

# **MRO FTT/NAS & FLC**

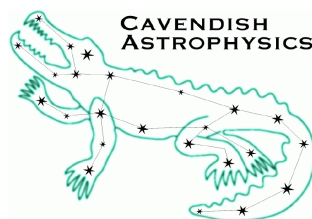
## **First Light Camera Description**

**MRO-TRE-CAM-1200-0181**

**The Cambridge FTT Team**

**rev 1.0**

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## Change Record

Revision	Date	Author(s)	Changes
0.1	2016-04-04	JSY	Initial version
1.0	2016-04-05	JSY	All design parameters included

## Objective

To outline the design of the MROI First Light Camera.

## Scope

This document provides a basic description of the First Light Camera that will be used for Site Acceptance Tests of the first MROI Unit Telescope.

## Reference Documents

RD1 [FLC Technical Requirements](#) (INT-403-TSP-0107) – rev 1.0, May 20<sup>th</sup> 2010

RD2 First Light Camera Assembly Procedure (MRO-PRO-CAM-1200-0180)

RD3 Software User Manual (MRO-MAN-CAM-1160-0165) – rev 1.0, April 4<sup>th</sup> 2016

## Acronyms and Abbreviations

<b>FTT</b>	Fast Tip-Tilt	<b>MROI</b>	Magdalena Ridge Observatory Interferometer
<b>FLC</b>	First Light Camera	<b>NAS</b>	Narrow-field Acquisition System
<b>GUI</b>	Graphical User Interface	<b>NMT</b>	New Mexico Tech
<b>ICD</b>	Interface Control Document	<b>TBC</b>	To be confirmed
<b>ISS</b>	Interferometer Supervisory System	<b>TBD</b>	To be determined

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# 1 Introduction

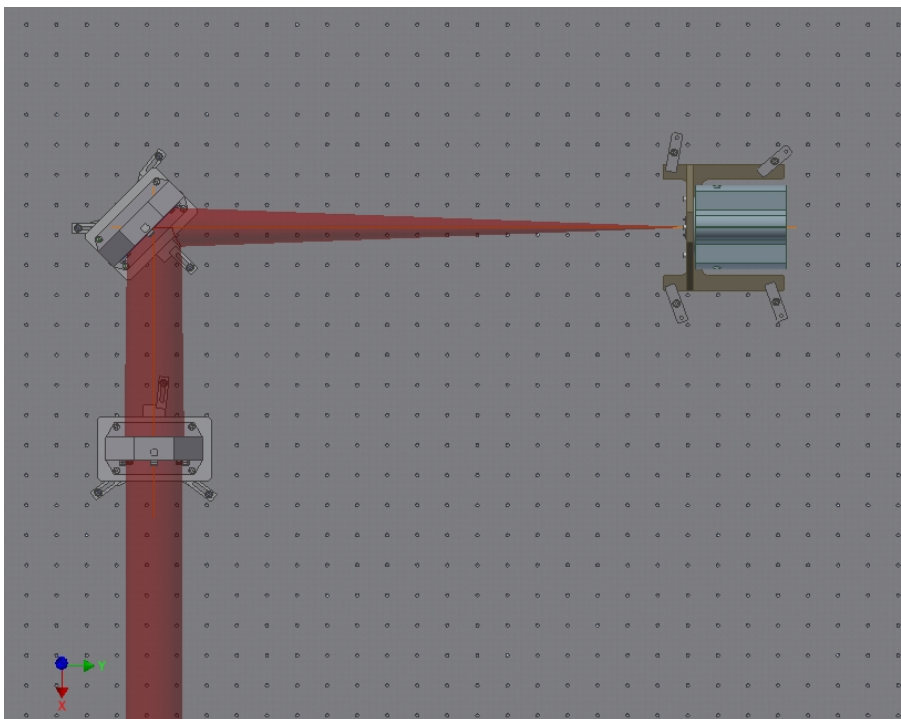
The First Light Camera (FLC) system will be used for commissioning and integration of the first AMOS-delivered Unit Telescope (UT) at the Magdalena Ridge Observatory Interferometer (MROI). The FLC will be a precursor for the more capable Fast Tip-Tilt/Narrow-field Acquisition System (FTT/NAS). The FTT/NAS will be delivered later and will replace the FLC for regular MROI scientific operations. The technical requirements for the FLC are specified in RD1.

