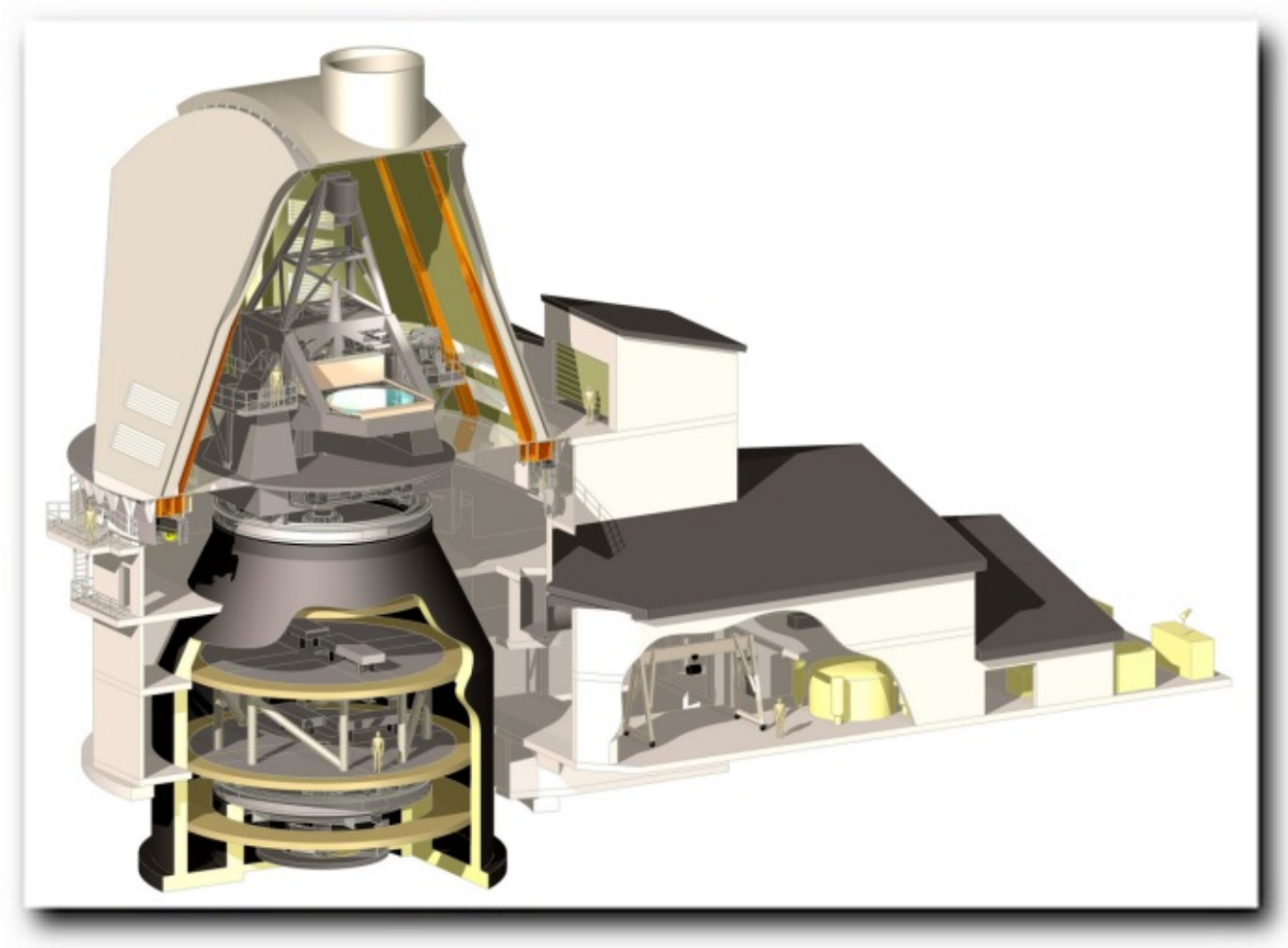
Project Documentation
Specification #0012
Revision D

Glossary of Terms and Abbreviations



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Revision Summary:

1. Date: 7 August 2003
   Revision: A
   Changes: Initial release.

2. Date: 5 December 2003
   Revision: B
   Changes: Changed title; made additions in both sections.

3. Date: 16 June 2004
   Revision: B1
   Changes: Small additions to both sections.

4. Date: 13 September 2004
   Revision: B2
   Changes: Small additions to both sections.

5. Date: 01 December 2004
   Revision: B3
   Changes: Small additions to both sections.

6. Date: 21 March 2005
   Revision: C
   Changes: Multiple software & controls additions to both sections.

7. Date: 11 October 2005
   Revision: C1
   Changes: Added BIT and CDSA; changed Azimuth, OCDD, and DRD definitions.

8. Date: 20 October 2005
   Revision: C2
   Changes: Added COTR, Technical Directive, and Change Control definitions.

9. Date: 16 November 2005
   Revision: C3
   Changes: Modified definitions of Axial Direction and Lateral Direction, included definitions of Geometrical Axis and Gut Ray.

