GMT Acronym List and GMT Glossary
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A GMT ACRONYMS

A.1 Project and Project Management

A.1.1 General

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
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<tbody>
<tr>
<td>A2D</td>
<td>Analog to Digital Converter</td>
</tr>
<tr>
<td>ACI</td>
<td>American Concrete Institute</td>
</tr>
<tr>
<td>AI</td>
<td>Action Item</td>
</tr>
<tr>
<td>AISC</td>
<td>American Institute of Steel Construction</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>AR</td>
<td>Anti-Reflection</td>
</tr>
<tr>
<td>ASCE</td>
<td>America Society of Civil Engineers</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer Aided Design</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations (US)</td>
</tr>
<tr>
<td>CG</td>
<td>Center of Gravity</td>
</tr>
<tr>
<td>CoF</td>
<td>Coefficient of Friction</td>
</tr>
<tr>
<td>COTS</td>
<td>Commercial Off The Shelf</td>
</tr>
<tr>
<td>CTE</td>
<td>coefficient of thermal expansion</td>
</tr>
<tr>
<td>D2A or DAC</td>
<td>Digital to Analog Converter</td>
</tr>
<tr>
<td>DGCA</td>
<td>Directorate General for Civil Aviation</td>
</tr>
<tr>
<td>DIQ</td>
<td>Delivered Image Quality</td>
</tr>
<tr>
<td>DOF</td>
<td>Degree of Freedom</td>
</tr>
<tr>
<td>EM</td>
<td>Electro-magnetic</td>
</tr>
<tr>
<td>EMC</td>
<td>Electromagnetic Compatibility</td>
</tr>
<tr>
<td>EMI</td>
<td>Electro-Magnetic Interference</td>
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<tr>
<td>EN</td>
<td>European Standard</td>
</tr>
<tr>
<td>FE</td>
<td>Finite Element</td>
</tr>
<tr>
<td>FEM</td>
<td>Finite Element Model</td>
</tr>
<tr>
<td>FMEA</td>
<td>Failure Modes and Effects Analysis</td>
</tr>
<tr>
<td>GD&amp;T</td>
<td>Geometric Dimensioning and Tolerancing</td>
</tr>
<tr>
<td>GND</td>
<td>Ground</td>
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<td>GS</td>
<td>Guide Star</td>
</tr>
<tr>
<td>HW</td>
<td>Hardware</td>
</tr>
<tr>
<td>IBC</td>
<td>International Building Code</td>
</tr>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
</tr>
<tr>
<td>IP (code)</td>
<td>Ingress Protection Rating</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------</td>
<td>------------</td>
</tr>
<tr>
<td>IQ</td>
<td>Image Quality</td>
</tr>
<tr>
<td>IR</td>
<td>Infrared</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>IT</td>
<td>Information Technology</td>
</tr>
<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
</tr>
<tr>
<td>LN2</td>
<td>Liquid Nitrogen</td>
</tr>
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<td>LOS</td>
<td>Line of Sight</td>
</tr>
<tr>
<td>LUT</td>
<td>Look Up Table</td>
</tr>
<tr>
<td>MTBF</td>
<td>Mean Time Between Failures</td>
</tr>
<tr>
<td>n/a</td>
<td>Not applicable or Not available</td>
</tr>
<tr>
<td>NEC</td>
<td>(US) National Electrical Code</td>
</tr>
<tr>
<td>NEMA</td>
<td>National Electrical Manufacturers Association</td>
</tr>
<tr>
<td>NFPA</td>
<td>(US) National Fire Protection Agency</td>
</tr>
<tr>
<td>NIR</td>
<td>Near Infra-Red</td>
</tr>
<tr>
<td>NRE</td>
<td>non-recurring engineering</td>
</tr>
<tr>
<td>OSHA</td>
<td>Occupational Health and Safety Administration</td>
</tr>
<tr>
<td>PDF</td>
<td>Portable Document Format</td>
</tr>
<tr>
<td>PSD</td>
<td>Power Spectral Density</td>
</tr>
<tr>
<td>RFI</td>
<td>Radio Frequency Interference</td>
</tr>
<tr>
<td>SFOV</td>
<td>Science Field of View</td>
</tr>
<tr>
<td>SNR or S/N</td>
<td>Signal to Noise Ratio</td>
</tr>
<tr>
<td>TBC</td>
<td>To Be Confirmed</td>
</tr>
<tr>
<td>TBD</td>
<td>To Be Determined</td>
</tr>
<tr>
<td>TBR</td>
<td>To Be Reviewed</td>
</tr>
<tr>
<td>TFOV</td>
<td>Technical Field of View</td>
</tr>
<tr>
<td>UHMW</td>
<td>Ultra High Molecular Weight</td>
</tr>
<tr>
<td>UPS</td>
<td>Uninterruptible Power Supply</td>
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### A.1.2 Units and Mathematical statistic

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<th>Definition</th>
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<tbody>
<tr>
<td>A</td>
<td>Amperes</td>
</tr>
<tr>
<td>atm</td>
<td>Atmospheres</td>
</tr>
<tr>
<td>AWG</td>
<td>American wire gauge</td>
</tr>
<tr>
<td>CFM</td>
<td>Cubic feet per minute</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
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<td>------</td>
<td>------------</td>
</tr>
<tr>
<td>In-lbf</td>
<td>Inch-pounds</td>
</tr>
<tr>
<td>Kg</td>
<td>Kilogram</td>
</tr>
<tr>
<td>kHz</td>
<td>kiloHertz</td>
</tr>
<tr>
<td>Kt</td>
<td>Coefficient of Thermal Conductivity</td>
</tr>
<tr>
<td>kV</td>
<td>kiloVolt</td>
</tr>
<tr>
<td>kVA</td>
<td>kiloVolt-Amps</td>
</tr>
<tr>
<td>lbf</td>
<td>Pounds of force</td>
</tr>
<tr>
<td>lpm</td>
<td>liters per minute</td>
</tr>
<tr>
<td>N</td>
<td>Newton</td>
</tr>
<tr>
<td>N-m</td>
<td>Newton-meter</td>
</tr>
<tr>
<td>P-V</td>
<td>Peak to Valley</td>
</tr>
<tr>
<td>PSI</td>
<td>Pounds per square inch</td>
</tr>
<tr>
<td>PWM</td>
<td>Pulse Width Modulation</td>
</tr>
<tr>
<td>RMS</td>
<td>Root Mean Square</td>
</tr>
<tr>
<td>RSS</td>
<td>Root Sum of Squares</td>
</tr>
<tr>
<td>RTC</td>
<td>Real-Time Computer</td>
</tr>
<tr>
<td>SRSS</td>
<td>Square Root Sum of Squares</td>
</tr>
<tr>
<td>Std</td>
<td>Standard deviation</td>
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**A.1.3 Optical**

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<td>BFD</td>
<td>Back Focal Distance</td>
</tr>
<tr>
<td>CoC</td>
<td>Center of Curvature</td>
</tr>
<tr>
<td>DL</td>
<td>Diffraction Limit</td>
</tr>
<tr>
<td>EE</td>
<td>Encircled Energy</td>
</tr>
<tr>
<td>FOV</td>
<td>Field of View</td>
</tr>
<tr>
<td>FWHM</td>
<td>Full-width, Half-Max</td>
</tr>
<tr>
<td>ID</td>
<td>Inner Diameter</td>
</tr>
<tr>
<td>IFOV</td>
<td>Instantaneous Field of View (Single Pixel)</td>
</tr>
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<td>MTBF</td>
<td>Mean Time Between Failures</td>
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<tr>
<td>OD</td>
<td>Outer Diameter</td>
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<td>OPD</td>
<td>Optical Path Differences</td>
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<tr>
<td>PSF</td>
<td>Point-Spread Function</td>
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<tr>
<td>ROA</td>
<td>Reference Optical Axis</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Strehl</td>
<td>Ratio of the actual on-axis peak intensity to the diffraction-limited peak</td>
</tr>
<tr>
<td></td>
<td>intensity.</td>
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<tr>
<td>Theta(0.80)</td>
<td>The far-field angular diameter that contains 80% of the total energy</td>
</tr>
<tr>
<td>WFE</td>
<td>Wavefront Error</td>
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**A.1.4 Roles**

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<tr>
<td>CSE</td>
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</tr>
<tr>
<td>PD</td>
<td>Project Director</td>
</tr>
<tr>
<td>PI</td>
<td>Principal Investigator</td>
</tr>
<tr>
<td>PM</td>
<td>Project Manager</td>
</tr>
<tr>
<td>PS</td>
<td>Project Scientist</td>
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<td>SE</td>
<td>Systems Engineering/Engineer</td>
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**A.1.5 Project**

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<tr>
<td>AIT</td>
<td>Assembly, Integration and Test</td>
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<tr>
<td>AITC</td>
<td>Assembly, Integration, Test and Commissioning</td>
</tr>
<tr>
<td>AP</td>
<td>Activity Plan</td>
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<td>ATP</td>
<td>Acceptance Test Plan</td>
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<td>CDR</td>
<td>Critical Design Review</td>
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<tr>
<td>CIW</td>
<td>Carnegie Institute of Washington</td>
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<tr>
<td>CoDR</td>
<td>Conceptual Design Review</td>
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<td>DSC</td>
<td>Detailed Science Case</td>
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<td>EAR</td>
<td>Export Administration Regulations</td>
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<tr>
<td>FDR</td>
<td>Final Design Review</td>
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<td>GMT</td>
<td>Giant Magellan Telescope</td>
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<tr>
<td>GMTO</td>
<td>Giant Magellan Telescope Organization</td>
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<td>ITAR</td>
<td>International Traffic in Arms Regulations</td>
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<tr>
<td>L1</td>
<td>Level One</td>
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<tr>
<td>L2</td>
<td>Level Two</td>
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<td>L3</td>
<td>Level Three</td>
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<tr>
<td>L4</td>
<td>Level Four</td>
</tr>
<tr>
<td>L5</td>
<td>Level Five</td>
</tr>
<tr>
<td>LCO</td>
<td>Las Campanas Observatory</td>
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<tr>
<td>Term</td>
<td>Definition</td>
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<td>------</td>
<td>------------</td>
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<tr>
<td>NIC</td>
<td>Not In Contract</td>
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<tr>
<td>PDR</td>
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<td>Risk Management Plan</td>
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<td>SAC</td>
<td>Scientific Advisory Committee</td>
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<tr>
<td>SPDR</td>
<td>System Preliminary Design Review</td>
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<td>TAA</td>
<td>Technical Assistance Agreement</td>
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<tr>
<td>WBS</td>
<td>Work Breakdown Structure</td>
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**A.1.6 Telescope Projects and Organizations**

