WEC Detailed Data Analysis Software
ISDAT 2.3 Architectural Design

Editors:
Gunnar Holmgren and Anders Lundgren
Swedish Institute of Space Physics
Uppsala Division
S-755 91 Uppsala
Sweden

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1	2	94 Nov 14	Updated the list of filters in section **??**. Added more details on the handling of calibration files, section 3.2. Added reference to the data structure document in section 4.3.1. Referred to CSDS User Interface document for the CSDS module design, section 5.1.3. Removed the CSDS description from this document. Clarified that no development of a graphic time manager is included in the work packages, section 5.2.1. The cuitm time manager is mentioned in section 5.2.1. Clarified that client *ghplot* only runs under ISDAT version 1, section 5.2.2.
1	3	94 Nov 23	Added section 4.3.2 about version tracking.
1	4	95 May 24	Changes after the WEC Data meeting 95-2. Replaced ESIS by CSDS UI in section 3.1. Added details on the access control in section 5.1. Added details on the WEC housekeeping status in section 5.1.2. Added "ISDAT 2.1" to the title of the document. Replaced the Filter description by *shared libraries (operator)* facility in section 5.4 Corrested the function of the *search* client in section 5.2.2. Added recommendations regarding labelling of hard copies in section 5.2.2.
1	5	95 Dec 12	Changes pertinent to ISDAT version 2.3. Added possibility to do local access control, section 5.1. Modified Table 5, section 5.1, page 12. Added referense to the CSDS UI ADD in section 1.4, page 1.

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1 Introduction

1.1 Purpose of the document

This document describes the architectural design of the Cluster WEC detailed data analysis system. It does not describe the design of the underlying ISDAT design. The main purpose of the document is to describe the WEC implementation of ISDAT and identify the modular location of each user functional requirement.

1.2 Scope of the software

The scope of the software is to provide tools for the detailed data analysis for the Cluster WEC instruments. This software is not concerned with the production of the CSDS data bases or any other CSDS services. The software is intended to be implemented on workstations at individual WEC scientists, at WEC CoI institutions or at WEC related data centres.

1.3 Definitions, acronyms, and abbreviations

A complete list of acronyms is given in Appendix A.

1.4 Applicable documents

The WEC architectural design is based on the WEC data user requirements [Ref. 3]. This document overlaps with the CSDS User Interface / ISDAT architectural Design Document [Ref. ?]. This document therefore covers the WEC/ISDAT parts in detail, while ISDAT system components may be described in more detail in [Ref. ?].

1.5 Reference Documents

A complete reference list is found on page 20.

1.6 Overview of the document

The general structure of the document adheres to the ESA recommendations for the architectural design phase [Ref. 2].

2 System overview

The *WEC data system* will be built on an already existing structure, *ISDAT*. The core of ISDAT consists of a well defined, project independent, interface between a data base handler and the scientific analysis and display software (clients), and a mechanism for communication between the data base handler and the clients. ISDAT depends on a client/server model, implying a full flexibility regarding physical locations of analysis programs and data bases. The ISDAT system is described further in [Ref. 5]. It is recommended to read that short introduction before continuing. To to illustrate the relation between the different components in the system we show the ISDAT structure in Figure 1, and the use of ISDAT over networks in Figure 2.

This document is not concerned with the design of ISDAT. It is rather concerned with the *Cluster WEC implementation* of the ISDAT system. We will use the term *ISDAT* for the underlying software structure and *WEC data system* for the WEC implementation.