10. Date: 9 January 2006
    Revision: C4
    Changes: Added definitions of M2 Module and Top End Optical Assembly.

11. Date: 18 January 2006
    Revision: C5
    Changes: Post-SDR, added several new acronyms and one new definition.

12. Date: 30 March 2006
    Revision: D
    Changes: Added several new acronyms and definitions.

13. Date: 4 April 2006
    Revision: D1
    Changes: Tip-tilt function becomes fast steering; added a few more acronyms

Table of Contents

1. ABBREVIATIONS

A&G	Acquisition and Guidance System
AASC	NSF/NASA Astronomy & Astrophysics Survey Committee
ABg	A scatter model similar to the Harvey model that uses parameters A, B, and g
ACS	ALMA Common Software
ADC	Analog to digital signal converter
AFRL	Air Force Research Laboratory
AG	Geocentric Apparent Place coordinates
Ag	Silver
AGCS	Acquisition and Guidance Control System
AHU	Air Handling Unit
Al	Aluminum
ALMA	Atacama Large Millimeter Array
ANSI	American National Standards Institute
aO	Active Optics
AO	Adaptive Optics
aO-C	Active Optics, Coudé
AO-C	Adaptive Optics, Coudé
AOCS	Adaptive Optics Control System
AOI	Active Occulter Insert
aO-LIC	Active Optics Local Interlock Controller
AO-LIC	Adaptive Optics Local Interlock Controller
aO-N	Active Optics, Nasmyth
aOS	Active Optics System
AOS	Adaptive Optics System
ASAP	Advanced Systems Analysis Program
ASCE	American Society of Civil Engineers
ASCII	American Standard Code for Information Interchange
ASDT	ATST Software Development Tree
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc.
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ASWG	ATST Science Working Group
AT	Topocentric Apparent Place coordinates
ATCS	ATST Control Services
ATST	Advanced Technology Solar Telescope
ATSTCS	ATST Common Services
AURA	Association for Universities for Research in Astronomy
AWS	American Welding Society
BBSO	Big Bear Solar Observatory
BCEL	Basic Class Engineering Library
BIT	Built-in Test
BRDF	Bidirectional Reflectance Distribution Factor
BSDF	Bidirectional Scattering Distribution Function
C^3Po	Charge Caching CMOS for Polarimetry
CA	EPICS' Channel Access
CAD	Computer Aided Design
CAN	Controller Area Network
CAR	Command/Action/Response software model
CASE	Computer-Aided Software Engineering

CCB	Change Control Board
CCD	Charge Coupled Device
CCM	Container/Component Model
CCM	CORBA Component Model
CDR	Critical Design Review
CDSA	Conceptual Design, Studies, and Analysis
CDUP	Conservation District Use Permit
CFD	Computational Fluid Dynamics
CFHT	Canada-France-Hawaii Telescope
CFRP	Carbon Fiber Reinforced Plastic
CG	Center of Gravity
CLI	Command-line Interface
CLU	Collimating Lens Unit
CME	Coronal mass ejections
CMOS	Complementary Metal Oxide Semiconductor
CNS	Communications and Network System
CoDR	Conceptual Design Review
Co-PIs	Co-Principal Investigator
CORBA	Common Object Request Broker Architecture
CORBA/IDL	CORBA's Interface Definition Language
CORBA/IIOP	CORBA's Internet nterORB Protocol
COTR	Contracting Officer's Technical Representative
COTS	Commercial Off The Shelf
CS	Control System
CT-C	Correlation Tracker, Coudé
CT-N	Correlation Tracker, Nasmyth
CVD	Chemical Vapor Deposition
CVS	Concurrent Versions System
D&D	Design and Development
DAC	Digital to Analog Converter
DBMS	Database Management System
dec	Declination
DHS	Data Handling System
DIMM	Dual In-Line Memory Module
DLSP	Diffraction-Limited Spectro-Polarimeter
DM	Deformable Mirror
DoD	US Department of Defense
DoF	Degrees of Freedom
DRAL	Daresbury & Rutherford Appleton Laboratories
DRD	Design Requirement Document
DSP	Digital Signal Processing
DST	Dunn Solar Telescope
ECS	Enclosure Control System
EE	Encircled Energy
EHS	Error Handling Service
EIS	Environmental Impact Statements
EIT	SOHO's Extreme ultraviolet Imaging Telescope
EJB	Enterprise Java Beans
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EMS	Experiment Management System

EPICS	Experimental Physics and Industrial Control System
EPO	Education and Public Outreach
ERD	Entity Relationship Diagram
ESD	Electrostatic Discharge
ESO	European Southern Observatory
ESS	Emergency Stop System
EUV/XUV	Extreme Ultraviolet
FAP	Fast Achromatic Polarimeter
FAR	Federal Acquisition Regulations
FASR	Frequency-Agile Solar Radio Telescope
FDR	Final Design Review
FEA	Finite Element Analysis
FeLC	Ferroelectric Liquid Crystal
FFP	Firm Fixed Price
FITS	Flexible Image Transport System
FLI	First Light Imager
FOC	Fiber Optic Cable
FOCS	Feed Optics Control System
FOV	Field of View
FPA	Focal Plane Array
FPI	Fabry-Perot Interference Filter
FPR	Functional and Performance Requirements
FSM	Fast Steering Mirror
FSM	Finite State Machine
FSR	Free spectral range
FWHM	Full-Width at Half-Maximum
GCM	Global Circulation Model
GIS	Global Interlock System
GONG	Global Oscillations Network Group
GOS	Gregorian Optics Station
GPS	Global Positioning System
GREGOR	German 1.5-m solar telescope in the Canaries
GTA	Ground Test Accelerator
GTC	Gran Telescopio Canarias
GUI	Graphical User Interface
HAO	High-Altitude Observatory
HBS	Hydrostatic Oil Bearing System
HC	Heliocentric coordinates
HESSI	High Energy Solar Spectroscopic Imager
HG	Heliographic coordinates
HIOSH	Hawaiian Occupational Safety and Health
HOAO	High Order Adaptive Optics
HOS	High-level Operations Software
HP	Helioprojective coordinates
HPP	High Precision Polarimeter
HS	Heat Stop
HS	Stonyhurst coordinates
HSA	Heat Stop Assembly
HSCS	Heat Stop Control System
I/O	Input/Output
IAC	Instituto de Astrofísica de Canarias

