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FIRST / PLANCK GROUND SEGMENT

INTERFACES

PT - XXXXX

DRAFT # 0

1.0 INTRODUCTION

1.1 Objective

The purpose of this document is to identify the major FIRST/PLANCK Ground Segment Interfaces (internal and external) and to list all the Interface Control Documents (ICDs) to be provided by ESOC, ESTEC, the ICCs, the FSC (for FIRST) and the DPCs. (for PLANCK)

1.2 Scope

The current version of this document only provides the information which is required by the potential PIs who intend to bid for the provision of a FIRST Instrument (and corresponding ICC) or for a PLANCK Instrument (and corresponding DPC). The document will be attached to the AO.

This document will be maintained throughout the development cycle of the Ground Segment for the FIRST/PLANK combined mission. Further versions (after instrument selection) will identify other Ground Segment interfaces and list the corresponding ICDs.

1.4 ICD Definition

Each major Ground Segment interface will be described in a high level ICD. Depending on the characteristics of the interface, lower-level related ICDs may describe, if necessary, specific interfaces within the framework of the high level interface.

Each ICD defines in detail the hardware (as far as needed for software implementation) and software interface between two or more software systems. When applicable, managerial and/or operational interfaces will be covered in the ICD. An ICD must be prepared each time that two software systems having a mutual interface have to be developed, integrated or maintained by different entities (i.e. different organisations or functionally independent parts of an organisation)

The purpose of an ICD is as follows:

- provide accurate, adequate and binding information that will permit software development and maintenance of the separate software systems as separate activities.
- serve as a vehicle for interface design, negotiation and change

control.

- document the total detailed system design when viewed together with documentation of the individual connected software systems.

Appendix A provides a proposed ICD's Table of Contents.

1.5 ICD Preparation and Maintenance Responsibility

Unless otherwise agreed by both parties to an interface, the responsibility for taking the lead in negotiating, drafting and maintaining the ICD lies with the organisation which produces the (software) product which generates the prime traffic across the interface. At a mutually agreed version (e.g. Issue 1) the ICD is put under strict Configuration Control. (under the responsibility of the *custodian*). Changes to the interface are from then on only possible by mutual agreement between the two parties. ICDs must be formally agreed and signed by all parties involved.

2.0 APPLICABLE AND REFERENCE DOCUMENTS

2.1 Applicable Documents

AD-1 MOC Implementation Requirements Documents (MIRD)

AD-2 MOC Implementation Plan (MIP)

AD-3 Science Operations Implementation Requirements Document (SIRD)

AD-4 Science Operations Implementation Plans (SIPs)

AD-5 FIRST Science Management Plan

AD-6 PLANCK Science Management Plan

AD-7 ESA Software Engineering Standards, PSS-05-0

AD-8 Guide to applying the Software Engineering Standards to Small Software Projects.

AD-9 FIRST/PLANCK Operations Interface Requirements Document

2.2 Reference Documents

RD-1 FIRST Science Operations Concept.

3.0 MAJOR ASSUMPTIONS

(to be expanded/updated)

- FIRST and PLANCK launched end-2005, to the L2 point, as a combined mission by an Ariane 5.
- Duration of orbital operations: 4.25 years
- Duration of post-operations Archive Phase: 5 years
- two mutually exclusive operations modes: PLANCK mode and FIRSTmode. 3 scenarii currently envisaged:
 - PLANCK survey (12+ months) + FIRST Mission
 - PLANCK survey (6 months) + FIRST survey (>6 months) + PLANCK survey (6+ months) + (rest) FIRST mission
 - FIRST survey (>6 months) + PLANCK survey (12+ months) + (rest) FIRST mission.
- Ground stations: Kourou (LEOP+Commissioning), Perth (all phases), VILSPA (LEOP+emergency)
- Operations (both modes) carried out according to the following scheme:
 - autonomously via on-board schedule
 - each 24-hour period divided into two sub-periods: 22 hr Daily Science Operations Period (DSOP), 2 hr Daily Telecommunication Period (DTCP).
 - data (Science + HK -spacecraft & instrument-) stored into on-board mass memory during the DSOP.
 - DSOP data down-linked during the DTCP (for next DSOP).
Note: data transmitted (HK first) from Ground Station to MOC vi a