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<tr>
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<tbody>
<tr>
<td>E-ELT</td>
<td>European Extremely Large Telescope</td>
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<tr>
<td>ELT</td>
<td>Extremely Large Telescope</td>
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<tr>
<td>ESO</td>
<td>European Southern Observatory</td>
</tr>
<tr>
<td>GMT</td>
<td>Giant Magellan Telescope</td>
</tr>
<tr>
<td>GTC</td>
<td>Gran Telescopio de Canarias</td>
</tr>
<tr>
<td>IRTF</td>
<td>Infrared Telescope Facility</td>
</tr>
<tr>
<td>JWST</td>
<td>James Webb Space Telescope</td>
</tr>
<tr>
<td>LBT</td>
<td>Large Binocular Telescope</td>
</tr>
<tr>
<td>LSST</td>
<td>Large Synoptic Survey Telescope</td>
</tr>
<tr>
<td>MMT</td>
<td>MMT Telescope</td>
</tr>
<tr>
<td>NOAO</td>
<td>National Optical Astronomy Observatory</td>
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<tr>
<td>SAO</td>
<td>Smithsonian Astrophysical Observatory</td>
</tr>
<tr>
<td>SOML</td>
<td>Steward Observatory Mirror Lab (at University of Ariz.)</td>
</tr>
<tr>
<td>SPM</td>
<td>San Pedro Martir Observatory</td>
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<tr>
<td>TMT</td>
<td>Thirty Meter Telescope</td>
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<tr>
<td>VLT</td>
<td>Very Large Telescope</td>
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**A.2 Systems Engineering**

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<td>Active Optics and Guiding</td>
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<td>ACQ</td>
<td>Acquisition</td>
</tr>
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<td>CCB</td>
<td>Change Control Board</td>
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<td>CDRL</td>
<td>Contract Data Requirements List</td>
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<tr>
<td>Term</td>
<td>Definition</td>
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<td>------</td>
<td>------------</td>
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<tr>
<td>CI</td>
<td>Configuration Item</td>
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<td>Configuration Management</td>
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<td>CMP</td>
<td>Configuration Management Plan</td>
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<td>CR</td>
<td>Change Request</td>
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<td>CW</td>
<td>Continuous Wave</td>
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<td>Design Requirements Document</td>
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<td>DS</td>
<td>Documentation Specialist</td>
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<td>Electronic Document Management System</td>
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<td>EIDP</td>
<td>End Item Data Package</td>
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<td>Enterprise Data Management</td>
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<td>Finite element analysis</td>
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<td>FHA</td>
<td>Final Hazard Analysis</td>
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<tr>
<td>FMECA</td>
<td>Failure, Modes Effects and Criticality Analysis</td>
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<td>FSO</td>
<td>Full Scale Output</td>
</tr>
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<td>FSV</td>
<td>Focal Surface Vertex</td>
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<td>GEMF</td>
<td>GMT Environmental Monitoring Facility</td>
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<td>HA</td>
<td>Hazard Analysis</td>
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<td>HMI</td>
<td>Human-Machine Interface</td>
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<td>Interface Control Document</td>
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<td>ICMP</td>
<td>Information and Configuration Management Plan</td>
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<td>Interlock and Safety System</td>
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<td>Multi-Aperture Scintillation Sensor</td>
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<td>Maximum Considered Earthquake</td>
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<td>MDT</td>
<td>Mean Down Time</td>
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<td>Mean Time to Repair</td>
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<td>Non-Standard Electronics Cabinet</td>
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<td>Operations Concept Document</td>
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<tr>
<td>OCDD</td>
<td>Operational Concept Definition Document</td>
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<tr>
<td>OLE</td>
<td>Operational Level Earthquake</td>
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<tr>
<td>OOP</td>
<td>Observatory Operations Plan</td>
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<tr>
<td>OPC UA</td>
<td>Object linking and embedding for Process Control Unified Architecture</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>------</td>
<td>------------</td>
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<td>PBS</td>
<td>Product Breakdown Structure</td>
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<td>PDL</td>
<td>Project Document List</td>
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<td>Power Distribution Unit</td>
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<tr>
<td>PGA</td>
<td>Peak Ground Accelerations</td>
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<td>PHA</td>
<td>Preliminary Hazard Analysis</td>
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<td>PR</td>
<td>Problem Report</td>
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<tr>
<td>PSM</td>
<td>Point-source microscope</td>
</tr>
<tr>
<td>QA</td>
<td>Quality Assurance</td>
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<tr>
<td>QAP</td>
<td>Quality Assurance Plan</td>
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<tr>
<td>QC</td>
<td>Quality Control</td>
</tr>
<tr>
<td>RAM</td>
<td>Reliability, Availability, and Maintainability</td>
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<tr>
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<td>Reliability, Availability, Maintainability, and Safety</td>
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<td>Reliability Block Diagram</td>
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<td>Reference Document</td>
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<td>Requirements Management Tool</td>
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<td>SEC</td>
<td>Standard Electronics Cabinet</td>
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<tr>
<td>SEMP</td>
<td>Systems Engineering Management Plan</td>
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<tr>
<td>SGH</td>
<td>Simpson, Gumperz &amp; Heger engineering firm</td>
</tr>
<tr>
<td>SICP</td>
<td>System Integration and Commissioning Plan</td>
</tr>
<tr>
<td>SLE</td>
<td>Survival Level Earthquake</td>
</tr>
<tr>
<td>SLR</td>
<td>System Level Requirements</td>
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<tr>
<td>SMR</td>
<td>Sphere Mounted Retroreflector</td>
</tr>
<tr>
<td>SOR</td>
<td>Starfire Optical Range</td>
</tr>
<tr>
<td>SRD</td>
<td>Science Requirements Document</td>
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<tr>
<td>SVD</td>
<td>Singular-Value Decomposition</td>
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<tr>
<td>T&amp;VP</td>
<td>Test and Verification Plan</td>
</tr>
<tr>
<td>VCRM</td>
<td>Verification Cross-Reference Matrix</td>
</tr>
<tr>
<td>WPDM</td>
<td>Workflow Project Data Management</td>
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</tbody>
</table>

### A.3 Telescope

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>AcO</td>
<td>Active Optics</td>
</tr>
<tr>
<td>AcWFS</td>
<td>Active Optics Wavefront Sensors</td>
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<tr>
<td>ADC</td>
<td>Atmospheric Dispersion Compensator</td>
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<tr>
<td>Term</td>
<td>Definition</td>
</tr>
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<td>Acquisition/Guide Sensors</td>
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<td>AGWS</td>
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<tr>
<td>ATCF</td>
<td>Ambient Tracking Chilled Fluid</td>
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<tr>
<td>BDA</td>
<td>Beam Director Assembly</td>
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<td>DGWF</td>
<td>Direct Gregorian-Wide Field</td>
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<td>LS</td>
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<td>M3 Deployment Mechanism</td>
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<td>Narrow Field</td>
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<td>OAGWS</td>
<td>On axis Guider and WFS</td>
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<td>OSS</td>
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<td>PMA</td>
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<td>Reaction Mass Actuator</td>
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<td>Tuned Mass Damper</td>
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<td>TS</td>
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<tr>
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<td>Wide Field</td>
</tr>
<tr>
<td>WFC (Corrector)</td>
<td>Wide Field Corrector</td>
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<tr>
<td>WFCS</td>
<td>Wavefront Control System</td>
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### A.4 Software & Control

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<th>Term</th>
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<td>API</td>
<td>Application Programming Interface</td>
</tr>
<tr>
<td>CAN</td>
<td>Controller Area Network</td>
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<td>Term</td>
<td>Definition</td>
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<td>----------</td>
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<tr>
<td>CLI</td>
<td>Command Line Interface</td>
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<tr>
<td>COTS</td>
<td>Commercial Off-The-Shelf</td>
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<td>DAS</td>
<td>Data Archiving System</td>
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<td>DCC</td>
<td>Device Control Computer</td>
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<td>DPC</td>
<td>Data Processing Computer</td>
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<td>DPF</td>
<td>Data Processing Framework</td>
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<tr>
<td>DPS</td>
<td>Data Processing System</td>
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<td>DSL</td>
<td>Domain Specific Language</td>
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<tr>
<td>ECM</td>
<td>EtherCAT Master</td>
</tr>
<tr>
<td>ESC</td>
<td>EtherCAT Slave Controller</td>
</tr>
<tr>
<td>ESI</td>
<td>EtherCAT Slave Information file</td>
</tr>
<tr>
<td>ETC</td>
<td>Exposure Time Calculator</td>
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<tr>
<td>ETG</td>
<td>EtherCAT technology group</td>
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<tr>
<td>EtherCAT</td>
<td>Ethernet for Control Automation Technology</td>
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<tr>
<td>FITS</td>
<td>Flexible Image Transport System</td>
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<td>GbE</td>
<td>Gigabit Ethernet</td>
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<tr>
<td>GPU</td>
<td>Graphics Processing Unit</td>
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<tr>
<td>HW</td>
<td>Hardware</td>
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<tr>
<td>IAU</td>
<td>International Astronomical Union</td>
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<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
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<tr>
<td>IFS</td>
<td>Integral Field Spectroscopy</td>
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<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
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<tr>
<td>IOF</td>
<td>I/O Framework</td>
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<tr>
<td>I/O</td>
<td>Input / Output</td>
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<tr>
<td>LTCS</td>
<td>Laser Traffic Control System</td>
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<tr>
<td>LST</td>
<td>Local Sidereal Time</td>
</tr>
<tr>
<td>MCS</td>
<td>Mount Control System</td>
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<td>MDD</td>
<td>Model Driven Development</td>
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<td>Model-driven Engineering</td>
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<td>MDF</td>
<td>Model Definition Files</td>
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<tr>
<td>NIC</td>
<td>Network Interface Card</td>
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<tr>
<td>NTP</td>
<td>Network Time Protocol</td>
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<tr>
<td>ODT</td>
<td>Observation Design Tool</td>
</tr>
<tr>
<td>OMG</td>
<td>Object Management Group</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>--------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>OPC UA</td>
<td>OPC Unified Architecture</td>
</tr>
<tr>
<td>OPS</td>
<td>Observatory Operations System</td>
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<tr>
<td>OPUI</td>
<td>Operations User Interface</td>
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<tr>
<td>OS</td>
<td>Observation Sequence</td>
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<tr>
<td>OSRV</td>
<td>Observatory Services</td>
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<tr>
<td>OT</td>
<td>Observing Tools</td>
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<tr>
<td>PAC</td>
<td>Programmable Automation Controller</td>
</tr>
<tr>
<td>PDO</td>
<td>Process Data Object</td>
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<tr>
<td>PID</td>
<td>Proportional, Integral, Derivative</td>
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<tr>
<td>PF</td>
<td>Persistence Framework</td>
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<tr>
<td>PLC</td>
<td>Programmable Logic Controller</td>
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<tr>
<td>PTP</td>
<td>Precision Time Protocol</td>
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<tr>
<td>QMS</td>
<td>Quality Monitoring System</td>
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<tr>
<td>QoS</td>
<td>Quality of Service</td>
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<tr>
<td>RDMA</td>
<td>Remote Direct Memory Access</td>
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<tr>
<td>ROC</td>
<td>Real-Time Observing Console</td>
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<tr>
<td>RPC</td>
<td>Remote Procedure Call</td>
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<td>RT</td>
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<td>Real Time Computer System</td>
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<td>Sequence Base Specification</td>
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<td>SCM</td>
<td>Software Configuration Management</td>
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<tr>
<td>SDK</td>
<td>Software Development Kit</td>
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<td>SDO</td>
<td>Service Data Objects</td>
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<tr>
<td>SDF</td>
<td>System Definition Files</td>
</tr>
<tr>
<td>SI</td>
<td>International System of Units</td>
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<tr>
<td>SW</td>
<td>Software</td>
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<tr>
<td>SWC</td>
<td>Software and Controls</td>
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<td>Software and Controls System</td>
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<tr>
<td>TCP</td>
<td>Transport Control Protocol</td>
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<td>TCS</td>
<td>Telescope Control System</td>
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<tr>
<td>UI</td>
<td>User Interface</td>
</tr>
<tr>
<td>UIF</td>
<td>User Interface Framework</td>
</tr>
<tr>
<td>UML</td>
<td>Unified Modeling Language</td>
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<tr>
<td>UTC</td>
<td>Coordinated Universal Time</td>
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### A.5 Adaptive Optics

