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Change Log

Date	Affected Section	Change / Reason / Remarks
15/10/2025	–	First draft (v. 01D1)
16/02/2025		Second draft (v 01D2). MAO-2136 system budget mandatory updates at FARR and OARR MAO-2041 Zemax files as RD MAO-2134 intermediate milestone for subsystem inspection/verification report MAO-2167 time for FDR review

Art. 1 Definitions and purpose of the document

1.1 Definitions

- **Bidder.** Any company or other economic operator that submits an offer for the present Call.
- **Contracting Authority.** INAF - Osservatorio Astronomico di Brera (INAF-OAB) is the contracting authority for this project.
- **Contractor.** The company or other economic operator that signs with INAF the contract for this project.
- **ESO.** The European Southern Observatory (ESO) is an intergovernmental science and technology organisation in astronomy. It is the commissioning party of MORFEO, a first-generation instrument of ELT, the Extremely Large Telescope under construction in Chile. ESO is entitled to participate, as a reviewer, to the Final Design Review.
- **Factory.** Throughout this document, “Factory” refers to the contractor premises, where the first acceptance test is carried out.
- **FDR.** Final Design Review
- **Functional requirements.** Requirements that indicate the purpose and function of the supply.
- **LGS.** MORFEO Laser Guide Star subsystem.
- **LGS Objective.** In this document, in the “Disciplinare” and in the Draft Contract the term ‘LGS Objective’ includes all the items to be supplied for the subsystem as shown in AD1 section 3.2.
- **LGSO.** LGS Objective.
- **On-site.** Throughout this document, “On-site” refers to the INAF integration hall.
- **Quality and Performance requirements.** Requirements that define what performance and level of service the supply must have.
- **SLA.** Service Level Agreement.
- **SoW.** Statement of Work
- **Technical requirements.** Requirements that define the characteristics and technical specifications of the supply.

In this document and in all other documents of the Call the following convention applies:

- **Shall** indicates a mandatory requirement
- **Should** indicates an optional, desired requirement
- **Will** indicates a circumstance expected to happen

1.2 Purpose of the document

This document describes and specifies the subject of the contract and the relative milestones and deliverables. The technical requirements for the system are described in the Technical Specification documents (AD1 and AD2) that are an integral part of this Statement of Work, while the contractual and financial aspects are described in the documents “Disciplinare di Gara” and drafted in “Schema di Contratto”.

Art. 2 Background, context and vision

MORFEO (formerly known as MAORY) is a post-focal adaptive optics module that forms part of the first light instrument suite for ELT, the ESO Extremely Large Telescope (39m diameter) currently under construction. The main function of MORFEO is to relay the light beam from the ELT focal plane to the client instruments while compensating the effects of the atmospheric turbulence and other disturbances affecting the wavefront from the scientific sources of interest. MORFEO enables high angular resolution observations in the near infrared over a large field of view ($\sim 1 \text{ arcmin}^2$) by real time compensation of the wavefront distortions due to atmospheric turbulence. Wavefront sensing is performed by laser and natural guide stars while the wavefront compensation is performed by adaptive deformable mirrors in MORFEO which work together with the telescope's adaptive and tip tilt mirrors M4 and M5 respectively.

MORFEO is being designed and built by a consortium of partners in Italy, France, Canada and Ireland (also referred to as “the Consortium” in the following), together with ESO. INAF, as the leading institute, is responsible for all the major procurements and for the integration of the instrument that will take place at the Bologna Integration Hall located beside INAF OAS Institute in Bologna, Via Gobetti 93/3, Italy.

2.1 Timeline of MORFEO project (Phases and Reviews)

Preliminary Design Phase

During this phase the conceptual design of MORFEO, originally produced during the Phase A Study, is developed into a preliminary design for the fulfilment of the requirements defined in the MORFEO Technical Specification.

Preliminary Design Review (PDR)

The purpose of this review is to scrutinise the compatibility of the preliminary design with the Technical Specification and its applicable documents. During the PDR the overall instrument, the cost, schedule and risks associated with the development of MORFEO as well as the status of the interface design documents shall be reviewed. The PDR shall take place when the hardware development specifications and the software top level design documents and their corresponding verification / test plans are available. The MORFEO PDR took place in two

distinct phases: April 2021 and July 2021. The formal conclusion of the PDR occurred in February 2023.

Final Design Phase

In this phase MORFEO is designed down to the level of components. The major manufacturing drawings must be available at the end of this phase.

Final Design Review (FDR)

The purpose of this review is to ensure that the detailed hardware and software design solutions as reflected in the submitted drawing set, the interface design documents and other relevant documents satisfy the requirements established by the Technical Specification (AD1) and its applicable documents. The review shall also demonstrate that the instrument can be successfully integrated into the observatory. There is the possibility of having earlier FDR for critical components.

The LGSO is a critical component of the MORFEO system since its design and implementation require a significant time and effort and can influence the overall schedule.

Manufacture, Assembly, Integration and Test (MAIT) Phase

The MORFEO MAIT phase comprises two main sub-phases:

1. The subsystem MAIT, including the construction/procurement of the pieces composing the subsystem, the assembly and integration of such pieces and the test of the integrated subsystem as a stand-alone unit at the factory.
2. The system AIT, that involves the assembly and integration of the various subsystems in order to compose the full system and the test of the integrated MORFEO system at the INAF Integration Site.

Preliminary Acceptance in Europe (PAE)

Once MORFEO has been assembled, aligned and all sub-system tests performed in the Consortium's Integration Facility, the system acceptance tests foreseen in the PAE test Plan shall be performed. During the PAE the Consortium shall demonstrate to ESO the conformity of the instrument performance with the technical specifications and its applicable documents.

After the successful completion, ESO will grant Preliminary Acceptance (Europe) and authorise the shipment of MORFEO to the final observatory location. The PAE meeting should be held at the Consortium's Integration Facility.

The Preliminary Acceptance in Europe (PAE) is scheduled for December 2030; however, the date remains subject to change.

Transport and Incoming Inspection Phase

After passing the PAE, the Consortium has to pack MORFEO in a manner suitable for road and air or sea transport. The transport will be organised by the Consortium.

Once arrived at the Chile location the material is inspected to verify that it hasn't received any damage during the transport.

Installation and Commissioning Phase

The MORFEO system will be assembled, integrated and tested in the Integration and Assembly Area at the telescope and then moved to the Nasmyth platform and commissioned.

Provisional Acceptance (Chile) (PAC)

The PAC has the objective to demonstrate that the instrument meets the requirements of the Technical Specifications and its applicable documents, and that all tasks described in this SoW have been satisfactorily fulfilled.

The PAC is planned for 2032 and is followed by a 2-year guarantee period.

Art. 3 Subject of the contract

This SoW applies to the delivery of one LGSO subsystem, as defined in AD1 section 3.2, needed by MORFEO and covers:

- the design phase
- the manufacturing phase which includes the assembly, integration and test (MAIT) at the company premises
- the delivery and commissioning at the integration hall in Europe (Bologna, Italy).

The Kick Off Meeting shall mark the official start of project activities. The Kick Off Meeting shall take place within 30 days from contract signature.

Assuming as T0 the date of the contract signature with the selected contractor, the project shall follow the timeline indicated in Section 4.2.

In the following the Applicable and Reference Documents for this supply are listed.

3.1 Applicable Documents

The following applicable documents (AD) of the exact issue shown form a part of this document to the extent described herein. In the event of conflict between the documents referenced herein and the contents of this document, the contents of this document are the superseding requirement.