64 Kbs communication lines.

- On-board schedule up-linked during the DTCP.
- while in FIRST mode (limited) -in terms of pointing freedom- scientific observations possible during the DTCP.
Note: Limitation due to requirement to point HGA towards Earth during DTCP
- *Note: Science and HK data generated during DTCP transmitted in real time to the ground TBC). It is also recorded in mass memory.*
- TC can be sent to and HK-TM received from the satellite, outside DTCP, during ground station(s) visibility period.

- FINDAS will serve both FIRST and PLANCK.

- While in PLANCK mode, PLANCK TM (and associated MOC products) are sent in parallel to the DCPs and to FINDAS.

- The FSC will (when in PLANCK mode) provide the pre-planned observation timeline, updates to this timeline and the corresponding PLANCK scientific instrument commands to the MOC.

- Science Instruments are designed to operate autonomously, i.e. they can ensure their own health and safety during non-contact periods (i.e. DSOP)

4.0 MAJOR GROUND SEGMENT INTERFACES

This chapter lists the major FIRST/PLANCK ground segment interfaces identified so far.

The ICDs governing the FIRST/PLANCK Ground Segment interfaces will constitute a hierarchy. The top level ICDs will describe the interfaces between the major elements/entities of the Ground Segment, i.e. MOC, ICCs, FSC, DPCs, External Community, etc. These top-level ICDs will include information on file transfer methods, communication lines, system aspects, etc. Under each top-level ICD, lower-level ICDs will describe in detail (e.g. definition of individual data items, file characteristics, data rates, synchronisation requirements, naming conventions, error handling, etc.) specific elements of the global interface. Fig. 1 provides a preliminary tree.

4.1 ICC TO FSC INTERFACE (FIRST)

The physical, operational and formal (managerial) interfaces between the FSC and the ICCs will be described in *top-level* "ICC to FSC ICDs".

The ICDs will be negotiated between the ICCs, the FSC and ESA after selection and establishment of the FSC and ICCs.

Each ICD will be signed separately between each ICC and the FSC, although all ICDs will be identical in contents and format. Exceptions to the general ICD would be discussed and agreed on a case by case basis.

The FSC will be the custodian of the ICDs.

4.1.1 Preliminary Definition

The *preliminary* information provided herein, should be sufficient for potential PIs to submit a bid for the ICC corresponding to the Scientific Instrument they propose. The "formal" "ICC to FSC ICDs" will be generated according to the format described in Appendix A.

4.1.2 Physical and Operational interface

- one dedicated 128-Kb line and one back-up (same capacity). To be provided, maintained and operated by the MOC (TBC).
- WWW, Internet, E-mail
- Fax and phone, surface mail
- operational interface through agreed procedures (custodian: FSC)

4.1.3 Data Interface

The data exchanged across this interface are listed below. Detailed definition will be provided via a series of ICDs. Note that most of the data exchanges take place via FINDAS.

Data type	Route	Custodian	Notes
- Science Processing Software	ICC - FSC	ICC	delivered to FINDAS
- "Time" estimator	ICC - FSC	FSC	available on FINDAS
- AOT definitions	ICC - FSC	FSC	
- Calibration Proposals	ICC - FSC		via FINDAS
- Engineering Proposals	ICC - FSC		via FINDAS
- Trend Analysis Results	ICC - FSC		via FINDAS
- Calibration Tables/ Files	ICC - FSC		via FINDAS
- Instrument Anomaly Reports	ICC - FSC		via FINDAS

4.2 ICC TO MOC INTERFACE (FIRST)

The physical, operational and formal (managerial) interfaces between the MOC and the ICCs will be described in *top-level* "ICC to MOC ICDs".

The ICDs will be negotiated between the ICCs and the MOC after selection and establishment of the ICCs.