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<tr>
<th>Term</th>
<th>Definition</th>
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<td>Adaptive Optics</td>
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<tr>
<td>AOS</td>
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<td>DM</td>
<td>Deformable Mirror</td>
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<tr>
<td>G2CF</td>
<td>GIR -2.5C Ambient Tracking Temperature Fluid</td>
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<tr>
<td>GLAO</td>
<td>Ground Layer Adaptive Optics</td>
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<tr>
<td>GLAOF</td>
<td>Ground Layer Adaptive Optics Facility</td>
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<tr>
<td>HO</td>
<td>High Order</td>
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<td>HOWFS</td>
<td>High Order Wavefront Sensing Functional Subsystem</td>
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<td>Hartman Wavefront Sensor</td>
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<tr>
<td>IMS</td>
<td>Image Motion Sensing</td>
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<tr>
<td>LGG</td>
<td>Laser Guide Star Generation Functional Subsystem</td>
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<tr>
<td>LGS</td>
<td>Laser Guide Star</td>
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<tr>
<td>LTAO</td>
<td>Laser Tomography Adaptive Optics</td>
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<tr>
<td>MCAO</td>
<td>Multi-conjugate adaptive optics</td>
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<tr>
<td>NGS</td>
<td>Natural Guide Star</td>
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<tr>
<td>NGSAO</td>
<td>Natural Guide Star Adaptive Optics</td>
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<tr>
<td>SALSA</td>
<td>Safe Aircraft, Satellite and Laser Traffic Localization System</td>
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<td>SPS</td>
<td>Segment Piston Sensing</td>
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<td>WCo</td>
<td>Wavefront Correction</td>
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<td>WP</td>
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### A.5.1 ASM System

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<td>Adaptive Secondary Mirror</td>
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<tr>
<td>ASM-S</td>
<td>Adaptive Secondary Mirror Segment</td>
</tr>
<tr>
<td>ASM-XS</td>
<td>Adaptive Secondary Mirror Off-axis Segment</td>
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### A.5.2 Visible WFS System

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<td>LTW CS</td>
<td>Laser Tomography Adaptive Optics Control System</td>
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<tr>
<td>LTWS</td>
<td>Laser Tomography Adaptive Optics Wavefront Sensor Subsystem</td>
</tr>
<tr>
<td>NGW</td>
<td>Natural Guide Star Adaptive Optics Wavefront Sensor</td>
</tr>
<tr>
<td>NGW CS</td>
<td>Natural Guide Star Adaptive Optics Control System</td>
</tr>
<tr>
<td>NGWS</td>
<td>Natural Guide Star Adaptive Optics Wavefront Sensor Subsystem</td>
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<tr>
<td>VW</td>
<td>Visible Wavefront Sensor</td>
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### A.5.3 On Instrument WFS System

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<td>OIWS</td>
<td>On-Instrument Wavefront Sensors System</td>
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<td>OIWS CS</td>
<td>On-Instrument Wavefront Sensor Control System</td>
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<td>TTWS</td>
<td>Tip/Tilt Wavefront Sensing Functional Subsystem</td>
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<td>Truth Wavefront Sensing Functional Subsystem</td>
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### A.5.4 Ground Layer AO Facility

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<td>Laser Ground Layer Adaptive Optics</td>
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<tr>
<td>LGLAOS</td>
<td>Laser Ground Layer Adaptive Optics System</td>
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<td>LGLDS</td>
<td>Laser Ground Layer Dichroic Subsystem</td>
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<td>LGLW</td>
<td>Laser Ground Layers Adaptive Optics Wavefront Sensor</td>
</tr>
<tr>
<td>LGLWS</td>
<td>Laser Ground Layer Adaptive Optics Wavefront Sensing Subsystem</td>
</tr>
<tr>
<td>LGLWSS</td>
<td>Laser Ground Layer Adaptive Optics Wavefront Sensing Support Structure</td>
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<td>AG</td>
<td>Natural Ground Layer Adaptive Optics</td>
</tr>
<tr>
<td>NGLAOS</td>
<td>Natural Ground Layer Adaptive Optics System</td>
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<td>Natural Ground Layer Adaptive Optics Wavefront Sensor</td>
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### A.5.5 Phasing System

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<td>AOPC</td>
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<td>M1ES</td>
<td>M1 Edge Sensor Subsystem</td>
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<td>M2ES</td>
<td>M2 Edge Sensor Subsystem</td>
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<td>PhCS</td>
<td>Phasing Camera Subsystem</td>
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### A.5.6 AO Real Time System

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<td>AORTC</td>
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### A.5.7 Laser Guide Star Facility

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<td>BCDS</td>
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<td>Beam Conditioning and Diagnostic Control System</td>
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<td>LA CS</td>
<td>Laser Guide Star Acquisition Control System</td>
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<td>LAC</td>
<td>Laser Guide Star Acquisition Camera</td>
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<td>LACSS</td>
<td>Laser Guide Star Acquisition Camera Support Structure</td>
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<td>LAS</td>
<td>Laser Guide Star Acquisition System</td>
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<td>LCS</td>
<td>Laser Control System</td>
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<td>LEC</td>
<td>Laser Electronic Cabinet</td>
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<td>Laser Guide Star Facility</td>
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<td>LGSU</td>
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<td>LHE</td>
<td>Laser Heat Exchanger</td>
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<td>LIS</td>
<td>Laser Interlock System</td>
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<td>LLT</td>
<td>Laser Launch Telescope</td>
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<td>Laser Launch Telescope Control System</td>
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<td>Laser Projection Assembly</td>
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<td>LPS</td>
<td>Laser Projection System</td>
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<tr>
<td>YAG</td>
<td>Yttrium Aluminum Garnet (laser crystal)</td>
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### A.5.8 AO Calibration System

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<td>AO Calibration Functional Subsystem</td>
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<td>Adaptive Optics Lab Calibration System</td>
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<td>AOWCal</td>
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<td>M2CalS</td>
<td>M2 Calibration Stand</td>
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<td>M2CCTS</td>
<td>M2 Center of Curvature Test Subsystem</td>
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<td>M2CIS</td>
<td>M2 Calibration Interferometer Subsystem</td>
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### A.5.9 AO Commissioning Camera System

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<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCS</td>
<td>Adaptive Optics Commissioning Camera System</td>
</tr>
</tbody>
</table>

### A.6 Instrumentation

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>CCD</td>
<td>Charge-Coupled Device (camera)</td>
</tr>
<tr>
<td>FCS</td>
<td>Facility Calibration System</td>
</tr>
<tr>
<td>G-CLEF</td>
<td>GMT-CFA Large Earth Finder</td>
</tr>
<tr>
<td>GMACS</td>
<td>GMT Areal Camera and Spectrograph</td>
</tr>
<tr>
<td>GMTIFS</td>
<td>GMT Integral Field Spectrometer</td>
</tr>
<tr>
<td>GMTNIRS</td>
<td>GMT Near Infrared Spectrograph</td>
</tr>
<tr>
<td>INST</td>
<td>Instrumentation</td>
</tr>
<tr>
<td>MANIFEST</td>
<td>MANy Instrument FibEr SysTem</td>
</tr>
<tr>
<td>NIRMOS</td>
<td>Near Infrared Multi-Object Spectrograph</td>
</tr>
<tr>
<td>TIGER</td>
<td>Thermal Infrared Imager</td>
</tr>
</tbody>
</table>

### A.7 Enclosure and Facilities

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUXB</td>
<td>Auxiliary Building</td>
</tr>
<tr>
<td>COMM</td>
<td>Communications</td>
</tr>
<tr>
<td>ENC</td>
<td>Enclosure</td>
</tr>
<tr>
<td>EQB</td>
<td>Equipment Building</td>
</tr>
<tr>
<td>ESS</td>
<td>Enclosure Support Structure</td>
</tr>
<tr>
<td>FAC</td>
<td>Facilities</td>
</tr>
<tr>
<td>FACB</td>
<td>Facilities Building</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>--------</td>
<td>-----------------------------------------</td>
</tr>
<tr>
<td>HPU</td>
<td>Hydraulic Power Unit</td>
</tr>
<tr>
<td>HVAC</td>
<td>Heating, Ventilation, and Air Conditioning</td>
</tr>
<tr>
<td>LOTO</td>
<td>Lockout/Tagout</td>
</tr>
<tr>
<td>M2 Bay</td>
<td>Adaptive Secondary Mirror Test Bay</td>
</tr>
<tr>
<td>M2AP</td>
<td>M2 Access Platform</td>
</tr>
<tr>
<td>M2SP</td>
<td>M2 Service platform</td>
</tr>
<tr>
<td>PLP</td>
<td>Pier Hydraulic Lift Platform</td>
</tr>
<tr>
<td>PWR</td>
<td>Power</td>
</tr>
<tr>
<td>SOB</td>
<td>Small Optics Bay</td>
</tr>
<tr>
<td>UTB</td>
<td>Utility Building</td>
</tr>
<tr>
<td>WH</td>
<td>Warehouse</td>
</tr>
<tr>
<td>WTR</td>
<td>Water</td>
</tr>
</tbody>
</table>
### B GMT GLOSSARY

