Software Requirements Specification for Automated Alignment System

INT-410-TSP-0100

Revision 3

AAS-SoftwareRequirementsSpecification-r3-2008-0702.doc

Prepared by	Requirements Analyst	Thomas Coleman		2008-07-14
Checked by	Lead Control Software Engineer	Thomas Coleman		2008-07-14
Approved by	Work Package Leader	Alisa Shtromberg		2008-07-14
Released by	Project Manager	Eric Bakker		

Magdalena Ridge Observatory
New Mexico Tech
801 Leroy Place
Socorro, NM 87801
USA
http://www.mro.nmt.edu

Revision History

Revision	Date	Author	Description
1	2008-05-24	TC	Initial draft. Software Requirements Elicitation Workshop #1.
2	2008-06-05	TC	Software Requirements Elicitation Workshop #2 & #3.
3	2008-07-02	TC	Added diagram and use case.
4	2008-07-23	AS,TC	Revised after Software Requirements review IDT 2008-07-16.

Table of Contents

1. Preface

1.1. Scope

This document provides the Software Requirements Specification for the Magdalena Ridge Observatory Interferometer (MROI) Automated Alignment System (AAS).

Software Requirements Specification (SRS) documents capture the user need and contract between the software development team and the customer. The SRS describes functional requirements by use cases. Each use case (UC) describes the system's behavior under various conditions as the system responds to requests. SRS also describe non-functional requirements for the system's completion. SRS drives implementation of the software products.

This document follows the guidelines for an SRS described in "MROI Software Project Management Plan" INT-409-xxx.xxx.[1].

1.2. Context

The Automated Alignment System (AAS) provides the real-time control, monitoring, and data acquisition for the MROI Automated Alignment System (AAS) sub-project. The AAS sub-project is described in "Requirements for the Automated Alignment System", INT-404-TSP-0003 [2].

1.3. Intended Audience

The primary audiences for this document are the stakeholders of the AAS and the MROI control software team. It is intended that software development will base designs on this SRS, and software testing will use this document as a reference to assess whether the software satisfies requirements.

1.4. Evolution of the SRS

The information in an SRS is intended to be evolving, but varying slowly, across the entire duration of the software project. The SRS achieves greater fidelity as the project progresses and requirements understanding matures. Each revision provides a baseline for software development activities and formally identifies the user needs for the software.

The initial version of this SRS coincides with the development of the AAS Conceptual Design. Revisions to this document are anticipated in conjunction with the development of the Preliminary and Final Designs, and Software Change Orders. Revisions are also anticipated in conjunction with iterations of software development life-cycles.

1.5. Document Conventions

Each software requirement in this document is labeled for identification purposes with a unique tag in accordance with guidelines described in "MROI Software Project Management Plan" [1].

1.6. References

[1] "MROI Software Project Management Plan" INT-409-xxx-xxxx.

[2] "Requirements for the Unit Telescope Enclosures for the MRO Interferometer", INT-404-TSP-0003.

[3] "Software Glossary for the Interferometer Software Project", INT-409-TSP-XXXX.

[4] "Conceptual Design of the Unit Telescope Enclosures", INT-404-TSP-0006.

1.7. Terms, Acronyms, and Abbreviations

The following terms, acronyms and abbreviations are provided here as an aid to the reader. Additional terms, acronyms, and abbreviations which the reader will find useful to properly interpret this SRS are defined in "Software Glossary for the Interferometer Software Project"[3].

AAS Automated Alignment System

AL Algorithm

CI Communications Interface

HI Hardware Interface

SRS Software Requirements Specification

UC Use Case

UI User Interface

2. System Overview

This section presents a high-level overview of the Automated Alignment System (AAS).

2.1. Essential Mission

The AAS provides the online control and monitor software for the Automated Alignment System (AAS). It has features to provide efficient execution of reoccurring alignment procedures for interferometer optical systems, coaligning each Unit Telescope, with each Delay Line, with each beam combiner.

Illustration 1 shows the system overview of the Automated Alignment Systems.

