OF AN OBDH BLOCK COMMAND



Mnemonic representation:

```
MNEMO1,0x77AF;     /* one parameter in hexadecimal */
MNEMO1,123;        /* one parameter in decimal */
MNEMO1,0777;       /* one parameter in octal */
```

Binary representation:

```
BINARY 0x1203,0x2401,0x77AF,0xADB3;   /* Only hexadecimal allowed */
```

Figure 3.2. Instrumenters Command Specification.

- The instrumenters can only use OBDH block commands when commanding their instruments through the ECS. However this does not apply to VIRGO.

- A mnemonic for an instrument command uniquely defines a single OBDH block command.

- For each such mnemonic, the PDB provides the binary equivalent of the OBDH block command header (including destination address, command identifier and number of data words associated with this command).

- For each mnemonic, the PDB also provides the binary equivalent of each 16-bit data word in the OBDH block command. Some data words may contain variable bits that the user must specify. These parameters specifications can be done using ASCII characters representing their decimal, octal or hexadecimal value.

The content of an OBDH block command may be represented in one of two general formats: binary format and mnemonic format as described in the following sections. Note that a procedural language such as STOL or ELISA is not used in the EOF.

3.2.2.1 Binary Format

In the binary format, the commanding data consist of a series of ASCII hexadecimal representations of all the 16-bit binary words contained in one OBDH block command including header and checksum:

1) The keyword "BINARY" indicates the start of an OBDH block command. It must be in upper case.

2) The content of an OBDH block command is represented as a series of up to 32 4-character hexadecimal words:
   - The first hexadecimal word represents the 16-bit OBDH block header.
   - The following words represent up to 30 16-bit data words.
   - The last word represents the 16-bit checksum of the header and data words.

3) Hexadecimal words are separated by a comma.

4) The end of the OBDH block command is indicated by a semicolon.

5) Comments in the form "/* text */" are allowed after the semicolon.

Example: BINARY 0x1203,0x2401,0x77AF,0xADB3; /* optional comment */

3.2.2.2 Mnemonic Format

Each mnemonic specification defines a single OBDH block command. It consists of a mnemonic optionally followed by ASCII representations of the data words which have been defined as user-specified in the PDB.

1) The mnemonic is followed by up to 30 user-specified parameters. The mnemonic must be defined in the telecommand description files of the PDB and the number of user-specified parameters must correspond to the number of user-defined values defined in the PDB. All command mnemonics must be specified in upper-case characters to conform to the PDB definition.

The user-specified 16-bit words are defined using ASCII character representations:

hexadecimal:	0xhhhh	'0x' followed by hexadecimal digits
octal:	0oooooo	'0' followed by octal digits without leading zeros
decimal:	ddddd	decimal digits without leading zeros

2) The representation of data words are separated by a comma.

3) The end of the command specification (mnemonic and optional data words) is indicated by a semicolon.

4) Comments in the form "/* text */" are allowed after the semicolon.

Examples:

```
CBEFILI,0x77AF;     /* in this command, only one word has user-defined values */
CBEFILI,073657;     /* same command using octal representation */
CBEFILI,30639;      /* same command using decimal representation */
```

Note: The checksum is not provided by the instrumenters in the case of the mnemonic format. It will be calculated by the CMS.

3.2.3. NEAR-REAL-TIME COMMANDING DATA SPECIFICATION _

The general format of the messages exchanged over the interface is defined in section 3.1.1. These messages all contain a 4-byte standard header followed by a data field. This section defines the specific functions and the content of the data field for the messages exchanged for near-real-time commanding.

3.2.3.1 Session-Init (ECS to IWS). This message is used to initiate a communication session between the ECS and a given IWS.

Data field content:

Integer*4	Endian check block data X'01020304' used to insure that the data transmitted by the ECS will correctly be interpreted by the IWS. The ECS uses the big endian format.

3.2.3.2 Session-Init-Response (IWS to ECS). This message is used to acknowledge a Session-Init message and to identify the entity with which the session is established.

Data field content:

Character*16	IWS Identification padded with ASCII blanks.
Integer*1	Endian check result indicating whether the endian check block included in the session-init message was correctly interpreted by the IWS: X'00': successful X'01': unsuccessful If the check is not successful, ECS will consequently terminate the session.
Integer*4	Endian check block data X'01020304' used to insure that the data transmitted by the IWS is compatible with the endian characteristics of ECS.

3.2.3.3 Session-End (ECS and IWS). This message is used to terminate a session, either immediately after the reception of a Session-Init-Response if a problem was found or to end an on-going session.

Data field content:

Integer*1	Reason Code X'00': normal end X'01': invalid ORIG_ID (IWS identification in Session-Init-Response) X'02': endian check error X'03': unsuccessful session-init-response or no Session-Init-Response received X'04': error reading/writing to socket

X'05': invalid IWS message received
X'06': lost connection to CMS

3.2.3.4 NRT-Command (IWS to ECS). This message is used to transfer the near-real-time command data. The message data field for a near-real-time command message is illustrated in Table 3.3.

Data field content:

Integer*2	Request ID generated by the IWS to uniquely identify this command message. ECS and SMOCC use the combination "instrument/request ID" to uniquely identify all NRT-Command messages and NRT-Command-Authority-Request messages. ECS uses the value X'FFFF' for special purposes (see section 3.2.3.7)
Character*6	Instrument name
Character var	The command data as defined in section 3.2.2. Each message will contain one and only one OBDH block command definition, that is one mnemonic definition or one "BINARY" keyword.

Table 3.3. Near-Real-Time Command Message Format

Field	Bytes	Description
Standard Header	4	Type (X'0301') and length
Request ID	2	2-Byte integer uniquely identifying this message
Instrument Name	6	Instrument commanded
Command data	var	Command data in mnemonic or binary format. See Section 3.2.2

3.2.3.5 Response-to-NRT-Command (ECS to IWS). This message is used to answer a NRT-Command message. There is one response for each NRT-Command message to indicate its processing status. If an error is detected either by the ECS, the CMS or the POCC, the Response-to-NRT-Command is sent immediately back to the IWS currently commanding the instrument, with a description of the error. Otherwise, an OK status will be sent once the successful uplink status is received from the POCC. This may represent a few seconds delay between the reception of the NRT-command and the response.

Data field content:

Integer*2	Request ID identical to the request ID in the corresponding NRT message.
Character*6	Instrument name
Integer*2	Response Code 00 NRT command message OK 01 NRT command message was rejected
Integer*2	Reason Code (see table 3.4)
Character var	Text explaining reason code (see table 3.4). Also indicates if the instrument error flag has been set, resulting in the need for an instrument reset (described in section 3.2.3.6).

Table 3.4. Response-to-NRT-Command Format Definition

Response Code	Reason Code	Reason Text
01	1	Rejected- throughput mode is disabled (ERROR FLAG SET)
01	2	Rejected - syntax error found in this command group (ERROR FLAG SET)
01	3	Rejected - mnemonic not found in PDB (ERROR FLAG SET)

01	4	Rejected - format error found in message received (ERROR FLAG SET)
01	5	Rejected - duplicate request ID for this instrument (ERROR FLAG SET)
01	6	Rejected - binary format disallowed for this instrument (ERROR FLAG SET)
01	7	Rejected- reserved time commanding in progress
01	8	Rejected - message received had invalid message type
01	9	Rejected - invalid instrument for this socket (ERROR FLAG SET)
01	10	Rejected- start command request not received for instrument
01	11	Rejected- instrument disabled by FOT or previous error
01	12	Uplink failed BARM verification (ERROR FLAG SET)
01	13	Uplink failed - NASCOM link is down (ERROR FLAG SET)
01	14	RCR rejected - RCR processing disabled (ERROR FLAG SET)
01	15	RCR rejected - was not on the approved list (ERROR FLAG SET)
01	16	RPR rejected - STOL procedure not found (ERROR FLAG SET)
01	17	Rejected - invalid first character in name (ERROR FLAG SET)
01	18	RCR terminated - contained invalid command (ERROR FLAG SET)
01	19	RCR terminated - contained critical command (ERROR FLAG SET)
01	20	RCR rejected - not found (ERROR FLAG SET)
00	0	OK - command group successfully uplinked
00	- 1	OK - command group uplinked without BARM verification
00	- 2	RPR notify - FOT has been notified to start the requested RPR

The Response-to-NRT-Command is also used to notify an instrumenter of the processing status of RCRs and RPRs. This message may indicate one of the following:

- the request was rejected
- the FOT has been notified to start the requested procedure
- the uplink status of the requested PCS

For RPR's, the final status is not systematically made available by the POCC and will not be sent to the instrumenters via this message. An informational message defined between the instrumenters and the FOT may be incorporated into the procedure itself.

Data field content for RPR's and RCR's:

Integer*2	Request ID as provided by instrumenter in the RPR or RCR message.
Character*6	Instrument name
Integer*2	Response Code 00 RPR/RCR message OK 01 RPR/RCR message was rejected
Integer*2	Reason Code (see table 3.4)
Character var	Text explaining reason code (see table 3.4). Also indicates if the instrument error flag has been set, resulting in the need for an instrument reset (described in section 3.2.3.6).

3.2.3.6 **<u>NRT-Command-Authority-Request</u> (IWS to ECS)**. This message identifies the commanding functions to be performed by a given IWS. It allows the ECS to verify that only one IWS is commanding a given instrument at a given time. This message can be used to start commanding, to stop commanding, or to reset commanding after an error for an instrument.

Data field content:

Integer*2	Request ID generated by the IWS to uniquely identify this message.
Character*6	Instrument name. ECS and SMOCC use the combination "instrument/request ID" to uniquely identify all NRT-Command messages and NRT-Command-Authority-Request messages. ECS uses the value X'FFFF' for special purposes (see NRT-Authority-Status messages, section 3.2.3.7).

Integer*2 Request code (see table 3.5)

Table 3.5. NRT-Command Authority Request Format Definition

Request Code	Description Text
00	Start commanding the instrument specified
01	Stop commanding the instrument specified
02	Reset after error: commanding for this instrument to restart with the near-real-time command message immediately following.

3.2.3.7 <u>NRT-Authority-Status</u> (ECS to IWS). This message is used to respond to a NRT-Command-Authority-Request, or to notify an IWS of changes affecting the commanding session. The possible values for the status code transmitted via this message are defined in table 3.6.

