AQUARIUS/SAC-D

6th Aquarius/SAC-D Science Meeting

Data Collection System (DCS) Overview

Héctor Raimondo & Felipe Madero

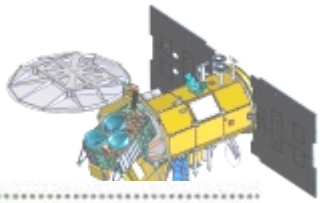
19-21 July 2010
Seattle, Washington, USA

NASA

CONAE
COMISION NACIONAL DE ACTIVIDADES ESPACIALES

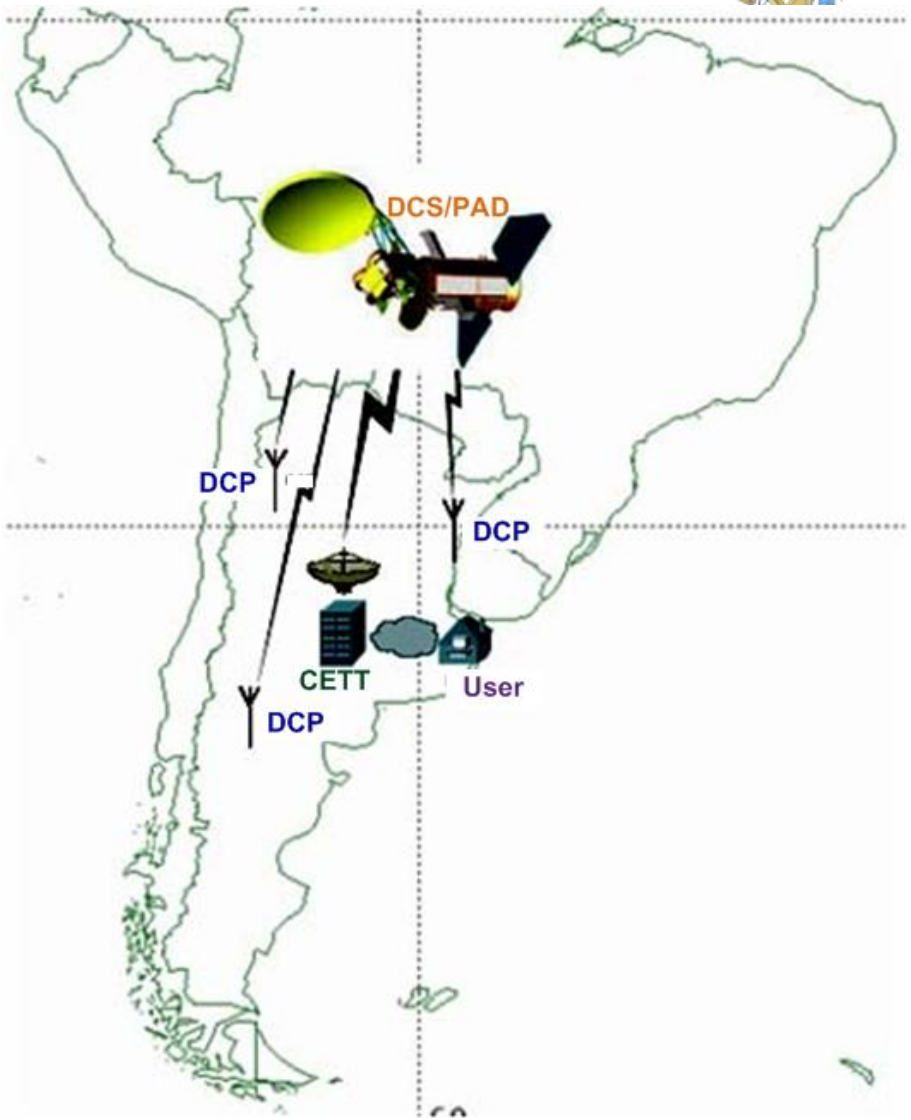
ESR

DCS Components

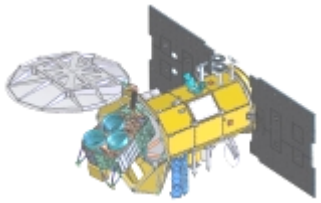


- Data Collection Platform (DCP)
- Instrument on board Observatory (DCS/PAD)
- TT&C Ground Station (CETT)
- Pre Processing and Distribution Center (CETT)
- Users