IAW	In Accordance With
IC	Integrated Control
ICD	Interface Control Document
ICE	Instantaneous Chemical Equilibrium
ICE	Internet Communications Engine
ICS	Instrument Control System
ID	Identifier
IDL	Interactive Data Language
IEEE	Institute of Electrical and Electronic Engineers
IfA	University of Hawaii Institute for Astronomy
IR	Infrared
IRAF	Image Reduction and Analysis Facility
IRIG-B	Inter-Range Instrumentation Group format B
IS	Instrument Sequencer
ISDN	Integrated Services Digital Network
ISO	International Standards Organization
ISOON	Improved Solar Observing Optical Network (now OSPAN)
IT&C	Integration, Test, and Commissioning
J2SDK	Java 2 Software Developer's Kit
JCMT	James Clerk Maxwell Telescope
JDK	Java Developer's Kit
JPEG	Joint Photographic Experts Group (an image standard)
JSX	Java Serialization to XML
KIS	Kiepenheuer-Institut für Sonnenphysik
LAN	Local Area Network
LASCO	Naval Research Laboratory's Large Angle and Spectrometric Coronagraph Experiment
LC	Liquid Crystal
LEST	Large Earth-based Solar Telescope
LIC	Local Interlock Controller
LOS	Line of Sight
LRG	Laser Ring Gyro
LSST	Large Synoptic Survey Telescope
LUT	Look Up Tables
LWS	NASA's Living With a Star program
M1	Primary Mirror
M1CS	Primary Mirror Control System
M2	Secondary Mirror
M2CS	Secondary Mirror Control System
M3	Fold Mirror
M4	Collimating Mirror
M5	Deformable Mirror
M6	Fold Mirror
MBA	Mount Base Assembly
MCAO	Multi-Conjugate Adaptive Optics
MCS	Mount Control System
MCSF	Mirror Cell Support Frame
MDI	Michelson Doppler Imager instrument on SoHO
MHD	Magnetohydrodynamic
MIL	Military Specification of US Department of Defense
MIP	Manufacturing Inspection Point
MIR	Mid-Infrared

MOU	Memorandum of Understanding
MTBF	Mean Time Between Failures
MVC	Model/View/Controller Model
N/A	Not Applicable
NAAAC	National Astronomy and Astrophysics Advisory Committee
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NDDS	Network Data Delivery System
NDI	Normalized Detector Irradiance
NEC	National Electric Code
NFS	Network File System
NIC	Not In Contract
NIR	Near-Infrared
NIRSP	Near-Infrared Spectro-Polarimeter
NIRSP-C	Coudé optical configuration
NIRSP-G	Gregorian optical configuration
NIST	National Institute for Science and Technology
NOAO	National Optical Astronomy Observatory
NPST	Normalized Point Source Transmittance
NRC	National Research Council
NSF	National Science Foundation
NSO	National Solar Observatory
NTP	Network Time Protocol
NTT	ESO's New Technology Telescope
O/S	Operating System
OCDD	Operational Concept Definition Document
OCS	Observatory Control System
OCSDD	Observatory Control System Design Document
ODB	Observing Database
OF	Occulted Field
OSHA	Occupational Safety and Health Administration
OSPAN	Optical Solar Patrol Network (formerly ISOON)
OSS	Optics Support Structure
PCS	Plume Control System
PD	Phase Diversity
PDF	Portable Document Format
PDR	Preliminary Design Review
PEM	Piezo-Elastic Modulator
PI	Principal Investigator
PIO	Public Information and Outreach
PMA	Primary Mirror Assembly
PRS	Package Requirement Specification
PSD	Power Spectral Density
PSF	Point Spread Function
PSS	Passive Support System
PST	Point Source Transmittance
PTC	Primary Thermal Control
PWV	Precipitable Water Vapor
QA	Quality Assurance
QC	Quality Control
QSA	Quasi-Static Alignment System

RA	Right Ascension
RAM	Random Access Memory
RDBMS	Relational database management system
RDSA	Reference Design Studies and Analyses
RET	Research Experience for Teachers
REU	Research Experiences for Undergraduates
RF	Radio Frequency
RFI	Radio Frequency Interference
RFP	Request for Proposal
RFQ	Request for Quote
RHESSI	Ramaty High Energy Solar Spectroscopic Imager
RMS	Root Mean Squared
ROB	Remote Operations Building
ROM	Read-Only Memory
ROM	Rough Order of Magnitude
RSS	Root Sum Squared
RTD	Resistive Temperature Device
RTF	Rich Text Format
RTOS	Real Time Operating System
Rx	Rotation about x axis
Ry	Rotation about y axis
Rz	Rotation about z axis
S&O	Support and Operations (Building)
SAP	Slow Achromatic Polarimeter
SCA	SOAR Communications Architecture
SCE	Servo Control Engineer
SCOPE	Southwestern Consortium of Observatories for Public Education
SCR	Software & Controls Requirements Document
SDD	Software Design Document
S-DIMM	Solar Differential Image Motion Monitor
SDO	Solar Dynamic Observatory
SDR	System Design Review
SEM	Scanning Electron Microscope
SHA	Seismic Hazard Analysis
SHABAR	Shadow Band Ranger method
SH-WFS	Shack-Hartmann Wavefront sensor
SiC	Silicon Carbide
SMA	Sheared magnetic arcade model
SMP	Software Management Plan
SMS	System Management Service
SOAR	Southern Astrophysical Research Telescope
SOC	Solar Observatory Council
SoHO	Solar and Heliospheric Observatory
SOLIS	Synoptic Optical Long-term Investigations of the Sun
SORCE	NASA's Solar Radiation and Climate Experiment
SOW	Statement of Work
SPIE	Society of Physical and Industrial Engineers
SQL	Structured Query Language
SRA	Summer Research Assistantship
SRD	Science Requirements Document
SST	Swedish 1-meter Solar Telescope