Data field content:

Integer*2	Request ID corresponding to ID in NRT-Command-Authority-Request, when applicable. ECS will use a fixed value of X'FFFF' for status codes 3, 5, 6, 7, 8, 9, 10, and 11.
Character*6	Instrument name
Integer*2	Status code (see table 3.6)
Character var	Text explaining status code (see table 3.6)

Table 3.6. NRT-Authority-Status Format Definition

Status Code	Description Text
- 1	Command Authority Request denied - duplicate request ID (ERROR FLAG SET)
- 2	Start commanding request denied - instrument already commanded
- 3	Command Authority Request denied - instrument specified incorrect (ERROR FLAG SET)
- 4	Start commanding request denied - session not properly established (incorrect Session-Init response)

Table 3.6. NRT-Authority-Status Format Definition (Cont.)

- 5	Command Authority Request denied - IWS not currently commanding instrument specified
- 6	Reset denied - instrument not in error
1	Start commanding request granted
2	Stop commanding request granted
3	Received SOC request to cancel this session (1)
4	Reset accepted
5	Throughput mode status = enabled / RCRs allowed (1) (2)
6	Throughput mode status = enabled / RCRs disallowed (1) (2)
7	Throughput mode status = disabled (1) (2)
8	Throughput mode status = paused (1) (2)
9	Warning: Throughput mode shutdown soon (1) (2)
10	Reserved time commanding has ended (1) (2)
11	Warning: reserved time commanding will begin soon (1) (2)
12	Reserved time commanding now in effect for this session (1)
13	Reserved time commanding no longer in effect for this session (1)

(1) Request ID is not applicable and will have a fixed value of X'FFFF'
(2) Message sent to all IWSs with open commanding sessions

3.2.3.8 Remote Command Request and Remote Procedure Request (IWS to ECS).

For RCRs, the message data field identifies the name of a Predefined Command Sequence (PCS); For RPRs, the message data field identifies the name of a STOL procedure.

Data field content:

Integer*2	Request ID generated by the IWS to uniquely identify this message.
Character*6	Instrument name
Character*20	The name of the predefined command sequence or the STOL procedure, in lower case characters, left-justified and padded with ASCII blanks if necessary. The first character of the name must be as follows: c for CDS f for CELIAS h for CEPAC e for EIT g for GOLF l for LASCO m for MDI s for SUMER n for SWAN u for UVCS v for VIRGO
Character var	Comments and execution instructions in the form /* text */, maximum of 256 characters, are allowed for RPRs.

3.2.3.9 Informational Message (Bi-directional).

This message is supplied for the exchange of free text between the ECS and the IWSs. For instance, it will be used by ECS to provide execution status for RPRs. The SMOCC passes an informational message to ECS that contains a text defined between the instrumenters and the FOT as part of the definition of the STOL procedures. ECS will forward that message to the IWS currently commanding the instrument.

Data field content:

Character var ASCII Free text (maximum of 256 characters)

3.2.4 DELAYED COMMANDING DATA SPECIFICATION

The delayed commanding data is received by the ECS as files. Each file is comprised of a file header followed by a file body that contains the command data as specified in section 3.2.2. The maximum number of OBDH block commands that can be included in a single delayed command file is 1000. If this number is exceeded, ECS will reject the file and indicate so in the command validation report. The file header is described in Table 3.7. It specifies the earliest and latest uplink times.

Table 3.7. File Header Format for Delayed Commanding.

KEYWORD	DESCRIPTION
DATATYPE	"DELAYED"
FILENAME	Name of this file: iiicccccccccc.DEL (see Appendix A)
INSTRUME	Instrument (full name) being commanded
ORIG_ID	ID of originating entity (IWS ID or remote host). No embedded blanks allowed.
OBSERVER	Person who generated this file
DATE_CRE	Date file was created YYYY/MM/DD HH:MM:SS (GMT)
NUM_CMDS	Number of commands (OBDH Block commands) in this file.
EARLIEST	Earliest uplink time YYYY/MM/DD HH:MM:SS (GMT)
LATEST	Latest uplink time YYYY/MM/DD HH:MM:SS (GMT)
COMMENT	Free text. May contain special instructions (i.e., contingency, end-item verification, etc...). This keyword may be repeated to allow several comment lines
END	

3.2.5 BACKGROUND-QUEUE COMMANDING DATA SPECIFICATION

The file header is defined in Table 3.8. It specifies the total number of commands contained in the file and an optional uplink window. The uplink window may be specified when it is critical to uplink the data by a given time. However, SMOCC does not guarantee uplink within that window and would only reject the data that has not yet been uplinked by the specified latest uplink time. In most cases the window will not be specified, and the data will be uplinked whenever possible.

The file body contains the commanding data which consists of a series of command specifications either in binary format or mnemonic format as specified in section 3.2.2. The command data, once expanded into the binary form of OBDH block commands, should be less than 0.5 Kbytes in length.

Table 3.8. File Header Format for Background-Queue Commanding.

KEYWORD	DESCRIPTION
DATATYPE	"BACKGROUND"
FILENAME	Name of this file: iiicccccccccc.BCK (see Appendix A)
INSTRUME	Instrument being commanded
ORIG_ID	ID of originating entity (IWS ID or remote host). No embedded blanks allowed.
OBSERVER	Person who generated this file
DATE_CRE	Date file was created YYYY/MM/DD HH:MM:SS (GMT)
NUM_CMDS	Number of commands (OBDH Block commands) in this file.
EARLIEST	Optional. Earliest uplink time YYYY/MM/DD HH:MM:SS (GMT)
LATEST	Optional. Latest uplink time YYYY/MM/DD HH:MM:SS (GMT)
COMMENT	Free text. May contain special instructions (i.e., contingency, end-item verification , etc...). This keyword may be repeated to allow several comment lines
END	

3.2.6 COMMAND VALIDATION REPORTS

These reports are generated by the CMS as soon as CMS receives and processes a delayed command group or a background-queue command group. They contain an echo of the original commanding data: list of mnemonics or binary specification, and error messages when applicable. There will be one validation report for each group (one uniquely named file) of delayed or background-queue commanding data generated by the instrumenters.

Table 3.9. File Header Format for Command Validation Reports.

KEYWORD	DESCRIPTION
DATATYPE	"COMMAND VALIDATION REPORT"
FILENAME	Name of this file: (see Appendix A) iiicccccccccc.DRP for Delayed command validation reports iiicccccccccc.BRP for Background queue validation reports
INSTRUME	Instrument commanded in original delayed or background command group
ORIGFILE	Filename of delayed/background command group this report applies to. iiicccccccccc.DEL or iiicccccccccc.BCK
DATE_CRE	Date this file was created YYYY/MM/DD HH:MM:SS (GMT)
NUM_CMDS	Number of commands (OBDH Block commands) covered in this report
COMMENT	Free text. This keyword may be repeated to allow several comment lines
END	

3.2.7 SPECIAL COMMANDING FOR THE VIRGO INSTRUMENT

The VIRGO instrument requires special commanding data specifications. At the present time, VIRGO sends time-tagged commands as delayed command files. These files are rejected by CMS as invalid and are then processed manually by the CMS operator. A final process to be used during operations still needs to be defined and accepted by CMS.

3.3 TELEMETRY DATA SPECIFICATION

3.3.1 REAL-TIME TELEMETRY

The general format of the messages exchanged over the interface was defined in section 3.1.1. They all contain a 4-byte standard header followed by a data field. This section defines the specific functions and the data field content of the messages exchanged for real-time telemetry distribution.

The Session-Init message (ECS to IWS), the Session-Init-Response message (IWS to ECS) and the Session-End messages (ECS and IWS) are identical to the messages used for NRT commanding, defined in section 3.2.3.

3.3.1.1 Telemetry-Packet-Distribution-Request (IWS to ECS). This message is used by an IWS to indicate what type of telemetry packets (i.e., what APID) it wants to receive. There must be one such message for every APID to be transmitted. This message contains an optional field that allows an instrumenter to choose to receive the Quality and Accounting capsule at the end of each telemetry packet for a given APID. If the flag is not specified, the Quality and Accounting capsule will not be provided at the end of the telemetry packets.

Data Field content:

- Integer*1 Spacecraft ID (X'00').
- Integer*2 APID to be received.
- Integer*2 Request ID: non-negative number generated by IWS to uniquely identify this telemetry exchange. It will be found in all the messages related to this TM distribution request.
- Integer*1 Optional: flag indicating if the Q&A capsule should be included (01) or omitted (00) after each telemetry packet for this APID for this telemetry exchange.

3.3.1.2 Telemetry-Packet-Distribution-Response (ECS to IWS). This message is used to indicate the result of the telemetry-packet-distribution-request:

Data Field content:

- Integer*2 Request ID corresponding to request ID in TM Packet Distribution Request message.
- Integer*1 Request Response Code
  - X'00' successful
  - X'01' unsuccessful
- Integer*1 Reason Code giving an explanation for success or failure
  - X'00' Success
  - X'01' Bad APID
  - X'02' APID already requested
  - X'03' Duplicate Request ID
  - X'04' Request ID in TM-packet-distribution-request is missing
  - X'05' TM data not available
  - X'06' ECS system capacity exceeded
  - X'07' to X'0F' other reasons

3.3.1.3 Start-of-Telemetry-Packet-Distribution (ECS to IWS). This message is used to indicate the start of telemetry transmission.

Data Field content:

- Integer*1 Spacecraft ID (X'00').
- Integer*2 APID of telemetry packets included in this distribution
- Integer*2 Request ID corresponding to request ID in TM Packet Distribution Request message.

3.3.1.4 Interrupt-Telemetry-Packet-Transfer (IWS to ECS). This message is used by an IWS to ask for immediate termination of the current telemetry transfer.

Data Field content:

Integer*2 Request ID corresponding to request ID in TM Packet Distribution Request message

3.3.1.5 End-of-Telemetry-Packet-Transfer (ECS to IWS). This message is sent by ECS to confirm the fact that the telemetry transfer is terminated. This may happen either upon receipt by ECS of an interrupt-telemetry-packet-transfer message, in the case of a system problem, or at the end of the real-time contact period.

Data Field content:

Integer*2 Request ID corresponding to request ID in TM Packet Distribution Request message

Integer*1 Status code

X'00' Canceled by IWS
X'01' Canceled by ECS
X'02' Telemetry transfer interrupted by PACOR
X'03' to X'0F' other reasons.

3.3.1.6 Telemetry-Packet (ECS to IWS). This message is used to transmit the real-time telemetry data, that is one complete telemetry source packet corresponding to the APID requested. Additional data may be included, such as the Quality and Accounting (Q&A) capsule. If requested by the receiving instrumenter in the Telemetry-Packet-Distribution-Request message, a 6-byte Q&A capsule will be appended to the end of each telemetry packet associated with this Request ID.