- AD1 E-MAO-PFH-INA-SPE-003_01 LGSO Technical specification

- AD2 SAF-GEN-MAN-3444 version 05 ESO Safety – Safety Conformity Assessment Procedure

3.2 Reference Documents

- RD1 E-MAO-SF0-INA-MOD-002_02 OFDR MORFEO Zemax model

3.3 Definition of Project Items

This project concerns the Laser Guide Star Objective of MORFEO and all the related documentation, as specified in the following sections.

The Contractor shall procure and deliver the items specified in Section 3.2 of AD1.

Art. 4 Contractual Phases, acceptance procedure, deliverables, timeline and milestones

4.1 Contractual Phases

The project shall comprise the following phases:

a) Phase 1 - Final Design and Optional Early Procurement of LLIs (firm phase)

Subphase 1.1 - Final Design:

- Design and performance analysis of LGSO
- Delivery of the expected documentation (full list and timeline specified in Section 4.4 and 4.5).
- Final Design Review

Subphase 1.2 - Optional Early Procurements of LLIs:

- Procurement of elements necessary for the construction of LGS Objective which require long production times (list to be proposed by the contractor and to be approved by INAF at contract signature)
- Delivery of the expected documentation (full list and timeline specified in Section 4.4 and 4.5).

b) Phase 2 - Procurement, Manufacturing, Assembly, Integration and Test (conditional phase)

Subphase 2.1 - Procurement, Manufacturing and Assembly:

- procurement, construction, and integration of all components required for the realization of the LGS Objective.
- Delivery of the expected documentation (full list and timeline specified in Section 4.4 and 4.5).

Subphase 2.2 - Integration and Test:

- Integration and Factory Acceptance Test of LGS Objective
- Delivery to INAF Integration Site, On-site Acceptance Test and commissioning of the LGS Objective at the INAF Integration Site
- Delivery of the expected documentation (full list and timeline specified in Section 4.4 and 4.5).

It is expected that the elements necessary for the construction of the optical elements which require long production times (Long-Lead Items) are the optics blanks. Additional items can be proposed by the company.

For the start of Phase 2 (conditional and not guaranteed) shall be subject to the following conditions:

- INAF accepts the Final Design for the LGS Objective upon review and implementation of the joint recommendations by the MORFEO Consortium and ESO

4.2 Acceptance procedure

For the LGS Objective the acceptance procedures shall be as follows:

Phase 1

INAF will approve the Final Design by evaluating the corresponding documents (full list and timeline specified in Section 4.4 and 4.5) and will declare it successfully closed after the successful implementation of all the relevant actions coming from the FDR.

INAF will accept the (optional) Early Procurements by evaluating the procurement documentation and by verifying that the purchased elements are available and in working conditions.

Phase 2

For Phase 2 there shall be a review and two separate acceptance procedures.

Integration Readiness Review: it ensures that the activities to be carried out in the Integration phase are clearly identified, sorted out and scheduled, have assigned resources

and the persons responsible and the success criteria for all activities are clear.

Factory Acceptance: acceptance procedure for the physical equipment (LGSO) shall be carried out through structured test sessions. The procedure shall start with the verification that all the expected items (See AD1, section 3.2) are present and in working conditions. Then specific test sessions shall verify that the LGSO fulfils all the technical specifications. The test sessions shall be executed at the Factory premises.

On-site Acceptance (also referred to as “commissioning”): it comprises the execution of the On-Site test and the correction of any non-compliance until the LGSO fulfils all the technical requirements. This acceptance phase ends under the condition that all the Requests for Waivers are closed and all agreed changes are implemented.

4.3 Timeline and Milestones

In the following the high-level project schedule is reported, under the form of Gantt chart and under tabular form.

The date of the Kick Off Meeting of Phase 1 shall be decided at the time of the contract signature (T0) and must in any case take place within 30 days from the date of the contract signature.

The start of Phase 2 (T1) shall happen when all critical Action Items arising from the LGSO’s FDR are closed, and in any case only after formal approval to proceed from INAF.

In the following schedules we have assumed, as the maximum reference time, a $T1=T0+19$. Please note that while this represents the upper limit, T1 may occur earlier.

All the dates of milestones are to be considered tentative and shall be confirmed at project start, except for the following milestones:

- LGSO delivery of Final Design documentation
- LGSO On-Site Acceptance (End of Phase 2)

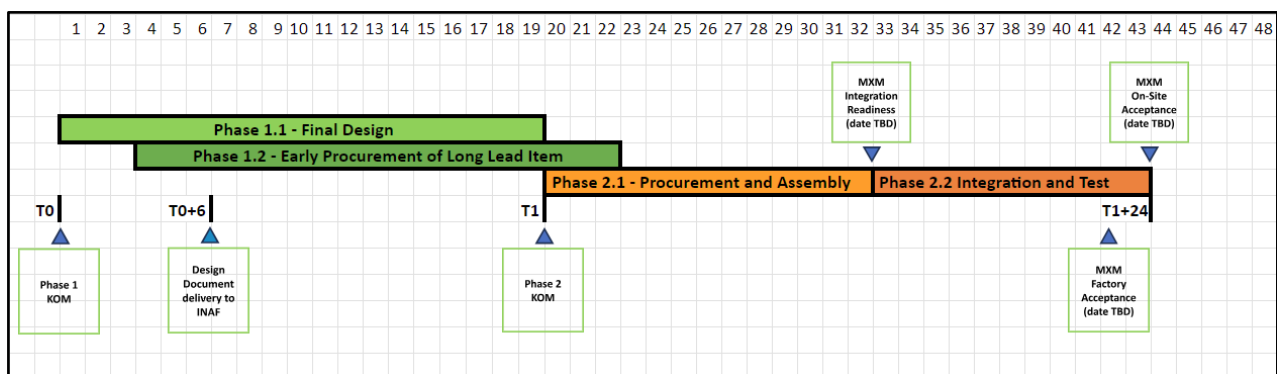


Figure 1 - Project schedule of the LGSO (Units are in Months)

LGS Objective Phase 1 (T0 start of activities TBD)			
Activity/Milestone	Start	Stop	Description
<i>Subphase 1.1 - Final Design</i>			
Contract Signature	T0		Contract signature. Kick-Off Meeting to be arranged within one month from contract signature
LGSO Kick Off Meeting (KOM)	T0+1		The main objectives of the Kick-Off Meeting are to confirm mutual understanding of the scope of work specified herein, including its applicable specifications. The documents supporting the Kick-Off Meeting shall be submitted to INAF one week before the KOM, for review.
LGSO interfaces finalisation	T0	T0+2	The objective of this activity is to ensure that all the interfaces are closed.
LGSO Design	T0	T0+6	The objective of this activity is to carry out the final design and analysis of the LGSO, in order to be ready to start Phase 2. If identified, Long-Lead item design should be submitted earlier in time to undergo a review by INAF
LGSO delivery of Final Design documentation	T0+6		All the documentation of Final Design is delivered to INAF.
LGSO Final Design Review (FDR)	T0+6	T0+K	The purpose of this review is to ensure that the detailed design solutions as reflected in the submitted drawing set, the interface design documents and other relevant documents satisfy the requirements established by the Technical Specification (AD1). The joint Final Design review meeting with ESO is expected 6 weeks after the delivery of the documentation. The FDR is considered successfully closed after the successful implementation of all the relevant actions. The FDR closure is a condition for the start of Phase 2. The value of K is TBD, though is expected to be 13 months at most.
<i>Subphase 1.2 - Optional Early Procurement of LLIs</i>			
Long-Lead Items Final Design Review (FDR)	T0+2.5	T0+3	This milestone has the objective of reviewing the documentation and design of Long-Lead Items (if needed), to assess their maturity and to formally authorise the start of such early procurements.
Early procurements of LLIs (if needed)	T0+3	T0+R	The objective of this activity is to procure all the elements that require a long time to be built and that

			could impact the overall schedule if their construction is not started in Phase 1. The value of "R" shall be proposed by the bidder.
Long-Lead Items Acceptance	T0+R	T0+R +0.5	Verification that the purchased elements are available and in working conditions in the factory.

