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DOCUMENT

PLATO Science Ground Segment Interfaces Document

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1 GENERAL

1.1 Purpose of this Document

This Science Ground Segment Interface Document (SGSID) provides a top level description of the architecture and design of the PLATO SGS and the set of technical and programmatic assumptions which will form the basis for the proposal and initial definition phase activities. It complies with the PLATO SGS and data management conditions given in the PLATO Science Management Plan, which was approved by the SPC.

The release of the PLATO AO for instrument and SGS components is taking place at an unprecedented early stage during the mission development because of the programmatic decision to involve the community in the payload and SGS development as early as possible. Therefore the proposal and definition phase activities are starting from this document which builds on and replaces the Science Operations Assumptions Document written during the assessment phase. The SGSID therefore contains the assumptions concerning the PLATO SGS implementation and operation at functional and programmatic levels and it describes the responsibilities, interfaces and high-level assumptions/requirements of the SGS that shall be considered in the design of the PMC SGS.

It ensures that the PMC can make a proposal such that their contribution to the PLATO SGS can be :

- Designed, developed and verified within the technical and programmatic constraints of the PLATO mission.
- The PLATO SGS can be operated to achieve the scientific objectives of the PLATO mission.

This document shall be used by all parties as the baseline for the proposal and for the activities at the start of the Definition Phase.

1.2 Mission Background

PLATO (PLAnetary Transits and Oscillations of stars) is an ESA mission with a possible contribution of NASA and the participation of ESA member states for the provision of the payload and part of the ground segment. PLATO was proposed as an M-class mission in the Cosmic Vision 2015-2025 programme to detect and characterise a large sample of exoplanets down to earth-size and below.

Upon completion of a one-year assessment study in late 2009, PLATO was selected by the SPC for a definition study in February 2010. The definition study is expected to last until June 2011.

1.3 Interface Responsibilities

1.3.1 ESA Ground Segment Commitments

ESA will contribute the PLATO Mission Operations Centre (MOC), the Ground Station Facilities and the PLATO Science Operations Centre (SOC). ESA will be responsible for the PLATO Legacy Archive and its interface to the public. ESA will be responsible for the development, operation and maintenance of the PLATO Mission Archive, which is the main (shared) data interface to all parties.

1.4 Product Tree

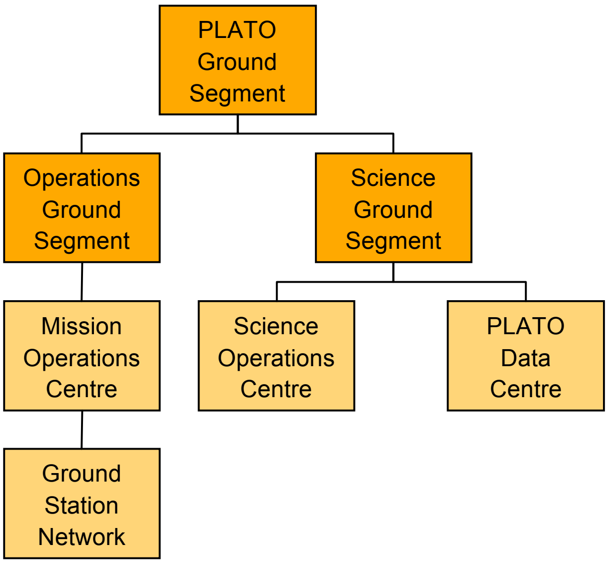

Figure 1: PLATO Ground Segment Product Tree

2 DOCUMENTS

2.1 Applicable Documents

AD1	PLATO Science Management Plan
AD2	Announcement of Opportunity for PLATO payload & SGS Components

2.2 Reference Documents

RD1	PLATO Science Operations Assumptions Document
RD2	PLATO Reference Payload Concept