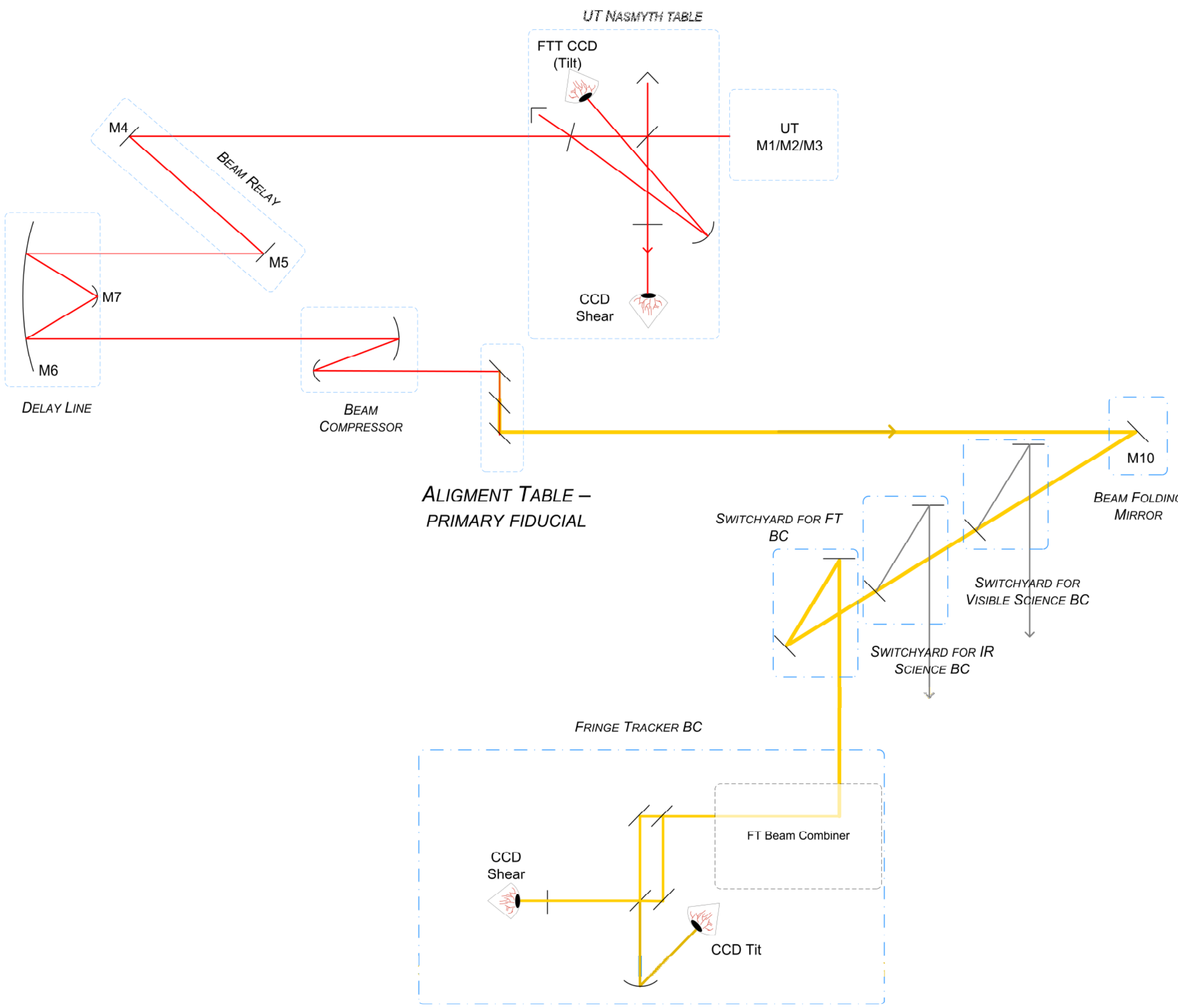

Illustration 1: System Overview of Automated Alignment System

2.2. Sub-system Summary

This section provides a brief summary of each major sub-system and identifies their major features to provide the reader with background for interpreting the requirements in the sections which follow.

2.2.1. Alignment Brain

The major feature provided by the Alignment Brain AAS subsystem is the computer automated, sequenced execution of alignment procedures.

2.2.2. Beam Relay

The major feature provided by the Beam Relay AAS subsystem is the tip and tilt positioning of mirrors M4 and M5.