Table 1 - Project schedule of the LGSO for Phase 1 in tabular form (Shifts in Months)

During this phase, intermediate milestones, to be agreed during contract negotiations, will require the supplier to submit reports documenting inspections, tests, and verification against the agreed subset of critical requirements.

The reviews reported in Table 1 are detailed in the following:

- **Long-Lead Item Final Design Review**

In this review the design of Long-Lead Items, the subsystem budget that drives this design and the overall subsystem design are verified in order to assess the maturity of the long lead items and to allow the start of their procurement.

- **FDR – Final Design Review**

In this review the final design of the LGSO is verified. Phase 2 cannot start until the FDR has been successfully accepted.

ESO can participate in this review as a reviewer and as joint approving authority.

LGS Objective Phase 2			
Activity/Milestone	Start	Stop	Description
<i>Subphase 2.1 - Procurement, Manufacturing and Assembly</i>			
LGSO Kick Off Meeting for Phase 2	T1		The objective of this Meeting is to verify the presence of all conditions to start Phase 2. The procurement of all non-LLI elements can start after this meeting.
Delivery of the LGSO dummy	T1+6		This milestone marks the delivery of the dummy (see AD1, Section 3.2 and 5.6) to INAF facilities

LGSO Procurement of elements	T1	T1+N	This activity has the objective to procure all the remaining elements (non-LLI) according to the LGSO subsystem list (See AD1, Section 3.2). (The value of “N” shall be proposed by the bidder)
<i>Subphase 2.2 - Integration and test</i>			
LGSO Integration Readiness Review (IRR)	T1+Q-14 days	T1+Q	The purpose of this activity is to verify that the elements of the integration phase (plans, tools, procedures and resources) are clearly identified. The positive conclusion of this review is the condition for the start of integration. (The value of “Q” shall be proposed by the bidder)
LGSO Integration	T1+Q	T1+M	The objective of this activity is to integrate the LGSO at the Contractor’s premises and to prepare the LGSO for the Factory Acceptance. (The value of “M” shall be proposed by the bidder)
LGSO Factory Acceptance Readiness Review (FARR)	T1+M		At this milestone the LGSO, fully integrated, shall be ready for the execution of Factory Acceptance Test. (The value of “M” shall be proposed by the bidder)
LGSO Factory Acceptance Test (FAT)	T1+M	T1+F	This activity has the objective to verify that the LGSO is performing according to its specifications at the Contractor's premises. (The value of “F” shall be proposed by the bidder)
LGSO Factory Acceptance Review	T1+F		This milestone marks the positive acceptance of the LGSO at the Contractor’s premises and the consequent authorisation to ship it to the INAF facility for MORFEO Integration. A Test and Inspection report is signed by both INAF and the Contractor.
LGSO On-Site Acceptance Readiness Review (OARR)	T1+23		After the transport of the LGSO to INAF facility and after its integration the LGSO is ready for the execution of the Acceptance Test.
LGSO On-Site Acceptance Test (OAT)	T1+23	T1+24	During this activity INAF reserves the possibility to carry out selected tests on the LGSO to verify the fulfilment of its specifications at INAF premises.

LGSO On-Site Acceptance Review (End of Phase 2)	T1+24	This milestone marks the positive conclusion of the Test and commissioning at INAF premises and the consequent final acceptance by INAF. A Test and Inspection report is signed by both INAF and the Contractor.
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Table 2 - Project schedule of the LGSO in Phase 2 in tabular form (Shifts in Months)

The readiness reviews reported in Table 2 are detailed in the following:

- **IRR - Integration Readiness Review**

The Integration Readiness Review takes place before starting the integration of the LGS Objective.

The Integration Readiness Review includes the verification that all the activities to be carried out in the Integration Phase are clearly identified, prioritised and scheduled. The responsibility for each of the activities must be also clearly identified.

- **FARR - Factory Acceptance Readiness Review**

The Factory Acceptance Readiness Review takes place before starting the tests at the Contractor's premises, with the LGSO fully integrated and all the required information is gathered in the documentation. FARR assess test objectives, scope, methods and procedures, and safety. FARR is also intended to determine if any changes are required in planning, resources, training, equipment, or timing to successfully proceed with the test.

- **OARR - On-site Acceptance Readiness Review**

The On-site Acceptance Readiness Review takes place before starting the tests at the INAF premises. OARR assess test objectives, scope, methods and procedures, and safety.

It also includes inspection and unboxing of the supply.

OARR is also intended to determine if any changes are required in planning, resources, training, equipment, or timing to successfully proceed with the test.

During the execution of the OARR the presence of Contractor personnel is required.

The test sessions reported in Table 2 are detailed in the following:

- **FAT - Factory Acceptance Test**

The FAT - Factory Acceptance Test is the process of provisional acceptance that assesses the proper functioning of the system(s) at the contractor's site. All interfaces, maintenance, packing and unpacking procedures are also verified.

Test procedures, modes and timeline of the FAT of the LGS Objective shall be defined in detail in the relevant LGSO MAIT Plan by the constructor. The LGSO MAIT Plan shall ensure the proper implementation of all requirements contained in the Compliance Matrix.

Once successfully passed the FAT, the system can be transported to the INAF integration site.

During the FAT all technical requirements and interface requirements described in the LGSO MAIT plan that are foreseen to be verified by test shall be verified by the Contractor. The result of such tests shall be documented in the test reports. The tests executed at the factory shall reproduce to the maximum possible extent the real operational conditions.

When needed, simulators and mock-up devices shall be used to mimic interfaces and operational conditions.

A Test and inspection report (FAT version) shall be issued at the end of the test session, signed by the appointed INAF responsible and counter-signed by a contractor's representative.

- **OAT – On-site Acceptance Test**

In this test session, executed at INAF premises under the responsibility of INAF, a subset of technical requirements and interface requirements is tested.

Test procedures, modes and timeline of the OAT shall be defined and agreed in detail in the relevant LGSO MAIT Plan.

The contracting authority reserves the possibility to carry out selected tests with its own personnel to verify the compliance of the delivered products with the technical and functional requirements.

During the execution of the OAT, the presence of contractor personnel is required.

A Test and inspection report (OAT version) shall be issued at the end of the test session, signed by the appointed INAF responsible and counter-signed by a contractor's representative.

4.4 Deliverables

Types:

D -> Document

M -> 2D/3D Model, Drawing

E -> Equipment

S -> Services

Refer to the tables 2, 6 and 7 for milestones and delivery dates

For the definition of "LGS Objective" (and of the elements composing them) refer to AD1 Section 3.2.

Note that the code used hereby is intended only to enumerate and identify the deliverable items, the proper document numbering shall be agreed with INAF at the contract signature.