Each ICD will be signed separately between each ICC and the MOC, although all ICDs should be identical in contents and format. Exceptions to the general ICD would be discussed and agreed on a case by case basis.

The MOC will be the custodian of the ICDs.

4.2.1 Preliminary Definition

The *preliminary* information provided herein, should be sufficient for potential PIs to submit a bid for the ICC corresponding to the Scientific Instrument they propose. The "formal" "ICC to MOC ICD" will be generated according to the format described in Appendix A.

4.2.2 Physical and Operational Interface

- WWW, Internet, E-mail
- Fax and phone, surface mail
- operational interface through agreed procedures (custodian: MOC)

4.2.3 Data Interface

The data exchanged across this interface are listed below. Detailed definition will be provided via a series of ICDs. Note that in most cases the exchange of data takes place via FINDAS.

Data type	Route	Custodian	Notes
- (near) real-time TM	MOC - ICC	MOC	"cleaned" packets
- auxilliary TM data	MOC - ICC	MOC	
- TM & TC Packet definition	ICC - MOC	MOC	
- Instrument Data Base (TM & TC)	ICC - MOC	MOC	
- Definition Health & Safety parameters	ICC - MOC	MOC	
- PCSs & ICSs	ICC - MOC	MOC	
- Instrument on-board software Images	ICC - MOC	MOC	format specified by MOC
- on-board memory dump Images	MOC - ICC		extracted by MOC from TM
- Instrument Command Translator	MOC - ICC	MOC	
- IFOPs & CRPs	ICC - MOC	MOC	format specified by MOC
- Instrument S/W Simulator	ICC - MOC		interface specified by MOC

4.3 MOC TO FSC INTERFACE (FIRST)

The physical, operational and formal (managerial) interfaces between the FSC and the MOC will be described in a *top-level* "MOC to FSC ICD".

The ICD will be negotiated between the MOC and the FSC after establishment of the FSC .

The MOC will be the custodian of the ICD.

4.3.1 Preliminary Definition

The *preliminary* information provided herein, should be sufficient for potential PIs to submit a bid for the ICC corresponding to the Scientific Instrument they propose. The "formal" "MOC to FSC ICD" will be generated according to the format described in Appendix A.

4.3.2 Physical and Operational Interface

- one dedicated 128-Kb line and one back-up (same capacity). To be provided, maintained and operated by the MOC.
- WWW, Internet, E-mail
- Fax and phone, surface mail
- operational interface through agreed procedures (custodian: FSC)

4.3.3 Data Interface

The data exchanged across this interface are listed below. Detailed definition will be provided via a series of ICDs. Note that in most cases the exchange of data takes place via FINDAS.

Data Type	Route	Custodian	Notes
- Observations Log	MOC-FSC	MOC	via FINDAS
- TC History	MOC-FSC	MOC	via FINDAS
- Sequence Observation List (SOL)	FSC-MOC	MOC	via FINDAS
- Central Command Schedule	MOC-FSC	MOC	via FINDAS
- Guide Star Catalog	MOC-FSC	MOC	via FINDAS

4.4 DPC TO MOC INTERFACE (PLANCK)

The physical, operational and formal (managerial) interfaces between the DPCs and the MOC will be described in *top-level* "DPC to MOC ICDs".

The ICDs will be negotiated between the DPCs and the MOC after selection and establishment of the DPCs.

Each ICD will be signed separately between each DPC and the MOC, although both ICDs will be identical in contents and format. Exceptions to the general ICD would be discussed and agreed on a case by case basis.

The MOC will be the custodian of the ICDs.

4.4.1 Preliminary Definition

The *preliminary* information provided herein, should be sufficient for potential PIs to define the tasks of the DPCs corresponding to the Scientific Instrument they propose. The "real" "DPC to MOC ICD" will be generated according to the format described in Appendix A.