2.3 Acronyms

AEU	Ancillary Electronics Unit
AIT	Assembly, Integration and Test
AIV	Assembly, Integration and Verification
AO	Announcement of Opportunity
AWG	Astronomy Working Group
BDCR	Baseline Design Configuration Review
CCD	Charge Coupled Device
DPS	Data Processing System
DPU	Data Processing Unit
EAC	Estimate At Completion
EGSE	Electrical Ground Support Equipment
EID	Experiment Interface Document
EMC	Electro Magnetic Cleanliness/Compatibility
ESA	European Space Agency
ESAC	European Space Astronomy Centre
ESOC	European Space Operations Centre
ESTEC	European Space and Technology Centre
FEE	Front End Electronics
FoV	Field of View
FPA	Focal Plane Assembly
FTE	Full Time Equivalent
FWHM	Full Width at Half Maximum
ICU	Instrument Control Unit
IP	Implementation Proposal
LoS	Line of Sight
MLA	Multi Lateral Agreement
MOC	Mission Operations Centre
OIRD	Operations Interface Requirements Document
PA	Product Assurance
PCDR	Preliminary Configuration Design Review

PDF	Portable Document Format
PDPM	PLATO Data Processing Manager
PIPM	PLATO Instrument Project Manager
PIRR	Preliminary Instrument Requirements Review
PLM	Payload Module
PMC	PLATO Mission Consortium
PRR	Preliminary Requirements Review
PST	PLATO Science Team
PSF	Point Spread Function
Sci-RD	Science Requirements Document
SEL2	2nd Sun-Earth Lagrange point
SGS	Science Ground Segment
SGSID	Science Ground Segment Interface Document
SIP	Science Implementation Plan
SIRD	Science Implementation Requirements Document
SMP	Science Management Plan
SOAD	Science Operations Assumption Document
SOC	Science Operations Centre
SOCD	Science Operations Concept Document
SPC	Science Programme Committee
SSAC	Space Science Advisory Committee
SVM	Service Module
TBD	To be decided
TBW	To be written
TRL	Technology Readiness Level
WASP	Wide Angle Search for Planets
WBS	Work Breakdown Structure
WP	Work Package
WPD	Work Package Description
AO	Announcement of Opportunity

3 MISSION DESCRIPTION

3.1 Mission and Satellite

PLATO is a mission with the objective to detect and characterise a sample of exoplanets sufficiently large and with a photometric accuracy high enough that the data can be used to:

- Build a statistically significant sample of Earth-size planets orbiting main sequence F-, G-, K-type (Solar Type) and M-stars in their habitable zone.
- Determine, through asteroseismology, the radius and mass of both the parent star and the planet(s) orbiting it with an accuracy of ~1%, and derive the age of the systems to an accuracy better than 10%
- Derive a planetary mass function extending from Brown Dwarfs down to planets smaller than the Earth.
- Allow the selection of a sample of bright and nearby systems for further studies with ambitious future facilities.

The above objectives are achieved by collecting long, uninterrupted, ultra-high precision photometric light-curves of a sample of at least 20,000 relatively bright stars, and using them for detecting exoplanets via the occultation techniques while simultaneously using the same light curves to characterise their host star by asteroseismology.

In addition to the seismic analysis of planet hosting stars, which is a key tool to reach the mission objectives, asteroseismology of the many other stars present in the field of view will be used to study stellar evolution. Light curves of stars of all masses and ages across the HR diagram, including members of several open clusters and old population II stars, will be collected for this purpose.

Besides the core program, PLATO will allow a broad range of studies involving photometric variability. Its high signal to noise, long time coverage and the very large field of view, will enable the study of variability on several time scales – between 1 minute and several years – on statistically significant stellar samples. These properties will be used to address many different questions, mainly (but not exclusively) in the area of stellar physics.

This is accomplished with a payload which consists of 34 refractive cameras (i.e. telescope & detectors) each with a 120 mm entrance pupil and 6 lenses (including one aspheric lens). Cameras are grouped in 4 subsets with slightly different Lines-of-Sight (LoS) but with significant overlap of their Field-of-Views (FoV). Each camera has a FoV with a diameter of 37o.
PLATO will be launched by a Soyuz Fregat into a large-amplitude libration orbit around the Sun-Earth second Lagrange point, L2. Commissioning of the spacecraft as well as

calibration and performance verification of the payload will be performed during the cruise phase to L2. The 6-years nominal duration of the scientific exploitation phase consists of three parts: two long-duration observations (of 3 & 2 years respectively), each focusing on a particular part of the sky with a high density of F, G and K dwarf stars, plus a one year long step-and-stare phase where a small number of selected fields will be monitored for a few months each. A mission extension of one (or more) years is possible.