LGSO Technical Deliverables (Documents)

Code	Title	Type	Description
PFH-CMX-001	Compliance Matrix	D	Compliance Matrix to Requirements. The Compliance Matrix shall, as a minimum: 1. List in a tabular format all requirements that have been identified in the Call documentation, including the interface requirements. 2. Recapitulate for each requirement the means of verification adopted (by Design, Analysis, Inspection or Test) 3. Provide a statement of compliance and the reference to the document where the compliance is demonstrated or shown. In case of non-compliance (or partial compliance) indicate the pending assessment, possible remarks and the link to the related requirement. 4. List any reference to NCs, CREs or RF(W/D)s documents. 5. Reference to the location of the verification description within the document datapack Note: the template will be provided by INAF
PFH-DER-001	Design Report	D	Design of the LGSO. The Design Report shall contain, as a minimum: a. Assumptions, such as design constraints, environmental conditions other than specified in technical specification, maintenance concept, access concepts b. Materials used in the design with physical properties as well as chemical behaviour, applicable treatments and their purposes c. Detailed description of the system design, all relevant components subsystems and function with reference to every specified requirement specified

			d. Any parts of the design that are not closed and problem areas e. all the description required to prove the requirement that has to be verified by design according to CMX f. TRL (according to appendix of the present document) assessment for critical technologies shall be provided, making sure that FDR TRL 6 is achieved for every items The design shall cover the optical, mechanical, electrical and SW design. The handling tools shall be part of the design.
PFH-ANR-001	Analysis Report	D	Analysis of the system. The Analysis Report, taking into account the actual system design demonstrating that the referred requirement is met, shall contain, as a minimum: a. Requirement analysis b. Functional analysis c. Performance analysis d. Interface analysis in operational conditions e. Reliability analysis f. Earthquake analysis g. Ghost & Stray Light analysis h. Further analyses, as appropriate i. all the analysis required to prove the requirement that has to be verified by analysis according to CMX
PFH-SPE-001	System Budget	D	Technical/Error Budget The Technical/Error Budget shall highlight, at all levels, how a requirement belonging to the Next Higher Assembly (NHA) is broken down into requirements belonging to the Next Lower Assemblies (NLA) which applies to individual elements of the concerned product. The Document shall contain the following set of information, as a minimum:

			1. Purpose of the Document; in this section the purpose of the document shall be identified Scope of the Document; in this section the scope of the document shall be identified 2. Applicable Documents; in this section all the documents referred to in the technical budget shall be listed Definition & Convention; in this section all definitions and conventions used in the Document shall be given. 3. General Assumptions; in this section all general assumptions used in elaborating the technical budget shall be given. This includes assumptions on the mode of error combination (linear, quadratic, etc.), assumptions on the load cases (worst case, average case, etc.), approach regarding margins, etc. 4. Operational Conditions; in this section all operational conditions under which the technical budget applies shall be given. This includes the operational mode and the environmental conditions. 5. Contributors/Error Sources; in this section all contributors or error sources included in the technical budget shall be identified, described and discussed. Any special assumption made as well as a justification of the allocated value (results of an analysis, test result, comparison with past experience, etc.) shall be given with proper references to relevant documentation 6. Technical Budget; in this section the technical budget shall be presented, for instance in the form of a flow chart or in a tabular format, with clear identification of margins at the relevant level. 7 Conclusion; the conclusion shall summarise the outcome of the technical budget in terms of compliance to the top-level requirement, associated margins, critical component(s) of the technical budget, associated Project risk and specific plan for conforming to the budget allocation and mitigating risks.
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PFH-ICD-001	Interface Document	Control	D	The ICD shall list for each interface 1. Interface name and reference number 2. The items to be interfaced 3. The description of the interface 4. The verification status of the interface 5. Reference to Change Request or Request for Waiver, if applicable 6. Status and comments For mechanical interfaces, the copies of the drawings of the items to be interfaced shall be attached to the document. The ICD shall be carefully amended with the updated versions of the drawings.
PFH-PLA-004	MAIT Plan		D	Manufacturing, Assembly, Integration and Test Plan. The system MAIT plan shall be established for the LGSO. The MAIT plan shall give detailed definitions, requirements, conditions and constraints of all manufacturing, assembly, integration, alignment and test activities performed in the factory. Facilities shall be identified and briefly described. Requirements and definitions shall be given for support equipment to cover MAIT phases including handling, transport and storage. The document contains a clear and well detailed verification plan describing the tests to be performed to verify the compliance of the LGSO to the specifications.
PFH-DWG-001	Manufacturing Drawings		M	The package shall contain Assembly drawings, parts drawings and manufacturing drawings. "Drawings" in this context include electronic circuit diagrams. The drawing set shall be delivered according to the product breakdown structure. (drawings numbering to be discussed and agreed with INAF). The document also includes cables, and cooling pipes routing.

PFH-DWG-002	As Built Drawings	M	Drawings after building. The package shall contain the drawings at all levels of the project, in particular of the as built product. "Drawings" in this context include electronic circuit diagrams. The drawing set shall be delivered according to the product breakdown structure. (drawings numbering to be discussed and agreed with INAF)
PFH-MOD-001	Models	M	3D Models and other technical Models. It includes CAD models, FE models, optical models and any other computational and simulation models. The models shall be delivered according to the product breakdown structure. ESO standards shall be used for the modelling as defined in following applicable documents of AD1: - AD4 (ESO-192984) - AD5 (ESO-191462)
PFH-LIS-001	Parts List/Bill of Materials	D	List of parts composing the system. The part list shall contain as minimum: 1. Title or Identification: Name of the item which is shown in its drawing. 2. Part Number. a. For standard components (Fasteners) the dimensions and quality shall be provided according to ISO standards. e.g. ISO 4017-M8x20-8.8 b. For COTS parts the number shall be complete to enable reordering. 3. Quantity: amount of pieces used in the assembly or subassembly 4. Original Equipment Manufacturer (OEM) Name: Extra information shall be given to enable the customer to contact the OEM. (This does not have to be in the parts list) In case an alternate component (or more than one) that may substitute a baseline component is available, this shall be listed and the same information as for the original

			component shall be provided. A clear indication of being an alternate component and for which baseline component shall also be given. For instance a motor of a certain type and make can be used in lieu of the baseline motor, then the alternate motor shall be listed, too. The BoM is a multilevel list of all components contained in a Configuration Item (CI). The BoM shall be delivered in a hierarchical multi-level form. Each sub-assembly shall be listed along with the components that make up that subassembly. An individual part may be listed in the BoM multiple times if it is included in more than one sub-assembly.
PFH-PLA-005	Development and Verification Plan	D	Development Plan. The Design, Development and Verification Plan shall present the overall instrument design development, validation and verification plan in terms of strategy, organisation and processes. It shall aim to demonstrate how to ensure the compliance of the instrument design and the means to verify it. It shall address the strategy regarding the main technical risks, associated foreseen prototype and testing activities and the achievement of the Technology Readiness Levels defined in Annex A as required for the different project phases.
PFH-CIDL-001	CIDL	D	Configuration Item Data List. The Configuration Item Data List (CIDL) shall present the product configuration for a CI at one moment in time of the Project (typically a project milestone) by means of listing the requirements, design/development, manufacturing and operational documentation that are relevant for a CI. It shall contain as a minimum: 1. CI identification (part number and serial

			number (where appropriate)) - List of the technical specifications - List of the ICDs - List of the design/analysis reports - List of the drawings - Bill of Material (BoM) & Parts List - List of plans - List of procedures - List of manuals - List of verification documentation - A section called Change Status Report (CSR) which identifies the status of approved CREs and RF(W/D)s. All documents shall be recorded in the CIDL as a minimum with their: - Document Title - Document Number - Document Version - Document Status (draft, released, etc.) - Status Date.
PFH-TRP-001	Report on LGSO Integration Readiness Review	D	Report on integration readiness of the LGSO. The document shall clearly describe the steps executed to assess integration readiness at the factory and the corresponding detailed results. It has the structure of a Test and Inspection Report. This document shall clearly assess the presence of all the elements and all the conditions needed to start the integration.
PFH-TRP-002	Report on Test and Inspection of the LGSO	D	Report on Test and Inspection. This document shall include at least the following sections: Purpose; in this section the purpose of the Test Report explicitly stating the requirements that have been verified, shall be identified

