Software and Controls Requirements

Steve Wampler and Bret Goodrich
Controls Software

25 August 2003
Revision Summary:

1. Date: October 4, 2002
   Revision: 0.3
   Changes: Initial public version

2. Date: October 10, 2002
   Revision: 0.4
   Changes: More details on tie-backs to SRD

3. Date: August 25, 2003
   Revision: A
   Changes: Initial release after CoDR.
Table Of Contents

1. INTRODUCTION ........................................................................................................................................... 2
  1.1. Sources ................................................................................................................................................. 2
  1.2. Glossary .................................................................................................................................................. 2
2. FUNCTIONAL REQUIREMENTS .................................................................................................................. 2
3. PERFORMANCE REQUIREMENTS ............................................................................................................ 4
4. INTERFACE REQUIREMENTS .................................................................................................................. 6
5. OPERATIONAL REQUIREMENTS ........................................................................................................... 6
6. DOCUMENTATION REQUIREMENTS .................................................................................................... 6
7. SECURITY REQUIREMENTS ..................................................................................................................... 6
8. SAFETY REQUIREMENTS .......................................................................................................................... 7
9. REFERENCES ............................................................................................................................................ 7
1. **INTRODUCTION**

This document provides a comprehensive list of the requirements imposed on the ATST software and controls systems. It acts as an intermediary between the Science Requirements Document (SPEC-0001) and the Controls System Design Document. The intent is to provide a single point of reference for all software and controls requirements.

1.1. **SOURCES**

The majority of requirements listed here are either taken directly from the Science Requirements Document or have been derived from those requirements. A few have been added that reflect normal good software engineering practices. Those taken from the Science Requirements Document are marked as having the source: **SRD**. Requirements derived from those and other requirements are marked **derived**. Requirements arising from standard software engineering practice are marked **common practice**.

1.2. **GLOSSARY**

The following terms are defined and used in this document:

- **Facility system** - any control system provided as part of ATST beyond those systems specific to a given instrument. This includes the telescope control systems and any facility instrumentation support (filter wheels, polarization units, etc.).

- **Local instrument set** - any instrument set consisting of on-site instruments only.

- **Active instrument set** - the local instrument set currently accessing the light beam.

- **Off-beam instrument set** - any local instrument set operating without access to the light beam.

- **Remote instrument** - an instrument that does not have access to the ATST light beam. Note that this definition encompasses both local instruments that are not in the active instrument set as well as instruments located at other sites (e.g., in orbit).

- **Synchronous observing** - the observing of a common solar phenomenon by multiple instruments using a shared exposure timing sequence.

- **Coordinated observing** - the simultaneous observing of multiple solar phenomenon by multiple instruments.

2. **FUNCTIONAL REQUIREMENTS**

Functional requirements specify functions that a system or system component must be capable of performing.

**SR02001 Observing support**

**Priority: 1  Source: SRD**

The control system must be capable of providing support for all modes of observations described in the SRD.

**SR02002 Multiple simultaneous active instruments**

**Priority: 1  Source: SRD**

The control system must support observing with multiple instruments simultaneously. In practice, the software should allow any number of simultaneously active instruments to operate - the constraint should be limited only by optical and mechanical considerations.
SR02003  Synchronous observing within an active instrument set

Priority: 1   Source: SRD

The control system must support *synchronous observing* among instruments in the active instrument set.

SR02004  Synchronous observing with facility systems

Priority: 1   Source: derived from SR02001 and SR02003

Instruments and facility systems (polarimeters, AO, etc.) must be capable of operating synchronously with each other.

SR02005  Coordinated observing

Priority: 2   Source: SRD

The control system must support *coordinated observing* involving one or more instruments in the active instrument set and remote instrument sets.

SR02006  Target acquisition

Priority: 1   Source: SRD

The control system must support rapid selection, acquisition, tracking, and scanning of science targets on or near the Sun.

SR02007  Multiple acquisition sources

Priority: 2   Source: derived from SRD

The control system must support acquisition images from multiple sources including, but not limited to: acquisition camera feeds from instruments in the active instrument set (including a separate acquisition camera as part of the active instrument set), separate acquisition camera not using the main light path, and acquisition camera feeds from facility systems.

SR02008  Switchable active instrument set

Priority: 1   Source: derived from SRD

The control system must provide for switching the light beam between multiple instrument sets. In practice, the software should support switching among any number of instrument sets - the only limits should be those imposed by optical and mechanical considerations.

SR02009  Instrument control of facility systems

Priority: 1   Source: derived from SRD

It must be possible for a (single) instrument in an instrument set to adjust facility systems parameters. The set of parameters that can be adjusted in this manner is *TBD* and can change dynamically depending on the active instrument set and the planned observations.

SR02010  Off-beam instrument control

Priority: 1   Source: derived from SRD

The control system must prevent off-beam instrument sets from interfering with operation of the active instrument sets. Beyond this, there must be no restrictions placed on the operation of off-beam instrument sets.
SR02011  Calibrations
Priority: 1  Source: SRD
The control system must support the operation of instruments and facility systems when acquiring calibration data.