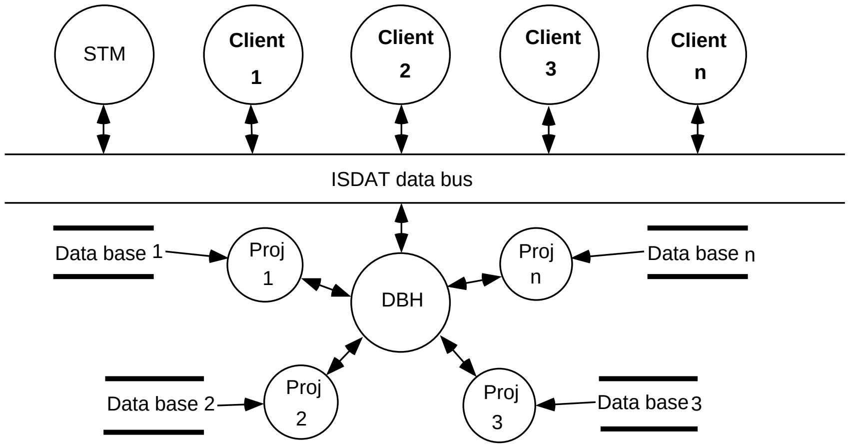

Figure 1: ISDAT general structure

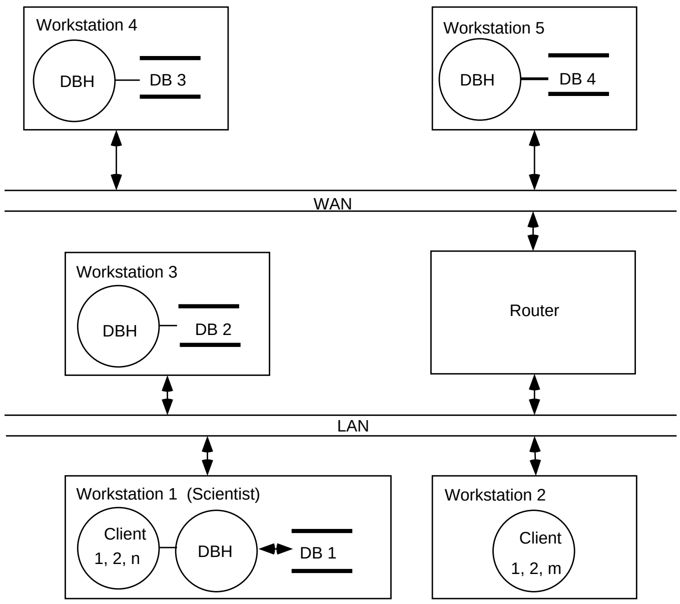

Figure 2: ISDAT distribution over networks

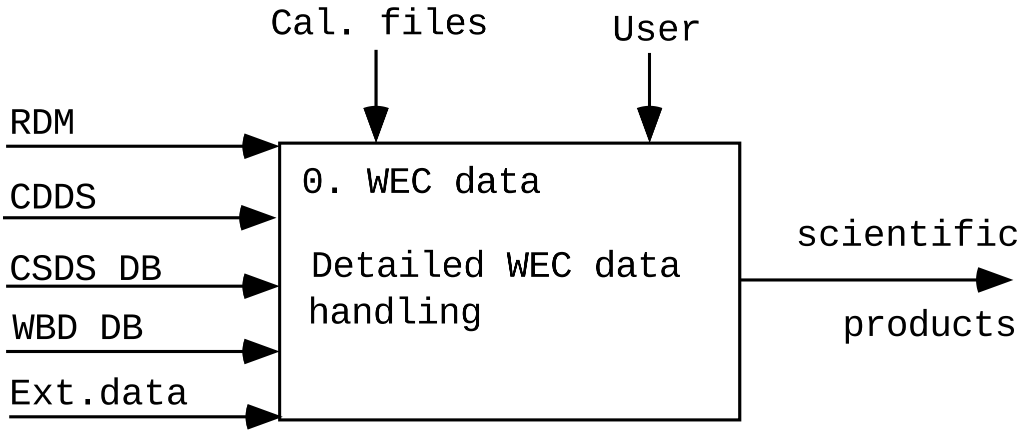

Figure 3: WEC data analysis system context

3 System context

The WEC data system context is shown in Figure 3

The external interfaces are described in the following sections.

3.1 Data input

The input to the system consist of external data bases in various formats. The Data bases identified so far are:

RDM The RDM data is stored on CD-ROM's delivered from the Cluster project directly to each WEC CoI. The format is described in [Ref. 6].

CDDS This is the formerly called "short history file" stored on line at ESOC. Access is restricted to PI's. The format and content is identical to the RDM format.

CSDS DB's Can be retrieved from the CSDS national data centres via the CSDS User Interface. These files may be stored on the local working station or they may be accessed remotely ove networks. The CSDS files are delivered in CDF format.

WBD DB This data base contains WBD data and one copy is delivered to each CSDS NDC on a TBD medium. It is up to the user to get access to the actual data.

Ext. data External data, like magnetic indices, can be fed into the system directly to a client.

3.2 Control data flow

WEC instrument calibration files These are normally stored on line on the site where the RDM file is residing. However, it is foreseen to update the calibration files throughout the mission. To make the updated calibration files available to all users, a calibration file server with the following characteristics will be used:

Location: CNES

Type: ftp

Experiments: STAFF_SA, STAFF_SC, EFW, DWP, WHISPER, WBD

Access: With password.

- WEC PI's, CoI's, and JSOC, read only all
- One person from each experiment read + write only the corresponding instrument file.
- Under responsability of CNES with PI's information.
- Active 24/24 h and 2 years after the end of the mission on a best effort basis.

Organisation:
- only one directory.
- one file/instrument/spacecraft
- ASCII file with comments in the file, comments are indicated by #.
- A file will contain all the calibration parameters needed for the data processing.
- In case of hardware failure regular save will be performed by CNES.
- Will start during the last three months of 1994.

The file formats are specified in [CWD-DDD-003, to be written].

User interface The ISDAT is an interactive system. The system is fully controlled by the individual user (scientist) in real time via clients (see 5.2).

3.3 Data output

There is no well defined format of the output. It is inherent in the design of the ISDAT to allows for great flexibility in output products. Normally, however, we think of the output products as screen images or hard copies.

4 System design

4.1 Design method

No rigorous analysis method is used for the architectural design. However, the design is presented in terms of data flow diagram in a form influenced by the structures analysis (SADT) method. Boxes represent functions (activity described by a verb). Arrows from the left represent input data, arrows to the right represent output data, and arrows from above represent control data. One level of decomposiion may be described by one or several diagrams. The level is indicated by a successive expansion of the number levels (for example 1.1.1).

4.2 Decomposition method

[This section will not be written]

4.3 System level description

The top level data flow diagram is shown in Figure 4.

The two top level components are described in section 5.

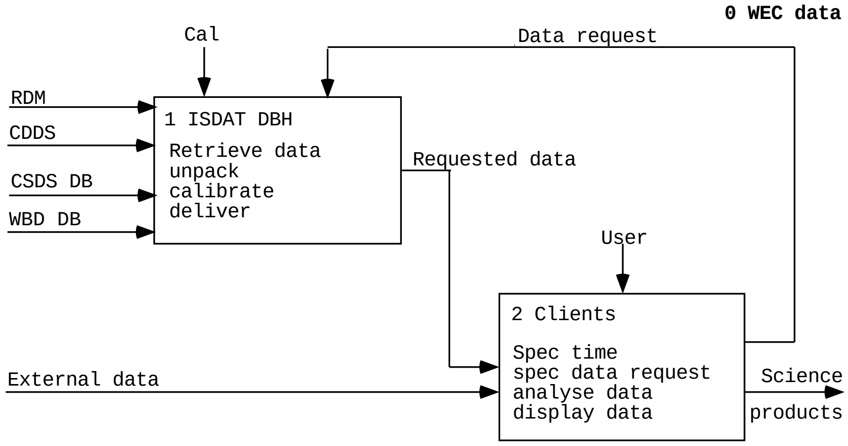

Figure 4: WEC data analysis data flow

4.3.1 Internal interfaces and formats

The interface between the ISDAT DBH and the *clients* is of client/server type. That is, the two processes are individual processes that may or may not run on the same workstation and at the same geographical location.

The format of the data exchange is very well defined and is described in the on-line manuals (DbLib). The DBH/client interface is in fact the key to the project independent nature of the ISDAT. The *request data* control data flow may be an actual data request or a query of the available instruments and their properties. The data request allows for a very flexible specification of the data, like physical units/raw data, data interpolation/original data set, time tagging/no time tags etc.

The data description structure for the WEC version (ISDAT version 2) will differ from earlier versions in that the structure is even more general in nature. The structure is extensively described in [Ref. 7].

4.3.2 Software version tracking

The software version numbering will use the following levels:

ISDAT major describes the overall ISDAT version number. This number will be incremented whenever the ISDAT client/server data exchange format is changed. That is clients of version 2 cannot communicate with a server of version 1. The following versions exist:

- **0** ISDAT prototype used with Viking data.
- **1** ISDAT test version used mainly with Freja and Eiscat data.
- **2** ISDAT cluster version used both for the CSDS User Interface and WEC.

ISDAT minor used for revisions inside the ISDAT server for revisions that do not affect the interface to clients in a critical manner. The numbering starts from zero.

Instrument module major used for changes of the general parts of the WEC module.

Instrument module minor used for changes of instrument specific parts of the WEC module. Changes might affect *instrument specific* clients. Note that this number is unique only for the specific instrument.

Calibration file used for version numbering of calibration files. The version number is unique only for a specific instrument.

The ISDAT server will return the complete five number version code with each data request. The returned string might look like: *2.0.1.3.14* for example, where 14 signifies the calibration file version number for the specific instrument, 3 signifies the instrument specific source code version number, 1 is the WEC specific server module version, and 2.0 specifies the ISDAT version and revision numbers.