SSWG	Site Survey Working Group
STEREO	Solar-Terrestrial Relations Observatory
SUMER	Solar Ultraviolet Measurements Of Emitted Radiation
SXR	Soft X-ray
TAC	Telescope Allocations Committee
TAI	Temps Atomique Internationale (International Atomic Time)
TAP	Test Acceptance Plan
TBD	To Be Determined
TBP	To Be Provided
TBR	To Be Resolved
TCP/IP	Transmission Control Protocol/Internet Protocol
TCS	Telescope Control System
TEOA	Top End Optical Assembly
TFR	Twisted flux rope model
ThCS	Thermal Control System
THEMIS	Télescope Héliographique pour l'Étude du Magnétisme et des Instabilités Solaires (Heliographic Telescope for the Study of the Magnetism and Instabilities on the Sun)
TIFF	Tagged Image File Format
TIPS	Thermal Infrared Polarimeter and Spectrometer
TIS	Total Integrated Scatter
TLRBSE	Teacher Leaders in Research-Based Science Education
TMA	Telescope Mount Assembly
TMS	Thermal Management System
TRACE	Transition Region and Coronal Explorer spacecraft
TSI	Total solar irradiance
TTF	Tip-Tilt-Focus
TTL	Transistor-transistor Logic
Tx	Translation in x
Ty	Translation in y
Tz	Translation in z
UBC	Uniform Building Code
UDP/IP	User Datagram Protocol/Internet Protocol
UHV	Ultra High Vacuum
UI	User Interface
UKIRT	United Kingdom Infrared Telescope
UL	Underwriters' Laboratories, Inc.
ULE	Corning Ultra Low Expansion™ Glass
UML	Unified Modeling Language
UOS	Unless Otherwise Specified
UPI	Undesired Portion of Image
USA	United States of America
USS	User Support System
UTC	Coordinated Universal Time
UTS	Utility Transfer System
UV	Ultraviolet
Vis	Visible
ViSP	Visible Spectro-Polarimeter
VisTF	Visible Tunable Filter
VLA	Very Large Array
VLBA	Very Large Baseline Array
VLBI	Visible-Light Broadband Imager

VLDS	Visible Light Detector System
VLT	ESO's Very Large Telescope
VME	A real-time system obeying the ANSI/IEEE 1014-1987 Versatile Backplane Bus Standard
VSO	Virtual Solar Observatory
WAN	Wide Area Network
WBS	Work Breakdown Structure
WCCS	Wavefront Correction Control System
WFC-C	Wavefront Correction, Coudé
WFC-N	Wavefront Correction, Nasmyth
WFS	Wavefront Sensor
WI	Without Interruption
WIYN	University of Wisconsin, Indiana University, Yale University, and NOAO telescope
WP	Work Package
WPM	Work Package Manager
WPR	Work Package Responsibles
wrt	With Respect To
XML	Extensible Markup Language
ZIMPOL	Zurich Imaging Polarimeter

2. GLOSSARY

Aberration	Deviation from what is normal, right or natural. In optics, defects of a lens system that cause its image to deviate from the rules of paraxial imagery.
Abg Model Scattering	The Abg scattering model is a very powerful and widely used method for defining the BSDF, similar to the Harvey model using parameters A, B, and g.
Absorptance	Ratio of the absorbed radiant or luminous flux to the incident flux.
Active instrument set	The local instrument set currently accessing the light beam.
Active Optics	Optical elements such as mirror surfaces whose shape is actively and continuously deformed by various electromechanical means for the purpose of correcting or controlling the performance of an optical system. For ATST this refers to the correction provided by the M1 support system. This system is run closed loop for on-disk observations, but must be run open loop (based on best available information in a look-up table) during coronal observations.
Actuator	An electro-mechanical or pneumatic device that provides a controlled force.
Adaptive Optics	Optical components or assemblies whose performance is monitored and controlled so as to compensate for aberrations, static or dynamic perturbations such as thermal, mechanical and acoustical disturbances, or to adapt to changing conditions, needs or missions. For ATST this presumes a high-order (approximately 1000 degree-of-freedom) deformable mirror.
Altitude	The complement of the zenith angle, ALT = 90º – ZA.
Ancillary Equipment	Consists of the Aperture Plate and Utility Services
Aperture Plate	A continuous circular ring that defines the outer clear aperture of M1.
ATST Common Software (ATCS)	Software provided as part of the ATST control system for use by all system components.
ATST Control Services	Common software provided as part of the ATST control system.
Attribute	An entity that describes some aspect of the configuration of a system, subsystem, or component. Certain attributes will be used as command parameters.
Axial Direction	A direction parallel to the geometrical axis of M1.

Axial Support System	Consists of 120 support actuators arranged in five circular rings. Support pads at the upper end of each actuator are bonded to the back of M1.
Azimuth	An arc of the horizon measured between true north and the vertical circle passing through the center of an object clockwise (eastward) through 360 degrees. This preserves the right-handed coordinate system adopted by ATST.
Azimuth Track	The large steel ring that is affixed to the top of the stationary enclosure base. The ATST enclosure carousel is supported on top of, and allowed to rotate on, this azimuth track via the support and drive bogies. The azimuth rotation of the enclosure is coincident with the azimuth rotation of the telescope.
Azimuth Track Assembly	The Azimuth Track is the large steel ring upon which the Mount sits. These Azimuth Tracks provide a smooth and flat surface for the hydrostatic axial bearings. They also provide appropriate mounting surfaces for a variety of azimuth Mechanical Systems.
Bearing Systems	The bearings systems are comprised of the Mount altitude and azimuth bearings, and the Coudé Rotator azimuth bearings.
Built-in Test	An internal script intended to check the health of a subsystem, run periodically or on demand.
Carousel	The large structure that forms the basic building envelope of the enclosure. It consists of a large diameter ring beam at its base, two large arch girders that form the upper structural portion, and all intermediary structural members. The carousel also includes the dual skin system (i.e., inner and outer cladding). The carousel is capable of tracking the sun about the azimuth axis at solar and sidereal rates.
Change Order	A written amendment to a Contract signed by all parties; the only way a change may be made to a Contract or Scope of Work.
Client	A software entity that makes requests of other software entities (called *servers*).
Command	An instruction commanding a system to start some action. The action may result in some internal parameters being set to particular values. A command may have command parameters that contain the details of the instruction to be obeyed.
Component	A software entity within a Virtual Instrument with formal interfaces and explicit dependencies; Components are combined to form a Virtual Instrument. Components must be remotely accessible in a distributed environment.