Data Field content:

Integer*2 Request ID corresponding to request ID in TM-Packet-Distribution-Request.

Binary data Telemetry data packet, including packet header as defined in table 3.10. Note that for some APIDs, the packets do not contain a time field.

Integer*6 (Optional, supplied only if requested in Telemetry-Packet-Distribution-Request) Real-time Q&A capsule, as provided by PACOR (see Reference 9) and defined in table 3.11.

Table 3.10. Telemetry Data Packet

PACKET HEADER							PACKET DATA FIELD	
Packet ID				Sequence Control		Packet length	Time field (OBT or LOBT)	Source data
Version No.	Packet type	Data field header flag	APID	Segment flags	Source sequence count			
3 bits	1 bit	1 bit	11 bits	2 bits	14 bits	16 bits	48 bits	variable
(2 bytes)				(2 bytes)		(2 bytes)	(6 bytes)	variable

Table 3.11. Real-Time Quality and Accounting Capsule

Field Name	Length	Description
Virtual Channel ID	1 byte	Virtual channel the packet was transmitted on
Data Type Flag	1 byte	PACOR uses each bit is a flag indicating the data type: 00010000 for real-time and 00001000 for test telemetry
Sequence Continuity Flag	1 byte	00 (hexadecimal) no sequence discontinuity 01 (hexadecimal) sequence discontinuity
Reed-Solomon Error Flag	1 byte	00 (hexadecimal) no Reed-Solomon correction 01 (hexadecimal) Reed-Solomon error corrected.
Data Fill Location	2 bytes	Location of the start of fill in the source data unit. A value of 0000 hex indicates there is no fill.

3.3.1.7 Informational Message (Bi-directional).

This message is supplied for the exchange of free text between the ECS and the IWSs. For instance, ECS sends an informational message to an IWS when a telemetry session is canceled by the ECS operator. ECS displays the informational messages it receives from the IWSs on the ECS event page.

Data field content:
Character var ASCII Free text (maximum of 256 characters)

3.3.2 ARCHIVED TELEMETRY DATA

The telemetry data is stored in the ECS for retrieval by the instrumenters. The archived telemetry is sorted by APID and by time. Each file contains approximately 2 hours of telemetry and contains a header followed by the file body. The telemetry data is organized among several system directories, one directory per APID. Under each directory, each file contains packets consecutively received by ECS for the given APID. The instrumenters can obtain the archived telemetry data via file transfer. In order to select the files they want to retrieve, the instrumenters will use the file naming conventions described in Appendix A or will formulate a standing request with the SOC to receive files corresponding to a given APID as soon as these files are available within ECS.

3.3.2.1 Archived Telemetry File Header.

Table 3.12 defines the format of the file header.

3.3.2.2 Archived Telemetry File Body.

The file body contains the telemetry packets followed by quality and accounting information as illustrated in table 3.13. The format of the file body is illustrated in Appendix C. It was kept as much as possible identical to the format of the production data as defined in the ICD between the SDPF and the SOHO Consumers (Reference 9).

Table 3.12. Archived Telemetry File Header

DATATYPE	"ARCHIVED REAL-TIME TELEMETRY" or "ARCHIVED RETRANSMITTED REAL-TIME TELEMETRY" or "ARCHIVED TAPE RECORDER DUMP TELEMETRY"
FILENAME	As defined in Appendix A
APID	APID of the telemetry packet (see Appendix A)
DATE_CRE	Date file was created by ECS YYYY/MM/DD HH:MM:SS (GMT)
NUM_PACK	Number of telemetry packets stored in this file
STARTIME	Start of period covered (Time stamp of first packet) YYYY/MM/DD HH:MM:SS when applicable. Othewise, time of reception by ECS of the first data packet.
ENDTIME	End of period covered (Time stamp of last packet) YYYY/MM/DD HH:MM:SS when applicable. Othewise, time of reception by ECS of the last data packet.
COMMENT	Free text. When applicable, will indicate if the file name is based on the ECS system time (time of first packet not available)
END	

Table 3.13. Archived Telemetry File Body

Source Data Units	Series of telemetry packets: Telemetry packet 1 Telemetry packet 2 . . . Telemetry packet n
Quality and Accounting List Length	Length in bytes of the Quality and Accounting List
Quality and Accounting List	Series of Quality and Accounting Capsules: Quality and Accounting capsule for first packet in error Quality and Accounting capsule for second packet in error . . . Quality and Accounting capsule for m^{th} packet in error
Missing Data Units List Length	Length in bytes of the Missing Data Units List
Missing Data Units List	Series of Missing Data Units Entries: Offset, "From" packet and "To" packet . . .

3.3.3 TELEMETRY GAP REPORT

The ECS generates a Telemetry Gap Report for each operational day. This report is generated from the archived telemetry Selective reports for shorter time ranges can be generated by SOC. Appendix B contains an example of the Telemetry Gap Report.

3.4 MISSION SUPPORT DATA SPECIFICATION

3.4.1 SUMMARY DATA

The summary data received by ECS from the instrumenters is in FITS format. There may be one or more input files for each instrument and each day (some instruments may provide more than one file for the same day, while other instruments may not provide a file for every day). The SOC is responsible for gathering the instrumenters' input before sending it to CDHF which requires detached SFDU headers.

The instrumenters submit their input to ECS in FITS format optionally with detached SFDU headers. The file naming convention used for the summary data will comply with the CDHF conventions (see Appendix A).

3.4.2 ORBIT AND ATTITUDE DATA

Orbit and attitude data are received by the ECS from CDHF at a frequency that will be defined within the EOF and operationally agreed upon with CDHF. These data are received in files in CDF format with detached SFDU headers. Each file contains data for one operational day.

That data is provided to the instrumenters in CDF format with detached SFDU headers, and the CDHF file naming conventions described in Appendix A are used.

The files will be organized among system directories in the ECS. The data files and the corresponding SFDU header files are contained in the same directory.

3.4.3 COMMAND HISTORY

The command history file covers one operational day. ECS receives a file from the SMOCC typically at the end of every DSN contact. The ECS merges the individual files into a single file per day. It then generates an SFDU header before transmitting the final report to CDHF.

The command history is available to the instrumenters as an ASCII text file with a detached SFDU header. See Appendix B for an example of the command history file format as proposed by the SMOCC (ASCII text with fixed fields).

3.4.4 TIME CORRELATION LOG

The time correlation log is an ASCII text file containing a cumulative log of all SOHO spacecraft clock time offsets since the start of the mission. Once each day that the spacecraft clock is adjusted, ECS updates the time correlation file by appending the new information at the end. ECS extracts the time correlation information from a command history file by recognizing commands that were used to reset the spacecraft clock.

The time correlation log is made available to the instrumenters as an ASCII text file with detached SFDU header.

3.4.5 SYNOPTIC DATA

The format of that data is not defined in this ICD. The synoptic data will be gathered by the SOC and will reside in a dedicated ECS file directory from where the instrumenters will be able to retrieve it. The management of the synoptic data is not an ECS function.

3.4.6 PROJECT DATA BASE

The ECS will make the PDB available to the instrumenters as ASCII files in the Data Format Control Document (DFCD) format as supplied by the POCC.

3.4.7 PROJECT DATA BASE UPDATE REQUEST

The format of this free-form text E-mail message exchanged between the instrumenters and the FOT is not described in this ICD.

3.4.8 SOHO DAILY REPORT

The SOHO Daily Report is an ASCII text file with detached SFDU header. Each file covers one operational day. The files are named according to the CDHF file naming conventions described in Appendix A. The format of the SOHO Daily Report will be defined in an operational agreement between the FOT and the Instrumenters.

3.5 PLANNING AND SCHEDULING DATA SPECIFICATION

There are two types of data related to the planning functions: the ECS activity (EAP) plan which ECS sends to the instrumenters and the instrumenters' input to the activity plan (IAP). These data are in a file format as described in the following sections.

3.5.1 INSTRUMENTERS INPUT TO THE ACTIVITY PLAN

The IAP is a file used by each instrument team to specify their activity requests. One input file relates to a single instrument and covers an entire operational day. When updates and modifications are necessary, the IAP for the entire operational day must be re-submitted to the ECS. In order to allow for greater flexibility in the input, the "keyword=value" format is used for the IAP files.

3.5.1.1 Input to the Activity Plan File Header

The IAP file header is defined in table 3.14.

Table 3.14. File Header for the Instrumenter Input to the Activity Plan

KEYWORD	DESCRIPTION
DATATYPE	"INSTRUMENTER INPUT TO THE ACTIVITY PLAN"
FILENAME	Name of this file: iiicccccccccc.IAP (see Appendix A)
INSTRUME	Instrument for which this IAP is submitted (see section 3.1.4)
ORIG_ID	E-Mail address where a validation report on the IAP will be sent
OBSERVER	Person who generated this file
DATE_CRE	Date file was created YYYY/MM/DD HH:MM:SS (GMT)
STARTIME	Start time of period covered YYYY/MM/DD HH:MM:SS (GMT) ECS will assume that HH:MM:SS is 00:00:00
ENDTIME	End time of period covered YYYY/MM/DD HH:MM:SS (GMT) ECS will assume that HH:MM:SS is 00:00:00 for the day following the start time
COMMENT	Free text. This keyword may be repeated to allow several comment lines
END	

3.5.1.2 Input to the Activity Plan File Body Format

The file body is in the keyword format. It contains a list of statements, each statement consisting of a series of fields of the form KEYWORD = value. A list of keywords that may be used in the IAP is provided in Appendix B.

Notes:

- Comment lines may be inserted anywhere in the IAP file. They consist of the keyword COMMENT= followed by free text.

- Typically, the duration of an activity is specified using the STARTIME= and ENDTIME= keywords, followed by a time field.
  All time fields are in the standard format YYYY/MM/DD HH:MM:SS.

- The originator ID (ORIG_ID) must be a valid E-Mail address where a validation report on the IAP will be sent. When it receives the IAP, the ECS planning software validates it and generates a report indicating errors if any are found. This report is sent in the form of an E-mail message to the address indicated in the ORIG_ID field. This address will also be used to send availability notifications for the EAP.