5 Component description

Note that the following subsection numbers correspond to the module numbers if the leading section number is removed.

5.1 ISDAT DBH

The data base handler accommodates the unpacking and calibration of experiment data, as well as formatting of the data communicated to the clients requesting the data. The DBH is designed to randomly access the data, and is capable of handling a wide variety of requests in a general manner. Examples of such capabilities are data gap handling, interpolations, delivery of raw or calibrated data, supplying alphanumeric strings corresponding to delivered units, signals etc., warning flags and messages. The DBH is also capable of responding to client queries regarding instrument descriptions and available data hierarchy at the connected DBH. The available data is specified in terms of *conceptual instruments* that may or may not directly correspond to the actual hardware instruments. The conceptual instrument is described in a hierarchical manner as *project-member-instrument-sensor-signal-channel-parameter*. The DBH can handle multidimensional data up to five dimensions. The detailed descriptions are gi ven in the on line manuals.

Clients can connect locally or remotely using TCP/IP protocol. Several data base handlers can run simultaneously on one workstation. The DBH is built in a modular structure, with all project specific software residing in separate modules. The local installation thus only includes one or several project modules of use for that particular installation.

The DBH contains a mechanism to do access control based on the requesting host and/or user in the following way:

```
- Host/user based access control.

The ISDAT server (dbh) can be configured to only accept
connections from a set of specified hosts and users.

The feature is enabled by adding the line

*.common.hosts:               /home/isdat/ishosts

to the .isdat.server or isdat/config/isdat.server file,
where /home/isdat/ishosts is the access control file.

The syntax of the file is simple, it contains lines of the form:

host [user1 users2 ...]

A comment starts with a #.

The following example will allow access to all users
connecting from tiger.irfu.se and to the users eric
and vicky on plum.rol.berkeley.edu.
```

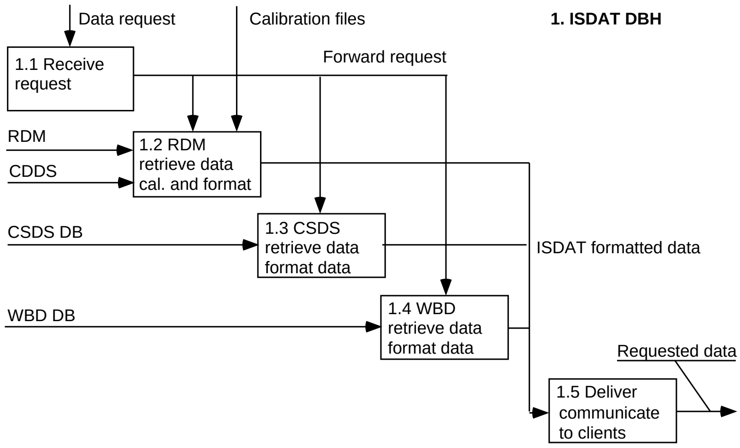

Figure 5: ISDAT DBH data flow

```
# Example of access control list for
# the ISDAT database handler.

tiger.irfu.se
plum.rol.berkeley.edu eric vicky
```

Normally no access control is made on the server host machine. However, with the following extension, also access control on the server host machine is enabled:

```
# setting checklocal=1 will enable access control also for local
# connections
#checklocal=1
```

The decomposition of the ISDAT DBH module is shown in Figure 5.

5.1.1 Receive request

This activity receives the requests from the clients, validates it and forwards the request to the relevant module.

5.1.2 RDM

This is the module handling the processing of the RDM and CDDS data. The decomposition is shown in Figure 6. The *RDM* module consist of:

5.1.2.1 RDM Index In order to achieve fast random access to the data, ISDAT uses index files that relates a particular time to a byte on the data file. If the index file does not exist this module creates it. If it already exists, the index file is read for use in the eventual data access. Similarily a status file is used for fast search for a particular mode of operation etc.

5.1.2.2 UNPACK Here the telemetry package relevant for the particular instrument[1] is selected.

[1] Where WEC is regarded as one instrument

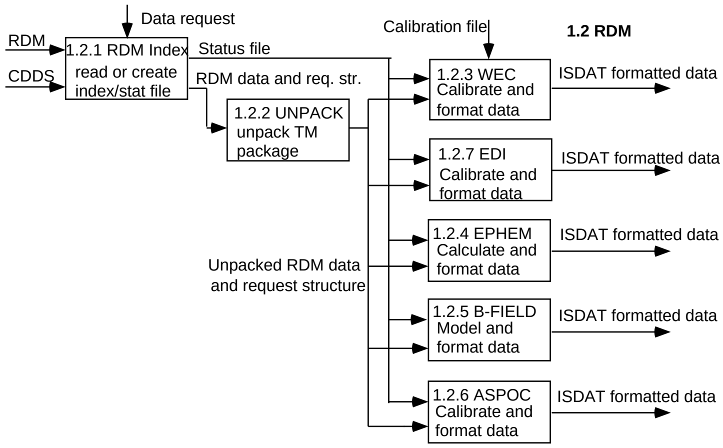

Figure 6: RDM module data flow

5.1.2.3 WEC This is where the WEC data is split into individual instruments, decompressed, calibrated, and formatted to ISDAT format. The decomposition of the WEC module is shown in Figure 7.

Here, we also obtaain the WEC housekeeping status data independent of the WEC instruments:

```
- WEC housekeeping status data

1)
To get WEC housekeeping status the following specification
is used, note that the same housekeeping block (192 bytes)
will be returned independent of the specified WEC instrument.

project = DbCLUSTER
member = DbCLU_C1 (or DbCLU_C2, DbCLU_C3, DbCLU_C1)
instrument = DbCLU_EFW (or DbCLU_STAFF, DbCLU_WHI, DbCLU_WBD, DbCLU_DWP)
sensor = DbCLU_HK

The return data object will have the characteristics
rank = 0
dataType = DbTYPE_REAL_UCHAR
dimension = 1
n[0] = 192
mapType = DbTYPE_REAL_UCHAR


2)
To get spacecraft housekeeping status the following specification
is used.

project = DbCLUSTER
member = DbCLU_C1 (or DbCLU_C2, DbCLU_C3, DbCLU_C1)
instrument = DbCLU_SC
sensor = DbCLU_HK

The return data object will have the characteristics
rank = 0
dataType = DbTYPE_REAL_UCHAR
```

```
dimension = 1
n[0] = TBD
mapType = DbTYPE_REAL_UCHAR


- WEC instrument status data

The specification of status from individual WEC instruments
is under the control of each instrument team.

1)
To get EFW Fast Digital Monitor status the following specification
is used.

project = DbCLUSTER
member = DbCLU_C1 (or DbCLU_C2, DbCLU_C3, DbCLU_C1)
instrument = DbCLU_EFW
sensor = DbCLU_EFW_FDM

The return data object will have the characteristics
rank = 0
dataType = DbTYPE_REAL_UCHAR
dimension = 1
n[0] = 4
mapType = DbTYPE_REAL_UCHAR


2)
To get EFW Digital SubCom status the following specification
is used.

project = DbCLUSTER
member = DbCLU_C1 (or DbCLU_C2, DbCLU_C3, DbCLU_C1)
instrument = DbCLU_EFW
sensor = DbCLU_EFW_DSC

The return data object will have the characteristics
rank = 0
dataType = DbTYPE_REAL_UCHAR
dimension = 1
n[0] = 256
mapType = DbTYPE_REAL_UCHAR
```