Computational Fluid Dynamics	A computational technology that enables study of the dynamics of things that flow. CFD is a sophisticated analysis technique. It not only predicts fluid flow behavior, but also the transfer of heat, mass (such as in perspiration or dissolution), phase change (such as in freezing or boiling), chemical reaction (such as combustion), mechanical movement (such as an impeller turning), and stress or deformation of related solid structures (such as a mast bending in the wind).
Conceptual Design Review	The first major review in the life of an observatory project. It outlines the conceptual approach of the project team to the engineering challenges of the observatory design and development phase.
Conceptual Design, Studies, and Analysis	This is a document or document set included in some ATST bid packages describing prior design work performed by or for ATST during the design and development phase of the project.
Construction Drawings	The drawings prepared by a Contractor and approved by AURA for use in the construction of the Work.
Construction Specifications	The specifications prepared by a Contractor and approved by AURA for use in the construction of the Work.
Container	Part of the ATCS, containers insulate Components and Devices from their physical location and provide core services to those Components.
Contract Documents	The sum of a Design and Construction Contract, a Design Requirements Document, and all Modifications issued after execution of the Contract.
Contract Modification	*See "Change Order"*
Contracting Officer's Technical Representative	The COTR will be the single point of contact between a Contractor and the ATST Project.
Control Component	A Component that services as the interface to a Virtual Instrument.
Control System	A system for controlling the operation of another system.
Control Systems	The computer system that actively positions and controls the various moving components of the Telescope Mount Assembly, including the Mount and the Coudé Rotator.
Controller	A controller is a computing component that executes software to close servo loops, read external sensors, and interface with higher level software.
Coordinated observing	The simultaneous observing of multiple solar phenomena by multiple instruments.

Coudé Rotator	Also known as the Coudé Platform. The Coudé Rotator is comprised of the structural elements that support Coudé instruments and optical benches underneath the Mount. The Coudé Rotator provides for complete image de-rotation and positioning of the instruments with respect to the incoming light beam that is delivered from the Mount along the azimuth axis of rotation. Included as part of the Coudé Rotator is an Azimuth Track that is identical to that of the Mount Azimuth Track.
Coudé Rotator Optics	This will include the beam path from the Azimuth Crossover Plane, M7, M8, M9, M10, M11, M12 and M13. The beam envelopes and the gut ray move with the Coudé Rotator.
Critical Design Review	The final major review in the life of an observatory project. Any and all subsystem, functional and interim reviews must be completed and all issues resolved prior to CDR. The CDR must include verification of compatibility with higher level and interfacing subsystems. The design must be confirmed to be comprehensive, addressing all products and processes.
CVS	Concurrent Versions System, an open-source network-transparent software version control system
Data Array	The data, while it is stored in data processing memory, which resulted from one or more readouts of an IR array or CCD detector.
Data Handling System	Provide the mechanisms needed to support distributed data access across heterogeneous data resources in computational grids and data grids.
Data Set	A self-contained collection of data generated as a result of a command.
Deformable Mirror	A very thin mirror whose shape can be changed by the force applied by many small pistons behind the mirror.
Degrees of Freedom	The number of unique ways in which a part can move in an alignment system. In static alignment, there are six: one in the direction of and one in rotation about each of the X, Y and Z axes. In dynamic alignment, as of a scanning system, there are up to five more. When aligning a part, each degree of freedom must be constrained sufficiently to avoid unwanted motion but not so much as to create stress. Initially assumed to be of order 1000 for ATST.
Design and Development	The first phase of overall observatory construction, this is when the engineering design of the observatory is developed to meet the existing Science Requirements. Followed by a Construction Phase.

Design Requirements Document	Known as Specification Documents. This specifies the ‘‘build to’’, ‘‘code to’’, and ‘‘buy to’’ requirements for products. It includes the Functional Requirements (which are necessary tasks, actions, or activities that must be accomplished by a system) and Performance Requirements (which quantitatively state the extent to which a system function must be executed). It may reference the OCDD and should include a list, at minimum, of identified ICDs. This document should be complete by PDR.
Device	A Component that is not visible at the Virtual Instrument level. Devices may also have custom interfaces to physical devices.
Dome cranes	The array of fixed and moveable jib cranes mounted to the inside of the enclosure carousel. They are used for various handling and maintenance tasks associated with ATST construction and operations.
Doxygen	A document system under *nix for C++, C, Java, IDL, etc (see www.doxygen.org for more)
Encircled Energy	The angular diameter (usually expressed in arcsec) of a circle containing the specified percentage of the total energy in an image (often 50% EE or 80% EE).
Enclosure Base	The stationary, approximately cylindrical structure below the azimuth track that transfers all loads from the enclosure to the ground. It includes an approximately circular ring beam as well as the support elements for the utility transfer systems.
Enclosure Control System	The computer-based system that actively positions and controls the various moving components of the enclosure, including carousel azimuth rotation, shutter operation, sun shade deployment, control of the ventilation gates, and control of the exterior skin temperature via the thermal system sun shade deployment, and control of the ventilation gates.
Engineering GUI	The engineering GUI provides control and status information to a user for a particular subsystem. An engineering GUI may be instantiated on a remote computer via a network connection. More than one engineering GUI may be simultaneously opened.
***F* number (f/#)**	The expression denoting the ratio of the equivalent focal length of a lens to the diameter of its entrance pupil.
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.).

Froude number — In fluid mechanics, a dimensionless number expressing the ratio of nonlinear advection to the pressure gradient acceleration associated with the variation of fluid depth, i.e. of the fluid speed to a measure of the internal wave speed.

Functional and Performance Requirements — A Functional Requirement is a necessary task, action, or activity that must be accomplished by a system. Performance Requirements state quantitatively the extent to which a system function must be executed. These are a subset of a DRD.

Functional Architecture — A view of the software architecture that focuses on system behavior and component interactions

Functional Interfaces — Those interfaces that characterize the functional behavior of specific Components.

Furnish — Contractor shall supply and deliver to the Project site, unload, unpacked, and assembled ready for the intended use or installation, as applicable in each instance.

Geocentric Apparent Place — Geocentric apparent right ascension and declination (α, δ) will be available to assist in recording observations but will not in fact be the interface to the telescope control system. The pole is the precessing-nutating celestial intermediate pole (CIP); the zero point of right ascension will be the true equinox of date and/or the celestial intermediate origin (CIO).

Notes:

- This is not a spatial coordinate system, but one specifically used to describe a pointing direction; hence there is no radial coordinate.
- Geocentric apparent place differs from topocentric apparent place by being free from diurnal parallax and diurnal planetary aberration. Thus it is a convenient starting point from which another solar observatory could begin the pointing calculation.