3.5.2 ECS ACTIVITY PLAN

The ECS Activity plan (EAP) is a file containing information provided by the SMOCC such as DSN contacts and FOT-reserved times as well as the merged activity requests that were specified by the instrumenters in the IAP files. The activity plan file is made available in two different formats: the fixed-field format which provides more readability but limits the amount of information provided, and the keyword format which offers more flexibitity.

3.5.2.1 ECS Activity Plan File Header

The activity plan file header is defined in table 3.15.

Table 3.15. File Header for the ECS Activity Plan

KEYWORD	DESCRIPTION
DATATYPE	"ECS ACTIVITY PLAN"
FILENAME	Name of this file: (see Appendix A) ECSYYYYMMDDvvv.EAP for files in the fixed-field format ECSYYYYMMDDvvv.KAP for files in the keyword format
OBSERVER	Person who generated this file
DATE_CRE	Date file was created YYYY/MM/DD HH:MM:SS (GMT)
STARTIME	Start time of period covered YYYY/MM/DD HH:MM:SS (GMT) where HH:MM:SS is 00:00:00 for a given day DD
ENDTIME	End time of period covered YYYY/MM/DD HH:MM:SS (GMT) where HH:MM:SS is 00:00:00 for day DD+1
OUT_FORM	Format indicator KEYWORD for the keyword format FIXED_FIELD for the fixed field format
COMMENT	Free text. This keyword may be repeated to allow several comment lines
END	

3.5.2.2 ECS Activity Plan Fixed-field Format

In the fixed-field format, the file body for the ECS activity plan is an ASCII-text formatted report. Each line corresponds to the description of one activity and contains the fixed-length fields defined in table 3.16.

Table 3.16. ECS Activity Plan Fixed-field Format

FIELD NAME	Byte Number	Length (Bytes)	DESCRIPTION
Activity	1	20	Name of the activity or resource (see Appendix B)
Blank-fill	20	2	
Activity Qualifier	22	6	Instrument performing the activity or Ground station ID for DSN contacts or Originating entity for the activity such a FOT or

Blank-fill	28	2	
Start Time	30	19	Start time of the activity in the format YYYY/MM/DD HH:MM:SS
Blank-fill	49	2	
End Time	51	19	End time of the activity in the format YYYY/MM/DD HH:MM:SS
Blank-fill	70	2	
Duration	72		Duration of the activity in the format HH:MM:SS
Blank-fill	80	2	
Description/Comment (optional)	82	80	Textual description of or remarks applying to the activity
New-line separator	162	1	X'0A'

3.5.2.3 ECS Activity Plan Keyword Format

In the keyword format, the file body for the ECS activity plan is ASCII text. Refer to Appendix B for a list of valid keywords and their format specification.

SECTION 4. COMMUNICATIONS PROTOCOLS

4.1 COMMUNICATIONS OVERVIEW

The workstations for the EOF-resident instrumenters (IWSs) will be connected to ECS and among themselves using Ethernet. Upgrades to provide higher capacity to some instrumenters' teams may be implemented if necessary (for instance, upgrade to CDDI). The communications among the IWSs may use either TCP/IP or DECNET. Additionally, TCP/IP will be routed to Internet and DECNET to SPAN. Communications between the ECS and the IWSs will take place using a subset of TCP/IP services and protocol as illustrated in Figure 4-1. Internet connections from remote instrumenters will be routed through NASA GSFC. All instrumenters, resident or not, may access ECS through FTP and SMTP. The IWSs may additionally use sockets, NTP, X11 and rlogin to access various resources on ECS.

4.1.1 FILE TRANSFER

FTP is used to support file transfers between the ECS and all instrumenters' teams (resident or remote). As described in the following paragraphs, four different methods may be used to exchange files between the ECS and the instrumenters. The method selected depends on the type of data exchanged.

1) Files that ECS needs to send to specific instrumenters' teams (i.e., command validation reports).
ECS maintains a list of designated computer addresses where each type of file is to be forwarded, typically two addresses per instrument team. As soon as a file becomes available, ECS initiates an FTP session with the computers designated to receive that type of file for that particular instrument, and writes the file to that computer. ECS must maintain a list of Internet addressees for all the instrumenters' teams. ECS must also have an account on each of these instrumenters' computers and maintain a list of current account names and passwords. In the case where ECS would be unable to connect to any of the receiving computers, the SOC will notify the addressees via E-mail, and ECS will keep the files for a certain period of time for possible manual retransmission by the SOC.

2) Files generated by ECS and retrieved by the instrumenters when needed (i.e., Activity Plan).
These files are deposited by ECS on specific system directories. Read access is available to instrument teams and members of the scientific community with a valid FTP account: the ECS system administrator will maintain a list of these valid account and passwords. Anonymous FTP is not allowed.

3) Commanding files generated by the instrumenters. The transfer of these files (delayed command files and background-queue files) requires the use of a SecureID card. The instrumenters initiate these FTPs and write the files to specified ECS systems directories. When performing the FTP, the originating instrumenter must be in possession of a SecureID card and enter the proper numeric code. These FTPs must also be done on a specific port number different from the default FTP port number.

4) Other files generated by the instrumenters (e.g., input to the summary data or input to the activity plan). These FTPs will be initiated by the instrumenters and performed using account name and password on the default port number. The instrumenters write their files to specified ECS systems directories. The ECS system administrator maintains a list of authorized computers and account information.

	FTP RFC-959	SMTP RFC-821	X 11	SOCKET I/F	NTP RFC-123
Communication Protocols and Application Level Services	TCP RFC-793				UDP RFC-768
	IP/ICMP RFC-791 RFC-792				
	ETHERNET Link Level RFC-826 RFC-894				
Physical Interface	ETHERNET IEEE 802.3				

Note: The Requests for Comment (RFCs) listed above are the specifications for the various protocols for Internet. The full listing of each RFC is available via anonymous FTP on various Internet computers (i.e., NIC.DN.MIL).

Figure 4.1. SOHO/ECS Communication Architecture

4.1.2 E-MAIL

SMTP mail utility will be used to exchange non-time-critical information between ECS and the instrumenters. ECS must obtain and maintain a list of Internet addresses and user-names where to send mail. Similarly, ECS must supply the instrumenters with the ECS Internet address, user-name and password.

4.1.3 XWINDOWS

X11 will be used by the IWSs (i.e., EOF-resident) to view ECS displays such as the commanding status window or telemetry distribution monitoring display. ECS will make 'C' language software available to the instrumenters to allow the display of these Motif windows.

4.1.4 REMOTE LOGIN

Rlogin will be used by the IWSs to initiate an X11 session. ECS will maintain a list of network addresses and user-names of these IWSs allowed to do remote login.

4.1.5 TIME SERVICES

NTP will be used to supply standard time to the instrumenters. This protocol allows the synchronization of the internal clock of each served computer to a time server computer. No special hardware or software is needed on the instrumenter computers: NTP is part of the suite of software distributed with almost all implementations of TCP/IP. The time server computer provides the Coordinated Universal Time (UTC). Using NTP, the instrumenters can synchronize the system clock of their computers to within 20 milliseconds of UTC. Then, they can obtain UTC by using system utilities to read their system clock. System clocks are generally readable down to milliseconds and sometimes microseconds.

4.1.6 SOCKETS

Sockets are used for the transmission of real-time data streams (primarily, near-real-time commanding and telemetry distribution) between the IWSs and the ECS. The IWSs will serve the necessary sockets and ECS will connect to them when data need to be transferred (for instance, at the beginning of a pass when real-time telemetry is received by ECS or when the NRT throughput mode is enabled). ECS has reserved a group of port numbers for the sockets to be served by the IWSs (see Table 4.1 below).

- For telemetry data, 4 sockets are available to each IWS, one of these being reserved for the transmission of MDI-M data. This could allow a given IWS to receive telemetry simultaneously on up to 3 separate sockets for non-MDI data, and a fourth socket for MDI-M data. It is envisioned that operationally, an IWS will not use more than one or two sockets at one time. However, this is provided to allow separate processes to run and accept different types of telemetry on a single IWS. ECS will maintain a list of 'default IWS-socket pairs' which are the sockets over which telemetry is expected to be distributed during a real-time pass. At the beginning of the pass, ECS will attempt to initiate a session with each of these 'default IWS-socket pairs'. Additional connections may be requested at any time via the SOC.

- For commanding data, 11 sockets are available to each IWS, each socket corresponding to one instrument. Each IWS will use the port socket(s) it needs to command the instrument(s) it intends to command. ECS will maintain a list of 'default IWS-instrument pairs'. When the throughput mode is enabled, ECS attempts to initiate a session with each 'default IWS-instrument pair'. It is expected that an IWS will not serve a socket for an instrument it is not authorized to command or an instrument it will not command during the current NRT session.

Table 4.1 Port number assignments for NRT sockets.

FUNCTION		PORT NUMBER
Telemetry	Connection	
	First	20100
	Second	20101
	Third	20102
	Fourth	20103

Commanding	Instrument	
	CDS	20200
	CELIAS	20201
	CEPAC	20202
	EIT	20203
	GOLF	20204
	LASCO	20205
	MDI	20206
	SUMER	20207
	SWAN	20208
	UVCS	20209
	VIRGO	20210

4.2 ECS HARDWARE CONFIGURATION

The current ECS hardware configuration is illustrated in figure 4.2. It is only included in this document for informational purpose and may be modified during the life of the mission. The ECS hosts are RS/6000 workstations running AIX. The hardware configuration has been in part dictated by the interface with MODNET an by security considerations. The description of specific security measures, policies and procedures are not within the scope of this ICD. The following section outlines the main characteristics of the security implementation within the ECS.

1) The filtering capability of the routers will be utilized to limit external access to the EOF. Only packets with specific combinations of source address, destination address and IP port number or DECNET packet type will be allowed to pass.

2) Only specific services (e.g., E-mail, or FTP) on specific ECS hosts will be available to external users. The ECS itself will support only TCP/IP. The use of the SecureID card is required for FTP of commanding data.

3) Host protection measures will remain the primary security measures. They vary from host to host, depending on the capabilities of the various operating systems. It is recommended that remote logins not be allowed on a given IWS while this IWS supports an active near-real-time commanding session.