#### B.1 General

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td>Accuracy refers to the closeness between measurements (observations) and their expectations (“true” values). The farther a measurement is from its expected value, the less accurate it is.</td>
</tr>
<tr>
<td>Altitude</td>
<td>The complement of the zenith angle, ( ALT = 90° - ZA ).</td>
</tr>
<tr>
<td>Altitude Axis</td>
<td>See Elevation Axis.</td>
</tr>
<tr>
<td>Atmospheric Dispersion Compensator</td>
<td>An optic or set of optics that compensate for the spectral dispersion introduced by the earth's atmosphere.</td>
</tr>
<tr>
<td>Azimuth</td>
<td>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 GMT.</td>
</tr>
<tr>
<td>Bill of Materials</td>
<td>A documented formal hierarchical tabulation of the physical assemblies, subassemblies, and components needed to fabricate a product.</td>
</tr>
<tr>
<td>Blind Pointing</td>
<td>Blind pointing relies on the accuracy of the telescope encoder system and open loop corrections. Blind pointing is used to position the telescope to within the capture range of the acquisition/guide sensors.</td>
</tr>
<tr>
<td>Cold Start</td>
<td>Cold Start is the process of re-starting a system from a shutdown state. System will require power up, full initialization and calibration.</td>
</tr>
<tr>
<td>Degrees of Freedom (DoF)</td>
<td>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.</td>
</tr>
<tr>
<td>Dithering</td>
<td>Dithering is the process of repetitively offsetting the telescope between two or more positions on the sky, with a dwell time at each end point where the system may or may not be guiding.</td>
</tr>
<tr>
<td>Dome Seeing</td>
<td>Dome Seeing is the image blurring caused by non-thermally equilibrated turbulent air inside of the Telescope Chamber.</td>
</tr>
<tr>
<td>Dwell Time</td>
<td>Dwell time is the amount of time that the telescope remains at a fixed guided position on the sky during offsetting operations.</td>
</tr>
<tr>
<td>Elevation Angle</td>
<td>The angle between astronomical horizon and the optical axis of the Telescope. The elevation angle is 90 degrees when the telescope is at zenith and decreases toward horizon. It is the complement of the zenith angle.</td>
</tr>
<tr>
<td>Geometric Dimensioning and Tolerancing</td>
<td>GD&amp;T is a system for defining and communicating tolerances on engineering drawings.</td>
</tr>
<tr>
<td>GMT</td>
<td>The telescope, associated buildings, equipment and instrumentation taken together is the “GMT”.</td>
</tr>
<tr>
<td>GMT Project</td>
<td>The planning, design, construction and operation of the GMT.</td>
</tr>
<tr>
<td>GMTO</td>
<td>The corporation founded to own and administer the planning, design, construction and operation of the Giant Magellan Telescope (GMT).</td>
</tr>
<tr>
<td>Guide Stars (Position Reference Stars)</td>
<td>Position reference stars are fairly bright stars offset from target objects that are used for telescope guiding or wavefront sensing during observations.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Interface Control Document (ICD)</td>
<td>Details the specific ways in which two systems interact with each other, including mechanics, electronics, software, and safety interfaces.</td>
</tr>
<tr>
<td>N+1 Redundancy</td>
<td>Components (N) have at least one independent backup component (+1) to ensure system availability in the event of a component failure.</td>
</tr>
<tr>
<td>Nodding</td>
<td>Nodding is the process of repetitively offsetting the telescope between two or three positions on the sky, with a dwell time at each end point where the system may or may not be guiding.</td>
</tr>
<tr>
<td>Offsetting</td>
<td>Offsetting is the process of accurately moving from one guided pointing to another guided position relative to the first.</td>
</tr>
<tr>
<td>Over-Travel Hazard</td>
<td>An over-travel hazard exists when a motion control system has a mechanical limit of travel that could cause component damage or injury if the limit is exceeded.</td>
</tr>
<tr>
<td>Pointing</td>
<td>Pointing is the process of repositioning the telescope to new sky coordinates with precise placement of science objects in the field of view. Pointing relies on the use of guide sensors in the TFOV to accurately center objects in the SFOV.</td>
</tr>
<tr>
<td>Precision</td>
<td>Precision pertains to the closeness to one another of a set of repeated observations of a random variable. Thus, if such observations are closely clustered together, then these observations are considered to have been obtained with high precision.</td>
</tr>
<tr>
<td>Resolution</td>
<td>The smallest change in the underlying physical quantity that produces a response in the measurement.</td>
</tr>
<tr>
<td>Scanning</td>
<td>Scanning is the process of moving the image in the focal plane at a set rate relative to a reference.</td>
</tr>
<tr>
<td>Shutdown</td>
<td>Shutdown is the process of bringing a system to fully off state in a controlled safe manner. E.g., power and all utility services turned off.</td>
</tr>
<tr>
<td>Standby</td>
<td>Standby is the process of bringing a system to an off-line, but ready for operation state in a controlled and safe manner. Standby does not include the need of any initialization and/or calibration.</td>
</tr>
<tr>
<td>Tracking</td>
<td>Tracking is the process of maintaining alignment of the telescope pointing with the science target during an observation using position feedback from reference guide stars to track the telescope mount in azimuth, elevation, and GIR angle.</td>
</tr>
<tr>
<td>Warm Start</td>
<td>Warm Start is the process of starting a system from a half way state. E.g., power is on/off and/or utility services on/off. A warm start may include initialization and calibration if the processes are routine and efficient.</td>
</tr>
<tr>
<td>Zenith Angle</td>
<td>The angle between vertical and the optical axis of the Telescope. The zenith angle is zero when the telescope is at zenith and increases toward horizon. It is the complement of the elevation angle.</td>
</tr>
</tbody>
</table>
### B.2 System

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Can”, “May”, or “Should”</td>
<td>“Can”, “May”, or “Should” indicate recommendations and are not subject to any requirement acceptance testing or compliance verification by the supplier. The supplier is free to propose alternative solutions.</td>
</tr>
<tr>
<td>“Is” or “Will”</td>
<td>“Is” or “Will” indicate a statement of fact or provide information and are not subject to any requirement acceptance testing or verification compliance by the supplier.</td>
</tr>
<tr>
<td>“Shall”</td>
<td>“Shall” denote requirements that are mandatory and will be the subject of specific acceptance testing and compliance verification.</td>
</tr>
<tr>
<td>Analysis</td>
<td>Analysis is the use of established technical or mathematical models or simulations, algorithms, or other scientific principles and procedures to provide evidence that the item meets its stated requirements. Analysis (including simulation) is used where verifying to realistic conditions cannot be achieved or is not cost effective and when such means establish that the appropriate requirement, specification, or derived requirement is met by the proposed solution.</td>
</tr>
<tr>
<td>ATCF Coolant</td>
<td>Ambient Tracking Chilled Fluid (ATCF) maintains a temperature at 8°C below ambient and is provided for removing heat from components and maintaining their surface temperatures near ambient to eliminate active heat sources in the observing environment. The 8°C below ambient differential allows headroom for heat exchangers or thermal electric coolers to be used by the subsystems for local temperature control. The ATCF is a water/glycol mixture with a concentration of 60/40.</td>
</tr>
<tr>
<td>Availability</td>
<td>Availability is defined as an entity’s capability of being used over a period of time. The measure of an entity’s availability can be defined as “the percentage of time in which the entity is in a usable state”. 99% Availability means that the entity is operational for 99% of the time, or is out of operation 1% of the time.</td>
</tr>
<tr>
<td>Controlled Documents</td>
<td>Controlled documents are identified with GMT document numbers, titles, authorized signatures, and revision indicators and are tracked in the Project Document List (PDL).</td>
</tr>
<tr>
<td>Critical Items</td>
<td>Critical items are those items or processes that, because of the significance and/or likelihood of failure, need to be identified and managed.</td>
</tr>
<tr>
<td>Demonstration</td>
<td>Demonstration is the actual operation of an item to provide evidence that it accomplishes the required functions under specific scenarios. Given input values are entered and the resulting output values are compared against the expected output values.</td>
</tr>
<tr>
<td>Down Time</td>
<td>Down time is the amount of scheduled science observing time lost to equipment failure or other non-weather interruption of science operations. Down time is measured in units of hours over the period of one year. Down time includes observations that are lost due to a failure or a system not performing up to specifications, the time to diagnose and resolve problems or to switch to a backup system, and the time to bring the system back to normal science operation. Down time does not include science observing time that would otherwise be lost due to adverse weather conditions.</td>
</tr>
<tr>
<td>Draft</td>
<td>A Draft document is on that contains information but is still be missing critical and non-critical data or requirements.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>FTCF Coolant</td>
<td>Fixed Temperature Chilled Fluid (FTCF) maintains a temperature at a constant 7.2°C and is provided for equipment that requires a constant room temperature environment (e.g., sensitive electronics where performance is impacted by temperature variations). The G2CF is a water/glycol mixture with a concentration of 70/30.</td>
</tr>
<tr>
<td>Functional Architecture</td>
<td>A Functional Architecture is a set of activities or functions arranged in a specified (partial) order that, when activated, achieves a defined goal. The Functional Architecture representation ranges from: A pure activity or process model with a Data Dictionary; an activity model that is supported by a data model, with a common Data Dictionary; an activity model that includes an embedded rule model, supported by a data model, with a common Data Dictionary. The Functional Architecture does not include a Dynamics Model or an Organization Model.</td>
</tr>
<tr>
<td>G2CF Coolant</td>
<td>GIR 2nd stage tracking Chilled Fluid (G2CF) is derived from the ATCF and maintains a temperature that tracks at 2.5°C below ambient. This is provided as coolant for equipment (e.g., detectors) where condensation is a concern. The G2CF is a water/glycol mixture with a concentration of 60/40.</td>
</tr>
<tr>
<td>High Impact Maintenance</td>
<td>High Impact maintenance refers to unscheduled activities that preclude science observing and cause GMT Downtime. This is usually a failure during the night that requires reactive maintenance, but may also be caused by delays in starting night operations due to daytime maintenance activities.</td>
</tr>
<tr>
<td>Inspection</td>
<td>Inspection is an examination of the item against applicable documentation to confirm compliance with requirements. Inspection is used to verify properties best determined by examination and observation (e.g., paint color, weight, size, etc.).</td>
</tr>
<tr>
<td>Interlock</td>
<td>An interlock is a hardwired connection between two systems or mechanisms that provides time-critical safety information.</td>
</tr>
<tr>
<td>Life-limited Item</td>
<td>A life-limited item is one which has a limited and quantifiable useful life, and could be considered for replacement on a pre-planned basis for reliability, economic, or safety reasons.</td>
</tr>
<tr>
<td>Low Impact Maintenance</td>
<td>Low Impact maintenance refers to activities that can be done without impacting other normal daily preparation activities. Low impact maintenance is primarily preventative maintenance activities, but may include reactive maintenance activities, such as replacement of a redundant system.</td>
</tr>
<tr>
<td>Maintainability</td>
<td>Maintainability is defined as the probability that failed entity can be restored to an operational effective condition within a given period of time.</td>
</tr>
<tr>
<td>Medium Impact Maintenance</td>
<td>Medium Impact maintenance refers to the activities that preclude other normal daily observing preparation activities, such as instrument configurations and calibrations, from occurring. Medium impact maintenance is primarily reactive maintenance activities, but will include preventative maintenance activities, such as washing the primary mirrors.</td>
</tr>
<tr>
<td>Operations Maintenance</td>
<td>Operations maintenance includes preventative and reactive maintenance activities that are not allocated to downtime or scheduled maintenance time.</td>
</tr>
<tr>
<td>Pre-Release</td>
<td>A “Pre-Release” state for a document is when it contains all the critical information needed, but may still have non-critical information that is to be determined or reviewed.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Preventative Maintenance</td>
<td>Preventative Maintenance is the servicing work that is performed on a planned (scheduled) basis to prevent failures and maintain peak operational performance.</td>
</tr>
<tr>
<td>Reactive Maintenance</td>
<td>Reactive Maintenance is the response and effort to diagnose and resolve an unexpected system failure or degradation of performance to unacceptable levels.</td>
</tr>
<tr>
<td>Reference Optical Axis (ROA)</td>
<td>This is the axis of revolution of the primary mirror parent optical surface.</td>
</tr>
<tr>
<td>Released</td>
<td>Released documents have letter revisions (starting with “A”) and contain complete and reliable information on the current configuration of GMT.</td>
</tr>
<tr>
<td>Reliability</td>
<td>Reliability is defined as the provability that an entity will perform a specified function under given environmental conditions for a specified time.</td>
</tr>
<tr>
<td>Revision Controlled</td>
<td>Revision-controlled document have been reviewed, approved, and authorized for release in accordance with the release process and then are subject to changes per change control process.</td>
</tr>
<tr>
<td>Scheduled Maintenance Time</td>
<td>Scheduled Maintenance Time is defined as nights or partial nights scheduled for routine maintenance operations that preclude science operation (e.g., mirror recoating, mounting and check out of a science instrument after initial commissioning, night time testing and recalibration of telescope systems, etc.). Scheduled Maintenance Time and Commissioning Time are included as Engineering Time in the GMTO Founders’ Agreement.</td>
</tr>
<tr>
<td>Test</td>
<td>A test is an action by which the operability, supportability, or performance capability of an item is verified when subjected to controlled conditions that are real or simulated. These verifications often use special test equipment or instrumentation to obtain very accurate quantitative data for analysis.</td>
</tr>
<tr>
<td>Version Controlled</td>
<td>Version-controlled documents are working documents that are managed using a configuration management tool to track changes, but are not formally “released”. Version-controlled documents may achieve a “pre-release” state where they contain all the critical information needed, but may still contain non-critical information that is to be determined or reviewed.</td>
</tr>
</tbody>
</table>