CETT: Centro Espacial Teófilo Tabanera / Teófilo Tabanera Space Center.
(Cordoba – Argentina)



DCS Definitions

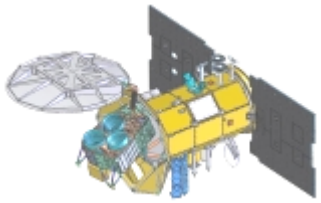


- DCS (Data Collection System) is a system designed to collect information from ground or near ground user platforms (Data Collection Platform - DCP) by a satellite with a data receiver.

- The DCP transmit information asynchronously and this data is decoded and stored onboard the satellite for later transmission to Earth.

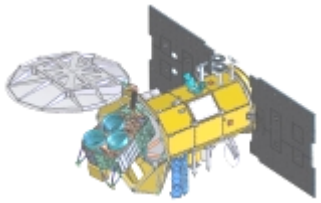
- The Pre Processing and Distribution Center receives the data from the Observatory, which is processed and addressed to the users.

Main Characteristics Overview

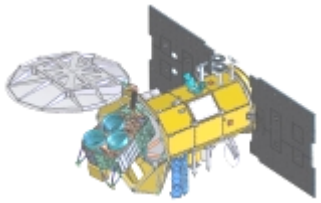


- System — Argentine DCS
- Mission — SAC-D (Environmental Data Collection)
- Coverage — National / Regional
- Operational Mode — Store and Forward
- Routing — Falda del Carmen
- Proc and Dist Center — Falda del Carmen
- Platform Density — 200 (maximum at Argentine territory)
- Platform Operation — Random transmission (30 to 220 sec period)
- Revisit — 2/4 contacts per day
- Footprint — 2300 Km

Main Characteristics Overview

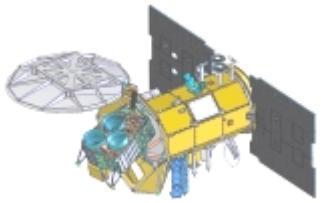


• Message type	Argos Compatible
• Message Size	46 bytes Maximum useful data 32 bytes
• Tx Message duration	Max 920 ms
• DCP position	none (GPS optional)
• Reliability	CRC (optional)
• Uplink	UHF 401.55 MHz
• Data Security	N/A
• Platform compatible	Argos Compatible
• User access delay	< 1day
• Simultaneous message received	1 max



Science Data

Modos de Operación

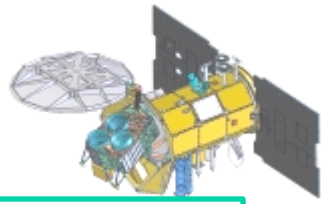


The DCS has 5 operation modes. One of them is related to the data acquisition (environmental parameters). The others 4 operation mode refer to configuration and test.

Mode	ID	Description
Mode 0	**INIT**	Initialization
Mode 1	**STAND-BY**	Stand-By
Mode 2	**DCP_RX**	DCP-Reception
Mode 3	**TEST**	Test
Mode 4	**POWER_OFF**	DCS off

MODE 2 – DCP_RX: In this mode the DCS could collect and store data from land platforms (DCPs).

DCS-FRAMES



5 frame types was defined to the DCP-DCS-PAD system:
C-FRAMES, R-FRAMES, DCP-FRAMES, I-FRAMES and T-FRAMES

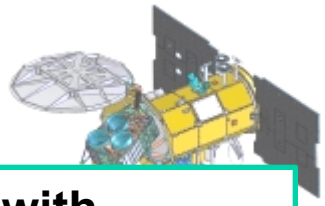
- **The land platforms (DCPs) send data frames with information to DCS, then the DCS generates the DCP-FRAMES.**

- **When the DCP Frames are received by DCS, the data is merged with other information generated by DCS, such as: doppler-shift, local time-stamp, AGC value, etc.**

- **This mixture of DCP Frame and DCS Information is called I-FRAME.**

(Mode 2 - DCP_RX ➔ I-FRAME)

DCP-FRAMES



The data received from land platform will be completely compatible with ARGOS system format.