2.2.3. Delay Line

The major feature provided by the Delay Line AAS subsystem is to provide the RMS trajectory defining the delay line optical axis.

2.2.4. FT Switchyard

The major feature provided by the FT Switchyard AAS subsystem is to provide the tip and tilt positioning of mirrors M15 and M16.

2.2.5. FT Table

The major feature provided by the FT Table AAS subsystem is to measure the tilt and shear errors of the FT Switchyard.

2.2.6. Guest Instrument Switchyard

The major feature provided by the Guest Instrument Switchyard AAS subsystem is to provide the tip and tilt positioning of mirrors M17 and M18.

2.2.7. Guest Instrument Table

The major feature provided by the FT Table AAS subsystem is to measure the tilt and shear errors of the Guest Instrument Switchyard.

2.2.8. IR Science Switchyard

The major feature provided by the IR Science Switchyard AAS subsystem is to provide the tip and tilt positioning of mirrors M13 and M14.

2.2.9. IR Science Table

The major feature provided by the IR Science Table AAS subsystem is to measure the tilt and shear errors of the IR Science Switchyard.

2.2.10. Primary Fiducial

The major feature provided by the Primary Fiducial AAS subsystem is to provide light source insertion into the Unit Telescope optics axes and the Beam Combiner optical axes.

2.2.11. Secondary Fiducials

The major feature provided by the Secondary Fiducials AAS subsystem is to provide positional measurements of the optical axis trajectory in the Beam Relay.

2.2.12. UT Nasmyth Table

The major feature provided by the UT Nasmyth Table AAS subsystem is to measure the coalignment tilt errors of the UT optical path and the Beam Relay optical path.

2.2.13. FTT System

The major feature provided by the FTT System AAS subsystem is to measure the coalignment shear errors of the UT optical path and the Beam Relay optical path.

2.2.14. UTCS System

The major feature provided by the UTCS System AAS subsystem is to command the Unit Telescope into retro-reflection mode.

2.2.15. Visible Science Switchyard

The major feature provided by the Visible Science Switchyard AAS subsystem is to provide the tip and tilt positioning of mirrors M11 and M12.

2.2.16. Visible Science Table

The major feature provided by the Visible Science Table AAS subsystem is to measure the tilt and shear errors of the Visible Science Switchyard.

3. Performance Verification Milestones

3.1.1. Incremental Capability

The AAS shall be delivered with incremental capability which is coordinated with Interferometer project-wide Performance Verification Milestones (PVM). The following table presents the AAS subproject goals for each PVM.

Sub-Project	Milestone	# of UT	Performance Goal	Comments
AAS	PVM-03	1	Align UT01 & FT Table to DL, one beamline, efficiency	
AAS	PVM-04	2	Full capability of UT01 & UT02, efficient in afternoon	
AAS	PVM-06	3	Full capability of UT03, some enhanced automation	
AAS	PVM-07	3	Upgrades to support optimum sensitivity for FT with faint targets	
AAS	PVM-08	3	Support for SCI table, monitoring between FT and SCI tables	
AAS	PVM-09	3	Maintain inter-night alignment, monitor stability after reconfiguration	
AAS	PVM-10	3	Optimize and maintain system alignment for maximum S/N	
AAS	PVM-11	4	Support UT04, Fully automated system alignment after relocation	
AAS	PVM-12	6	Support UT05 & UT06, Full automation of one 6-UT configuration	
AAS	PVM-13	6	Support all operating modes of interferometer array	

4. Feature Set Deliverables

4.1.1. Iterative Releases

The AAS shall be delivered in iterative releases aimed to reach each PVM goal. Releases shall be coordinated based on feature priority, software staff availability, and other project constraints. The following table presents the AAS feature release goals. Release identifiers "N.x" is used to identify an iterative release 'x' required to reach PVM 'N'.