Geometrical Axis — A line perpendicular to the center of the back surface of an off-axis mirror. It corresponds in usage roughly to the optical axis of an axially symmetric conic mirror. Since the back surface of an off-axis mirror is typically a best-fit sphere or a flat surface, this definition offers a simpler interpretation than one involving the more complex front surface.

Global Circulation Model — Calculations used to understand the relative importance of anthropogenic and natural sources of climate change.

Global Coordinate System — The ATST project has adopted the global coordinate system with the origin of coordinates at the "crossover" point of the mechanical altitude and azimuth axes. The *x* and *y* axes are in the horizontal plane, and the *z*-axis is vertical. "Up" is +*z*, and the mirror is displaced in the +*y* direction. The positive *x* direction is determined by the right-hand rule.

Global Interlock System The GIS provides a redundant, stand-alone safety mechanism for personnel and equipment.

Grashof number Parameter used in convection study to express the ratio of buoyant force to viscous force.

Gregorian Optics Station The Upper GOS contains primarily calibration optics (retarders, waveplates, polarizers, etc.).

The Lower GOS contains the □avefront sensor, alignment targets, the adjustable iris, and other engineering optics.

Gregorian telescope The Gregorian design consists of a concave elliptical secondary mirror, located outside the prime focus and forming an image on the axis of the primary.

Gut Ray That ray in an off-axis optical system that passes through the geometric center of the optical elements. The term corresponds roughly in usage to the chief ray of an axially symmetric optical system.

Hanle effect Represents the totality of ways in which the scattering polarization can be modified by magnetic fields. The Zeeman and Hanle effects are highly complementary to each other because they respond to magnetic fields in very different parameter regimes.

Harvey-Shack model The Harvey-Shack model applies to the measurement of a material's scatter properties, as a function of the angle of the detector, and with respect to the normal (θ, ϕ). It presumes a power-law relationship between scatter angle and BSDF.

Heliocentric Heliocentric coordinates are Sun-centered but are tied neither to the Sun's equator nor to the solar rotation. They could be used when specifying a target in the corona. A good choice of units would be meters, though for some applications AU might be more convenient.

The only directly supported orientation is that of the International Celestial Reference System. For ATST purposes this is the same as the J2000 mean equator and equinox (within 25 mas) and FK5 (with 0.1″).

Heliographic	Heliographic coordinates (Ψ,Φ) are based on the solar equator, with a prime meridian that rotates relative to the Earth and stars. In a solid body this meridian would be defined by surface features, but in the case of the Sun it is provided by a conventional ephemeris. The heliographic longitude and latitude of a sunspot is approximately constant, though its position on the Sun's disk changes from day to day. HG coordinates will be the primary method for specifying the solar surface feature that is to be observed. Conversely, when the position of an object is to be recorded, HG coordinates will be the usual choice. If the radial distance *r* is specified, the default unit is the photospheric solar radius.
Helioprojective	Helioprojective coordinates specify the position of a feature seen in a solar image that has been projected onto a plane. Only one projection will be supported, namely gnomonic (i.e. tangent-plane), with the origin at the center of the Sun's disk. The default units will be the projected radius of the solar disk. Helioprojective coordinates can be used when displaying or storing solar image data.
IceStorm	ICE Event Service
Index Position	The index position is a specific location within the range of travel of a mechanism that has a unique sensor or marker to identify it.
Insolation	The incoming solar radiation that reaches a planet and its atmosphere or, by extension, any object exposed to solar rays.
Install	Contractor shall construct, erect, or set in place for the intended use and includes to finish and to clean, as applicable in each instance.
Interface Control Document	This details the specific ways in which two systems interact with each other, including mechanics, electronics, software, and safety interfaces. These documents should be in at least draft form by PDR.
Interlock	An interlock is a hardwired connection between two systems or mechanisms that provides time-critical safety information.
Interlock Condition	An interlock condition exists if a system or mechanism raises an interlock connection because it has detected a possible safety conflict.
Interlock Override	An interlock override is a manually set condition to inform a system to ignore a particular interlock condition.
Laminar Flow	State of fluid flow, where the particles move smoothly without vortices or other turbulence.

Lateral Direction	A direction perpendicular to the geometrical axis of M1.
Lateral Support System	Consists of 6 support links arranged at equal intervals around the outside diameter of M1.
Lifecycle interface	The interface allowing control of a Component's lifecycle: starting, stopping, relocating, monitoring, etc.
Local instrument set	Any instrument set consisting of on-site instruments only.
Local Interlock Controller	For complex subsystems a Local Interlock Controller diagnoses and responds to failures within the subsystem to reduce the burden on the Global Interlock Controller.
M1	The 4-meter diameter concave primary mirror of ATST.
M1 Cell Structure	A large structural steel weldment to which all of the M1 Assembly subsystems interface.
M1 Cleaning System	M1 will be cleaned daily using CO_2 snow. During cleaning the telescope will be near horizon pointing and the CO_2 dispersal device will be attached to the M1 cover; as the cover opens, the mirror surface is sprayed with CO_2. The M1 Cleaning System is a system to collect and remove the dust that is released during M1 cleaning. It consists of a dust collecting duct located at the lower edge of M1 and a vacuum system to remove the dust.
M1 Safety Restraint System	The M1 Safety Restraint System provides protection of M1 in the event of shock and vibration due to seismic activity.
M1 Thermal Control System	The M1 Thermal Control system controls the surface temperature of M1. It consists of heat exchangers, piping, manifolds and air jet tubes on the rear side of M1.
M1 Washing System	M1 will be washed in-situ periodically. During washing the telescope will be near horizon pointing, the aperture ring will be removed the mirror surface will be carefully washed using a liquid soap solution and rinsed with distilled water. The M1 Washing System is a system to collect the liquid effluent and prevent its leaking into the volume behind M1. It consists of a liquid collecting trough located at the lower edge of M1 and a sealing system around the outside diameter of M1.
M2	The 65-cm diameter concave secondary mirror of ATST.
M2 Module	Includes the M2 mirror, hexapod, and the fast steering mirror stage
M2 Positioning System	Supports, defines and controls the position of both M2 and the M2 Tip-Tilt System. The baseline design for this system is a computer controlled hexapod.