5.1.2.3.1 DWP-1 This is where the RDM data is split into individual WEC instruments and the data is decompressed if needed. This is also the place where the final time tagging of data takes place if requested.

5.1.2.3.2 STAFF This is the STAFF instrument specific part of the data base handler. This module shall contain all necessary knowledge about the particular instrument. This knowledge includes the *conceptual instrument* concept, antennae locations and directions etc. This module shall also be capable of communicating the information to the clients (via the Deliver module) in the ISDAT format. The calibration files are normally stored on line. However, mechanisms have to be present to update the calibration files. This is indicated in Figure 6 by the *Calibration file* control data input.

The physical instrument STAFF is divided into two conceptual instrument hierarchies, one for the search

Sensor	Signal	Channel	Parameter	Comment
DbSTAFFSC_B	DbSTAFFSC_SCX	DbSTAFFSC_10_HZ	not used	
		DbSTAFFSC_108_HZ	not used	
	DbSTAFFSC_SCY	DbSTAFFSC_10_HZ	not used	
		DbSTAFFSC_108_HZ	not used	
	DbSTAFFSC_SCZ	DbSTAFFSC_10_HZ	not used	
		DbSTAFFSC_108_HZ	not used	

Table 1: Conceptual instrument hierarchy for instrument STAFF SC

Sensor	Signal	Channel	Parameter	Comment
DbSTAFFSA_B	DbSTAFFSA_ACF	DbSTAFFSA_64_to_4096_HZ	not used	3 comp, 18 channels
		DbSTAFFSA_8_to_64_HZ	not used	9 channels
	DbSTAFFSA_ACF_CCF	DbSTAFFSA_64_to_4096_HZ	not used	18 channels
		DbSTAFFSA_8_to_64_HZ	not used	9 channels
	DbSTAFFSA_AGC	DbSTAFFSA_64_to_4096_HZ	not used	18 channels
		DbSTAFFSA_8_to_64_HZ	not used	9 channels
DbSTAFFSA_E	DbSTAFFSA_ACF	DbSTAFFSA_64_to_4096_HZ	not used	2 comp, 18 channels
		DbSTAFFSA_8_to_64_HZ	not used	9 channels
	DbSTAFFSA_ACF_CCF	DbSTAFFSA_64_to_4096_HZ	not used	18 channels
		DbSTAFFSA_8_to_64_HZ	not used	9 channels
	DbSTAFFSA_AGC	DbSTAFFSA_64_to_4096_HZ	not used	18 channels
		DbSTAFFSA_8_to_64_HZ	not used	9 channels
DbSTAFFSA_E_AND_B	DbSTAFFSA_CCF	DbSTAFFSA_64_to_4096_HZ	not used	3 comp
		DbSTAFFSA_8_to_64_HZ	not used	
DbSTAFFSA_E_AND_B	DbSTAFFSA_ACF_CCF	DbSTAFFSA_64_to_4096_HZ	not used	3 comp
		DbSTAFFSA_8_to_64_HZ	not used	

Table 2: Conceptual instrument hierarchy for instrument STAFF SA

coil and one for the spectrum analyzer. The conceptual instrument definitions are shown in Tables 1 and 2. Explanations of acronyms and the instrument is found in [Ref. 1].

5.1.2.3.3 EFW This is the EFW instrument specific part of the data base handler. This module shall contain all necessary knowledge about the particular instrument. This knowledge includes the *conceptual instrument* concept, antennae locations and directions etc. This module shall also be capable of communicating the information to the clients (via the Deliver module) in the ISDAT format. The calibration files are normally stored on line. However, mechanisms have to be present to update the calibration files. This is indicated in Figure 6 by the *Calibration file* control data input. The EFW conceptual instrument hierarchy is shown in Table 3.

5.1.2.3.4 WHISP This is the WHISPER instrument specific part of the data base handler. This module shall contain all necessary knowledge about the particular instrument. This knowledge includes the *conceptual instrument* concept, antennae locations and directions etc. This module shall also be capable of communicating the information to the clients (via the Deliver module) in the ISDAT format. The calibration files are normally stored on line. However, mechanisms have to be present to update the calibration files. This is indicated in Figure 6 by the *Calibration file* control data input. The conceptual instrument hierarchy is shown in Table 4.

5.1.2.3.5 DWP This is the DWP instrument specific part of the data base handler. This module shall contain all necessary knowledge about the particular instrument. This module shall also be capable of communicating the information to the clients (via the Deliver module) in the ISDAT format. The calibration files are normally stored on line. However, mechanisms have to be present to update the calibration files. This is indicated in Figure 6 by the *Calibration file* control data input. The DWP correlator conceptual instrument hierarchy is shown in Table 5.

5.1.2.3.6 WBD/RDM This is the WBD instrument specific part of the data base handler. This module shall contain all necessary knowledge about the particular instrument. This knowledge includes