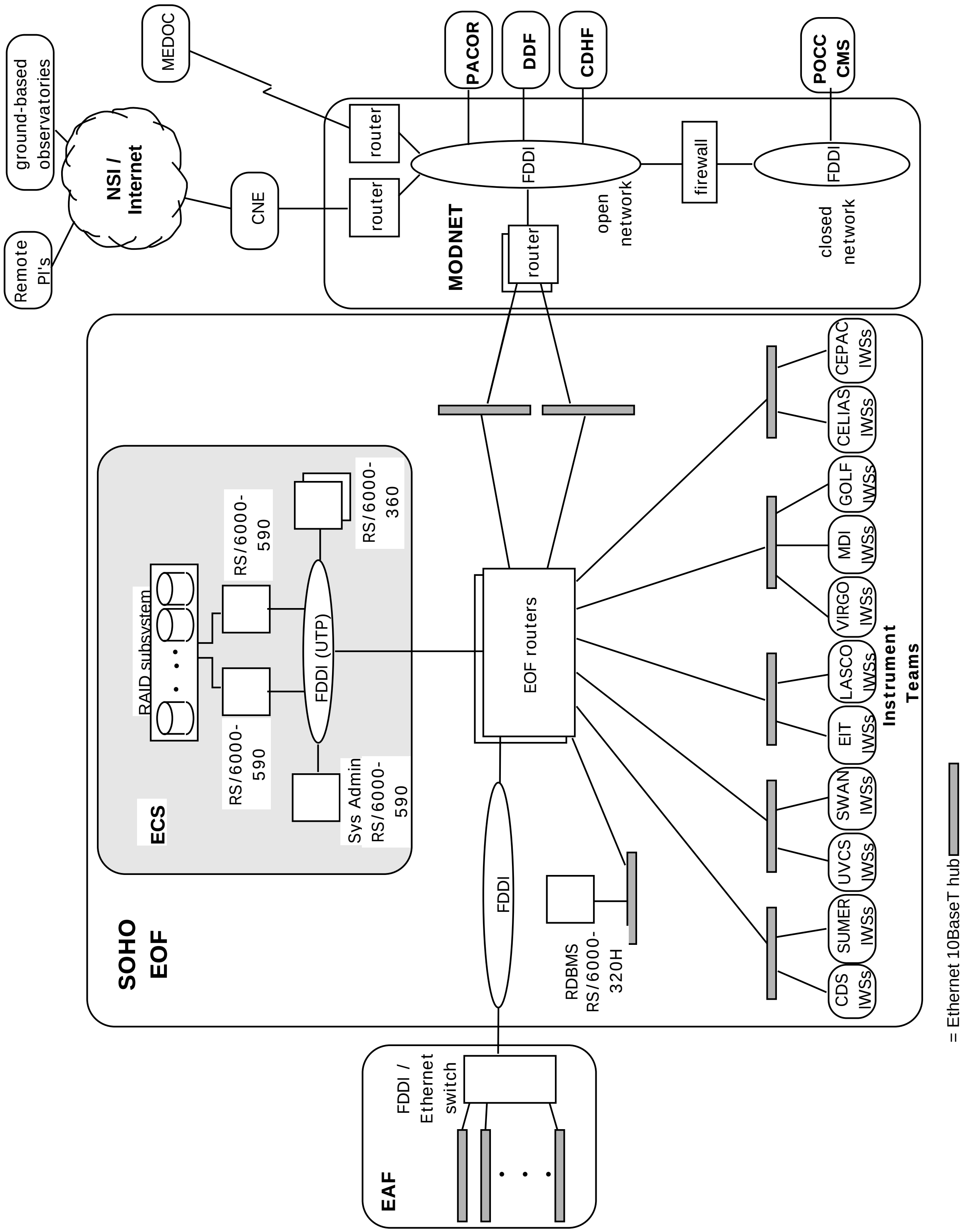


Figure 4.2. SOHO/EOF Hardware Architecture

APPENDIX A. FILE NAMING CONVENTIONS

A.1 "ORIGINATOR/ID" SCHEME

In this scheme, the first 3 characters of the identifier represent the originator of the file. The file name extension is three-characters long and is used to indicate the type of data contained in the file.

A file name is of the general form: **iiiccccccccccc.EXT** where:

iii: 3-letter abbreviation of the file originator name (upper-case)

CDS	for CDS	CEL	for CELIAS
CEP	for CEPAC	EIT	for EIT
GOL	for GOLF	LAS	for LASCO
MDI	for MDI	SUM	for SUMER
SWA	for SWAN	UVC	for UVCS
VIR	for VIRGO	ECS	for ECS

ccccccccccc: alphanumeric characters to uniquely identify this file

A suggestion for this field is to use 11 characters: YYMMDDHHvvv where:

YYMMDDHH represents the year, month, day and hour, and

vvv uniquely identifies this file.

For the activity plan, ECS uses the convention YYYYMMDDvvv.

For delayed and background-queue command files, this field should be limited to 9 characters since this is the maximum number of characters that the POCC and CMS software can handle. Any longer file name would be truncated. In order to avoid duplicate file names after truncation, the instrumenters are required to limit the names of delayed and background-queue files to 12 characters. For example, iiiYYMMDDHHv.DEL and iiiYYMMDDHHv.BCK are valid file names.

The validation reports for delayed and background-queue commands keep the same name as the corresponding .DEL or .BCK file with a different extension (.DRP and .BRP respectively).

.EXT: 3-letter field defining the data type contained in the file (upper case)

DEL	for delayed commanding data
BCK	for background-queue commanding data
IAP	for instrumenter input to the activity plan
EAP	for the ECS activity plan in fixed-field format
KAP	for the ECS activity plan in keyword format
DRP	for delayed command validation report
BRP	for background queue command validation report

A.2 "TELEMETRY FILE" SCHEME

This scheme is used for archived telemetry files. It includes a representation of the APID followed by a date representative of the data contained in the file.

A file name is of the general form: **apid_yymmdd_hhmmss.EXT** where:

apid: up to 6 alphanumeric characters (upper case) as described in table A1

yymmdd_hhmmss: a unique time stamp for this file (year, month, day, hours, minutes and seconds)

.EXT: 3-letter field defining the data type contained in the file (upper case)

.REL for ECS-archived real-time telemetry data

.QKL for ECS archived tape recorder files or retransmitted real-time telemetry data.

If the time-stamp of the first packet in the file contains a valid OBT or LOBT time, the file name will represent the time stamp in UT of the first packet in the file.

If the first packet of the file does not contain a valid time-stamp, the file name will represent the system time when the file was created. For example, this will apply to VIRGO telemetry packets which do not contain a time-stamp. It will also apply when an instrument is turned off. This difference in the naming process will be indicated by using the character X at the end of the file name.

File name examples:

apid_yymmdd_hhmmss.EXT
for telemetry files when the first telemetry packet contains a valid OBT or LOBT time

apid_yymmdd_hhmmssX.EXT
for telemetry files when the first telemetry packet does not contain a valid time stamp

Table A.1. SOHO APID Abbreviations

Packet Name	APID	Abbreviation
SVM HK1	8803	SVMHK1
SVM HK2	8805	SVMHK2
SVM HK3	8806	SVMHK3
SVM HK4	8809	SVMHK4
AOCS HK1	8833	AOCHK1
AOCS HK2	8835	AOCHK2
ATTITUDE 1	8836	ATTIT1
ATTITUDE 2	8839	ATTIT2
S/W	880A	SW
OBT	8000	OBT
Low Rate EXPERIMENT HK	8860	EXPHK
CDS HK	8863	CDSHK
CELIAS HK	8865	CELHK
CEPAC HK	8866	CEPHK
EIT/LASCO HK1	8869	ELAHK1
EIT/LASCO HK2	886A	ELAHK2
EIT/LASCO HK3	886C	ELAHK3
GOLF HK	886F	GOLHK
MDI HK1	8893	MDIHK1
MDI HK2	8895	MDIHK2
SUMER HK	8896	SUMHK
SWAN HK	8899	SWAHK
UVCS HK	889A	UVCHK
VIRGO HK	889C	VIRHK
CDS Science Low Rate	88A3	CDSSCL
CDS Science Medium Rate	88A5	CDSSCM
CDS Science High Rate	88A6	CDSSCH
CELIAS Science	88A9	CELSC1
CEPAC Science	88AA	CEPSC
EIT/LASCO Science Low Rate	88AC	ELASCL
EIT/LASCO Science High Rate	88AF	ELASCH
GOLF Science	88C3	GOLSC
MDI Science	88C5	MDISC
SUMER Science Low Rate	88C6	SUMSCL
SUMER Science High Rate	88C9	SUMSCH
SWAN Science	88CA	SWASC
UVCS Science	88CC	UVCSSC
VIRGO Science	88CF	VIRSC
MDI M	80C4	MDIHR
IDLE	87FF	IDLE

A.3 CDHF CONVENTION

This naming convention used for files that are exchanged between the ECS and CDHF is defined in the ICD between CDHF and the EOF (Reference 11). It applies to:

- Summary data
- As-Run plan
- Command history report
- Time correlation log
- SOHO daily report
- Orbit data
- Attitude data

The general file name is:
mission_datatype_descriptor_date_version.extension where:

• The logical file identifier is a concatenation of 5 fields:

mission SO for SOHO

datatype: identifies the type of data.

Valid datatypes for SOHO are:

AN	for ancillary data
AR	for as-run plan
AT	for attitude data
CH	for command history report
OR	for orbit data
SU	for summary data

descriptor: further qualifies the type of data.