### B.3 Telescope

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition, Guide, and Wavefront Subsystem</td>
<td>The mechanical assembly located at the top of the GIR that houses the AGS and WFS probes and mechanisms to move them within the Technical Field of View (TFOV) patrol areas.</td>
</tr>
<tr>
<td>Active Optics</td>
<td>Active Optics (AcO) functions to actively maintaining low frequency alignment, focus, and figure of the telescope optics by optical feedback using natural guide stars. The Active Optics typically operates at &lt;1 Hz.</td>
</tr>
<tr>
<td>Active Optics Wavefront Sensor (AcWFS)</td>
<td>The AcWFS provides the Shack-Harmann wavefront sensing capability to the AGWS.</td>
</tr>
<tr>
<td>Azimuth Axis</td>
<td>This is the vertical axis about which the Azimuth Platform rotates to point the telescope at celestial targets at all bearing angles of the compass.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Azimuth Disk</td>
<td>This is the large circular steel structure that rides on the azimuth track and carries the optical support structure. The main axis drives and hydrostatic bearings are mounted on the platform.</td>
</tr>
<tr>
<td>Azimuth Drive</td>
<td>The Azimuth Drive consists of a track of magnets on the top surface of the Azimuth Track and four forcer heads on the Azimuth Structure.</td>
</tr>
<tr>
<td>Azimuth Structure (Assembly)</td>
<td>This assembly consists of the Azimuth Disk, Azimuth Extension (skirt), Azimuth Deck (insulated floor), seals, stairs and utility platforms.</td>
</tr>
<tr>
<td>Azimuth Track (Assembly)</td>
<td>The Azimuth Track provides a smooth and flat surface for the Hydrostatic Bearings. This assembly includes the structure, adjusters and anchor bolts. The Azimuth Track consists of the Azimuth Track Structure, Adjusters and Anchor Bolts.</td>
</tr>
<tr>
<td>Azimuth Utility Wrap</td>
<td>This is a system of fixed and flexible cabling that allows transfer of utilities such as power, gases, coolant and data signals from the fixed enclosure base onto the rotating azimuth platform.</td>
</tr>
<tr>
<td>Bare Gregorian Focus</td>
<td>The Bare Gregorian (BG) Focus configuration uses just the primary and secondary mirrors to form images at the Gregorian focus.</td>
</tr>
<tr>
<td>Base Vacuum Pressure</td>
<td>The minimum vacuum pressure in the coating chamber</td>
</tr>
<tr>
<td>C-Ring Assembly</td>
<td>The C-Ring Assembly consists of C-Ring Segments, the Instrument Platform (IP), IP Extension, C-Ring bracing, IP bracing and Outer Cell Supports. It serves as the structural foundation for the upper OSS by supporting the Cell Connector Frame (CCF), Primary Mirror Subsystem, and Main Truss and distributing that support to the Azimuth Structure below it.</td>
</tr>
<tr>
<td>C-Rings</td>
<td>The two large diameter circular structural elements that provide support for the OSS through hydrostatic bearings to the Azimuth Disk Assembly and an interface for the Elevation Axis Drive and elevation axis encoder.</td>
</tr>
<tr>
<td>Cell Connector Frame (CCF)</td>
<td>The CCF serves to locate and support the seven primary mirror cells and the secondary truss. The CCF consists of a central hub and six radial spokes. It is a plate fabrication which serves the purpose of connecting the cells together and maintaining the geometry of the segmented primary mirror.</td>
</tr>
<tr>
<td>Corrector-ADC</td>
<td>The Corrector-ADC Subsystem is an optical subsystem consisting of a wide-field corrector and atmospheric dispersion compensation (ADC). The Corrector is designed to widen the field of view of the Gregorian optical design of the telescope to the full Science Field of View of 20 arcminutes. The ADC is used to mitigate the effects of the atmospheric refraction as the telescope moves to off zenith observing targets.</td>
</tr>
<tr>
<td>Direct Gregorian Port</td>
<td>The Direct Gregorian Port (DG), located below the upper GIR platform, provides a high-throughput, low-background focus with the minimum number of reflections. The DG port may be configured in one of two ways, Narrow-Field and Wide-Field.</td>
</tr>
<tr>
<td>Elevation Axis</td>
<td>This is the horizontal axis about which the OSS rotates to point the telescope optics at celestial targets above the minimum elevation angle. Also known as the Altitude Axis.</td>
</tr>
<tr>
<td>Elevation Drive</td>
<td>The elevation axis linear motors consisting of an Elevation Drive Track and two Forcer Heads on each of two C-Rings.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Elevation Utility Wrap</td>
<td>This is a system of fixed and flexible cabling that allows transfer of utilities such as power, gases, coolant and data signals from the azimuth platform onto the rotating OSS.</td>
</tr>
<tr>
<td>Fast-steering Secondary Mirror (FSM)</td>
<td>The FSM is a subsystem located at the top of the OSS and interfaces to the Top End Frame. The subsystem consists of the FSM segments, their cells and mounts, counterweights, controls and FSM Simulators (if required).</td>
</tr>
<tr>
<td>Folded Port</td>
<td>The Folded Port is located at the upper GIR platform and using the tertiary mirror provides optimized foci for narrow-field instruments which operate at visible, IR and NIR wavelengths (400 nm to 25 microns) where adaptive optics is most effective.</td>
</tr>
<tr>
<td>Forcer Head</td>
<td>The fixed, forcing component of the linear motor.</td>
</tr>
<tr>
<td>GIR Mechanical Assembly</td>
<td>The GIR Mechanical Assembly consists of the GIR Encoder, GIR Drives, GIR Axial and Radial Bearings, the GIR Static and Dynamic Counterweights, GIR Cable Wrap, GIR Locking Pins, GIR DG Cover, GIR DG Instrument Utility Transfer Mechanism, and the GIR DG Instrument Deployment Mechanism.</td>
</tr>
<tr>
<td>GIR Structural Assembly</td>
<td>The GIR Structural Assembly consists of the GIR Upper Disk, GIR Lower Disk, service platforms, and the GIR Corner Braces.</td>
</tr>
<tr>
<td>GIR Utility Wrap</td>
<td>This is a system of fixed and flexible cabling that allows transfer of utilities such as power, gases, coolant and data signals from the OSS onto the rotating GIR.</td>
</tr>
<tr>
<td>Gravity-Invariant Instrument Station (GIS)</td>
<td>The Gravity-Invariant Instrument Station is located on the azimuth disk and provides a gravity invariant mounting location for science instruments.</td>
</tr>
<tr>
<td>Gregorian Instrument Rotator (GIR) Subsystem</td>
<td>This is a large, cylindrical structure imbedded in the floor of the Instrument Platform. The structure includes the GIR Mechanical Assembly, Structural Assembly and the GIR Control. Direct Gregorian science instruments are deployed on slides in the GIR. The Folded Port instruments are mounted on the top surface of the GIR. The GIR rotates to compensate for the rotation of the field of view as the telescope moves in altitude and azimuth.</td>
</tr>
<tr>
<td>High Frequency Over-Constraint (HFOC)</td>
<td>A feature of slave bearing that restricts oil flow to and from the internal slave piston such that backpressure generated during high frequency force oscillations results in dynamic stiffness of the slave bearing.</td>
</tr>
<tr>
<td>Hydraulic Control System</td>
<td>The system comprised of the control panel and all controls and interlocks necessary to safely and efficiently operate the Telescope Bearing System.</td>
</tr>
<tr>
<td>Hydraulic Cooling System</td>
<td>The system that controls the temperature of the hydraulic oil supplied to the altitude and azimuth hydrostatic bearings.</td>
</tr>
<tr>
<td>Hydraulic Pumping Subsystem</td>
<td>The system comprised of the oil tank, pumps, filters, accumulators, manifolds, local PLC controller and other equipment necessary to supply a constant flow of pressurized oil to the altitude and azimuth hydrostatic bearings.</td>
</tr>
<tr>
<td>Hydrostatic Bearing</td>
<td>An assembly consisting of a bearing housing, bearing pad and flow control device.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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</tr>
<tr>
<td>Hydrostatic Bearings System</td>
<td>The Hydrostatic Bearing System (HBS) supports and defines the movement of the two main axes of the telescope. The system is comprised of the altitude and azimuth bearings, the hydraulic pumping unit and the hydraulic cooling unit, associated plumbing and controls.</td>
</tr>
<tr>
<td>Instrument Platform (IP)</td>
<td>This is a platform fixed to the C-Rings of the OSS below the Primary Mirror Assembly. The platform provides a mounting base for the Gregorian Instrument Rotator (GIR). IP Instruments are mounted to the IP Platform.</td>
</tr>
<tr>
<td>Instrument Utility Transfer System</td>
<td>This is a system of fixed and flexible cabling that allows transfer of utilities such as power, gases, coolant and data signals from the OSS onto the rotating GIR.</td>
</tr>
<tr>
<td>IP Extension</td>
<td>The IP Extension Platform is stored off telescope and installed at the back or front of the Instrument Platform (IP) for installation and removal of IP and Folded Port instruments from the IP platform.</td>
</tr>
<tr>
<td>M1 Coating Plant</td>
<td>The M1 Coating Plant will be used to apply reflective coatings to the M1 segments. The Plant consists of the vacuum chamber, vacuum pumping system, pre-disposition cleaning system, disposition system, and supervisory control system.</td>
</tr>
<tr>
<td>M2 Positioner</td>
<td>The M2 Positioner produces translation and rotation to assure the accurate alignment of the FSM/ASM mirror to M1. The M2 Positioner will be used to correct for telescope structural flexure at different zenith angles and temperature gradients. It will be also be used to correct for initial misalignments within the FSM/ASM and M1.</td>
</tr>
<tr>
<td>M3 (Tertiary Mirror) Assembly</td>
<td>This is an assembly at the FP/AGWS level of the GIR, which houses M3 and its mechanisms. The mechanisms move M3 into and out of the telescope beam and also rotate M3 to reflect the incoming light toward the FP instrument in use.</td>
</tr>
<tr>
<td>M3 Beam Director Mechanism</td>
<td>A rotational stage of the M3 Mirror Cell and Support System that rotates about the optical axis to deflect the incoming beam to any one of the folded port stations</td>
</tr>
<tr>
<td>M3 Cell and Support Assembly</td>
<td>An Assembly consisting of the M3 Mirror and its Mirror Cell and Supports. The Mirror Supports include the M3 Beam Deflector Mechanism and actuators to provide tip, tilt and piston motion of the M3 Mirror</td>
</tr>
<tr>
<td>M3 Subsystem</td>
<td>A subsystem consisting of the M3 Mirror, M3 Mirror Cell and Support Assembly, M3 Beam Director, Cover and Enclosure and the M3 Deployment Mechanism</td>
</tr>
<tr>
<td>Main Axes Encoder System</td>
<td>Encoders that provide position feedback for the Main Axes Drive System.</td>
</tr>
<tr>
<td>Main Truss</td>
<td>The Main Truss sub-assembly supports the secondary mirror assembly (FSM or ASMS). It is a braced structural hexapod which attaches to the Top End Frame and stiffly defines all six degrees of freedom for the secondary assembly.</td>
</tr>
<tr>
<td>Master Bearings</td>
<td>Hydrostatic Bearings that incorporates a solid structure bearing housing and bearing pad between its supporting structure and the bearing pad surface.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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</tr>
<tr>
<td>Mirror Coating Facility</td>
<td>The M1 segments will need to be coated at regular intervals therefore having the means to do so on-site is necessary, as the logistics of shipping the mirrors for this purpose is cost and schedule prohibitive. The Mirror Coating Facility includes the M1 Coating Plant and M1 Washing and Stripping Equipment.</td>
</tr>
<tr>
<td>Mount Drives Assembly</td>
<td>The Mount Drives Assembly provides the thrust to the telescope structure to slew and track the axes. The Mount Drives Assembly is comprised of the Azimuth and Elevation Drives, encoders, limit switches and overspeed sensors.</td>
</tr>
<tr>
<td>Mount Subsystem</td>
<td>The Mount Subsystem is the structural, mechanical, hydraulic, and electronic system that is required to support, align, point and track. This subsystem is comprised of the following assemblies: Optical Support Structure, Azimuth Structure, Azimuth Track, the Hydrostatic Bearings System, the Mount Drives, restrictors and locking pins, and the AZ and EL cable wraps. The Mount Subsystem is arranged in an altitude over azimuth configuration. It does not include but supports the optics, AOS, instruments and GIR.</td>
</tr>
<tr>
<td>Natural Seeing</td>
<td>This is the seeing limited image quality that relies on the imaging and tracking properties of the telescope without the use of adaptive optics. Slowly varying effects that affect image quality such as gravitational and thermal distortion of the structure and optics, tracking errors and telescope shake are corrected but rapidly varying atmospheric effects (seeing) are not. Our definition of natural seeing does not include “dome” seeing effects.</td>
</tr>
<tr>
<td>Oil Collection System</td>
<td>Troughs, piping, drip lips, and other features that trap and collect the oil from the elevation and azimuth bearings and delivers it to the oil return system</td>
</tr>
<tr>
<td>Oil Return System</td>
<td>The system of pipes, hoses, and fittings that return the oil from the Oil Collection System to the Hydraulic Pumping System.</td>
</tr>
<tr>
<td>Oil Supply System</td>
<td>The rigid pipes, hoses and connections that supply high-pressure oil to the bearings. This subsystem includes the manifolds for delivering oil to the bearings, accumulators (if required) for vibration control, and actuated valve(s) for turning on and shutting off the oil flow.</td>
</tr>
<tr>
<td>Oil-line Transfer System</td>
<td>The mechanism for transferring the high pressure oil supply line across the rotating interface between the fixed telescope pier and the rotating Azimuth Disk Assembly.</td>
</tr>
<tr>
<td>Optical Alignment Subsystem</td>
<td>The Optical Alignment Subsystem is used to align the telescope optics and consists of laser trackers and targets and other alignment fixtures.</td>
</tr>
<tr>
<td>Optical Support Structure</td>
<td>This consists of all of the telescope structure and mechanical assemblies that move with the elevation axis. See the definitions for OSS Mechanical Assembly and OSS Structure Assembly.</td>
</tr>
<tr>
<td>OSS Mechanical Assembly</td>
<td>The mechanical sub-assemblies of the OSS are: (a) Elevation Assembly Static Counterweights, (b) Elevation Assembly Dynamic Counterweights, (c) IP Jib Crane, (d) FP GIR Equipment Hoist and (e) Facility Calibration Deployment Mechanism, (f) M2 Positioner Assembly, and (g) M2 Baffles.</td>
</tr>
</tbody>
</table>
### OSS Structure Assembly
The structure subassemblies of the OSS are (a) the Top End Frame, (b) C-Ring Structure and Braces (c) Cell Connector Frame, (d) Instrument Platform, (e) Main Truss, (f) M1 Cell Support Struts, (g) GIR, C-Ring, and CCF Access Platforms, (h) CCF and C-Ring Stairs and (i) M1 Cell Weldments.