Milestone	Sub-Project	Release	Feature Set Description
PVM-03	AAS	aas-03.1	Lab tests I, Initial open loop FT Table components
PVM-03	AAS	aas-03.2	Lab tests II, Initial closed loop FT Table components, two beams
PVM-03	AAS	aas-03.3	Lab tests III, Initial UT Nasmyth Table components
PVM-03	AAS	aas-03.4	Lab Tests IV, Primary Fiducial components
PVM-03	AAS	aas-03.5	Align PF and DL to be on same axis
PVM-03	AAS	aas-03.7	Align UT01 axis to DL axis
PVM-03	AAS	aas-03.8	Align FT Table to DL, one beamline, efficiency
PVM-04	AAS	aas-04.1	Align UT01 and UT02 to DL axis and FT BC to DL axis
PVM-04	AAS	aas-04.2	Full capability of UT01 & UT02, efficient in afternoon
PVM-06	AAS	aas-06.1	Full capability of UT03, some enhanced automation
PVM-07	AAS	aas-07.1	Upgrades to support optimum sensitivity for FT with faint targets
PVM-08	AAS	aas-08.1	Support for SCI table, monitoring between FT and SCI tables
PVM-09	AAS	aas-09.1	Maintain internight alignment, monitor stability after reconfiguration
PVM-10	AAS	aas-10.1	Optimize and maintain system alignment for maximum S/N
PVM-11	AAS	aas-11.1	Support UT04, Fully automated system alignment after relocation
PVM-12	AAS	aas-12.1	Support UT05 & UT06, Full automation of one 6-UT configuration
PVM-13	AAS	aas-13.1	Support all operating modes of interferometer array

5. User Expectations

5.1. User Classes and Characteristics

This section describes the general characteristics of the intended users.

5.1.1. Operator

The Operator user class is primarily interested is access to automated operations to check and align all system components without entering the inner BCA, UT enclosure, or Beam Relay.

5.1.2. Technician

The Technician is interested in manual operations, hands-on calibration procedures, ability to diagnose and fix optical, electronics, mechanics, and perform all internal optical alignment.

6. Use Cases (UC)

This section specifies the software requirements of the AAS by use cases. Each use case represents a desired sequence of interaction with the AAS.