CARRIER ONLY	MODULATED CARRIER						
160 ms	A	B	C	D	E	F	G

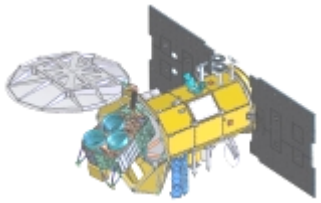
A – bit synchronization	15 bits “1”
B – Word synchronization	8 bits (“00010111”)
C – initialization	1 bit “1”
D – number of 32 bit blocks	4 bits (N = 1,2,...8)
E – DCP identification	20 bits
F – Sensor data	32*N bits
G – CRC (optional)	8 bits

The DCS will save the D to G fields as DCP-FRAME. This frame could have between 7 bytes (N=1, without CRC) and 36 bytes (N=8, with CRC). The CRC (cyclic redundancy check) is set by the platform and it is optional.

“F-Sensor data” field:

- **32 sensors could be connected to one DCP Transmitter**
- **Each measure, from one instrument, could use since 1 to 32 bits.**
- **The length of Sensor Data Field could be on range of 32 to 256 bits**

TimeStamp

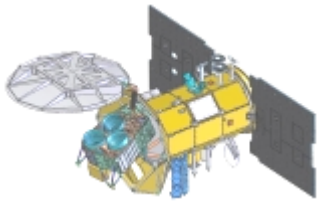


- The DCS system stamps a time mark (OBT+OBTfix) on data received from land platforms (DCP) with milliseconds precision but those data could have been acquired long time before to be transmitted by DCP and received by DCS.
- The DCP should mark the instrument measures with the hour and the day at least. The rest of date could be calculated from OBT.

Generic schema for the "F-Sensor data" field

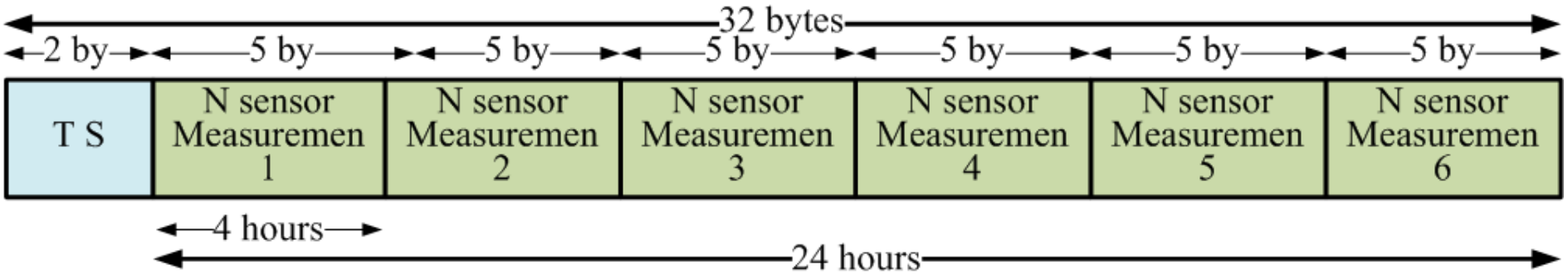
- N sensor could be installed on each land platform.
- Measurements (of de N sensors set) could be separated in period of X hours of time and it could be stored up to Y measurements' set in one message (message max length: 32 bytes)
- It must be fulfilled the next rules:
  a) X period * Y measures = 24 hours
  b) Bytes needed to store N sensors * Y measures <= 30 bytes
- The first 2 bytes of F field will be used to specify the day of month and the hour of the last measure period stored on message. The previous message hour will be calculated subtracting the interval or X period.