Valid descriptors for SOHO are:

CDS	for CDS
CEL	for CELIAS
CEP	for CEPAC
EIT	for EIT
GOL	for GOLF
LAS	for LASCO
MDI	for MDI
SUM	for SUMER
SWA	for SWAN
UVC	for UVCS
VIR	for VIRGO
TCF	for Time Correlation File
SDR	for SOHO Daily Report
FTR	for full resolution attitude data
DEF	for definitive data
PRE	for predicted data
NUL	when this field does not apply (e.g, command history report)

date YYYYMMDD

version Vnn where nn = 01 to 99

• The file extension may be

.SFDU	for an SFDU file
.DAT	for a generic data file
.CDF	for a CDF file
.Snn	where nn=01 to 99, for files with several segments (e.g., summary data for a same instrument and same day)

File name examples

Summary data

Several files for the same instrument and the same day SO_SU_EIT_19960523_V01.SFDU
SO_SU_EIT_19960523_V01.S01
SO_SU_EIT_19960523_V01.S02
SO_SU_EIT_19960523_V01.S03
Single file for a given instrument on a given daySO_SU_VIR_19960523_V01.SFDU
SO_SU_VIR_19960523_V01.DAT

Command history report

SO_CH_NUL_19960523_V01.SFDU
SO_CH_NUL_19960523_V01.DAT

As Run Plan

SO_AR_UVC_19960523_V01.SFDU
SO_AR_UVC_19960523_V01.DAT

Time correlation file

SO_AN_TCF_19960523_V01.SFDU
SO_AN_TCF_19960523_V01.DAT

SOHO Daily report

SO_AN_SDR_19960523_V01.SFDU
SO_AN_SDR_19960523_V01.DAT

Definitive attitude data

SO_AT_DEF_19950523_V01.SFDU
SO_AT_DEF_19950523_V01.CDF

Full-time resolution attitude data

SO_AT_FTR_19950523_V01.SFDU
SO_AT_FTR_19950523_V01.DAT

Predictive orbit data

SO_OR_PRE_19930523_V01.SFDU
SO_OR_PRE_19930523_V01.CDF

Definitive orbit data

SO_OR_DEF_19930523_V01.SFDU
SO_OR_DEF_19930523_V01.CDF

APPENDIX B. EXAMPLES OF ECS DATA SETS AND REPORTS

B.1 NEAR-REAL-TIME COMMAND DATA EXAMPLE

B.1.1 BINARY FORMAT

```
X'03010023'          (4 binary bytes for message type and length)
X'1010'              (Request ID)
CDS                  (6-Char, padded with blanks)
BINARY 0x1203,0x2401,0x77AF,0xADB3; /* OBDH block with header, 2 data
                                       words and checksum */
```

B.1.2 MNEMONIC FORMAT

```
X'03010033'          (4 binary bytes for message type and length)
X'A001'              (Request ID)
LASCO         (6-Char, padded with blanks)
MNEMO1,0x1AB,0x1234;  /*command with 2 variable words in hex format */.
```

B.2 DELAYED COMMAND GROUP

This example contains commands in mnemonic format. The binary format could also have been used. The example also contains errors in the command data to illustrate the validation report format in section B.3.

```
DATATYPE=   DELAYED
FILENAME=   CDS0126001.DEL
INSTRUME=   CDS
ORIG_ID=    CDS_OPS_1
OBSERVER=   Ricky Ricardo
DATE_CRE=   1996/01/25 15:27:30
NUM_CMDS= 3
EARLIEST=   1996/01/26 18:00:00
LATEST=     1996/01/26 18:30:00
COMMENT=    In case of contingency, notify PI team by telephone
COMMENT=    This example contains errors as illustrated in the associated validation report
END
CDSMNEMO1;  /* first command, no argument */
LASCOMNEMO, 10;  /* 2nd command, argument in decimal */
CDSMNEMO2,01AB,1234;  /* 3rd command, first argument in octal, second in decimal*/
```

B.3 DELAYED COMMAND VALIDATION REPORT

NOTE: This is an example of the report which is produced by CMS and is described in Reference 8.

```
DATATYPE=   COMMAND VALIDATION REPORT
FILENAME=   CDS0126001.DRP
INSTRUME=   CDS
ORIGFILE=   CDS0126001.DEL
DATE_CRE=   1996/01/26 15:37:53
NUM_CMDS=   3
COMMENT=    "Errors in input file"
END


SOHO CMS INPUT VALIDATION REPORT FOR CDS GROUP CDS0126001.DEL
  Started At Thu Jan 25 20:30:51 1996

Original Header:
INSTRUME=   CDS
FILENAME=   CDS0126001.DEL
ORIG_ID=    CDS_OPS_1
OBSERVER=   Ricky Ricardo
DATE_CRE=   1996/01/25 15:27:30
NUM_CMDS=   3
EARLIEST=   1996/01/26 18:00:00
LATEST=     1996/01/26 18:30:00
COMMENT=    "CDS Calibration"
END

CDSMNEMO1;  /* first command */

LASCOMNEMO, 10; /* 2nd command */

***  IV_MNEMON    Invalid mnemonic.

CDSMNEMO2,01AB,1234;  /* 3rd command */

***  MAX_ARGS    Improper number of arguments for a fixed length command.



***  Command Group Is Invalid  ***
```

B.4 BACKGROUND-QUEUE COMMAND GROUP

This example contains

```
DATATYPE=   BACKGROUND
FILENAME=   MDITBL0001.BCK
INSTRUME=   MDI
ORIG_ID=    MDI_IWS_2
OBSERVER=   C. Moi
DATE_CRE=   1996/01/25 15:27:30
NUM_CMDS=   8
EARLIEST=
LATEST=
COMMENT=    This will be uplinked by SMOCC as soon as possible.
END
BINARY 0x1000,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0xF,
0x0,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0x1234;
BINARY 0x2000,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0xF,
0x0,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0x1234;
BINARY 0x3000,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0xF,
0x0,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0x1234;
BINARY 0x4000,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0xF,
0x0,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0x1234;
BINARY 0x5000,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0xF,
0x0,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0x1234;
BINARY 0x6000,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0xF,
0x0,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0x1234;
BINARY 0x7000,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0xF,
0x0,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0x1234;
BINARY 0x8000,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0xF,
0x0,0x1,0x2,0x3,0x4,0x5,0x6,0x7,0x8,0x9,0xA,0xB,0xC,0xD,0xE,0x1234;
```

B.5 FORMAT FOR THE INSTRUMENTER INPUT TO THE ACTIVITY PLAN (IAP)

The IAP will be in the keyword format only. (Fixed format is no longer used)
Note that the keywords as listed below can be specified in any order. However, they must be used as described, and they are case sensitive.

SCIPLAN

The SCIPLAN entry specifies the first level of science planning information, i.e. the overall plan as developed during the weekly and daily science planning meetings. The xyz field which follows SCIPLAN_ should be descriptive of a specific science plan. It can be up to 10 alphanumeric characters long, no blanks embedded, but underscores are allowed. This field will be used to specify the occurence of Joint Operations Procedures (JOP). For example, SCIPLAN_JOP_3. All fields described as "strings" contain a maximum of 50 alphanumeric characters, blanks, commas and underscores being allowed.

SCIPLAN_xyz

STARTIME=	Start time of the special activity
ENDTIME=	End time of the special activity
INSTRUME=	Instrument or group implementing the planned activity
SCI_OBJ=	Scientific objective, e.g. "Bright Point Studies". (1)
SCI_SPEC=	(Optional). More specific scientific objective, e.g. "Density Profile". (1)
OBJECT=	Generic name for the object planned to be observed, from a limited list of possible objects, e.g., "Bright point". (1) (5)
OBJ_ID=	(Optional). Unique identifier for the object to be observed. Up to 6 alphanumeric characters, no blank embedded, e.g. BP. (5)
XCEN=	Center of the instrument field-of-view along the solar X-axis (2) (3) (4)
YCEN=	Center of the instrument field-of-view along the solar Y-axis (2) (3) (4)
NOTES=	(Optional). May include references to specific studies or rasters to be run. (1) (2)
PROG_ID=	(Optional). An ID number specifying that this observation is part of a continuing series. Up to 6 numeric characters.
CMP_NO=	(Optional). ID number of the coordinated observing program this observation supports. Up to 6 numeric characters.
DISTURB=	(Optional). Description of any possible disturbances. (1).
DATE_MOD=	(OPtional). Last date modified.

Notes :

(1) String.
(2) This field can be repeated if nercessary. The value can be an array of n elements: elements separated by a comma, no blanks embedded.
(3) Units are arc-seconds from Sun center for coordinates and degrees from Solar North for angles.
(4) Optional. Applies to coronal instruments only.
(5) The list of objects is provided at the end of this section.

PROGRAM

The PROGRAM entry is used to describe the specific programs that the instruments would run to satisfy the scientific objectives of the corresponding SCIPLAN activity: for each SCIPLAN entry, there will be a sequence of PROGRAM entries that represent the details of the SCIPLAN. The _xyz which follows PROGRAM is the name of the activity that the instrumenter provides. It can be up to 10 alphanumeric characters long, with no embedded blanks, but underscores are allowed.

PROGRAM_xyz

STARTIME=	Start time of the special activity
ENDTIME=	End time of the special activity
INSTRUME=	Instrument or group implementing the planned activity
OBS_PROG=	The observing program that will be run
SCI_OBJ=	Scientific objective, e.g. "Bright Point Studies". (1)
SCI_SPEC=	(Optional). More specific scientific objective, e.g. "Density Profile". (1)

OBJECT=	Generic name for the object planned to be observed, from a limited list of possible objects. (5)
OBJ_ID=	(Optional). Unique identifier for the object to be observed. Up to 6 characters. (5)

XCEN=Center of the instrument field-of-view along the solar X-axis. (2) (3) (4)
YCEN=Center of the instrument field-of-view along the solar Y-axis. (2) (3) (4)

ANGLE=	Rotation angle of vertical axis of instrument field-of-view relative to solar north. (2) (3) (4)
IXWIDTH=	Maximum width of the instrument field-of-view in the instrument X axis, i.e. the direction perpendicular to the vertical axis as used in keyword ANGLE. (2) (3) (4)
IYWIDTH=	Maximum width of the instrument field-of-view in the instrument Y axis, i.e. the direction perpendicular to the vertical axis as used in keyword ANGLE. (2) (3) (4)
PROG_ID=	(Optional). ID number specifying that this observation is part of a continuing series
CMP_NO=	(Optional). ID number of the coordinated observing program that this observation supports
DISTURB=	(Optional). Description of any possible disturbances
JITTER_LIMIT=	(Optional). Maximum amount of jitter allowable for this program and this instrument (in 1/10 arc-seconds)
STATUS=	Acceptance status (6)

Notes :

(1) String. The list of objects is provided at the end of this section.
(2) This field can be repeated if nercessary. The value can be an array of n elements: elements separated by a comma, no blanks embedded.
(3) Units are arc-seconds from Sun center for coordinates and degrees from Solar North for angles.
(4) Optional. Applies to coronal instruments only.
(5) The list of objects is provided at the end of this section.
(6) This keyword will only be present in the KAP. If present in the IAP, it will be ignored by the ECS. The possible values are REQUESTED, CONFIRMED, DENIED.

ACTIVITY

The ACTIVITY entry is used to specify predefined activities that the ECS planning system knows about, that is that have been entered in the knowledge base. These activities typically have constraints associated with them that are checked by the scheduling system. The xyz which follows ACTIVITY is the name of the predefined activity.

ACTIVITY_xyz (1)

STARTIME=	Start time of the special activity
ENDTIME=	End time of the special activity
INSTRUME=	Instrument or group implementing the planned activity
AMOUNT=	(Optional). Should be specified for certain activities such as jitter (1)
STATUS=	Acceptance status (2)

Notes :

(1) Example: specify the amount of jitter generated by this activity estimated in 1/10 arc-seconds.
(2) This keyword will only be present in the KAP. If present in the IAP, it will be ignored by the ECS. The possible values are REQUESTED, CONFIRMED, DENIED.