SR02012  Active control of facility systems
Priority: 1  Source: derived from SRD
The control system must be capable of actively controlling instruments and facility systems to maintain image quality, timing constraints, synchronization, etc.

SR02013  Instrument integration
Priority: 1  Source SRD
The control system must facilitate the integration of new instruments as they are developed and delivered to ATST.

SR02014  Status logging
Priority: 1  Source: SRD
The control system must support logging of key status information from all system components (including instruments). The control system must not impose any restriction on the content of logged status information, though it may restrict the form (e.g., only strings) of such information.

SR02015  Status archiving
Priority: 1  Source: derived from SR02014
The control system must provide an on-line, searchable archive of logged status information.

SR02016  Data tracking
Priority: 3  Source: derived from SRD
The control system must allow for tracking and storing data from the instruments.

SR02017  Data acquisition and storage
Priority: 3  Source: SRD
The control system must be consistent with the use of a common Data Acquisition System.

SR02018  Observation tracking
Priority: 3  Source: common practice
The control system must be consistent with an Observation Management System for tracking Science Programs and Observations.

3.  PERFORMANCE REQUIREMENTS
Performance requirements specify numerical values for measurable variables used to define a function (e.g., rate, frequency, capacity, speed, and accuracy).

SR03001  Pointing and tracking accuracy
Priority: 1  Source: SRD
The pointing and tracking kernel of the control system must not degrade the accuracy provided by the optical/mechanical systems beyond error budget allocations.

**SR03002 Accuracy of synchronous observing**
Priority: 2  Source: derived from SR02003, SR02004

The time coordination between instruments involved in synchronous observing must be within SRD constraints.

**SR03003 Accuracy of coordinated observing**
Priority: 2  Source: derived from SR02005

The time coordination between active instrument and remote instrument observations must be within SRD constraints.

**SR03004 Time to acquire new target**
Priority: 2  Source: derived from SR02006

The control system must impose no more than a ???% penalty above the time it takes the optical/mechanical systems to move to a new target position.

**SR03005 Time to switch active instrument set**
Priority: 1  Source: derived from SR02008

The control system must impose no more than a ???% penalty above the time it takes the optical/mechanical systems to switch active instrument sets.

**SR03005 Availability**
Priority: 1  Source: SRD

The control system must meet the availability requirement given in the SRD.

4. **INTERFACE REQUIREMENTS**

Interface requirements specify hardware, software, or database elements that the system or system component must interact or communicate with.

**SR04001 Interfacing with other facilities**
Priority: 2  Source: derived from SR02005

The control system must support communication between ATST and other sites sufficient to provide synchronous observing with those sites.

**SR04002 Offsite data delivery**
Priority: 2  Source: derived from SR02005

The control system must provide a means of delivering data offsite.

**SR04003 Visitor instrument support**
Priority: 2  Source: defined from SRD

The control system must support visitor instruments.

5. **OPERATIONAL REQUIREMENTS**

Operational requirements specify how the system will run (i.e., when it is to be operated) and how it will
communicate with human operators.

**SR05001  Graphical control interfaces**

**Priority:** 1  **Source:** common practice  
The control system must provide a GUI control interface for operators.

**SR05002  Quality control check**

**Priority:** 1  **Source:** common practice  
The control system must provide a quick-look display for determining data quality while observing.

### 6. DOCUMENTATION REQUIREMENTS

Documentation requirements specify the requirements for documentation.

**SR06001  Versioning of documentation**

**Priority:** 2  **Source:** common practice  
All control system documents are to be identified using a dated versioning system. Previous versions must be retrievable from a document repository.

**SR06002  Currency of documentation**

**Priority:** 2  **Source:** common practice  
All control system documentation must reflect existing conditions. Any documents that are not current must be marked *out-of-date* until they are made current.

**SR06003  On-line documentation**

**Priority:** 3  **Source:** common practice  
Current versions of all control system documentation must be available on-line through a web interface.

**SR06004  Source code documentation**

**Priority:** 1  **Source:** common practice  
All source code developed for, and provided to, ATST must conform to the documentation conventions as described in TBD.

### 7. SECURITY REQUIREMENTS

Security requirements specify the requirements for securing the system against threats to confidentiality, integrity, and availability.

**SR07001  Restricting instrument control of facility systems**

**Priority:** 1  **Source:** common practice  
The control system must be able to grant and remove access to facility system control from any instrument at any time. No instrument is permitted to control facility systems unless granted permission to do so by the control system.

**SR07002  Unauthorized access**

**Priority:** 1  **Source:** common practice
The control system must provide a means for limiting unauthorized access to the control systems and subsystems.

8. **SAFETY REQUIREMENTS**

Safety requirements specify any and all personnel and equipment safety restrictions.

**SR08001  Non-interference**

**Priority: 1  Source: common practice**

No part of the control system is allowed to be a part of, or interfere with, any of the telescope safety systems.

**SR08002  Safety system monitoring**

**Priority: 1  Source: common practice**

The status of the safety system must be monitored by the control system. Unsafe conditions must be reported directly to the telescope operators as well as logged by the control system.

9. **REFERENCES**

1) Rimmele, Thomas, ATST SPEC-0001, *Science Requirements Document*