TimeStamp

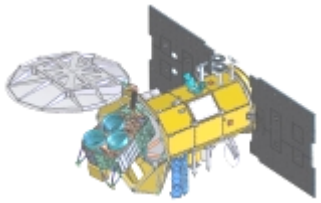


Example:

- **DCP' sensors : N**
- **Period of measurement (of de N sensors set) : 4 hours**
- **Measurement (of de N sensors set) per day: 6**
- **Measurements (of de N sensors set) could be included in 5 bytes.**



I-FRAMES

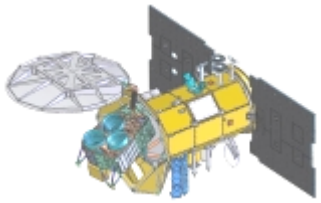


The I Frames are generated by the DCS joining the DCP-Frame and DCS data at the DCP Frame acquisition moment.

Description	Length in Bits	Length in Bytes
A – DCP-FRAME	36*8 bits If the DCP Frame received has less than 36 bytes, it will be filled with 0 (cero) to the right	36
B – LOCAL DATA	6*8 bits	6
TOTAL		**42**

<u>Local Data</u>: Doppler-shift, local time-stamp, AGC value, etc. (Engineering Data)

DCS Ground Segment Overview



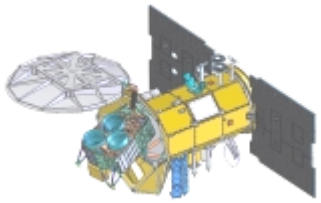
TT&C Ground Station

- Command and manage the on board DCS Instrument
- Receive and process the DCS data
- Add ancillary data to the data
- Send the information to Data Collection Distribution Facilities

Data Collection Pre Processing Distribution Facilities

- DCP Data classification and catalog
- DCP Data processing (user optional)
- Data distribution to user

Products

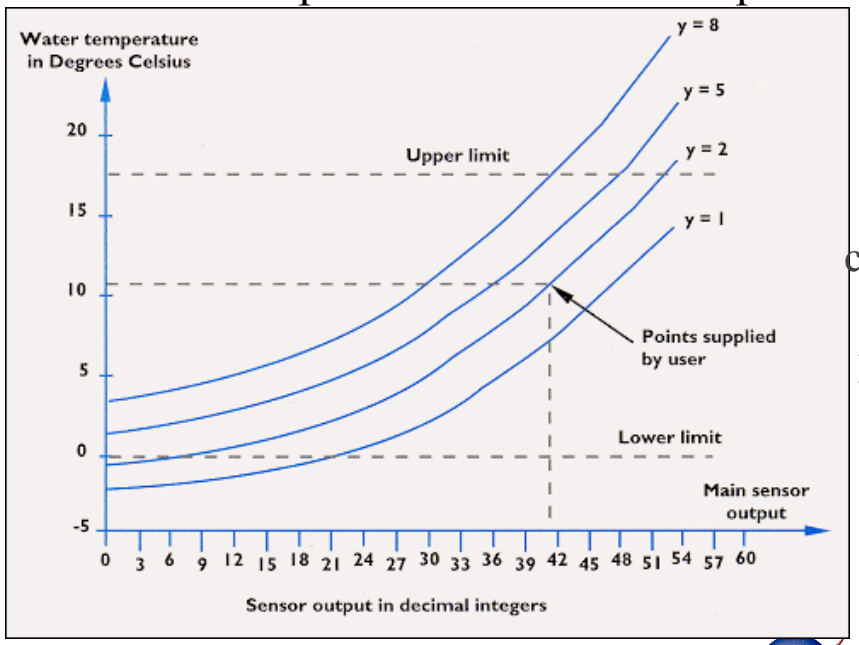


➢Raw Data (Level 0)

