NGAO Functional Requirements

Key	Name	Sect	Cat	Priority	WBS	Description	Rationale	Traceability	Status	Version	Verification	Originator	Last Modified
FR-1234	Minimum elevation	Overall	Functional	Essential	2.4.4	The LGS asterism shall point up till 60 degrees off zenith	Science requirements	This requirement is derived from SRD requirements XXXX. The stressing science case is the imaging of the Galactic center see also: Architecture_reqments_summary_v7.xls	Draft	1.0	Test	Viswa Velur	Mar 10, 2009 12:33 PM
FR-1236	Launch telescope alignment to Keck telescope	Overall	Performance	Essential	2.4.4	LTA: Alignment accuracy/tolerance (internal and to the optical axis of the K1 telescope) shall be TBD	Alignment standard, pointing standard	Engineering decision made by VNV	Draft	1.0	Inspection	Viswa Velur	Mar 10, 2009 10:24 AM
FR-1237	Coating damage threshold	Optical	Performance	Essential	2.4.4	LTA: The optical coatings used in the LTA optics shall withstand TBD J of power in TBD mSec.	Safety, throughput standard	Engineering decision made by VNV	Draft	1.0	Inspection	Viswa Velur	Mar 10, 2009 12:19 PM
FR-1238	Input beam format	Optical	Functional	Essential	2.4.4	LTA: The input beam shall be TBD (beam format)	LTA input beam format (as prescribed by LTA vendor)	Engineering decision made by VNV and JC	Draft	1.0	Test	Viswa Velur	Mar 10, 2009 12:20 PM
FR-1239	Output beam format	Optical	Functional	Essential	2.4.4	LTA: the output beam shall be TBD mm dia.	LTA spec for RFQ to possible vendors	Engineering decision made by VNV	Draft	1.0	Test	Viswa Velur	Mar 10, 2009 12:19 PM
FR-1240	Depth of focus at sodium layer	Optical	Performance	Essential	2.4.4	. And shall focus anywhere between 90 Km -180k			Draft	1.0	Test	Viswa Velur	Mar 10, 2009 12:28 PM
FR-1241	Testable without 589 nm light	Optical	Functional	Essential	2.4.4	LTA: The LTA shall be testable without the use of a 589 nm laser	So that LTA tests can be performed independent of the laser	Engineering decision made by VNV	Draft	1.0	Demonstration	Viswa Velur	Mar 10, 2009 12:21 PM
FR-1242	Wavefront error	Optical	Performance	Essential	2.4.4	LTA: The total RMS error of the LTA shall be TBD nm	Optical quality of LTA should not limit laser spot size.	Engineering decision made by VNV	Draft	1.0	Test	Viswa Velur	Mar 10, 2009 12:22 PM
FR-1243	Elevation range	Optical	Performance	Essential	2.4.4	LTA: The LTA shall work between -5° to 90.5°.			Draft	1.0	Test	Viswa Velur	Mar 10, 2009 12:22 PM
FR-1244	transmission	Optical	Performance	Essential	2.4.4	LTA: The LTA throughput shall be > 95%.	Limit laser power loss at LTA	Engineering decision made by VNV	Draft	1.0	Inspection	Viswa Velur	Mar 10, 2009 12:23 PM
FR-1245	Optical bandwidth	Optical	Performance	Essential	2.4.4	LTA: The LLT shall work over 400-700 nm so that star-light can be used to align it properly (should we specify some chromatic spec. here?)	Specify performance during star viewing mode	Engineering decision made by VNV	Draft	1.0	Inspection	Viswa Velur	Mar 10, 2009 12:29 PM
FR-1246	Star viewing mode	Optical	Functional	Essential	2.4.4	LTA: Shall work both in laser projecting mode and star viewing mode	Facilitate LTA alignment, coarse focusing and boresiting WRT to Keck telescope	Engineering decision made by VNV	Draft	1.0	Demonstration	Viswa Velur	Mar 10, 2009 12:24 PM
FR-1247	Focus mechanism	Optical	Functional	Essential	2.4.4	LTA: Shall have a active focus mechanism	To keep the Na spot focused.	Engineering decision made by VNV	Draft	1.0	Demonstration	Viswa Velur	Mar 10, 2009 10:39 AM
FR-1248	Focus resolution	Optical	Performance	Essential	2.4.4	LTA: The focus resolution shall be TBD	To limit the spot blur at the sodium layer	PALAO, K1 LGS	Draft	1.0	Test	Viswa Velur	Mar 10, 2009 10:30 AM
FR-1249	Focus range	Optical	Performance	Essential	2.4.4	LTA: The active focus range shall be TBD	To keep the Na spot focused.	PALAO.	Draft	1.0	Test	Viswa Velur	Mar 10, 2009 10:33 AM
FR-1250	Field of view	Optical	Performance	Essential	2.4.4	LTA: The LTA shall have a unvignetted FoV of 202" with an	Optical quality over the entire FoV of LTA spec.	EBS, sky coverage	Draft	1.0	Inspection	Viswa Velur	Mar 10, 2009 10:34 AM