4.4.2 Physical and Operational Interface

- one dedicated 128-Kb line and one back-up (same capacity). To be provided, maintained and operated by the MOC.
- WWW, Internet, E-mail
- Fax and phone, surface mail
- operational interface through agreed procedures (custodian: MOC)

4.4.3 Data Interface

TBW

4.5 FIRST/PLANCK PROJECT INTERFACES

- Satellite DB (SDB):	Project to MOC	Project	definition of all TM/TC
- Flight Dynamics DB (FDDB)	Project to MOC	Project	FD related TM/TC
- Spacecraft on-board S/W Images	Project to MOC	Project	format specified by MOC
- Spacecraft-Ground Station Interface	Project to MOC	Project	Mainly RF parameters

4.6 EXTERNAL INTERFACES (FIRST AND PLANCK)

There are several categories of external users:

- (i) FIRST users, i.e. observers and potential observers.
- (ii) FIRST Time Allocation Committee (FOTAC)
- (iii) the wider astronomical community (FIRST and PLANCK)
- (iv) other observatories
- (v) the press
- (vi) the general public.

The interfaces between the FIRST/PLANCK Ground Segment and the external users are controlled through the FSC (for both FIRST and PLANCK) or, directly, through the FIRST and PLANCK Project Scientist (i.e. categories iv to vi).

For categories (i) - (iii) the FIRST and PLANCK Project Scientists will define the products and/or services which shall be made available to the corresponding external users. Products and/or services will be accessible through FINDAS. They will be identified and described in the relevant top-level and/or lower level FINDAS-related ICDs. The FSC will be responsible for the generation and maintenance (as custodian) of these ICDs.

5.0 LOWER LEVEL INTERFACES

The following lower-level interfaces are identified. They are listed here in order to provide the overall picture. The list will be expanded, and the corresponding ICDs will be defined as the definition work progresses.

Note that a for the sake of efficiency and proper configuration control a single ICD may describe several interfaces.

5.1 Flight Dynamics Interfaces

Data type	Route	Custodian	Notes
- Orbit Data File	FD to FSC	FD	
- Attitude History File	FD to FSC	FD	
- Attitude Constraint Checker	FD to FSC	FD	Sc. Mission Planning
- Slew Time Predictor	FD to FSC	FD	Sc. Mission Planning
- Focal Plane Geometry Calibration offsets	FSC to FD	FSC	Commissioning Phase
- Sky Visibility Constraints	FD to FSC	FD	
- Planning Files	FD to FSC FSC to FD	-	

5.2 Other Low Level Interfaces

TBW

APPENDIX A

ICD LIST OF CONTENTS

- Title Page with signatures
- Distribution List
- Change Log Record
- Table of contents

Introduction

- Purpose
- Scope
- Applicable Documents
- Reference Documents
- Acronyms List

Operational Assumptions and Constraints

Requirements

- Functional Requirements
- On-Line Delivery Requirements
- Off-Line Delivery Requirements

Interface Characteristics

- Interface Location and Medium
- Hardware Characteristics and Limitations
- Data Source, Destination and Transfer Mechanism
- Node and Device Addressing
- Relationship with other interfaces

Access

- Programs generating or using the Interface Data
- Failure Protection, Detection and Recovery Procedures
- File Naming Conventions
- Storage and File Deletion Requirements
- Security Requirements
- Data Integrity Checks
- Backup Requirements
- Input / Output Protocols, Calling Sequences

Synchronisation Requirements
Timing and Sequencing Characteristics
Effective Duration
Priority

Error Handling
e.g. Transport / Network layer
e.g. Application Layer

Detailed Interface Specifications
Data Structure
Generation Method
Data passed across the interface - direction of transfer
Size and Frequency of Transfers

Data Definition (for example a file)
File Characteristics
Header Records
Data Records
File example

Figures

Tables

Note: Upon approval this List of Contents will be used for all ICDs produced for the FIRST/PLANCK Ground Segment.

Note: Depending on the level of the ICD in the hierarchy and on the characteristics of each interface, some items in the List of Contents might not be applicable. In this case, the heading must still be present, the corresponding text will be: "N/A"