M2 Thermal Control System	Dissipates the solar heat load on the M2 surface and controls the surface temperature of M2 to follow the ambient air temperature. It consists of heat exchangers, piping, manifolds and air jet tubes on the rear side of M2.
M2 Tip-Tilt System	Provides fast tip-tilt motion of M2 over a very small angular range to offset certain types of atmospheric seeing.
Mechanical Systems	The telescope Mechanical Systems include drive motors, encoders, brakes, over-travel stops, cable wraps, and other equipment used to position and control the movement of the Telescope Mount Assembly.
Mie theory	A rigorous derivation of bulk (volume) scatter by suspended spherical particles over a broad range of particle sizes ranging from sub-wavelength dimensions to particles much larger than the wavelength of light.
Module	The implementation of a Component or Device within a container.
Monte Carlo Simulation	A method of estimating system errors by sampling each individual error distribution at random (i.e., according to its own probability distribution which need not be normal) and looking at the resulting system error distribution after many of these random manifestations.
Mount Base	Also known (informally) as the Yoke. The Mount Base is comprised of the major structural elements that support and hold the OSS and allow it to rotate and track the sun.
Mount Base Assembly Transfer Optics	This will include the beam path from the Altitude Crossover Plane, M5, M6 and up to the Azimuth Crossover Plane. The beam envelopes and the gut ray move with the Mount Base Assembly.
Mueller matrix	A matrix that can be used to reproduce the polarizing effect of a given optical element when applied to a Stokes vector.
Observatory Control System (OCS)	The OCS is the highest level software system, responsible for coordinating observations and providing system services.
Off-beam instrument set	Any local instrument set operating without access to the light beam.
Operational Concept Definition Document	The source of all DRD requirements that cannot be derived directly from the SRD. This includes information on the philosophy and concept that underpins a subsystem, trade studies, meeting notes and presentations, etc. It does not include DRD information. Not every subsystem will have a complete OCDD (for example, the enclosure) but, if one is requested, Systems Engineering will pull the relevant pieces together to make an OCDD. The main components of this document shall be completed by CoDR, even if a formal OCDD does not exist.

Optics Support Structure	Also known as the OSS, or (informally) as the Telescope Tube. The OSS is comprised of the major structural elements that support and hold M1 and its cell; the secondary mirror and its support equipment; and other mirrors and/or optical devices used to relay the optic beam to the ATST scientific instrumentation. The OSS may also provide support to a variety of other related equipment, such as calibration optics, Lyot stops and filters, and various mechanical equipment (e.g., heat stop, mirror covers, etc).
OSS Coudé Transfer Optics	This will include the beam path from the Gregorian focus, M3, M4 and up to the Altitude Crossover Plane. The beam envelopes and the gut ray move with the OSS.
OSS Gregorian Optics	This will include the incoming 4 meter diameter solar beam, M1, M2 and up to the Gregorian focus. The beam envelopes and the gut ray move with the OSS.
OSS Nasmyth Transfer Optics	This will include the beam path from the Gregorian focus, M3N, M4N, M5N and up to the Nasmyth focus. The beam envelopes and the gut ray move with the OSS.
Parallax	The apparent angular displacement of an object due to a shift in the observer's point of view.
Poincaré sphere	A reference sphere used to represent all possible states of polarization. All linear polarizations will lie on the equator and circular polarizations will correspond with the poles. Named for the French mathematician Henri Poincaré.
Point Spread Function	The power within the image of a point source, plotted as a function either of position in the focal plane, or angle subtended on the sky.
Polarization	With respect to light radiation, the restriction of the vibrations of the magnetic or electric field vector to a single plane. In a beam of electromagnetic radiation, the polarization direction is the direction of the electric field vector (with no distinction between positive and negative as the field oscillates back and forth). The polarization vector is always in the plane at right angles to the beam direction. Near some given stationary point in space the polarization direction in the beam can vary at random (unpolarized beam), can remain constant (plane-polarized beam), or can have two coherent plane-polarized elements whose polarization directions make a right angle. In the latter case, depending on the amplitude of the two waves and their relative phase, the combined electric vector traces out an ellipse and the wave is said to be elliptically polarized. Elliptical and plane polarizations can be converted into each other by means of birefringent optical systems.

Power and Data Transfer System	The system of flexible cabling and carriers that allow transfer of coolant, electrical power, and data lines (1) from the stationary azimuth track onto the enclosure carousel; and (2) from the enclosure carousel onto the shutter.
Precision Elastic Limit	The stress that produces a permanent strain of one part in 10^6 in a material tension test.
Preliminary Design Review	The second major review in the life of an observatory project. The PDR forms the basis for determining whether the preliminary design approach for the observatory is acceptable to start detailed design.
Primary Mirror	The 4-meter diameter mirror in the ATST telescope and the entrance aperture of the optical system. Referred to as M1 in all ATST documentation.
Project	The total design and construction of the ATST facility.
Provide	Contractor shall furnish and install, complete and ready for intended use, as applicable in each instance.
Quasi-Static Alignment System	The QSA maintains diffraction-limited optical performance during observations as changing gravity flexure moves the optical components.
Rayleigh scattering	Scattering by particles very small compared with the wavelength of the radiation being considered. A feature of Rayleigh scattering is that the scattered flux is inversely proportional to the fourth power of the wavelength. Thus in the visible region, blue light is scattered more strongly by the molecules of the air than longer wavelengths, accounting for the blue color of the sky.
Recovery Time	Refers to the length of time required for a system to return to its specified level of performance or accuracy after a significant external disturbance.
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).
Response Time	Refers to the allowable length of time between sending a signal commanding a system to execute an action and completion of the action, including settling time required for the system to return to its specified level of performance or accuracy.