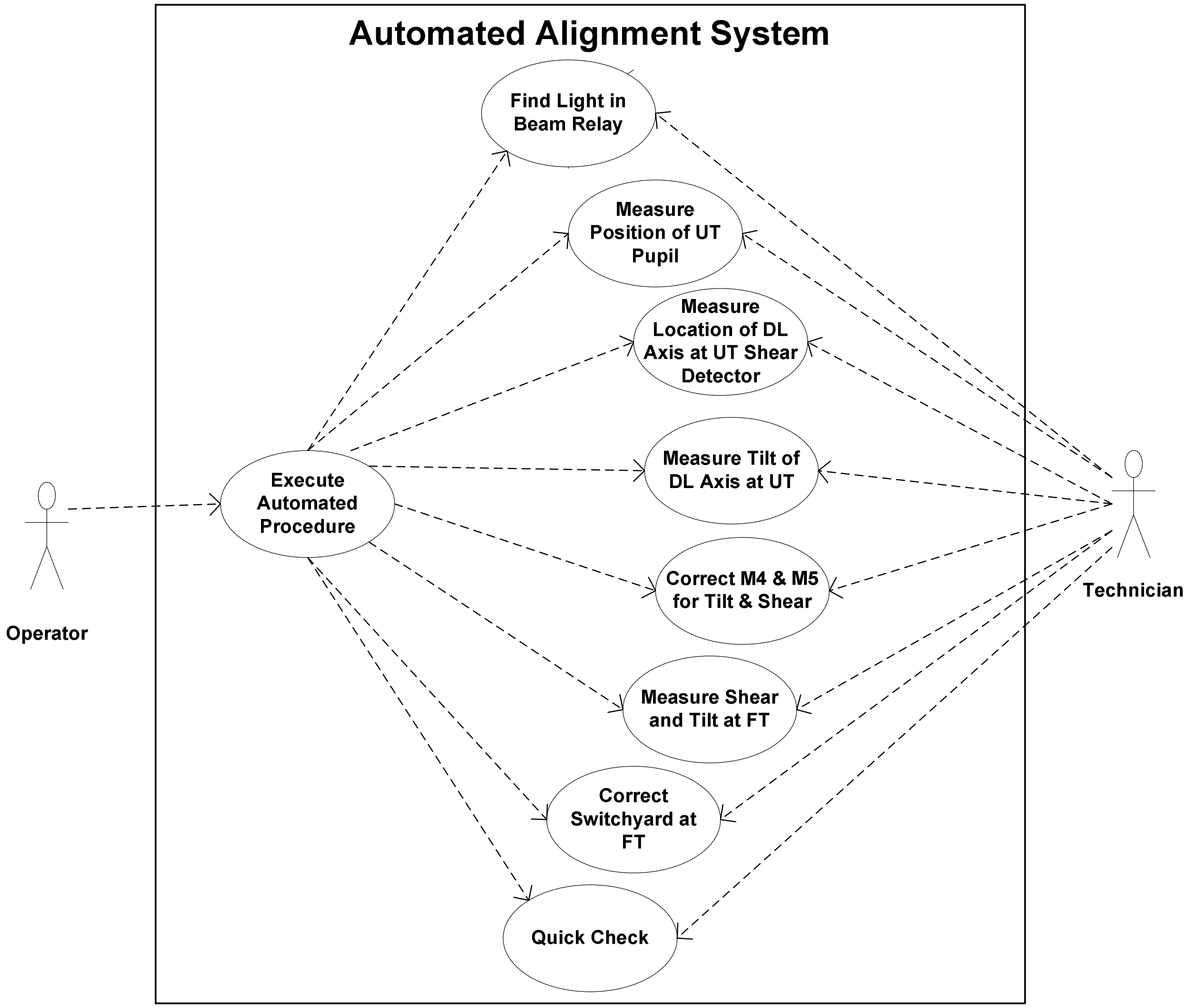

Illustration 1: A Use Case diagram for Automated Alignment System

UC-001 Measure Position of UT Pupil Use Case

Actors: Technician

Precondition:

1. UT is in alignment position

Context of Use: Nightly, pre-sunset procedure

Description:

1. Move UT beamsplitter into alignment position.
2. Turn on UT LEDs.
3. Measure centroid location at UT Nasmyth shear detector.
4. Store measured values for later comparisons.

Alternative:

2.a. Centroid location not found on detector.

Post Condition: Centroid location is determined at the UT Nasmyth

Specified Data:

Open Issues:

UC-002 Measure Location of DL Axis at UT Shear Detector Use Case

Actors: Technician

Precondition:

1. UT is in alignment position
2. UT beamsplitter is in alignment position.

Context of Use: Nightly, pre-sunset procedure

Description:

1. Move Primary fiducial beamsplitter into position to send MOB laser diode light to UT.
2. Turn on MOB laser diode source.
3. Measure centroid location at UT Nasmyth shear detector.
4. Store measured centroid location values for later comparisons.

Alternative:

2.a. Centroid location not found on detector.

Post Condition:

Specified Data:

Open Issues:

UC-003 Measure Tilt of DL Axis at UT Use Case

Actors: Technician

Precondition:

1. Primary fiducial beamsplitter is in position to send MOB laser diode light to UT.

2. UT is in alignment position

Context of Use: Nightly, pre-sunset procedure

Description:

1. Turn on MOB laser diode source.
2. Measure centroid location at UT Nasmyth shear detector.
3. Store measured values for later comparisons.

Alternative:

2.a. Centroid location not found on detector.

Post Condition:

Specified Data:

Open Issues:

UC-004 Correct M4 & M5 for Tilt & Shear Use Case

Actors: Technician

Precondition: Tilt and Shear centroiding completed and error has been calculated.

Context of Use:

Description:

1. Move M4 and M5 in some combination TBD to correct tilt and shear.
2. Remeasure centroids and repeat until within tolerances.

Alternative:

2a. Tolerance cannot be reached.

Post Condition:

Specified Data:

Open Issues:

UC-005 Measure Shear and Tilt at FT Use Case

Actors: Technician

Precondition:

1. PF beamspiltter is in path and measurement and corrections has been completed at UT.

Context of Use:

Description:

1. Turn on MOB white light source

2. Flip in corresponding FT flipper mirror for first beam combiner output.
3. Determine centroid location at shear CCD & tilt CCD.
4. Calculate centroid error.

Alternative:

3.a. Spot not focused on CCD.

3.a.1 Move slide.