INST_IIE_MASTER and INST_IIE_RECEIVER

These entries are used to plan the role individual instruments in the Inter-Instrument Exchange (IIE). They are first included in the IAP for planning and coordination. The INST_IIE_MASTER entry is used by a given instrument to indicate that this instrument will be master for the specified period of time.

The INST_IIE_RECEIVER entry is used to specify that an instrument will be receiver for the specified period of time.

INST_IIE_MASTER

MSTR_TYPE=	Type of flag
INSTRUME=	Name of the master intrument
MSTR_START=	The start time for the instrument being the master
MSTR_STOP=	The stop time for the instrument being the master
STATUS=	Acceptance status (1)

INST_IIE_RECEIVER

INSTRUME=	Name of a receiving intrument
RCVR_START=	The start time for the instrument being a receiver
RCVR_STOP=	The stop time for the instrument being a receiver
STATUS=	Acceptance status (1)

Notes :

(1) This keyword will only be present in the KAP. If present in the IAP, it will be ignored by the ECS. The possible values are REQUESTED, CONFIRMED, DENIED.

INST_NRT_SESSION

The INST_NRT_SESSION entry is used to specify that an instrumenter is going to be doing near-real-time commanding during a specified period of time.

INST_NRT_SESSION

STARTIME=	Start time of the requested near-real-time commanding activity
ENDTIME=	End time of the requested near-real-time commanding activity
INSTRUME=	Instrument which will have near-real-time privileges
IWS_ID=	Identification of the IWS from which the NRT commanding activity will be performed
CMD_RATE=	Expected average number of commands per minute between start time and end time
STATUS=	Acceptance status for this activity (1)

Notes :

(1) This keyword will only be present in the KAP. The possible values are REQUESTED, CONFIRMED, DENIED. If present in the IAP, it will be ignored by the ECS.

INST_NRT_RESERVED

The INST_NRT_RESERVED entry is used to request a reserved time slot for some special near-real-time commanding activities. This time is reserved for that instrument and no other instrument can request time during that period.

INST_NRT_RESERVED

STARTIME=	Start time of the reserved time NRT commanding activity
ENDTIME=	End time of the reserved time NRT commanding activity
INSTRUME=	Instrument which will have reserved time
CMD_RATE=	Expected average number of OBDH block commands per minute between the start time and end time
STATUS=	Acceptance status for this activity (1)

Notes :

(1) This keyword will only be present in the KAP. If present in the IAP, it will be ignored by the ECS. The possible values are REQUESTED, CONFIRMED, DENIED.

INST_DELAYED_CMD

The INST_DELAYED_CMD entry is used to specify a time window during which a group of delayed commands must be uplinked.

```
INST_DELAYED_CMD
    EARLIEST=       Earliest uplink time
    LATEST=         Latest uplink time
    INSTRUME=       Instrument which will performed the delayed commanding
    NUM_CMDS=       Number of obdh block commands to be uplinked
    STATUS=         Acceptance status (1)
```

Notes :

(1) This keyword will only be present in the KAP. If present in the IAP, it will be ignored by the ECS. The possible values are REQUESTED, CONFIRMED, DENIED.

INST_TSTOL_EXECUTION

The INST_TSTOL_EXECUTION entry is used to specify a time window during which FOT will be required to execute a given TSTOL procedure.

```
INST_TSTOL_EXECUTION
    PROC_NAME=      Name of procedure to be executed by the FOT
    EARLIEST=       Earliest execution time
    LATEST=         Latest execution time
    INSTRUME=       Instrument to which the procedure applies
    DURATION=       Approximate duration for execution of the procedure (minutes)
    STATUS=         Acceptance status (1)
```

Notes :

(1) This keyword will only be present in the KAP. If present in the IAP, it will be ignored by the ECS. The possible values are REQUESTED, CONFIRMED, DENIED.

LIST OF POSSIBLE OBJECTS

This list applies to the keywords OBJECT and OBJ_ID .

ARC	arcade	LE	loop evacuation
AFS	arch filament system	LMB	solar limb
ANE	anemone	LO	loop
AR	active region	CME	coronal mass ejection
BP	bright point	MHR	MDI high resolution field
CR	coronal rain	MS	magnetic shear
CH	coronal hole	MT	mercury transition
COM	comet	MW	moreton wave
COR	corona	NET	network
CHR	chromosphere	NL	neutral line
CS	coronal streamer	PC	polar crown
CT	coronal transient	PCH	polar coronal hole
CUS	cusp	PEN	sunspot penumbra
DB	disparation brusque	PFL	postflare loops
DC	disk center	PHO	photosphere
DFL	disappearing	PLG	plage
filament		POR	pore
DFX	disapppearing flux	PP	polar plume
DF	downflow	PR	prominence
EFL	emerging flux	PLT	planet
EPR	eruptive prominence	QS	quiet sun
EFI	erupting filament	RIB	two-ribbon flare
EVF	evershed flow	SPR	spray
FAC	faculae	SG	supergranulation
FC	filament channel	SPI	spicule
FLC	flux cancellation	SR	surge
FLG	filigree	SS	sunspot
FIL	filament	ST	star
FLR	flare	SW	solar wind
FP	footpoint	SYN	synoptic observation
FS	full sun / full disk	TR	transition region
FL	flow	UF	upflow
GR	granulation	UMB	sunspot umbra
HR	hedge row	VT	Venus transition
JET	jet	WAV	wave
LB	loop brightening	WLF	white light flare

B.6 <u>FORMAT FOR THE ECS ACTIVITY PLAN</u>

The ECS Activity Plan will be available in two formats:

1) the keyword format, providing more flexibility (KAP)
2) the fixed format, providing more readability (EAP)

In addition to the keywords found in the IAP, the following keywords will be used in the KAP. These keywords originate from CMS/FOT and could be modified by operations personnel.

DSN_Contact_xyz

The DSN_Contact_xyz entry provides information on a given DSN contact. The _xyz field represents the ground station name, for example, _CAN or _MAD.

DSN_Contact_xyz

STARTIME= Start time of contact for this station
ENDTIME= End time of contact for this station

SVM_Reserved

The SVM_Reserved entry is used to indicate time periods that are reserved by the FOT to perform activities exclusively related to the service module. During these time periods, all instrument-related activities are excluded: near-real-time commanding, uplink of delayed commands and execution of TSTOL procedures for instrument operations.

SVM_Reserved
STARTIME= Start time
ENDTIME= End time

Payload_Reserved

The Payload_Reserved entry is used to indicate time periods that are reserved by the FOT but during which some payload operations activities can be performed. These include uplink of instrument delayed commands and execution of TSTOL procedures for instrument operations

Payload_Reserved
STARTIME= Start time
ENDTIME= End time

Throughput_RCR

The Throughput_RCR entry is used to specify time periods during which the throughput channel will be opened, the instrument teams will be allowed to command in near-real-time and send RCRs.

Throughput_RCR
STARTIME= Start time of throughput mode with RCR allowed
ENDTIME= End time of throughput mode with RCR allowed

Throughput_NoRCR

The Throughput_NoRCR entry is used to specify time periods during which the throughput channel will be opened, the instrument teams will be allowed to command in near-real-time and but RCRs will not be permitted.

Throughput_NoRCR
STARTIME= Start time of throughput mode with RCR not allowed
ENDTIME= End time of throughput mode with RCR not allowed

Spacecraft_Maneuver

The Spacecraft_Maneuver entry is provided by the FOT for informational purpose. This will allow the instrument teams to be aware of the occurrence of spacecraft maneuvers that may affect the operations of the instruments.

Spacecraft_Maneuver
STARTIME= Start time of maneuver
ENDTIME= End time of maneuver
NOTES= Description of maneuver

Clock_Adjust

The Clock_Adjust entry is provided by the FOT for informational purpose. It will allow the instrument teams to be aware of upcoming OBT clock adjusts.

Clock_Adjust
STARTIME= Start time / occurence of clock adjust
TYPE= Description of adjust / reset

TLM_Tape_Dump
The TLM_Tape_Dump entry is provided by the FOT for informational purpose. It will allow the instrument teams to be aware of planned times for tape recorder dumps.

TLM_Tape_Dump
STARTIME= Start time
ENDTIME= End time

TLM_MDI_M
The TLM_MDI_M entry is provided by the FOT for informational purpose. It will allow the instrument teams to be aware of planned times for MDI-M downlink.

TLM_MDI_M
STARTIME= Start time
ENDTIME= End time

TLM_MDI_H
The TLM_MDI_H entry is provided by the FOT for informational purpose. It will allow the instrument teams to be aware of planned times for MDI-H downlink.

TLM_MDI_H
STARTIME= Start time
ENDTIME= End time

TLM_HR_Idle
The TLM_HR_Idle entry is provided by the FOT for informational purpose. It will allow the instrument teams to be aware of planned times for idle high rate telemetry.

TLM_MDI_Idle
STARTIME= Start time
ENDTIME= End time

TLM_Mode
The TLM_Mode entry is provided by the FOT for informational purpose. It will allow the instrument teams to be aware of planned times for switching telemetry mode to low rate, medium rate, high rate or idle. The telemetry mode remains set to the current value until a new TLM_Mode entry changes it.

TLM_Mode
MODE= LR, MR HR or IDLE
STARTIME= The start time for this mode.

TLM_Submode
There are four TLM_Submode keywords that defines the start time for a given telemetry submode. This submode will remain in effect until it is modified by another TLM_Submode entry. The TLM-Sumode entries are input by the ECS operator once the weekly plan has been finalized. Since the FOT will be in attendance at the weekly and daily meetings, modifications to these entries by the FOT are not expected. There are four different telemetry submodes (1 to 4) applying to the medium and high rate telemtry modes.

TLM_Submode_1
STARTIME= The start of mode 1
TLM_Submode_2
STARTIME= The start of mode 2

TLM_Submode_3
    STARTIME= The start of mode 3
TLM_Submode_4
    STARTIME= The start of mode 4.

Other_Obs_xyz

The Other_Obs_xyz entry is used to describe other science programs and events which are of interest to the SOHO team. These activities will be input by the ECS operator interactively from the timeline editor. The possible keywords listed for this entry are similar to the SCIPLAN entry, and they will most likely not apply in many cases. The xyz field is descriptive of a specific event: it can be up to 10 alphanumeric characters, with no blanks embedded, but possible underscores. The Other_Obs_xyz entries may not be included in the IAP.

