Resumen:
D2-DMS-TEC-ADD01-2B-ARCHITECTURAL DESIGN DOCUMENT

Name / ICD	From	To	Description	Format	Protocol	Frequency
Payload Data "SC to GS ICD" by SI	G/S	MAC	Instrument and associated ancillary TM data stream received at the GS station on X-band as generated by the D2 S/C. It is initially stored within the G/S HDR component.	The stream of data (saved as binary files) contains annotated encrypted payload TM frames defined according to the ICD.	FTP transfer initiated by MAC.	Programmed X-band G/S passes. Data rate is fixed at 160 Mbps and it is compressed with lossless compression logic.
Products "PP ICD"	MAC	Users	Payload data TM processed at several levels: • L0 • L1A • L1B • L1C	Binary files.	Product files will be made available at an outgoing directory.	Product files are transferred the external outtray by the MAC operator.

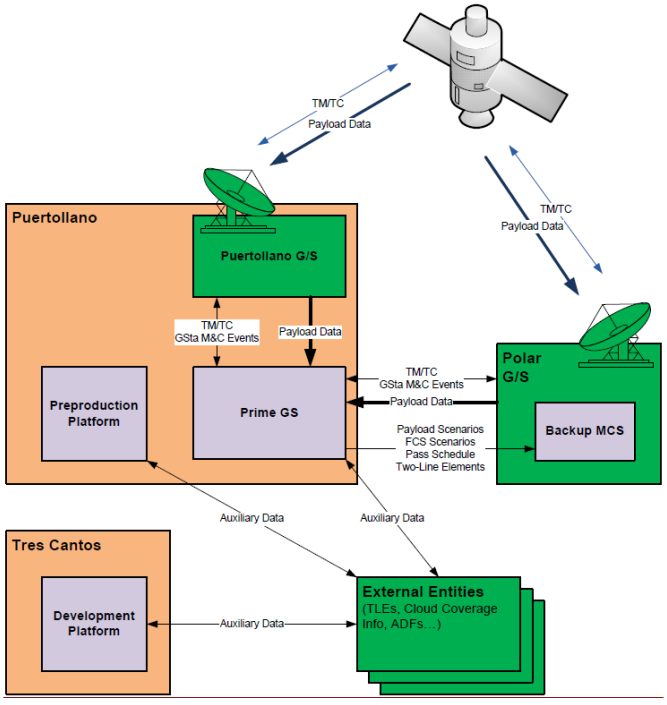

Figure 1. Hacer esquema similar para nuestro sistema

- Downloading of image data (GSCS).
- Ingestion of image data (PDGS).
- Processing of images (PDGS).
- Archiving and recovery of images (MAC).
- "Packaging" of image products (PDGS).

❑ **FOS** (Flight Operations Segment)
The FOS will include all the required elements allowing the operations team to monitor and control de S/C for both the platform and the mission payload.

❑ **PDGS** (Payload Data Ground Segment)
The PDGS will include all the required elements allowing the operations team to process and archive the payload data produced by the DEIMOS-2 on-board optical instrument. The main functions of the PDGS could be summarized as follow:

- Payload data ingestion. The PDGS will get the payload raw data from the X-band stations and ingest it into the system. Additionally it will ingest all the needed auxiliary data.
- Product archive and inventory. The PDGS will provide archiving services for the products generated by the subsystems and external auxiliary data while maintaining a database on archived products. A catalogue function will allow the managing of the archived data.
- Product Processing. The PDGS includes the functionality for the generation of high-resolution multispectral and optical image products from the received raw data up to L1C, including the intermediate L0, L1A and L1B.
- Calibration and product monitoring. The PDGS includes the functionality for obtaining the instrument and processing calibration parameters to be used at the instrument on-board and the product processors. Additionally it will include the monitoring of the received payload data and processing activities.

❑ **GS M&C** (Ground Segment Monitoring & Control)
The GS M&C includes a number of functionalities that give support to the rest of the GS, including:

- This element will allow the operations team to monitor the health and to carry out (to a certain level) some control actions over the DEIMOS-2 GS and communication infrastructure.
- Support the G/S configuration activities and their configuration control.
- Control the execution of the processing chain and automatic calibration activities.
- Support the exchange of data among the different GS elements and with several external entities.
- Provides authentication services to the rest of GS elements.