			2. Scope of the Test Report; in this section the scope of the Test Report shall be identified 3. Applicable and Reference Documents; in this section all the documents applicable to the Test Report shall be listed along with the documents used as reference. 4. Test Results; in this section the findings of the Test shall be provided. The results shall be processed in such a way that they will be directly comparable with the verification items verified. A comparative table shall summarise the actual versus the nominal ones required. 5. Conclusions; in this section a statement concerning the conformance of the Test results with the requirements specified shall be given. In case of non-compliances, the reference to the related requirements shall be provided and the impact on the final performance and recovery actions shall be discussed.
PFH-RRR-001	Risk Analysis	D	This document shall provide: 1. Introduction 2. Methodology 3. The Risk Register. This document describes the approach to Risk Management, risk classification, ranking and mitigation. The Risk Register shall be kept updated as new risks emerge, change or aren't valid anymore.
PFH-LIS-002	Spare Parts List	D	The Spare Part List shall contain all the information related to the spare parts necessary to operate and maintain the Product. The Spare Part List shall include as a minimum: 1. Recommended amount of spare parts taking into account the findings of the RAM Analysis and the information provided in the Maintenance Manual

			2. OEM name and contact details (website, etc.) 3. Vendor name and contact details 4. Item name 5. Type designation 6. Dimensions 7. Specification 8. Delivery times 9. Expected lifetime on the shelf 10. Any special storage prescription (power up, high altitude influence, etc.) 11. Storage conditions. 12. Consumables 13. Fragile and/or critical parts 14. Components or parts with very long delivery time or which are custom-made 15. Off-the-shelf/custom-made Products.
PFH-ANR-002	RAMS document	D	This document shall contain: RAM Analysis, including as a minimum 1. Description of the System under examination 2. Assumptions used in the Analysis 3. Methodology used (e.g. Parts Count method as per Military Handbook (MIL-HDBK)-217F) 4. Reliability data sources (e.g. Non-electronic Parts Reliability Data (NPRD)-95) 5. Prediction of Reliability and Availability based on failure rates 6. Optimum preventive replacement time for components in a repairable System. 7. Spare parts requirements and production rate, spare parts inventory 8. MeanTime Between Failures (MTBF) computation 9. Down time of the Product and its

			availability taking into account the MTBF, Mean Time To Repair (MTTR) and the Time for Preventive Maintenance. 10. FMEA Hazard List and Analysis, which shall identify all hazards arising from the design of the instrument including component failures, critical human errors and hazards resulting from functional relationships between components and equipment belonging to the instrument. Hazardous Material List, including as a minimum 1. Hazardous Materials (HAZMAT) identification 2. HAZMAT Categorization 3. HAZMAT data tracking Safety File, collecting all safety relevant documentation applicable to the product.
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Table 3 - Technical documents

LGS Objective Technical Deliverables (Hardware)

Code	Title	Type	Description
PFH	LGS Objective	E	LGS Objective Subsystem, as specified in AD1, Section 3.2.

Table 4 - Hardware deliverable items of LGS Objective

LGS Objective Management Deliverables (Documents)

Code	Title	Type	Description
PFH-PRR-001	Progress	D	Description of project status and activities carried out for

	Report		the LGSO in the reporting period (every 2 months) The Progress Report shall summarise on a periodic basis the progress of the Project. The Progress Report shall summarise the results achieved in the period and planned for the next period at all levels of the Project and show them against the planned date identified in the Project Schedule highlighting any deviation. It shall also describe the critical issues detected at any level (i.e. technical, programmatic) of the Project during the reporting period and identify the mitigation actions. The progress report shall be accompanied with the Action Item List and the status of all Action Items which shall also be reviewed at each progress meeting. The Progress Reports shall cover a full calendar month and shall be issued not later than 3 (three) working days after the end of the reporting period. 1. Schedule update 2. Status List of Change Requests (CREs), RF(W/D)s, Nonconformities and Audits including trends 3. Risk Register update 4. Overview of major events in the forthcoming period (in particular inspections and tests).
PFH-LIS-001	Action Item List	D	This document shall list all the actions agreed between the Contractor and INAF. For each Action Item it shall contain as a minimum: 1. The content of the action 2. The originator 3. The actionee 4. The due date and the closure date 5. The reference to the documents containing a verifiable basis for the closure of the action.
PFH-MIN-001	MoM	D	Minute of Meeting, including Action Item List for the LGSO. (prepared by Contractor's personnel and sent 2 days after each meeting).
PFH-SCD-001	Schedule	D	Project Schedule of the LGSO. GANTT Charts (in single A4 sheets) of the project with

			indication of the critical path
PFH-PLA-001	Project Management Plan	D	Project Management Plan of the LGSO. This document shall: 1. Describe the management approach implemented by the Contractor to control the project 2. Describe the organisational structure of the project 3. Contain an organisational chart which summarises the organisation and the lines of authority including all Contractor partners 4. Describe the responsibility and the authority of each function in the organisational charts: job descriptions for the key functions 5. Describe the interrelation among the different functions in the organisation 6. Contain a list of key personnel including job position, relevant qualification and experience and contact information The Project Management Plan shall also include the project plan: 1. Master Plan which shall describe the program logic and the main project phases 2. Procurement and payment schedule 3. Work Breakdown Structure (WBS) 4. Work Package (WP) descriptions for the WPs in the WBS containing at least: a. WP number according to the WBS b. Title of the WP c. Input to the WP d. Description of the task(s) to be performed e. Output of the WP f. Staff allocated in Full Time Equivalents g. Responsible WP manager h. Duration of the task i. Milestones j. Start / end dates/ events
PFH-PLA-002	Product Assurance Plan	D	System Product Assurance/Quality Assurance Plan of the LGSO.

			The Product Assurance Plan shall describe the Project Product and Quality Assurance organisation, methods, tools and Procedures that the Contractor intends to implement for the work under Contract. The document shall contain the following information as a minimum: 1/ Purpose: Relation to product development 2/ Quality Assurance Functions: organisation and work tasks 3/ Documentation: Control, changes, deliverable and non-deliverable documents that are subject to configuration control 4/ Policies, Procedures and Practices: listing all requirements, design implementation, test and documentation 5/ Reviews and Audits: Scheduled and non-scheduled Configuration Management: Means of assuring that adequate procedures and controls are documented and implemented (Unless described in a dedicated document 6/ Problem Reporting: Processing, tracking and reporting 7/ Corrective and Preventive Actions: Processing, tracking and reporting 8/ Media Control: Libraries, protection 9/ Testing and Inspection: Environment, traceability, sampling methodology
PFH-PLA-003	Configuration Management Plan	D	LGSO Configuration Management Plan. The Configuration Management Plan shall describe the Project configuration Management organisation, methods, tools and Procedures that the Contractor intends to implement for the work under Contract. Alternatively the Software part may be covered in a separate dedicated document and reference provided. The Plan shall define as a minimum: 1. Configuration Management Responsibilities and Authorities 2. Responsibilities and Authorities 3. Dispositioning authority 4. Configuration Management Process 5. Configuration Management Planning 6. Configuration Identification 7. Change Management