Post Condition:

Specified Data:

Open Issues:

UC-006 Correct Switchyard at FT Use Case

Actors: Technician

Precondition:

Context of Use:

Description:

1. Move M15&M16 in some combination TBD to correct tilt and shear.
2. Remeasure and move until reach tolerance.

Alternative:

Post Condition:

Specified Data:

Open Issues:

UC-007 Find Light in Beam Relay Use Case

Actors: Technician

Precondition:

Context of Use: Light has not been found on UT shear detector.

Description:

1. Slide in PF beamsplitter.
2. Turn on MOB laser diode.
3. Pop-up Quad cell.

Alternative:

3.a. Light not found on quadcell.

3.a.1 Move PF beamspiltter.

Post Condition:

Specified Data:

Open Issues:

UC-008 Quick Check Use Case

Actors: Technician

Precondition:

Context of Use: Every several hours during night, or on demand as needed.

Description:

1. Turn on MOB Laser diode.
2. Pop-up nearest quadcell and measure centroid.
3. Pop-up next farther quadcell and measure centroid.
4. Repeat for additional quadcells.
5. Calculate shear errors and display to operator.
6. Save values for later comparison to additional quick checks.

Alternative:

Post Condition:

Specified Data:

Open Issues:

UC-009 Execute Automated Procedure

Actors: Operator

Precondition:

Context of Use: Every several hours during night, or on demand as needed.

Description:

1. Select automated procedure. (TBD)
2. Execute automated procedure. (TBD)

Alternative:

Post Condition:

Specified Data:

Open Issues:

UC-010 Align Primary Fiducial to Delay Line Use Case

Actors: Technician

Precondition:

Context of Use: Nightly to weekly.

Description:

1. Turn on MOB.
2. Position delay line cart at some arbitrary position defined at “zero” starting point.
3. Get light to shear camera.
4. Start moving cart to determined locations some distance distance repeatedly, and measure.
5. Correct tip/tilt of beamsplitter to insure light on Nasmyth shear camera.
6. Continue moving cart until all delayline positions have been measured on the Nasmyth shear camera.

Alternative:

3.a Light not found at Nasmyth shear.

5.a Tip/tilt out of range.

Post Condition:

Specified Data:

Open Issues:

UC-011 Calibrate Quad Cell Use Case

Actors: Technician

Precondition:

Context of Use: 6-months.

Description:

1. Take dark current measure, for each cell determine offset and gain.
2. Store calibrations.

Alternative:

Post Condition:

Specified Data:

Open Issues:

UC-012 Calibrate CCD Use Case

Actors: Technician

Precondition:

Context of Use: 6-months.

Description:

1. Take dark current measurements.
2. Take flood field images.
3. Store offset and gain calibrations.

Alternative:

Post Condition:

Specified Data:

Open Issues:

UC-013 Manual Mode Adjustment Use Case

Actors: Technician

Precondition:

Context of Use: 6-months.

Description:

1. System displays image.
2. User selects pixel offset.
3. System computes offset for tip/tilt actuator.

Alternative:

Post Condition:

Specified Data:

Open Issues:

7. Requirements Listing

This section lists the software requirements of the AAS.

Release	Sub-Project	Req. Type	Req#	Subsystem	Requirement Title	Description
AAS-03.x	AAS	AL	006	AAS System	Calculate DL Trajectory from UT Nasmyth Shear Camera Algorithm	
AAS-03.x	AAS	AL	007	AAS System	Use Centroid of UT Nasmyth Shear for adjustment of Beamsplitter Tip-Tilt while moving DL Trolley Algorithm	
AAS-03.1	AAS	CO	001	AAS System	JPL RTC Design Constraint	Software shall utilize the Jet Propulsion Laboratory (JPL) Real-Time Control (RTC) framework.
AAS-03.1	AAS	OE	001	AAS System	Lab Operating Environment	
AAS-03.x	AAS	OE	002	AAS System	Ridge Operating Environment	
AAS-09.x	AAS	AL	002	Alignment Brain	Alignment Procedures TBD Algorithm	
AAS-09.x	AAS	UI	006	Alignment Brain	One Button Fully-Ultra-Enhanced Automation User Interface	
AAS-03.2	AAS	HI	001	Beam Relay	M4 Tip-Tilt Controller Hardware Interface	
AAS-03.2	AAS	HI	002	Beam Relay	M5 Tip-Tilt Controller Hardware Interface	
AAS-03.x	AAS	HI	003	Beam Relay	M4/M5 Temperature Sensor Hardware Interface	
AAS-03.2	AAS	UI	001	Beam Relay	M4 Tip-Tilt User Interface	
AAS-03.2	AAS	UI	002	Beam Relay	M5 Tip-Tilt User Interface	
AAS-03.x	AAS	UI	003	Beam Relay	M4/M5 Temperature Sensor User Interface	
AAS-03.x	AAS	AL	001	Delay Line	DL Trolley Trajectory RMS Calculation Algorithm	Reuse DL interface
AAS-03.x	AAS	CI	001	Delay Line	DL Trolley System Communications Interface	Move the trolley
AAS-03.x	AAS	CI	002	Delay Line	DL Shear Camera System Communications Interface	Access to RMS trajectory results & raw data
AAS-03.x	AAS	UI	004	Delay Line	DL Trolley System User Interface	Reuse DL Interface
AAS-03.x	AAS	UI	005	Delay Line	DL Shear Camera System User Interface	Reuse DL interface
AAS-03.1	AAS	HI	015	FT Switchyard	FT Switchyard Tip-Tilt Communications Interface	Newport Agilis Mounts with Newport Controller, FT system has control
AAS-03.1	AAS	UI	007	FT Switchyard	FT Switchyard Tip-Tilt User	Reuse FT interface