### Primary Mirror (M1)
The M1 is the subsystem consisting of the seven primary mirror assemblies.

### Primary Mirror (M1) Assembly
The M1 Assembly consists of a single Primary Mirror Segment, Primary Mirror Cell, cover, mirror support system, dummy mass (if required), baffle, and thermal control system.

### Primary Mirror Cell (PMC)
The Giant Magellan Telescope is built around seven 8.4 meter borosilicate honeycomb mirrors on a common mount. These mirrors are each located in an associated primary mirror cell. The cells themselves are fabricated steel structures which protect, support and position the primary mirrors. The overall function of the primary mirror cells is to position each primary mirror with respect to the telescope and provide an environment that limits distortions. Three essential elements achieve these ends: the mirror support system, the mirror positioning system and the ventilation and thermal monitoring system.

### Slave Bearing
A Hydrostatic Bearing that incorporates an internal, pressure controlled hydraulic piston, allowing the bearing pad to move freely in the force direction, thus accommodating geometric irregularities in the runner bearing surface without changes in the bearing force.

### Step and Integrate
Step and Integrate is the process of moving the image in the focal plane discrete angular steps with pauses to integrate between steps.

### Technical Field of View (TFOV)
The Technical Field of View is the area accessible to guide and wavefront sensors in the AGWS.

### Telescope Chamber
The Telescope Chamber is the volume inside of the Enclosure where GMT resides.

### Telescope System
The Telescope System is a ground-based 25m telescope design intended for astronomical research at near-UV, optical and infrared wavelengths. The Telescope System will operate in both natural-seeing and adaptive optics modes and provide mountings for multiple scientific instruments with varying capabilities. The GMT Telescope system will include the following subsystems: (1) Mount (2) Gregorian Instrument Rotator (GIR), (3) Primary Mirror (M1) (4) Secondary Mirror (M2) (5) Tertiary Mirror (M3) (6) Corrector-ADC (7) Acquisition, Guide and Wavefront Subsystem (AGWS) (8) Optical Alignment and (9) Telescope Auxiliary Equipment.

#### B.4 Software & Controls

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Device Control Subsystems</td>
<td>Device Control Subsystems command mechanical degrees of freedom or read optical and other sensors.</td>
</tr>
<tr>
<td>Observatory Operations System (OPS)</td>
<td>The OPS provides telescope staff and astronomers the high-level software tools necessary to operate the GMT observatory.</td>
</tr>
<tr>
<td>Term</td>
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</tr>
<tr>
<td>Observatory Services (OSRV)</td>
<td>A set of common services providing the basic infrastructure to enable control components to communicate and collaborate in order to execute high-level control and monitoring tasks.</td>
</tr>
<tr>
<td>Pointing Kernel</td>
<td>The Pointing Kernel predicts the mount encoder angles required to image a specific coordinate on the sky to a given location in the focal plane. It also enables the celestial coordinates for a focal plane location to be determined, and the expected focal plane coordinates of a celestial target.</td>
</tr>
<tr>
<td>Service Adapters</td>
<td>Service adapters isolate application components from the platform used to implement the service.</td>
</tr>
<tr>
<td>Service Supervisors</td>
<td>Service supervisors coordinate and supervise the operation of the corresponding service.</td>
</tr>
<tr>
<td>Software and Controls System (SWCS)</td>
<td>The SWCS encompasses the software and hardware components necessary to control and monitor the GMT optical and electromechanical subsystems and to efficiently operate the GMT observatory.</td>
</tr>
<tr>
<td>Telescope Control System (TCS) -</td>
<td>This is composed of the software and hardware necessary to control and monitor the optical and electromechanical devices of the telescope, including the AO System. TCS is responsible for pointing and tracking the structure, maintaining optical alignment and focus, and correcting wavefront errors due to distortion of the optical surfaces, the telescope structure and turbulence in the atmosphere. TCS consists of a hierarchical system of open and closed control loops operating in frequency regimes ranging from sub-hertz up to over a kilohertz. The TCS also provides interfaces to other subsystems of the telescope and observatory (instruments, archive, User Interface, enclosure, environmental controls, etc.).</td>
</tr>
<tr>
<td>Wavefront Control System (WFCS)</td>
<td>The WFCS includes all of the software and hardware necessary to convert the optical aberrations detected by the AO and Telescope wavefront sensors to corrections applied to the AO and Telescope optics.</td>
</tr>
</tbody>
</table>