Sensor	Signal	Channel	Parameter	Comment
DbEFW_E	DbEFW_P1	DbEFW_10_HZ	not used	
		DbEFW_180_HZ	not used	
		DbEFW_4_KHZ	not used	
		DbEFW_32_KHZ	not used	
	DbEFW_P2	DbEFW_10_HZ	not used	
		DbEFW_180_HZ	not used	
		DbEFW_4_KHZ	not used	
		DbEFW_32_KHZ	not used	
	DbEFW_P3	DbEFW_10_HZ	not used	
		DbEFW_180_HZ	not used	
		DbEFW_4_KHZ	not used	
		DbEFW_32_KHZ	not used	
	DbEFW_P4	DbEFW_10_HZ	not used	
		DbEFW_180_HZ	not used	
		DbEFW_4_KHZ	not used	
		DbEFW_32_KHZ	not used	
	DbEFW_P12	DbEFW_10_HZ	not used	
		DbEFW_180_HZ	not used	
		DbEFW_8_KHZ	not used	
		DbEFW_BP	not used	
		DbEFW_BPC	not used	
	DbEFW_P34	DbEFW_10_HZ	not used	
		DbEFW_180_HZ	not used	
		DbEFW_8_KHZ	not used	
	DbEFW_P1234	DbEFW_10_HZ	not used	
		DbEFW_180_HZ	not used	
		DbEFW_8_KHZ	not used	
	DbEFW_P32	DbEFW_10_HZ	not used	
		DbEFW_180_HZ	not used	
		DbEFW_8_KHZ	not used	
DbEFW_B	DbEFW_SCX	DbEFW_4_KHZ	not used	
	DbEFW_SCY	DbEFW_4_KHZ	not used	
	DbEFW_SCZ	DbEFW_4_KHZ	not used	
	DbEFW_SC	DbEFW_4_KHZ	not used	
DbEFW_N	DbEFW_P1	DbEFW_10_HZ	not used	
		DbEFW_180_HZ	not used	
		DbEFW_4_KHZ	not used	
	DbEFW_P2	DbEFW_10_HZ	not used	
		DbEFW_180_HZ	not used	
		DbEFW_4_KHZ	not used	
	DbEFW_P3	DbEFW_10_HZ	not used	
		DbEFW_180_HZ	not used	
		DbEFW_4_KHZ	not used	
	DbEFW_P4	DbEFW_10_HZ	not used	
		DbEFW_180_HZ	not used	
		DbEFW_4_KHZ	not used	

Table 3: Conceptual instrument hierarchy for instrument EFW

Sensor	Signal	Channel	Parameter	Comment
DbWHI_NATURAL	not used	not used	not used	512 freq. bins
DbWHI_ACTIVE	not used	not used	not used	512 freq. bins
DbWHI_ENERGY	not used	not used	not used	scalar

Table 4: Conceptual instrument hierarchy for instrument WHISPER

Sensor	Signal	Channel	Parameter
acf1	not used	not used	not used
acf2	not used	not used	not used
acf3	not used	not used	not used
energy1	not used	not used	not used
energy2	not used	not used	not used
energy3	not used	not used	not used

Table 5: Conceptual instrument hierarchy for instrument DWP

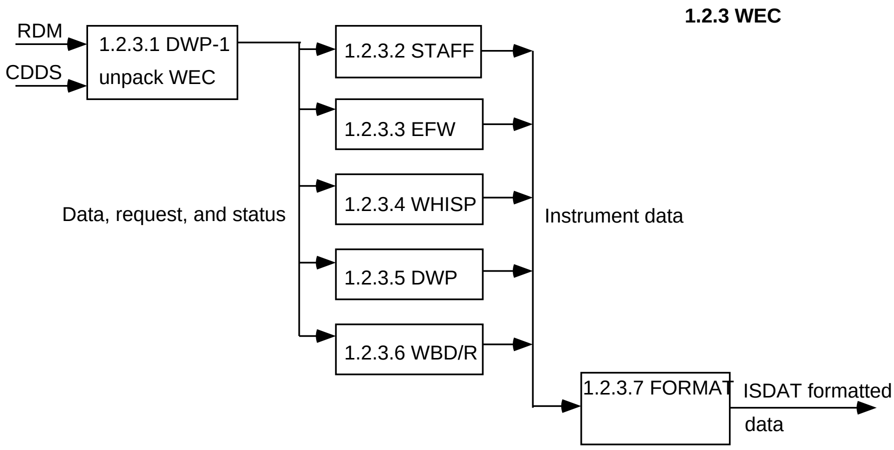

Figure 7: WEC data flow

the *conceptual instrument* concept, antennae locations and directions etc. This module shall also be capable of communicating the information to the clients (via the Deliver module) in the ISDAT format. The calibration files are normally stored on line. However, mechanisms have to be present to update the calibration files. This is indicated in Figure 6 by the *Calibration file* control data input. Note that there is also a WBD specific module (1.4), described in section 5.1.4, that reads data directly from the WBD specific data base. The WBD conceptual instrument hierarchy is sholn in Table 6.

5.1.2.4 EPHEM This module is responsible for providing and formatting position and attitude data. The results are presented to the clients as conceptual instruments. The conceptual instrument hierarchy is shown in Table 7.

5.1.2.5 B-FIELD Here magnetis field models are handled. The result is presented as conceptual instruments to the clients.

5.1.2.6 ASPOC This module handles all ASPOC related activities.

5.1.3 CSDS

This is the module handling the access to the CSDS databases. The CSDS data files are available at the CSDS national data centres via the CSDS user interface. The ISDAT design is sescribed in [Ref. 4].

5.1.4 WBD

This is the module handling the access to the WBD database. The WBD data files are available at the CSDS national data centres. Here it is assumed that copies of the WBD files are residing at the local workstation. The decomposition is shown in Figure 8.

Sensor	Signal	Channel	Parameter	Comment
DbWBD_E_Z	DbWBD_BB	DbWBD_9_KHZ	not used	P12
		DbWBD_19_8BIT	not used	
		DbWBD_77_8BIT	not used	
		DbWBD_19_4BIT	not used	
		DbWBD_77_4BIT	not used	
	DbWBD_125_KHZ	DbWBD_9_KHZ	not used	
		DbWBD_19_8BIT	not used	
		DbWBD_77_8BIT	not used	
		DbWBD_19_4BIT	not used	
		DbWBD_77_4BIT	not used	
	DbWBD_250_KHZ	DbWBD_9_KHZ	not used	
		DbWBD_19_8BIT	not used	
		DbWBD_77_8BIT	not used	
		DbWBD_19_4BIT	not used	
		DbWBD_77_4BIT	not used	
	DbWBD_500_KHZ	DbWBD_9_KHZ	not used	
		DbWBD_19_8BIT	not used	
		DbWBD_77_8BIT	not used	
		DbWBD_19_4BIT	not used	
		DbWBD_77_4BIT	not used	
DbWBD_E_Y	DbWBD_BB	DbWBD_9_KHZ	not used	P34
		DbWBD_19_8BIT	not used	
		DbWBD_77_8BIT	not used	
		DbWBD_19_4BIT	not used	
		DbWBD_77_4BIT	not used	
	DbWBD_125_KHZ	DbWBD_9_KHZ	not used	
		DbWBD_19_8BIT	not used	
		DbWBD_77_8BIT	not used	
		DbWBD_19_4BIT	not used	
		DbWBD_77_4BIT	not used	
	DbWBD_250_KHZ	DbWBD_9_KHZ	not used	
		DbWBD_19_8BIT	not used	
		DbWBD_77_8BIT	not used	
		DbWBD_19_4BIT	not used	
		DbWBD_77_4BIT	not used	
	DbWBD_500_KHZ	DbWBD_9_KHZ	not used	
		DbWBD_19_8BIT	not used	
		DbWBD_77_8BIT	not used	
		DbWBD_19_4BIT	not used	
		DbWBD_77_4BIT	not used	
DbWBD_BX	DbWBD_BB	DbWBD_9_KHZ	not used	
		DbWBD_19_8BIT	not used	
		DbWBD_19_4BIT	not used	
DbWBD_BZ	DbWBD_BB	DbWBD_9_KHZ	not used	
		DbWBD_19_8BIT	not used	
		DbWBD_19_4BIT	not used	