5.4. PDGS

5.4.1. PDGS Decomposition

The following figure outlines the PDGS context including the elements in which it is decomposed and their internal and external interfaces:

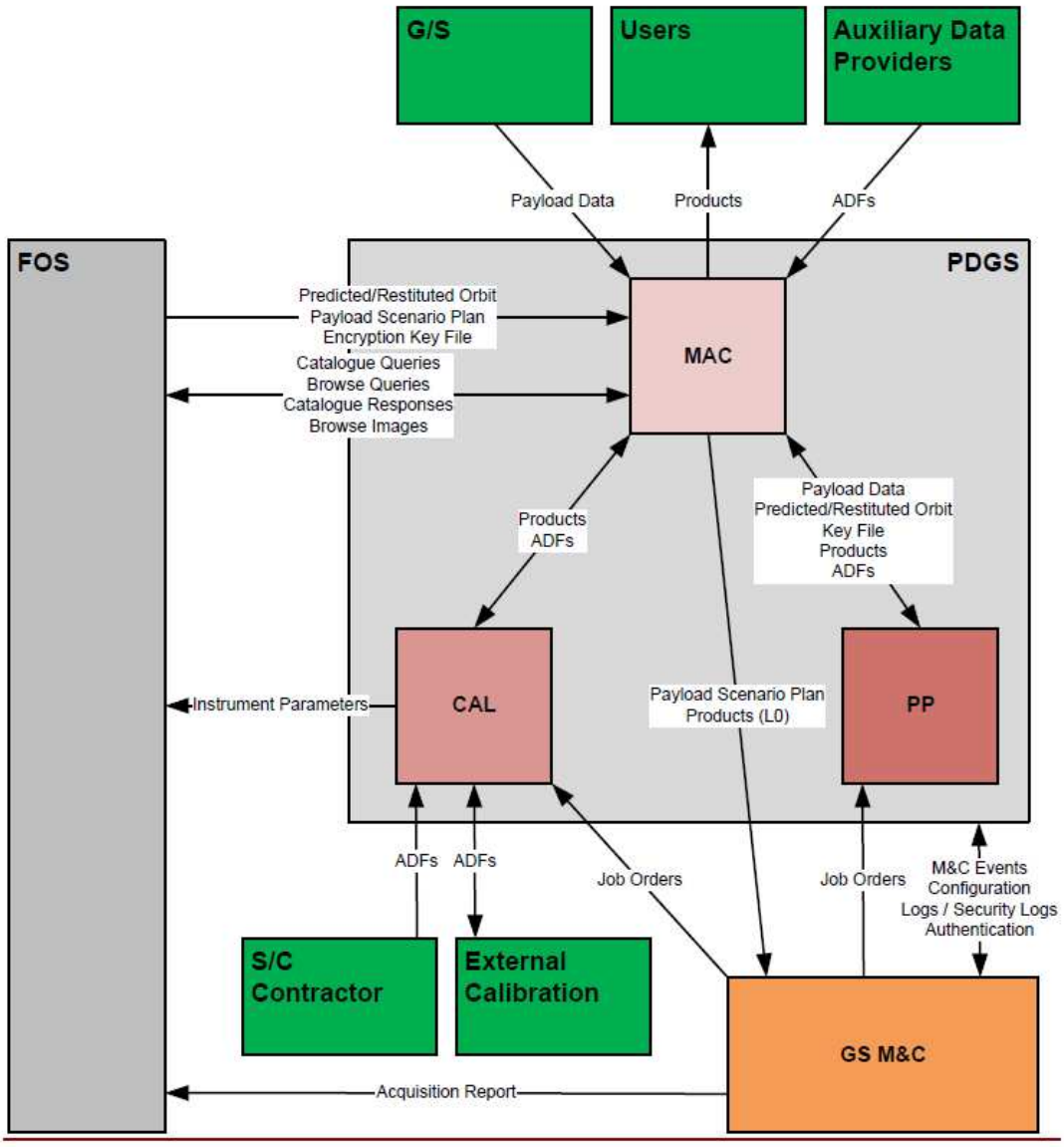

Figure 7: PDGS Decomposition

In the above diagram components external to the PDGS (either within or outside the D2 GS) that interface with any PDGS element are also shown. As seen in the diagram above PDGS comprises the following elements:

- ❑ Mission Archive and Catalogue (MAC)
- ❑ Product Processors (PP)
- ❑ Calibration (CAL)

5.4.2. PDGS Elements

The following subsections outline the functionality assigned to each PDGS element. A detailed description of each element is included in the corresponding ADDs.

5.4.2.1. MAC

The MAC basically consists of:

❑ The Archive is composed by optimized storages structure allowing managing a huge amount of data, efficient storage and retrieval of any kind of file. The Archive shall be organized in hierarchical levels of storage in order to provide a cost effective storage solution

- Short Term Archive (STA): Fast response for storing and retrieving most recent used data, high cost per gigabyte. This level provides redundancy in online storage.
- Online Rolling Archive (ORA): On-line storage but slower than Data-cache. In principle, for DEIMOS-2, it will have all the data of the mission.

- Backup [Optional Tape]: for safely maintaining an archive copy of all data in disk. Alternatively, media could be used that is slower but it is more cost effective storage solution for huge amount of data. The Archive component shall be responsible for handling those archive levels, STA and ORA, which automatically moves data between archive levels. The Archive will store the minimum information of the archived files to allow quick access to the files.