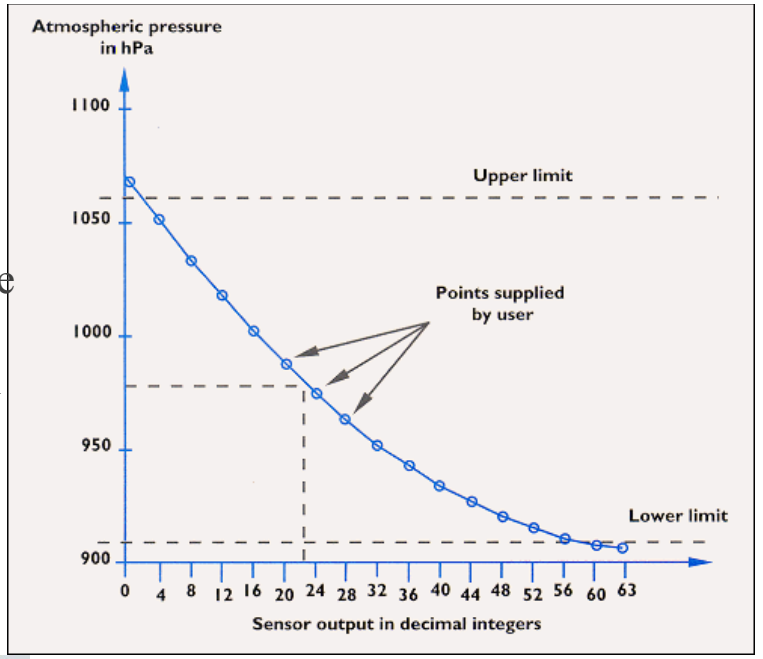
- Numerical values of sensor output (no physical parameter) .
- it's up to user to convert them to physical values.

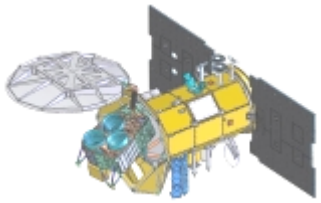
➢Physical Parameter (Level 1)

- Correspond to the physical parameter measured by the sensor, for example, air temperature, wind speed, etc.
- Physical values calculated by reading a calibration curve or transfer function, to interpret the raw sensor outputs.



Examples of a sensor calibration curve defined with points supplied by user.



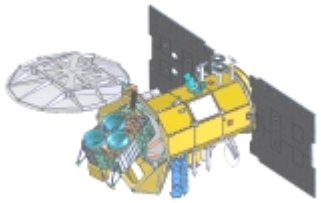


Characteristics:

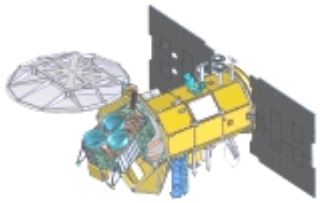
- **Both product levels (L0-bin and L1-physical)** will be stored **in the CUSS.**
- **Level0 will be stored as separated files in binary format**
- **All Level1 data will be stored in Relational Database.**
- **Those values** will be accessed **using query by form.**
- **DB will be prepared with an specifically structure related on project organization.**
- **There will be different access configurations for the different kind of users.**
- **Some data will be published and other will be restricted. This restriction level could be configured following our requirements.**

The way of data will be grouped is:

- Users**: the person who is responsible of the one or more programs**
- Programs**: agreement which links the user with each platform.**
- Platforms**: DCP**
- Sensor Type
- Geographic Location
- Time Range



E N D



BACKUPS

I-FRAMES

- Con los campos D, E, F y G, del frame que envía la DCP, el instrumento DCS arma el DCP-FRAME y con el DCP-FRAME + los “Datos Locales” arma el I-FRAME que es lo que se enviará al PAD. Estos I-FRAMES son los que el PAD empaquetara en el CSDP y enviara a tierra.
- El campo G – CRC” es el CRC que pone la plataforma de tierra y lo usa el DCS para verificar la integridad de los datos de subida (campos A, B, C, D, E y F). Los frames de subida (provenientes de las DCP) con CRC erróneos serán descartados a bordo directamente por el DCS.
- Este CRC es opcional, pero será incluido en el DCP-FRAME tal como llegue desde la Plataforma, es decir tendrá el CRC de todos los campos (A hasta F) o cero (si la DCP no calcula CRC).