**B.5 Adaptive Optics**

<table>
<thead>
<tr>
<th>Term</th>
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<tbody>
<tr>
<td>Adaptive Optics System</td>
<td>A telescope system for correcting rapidly varying wavefront errors by optical means. The GMT Adaptive Optics System uses an Adaptive Secondary Mirror to correct disturbances caused by variations across the pupil of the index of refraction integrated along the line of sight through the atmosphere, and slowly varying telescope and instrument-caused wavefront errors. The distinction between adaptive optics and active optics is one of purpose and correction bandwidth, with adaptive optics operating at &gt;10 Hz and active optics at &lt;1 Hz.</td>
</tr>
<tr>
<td>Adaptive Secondary Mirror</td>
<td>The Adaptive Secondary Mirror (ASM) forms the primary corrective element of the GMT Adaptive Optics System. It is formed of seven independent ASM segments and it is part of the ASM System.</td>
</tr>
<tr>
<td>Adaptive Secondary Mirror System</td>
<td>The Adaptive Secondary Mirror System (ASMS) is formed of seven independent ASM segments, an ASM Control System and ASM Shipping and Handling Equipment.</td>
</tr>
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<tr>
<td><strong>Coarse Phasing</strong></td>
<td>Coarse phasing is the process of aligning the M1 and M2 segments to approximately 200 nm RMS wavefront error in piston. This is the level of segment piston control required for AO spectroscopy with large (e.g., 50x50 mas) apertures.</td>
</tr>
<tr>
<td><strong>Fast Tip/tilt errors</strong></td>
<td>Fast Tip/tilt errors are defined as wavefront errors at frequencies more than 0.1 Hz.</td>
</tr>
<tr>
<td><strong>Fine Phasing</strong></td>
<td>Fine phasing is the process of aligning the M1 and M2 segment to significantly better than 200 nm RMS wavefront error in piston. This level of segment piston control is necessary for diffraction-limited imaging.</td>
</tr>
<tr>
<td><strong>Galactic Plane</strong></td>
<td>The Galactic plane is defined as the primary plane of symmetry of the mass distribution of the Milky Way Galaxy.</td>
</tr>
<tr>
<td><strong>Ground Layer AO (GLAO)</strong></td>
<td>The Ground-Layer Adaptive Optics (GLAO) observing mode uses a guide star asterism (either LGS/NGS or NGS-only) to detect and correct wavefront errors common to sky objects within a large (up to 10 arcmin in diameter) field of view. These errors are mainly due to low (up to 1 km) altitude components of the atmospheric wavefront aberrations. The wavefront aberration will be detected using multiple wavefront sensors and compensated by the ASM, resulting in improved natural seeing images over a field of view comparable to the GS constellation size. While providing some improvement in the visible, GLAO correction is expected to be particularly useful at wavelengths longer than 1 µm.</td>
</tr>
<tr>
<td><strong>High Order errors</strong></td>
<td>High Order errors are defined as all wavefront aberrations except global piston, tip and tilt.</td>
</tr>
<tr>
<td><strong>Laser Ground Layer Adaptive Optics (LGLAO)</strong></td>
<td>The Laser Ground-Layer Adaptive Optics (LGLAO) observing mode uses a wide (&gt;4 arcminute diameter) constellation of laser guide stars (LGS) to correct only the low altitude components of the atmospheric wavefront aberrations. Several faint natural guide stars must be used to measure tip-tilt, focus, and dynamic calibration terms. The wavefront aberration will be compensated by the ASM, resulting in improved natural seeing images over a field of view comparable to the LGS constellation size. While providing some improvement in the visible, LGLAO correction is expected to be particularly effective at wavelengths longer than 1 µm.</td>
</tr>
<tr>
<td><strong>Laser Guide Star Facility</strong></td>
<td>The LGSF system includes the following subsystems: the Laser Projection System (LPS); the LGS Acquisition System (LAS) and the Laser Heat Exchanger.</td>
</tr>
<tr>
<td><strong>Laser Guide Star Unit</strong></td>
<td>Each LGS Unit includes: a Laser System; a Beam Conditioning and Diagnostic System (BCDS); a Laser Launch Telescope (LLT); and a LGS Unit Control System (LGSU CS)</td>
</tr>
<tr>
<td><strong>Laser Projection Assembly</strong></td>
<td>Each LPA includes: a Laser System; a Beam Conditioning and Diagnostic System (BCDS); and a Laser Launch Telescope (LLT)</td>
</tr>
<tr>
<td><strong>Laser Projection System</strong></td>
<td>The Laser Projection System is the LGSF subsystem in charge of creating the required LGS asterism on the sky. To do so, the LPS includes one LGS Units (LGSU) per LGS, thus six LGS Units in total.</td>
</tr>
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<tr>
<td>Laser Tomography AO (LTAO)</td>
<td>The Laser Tomography Adaptive Optics (LTAO) observing mode uses a ~1 arcminute diameter constellation of LGS to tomographically reconstruct the high-order components of the atmospheric wavefront aberrations in the direction of a central science target. One or more faint natural guide stars must be used to measure tip-tilt, focus, segment piston, and dynamic calibration terms. The wavefront aberration will be compensated by the ASM, providing diffraction-limited imaging at 0.9-25 µm wavelength over a field of view limited by atmospheric isoplanatism.</td>
</tr>
<tr>
<td>Laser Tomography AO WFS Subsystem (LTWS)</td>
<td>The LTAO Mode uses the light from a constellation of Laser Guide Stars (LGS), produced by the Laser Guide Star Facility (LGSF), to tomographically reconstruct the high-order components of the atmospheric wavefront aberrations in the direction of a central science target. The LTAO Mode requires one faint natural guidestar to measure tip-tilt and focus terms and provides dynamic calibration of the reconstruction. The wavefront aberration will be compensated by the Adaptive Secondary Mirror (ASM), providing diffraction-limited imaging at wavelengths longer than 960nm over a field of view limited by atmospheric isoplanatism. The LTAO WFS Subsystem has three main characteristics that dominate the design of its optical and mechanical assembly. These characteristics are: [1] The LGS constellation sets the arrangement of the LGS images at the LGS focal plane. If a simple design is to be sought this in turns sets the configuration of the LTAO WFS. The LGS constellation consists of 6 LGS equally spaced on an approximately 60” diameter circle which is centered on the telescopes optical axis. The LTAO WFS Assembly therefore consists of 6 LGS WFS, with at least the first optical elements equally spaced on an approximately 60” diameter circle, also centered on the telescopes optical axis. [2] The LGS constellation is fixed with regards to the telescope, but moves on the sky relative to the star field. The location of the WFS on the rotating Instrument Platform requires the LTAO WFS Assembly to rotate and counter this rotation. The distance to the LGS varies with the telescope elevation, and with the mean altitude of the sodium layer. The back focal distance of the LGS image therefore changes with the telescope elevation angle and mean sodium altitude. The LTAO WFS Assembly includes a Focus Stage that maintains the LGS focal plane at a set point relative to the rest of the assembly.</td>
</tr>
<tr>
<td>M1 Edge Sensor Subsystem (M1ES)</td>
<td>The M1 Edge Sensor subsystem is a major metrology component of the GMT phasing system. It is responsible for measuring piston errors between the seven M1 segments and work in closed-loop with the M1 and M2 actuators for course and fine phasing corrections, respectively. Piston errors to be measured are on the order of 10nm in the wavefront, which makes short and long term mechanical stability of the M1 edge sensor support a challenge. A hybrid metrology system is proposed due to the minimum distance of 500 mm between M1 segments and the 30mm motion of any segment when its active support system is shut-down. The performance and functional requirements differentiate between the following M1ES components: M1ES Unit (A DMI/Retroreflector or Camera/Target pair, with all associated electronics, mounting, and baffling components); M1ES Sensor (A DMI or Camera, with its mounting hardware [no electronics or baffling]); M1ES Target (A retroreflector or imaging target with its mounting hardware [no electronics or baffling]) and M1ES Fine Sensor (A DMI with its mounting hardware [no electronics or baffling]).</td>
</tr>
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<td>Term</td>
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</tr>
<tr>
<td>M2 Edge Sensor Subsystem (M2ES)</td>
<td>A set of 24 capacitive sensors mounted to the Adaptive Secondary Mirror reference bodies which measure the relative displacement between segments.</td>
</tr>
<tr>
<td>Natural Ground Layer Adaptive Optics (NGLAO)</td>
<td>The Natural Ground-Layer Adaptive Optics (NGLAO) observing mode uses a guide star asterism of NGS only to detect and correct wavefront errors common to sky objects within a large (up to 10 arcminutes in diameter) field of view. These errors are mainly due to low (up to 1 km) altitude components of the atmospheric wavefront aberrations. The wavefront aberration will be detected using multiple wavefront sensors and compensated by the ASM, resulting in improved natural seeing images over a field of view comparable to the GS constellation size. While providing some improvement in the visible, NGLAO correction is expected to be particularly useful at wavelengths longer than 1 µm.</td>
</tr>
<tr>
<td>Natural Guide Star AO (NGSAO)</td>
<td>The Natural Guide Star Adaptive Optics (NGSAO) observing mode uses a single star and wavefront sensor to provide all of the wavefront correction information for the AO System. The wavefront aberration will be compensated by the ASM, providing diffraction-limited imaging at 0.9-25 µm wavelength over a field of view limited by atmospheric isoplanatism.</td>
</tr>
<tr>
<td>Natural Guide Star AO WFS Subsystem (NGWS)</td>
<td>The GMT AO system in the NGSAO observing mode will use the light from a single guide star and the facility ASM to provide high-performance wavefront correction to narrow-field infrared instruments over a field of view limited by natural anisoplanatism. The Natural Guide Star Adaptive Optics Wavefront Sensor Subsystem (NGWS) is solely responsible for high-rate wavefront sensing in the NGSAO observing mode, and must therefore sense all wavefront aberrations due to both the atmosphere and telescope, including tip-tilt, segment piston, and higher-order modes. The Natural Guide Star Wavefront Sensor (NGW) is a pyramid-type wavefront sensor which combines high sensitivity and low aliasing properties, and is capable of sensing segment piston across the gaps in the GMT pupil. The NGWS also includes an acquisition imager for guidestar identification. The NGWS is a subsystem of the Visible Wavefront Sensor System (VWS), which will be replicated and mounted to the front of any FP AO instrument requiring the NGSAO observing mode. To accommodate instruments using the LTAO observing mode, the VWS also supports a LGS Fold optics, which redirects light at 589 nm wavelength to the Laser Tomography Adaptive Optics Wavefront Sensor Subsystem (LTWS).</td>
</tr>
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<td>Term</td>
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</tr>
<tr>
<td>Off-axis OIWFS</td>
<td>The Off-axis On Instrument WFS has four main functional requirements that drive its architecture. These are:[1] The OIWFS must measure the Tip-Tilt of the natural guide star at rates up to 1kHz in order to compensate for the image motion introduced by the atmosphere and wind induced vibration of the telescope. [2] The OIWFS must measure Focus at rates of up to 10Hz. [3] The OIWFS must measure Telescope Segment Piston. Due to the possibility of tomographic reconstruction errors, the OIWFS must include a dynamic calibration WFS (also called a Truth WFS) that monitors the reconstruction being applied to the Adaptive Secondary Mirrors (ASM). Also the Off-axis OIWFS reside inside the FP AO Instrument and the natural guide star is selected from within a 180” diameter guide field by a Beam steering mirror/probe provide by the Instrument. For the off-axis OIWFS, the FP AO instrument fulfills the following functions: [1] Accurately setting the offset between the NGS and the science target. [2] Adjusting the offset for the effect of atmospheric dispersion between the tip-tilt WFS wavelength and the wavelength of the science target during the observation. [3] Implementing all telescope pointing operations required by the science instrument. For example, offsetting, nodding, etc.</td>
</tr>
<tr>
<td>On-axis OIWFS</td>
<td>For FP AO instruments using a single on-axis guide star the science instrument is required to send part of the light from the star to the On-axis on instrument WFS. This may be out of band light or a percentage of the total light. Which solution depends on the science instrument? The OIWFS is used to measure Tip/Tilt, Focus and HO corrections.</td>
</tr>
<tr>
<td>Phasing Camera Subsystem (PhCS)</td>
<td>A wavefront sensor carried by the Acquisition, Guide, and Wavefront Subsystem which provides initial piston alignment of the telescope segments in the diffraction-limited AO observing modes.</td>
</tr>
<tr>
<td>Sky coverage at the Galactic Pole</td>
<td>How often a random pointing around the Galactic Pole will allow to finding a suitable guide star.</td>
</tr>
<tr>
<td>Slow Tip/tilt errors</td>
<td>Slow Tip/tilt errors are define as wavefront errors at frequencies less or equal than 0.1 Hz</td>
</tr>
<tr>
<td>Visible WFS Support Subsystem (VWSS)</td>
<td>The VWSS is composed of a support structure, a deployment mechanism, and an enclosure so as to provide structural support, deployment and protection housing for the NGWS, LTWS, LGS Dichroic and the Telecentric Lens. It is mechanically connected to the frontal surface of each FP AO instrument, and mounted on the GIR upper deck. This means that VWSS and visible wavefront sensors will experience variation in the gravity loading as the telescope tracks across a star, and consequently, a differential flexure. Because fold optics on a deployment mechanism are included in the optical path of the visible wavefront sensors, this may significantly impact registration between their focal planes in decenter, tilt of image planes, and focus. The VWS fulfills the function to support and protect the LGS Dichroic, Telecentric Lens, NGWS, and LTWS.</td>
</tr>
<tr>
<td>Visible WFS System (VWS)</td>
<td>The VWS is located in front of the FP AO Instruments. It feeds the NGSAO and LTAO capabilities to those instruments. It has four major subsystems: NGWS, LTWS, VWSS and VWS Heat exchanger Subsystem.</td>
</tr>
</tbody>
</table>
### B.6 Instrumentation