Table 6: Conceptual instrument hierarchy for instrument WBD

Sensor	Signal	Channel	Parameter	Comment
DbDbEPH_POS	not used	not used	not used	
DbEPH_VEL	not used	not used	not used	
DbEPH_SEP	DbEPH_C1	not used	not used	Separation between
	DbEPH_C2	not used	not used	the satellite selected as
	DbEPH_C3	not used	not used	member and satellite
	DbEPH_C4	not used	not used	selected as signal
DbEPH_Q_VALUE	not used	not used	not used	
DbEPH_PHASE_ANGLE	not used	not used	not used	

Table 7: Conceptual instrument hierarchy for instrument EPHEMERIS

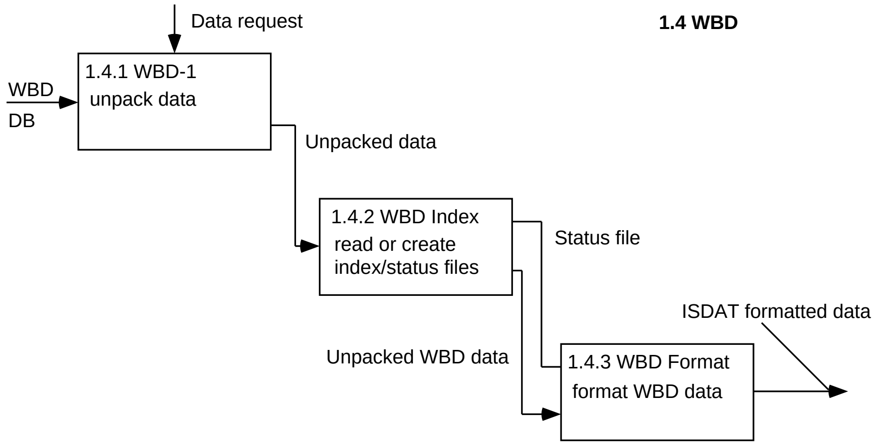

Figure 8: WBD data flow

The *WBD* module consist of

1.4.1 WBD-1 The first step is to unpack the files, provided that has not already been done, and the unpacked files are stored locally.

1.4.2 WBD Index In order to achieve fast random access to the data ISDAT uses index files that relates a particular time to a byte on the data file. If the index file does not exist this module creates it. If it already exists, the index file is read for use in the eventual data access. Similarily a status file is used for fast search for a particular mode of operation etc.

1.4.3 WBD Format This module takes care of the formatting of the WBD data to ISDAT delivery format.

5.1.5 Deliver data

This module is sesponsible for communicating the requested data out to the ISDAT software bus. Note that data can be made available to all clients that are grouped together via one *time manager*, not only to the client that actually requested the data.

5.2 Clients

By *clients* we understand analysis and display programs by which the user interacts with the ISDAT and receives his products. There are three kinds of clients:

1. time managers
2. general clients
3. specific clients

A particular client may or may not be a part of the ISDAT distribution within WEC. It could well be a personal client residing at a local workstation. Every client is self standing program (main program) that may or may not run at the same work station as the ISDAT DBH from which it gets its data. The two latter classes of clients may include direct links to commercial program packages like IDL or Matlab. The data flow related to clients is well shown in Figure 4 where the activity *2. clients* can be replaced by the specific client. We will describe some basic clients that will be included in the WEC data system. The number of clients will, however, vary during the liftime of the mission.

5.2.1 Time managers

Time managers are special *clients* that are used to coordinate the behaviour of an associated group of clients. A typical set of functions for a time manager may be:

Activate other clients At start time, the time manager traverses the ISDAT directory tree, identifies all executable files, builds a menu or a list of clients. The user then can select clients from the list to be activated and added to the group of clients controlled by the particular time manager.

Select project At start time the time manager identifies available projects, and the user may choose one of the available projects.

Select data file At start time the time manager identifies available data periods, and the user can select a suitable time interval. As the time interval is updated, all active clients are informed about the currently selected interval. This means that the user can have several graphic windows open and he can be sure that all windows belonging to the group of clients represent the same time interval.

Several time managers, each controlling its group of clients, may be active simultaneously.

The following time managers may be included:

5.2.1.1 STM Simple Time Manager is already in existence. It uses a simple alphanumeric user interface.

5.2.1.2 GTM Graphic Time Manager with a graphic user interface. The development of a GTM is not included in the work packages.

cuitm A time manager that is included in the CSDS User Interface, see [Ref. 4].

5.2.2 General clients

The *general clients* do not depend on any particular project or instrument etc. It normally starts by quering the ISDAT DBH about the supported projects and its properties and build up menues to support the user in requesting data.

It is recommended that all hard copies produced by the general clients are labelled to facilitate the tracing of the origin of the data. The recommended format of the labelling is: ISDAT version, client name and version, user name, platform, date of production. For example:

`isdat 2.1.0(.4) igr 2.1 gh@tiger 1995-05-24 13:23:14`

The foreseen general clients are:

5.2.2.1 ts This is an already existing graphic program written in GKS, and mainly used in connection with software development of other clients. There are no formal user requirements linked to this client.

5.2.2.2 igr This is the *general purpose* graphics client (Isdat GRaphics) to be implemented in Xlib for maximum portability.

5.2.2.3 ghplot This is an already existing general purpose software package, developed in connection with the Freja and Viking projects. It is implemented in PHIGS/PEX. It might not be further maintained after the *igr* has been implemented. There are no formal user requirements linked to *ghplot*. There are no guarantees that it will be ported to ISDAT 2.1. . At present it runs under ISDAT version 1.

5.2.3.4 search This client searches events based on data stored in the scientific data packages.

5.2.2.6 variance

5.2.2.7 IDL-client

5.2.3 Specific clients

The *specific clients* depend on a particular project or instrument etc. and are intended for particular data analysis purposes. The foreseen specific clients are:

5.2.3.1 WEC status

5.2.3.2 STAFF status

5.2.3.3 EFW status

5.2.3.4 WHISPER status

5.2.3.5 DWP status

5.2.3.6 WBD status

5.2.3.7 epGraph

5.3 Libraries

There are a number of ISDAT libraries in support of time managers and clients. The currently implemented or planned libraries are:

IsLib Client/manager communication.