Each of the long-duration observations will monitor a separate field in the sky that together will be encompassing a minimum of 20 000 dwarf stars of spectral type later than F5, each sufficiently bright to reach a photometric accuracy ≤ 2.7 * 10-5 hr-1. The photometric precision required by the mission puts stringent requirements on the pointing stability and accuracy of the s/c which must reach 0.2 arcsec (Relative Pointing Error) over time scales of 2.5 seconds to 14 hours. The step-and-stare phase will consist of a series of separate observations each lasting up to 5 months. The rationale is to extend the surveyed area of the sky and to further characterise planetary candidates that were found to have two or more transits during the long observations.

The spacecraft operates autonomously for most of the time except for a period of 4 hours per day when data are downloaded to the Ground Station and telecommand sequences uploaded as required to activate the following 24 hours of observations. Data obtained outside the 4 hours visibility period are stored in an on-board mass-memory. The K-band facility allows science data rates of up to 850 Gbit per day

3.2 PLATO Ground Segment

The PLATO Ground Segment covers the in-flight operations of the satellite, such that the mission objectives can be met. The PLATO *Operations Ground Segment* consists of the Ground Station Facilities and the Mission Operations Centre (MOC), which operates the spacecraft and creates the telemetry and flight dynamics products.

The PLATO *Science Ground Segment* (PSGS) consists of the ESA provided PLATO SOC and the PLATO Mission Consortium provided science ground segment components. The Science Ground Segment is responsible for the end-to-end handling of the PLATO data and production of the PLATO Mission Products.

The SOC acts as the central node for the mission planning; it performs Level 1 data processing and populates the mission archive with the science and housekeeping telemetry after a first quality check. The quality check at the SOC directly feeds back to the mission planning by means of rescheduling of defective observations during each campaign. The SOC develops, maintains, populates and operates the public archive, which is the vehicle for delivering data products to the general scientific community.

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The PMC SGS consists of a Plato Data Centre (PDC) responsible for the science data processing, the generation of the Level 2 data products, and the development of simulation packages to support the development and testing of the operational pipelines.