			8. Configuration Status Accounting 9. Configuration Audit. The Configuration Management Plan shall define: 1. The handling of contractual and technical changes 2. The handling of the interfaces internal to the Project 3. The handling of the interfaces external to the Project. Configuration Management Plan shall ensure that: 1. The manufacturing documentation is in line with the design documentation 2. The Product is in line with the manufacturing documentation 3. Changes are not implemented without due Analysis and approval 4. Required design, item or component and/or manufacturing changes are properly documented in CREs to be established by the Contractor 5. RF(W/D)s and Nonconformities (NC)s are properly handled.
PFH-MAN-001	Operating Manual	D	Manual for operational use of the LGSO including all the operating instructions and safety procedures for the user including installation, packing and unpacking.
PFH-MAN-002	Maintenance Manual	D	The Maintenance Manual shall contain the detailed maintenance Procedures with drawings. It shall contain the maintenance requirements and scheduling for all items included in the supplies of the agreement. All the following types of Maintenance shall be considered and the related maintenance actions shall be provided in a tabular format: 1. Corrective: a. Deferred Maintenance b. Remedial Maintenance c. Shutdown Corrective Maintenance 2. Preventive: a. Routine Maintenance b. Running Maintenance

			3. Predictive: a. Condition-based Predictive Maintenance b. Statistical-based Predictive Maintenance Each intervention shall be described with the following information, as a minimum: 1. Item(s) to be maintained. 2. Number and qualification of maintenance personnel needed. 3. Total time needed to perform the intervention and each phase of the intervention 4. Supporting tools and equipment (including access). 5. Step by step procedure, including detection, preparation, location and isolation, disassembly (gaining access), repair or removal, reassembly, realignment/readjustment etc., checkout (Verification of fault elimination) 6. Required parts, consumables. 7. Safety measures. 8. Check after action and start up 9. Fault detection 10. Fault isolation 11. Fault elimination 12. Verification of fault elimination 13. The recoating procedure shall be included here
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Table 5 - Management documents

4.5 Deliverable timeline

The deliverables are expected to be delivered at each milestone according to the following table (I stand for Release Issued, D for Draft, U for Update):

Code	Title	Phase 1			Phase 2			
		KOM	LLI FDR	FDR	KOM	IRR	FARR	OARR
Technical Docs								
PFH-CMX-001	Compliance Matrix	I	U	U	(U)	U	U	U
PFH-DER-001	Design Report		D ¹	I	(U)	(U)	(U)	(U)
PFH-ANR-001	Analysis Report		D ¹	I	(U)	(U)	(U)	(U)

¹ The section related to the Early procurement shall be not in draft version. Alternatively a dedicated Early procurement related Design and analysis docs shall be provided.

Code	Title	Phase 1			Phase 2			
		KOM	LLI FDR	FDR	KOM	IRR	FARR	OARR
PFH-SPE-001	System Budget		I	(U)	(U)	(U)	U	U
PFH-ICD-001	Interface Control Document		I	(U)	(U)	(U)	(U)	(U)
PFH-PLA-004	MAIT Plan		D ¹	I	(U)	U	U	(U)
PFH-DWG-001	Manufacturing Drawings		I ²	I ³	(U)	(U)	(U)	(U)
PFH-DWG-002	As Built Drawings					I	U	(U)
PFH-MOD-001	Models		I ²	I ³	(U)	(U)	(U)	(U)
PFH-LIS-001	Parts List/Bill of Materials		I	U	(U)	U	(U)	(U)
PFH-PLA-005	Development and Verification Plan	I	(U)	U	(U)	(U)		
PFH-CIDL-001	CIDL	I	U	U	(U)	(U)	(U)	(U)

²Issued the early procurement relates, drafted the others

³All the drawings/models that were drafted for the early procurement

Code	Title	Phase 1			Phase 2			
		KOM	LLI FDR	FDR	KOM	IRR	FARR	OARR
PFH-TRP-001	Report on LGSO Integration Readiness					I		
PFH-TRP-002	Report on Test and Inspection						1 ⁴	2 ⁵
PFH-RRR-001	Risk Analysis	I	U	U	(U)	U	U	U
PFH-LIS-002	Spare Parts List		I	U	(U)	U	(U)	(U)
PFH-ANR-002	RAMS documents		I	U	(U)	U	(U)	(U)
HW								
PFH	LGS Objective						I	U

Table 6 - Technical Deliverables expected at each milestone for LGS Objective

⁴ Issued at the end of FAT by the Contractor

⁵ Issued at the end of OAT by INAF

Code	Title	Phase 1			Phase 2			
		KOM	LLI FDR	FDR	KOM	IRR	FARR	OARR
Management Docs								
PFH-PRR-001	Progress Report	At regular interval						
PFH-LIS-003	Action Item List	At regular interval						
PFH-MIN-001	MoM	At each meeting						
PFH-SCD-001	Schedule	I	(U)	U	(U)	U	U	(U)
PFH-PLA-001	Project Management Plan	I	(U)	U	(U)	U	U	(U)
PFH-PLA-002	Product Assurance Plan	I	(U)	U	(U)	U	U	(U)
PFH-PLA-003	Configuration Management Plan	I	(U)	U	(U)	U	U	(U)

Code	Title	Phase 1			Phase 2			
		KOM	LLI FDR	FDR	KOM	IRR	FARR	OARR
PFH-MAN-001	LGSO Operating Manual			D		I	U	(U)
PFH-MAN-002	LGSO Maintenance Manual			D		I	U	(U)

Table 7 - Management and Service Deliverables expected at each milestone

4.6 Meetings

We describe in the following the location and the objectives of the main project meetings. ESO is fully entitled to attend any of the meetings described below.

Kick-off meetings

Location:

The Kick-off meetings (both for Phase 1 and for Phase 2) shall take place at INAF premises (Italy, exact location will be communicated after the contract signature).

Objectives:

The purpose of the meetings is to verify the presence and adequacy of all the foreseen documentation and to assess the preparedness of the company to start the activities foreseen in the phase and to review the identified risks.

Process:

The Contractor sends to INAF all the requested documentation 2 weeks (10 working days) before the meeting.

During the meeting the documents are commented on and discussed. Actions can be taken in order to correct errors, insert missing information or improve the quality of the documents.

Acceptance criteria for all the deliverables are agreed.

Success Criteria:

The meeting is considered successfully completed if:

- all the KOM documentation is delivered on time and has the expected level of completeness and quality;
- the project team is ready and adequate for the work to be started;
- all critical actions taken during the review are successfully closed.

Reviews

Location:

Reviews may take place alternatively at the Contractor's premises, at INAF premises or by teleconference.

Objectives:

The purpose of Reviews is to formally assess the preparation of the expected deliverable items, at the level of completeness foreseen at that stage of the project. The Reviews are identified as such in Table 1 and 2.

Agenda items of Reviews shall include but not necessarily be limited to

1. Presentation of the deliverables due for that Review and discussion of RIXs;

2. Status of pending Action Items;
3. Outcome of the Review
4. Recommendations;

Process:

The Contractor sends to INAF all the requested documentation with due advance with respect to the meeting date (in any case not less than 2 weeks (10 working days)).

INAF representatives read the documentation and prepare comments and indications under the form of RIXs (Review Item Comments, Questions or Discrepancies).