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						RMS error over this field as specified in							
FR-1251	LGS positioning accuracy	Optical	Performance	Essential	2.4.4	LTA: Each LGS beacon shall have a pointing accuracy of TBD arcsec.	To keep LGS asterism deformation error in check	tomography error, LGS asterism deformation allocation	Draft	1.0	Test	Viswa Velur	Mar 10, 2009 10:34 AM
FR-1253	High power operation	Optical	Performance	Essential	2.4.4	The LTA shall be able to withstand TBD Watts of 589 nm laser power with spectral and temporal format specified by	Leads to optical specification on the optics and coatings.	Optics and coatings performance specs.	Draft	1.0	Analysis	Viswa Velur	Mar 10, 2009 12:32 PM
FR-1254	Obscuration in beam	Optical	Functional	Essential	2.4.4	LTA: The secondary structure and spiders shall have an area of 1/100th or lesser as compared to the laser beam.	Assumes a on-axis telescope for a projector, to limit the size of the secondary.	Engineering decision made by JC based on K1 LGS	Draft	1.0	Analysis	Viswa Velur	Mar 10, 2009 10:36 AM
FR-1255	In-situ testing	Optical	Functional	Essential	2.4.4	LTA: The optical quality of the LTA shall be testable in-situ.	In situ testing requirement. It is very hard to access the LTA.	Engineering decision made by VNV	Draft	1.0	Test	Viswa Velur	Mar 10, 2009 10:38 AM
FR-1260	Launch telescope flexure	Mechanical	Performance	Essential	2.4.4	Flexure/ FEA: The LTA flexure and strain characteristics shall conform to those prescribed by xxx document.	LTA flexure specs to vendor	K1 LTA documentation	Draft	1.0	Analysis	Viswa Velur	Mar 10, 2009 10:40 AM
FR-1261	Launch telescope volume	Overall	Functional	Essential	2.4.4	The LTA must fit within a volume of 610x680x635 mm	total LTA volume requirement.	Based on advice by JC	Draft	1.0	Demonstration	Viswa Velur	Mar 10, 2009 10:40 AM
FR-1262	Center of gravity	Mechanical	Functional	Essential	2.4.4	LTA: Center of Gravity (TBD)	LTA mechanical requirement	K1 LGS documentation	Draft	1.0	Analysis	Viswa Velur	Mar 10, 2009 10:41 AM
FR-1263	Mechanical eignemodes	Mechanical	Performance	Essential	2.4.4	LTA: Eigen modes (TBD)	LTA mechanical requirement	K1 LGS documentation	Draft	1.0	Analysis	Viswa Velur	Mar 10, 2009 10:42 AM
FR-1264	Hermetically sealed	Mechanical	Functional	Essential	2.4.4	LTA: The LTA shall be hermetically sealed with dry N2.	Protect most of the optics from the elements and condensation	K1 LGS documentation	Draft	1.0	Demonstration	Viswa Velur	Mar 10, 2009 10:43 AM
FR-1265	Nitrogen filled	Mechanical	Functional	Essential	2.4.4	The LTA unit shall be kept in a controlled atmosphere filled with dry N2. The LTA shall be air-tight from the entrance window to the exit window between xx-yy PSI pressure prevailing inside the assembly.	Protect most of the optics from condensation	K1 LGS documentation	Draft	1.0	Demonstration	Viswa Velur	Mar 10, 2009 10:43 AM
FR-1354	Single launch telescope	Overall	Functional	Essential	2.4.4	A single Laser Launch Telescope shall be used to propagate all nine laser beams.	Space, cost and serviceability	Engineering decision made by VNV and JC	Draft	1.0	Demonstration	Viswa Velur	Mar 10, 2009 12:27 PM
FR-1357	Launch telescope location	Overall	Functional	Essential	2.4.4	The LLT shall be mounted behind the secondary and the laser guide stars shall be launched from the optical axis.	Arch. Choice, also keeps LGS spot elongation to a min.	Arch. Retreat decision, KAON 499?, van Dam's paper on LGS spot elongation errors.	Draft	1.0	Inspection	Viswa Velur	Mar 10, 2009 12:27 PM
FR-1364	Laser Launch Telescope location	Overall	Functional	Essential	2.4.4	The LLT shall be mounted behind the secondary, on-axis w.r.t. the Keck telescope optics axis.	[Architectural choice to reduce spot elongation effects	KAON 499 "NGAO System Architecture Definition"	Draft	1.0	Inspection	Viswa Velur	Mar 10, 2009 12:26 PM
FR-1372	Motion control	Overall	Functional	Essential	2.4.4	LTA: Motion control lines (TBD)	TBD	TBD	Draft	1.0	Test	Viswa Velur	Mar 10, 2009 11:47 AM
FR-1375	Cooling	Overall	Functional	Essential	2.4.4	LTA: Cooling - The LTA electronics shall be cooled using facility glycol lines	To ensure that heat emitted by the electronics doesn't contribute to dome seeing	Keck engineering practice	Draft	1.0	Demonstration	Viswa Velur	Mar 10, 2009 11:46 AM
FR-1376	Storage and shipment	Overall	Environmental	Essential	2.4.4	LTA: Storage and shipping requirements - need to cross reference a table or write out as individual requirements	TBD	TBD	Draft	1.0	Test	Viswa Velur	Mar 10, 2009 11:44 AM

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FR-1377	Power usage	Overall	Performance	Essential	2.4.4	LTA: The LTA and associated electronics shall consume less than xx KW of electrical power	Observatory requirement	Observatory requirement	Draft	1.0	Test	Viswa Velur	Mar 10, 2009 11:47 AM
FR-1378	Gycol cooling	Overall	Functional	Essential	2.4.4	LTA: LTA electronics shall use facility glycol to vent heat.	Observatory requirement to limit heat dissipation into the dome.	Keck engineering practice	Draft	1.0	Inspection	Viswa Velur	Mar 10, 2009 11:46 AM
FR-1379	Heat dissipation	Overall	Performance	Essential	2.4.4	LTA: The LTA shall not dissipate more than TBD W of heat to the ambient air	Observatory requirement to limit heat dissipation into the dome.	Keck engineering practice	Draft	1.0	Inspection	Viswa Velur	Mar 10, 2009 11:45 AM