MRO FTT/NAS & FLC

FTT/NAS SAT Requirements

MRO-PLA-CAM-1100-0178

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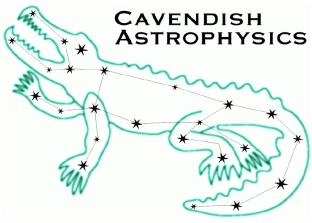

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Change Record

Revision	Date	Author(s)	Changes
0.1	2015-11-05	JSY	Initial version
1.0	2015-11-17	JSY	Added possible Cambridge tasks

Objective

To identify the functionality and level of integration of the ISS and associated MRO software needed to perform SATs of the FTT/NAS.

Scope

This document is primarily concerned with SATs of the FTT/NAS. Brief consideration is also given to acceptance testing of the Unit Telescope Mount by AMOS.

Reference Documents

RD1 Technical Requirements: Fast Tip-Tilt/Narrow-field Acquisition System (INT-403-ENG-0003) – rev 2.2, May 20th 2010

RD2 FTT/NAS to ISS ICD (MRO-ICD-CAM-1100-0112) – rev 1.12, June 30th 2015

Applicable Documents

Acronyms and Abbreviations

AMOS Advanced Mechanical and Optical Systems (UTM vendor)

CSV Comma Separated Values

FLC **First Light Camera**

FTT Fast Tip-Tilt

GUI Graphical User Interface

ICD Interface Control Document

ISS Interferometer Supervisory System

MRO Magdalena Ridge Observatory

MROI Magdalena Ridge Observatory Interferometer

SATs Site Acceptance Tests

TBC To be confirmed

TBD To be determined

TIM Technical Interchange Meeting

UT Unit Telescope

UTCS Unit Telescope (Mount) Control System

UTM Unit Telescope Mount

Table of Contents

1 Introduction

During the FTT TIM on 27th November 2015, MRO requested a summary of Cambridge's objectives for SATs of the FTT system and the MRO software functionality that would be needed to achieve these. This document attempts to satisfy that request.

The requirements to be tested are listed in RD1. This note does not provide an exhaustive list of individual tests to be performed for SATs. Rather, as an initial step, it identifies groups of tests that require different levels of functionality and integration from the MRO ISS and associated software. This level of detail should be sufficient to inform project planning at MRO.

2 Scenarios

In this section we present four possible scenarios (identified by the letters A to D and shown in Figures 1 to 4 respectively) for the implemented functionality of the MRO software components and their integration with each other and the Cambridge-delivered FTT/NAS software. These scenarios are presented in the form of data flow diagrams, showing the software components that are running once the systems have been started and configured. These diagrams are conceptual in nature, and may not show the actual data flows between ISS components accurately. The interfaces between the FTT software and the ISS are described fully in RD2.

For several of the groups of acceptance tests, there is a need to visualise and perhaps process monitor data published by the FTT systems. Offline software for this purpose is not in MRO's near-term plans so we have assumed that the Cambridge Analysis GUI will be used instead. The Analysis GUI reads data in the FITS format written by the Cambridge Control GUI, and so this component must be used to record data. The Control GUI can be used either to control the FTT systems, or simply to display and record data when the ISS is in control. Scenarios A, B, and C assume the former configuration, while scenario D is based on the latter.

A special “FLC” version of the Cambridge Control GUI includes functionality requested by AMOS for SATs of the UTM (principally data export to CSV).

The following points apply to all of the figures:

- the FTT system and environment controllers are combined into a single rectangle for brevity; and
- software components delivered by Cambridge are shown as light blue rectangles.

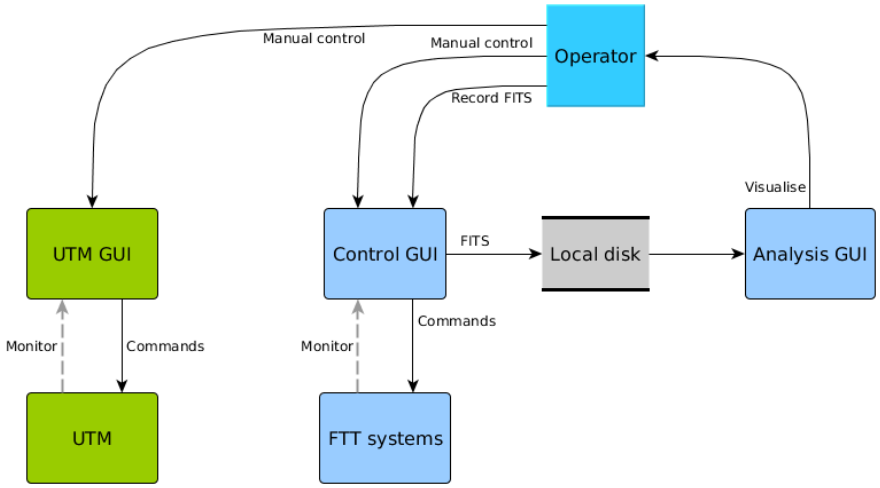

Figure 1: Data flow diagram for scenario A, where the FTT and UTM systems operate in a standalone mode. The Cambridge Analysis GUI is used to visualize monitor data recorded to a local file.