IsutilLib Time transformations.

DbLib Data base handler communication

UiLib User interface library for creation of plot panels, buttons, potentiometers etc.

GiLib Plot functions, auto scaled plots, tic marks, labels, scales etc.

TsLib Time series analysis functions, FFT, correlation etc.

BfLib Magnetic field models

IDLLib A library that, linked with the IDL, connects the IDL software with ISDAT.

5.4 Shared Libraries (Operators) facility

In ISDAT versions 0 and 1, *filters* were used to *pipe* data through algorithms etc. in order to have a possibility to manipulate data at run-time. *Filters*, however, only allowed for passing a fixed list of arguments and thus limited the flexibility. In ISDAT version 2, *filters* are replaced by *ISDAT operators* using shared libraries thus allowing the users to add personal data manipulation modules with a very high degree of flexiblity. A number of *operators* will be centrally supplied. In ISDAT 2.1, the provided *operators* will be provided via the *igr calculator* facility. The *operators* will be included in the WEC/ISDAT 2.1 are:

Coordinate transformations covering most of the foreseen coordinate transformations.

Joining with fuzzy join and other join algorithms.

arithmetic operations with the four basic arithmetic operations directly implemented in the *igr calculator* and possibilities to add any other manipulation routine as a personal operator.

Additional identified desired *operators* are:

File import for reading of ASCII files

Averaging operator

Units conversion operator

Modulus operator for computation of modulus.

6 Traceability matrix

Functional user requirement		Component	Depends on
UR-WEC-001	General requirement	0 WEC data	
UR-WEC-101	Add personal s/w	0 WEC data	
UR-WEC-102	Interface to IDL	0 WEC data	IDLLib
UR-WEC-102a	Interface to MATLAB		Priority 3
UR-WEC-103	Operate over networks	0 WEC data	
UR-WEC-104	Unpack all WEC param.	1.2.3.2 STAFF	1.2.3.1 DWP-1
		1.2.3.3 EFW	1.2.3.1 DWP-1
		1.2.3.4 WHISP	1.2.3.1 DWP-1
		1.2.3.5 DWP	1.2.3.1 DWP-1
		1.4.3 WBD	
		1.2.3.6 WBD/RDM	1.2.3.1 DWP-1
UR-WEC-105	TM units or phys. units	1.2.3.2 STAFF	
		1.2.3.3 EFW	
		1.2.3.4 WHISP	
		1.2.3.5 DWP	
		1.2.3.6 WBD/RDM	
UR-WEC-106	Search based on h/k data	2.3.4 Search	
UR-WEC-107	Search algorithms		Priority 3
UR-WEC-108	Display h/k data	2.3.1 WEC status	
		2.3.2 STAFF status	
		2.3.3 EFW status	
		2.3.4 WHISPER status	
		2.3.5 DWP status	
		2.3.6 WBD status	
UR-WEC-109	Not used		
UR-WEC-110	RDM format as input	0 WEC data, 1.2.2 DWP-1	
UR-WEC-110a	Convert RDM to level 1 and 2	1.2.3.2 STAFF	
		1.2.3.3 EFW	
		1.2.3.4 WHISP	
		1.2.3.5 DWP	
		1.2.3.6 WBD/RDM	
UR-WEC-111a	CDDS format as input	0 WEC data, 1.2.2 DWP-1	
UR-WEC-111b	CSDS DB format as input	CSDS User Interface	
UR-WEC-112	Not used		
UR-WEC-113	Produce hard copies in B/W and C	2.2.2 igr	
UR-WEC-114	Import external data	2.3.5 fileFilter	
UR-WEC-114a	Time tags to highest accuracy	1.2.2 DWP-1	
UR-WEC-114b	Join data sets	0 WEC data	
UR-WEC-114c	Provide a number of join algorithms	TBD	Pending task group
UR-WEC-114d	Provide sub-sampling	TBD	Pending task group
UR-WEC-114e	Provide sub-sets of data	TBD	Pending task group
UR-WEC-114f	Provide re-sampling	TBD	Pending task group

Functional user requirement		Component	depends on
UR-WEC-115	Provide satellite velocities	1.2.4 EPHEM	
UR-WEC-116	Provide aspect angles	1.2.4 EPHEM	
UR-WEC-117	The 4 satellites simultaneously	0 WEC data, 2.2.2 igr	
UR-WEC-118	Aspect angles wrt B-model		Priority 3
UR-WEC-119	Aspect angle wrt measured B	1.2.4 EPHEM	
UR-WEC-121	Sat. pos. in different coord	coordFilter	1.3.7 ephemeris
UR-WEC-121a	Estimate errors based on tetrahedron		Priority 3
UR-WEC-122	Pointing flux		Priority 3
UR-WEC-124	Provide B-models	1.2.5 B-FIELD	BfLib
UR-WEC-125	Display WHISPER on flag	1.2.3.3 EFW	
UR-WEC-126	Display ASPOC on flag	1.2.6 ASPOC	
UR-WEC-127	Not used		
UR-WEC-127a	Not used		
UR-WEC-128	Not used		
UR-WEC-129	Not used		
UR-WEC-130a	2D line plots on fine time scale	2.2.2 igr	
UR-WEC-130b	2D line plots covering an orbit	2.2.2 igr	
UR-WEC-130c	Colour coded 2D plots	2.2.2 igr	
UR-WEC-130d	Hodograms	2.2.2 igr	
UR-WEC-130e	Scatter plots	2.2.2 igr	
UR-WEC-131	Rotate presented data		Priority 3
UR-WEC-131a	variance of vectors	2.2.6 variance	
UR-WEC-131b	Vector field coord transf.	coordFilter	
UR-WEC-131c	Import personal transf. matrix	coordFilter	
UR-WEC-132	Variable number of panels	2.2.2 igr	
UR-WEC-132a	Customise plots	2.2.2 igr	
UR-WEC-133	Move around on screen	2.2.2 igr	
UR-WEC-133a	Multi-parameter plot on one panel	2.2.2 igr	
UR-WEC-134	Fixed or pre-set scales	2.2.2 igr	
UR-WEC-135	Variety of colour scales	2.2.2 igr	
UR-WEC-136	Zoom in facility		Priority 3
UR-WEC-137	Select time from plot	2.2.2 igr	