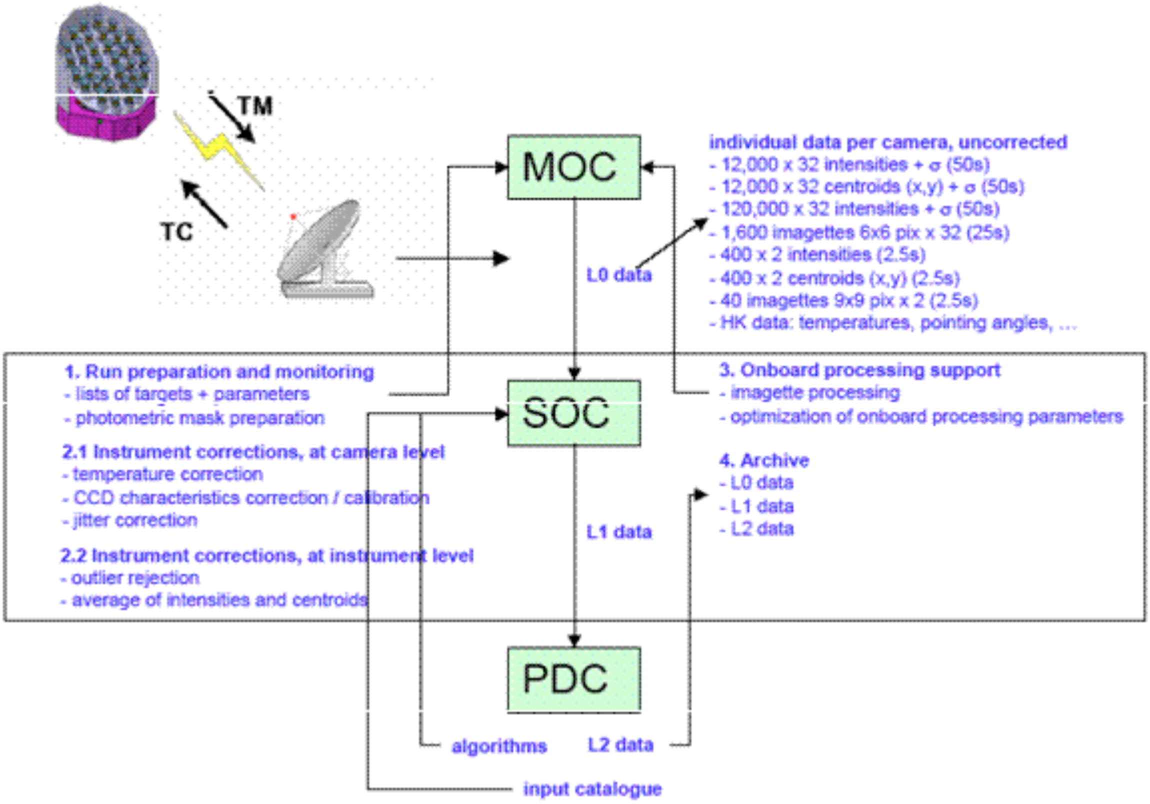

Figure 2: Schematic presentation of the PLATO Ground Segment with its main elements & main interactions.

3.3 PLATO Operations Ground Segment

The PLATO Operations Ground Segment consists of the ESA Mission Operations Centre (MOC) and supporting Ground Station facilities.

3.3.1 PLATO Mission Operations Centre

The ESA PLATO Project Manager delegates to ESA's Space Operations Centre (ESOC) the design, development, validation, and operation of the Operations Ground Segment.

The ESA/ESOC (GS/MOC) ground segment consists of:

- The Ground Stations and the Communications Network
- The Mission Control Centre (infrastructure and computer hardware)
- The Flight Control software System (data processing and Flight Dynamics Software)

- Computer Infrastructure (Mission Control System, Simulator, etc).

ESA is responsible for the readiness of the ground station facilities. MOC is responsible for the availability and operations during the operations phase. Data transfer and supporting infrastructure within the operations ground segment is managed by MOC. The data transfer scheme between the OGS and SGS during routine phase will be defined although given the PLATO data volumes use of the public internet is probably more cost-effective than dedicated lines. Dedicated links between MOC and the instrument teams' facilities during commissioning and PV phases may be considered. The MOC is in charge of the following tasks:

- Monitoring spacecraft health and safety
- Monitoring the payload safety and reacting to contingencies and anomalies according to procedures provided by the PLATO consortium.
- Alerting the SGS of all significant anomalies or deviations from nominal behaviour of the satellite
- Executing predetermined procedures to safeguard the spacecraft and payload, and preserve data integrity
- The uplink of the satellite and payload telecommands
- The maintenance of the satellite's on-board software
- The uplink of payload on-board SW executables as generated, validated and delivered by the PDC via the SOC.
- The flight dynamics support including determination and control of the satellite's orbit and attitude
- Handling and provision of the telemetry to the SOC
- Production and provision of ancillary data to the SOC (e.g. orbit files, pointing information)
- Archiving the full telemetry data for a period of no less than 10 years

3.3.2 Ground Station Facilities

The ESA Deep Space station at Cebreros is baselined as the primary ground station for PLATO operations and is equipped with K(26 GHz) and X band facilities.

3.4 PLATO Science Ground Segment

The PLATO Science Ground Segment consists of the PLATO Science Operations Centre (SOC) and the PMC provided Plato Data Centre (PDC).