					Interface	
AAS-03.1	AAS	AL	003	FT Table	Determine Shear & Tilt References using AAS light returning from W0 Algorithm	
AAS-03.1	AAS	AL	004	FT Table	Determine Shear Displacement from AAS light on Tilt CCD Algorithm	
AAS-03.1	AAS	AL	005	FT Table	Determine Tilt Displacement from AAS light on Shear CCD Algorithm	
AAS-03.1	AAS	AL	014	FT Table	FT Table Shear & Tilt Centroiding Algorithm	
AAS-03.1	AAS	HI	004	FT Table	Flipper Mounts Controller Hardware Interface	Flipping Flippers, New-Focus, TTL
AAS-03.x	AAS	HI	005	FT Table	Shutter Controller Hardware Interface	
AAS-03.1	AAS	HI	006	FT Table	Shear CCD Camera Hardware Interface	Edmund Optics, NT56-567 Near IR Camera, NI 1405 (H)
AAS-03.1	AAS	HI	007	FT Table	Tilt CCD Camera Hardware Interface	Edmund Optics, NT56-567 Near IR Camera, NI 1405 (H)
AAS-03.1	AAS	HI	008	FT Table	Tilt CCD Focus Slide Controller Hardware Interface	Sliding focus slide, TBD P/N.
AAS-03.1	AAS	UI	008	FT Table	Flipper Mounts User Interface	
AAS-03.x	AAS	UI	009	FT Table	Shutter User Interface	
AAS-03.1	AAS	UI	010	FT Table	Shear CCD Camera User Interface	
AAS-03.1	AAS	UI	011	FT Table	Tilt CCD Camera User Interface	
AAS-03.1	AAS	UI	012	FT Table	Tilt CCD Slide User Interface	
AAS-14.x	AAS	TBD	TBD	Guest Instrument Switchyard		Newport Agilis Mounts with Newport Controller, FT system has control
AAS-14.x	AAS	TBD	TBD	Guest Instrument Table		
AAS-08.x	AAS	TBD	TBD	IR Science Switchyard		Newport Agilis Mounts with Newport Controller, FT system has control
AAS-08.x	AAS	TBD	TBD	IR Science Table		
AAS-03.3	AAS	HI	009	Primary Fiducial	MOB Light Controller Hardware Interface	Two on/off switches
AAS-03.3	AAS	HI	010	Primary Fiducial	MOB Lens Flipper Mount Hardware Interface	Directs light to focusing optic / pinhole
AAS-03.3	AAS	HI	011	Primary Fiducial	Beamsplitter Tip-Tilt Contoller Hardware Interface	Newport Ultima-Series Gimbal mount P/N U100-ACG-2K-NL
AAS-03.3	AAS	HI	012	Primary Fiducial	Beamsplitter Slide Controller Hardware Interface	
AAS-03.3	AAS	UI	013	Primary Fiducial	MOB Lights Control/Status	