The FLC will be operated in two distinct roles:

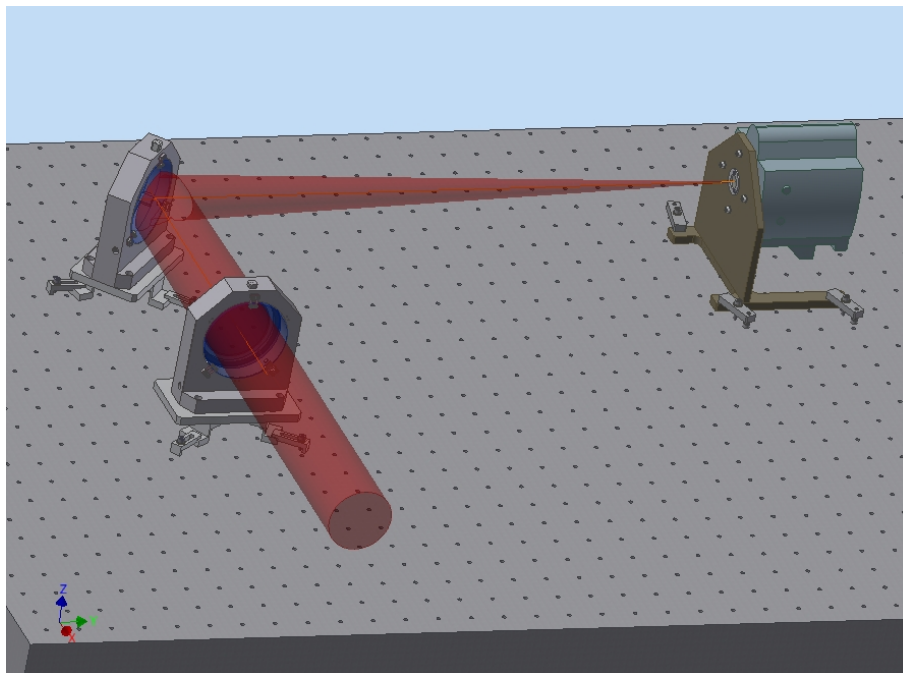
- A standalone role, independent of the MRO ISS, which will primarily be used for commissioning and acceptance testing of the UTM. In this role the FLC will be used for manual target acquisition and to develop pointing models and perform open-loop tracking tests;
- A role where it operates under the control of the MRO ISS and performs the NAS functions (for example automatic target acquisition and tracking) that are anticipated for the FTT/NAS system. This role can be used when integrating the UT with the ISS, prior to delivery of the first FTT/NAS system.

In the standalone role, the FLC will be controlled from its own GUI, capable of being displayed either on an MRO-owned computer at the telescope operator's station or from an MRO-owned laptop.

# 2 FLC Overview



*Figure 1: Plan view of the FLC opto-mechanical components on the UT Nasmyth table. The beam from M3 first intercepts the lens, which images it onto the EMCCD camera via reflection from the intervening plane mirror. Note that the exact layout may differ from that shown.*



*Figure 2: Perspective view of the FLC opto-mechanical components installed on the UT Nasmyth table.*

The FLC comprises a focusing lens and mount, fold mirror and mount, and an Andor iXon 897 EMCCD camera and custom camera support. A bandpass filter is mounted in the camera support. These components are mounted on the UT Nasmyth table as shown in Figure 1 and Figure 2. The FLC will be assembled by MRO staff by following the procedure described in RD2. The EMCCD camera is interfaced to a control computer located in electronics cabinet Q5.

The FLC is supplied with all of the software needed to operate in the standalone role outlined above. The software is documented in RD3. Integration of the FLC with the MRO ISS will take place at a later date and will require further development of the current software.

### 3 Design Parameters

The key design parameters of the FLC are shown in Table 1.

Parameter	Value
Focal length	1.25 m
CCD format	512 × 512
Pixel size	16 × 16 μm
Field of View (full frame readout)	91.7" × 91.7"
Pixel scale	0.179"/pix
Wavelength band	Bessell <i>R</i> (set by installed filter)
Image quality	0.2"
Focus	Tolerance 1mm; focus adjustment by manually repositioning camera support
Magnitude range (EM gain off, exposure ≤ 1 sec)	<i>R</i> =1.0 to 14.8 in 1" seeing
Exposure time	0.001–10.0 sec
Frame rate (full frame readout)	0.1–35 Hz

*Table 1: FLC design parameters.*