3.4.1 Science Operations Centre

The ESA Project Manager delegates to the Science Operations Department of the Science and Robotic Exploration Directorate based at the European Space Astronomy Centre (ESAC) the design, development, validation, and operation of the SOC. The SOC is the only interface to the MOC during routine operations. Within the overall ESA responsibility for the PLATO SGS, the SOC co-ordinates the overall design, implementation and operation of the PLATO Science Ground Segment with the PMC. It is specifically responsible for:

- Acquisition and distribution of spacecraft telemetry from MOC
- Acting as interface between the PDC and the MOC for payload operations and for all files and procedures required for optimizing the quality of the data and safeguarding of the payload
- Scientific mission planning based on input from the PDC after endorsement by the PST. In particular, Provision to the MOC of all parameters for each sequence of observations : at each rotation of the satellite (every 3 months), and at each field re-pointing (every 2 or 3 years for the long sequences, every few months for the step & stare phase), the full list of targets with their expected location on the focal planes, and the full list of parameters for each star (essentially photometric mask parameters)
- Quality control: Monitoring of data integrity and quality
- Fine tuning of on-board software, parameters and payload configuration, based on quick look data
- Ground support for onboard processing. The SOC issues payload configuration change requests to the MOC as appropriate to optimize the quality of the PLATO data. In particular, the SOC provides support to the on-board processing through parallel running on-board algorithms on the downlinked imagettes and provision of updated optimized parameters to the MOC for uplink
- Design, development, testing and maintenance of the modules in the data analysis system required for the quick-look assessment and the validation of L0 data
- Design, development, testing and maintenance of the data analysis modules required for the generation of the L1 data
- Archiving of all PLATO data products, HK data, and ancillary data
- Distribution of the data products to the scientific community
- Providing support to the general scientific community.
- Post-operations activities

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3.4.2 PMC Provided Components of the SGS

The PLATO Mission Consortium are responsible to provide the following for the Science Ground Segment : the Consortium part of the SGS, manpower and facilities for the processing of the PLATO scientific and housekeeping data generated by the payload as specified in the SMP.

As such, the prime contribution shall be the provision of the PLATO Data Centre. The PLATO Data Centre is under the responsibility of the PLATO Consortium. It is foreseen that the PDC will be distributed among a few physical institutes in Europe and the US. The PDC supports the SOC in the production of the L1 data by carrying out the following tasks:

- This includes the definition of a calibration plan, the specification of observations or payload configurations required to gather calibration data, the derivation of the calibration parameters and their delivery to the SOC for implementation into the L1 processing pipeline.
- Definition of algorithms and support to the implementation of modules in the data analysis system for the generation of L1 data.

The PDC designs, implements, tests and maintains the data analysis tools needed to generate the level 2 data and higher level scientific products, which include catalogues, list of planets, their parameters and additional characterisation information.

The PDC supports the spacecraft operations by providing input to the procedures needed for payload operation and for scientific mission planning. The PLATO Consortium organizes the field analysis and selection prior to the mission. The PDC provides the field selection information to the SOC for the scientific mission planning.

The PLATO Consortium is fully responsible for the organization of the ground-based follow-up activities. The PDC manages the database that assembles all follow-up data on PLATO targets, plus ancillary data extracted from various existing catalogues and databases, and places them at the disposal of the PLATO Consortium scientists during the proprietary period of the PLATO L1 products, and at the disposal of the world-wide community after this period.

4 DATA PRODUCTS AND MANAGEMENT - ASSUMPTIONS

4.1 PLATO Databases - Assumptions

4.1.1 PLATO Archive

As soon as data products have passed quality control and after suitable proprietary period the data will be accessible to the astronomical community through the PLATO Archive, assumed to be developed and maintained by the SOC.

It is envisaged that this same archive will be used for the provision of Level 0 and Level 1 products to the PLATO Data Centre.

It is also assumed that this archive will be a central repository for all supporting mission data of relevance to the PMC.

4.1.2 PLATO Mission Data Base

It is assumed that the PLATO mission database will be transferred from industry to MOC and from MOC to SOC before launch. The SOC database will be part of the PLATO Archive and maintained by SOC, such that it forms an exact copy of the MOC database. The mission database will be validated by MOC against the spacecraft during System Validation Tests prior to launch. The mission database will be maintained by MOC. During routine operations, the PMC shall provide updates to the instrument section of the mission database via SOC.

4.1.3 External data

To support the fulfilment of the PLATO science objectives, the PLATO mission requires complementary datasets obtained via ground or space based observations to be stored in an ancillary database e.g. high spectral resolution observations and radial velocity monitoring.

