FIRST Common Uplink System (CUS) URD

prepared by H. Feuchtgruber and U. Klaas

0. Introduction

This document describes the requirements for the Common Uplink System of all three FIRST instruments. It is a tool for generating relative time tagged command sequences for all FIRST instrument measurement types: general user observations (also called AOT), calibration observations and engineering measurements.

The design of the FIRST Common Uplink System described here is based on the ISO experience (cf. Baseline Requirements Document for Calibration Uplink System, SAI/93-94/Dc). A discussion of the applicability of the ISO system to the above measurement types has been presented in some detail in the technical note PACS-MA-TN-001 (new document number PICC-MA-TN-001) "Towards a Common Uplink System for FIRST", which is strongly recommended to be read before proceeding to the subsequent sections.

1. CUS Development Responsibility and Maintenance

a) The development and maintenance of the CUS is with the ICCs.

b) Responsibility splits are TBD.

2. Interfaces

a) The outcome of the CUS tool, relative time tagged command sequences, are meant as input for the FSC/MOC mission planning tools, or in the ILT case for Test Control.

b) At the front end there are some interfaces to data bases and "helpers" (e.g. AOT online help, instrument documentation etc.) which are not considered as part of the CUS and should be discussed elsewhere. Also the AOT User Interface which will have to be developed by FSC is not considered here, however the underlying AOT logic will be part of the CUS.

3. Users

Users of the CUS will be:

a) The instrument experts at the ICCs for generation of calibration observations and engineering measurements. AOT type observations will be handled as for every general observer by using the AOT User Interface.

b) General FIRST observers, restricted to the AOT logic and translator part in order to design and optimise their observations.

4. CUS Basic Building Blocks

A schematic view of the CUS as described in detail below is given in fig. 1. It consists of the following four essential elements.

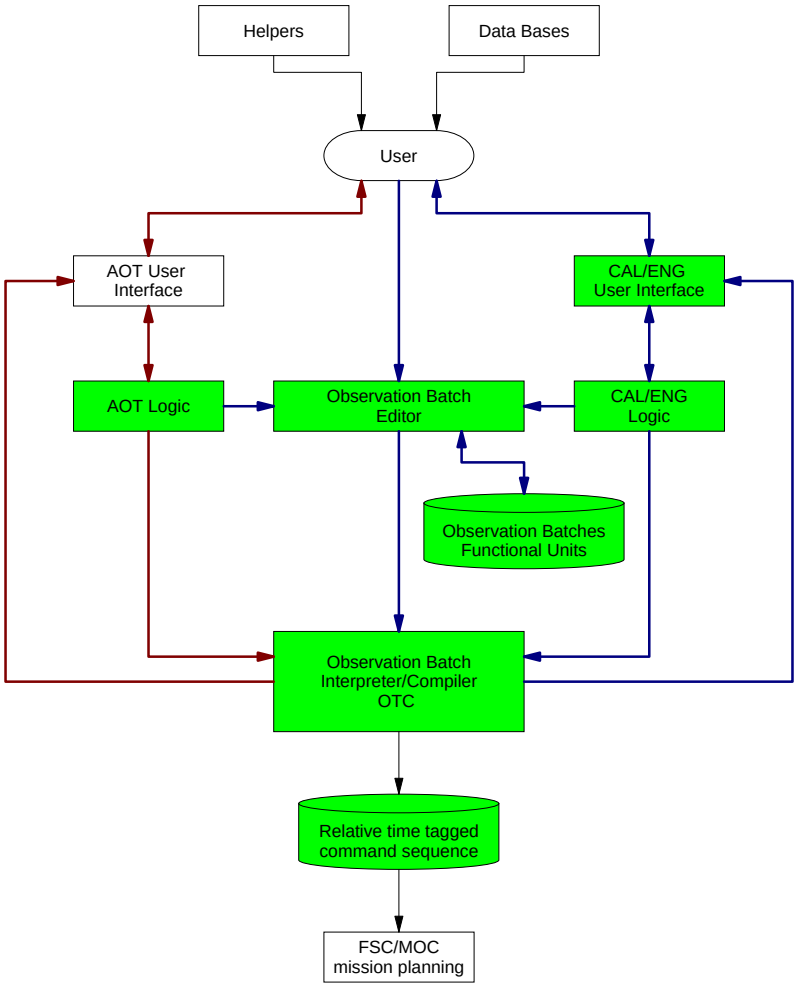

Fig.: 1 Simplified flow diagram of the Common Uplink System. The green boxes represent the elements of CUS. The arrows indicate the direction of transfer of products/information. The red lines are applicable to all users (=Astronomers, FSC and ICC). The blue lines are applicable to ICC users only.