During the meeting the RIXs are discussed and closed, as much as possible. Actions can be taken in order to correct non-compliances, insert missing information or improve the quality of the documents.

Approval conditions:

Reviews are considered successfully completed if:

- all the deliverable items have the expected level of completeness and quality as per criteria defined and agreed at Kick Off;
- all critical actions taken during the review are successfully closed.

The Contractor's personnel shall attend, if invited, MORFEO reviews with ESO, at ESO premises or at INAF premises. The costs of these missions shall be in charge of the contractor for up to 4 travels (2 days for 2 persons).

ESO is allowed to send representatives to attend any project milestone meetings, factory and on-site acceptance testing.

The Factory Acceptance Test shall take place at the Contractor's premises.

The On-Site Acceptance Test shall take place at the INAF premises.

Progress Meetings

Location:

Progress meetings may take place alternatively at the Contractor's premises, at INAF premises or by teleconference.

Objectives:

The purpose of these meetings is to assess the preparation of the expected deliverable items as defined in Table 3 to 5, i.e. the deliverables foreseen for the next Review (Table 6 and 7) at the level of completeness foreseen at that stage of the project.

Progress Meetings are normally held every month. More frequent Progress Meetings can be requested by INAF.

Agenda items shall include but not necessarily be limited to

1. Status of the Action Items List;
2. Progress over the reporting period ;
3. Activities for the next period;
4. Changes to status of compliance, configuration changes (if any);
5. Updated schedule.

Process:

The Contractor sends to INAF all the requested documentation as defined in Tables 3 to 5 with due advance with respect to the meeting date (in any case not less than 2 weeks (10 working days)).

Approval conditions:

Progress Meetings are informative meetings and no specific approval conditions are foreseen.

Additional meetings may be requested either by INAF or the Contractor. With due notice to the Contractor, INAF reserves the right to invite Third Parties to meetings to facilitate information exchange. Third Parties can include, for example, INAF personnel not directly involved in the project, members of the MORFEO Consortium, external experts in technical or management/administrative matters.

For each meeting the requester shall propose an agenda in electronic form and shall compile and distribute any presentation given at the meeting.

INAF may request, with at least 15 days in advance, access to the integration laboratories and support to make extra measurements directly on the units. The Contractor shall answer to this request by an acceptance of the proposed date or by an alternative proposition of date(s) within 10 days from the initial proposed date.

Access to laboratories may be requested at any time during Phase 2, whenever deemed necessary by INAF.

The best time slot shall be agreed into a reasonable amount of time.

Art. 5 Supporting Tasks

5.1 Project Management

The Contractor shall implement a centralised Project Management System and shall nominate a Project Manager.

The Contractor's Project Management Office shall coordinate and control the project resources, all technical and commercial activities, and manage all activities required to successfully complete the Contract.

The Contractor's Project Manager shall be the principal point of contact and have full authority to deal with all matters related to the contract, including but not limited to technical matters.

The Contractor shall implement a product-oriented Work Breakdown Structure starting from the activities described in this document. The Work Packages shall be clearly identified, with appointed Work Package Managers, Work Package input / output, milestones and timelines.

The Contractor shall implement a Master Plan based on the Work Breakdown Structure. The Master Plan shall be updated or reconfirmed with each Progress Report.

In addition to the Master Plan the Contractor shall establish a detailed planning, including detailed networks, dependencies, bar charts, milestones, resource allocation, etc..

The detailed schedule shall integrate the activities of all subcontractors involved in the project (if any).

Progress reports shall provide a brief account of the progress of the work done by the Contractor, encompassing all aspects within the reporting period.

Progress Reports shall be communicated to the INAF point of contact in electronic format (e.g. as email attachment). Progress Reports shall include the draft agenda of the next progress meeting.

The Contractor's Project Management System (procedures, personnel, documents and tools) shall be described in the Project Management Plan (see description of deliverable items).

Management deviations, impacting project scope/quality, time or cost, shall be reported to INAF, as change request or request for waiver for approval. Once approved by INAF and by the Contractor, the change shall be formalised in a contract amendment. If the change comprises schedule shift or other variations that would imply penalties, such penalties can be waived by mutual agreement in the updated contract.

Technical deviations, that do not have impacts on scope/quality, time or cost, may be proposed by both parties and discussed in the first available Progress Meeting (or in a dedicated Meeting in case of urgency). Once agreed by INAF and by the Contractor, these deviations shall become part of the technical baseline and shall be reported in detail in the project documentation.

5.2 Configuration Management

To make sure proper Configuration Management is implemented, the Contractor shall have in place a sound and effective Configuration Management System.

This means that any element to be developed in the project shall comply with the configuration control requirements and principles stated in the following.

- “Item” is any physical or non-physical component of inventory, single pieces, assemblies, software code or similar that will make part of the product.
- Every configured product item shall have a unique identifier that shall be used to manage (document, retrieve, identify) and to reference the configuration item.
- As a minimum, all configuration items delivered by the Contractor or referenced by a document delivered by the Contractor shall be the subject of the Configuration Management System.
- The Contractor shall provide information (e.g. as part of the Configuration Management Plan), on how the item numbering system works.
- The contractor shall provide evidence that their numbering system is capable of providing unique numbers across all their contracts for the foreseeable future.
- The item number shall only contain the following characters: modern alphabet, ciphers, space, underscore, hyphen-minus and dot.
- Configuration items with the same identifier shall be interchangeable. I.e. if the specification, or criteria, for Form, Fit and Function of a particular item are met, then the item may generally be considered interchangeable with other items with the same requirements. If not, it needs a new dedicated identifier.
- Items shall be identified and where possible marked by the items unique reference and serial number to provide traceability and configuration control.
- The Configuration Item List (CIL) shall contain all product elements that will be under configuration control. This list is applicable for both hardware and software elements.
- For each configuration item the contractor shall provide a Configuration Item Data List (CIDL) containing all documents relevant to such configured item. As such, the CIDL shall list all applicable requirements and specification documents, drawings, analyses, models, test reports, bill of materials, lists, etc.. The CIDL shall be updated and delivered with each progress report. The 'as-built' version of the CIDL shall be delivered at delivery of the product/item.

The Contractor’s Configuration Management System applied in the execution of the specific Contract shall fulfil, as a minimum all requirements, principles and applicable documents contained in this SOW.

The Configuration Management Plan shall be produced by the Contractor and shall define the Configuration Management procedures and the Configuration Management System that is used in the execution of this contract.

The Configuration Management Plan may use company-wide or standard documents but shall detail how such procedures will be used in the execution of the specific Contract.

5.3 Product Assurance

The general approach concerning the fulfilment of all specified PA requirements (including quality assurance, RAMS, Configuration Management, and Software Product Assurance) shall be described in the Product Assurance Plan. The detailed tasks to be performed during the individual project phases shall be included as all other project activities in the project planning.

If the contractor is not ISO9001 certified, under request of the MORFEO PA manager it shall provide evidence that the production and service provision proceed under controlled conditions, thus assuring that manufacturing and procurement processes are under adequate control and monitoring

In addition to the specified safety requirements foreseen by ISO9001 and where not explicitly stated otherwise, the Contractor shall comply with all relevant National safety laws and legislation applicable to the design, development, manufacturing, installation and operation of the contracted item.

Art. 6 Commercial guarantee and technical assistance

A standard warranty of 2 years after the final acceptance of the LGS Objective shall be provided by the Contractor

The extension of the warranty beyond the 2 years will be considered a useful plus and will give additional points in the proposal evaluation.