As a starting point, the proposal shall assume that the implementation of a database system for PLATO ancillary data and of software to determine stellar rotation and activity are covered under a preliminary international cooperation agreement.

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4.2 Data (Processing) Level Assumptions

The data analysis system for PLATO is jointly developed by the SOC and the PDC to provide support for the validation, calibration, and scientific analysis of PLATO observations. In particular, this system provides tools to monitor and validate the quality of the light curves and generate the PLATO scientific products.

The data analysis consists of three data processing levels:

- L0 (Level 0) data, which corresponds to the data delivered by the individual telescopes. They include individual light curves and centroid curves, as well as imagettes for a set of selected targets (an imagette is a "postage-stamp" image around a target star, transmitted to the ground with the same cadence as a light curve). L0 data does not include instrument corrections other than those already applied on board. Treatments at this level also includes a processing of the available imagettes, in order to validate the performances of the on board treatment and provide elements to optimize it.
- L1 (Level 1) data, which includes further instrumental corrections, such as those related to temperature sensitivity, some specific CCD corrections, and most importantly jitter a posteriori correction. L1 treatment also includes the calculation of suitable averages of individual light curves and centroid curves for each star.
- L2 (Level 2) data, which includes transit detection and measurements, stellar oscillation mode parameters, as well as star and planet characteristics. The L2 data has a high scientific added value, and makes use of the PLATO L1 data on one hand, and of information gathered on the PLATO targets on the other hand (e.g. high spectral resolution observations and radial velocity monitoring), assembled in an ancillary database.

L0 and L1 data are produced under the responsibility of the SOC. The SOC makes available the L1 data to the PDC, which is responsible for the production of the L2 data. The PDC delivers the L2 data to the SOC for archiving.

When data products have passed quality control and after the established proprietary period (when applicable), the data are accessible to the wide astronomical community through an archive which is managed and maintained by ESA/SOC. The long-term responsibility of this archive will remain with ESA for as long as the archive is scientifically usable. In this respect ESA will be advised by the normal scientific advisory groups.

The mission delivers not only the complete set of data products but also software tools, and the applications to interface to the data obtained during the mission. Results in the form of proper identification of targets, catalogues and relevant associated supporting follow-up observations are made available. The external users will be able to access the Archive through a web interface.

5 SGS IMPLEMENTATION ASSUMPTIONS

In this section the overall function of the PLATO SGS is presented with some consideration of SGS organisation and interface aspects as well as the development and validation/verification of the SGS.

5.1 SGS Function and Structure Assumptions

The following assumptions refer to the PLATO SGS (PSGS) as a whole and apply to the SOC and PDC.

The PSGS will develop and validate all algorithms and processing systems required for the scientific processing of the PLATO data and the production of all PLATO products. It also provides the infrastructure required for their processing systems. These processing systems will be operated and maintained until the final PLATO products are produced and validated.

The PSGS will support the spacecraft in-orbit commissioning and performance verification phases as required. It will also support instrument operations through the entire routine operations phase. A smooth transition between instrument level tests, system level tests and the operational phases of the mission would be facilitated by maximising the commonality of ground support equipment used through these mission phases.

The PSGS produces, validates and documents the intermediate and final PLATO products, according to the schedule and content defined by the PS and PST. The concomitant milestones and schedule for the data reduction activities will be defined by the PSGS. The final PLATO products are anticipated to consist of at least Data Levels 1 & 2 as described in Section 4.2 with accompanying interrogation tools. Access tools and mechanisms will be defined during the definition phase.

The PSGS will generate or procure any necessary data sets for test and validation purposes. These could be simulation datasets produced internally or external datasets required to validate the PSGS processing systems.

The Plato Data Centre will develop and test the processing systems. They are responsible for the integration and operation of these processing systems into the hardware and infrastructure at the PDC.

The Plato Data Centre will maintain the instrument operational modes and monitor the instrument health until the end of routine operations.

5.2 SGS Interface Assumptions

The **PLATO Archive** is assumed to be the interface between the SOC and PDC in the PSGS.

The PLATO Archive is the primary point of distribution of all PLATO data products within the SGS, which includes the quality data and meta-data. This includes all for example the data levels referred to in Section 4.2 and auxiliary data from MOC

SOC and PDC use the PLATO Archive to obtain the input data (L1 and higher) and to store the products together with the quality control data.