4.1 Scripting Language and Editing Environment

a) The CUS shall offer a comfortable editing/development environment for writing engineering measurements and calibration observations in a flexible scripting language.

b) The properties and functionalities of this scripting language shall comprise:

- start and end statements to explicitly bracket a measurement entity
- spacecraft related pointing commands (incl. all scientific pointing modes offered by FIRST)
- single instrument commands (incl. dummy commands) with their respective parameters represented by "verb elements" of the scripting language
- all onboard control procedures (OBCP) as stored onboard with their respective parameters represented by "verb elements" of the scripting language
- default parameter settings shall be identified by a special character
- flags to disable certain parameter and limit checks in the subsequent translation process needed for special engineering procedures
- branches
- loops
- use of variables and constants
- integer and floating point calculations
- string operations
- comments
- read/write statements from/into local files or displays
- call and/or inclusion of sub-routines or other routines with and without parameters to allow easy access to already written batch code
- call of functional units (the meaning of functional units follows the abstraction level description in the PACS ICC software URD, note that a functional unit may consist of a combination of OBCPs and single instrument commands

c) The goal of an editing session shall be the generation of a piece of source code representing a schedulable entity, i.e. a measurement or an observation of a fixed duration with a first line containing the TBD "start" instruction and the last line containing the TBD "end" instruction. Such a piece of code will be called an "Observation Batch" for the remainder of this URD.

d) The environment shall also be used to modify or adapt already existing and stored Observation Batches and requires therefore fast access to them.

e) The AOT and CALG/ENG logic will be in the format of Observation Batches. However, it shall be possible to edit them before translation (ICC instrument experts only).

f) It shall be possible to start the translator from the editing environment.

4.2 Translator

a) The Observation Batch code must be checked for correctness of syntax by a dedicated interpreter or compiler.

b) If not disabled by flags for certain blocks or individual statements, a check whether the provided parameters for the individual commands have valid values and are within allowed limits shall be carried out as well at this stage.

c) In case of errors an error message log shall be provided which will support to correct the code by going back to the editing environment.

d) In case of correct syntax and parameter settings a sequence of Δt time tagged commands (S/C pointing related + instrument specific) shall be generated in a TBD format and output into a TBD intermediate repository (e.g. local file, etc.).

e) During the translation process a detailed report shall be generated and stored, which provides TBD information about functional units and acts also as the "Observation Time Calculator (OTC)".

f) This report shall contain not only the total duration of the observation/measurement, but also detailed durations of its individual building blocks or functional units.

g) The result of this translation process, the actual schedulable entity, will have the format required by the FSC as input for the mission planning system and command line generator or for ILT cases required by Test Control, according to a TBD procedure.

4.3 Logic

a) For many test and calibration purposes and especially for AOTs, quite similar predefined sequences of commands and pointing modes need to be defined, where only some parameters have to be changed. In order to avoid massive editing of individual observations or measurements, a logic layer shall be present inside the CUS, which has the format of an Observation Batch.

b) The Logic shall have the following properties:

- It shall be written in the scripting language
- It shall accept input parameters (numeric and/or string) via a TDB interface
- It shall be able to check the validity and limits of all inputs
- It shall be able to read/write from/into files (e.g. uplink calibration files, log files, etc.)
- It shall be able to generate messages (e.g. errors, warnings, infos, etc.)

c) All output generated by the logic shall be accessible from the user interface.

The bulk of the logic will consist of the AOT specific part, however also significant logic elements may be developed for calibration and engineering purposes.

Note: This definition of the logic represents a significant deviation from the ISO CUS system, since the logic itself is now just an Observation Batch. Like any other Observation Batch it can be edited within the described editing environment and it is coded in the same scripting language. No other translation process than the one by the above described translator is involved. The only actual uplink products which are available after a successful logic +

translator run will be the detailed report from the translator and the sequence of Δt time tagged commands.

4.4 User Interface

a) Two (likely three) different user interfaces shall be implemented for operating the CUS. One especially for the AOTs (FSC responsibility), another one for calibration observations and engineering measurements (ICC responsibility). The user profile for the first one will cover the full range from instrument specialists to the general astronomers, the second one will be used by instrument specialists at the ICCs. A third user interface may be needed for bulk processing of a large amount of observations in case of e.g. AOT logic changes (FSC responsibility).

b) The User Interface shall have the following properties:

- It shall pass all required parameters to the Logic
- It shall display the messages from the Logic to the user
- It shall be possible to start the translation process from the user interface
- It shall display the report (incl. the details from the OTC) from the Observation Batch Interpreter/Compiler to the user
- It shall be possible to manage (copy, rename, delete, etc.) the stored results of the translation process.

5.) References

a) Baseline Requirements Document (for the ISO) Calibration Uplink System, SAI/93-94/DC, Version 1.7, 20-December-1993

b) Towards a Common Uplink System for FIRST, Discussion Paper for Concept Development Based on Elements of the ISO Uplink System, PICC-MA-TN-001, Version 2.0, 28-June-1999