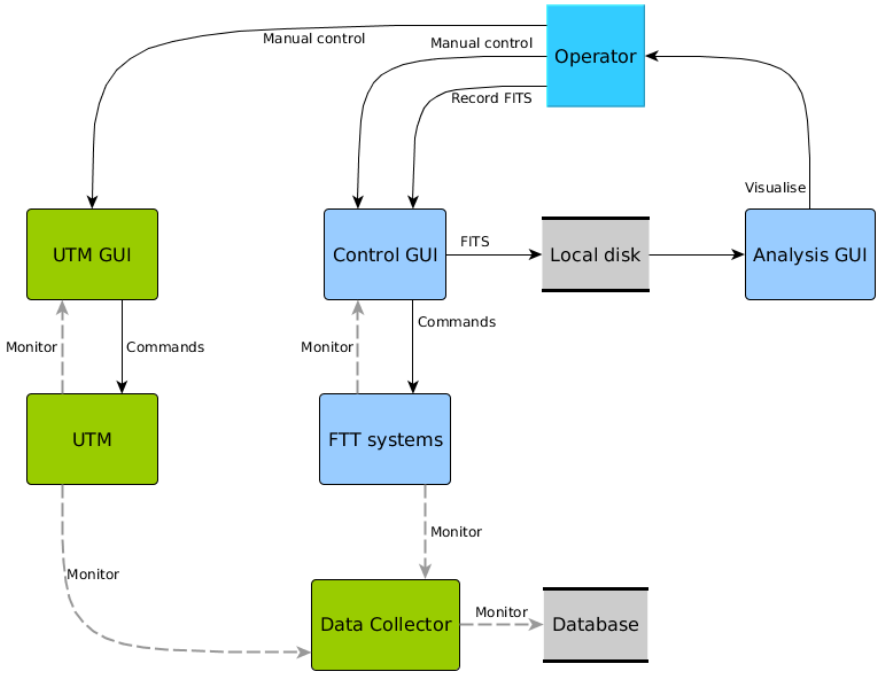

Figure 2: Scenario B, an extension of scenario A where monitor data are collected by the ISS data collector. The collected data are not used for the tests.

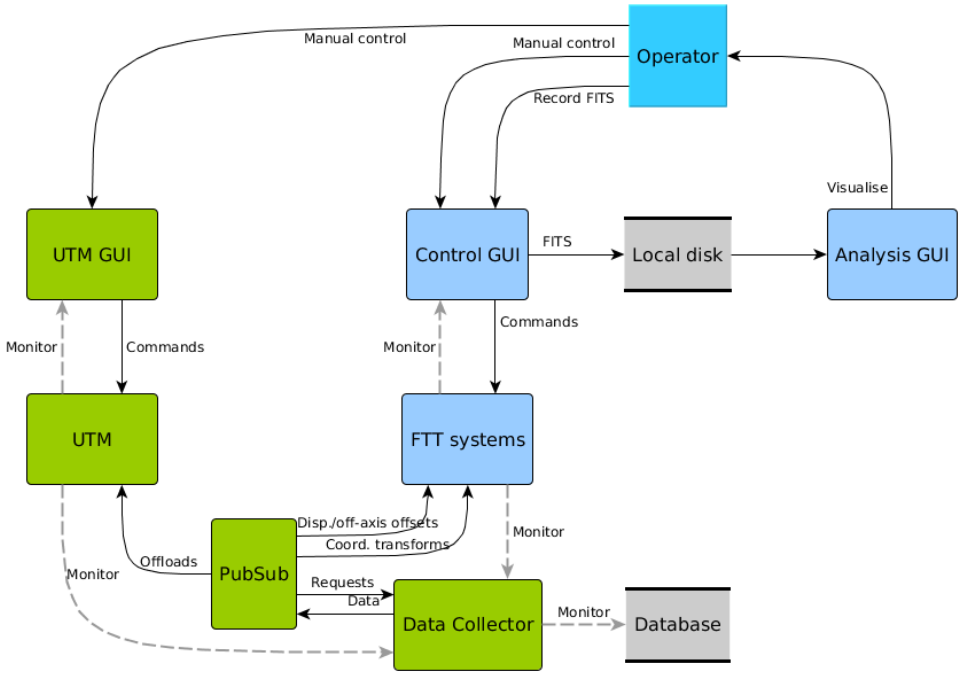

Figure 3: Scenario C, an extension of scenario B where the publish-subscribe system (labelled "PubSub") is used to integrate the UTM and FTT systems in a functional sense. The offload monitor points (steering corrections) published by the FTT must be supplied to the UTCS dedicated offload socket interface. The rotation matrices and guide target offsets published by the UTCS must be made available to the FTT via the publish-subscribe interface.