CONAE Sience Data Paquet -- Sacar

Los I-FRAMES del DCS serán empaquetados, por PAD, en un CSDP según el esquema mostrado en la siguiente figura:

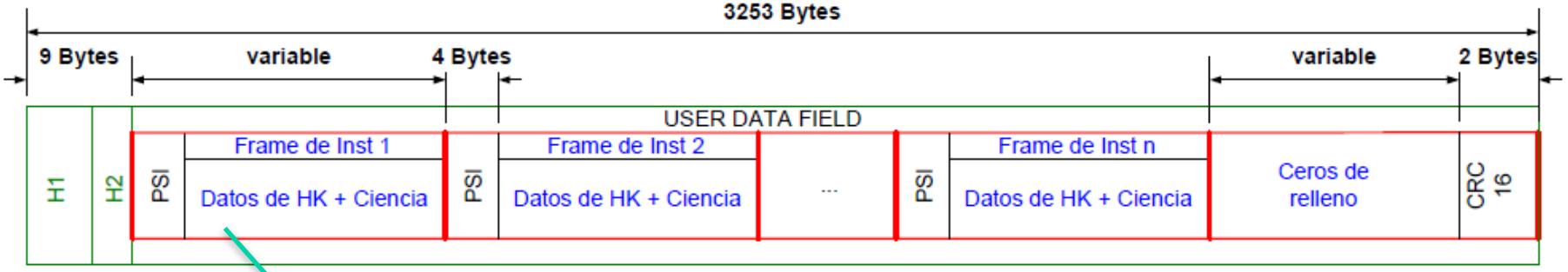


Figura 4: Formato de los paquetes de ciencia transmitidos por DLINK.

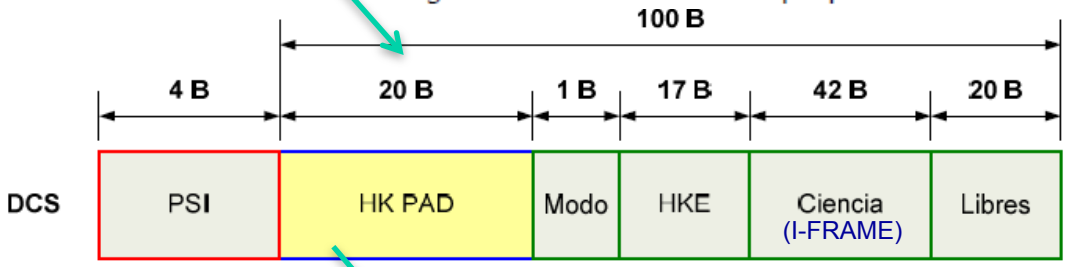
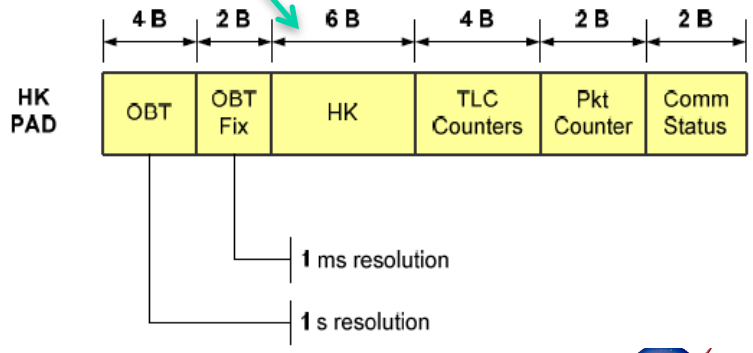


Figura 6: Formato de la trama de ciencia del DCS.



Los únicos datos útiles para el procesador son OBT, OBTfix, los datos de Ciencia (I-FRAME) y el Modo (de operación). El resto son datos de ingeniería.