Reynolds number	A dimensionless parameter in fluid dynamics, which indicates transition from laminar to turbulent flow. The Reynolds number is a very important parameter in fluid dynamics. Flows at the same Reynolds number are similar, which make it possible to use smaller models (length l) for tests at higher velocities (velocity v) to achieve the same Reynolds number.
Root Sum Square	A method of combining statistically based error values, taking the square root of the sum of the squares of the individual errors. In the strictest sense this is only appropriate when the errors have a normal distribution, equal weight, and are uncorrelated. It is often extended to other types of error as well to maintain consistency.
Secondary Mirror	A 65-cm diameter concave elliptical mirror in the ATST telescope. Referred to as M2 in all ATST documentation.
Seeing	Optical aberrations produced by density inhomogeneities in the atmosphere along the optical path.
Server	A software entity that responds to requests from other software entities (called *clients*).
Services interfaces	Interfaces used by Components to access ATCS services.
Shutter	The portion of the enclosure that rotates about a horizontal axis that is coincident with the telescope altitude axis. The shutter is capable of tracking the sun in elevation altitude (i.e., altitude elevation). It consists of a dual skin (inner and outer cladding) and the entrance aperture tube.
Stokes parameters	The parameters, relative to polarized light and the Poincaré sphere, that are usually represented as: I, the intensity of the light beam; M, that part of the beam polarized in the horizontal plane; C, that part polarized in the +45° direction; and S, that part circularly polarized.
Stonyhurst	Stonyhurst coordinates differ from heliographic coordinates in that longitudes are reckoned from the center of the Sun's disk. A given solar feature thus has a Stonyhurst longitude that changes at about 13° per day, corresponding to the synodic period of 27.2753 days. HS coordinates would not, as a rule, be used to specify a target. They are included mainly as a convenient link in the chain of transformations.
Strehl ratio	The ratio of the illuminance at the peak of the diffraction pattern of an aberrated point image to that at the peak of an aberration-free image as formed by the same optical system.

Sun shade	The portion of the enclosure that rotates about a horizontal axis that is coincident with the telescope altitude axis. The sun shade rotates up to close the opening formed created between the two arch girders of the carousel when the shutter has rotated toward zenith.
Support and drive bogie system	The system of steel drive and support wheels that provide for the controlled rotation of the carousel about the azimuth axis.
Synchronous observing	The observing of a common solar phenomenon by multiple instruments using a shared exposure timing sequence.
Technical Architecture	A view of the software architecture that focuses on the implementation and support structures
Technical Directive	A form that passes technical information to a Contractor that does not change the contract or scope of work. If the information may result in a change to the contract or scope of work, then it must be submitted using a Change Order.
Telescope	The optical/mechanical system comprised of the telescope structure, the Primary Mirror Assembly, Secondary Mirror Assembly and the telescope mount assembly.
Telescope Control System (TCS)	The TCS is responsible for control of all telescope subsystems.
Telescope Mount	Also known informally as the Mount. The Mount is arranged in an altitude-over-azimuth configuration. The Mount is comprised of all the major structural elements and bearings that provide support and rotation of the ATST optical mirrors, cells, and related instrumentation packages in azimuth and altitude. The Mount can be subdivided into three main structural subassemblies: (1) the Optics Support Structure, or OSS; (2) the Mount Base; and (3) the Azimuth Track Assembly.
Telescope Pier	Also known informally as the Pier. The Pier is a monolithic concrete foundation poured in place at the site. It includes interfaces to the Coudé Rotator and the Mount assemblies. Contractor is responsible for the detail analysis and design of the Pier, but is not responsible for constructing it at the site.

Thermal System	Provides active cooling of the exterior surfaces of the carousel and the shutter, as well as controlling other thermal aspects of the enclosure. It includes the cooling plant (e.g., chiller, a/c units situated in a remote, stationary location next to the observatory), delivery system to provide cooling media to the enclosure, and temperature sensors. The control system used to maintain the required skin temperatures is included in the overall enclosure system active cooling of the exterior surfaces of the carousel and the shutter, as well as controlling other thermal aspects of the enclosure. It includes the cooling plant (e.g., chiller, a/c units situated in a remote, stationary location next to the observatory), delivery system to provide cooling media to the enclosure, temperature sensors, and control system to maintain the required skin temperatures.
Top End Optical Assembly	Includes the M2 module, heat stop, Lyot stop, and M2 support frame
Topocentric Apparent Place	Topocentric apparent right ascension and declination (α, δ) will be the interface to the telescope control system. The pole is the precessing-nutating celestial intermediate pole (CIP); the zero point of right ascension will be the true equinox of date and/or the celestial intermediate origin (CIO). Notes: ▪ This is not a spatial coordinate system, but one specifically used to describe a pointing direction; hence there is no radial coordinate. ▪ Topocentric apparent place differs from geocentric apparent place by including the effects of diurnal parallax and diurnal planetary aberration. It is thus not suitable for record-keeping, as it is peculiar to the ATST observing site. ▪ Refraction is not included - the direction corresponds to the case where the telescope is *in vacuo*.
Total solar irradiance	The amount of radiant energy input by the Sun into the Earth's atmosphere.
Turbulent Flow	State of fluid flow, where the particles move in irregular, wavy paths. Shapes.
TWiki	A web-based, browser-independent enterprise collaboration system (see twiki.org for more)
Utility Services	The electrical, pneumatic and hydraulic services that are supplied to the Primary Mirror Assembly.
Ventilation gates	Ventilation apertures that penetrate the exterior walls of the carousel. The gates incorporate a system of closeable louvers doors that are used to attenuate the amount of wind entering and exiting the enclosure.

Virtual Instrument	A collection of Components that provides the instrumentation required to perform an experiment.
Virtual Instrument Model	The software architecture of virtual instruments
Wavefront Correction Control System (WCCS)	The Wavefront Correction Control System is responsible for determining and transmitting corrective values for observed errors in the wavefront delivered by the telescope.
Work	The completed design and construction required by Contract Documents and includes all materials and equipment incorporated or to be incorporated in the construction and all labor necessary to produce such construction.
Zeeman effect	The splitting of energy levels of an atom, ion or molecule because of a magnetic field.
Zenith Angle	The angle between vertical and the optical axis of the Telescope. It is the complement of the altitude.