Functional user requirement		Component	depends on
UR-WEC-140a	Provide FFT analysis	2.2.2 igr, 2.2.7 IDL-client	TsLib
UR-WEC-140b	Provide cross corr anal	2.2.2 igr, 2.2.7 IDL-client	TsLib
UR-WEC-140c	Provide cross spect anal	2.2.2 igr, IDL-client	TsLib
UR-WEC-140d	Provide averaging	0 WEC data	
		averFilter	
UR-WEC-140f	Provide high pass filtering	2.2.2 igr, 2.2.7 IDL-client	TsLib
UR-WEC-140g	Provide band bass filtering	2.2.2 igr, 2.2.7 IDL-client	TsLib
UR-WEC-140h	Provide wavelet analysis	2.2.7 IDL-client	
UR-WEC-141	Combine parameters in analysis	2.2.2 igr, analFilter	
UR-WEC-141a	Standard conversions	1.2.5 B-FIELD	BfLib
		analFilter	
UR-WEC-142	Change units	1.2.3.2 STAFF	
		1.2.3.3 EFW	
		1.2.3.4 WHISP	
		1.2.3.5 DWP	
		1.4.3 WBD format	
		unitsFilter	
UR-WEC-143	Treat NULL values properly	0 WEC data	instrument modules?
UR-WEC-144	Strict simultaneuity	TBD	Pending task group
UR-WEC-150	Labelling of hard copies	2.2.2 igr	Pending task group
UR-WEC-151	Sensor attitude	1.2.3.2 STAFF	
		1.2.3.3 EFW	
		1.2.3.4 WHISP	
		1.4.3 WBD format	
		1.2.4 EPHEM	
UR-WEC-152	Status info from all WEC instr	2.3.2 STAFF status	
		2.3.3 EFW status	
		2.3.4 WHISPER status	
		2.3.5 DWP status	
		2.3.6 WBD status	
		2.3.1 WEC status	
UR-WEC-153	EDI mode	2.3.1 WEC status	
UR-DWP-101	Provide house keeping data	1.2.3.5 DWP	
UR-DWP-102	Extract individual data sets	0 WEC data	
UR-DWP-103	Decompress data	1.2.2 DWP-1	
UR-DWP-104	Calibrate to produce level 2	1.2.3.2 STAFF	
		1.2.3.3 EFW	
		1.2.3.4 WHISP	
		1.2.3.5 DWP	
		1.4.3 WBD	
UR-DWP-105	Extract particle corr data	1.2.3.5 DWP	
UR-DWP-201	Show h/k data as text	2.3.1 WEC housekeeping	
UR-DWP-202	Show h/k data graphically	2.3.1 WEC housekeeping	
UR-DWP-203	Display data vs time with colour		
UR-DWP-204	Display significance amplitude		

Functional user requirement		Component	depends on
UR-EPH-POS-101	pos. for time spec by user	1.2.4 EPHEM	
UR-EPH-POS-102	User to spec accuracy of pos.	1.2.4 EPHEM	2.1.1 STM
UR-EPH-POS-103	User to spec time betw pos. comp.	1.2.4 EPHEM	2.1.1 STM
UR-EPH-POS-111	Access CSDS SP ephemeris	1.3.3 CSDS format	
UR-EPH-POS-112	Access pos. from RDM	1.2.4 EPHEM	
UR-EPH-POS-121	Calc. ephemeris from RDM	1.2.4 EPHEM	
UR-EPH-POS-122	Interpolate in pos. data	1.2.4 EPHEM	
UR-EPH-POS-123	ephemeris for other projects		
UR-EPH-POS-124	Transformation of pos. data	1.2.4 EPHEM	
UR-EPH-POS-201	Plot pos. in variable coord	2.3.7 epgraph	
UR-EPH-POS-202	Time tags on satellite track	2.3.7 epgraph	
UR-EPH-POS-203	Superimpose models and pos.	2.3.7 epgraph	
UR-EPH-POS-204	Show region traversed		
UR-EPH-POS-205	Plot pos of other s/c		
UR-EPH-SEP-101	Provide inter-s/c separations	1.2.4 EPHEM	
UR-EPH-SEP-102	Provide tetrahedron	1.2.4 EPHEM	
UR-EPH-SEP-201	Plot relative positions	2.3.7 epgraph	
UR-EPH-PA-101	Provide p/a of s/s	1.2.4 EPHEM	

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A Acronyms

Acronym	Meaning
AC	Alternating Current
AFGL	Air Force Geophysics Laboratory
AI	Artificial Intelligence
AO	Announcement of Opportunity
APX	Alpha APX is a computer architecture
ASPOC	Active Spacecraft Potential Control
C	A programming language
CD-ROM	Compact Disc Read Only Memory
CDAW	Coordinated Data Analysis Workshop
CEDAS	Cluster EFW Data Analysis System
CFC	Centre Français Cluster
CoI	Co-investigator
CDDS	Cluster Data Disposition System
CSDS	Cluster Science data System, replaces CSDC
DB	Data Base
DC	Data Centre
DC	Direct Current
DD	Data Distribution
EFW	Electric Field and Wave Experiment
ESA	European Space Agency
ESANET	European Space Agency Network
ESIS	European Space Information System
ESTEC	European Space Technology Centre
FFT	Fast Fourier Transform
FORTRAN	FORmula TRANslator
GSFC	Goddard Space Flight Center
HP	Hewlett Packard
IDL	Interactive Data Language
IRF-U	Institutet för Rymdfysik, Uppsalaavdelningen
	Swedish Inst. of Space Phys., Uppsala Division
ISDAT	Interactive Science Data Analysis Tool
ISEE	International Sun-Earth Explorer
IMF	Interplanetary Magnetic Field

Table 8: Acronyms part 1

Acronym	Meaning
ISDAT	Interactive Science Data Analysis Tool
JSOC	Joint Science Operations Centre
KHOROS	Graphics software package
KTH	Kungliga Tekniska Högskolan
	Royal Institute of Technology
Matlab	Matrix Laboratory
MB	Mega-byte
MHD	Magnetohydrodynamics
PC	Personal Computer
PEX	Phigs Extended to X
PHIGS	Programmers Hierarchical Interactive Graphics System
PI	Principal Investigator
POSIX	Operating system
PPDB	Prime Parameter Data base
RDM	Raw Data Medium
SDC	Scandinavian Data Centre
SPDB	Summary Parameter Data Base
SPlots	Summary Plots
SSL	Space Sciences Laboratory
SWT	Science Working Team
TBD	To be defined
TM	Telemetry
UCB	University of California at Berkeley
Unix	Operating system
UR	User Requirement
VAX	A Computer architecture
WBD	Wide Band Data
WEC	Wave Experiment Consortium
WHISPER	Waves of High Frequency and Sounder for Probing of the Electron Density by Relaxation
X11R5	X-Windows, revision 5
s/w	software
2D	Two dimensional
3D	Three dimensional

Table 9: Acronyms part 2