					User Interface	
AAS-03.3	AAS	UI	014	Primary Fiducial	MOB Lens Flipper Con-trol/Status User Interface	
AAS-03.3	AAS	UI	015	Primary Fiducial	Beamsplitter Tip/Tilt Con-trol/Status User Interface	
AAS-03.3	AAS	UI	016	Primary Fiducial	Beamsplitter Slides Con-trol/Status User Interface	
AAS-03.3	AAS	UI	025	Primary Fiducial	Beamsplitter Tip-Tilt Contoller User Interface	
AAS-04.x	AAS	AL	008	Secondary Fidu-cials	Quad Cell Centroid Calculation Algorithm	
AAS-04.x	AAS	HI	013	Secondary Fidu-cials	Quad Cell Pop-Up Controller Hardware Interface	Flipper Mount: New Focus P/N 8892 Moto-rized Flipper Mounts (TTL signal)
AAS-04.x	AAS	HI	014	Secondary Fidu-cials	Quad Cell Readout Hardware Interface	Cross Over cans; vol-tage read; Where do we convert to digital? In Can?
AAS-04.x	AAS	UI	017	Secondary Fidu-cials	Quad Cell Pop-Up User Inter-face	Flipper Mount: New Focus P/N 8892 Moto-rized Flipper Mounts (TTL signal)
AAS-04.x	AAS	UI	018	Secondary Fidu-cials	Quad Cell Centroid User Inter-face	Cross Over cans; vol-tage read; Where do we convert to digital? In Can?
AAS-03.2	AAS	AL	009	UT Nasmyth Table	Determine alignment fiducial spot on CCD Camera from AAS Light Algorithm	
AAS-03.2	AAS	AL	010	UT Nasmyth Table	Determine alignment fiducial spot on CCD Camera from UT LEDS Algorithm	
AAS-03.2	AAS	AL	011	UT Nasmyth Table	Calculate shear from AAS Light and UT LEDS Algorithm	
AAS-03.2	AAS	AL	012	UT Nasmyth Table	Determine tilt from FTT Sensor using AAS Light and Re-tro/Mount Algorithm	
AAS-03.2	AAS	AL	013	UT Nasmyth Table	Use UT Nasmyth Tilt & Shear for adjustment of M4/M5 Algorithm	
AAS-03.2	AAS	AL	015	UT Nasmyth Table	UT Nasmtyh Centroiding Algo-rithm	
AAS-03.x	AAS	CI	004	UT Nasmyth Table	FTT System Communications Interface	
AAS-03.x	AAS	CI	005	UT Nasmyth Table	UTCS System Communications Interface	
AAS-03.2	AAS	HI	016	UT Nasmyth Table	CCD Camera Hardware Inter-face	
AAS-03.2	AAS	HI	017	UT Nasmyth Table	Beamsplitter Slide Controller Hardware Interface	
AAS-03.2	AAS	HI	018	UT Nasmyth Table	Beamsplitter Tip-Tilt Controller Hardware Interface	

AAS-03.2	AAS	HI	019	UT Nasmyth Table	Focusing Lens Slide Controller Hardware Interface	
AAS-03.2	AAS	UI	019	UT Nasmyth Table	CCD Camera User Interface	
AAS-03.2	AAS	UI	020	UT Nasmyth Table	Beamsplitter Slide Controller User Interface	
AAS-03.2	AAS	UI	021	UT Nasmyth Table	Beamsplitter Tip-tilt Controller User Interface	
AAS-03.2	AAS	UI	022	UT Nasmyth Table	Focusing Lens Slide Controller User Interface	
AAS-03.2	AAS	UI	023	UT Nasmyth Table	FTT System (Images) User Interface	
AAS-03.2	AAS	UI	024	UT Nasmyth Table	UTCS System (Mount, LED, Tertiary) User Interface	
AAS-14.x	AAS	TBD	TBD	Visible Science Switchyard		Newport Agilis Mounts with Newport Controller, FT system has control
AAS-14.x	AAS	TBD	TBD	Visible Science Table		

8. Data Dictionary (DD)

This section TBD during later revisions.

9. Issues List

This section is a dynamic list of the open requirements issues that remain to be resolved. The issues here include items flagged as TDB, pending decision, information that is needed, conflicts awaiting resolution, and the like.