Other_Obs_xyz

STARTIME=	Start time of the support activity
ENDTIME=	End time of the support activity
TELESCOP=	Spacecraft or observatory implementing the activity
SCI_OBJ=	Scientific objective (1)
SCI_SPEC=	(Optional). More specific scientific objective (1)
OBJECT=	(Optional). Name of the object planned to be observed
OBJ_ID=	(Optional). Unique identifier for the object to be observed. Up to 6 alphanumeric characters, no blank embedded
NOTES=	(Optional). May include references to specific studies or rasters to be run. (1)
PROG_ID=	(Optional). An ID number specifying that this observation is part of a continuing series. Up to 6 numeric characters.
CMP_NO=	(Optional). ID number of the coordinated observing program this observation supports. Up to 6 numeric characters.
DISTURB=	(Optional). Description of any possible disturbances. (1).
DATE_MOD=	(Optional). Last date modified.

Notes : (1) Strings.

B.7 ECS COMBINED ACTIVITY PLAN FILE FORMAT

The Combined Activity Plan (CAP) is the file that ECS receives from the IDL planning tool. The IDL Planning tool will be used to support the weekly and daily science planning meetings. It generates the CAP file which allows to input the results of the science planning meetings into the ECS planning system. The CAP contains the SCIPLAN entries for certain instrumenters.
The CAP does not apply to the interface between ECS and the Instrumenters and its description is included for reference only.

The CAP file header is as follows:

KEYWORD	DESCRIPTION
DATATYPE	"COMBINED ACTIVITY PLAN"
FILENAME	Name of this file: (see Appendix A) ECScccccccccccc.CAP
INSTRUME	"ECS"
ORIG_ID	E-mail address where a validation report on the CAP will be sent.
OBSERVER	Person who generated this file
DATE_CRE	Date file was created YYYY/MM/DD HH:MM:SS (GMT)
STARTIME	Start time of period covered YYYY/MM/DD HH:MM:SS (GMT) where HH:MM:SS is 00:00:00 for a given day DD
ENDTIME	End time of period covered YYYY/MM/DD HH:MM:SS (GMT) where HH:MM:SS is 00:00:00 for day DD+1
COMMENT	Free text. This keyword may be repeated to allow several comment lines
END	

The CAP file body is in the keyword format and is identical to the format of the IAP described in section 3.5.1. However, the CAP only contains SCIPLAN entries.

The ECS planning system receives the CAP and merges its content with existing IAPs that may have been received from the instrumenters. For all the IAPs older than the CAP, all the SCIPLAN entries in the appropriate IAPs are replaced by the SCIPLAN entries in the CAP. Later, if ECS receives updated IAPs, ECS replaces the SCIPLAN entries from the CAP by the SCIPLAN entries from the new the IAPs.

B.8 COMMAND HISTORY REPORT EXAMPLE

NOTE: This is an example of the report which is produced by CMS and is described in Reference 8.

***** COMMAND HISTORY REPORT *****

```
95-265-16:34:19.3   6400   CMS MSG SENT:  0604   11ENABLE
95-265-16:34:41.2   6382   /NRT: remote command request processing has been enabled
95-265-16:37:25.0   6400   CMS MSG SENT:  0604   11RCREN
95-265-16:37:25.0   6415   CPAGE LINE:  0002 16:37:29 NRT 201 018 01 001 001 N  N
95-265-16:37:48.0   6354   /SEND:  command block successfully transmitted
95-265-16:37:48.0   6372   nrt group uplinked with verification on: CDS   14307
95-265-16:37:49.0   6400   CMS MSG SENT:  0601   59CDS    140370501-7Uplink begun with verification
95-265-16:38:10.0   6303   BARM:  TCB #201,1st mnem: CDS    14307, 1st tcm seq:1, 1st tcmseq:1 VERIFIED
95-265-16:38:10.0   6400   CMS MSG SENT:  0601   59CDS    1403705010Uplink verified
.
.
.
```

***** BACKGROUND QUEUE STATUS REPORT *****

Instr File	Time Received	Time to POCC	Status
MDITBL0001.BCK	1995/11/11 17:00:39	1995/11/12 03:10:10	Uplink Verified
MDITBL0002.BCK	1995/11/11 17:01:00	1995/11/12 03:10:12	Uplink Verified
MDITBL0003.BCK	1995/11/11 17:02:00	1995/11/12 03:10:14	Uplink Verified
MDITBL0004.BCK	1995/11/11 17:03:00	1995/11/12 03:10:15	Uplink Failed - BARM

B.9 TELEMETRY GAP REPORT EXAMPLE

***** TELEMETRY GAP REPORT *****

MISSION: SOHO
TIME RANGE: (START) 1995/08/22 00:00:00 (STOP) 1995/08/22 23:59:59

PACKET NAME	APID	MISSING SEQNUMS	START TIME	STOP TIME
SWACC	88CA	11 11	1995/08/22 14:06:10	1995/08/22 14:06:22
SWACC	88CA	26 28	1995/08/22 14:08:31	1995/08/22 14:08:50
MDISC	88C5	150 155	1995/08/22 14:42:10	1995/08/22 14:43:22
MDISC	88C5	226 228	1995/08/22 14:44:31	1995/08/22 14:44:50

B.10 ECS COMMANDING STATUS WINDOW

B.11 ECS TELEMETRY DISTRIBUTION MONITORING WINDOW

B.12 ECS DIRECTORIES

Data	Directory Name	Access by Insts	
Delayed commanding data	/iws_files/delcmd	Write SecureID	One directory for all instruments
Background-queue commanding data	/iws_files/bckque	Write SecureID	One directory for all instruments
Command validation reports	/cms_files/inputval	Read	One directory to store the validation reports generated by CMS for both delayed and background-queue commanding.
Science Activity plan	/iws_files/output_actplan	Read	Contains the ECS science activity plan for retrieval by the instrumenters.
Input to the Activity plan	/iws_files/input_actplan	Write	One directory is used by the instrumenters to deposit their input to the activity plan.
Archived telemetry data	/tlm_files/SVMHK1 /tlm_files/SVMHK2 /tlm_files/SVMHK3 /tlm_files/SVMHK4 /tlm_files/AOCHK1 /tlm_files/AOCHK2 /tlm_files/ATTIT1 /tlm_files/ATTIT2 /tlm_files/CDSHK /tlm_files/CDSSCH /tlm_files/CDSSCL /tlm_files/CDSSCM /tlm_files/CELHK /tlm_files/CELSC1 /tlm_files/CEPHK /tlm_files/CEPSC /tlm_files/ELAHK1 /tlm_files/ELAHK2 /tlm_files/ELAHK3 /tlm_files/ELASCH /tlm_files/ELASCL /tlm_files/EXPHK /tlm_files/GOLHK /tlm_files/GOLSC /tlm_files/MDIHK1 /tlm_files/MDIHK2 /tlm_files/MDIHR /tlm_files/MDISC /tlm_files/OBT /tlm_files/SUMHK /tlm_files/SUMSCH /tlm_files/SUMSCL /tlm_files/SW /tlm_files/SWAHK /tlm_files/SWASC /tlm_files/UVCHK /tlm_files/UVCSSC /tlm_files/VIRHK /tlm_files/VIRSC	Read	One directory for each APID ECS will automatically send files to a list of "default destinations". Instrumenters may also read data when needed.

Data	**Directory Name**	**Access by Insts**	
Telemetry Quicklook	/tlm_files/quicklook	Read	Contains telemetry quicklook files.
Telemetry Reports	/tlm_files/reports	Read	Contains the telemetry gap reports.
Summary data	/iws_files/sum_data	Write Read	One directory that contains all summary data (as deposited by instrumenters and as prepared for CDHF). All summary data files may be read by the instrumenters.
Orbit data	/cdhf_files/orbit_data	Read	Contains predictive and definitive orbit data.
Attitude data	/cdhf_files/attitude_data	Read	Contains the definitive attitude data.
Command history	/ancillary_data/chr	Read	One directory can be accessed by the instrumenters for file retrieval
Time correlation log	/ancillary_data/tcf	Read	One directory can be accessed by the instrumenters for file retrieval
SOHO Daily Report	/ancillary_data/sdr	Read	One directory can be accessed by the instrumenters for file retrieval
Project Data Base	/pdb_files	Read	Approximately 30 project data base files

APPENDIX C. ARCHIVED TELEMETRY FILE FORMAT

Production Data Format

<table>
<tr><td>Source Data Units</td><td colspan="2">Telemetry packet 1
Telemetry packet 2
Telemetry packet 3
. . .
. . .
. . .
. . .
. . .
. . .
. . .
. . .
Telemetry packet n</td></tr>
<tr><td>Quality and Accounting List Length</td><td colspan="2">32-bit integer specifying the length in bytes of the Quality and Accounting List</td></tr>
<tr><td rowspan="6">Quality and Accounting List</td><td>Offset of Data Unit</td><td>(32-bits): Position of errored packet in this file</td></tr>
<tr><td>Data Unit sequence number</td><td>(16-bits): Sequence number of packet in error</td></tr>
<tr><td>Error Type Flags</td><td>(8-bits): type of errors found
Bit 0 Not used
Bit 1 R-S header errors
Bit 2 Length code wrong
Bit 3 R-S frame errors
Bit 4 CRC frame errors
Bit 5 Sequence count error
Bit 6 Detected frame errors
Bit 7 Contain fill data</td></tr>
<tr><td>Count of segments CRC/RS errors</td><td>(8-bits): number of segments from frames with errors</td></tr>
<tr><td>Spare</td><td>(32-bits)</td></tr>
<tr><td>Fill start location</td><td>(16-bits); byte location of start of fill. 0000 for no fill</td></tr>
<tr><td>Missing Data Units List Length</td><td colspan="2">32-bit integer specifying the length in bytes of the missing data units list</td></tr>
<tr><td rowspan="3">Offset to Missing Data Units List</td><td>Offset to Missing Data Units List</td><td>(32-bit): position of start of data unit immediately preceding the first data unit of the list</td></tr>
<tr><td>From</td><td>Data unit sequence number</td></tr>
<tr><td>To</td><td>Data unit sequence number</td></tr>
</table>

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Between
the Solar and Heliospheric Observatory (SOHO)
Experimenters' Operations Facility (EOF)
Core System (ECS)
and the SOHO Instrumenters

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May 1995

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