During routine operations the SOC is the unique point of contact between MOC and the PMC SGS. The SOC receives telemetry and auxiliary data from the MOC, performs the L1 processing, and stores the L1 products and auxiliary data in the PMA. SOC will provide to MOC planning & associated regular updates, and instrument commanding files throughout routine operations phase.

The SOC will receive instrument commanding instructions, instruction database and procedure updates from the instrument operations PDC which are maintaining and monitoring the health of the instruments. These instructions and updated will be sent to MOC for implementation.

The PDC will procure the external data (either ground or space based) and ingest them in the PMA to make the data available for further processing.

The PLATO Achive shall also form the final scientific archive for the PLATO mission. The SOC will host the PLATO Archive and the data and meta-data forming the archive will be located at the SOC. The data and meta-data underlying the archive may be replicated elsewhere, although not necessarily with an identical access layer.

5.3 SGS Validation and Verification Assumptions

The overall validation and verification approach and schedule will be described in a top-level test plan. The PSGS will be tested and validated before launch in order to demonstrate the ability of the PSGS to support the mission. The schedule for this testing will be agreed with ESA. Subsystem and system tests are conducted according to the approved test plans and test reports shall be issued. The PSGS will have scheduled integration tests (e.g. interface tests, data flow tests, “end-to-end” tests) until the SGS integration is complete and operationally ready.

The operational elements of the PSGS will be included in at least 2 relevant space-ground segment system tests (e.g. System operations validation tests) in order to test their interfaces with the satellite and the other elements of the ground segment prior to launch.

The PSGS will be scientifically validated in order to give confidence in the final and intermediate data products. As far as possible this activity will commence and conclude before launch, however further in-orbit testing should be foreseen and the PSGS should be able to support such validation activities in parallel to routine operations.

5.4 SGS Development Assumptions

All SGS development will be performed according to agreed engineering guidelines. These engineering guidelines should include coding standards, data models, naming conventions, measurement units, reference frames, common physical and mission parameter definitions, etc.

All information relating to spacecraft or spacecraft component specification, design, implementation, test data or characterisation necessary for the design, implementation or validation of the PLATO SGS will be made available to the consortium as formal deliveries. All deliverables from ESA to the PMC will be governed by an Interface Control Document with a delivery schedule and agreed by ESA and the PMC.

Software developed specifically for PLATO jointly by ESA and its partners will be put under a worldwide license such as LGPL. In accordance with SPC(2009)6 approval for this action will be sought from the ATB (Agency Technology Transfer Board).

6 PROGRAMMATIC ASSUMPTIONS

In this section consideration is given to the overall management of the SGS.

6.1 Compliance to ECSS standards

ECSS standards form the core set of standard applicable to the development of the PSGS. During the definition phase these standards will be tailored to meet the needs of PLATO SGS development. Production of the tailoring will be led by the SOC. This tailoring should be documented with a compliance matrix to the ECSS standards.

6.2 Management Assumptions

A SOC Development Manager shall be assigned & given the responsibility to ensure the timely delivery of all the SOC deliverables and execution of all SOC tasks.

The PLATO Mission Consortium shall be led by a single person, the PLATO Consortium Lead (PCL). The PCL is the single formal interface for the consortium with the ESA project office. For the SGS, he/she shall be supported by a PMC Data Processing Manager (PDPM) for the Consortium contribution to the PLATO SGS.

The PCL & PDPM are responsible for the timely delivery of all the PMC SGS deliverables and execution of all PMC SGS tasks.

Experience from other missions (e.g. Gaia) have indicated that a dedicated and independently funded Project Office with personnel responsible for the project management activities (project control, schedule control, product assurance, risk management, document and product tree definition, document management and configuration control, etc.) would be an effective management approach for the PLATO SGS.

6.3 Product Assurance Assumptions

All SGS elements will be produced in accordance to the agreed management and engineering plans. In order to facilitate this a common Product Assurance Plan will be produced and implemented by the PMC and ESA in order to assure compliance to the management and engineering plans.