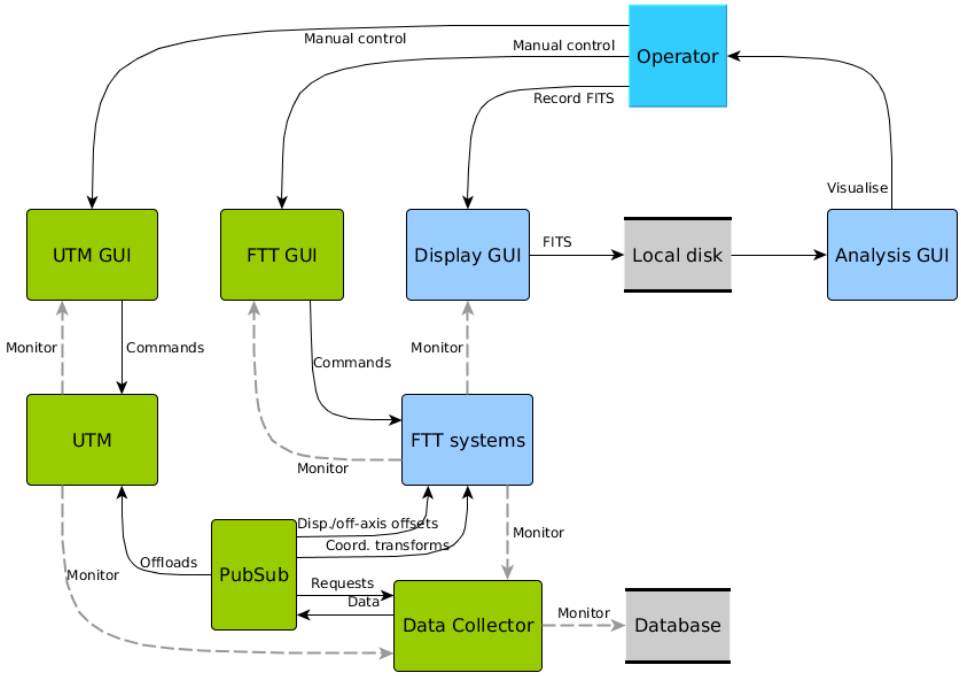

Figure 4: Scenario D, an extension of scenario C where the FTT systems are controlled by an MRO-provided GUI. The Cambridge GUI (now labelled "Display GUI") is only used to display and record monitor data.

3 Test Groups

The table below lists the groups of tests that have been identified. For each group, ticks in the relevant columns are used to indicate which of the scenarios A to D are suitable for carrying out the tests in that group. The "visualise recorded data" column indicates whether examination of monitor data is needed.

Sub-heading	Test group	Visualise recorded data	Scenario A	Scenario B	Scenario C	Scenario D
UTM SATs	Tests of UTM by AMOS	✔	✔	✔	✔	✔
FTT Functions	"Idle mode"		✔	✔	✔	✔
	"Acquisition check mode"		✔	✔	✔	✔
	Acquisition/guiding	✔			✔	✔
	Fast tip-tilt	✔			✔	✔
	Acquisition FOV		✔	✔	✔	✔
	Use of dark/flatfield	✔	✔	✔	✔	✔
	Seeing estimates	✔	✔	✔	✔	✔
	Sinusoidal dither	✔	✔	✔	✔	✔
FTT-ISS interfaces	Dark/flatfield set/get		✔	✔	✔	✔
	Coordinate transforms	✔			✔	✔
	Dispersion/off-axis offsets	✔			✔	✔
FTT Performance	Acquisition mode limiting mag.		✔	✔	✔	✔
	Tip-tilt residuals/limiting mag.	✔			✔	✔
	Tip-tilt zero point stability	?	?	?	✔	✔

4 Conclusions

- Scenario A is only suitable for the UTM SATs and a subset of the FTT SATs. In particular, tests of the key performance metrics will not be possible
- Extending to scenario B does not enable any further tests of the FTT system, but does test data collection by the ISS in a real-world situation
- Extending to scenario C (publish-subscribe) is required to complete acceptance testing of the FTT system
- Extending to scenario D allows the FTT command interface to be tested in a real-world situation

We recommend devising a project plan that will allow scenario C to be realised in time for FTT SATs. To facilitate this, Cambridge could take on additional tasks. Ideally, these extra tasks would be pre-requisites for implementing scenario C, yet loosely coupled to tasks being carried out by MRO. Our initial suggestions for suitable Cambridge tasks are as follows:

1. Implement an interface to the UTCS dedicated offload socket interface in the existing MRO adapter layer (assuming this has not already been done). The implementation would subscribe to the relevant FTT monitor points and push them to the offload interface.
2. Implement the test environment for the publish-subscribe system. This would provide an implementation of the API that has already been defined, capable of pushing fake monitor data to publish-subscribe clients.