❑ The Catalogue shall store an inventory database with the metadata of archive files. It allows the PDGS facilities to access to the metadata from the DEIMOS-2 products and ADFs.

❑ The Catalogue Web services (CSW) that shall include an application and web servers to allow access via HTTP interfaces to the MAC Archive and Catalogue through Description, Discovery and Publication operations.

❑ The Data Acquisition component is the responsible for processing the input data and place the corresponding information in the MAC Archive and Catalogue.

5.4.2.2. CAL

Cal/Val operations are the process of updating and validating on-ground configuration parameters to ensure the image data quality requirements. Calibration and Validation Tools (CVT) are to be used by the Instrument Product Calibration Expert Team, which is responsible for the calibration and validation of the instrument products. Calibration is based on characterisation measurements performed on-ground before launch and in-flight.

5.4.2.3. PP

The Product Processors is an element of the PDGS that is in charge of processing the payload raw data from the satellite to produce image products. The four, most important operations that the product processors perform on the input data are:

- A calibration, to convert the pixel elements from instrument digital counts into radiance units.
- A geometric correction, to eliminate distortions due to misalignments of the sensors in the focal plane geometry.
- A geolocation, to compute the geodetic coordinates of the input pixels.
- An ortho-rectification, to produce ortho-photos with vertical projection, free of distortions.

The previous steps also generate quality-related figures of merit that are made available in all the products. Moreover, the product processors generate metadata, in line with industry standards, to facilitate the cataloguing, filtering and browsing of the product image collection.

The output image products are classified into different levels, according to the degree of processing that they have been subjected to. In short:

- Level 0 products are unprocessed images, in digital count numbers.
- Level 1A products are calibrated products, in units of radiance.
- Level 1B products are calibrated and geometrically corrected products (ortho-rectified), blindly geolocated.
- Level 1C products are calibrated and geometrically corrected products (ortho-rectified), precisely geolocated using ground control points.

Within the L1B and L1C products, we make a distinction between resampled products in UTM projection (L1B-G and L1C-T), and products in the original raster format (L1B-R, L1C-R).

5.4.3. PDGS Data Flows

The following figure outlines the main PDGS data flows:

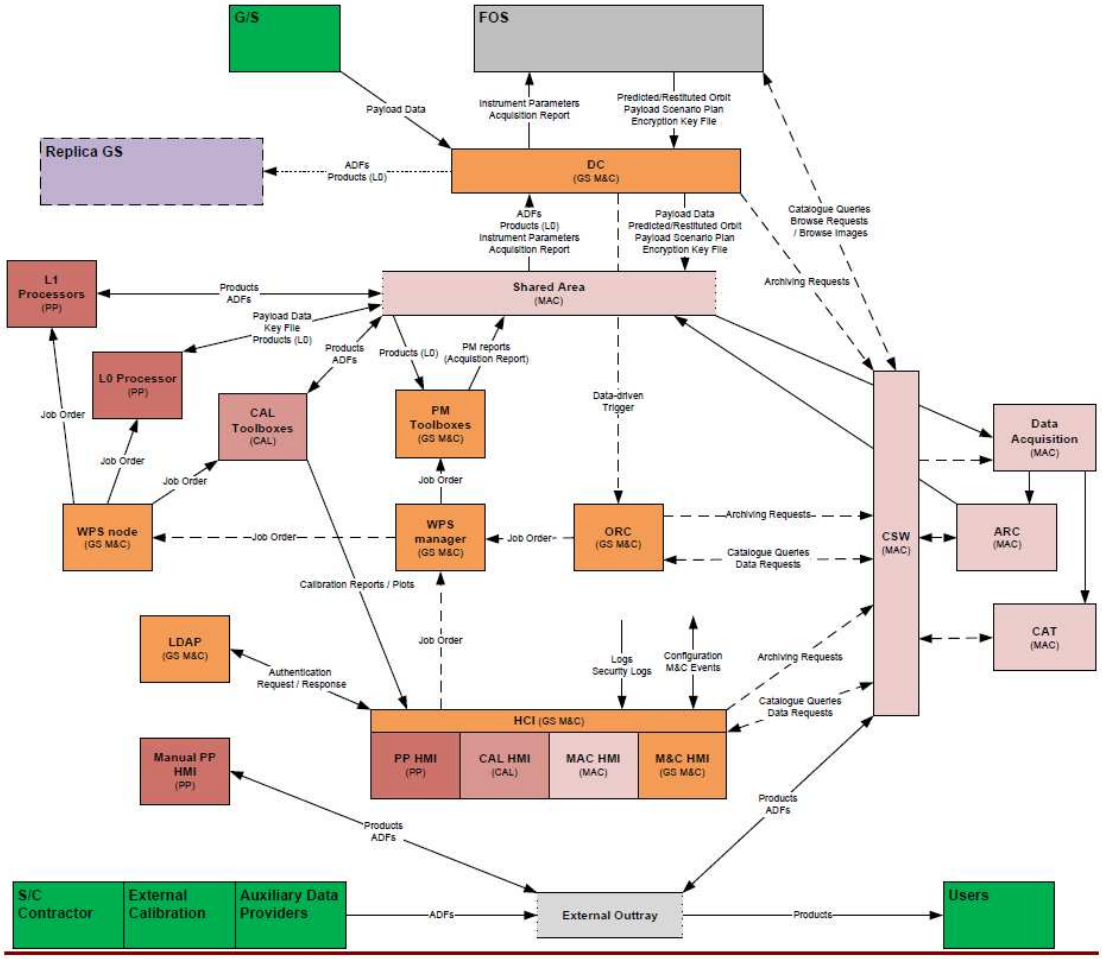

Figure 8: PDGS Data Flows

In the above diagram each PDGS element has been expanded into their main application components to clarify the data flows (those components can be installed on separate locations):

- The **MAC** is divided into several components that encapsulates the different functionality:
  - Archive (**ARC**): This component contains and handles the MAC permanent storage area. It is not directly connected to elements external to the MAC.
  - Catalogue (**CAT**): This component contains and handles the MAC inventory. It is not directly connected to elements external to the MAC.
  - Catalogue Services for Web (**CSW**): This component encapsulates the interface between the MAC archive and inventory and the rest of the system exporting all the archive and inventory functionalities.
  - **Data Acquisition**: This component manages the input data arriving to the MAC. It is divided in a data driven automatic ingestion component and a commanded based ingestion component.
  - **Shared Area**: Although this is not properly a MAC "component" it is included in the diagram for clarifying the PDGS data flows. It is a temporary storage space accessible by all the PDGS elements and the GS M&C mounted over a high speed network (see "HW & Network" section below) to easy the exchange of high volumes of data (e.g. products).

  - Human Machine Interface (**HMI**): The MAC HMI is included within the GS M&C HCI infrastructure to manage the MAC configuration and main operations.
- The **PP** is divided into several components that encapsulates the different functionality:
  - **L0 Processor**: This component processes the received raw payload data into L0 products.
  - **L1 Processors**: These components generate the different product levels (L1A, L1B & L1C) from the L0.
  - **Manual PP HMI**: This component is a dedicated HMI helping the operators to manually obtain orthorectified products using reference images.

 HMI. This is the main PP HMI that is included within the GS M&C HCI infrastructure to manage the processors configuration and main operations. It allows to configure the automatic processing chain and to launch individual processors manually.

- The **CAL** is divided into several components that encapsulates the different functionality:

 CAL Toolboxes: This component analyses the products and generates the corresponding instrument and processing calibration parameters and reports.

 HMI. This is the main CAL HMI that is included within the GS M&C HCI infrastructure to manage the calibration configuration and main operations.

As with the FOS the GS M&C provides several services to the different PDGS elements integrating its components within the PDGS infrastructure:

- Data Circulation (**DC**): This component manages all the file-based data exchanges for both internal and external interfaces.
- Human Control Interface (**HCI**): This component includes the main M&C HMI to visualize the PDGS monitoring events and logs and integrates the specific HMIs for each PDGS element. It has access to the elements configuration files.
- Lightweight Directory Access Protocol (**LDAP**): This component provides authentication services that shall be used by the different PDGS HMIs to gain appropriate access to the system according to the operator roles.
- Orchestrator (**ORC**): This component manages the automatic triggering of the different toolboxes (PP processors, CAL toolboxes and the M&C PM toolboxes) handling the complete automatic processing chain execution.
- Web Processing Services (**WPS**): This component encapsulates the interface that provides the access to the toolboxes services. It accepts execution queries (job orders) automatically generated by the ORC or manually generated within the HCI.
- **Action Layer**: This component handles the execution of the different toolboxes, distributing the work load among the several toolboxes instances.
- Product Monitoring Toolboxes (**PM Toolboxes**): This component includes the functions for monitoring the quality of the generated products and the received payload data.

An **External Outtray** space is included to support the exchange of data with external entities and operators working on the Office area.

As it can be seen in the above figure it is foreseen two types of interfaces that will provide the capabilities to pass information between PDGS components and other components within the D2 GS:

- File based interfaces, where the information is passed between the components using files, which are handled by the Data Circulation.
- Point to point connections between components, where a physical connection has to be established and maintained by each end in order to be able to pass the data. In this case different protocols and approaches will be used according to the constraints and needs identified in the context of each particular interface (e.g. TCP/IP based, Web services, etc).