During all phases of the PSGS implementation and operations each contributor will carry out a Product Assurance/Quality Assurance (PA/QA) activity.

PA/QA aspects will be also addressed at each review of the various components (i.e., SOC and PDC) of the Ground Segment as well as during the reviews of the entire Ground Segment and the Mission Level reviews.

6.4 Configuration Control and Management Assumptions

All SGS elements will be produced in accordance to a common Configuration Management Plan. This Configuration Management Plan will be applicable to documentation, software and hardware configuration control within SGS through all mission phases.

All PLATO SGS processing systems, documentation and data items will be delivered for integration and storage in accordance to the agreed configuration control system.

6.5 Reviews and Reporting Assumptions

The entire PLATO SGS will follow a schedule of reviews adapted from the standard ECSS review cycle. The review cycle will be defined by ESA and agreed with the PCL & PDPM during the definition phase.

Management reports will be produced on a regular (typically quarterly) basis in a format and frequency to be agreed with ESA. These reports will be prepared by the PDC and submitted to the PDPM & PCL. These reports, together with an overall summary, will be included in the reporting to ESA together with an overall summary report.

6.6 Common Tools and Facilities Assumptions

The PSGS will use common tools and facilities to support the development and management of the PSGS. Candidates for such tools include

- Requirements management, including facilities for requirement capture, maintenance and verification purposes,
- Document management. The ESA Livelink system has been used successfully in other missions and is a natural candidate for this system,
- Planning and schedule tracking,
- Software issue tracking and source code configuration control,
- Data model definition.

More general categories include Wikis, mailing lists, web-forums, etc. Provision of these tools will be agreed during the definition phase. The appropriate plans and guidelines should make reference to these tools.

7 SUMMARY OF AO PROCESS FOR THE PLATO SGS

7.1 Expected Contents of the Proposal

The proposal to be made in response to this AO by the Consortium for SGS-related activities must contain two elements. The first is a proposal for PMC definition phase activities and the second is an outline proposal for PMC activities for all other phases of the mission.

In more detail, these elements are expected to contain:

- Proposed planning for SGS definition phase
  - A technical/programmatic description of the consortium's approach to supporting the SGS activities during the definition phase,
  - A management proposal (c.f. Section 3.1.4 of the AO) including a Work Breakdown Structure and set of Work Package Descriptions which identify the activities required to support the SGS definition.
  - A financial plan (c.f. Section 3.1.5 of the AO)
- Proposed planning for the SGS implementation phase
  - An Implementation Proposal describing the technical and programmatic planning for the implementation phase (c.f. Section 3.2.3 of the AO)
  - A management proposal (c.f. Section 3.2.4 of the AO)
  - A financial plan for the implementation phase (c.f. Section 3.2.5 of the AO)

7.2 Definition Phase Activities

To make the SGSID self-contained, the following two paragraphs and figure are repeated verbatim from the AO section 3.1.3.

In order to define a coherent and optimised SGS, it is expected that all SGS-related activities in the definition phase shall be carried out in close co-operation between ESA (SOC) and the PMC. It is expected that the SOCD and draft SIRD will be jointly generated during the definition phase. As shown in Figure 1[of AO document], the draft SIRD after review and any necessary updates will be formally issued by ESA Project after the definition phase as an input to subsequent phases. Each party will be responsible for their draft SIP which responds to the draft SIRD.

Activities are expected to build upon those carried out in the assessment phase and in the Consortium proposal preparation. Thus, as summarised in Figure 1, the starting points for definition phase work will be the Science Management Plan (SMP), the PLATO SGS Interfaces Document (SGSID, derived from the assessment phase Science Operations

Assumption Document (SOAD) and defining the responsibilities, interfaces and high-level assumptions/requirements of the SGS), the Consortium proposal for definition phase activities (WBS/WPD, see management proposal paragraph, part IV [of AO document]) and the Consortium Implementation Proposal (IP, see section 3.2.3 [of AO document] for details). During the course of the definition phase, it is expected that the SGSID will evolve into the draft SIRD and the SGS part of the IP into the draft SIP for the PMC contributions (see overall schedule in table 1 [of AO document]).