<table>
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<tr>
<th>Term</th>
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<tbody>
<tr>
<td>Active Instrument Set</td>
<td>An active instrument set is any group of science instruments that are mounted on the telescope, configured and ready for observations on a given night. That is, they are in use or in a standby state.</td>
</tr>
<tr>
<td>AP Instrument</td>
<td>An AP Instrument is a science instrument mounted at one of the two Auxiliary Ports.</td>
</tr>
<tr>
<td>DG Instrument</td>
<td>A DG Instrument is a science instrument mounted at one of the Direct Gregorian Ports.</td>
</tr>
<tr>
<td>Expansion Instrument Ports</td>
<td>GMT will be designed to accommodate future expansion of the Science Instrument Ports. Optical relays or fiber feeds from above the GIR will be required in order to feed the beam to these stations. There are two auxiliary port instrument locations: An Instrument Platform (IP) Station is located on top and at one end of the Instrument Platform; and Auxiliary Port (AP) stations will be provided on the outside of the C-Rings above the level of the IP.</td>
</tr>
<tr>
<td>Facility Calibration System</td>
<td>The Facility Calibration System provides calibration illumination, both flat field and spectral, to the Science Instruments, and calibration illumination and a retro-reflector to the Adaptive Optics System and Telescope System. It is located at the prime focus of the telescope.</td>
</tr>
<tr>
<td>Facility Instruments</td>
<td>Facility Instruments are available to all users and are supported and maintained as part of the GMTO facility. Generally, instrument groups external to GMTO Corporation develop them under contract. Instrument teams may also provide long-term maintenance and continuing development of Facility Instruments under contract to GMTO.</td>
</tr>
<tr>
<td>FP AO Instrument</td>
<td>The FP AO instrument is a GMT Facility Instrument, located at the FP focus station in the GIR. It is intended to use with the VWS as part of the NGSAO and LTAO observing modes. The VWS is attached in front of the Instrument window.</td>
</tr>
<tr>
<td>FP Instrument</td>
<td>A FP instrument is a science instrument mounted at one of the Folded Ports locations.</td>
</tr>
<tr>
<td>IP Instrument</td>
<td>An IP Instrument is a science instrument mounted on the Instrument Platform.</td>
</tr>
<tr>
<td>PI Instruments</td>
<td>A PI Instrument is one developed by an external organization for private use at GMT by the instrument team and its collaborators. PI Instruments on GMT will require approval and authorization by GMTO. GMTO will provide limited support for logistics, mounting PI Instruments on the telescope, and normal telescope scheduling and operation. The instrument team will be responsible for instrument operation, support, and maintenance. Details will be spelled out in an agreement between GMTO and the instrument team institution before the instrument can be authorized for installation on the GMT.</td>
</tr>
<tr>
<td>Science Instrument</td>
<td>A Science Instrument is an optical device that detects the photons collected by M1, within the wavelength range of GMT, and converts the detected photons into a form that can be saved and later analyzed to yield information about the photon source, or about the environment(s) between the source and the instrument. Two types of science instruments are initially defined for GMTO, Facility Instruments and Principal Investigator (PI) instruments.</td>
</tr>
</tbody>
</table>
### B.7 Enclosure and Facilities

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Auxiliary Building Bridge Crane</td>
<td>An Auxiliary Building bridge crane that traverses the Instrument and M2 Bays.</td>
</tr>
<tr>
<td>Auxiliary Building Fixed Crane</td>
<td>An Auxiliary Building fixed crane for use primarily in M1 handling operations.</td>
</tr>
<tr>
<td>Drive and Idler Bogie System</td>
<td>System of wheels that support the weight of the Enclosure, react side loads, and provide for controlled rotation about the vertical axis. Rotational control is provided by drive motors on the Drive Bogies.</td>
</tr>
<tr>
<td>Enclosure</td>
<td>Large structure that forms the basic moving building envelope of the Enclosure Building. It consists of the main and secondary structural members, wall systems, overhead cranes, shutters, wind vents, bogies, enclosure control system, and building services. The Enclosure is capable of full 360 degree rotation about the vertical axis and tracking celestial objects at sidereal and other rates as specified.</td>
</tr>
<tr>
<td>Enclosure Azimuth Track</td>
<td>Large circular track that is located to the top of the stationary Enclosure Base. The GMT Enclosure is supported on top of, and rotates on, the Azimuth Track via the Drive and Idler Bogies. The enclosure rotation is mechanically independent of the rotation of the telescope.</td>
</tr>
<tr>
<td>Enclosure Base</td>
<td>All of the structures and entities below the enclosure Bogies. It includes the Enclosure Support Structure, Enclosure Azimuth Track, Enclosure Base Elevator 1 (EB-E1), Utility Room, Enclosure Base Foundations, Jib Crane, Building Services, Telescope Pier Wind Screen, Cart Guides and Rails, stairs, doors, access, etc.</td>
</tr>
<tr>
<td>Enclosure Base Elevator</td>
<td>The Enclosure Base Elevator is provided to lift small equipment and personnel between grade levels, the Enclosure Base Service level and the Observing Floor.</td>
</tr>
<tr>
<td>Enclosure Base Jib Crane</td>
<td>A jib crane, near the Telescope Pier Portal for general use in material handling.</td>
</tr>
<tr>
<td>Enclosure Base Service Level</td>
<td>A level, below the Observing Floor that provides access to the catwalk attached to the outer perimeter of the Telescope Pier.</td>
</tr>
<tr>
<td>Enclosure Building</td>
<td>The Enclosure Building is comprised of the Enclosure, Enclosure Base and the Telescope Pier.</td>
</tr>
<tr>
<td>Enclosure Control System</td>
<td>A PLC-based system that actively positions and controls the various components of the enclosure including enclosure rotation, shutter operation, wind vent operation, safety interlocks, lighting systems, ventilation systems, and other miscellaneous sensors.</td>
</tr>
<tr>
<td>Enclosure Cranes</td>
<td>Enclosure Cranes are attached to the inside of the Enclosure structure and are used for various handling and maintenance tasks associated with the operation of the telescope. They are also used in the final assembly and integration of the telescope. The Enclosure Crane is used for Primary Mirror Assembly exchange.</td>
</tr>
<tr>
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<tr>
<td>Enclosure Elevator</td>
<td>Enclosure Elevator provides a lift for equipment and personnel between the Observing Floor and the Secondary Mirror Service Platform and catwalks.</td>
</tr>
<tr>
<td>Enclosure Support Structure</td>
<td>Stationary structure below the Enclosure Bogies. It includes the primary and secondary structural elements, the stationary Observing Floor and Telescope Pier Wind Shield.</td>
</tr>
<tr>
<td>Equipment Building</td>
<td>Detached building housing the mechanical equipment (hydraulic, pneumatic, HVAC, liquid chillers) for the enclosure and facilities.</td>
</tr>
<tr>
<td>Exhaust System</td>
<td>The Exhaust System consists of a fan and ducting to remove waste heat from the enclosure and enclosure base and direct it away from the telescope line of sight.</td>
</tr>
<tr>
<td>Facilities Building</td>
<td>Detached building consisting of offices, telescope control room, computer room, kitchen, electronics lab, detector lab clean room and infirmary.</td>
</tr>
<tr>
<td>Horizontal Shutters</td>
<td>The Horizontal Shutters ride on tracks at the top of the Enclosure to close and seal the observing opening when the telescope is stowed. The shutters are nesting and can be partially closed to provide wind and moon light shielding for the telescope during science operations.</td>
</tr>
<tr>
<td>M2 Access Platform</td>
<td>A platform, temporarily attached to the Enclosure Crane, used to provide personnel access to the telescope top end with the telescope locked at zenith.</td>
</tr>
<tr>
<td>M2 Service Platform</td>
<td>A platform, attached to the Enclosure structure that provides personnel access to the telescope top end with the telescope at an elevation angle of approximately 30 degrees. The platform provides safe personnel access for maintenance and inspection activities.</td>
</tr>
<tr>
<td>M2 Test Pit</td>
<td>An excavated pit in the M2 Bay.</td>
</tr>
<tr>
<td>Observing Floor</td>
<td>Fixed floor of the Enclosure Base at the elevation of the top surface of the Azimuth Disk.</td>
</tr>
<tr>
<td>Pier Lift Platform</td>
<td>Pier Lift Platform is located in the center of the Telescope Pier and is used to raise Direct Gregorian (DG) Instruments from ground level into the GIR from inside the Telescope Pier.</td>
</tr>
<tr>
<td>Platform</td>
<td>The cleared and level area on the summit defined as grade level for the Enclosure Base and Summit Support Facility.</td>
</tr>
<tr>
<td>Power and Data Transfer System</td>
<td>System of fixed cabling and flexible cabling that allows transfer of power and data signals from the fixed enclosure base onto the rotating enclosure and shutters.</td>
</tr>
<tr>
<td>Stub-Up</td>
<td>A conduit or copper electrode that protrudes through concrete floors or walls that is used for connections to electrical installations. These are usually installed before pouring the concrete.</td>
</tr>
<tr>
<td>Summit Support Building</td>
<td>The Summit Support Building includes the Facility, Auxiliary and Equipment buildings.</td>
</tr>
<tr>
<td>Summit Support Facilities</td>
<td>The Summit Support Facilities include the Summit Support Building, the GMT environmental Facility and the Guide rails system</td>
</tr>
<tr>
<td>Telescope Pier</td>
<td>A cylindrical reinforced concrete structure at the center of the enclosure that supports the telescope. The top of the Telescope Pier interfaces to the Telescope Azimuth Track and Telescope Lower Utility Transfer system</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>Telescope Pier Portal</td>
<td>A large portal through the Telescope Pier at grade Level. The Portal is sized to allow DG Instruments, GIR parts and other objects to enter into the interior of the Pier.</td>
</tr>
<tr>
<td>Telescope Pier Wind Screen</td>
<td>An insulated wall system, surrounding the Telescope Pier</td>
</tr>
<tr>
<td>Ufer Ground</td>
<td>An Ufer ground includes concrete encased electrodes (rebar) in the footings and floors, which are bonded to the building steel and electrical ground to become part of the building grounding system. This provides a much improved grounding system because the increased pH of the concrete/soil interface makes a good conductor for electrical energy or lightning currents. The Ufer ground is especially effective for dry desert-like soil conditions where conductivity is poor.</td>
</tr>
<tr>
<td>Vertical Shutters</td>
<td>The Vertical Shutters are mounted on the front of the Enclosure to close and seal the observing opening when the Telescope is stowed. The shutters are nesting and can be partially closed to provide wind and moon light shielding for the telescope during science operations.</td>
</tr>
<tr>
<td>Wind Vents</td>
<td>System of openings in the exterior wall system that allow wind driven ventilation of the interior volume of the Enclosure. The openings incorporate a system actuated doors that allow control over the amount of ventilation.</td>
</tr>
</tbody>
</table>