The baseline for the warranty shall be the change/repair of the defective piece.

The Contractor responsibilities shall cover all costs related to shipment and repair of the defective piece and to travel of the personnel necessary in case of change/repair on site. This applies to any location in Europe.

INAF will be responsible for dismounting and remounting the LGS Objective from the MORFEO instrument.

When a defect is reported, INAF will give formal notice of the issue to the Contractor specifying if change/repair is needed on site.

The Contractor is released from its financial obligations only when an improper use of the product is proven. In such cases the Contractor shall anyway provide technical support upon separate and specific agreement with INAF.

It shall be possible to re-manufacture a deliverable item or some of its components for a duration of 15 years.

In addition, the Contractor shall guarantee the availability of technical assistance and support for a minimum of 15 years from the date of final acceptance, corresponding to the expected operational lifetime of the instrument (e.g., realignment of the instrument, troubleshooting, and other maintenance activities). This long-term support is separate from the legal warranty and shall be provided upon request, subject to specific agreements and applicable charges.

- **After-sales technical assistance to be provided.**

- 1) *times for replacement of defective products / spare parts.* The defective component must be replaced within 60 calendar days from its reception at the Contractor site or from the defect notification in case of on site replacement,
- 2) *mode that will be used to notify the malfunction.* The contracting authority will communicate the malfunction to the contractor using an agreed e-mail address.
- 3) *charges for replacement of spare / malfunctioning parts.* During the warranty period the replacement of the non-functioning product shall be borne by the Contractor including the collection of the defective part and the delivery of the replacement part. The replacement operation shall be conducted by Contractor's personnel or, as a second choice, by the contracting authority remotely assisted by the contractor.

Art. 7 Delivery

- **Transport insurance policy.** Insurance on transport is mandatory and shall be paid by the Contractor.
- **Packing and Transport method.** Care and responsibility of the contractor shall be to choose high quality external materials, rigid and in good conditions. The boxes must be new and must not have been used beforehand. The size of the boxes shall be based on the final size of the products, avoiding semi-empty packages. The packing must guarantee the maximum safety of the goods by the transport company. Care shall be taken of the internal packaging, which provides protection for the goods during transport and during delivery. The internal packaging must be able to protect the product from shocks and vibrations. All possible openings shall be sealed, using high quality resistive products. The contractor shall insert on the outer edges of the box plastic or cardboard protectors that distribute the pressure evenly and avoid damage to the outer casing.

Transport shall be carried out with means (trucks, trains, ships, air freight) that guarantee the absorption of vibrations and bumps, in order not to cause damages to the transported goods. Transport means shall also ensure that the products are kept within the acceptable range of temperature and humidity. Transport means (and their drivers) must be certified for the transport of fragile goods.

For details on packing requirements, refer to AD1, Section 5.6

- **Responsibilities and support.**

Delivery at INAF premises shall be under the responsibility of the Contractor, who shall give at least two weeks advance notice of the Estimated Time of Arrival of the concerned item.

Logistic support shall be provided by INAF according to plans and requirements set

in the Design and in the AIT Phases, and document as specified in Table 3.

Where INAF manpower is required to support delivery tasks, the Contractor shall provide all necessary manuals and instructions for such manpower to safely perform its tasks according to requirements.

- **Location and delivery times.**

The LGS Objective must be delivered to the following locations:

- Bologna Integration Hall, at CNR Research Area - Via Piero Gobetti, 101, 40129 Bologna BO;

Alternate delivery locations must be agreed with due advance.

Detailed information will be provided at the time of shipping.

- **Shipping methods.**

In accordance with the terms **INCOTERMS DDP** - *Delivered Duty Paid*. In the DDP mode the contractor covers all costs and risks of the shipment and of import/export.

- **Method of unloading goods.**

Unloading shall be on the ground floor, by the courier appointed by the Contractor.

Personnel of the Contractor shall oversee the unloading and perform the unloading inspection to check that no damage was done during the transportation (data logger, shock witnesses, etc.).

Art. 8 General Conditions

8.1 Quality System

The Contractor shall implement a quality system based on the ISO 9001 standard.

The certification of the Contractor with ISO 9001 standard is considered a plus. Alternatively, the Contractor should be able to demonstrate the existence and the use of an equivalent internal quality system.

More specifically the Contractor shall demonstrate the existence and use processes ensuring the final quality of the product by means of:

- Contractual management and validation
- Documentary management
- Manufacturing management

- Personnel Safety
- Production controls and calibration of the associated measuring tools

8.2 Audits

INAF is authorised to perform audits at the Contractor premises during all the duration of the contract in order to validate and evaluate the contractor quality system, as well as the progress of the contract execution.

INAF will inform the contractor of its intention to perform an audit for a given date at least 15 days in advance. The contractor shall answer to this request by an acceptance of the proposed date or by an alternative proposition of date(s) within more or less than 10 days from the initial proposed date.

8.3 Personnel Safety

The contractor shall respect all applicable laws and regulations relative to personnel safety and working conditions. The Contractor is fully liable for the safety of its personnel.

The contractor shall formally notify to INAF before implementation any use of known or potential harmful material (including, but not limited to, radioactive, bio-hazardous, chemically dangerous materials) during the manufacturing process or included in the delivered product. In that case, an official acceptance from INAF of this (these) material(s) is mandatory prior to its implementation.

The contractor shall formally notify to INAF of all potential risk or danger linked with the use or the handling of its products. In that case, safety measures shall be transmitted to INAF and accepted before any delivery.

8.4 Traceability

The contractor shall ensure the traceability and the recording of the product's main components, materials or sub-contracted operations. The rules and conventions for the tracing components and elements of the system will be detailed in the relevant documentation produced by the contractor (Parts List/ Bill of Materials and CIDL).

The list of these items shall be agreed with INAF before manufacturing. For each delivered product and for each of the identified item the following information shall be available:

- Item manufacturer or sub-contractor
- Identification number
- Batch or serial number
- Manufacturing or service date

8.5 Documentation

All deliverable documents produced during the project shall be written in English language and shall be transmitted under electronic format.

Applicable associated file formats are:

- Word, Excel and PDF under ISO A4 size for textual documents
- PDF, Autocad DWG, Inventor IDW under ISO A0 to A4 size for drawings
- Zemax ZMX for optical design files
- STEP, IGES, Inventor IAM and IPT for 3D models

Other formats must be agreed between the Contractor and INAF.

Templates for Change Request, Request for Waiver and Non Conformance Report will be provided by INAF and will be applicable.

All internal or deliverable documentation related to the present Statement of Work associated contract shall be archived and recoverable during the duration of 15 years after the end of the manufacturing phase.

The contractor is responsible for verifying all documentation made available by INAF for the contract execution including the present Statement of Work and its applicable documents. The contractor shall give notice to INAF of any errors, discrepancy or missing information in this documentation. The contractor shall not modify documents made available by INAF. In case of errors, discrepancy or missing information, the correct information will be provided by INAF.

8.6 Confidentiality

Both parties undertake to ensure confidentiality of information communicated by the terms of the present contract and not to publish it, divulge it to third parties (apart from ESO) for use it for any other purpose than those stated in the present contract, and the parties agree to do so for the entire duration of the contract and for a period of five years following expiry or termination of the contract. Confidential information must be sent only by registered letter with recorded delivery.

Art. 9 Modification Management

9.1 Change Request

During contract execution, the Contractor and INAF can propose modifications to the contract. Such proposals shall be addressed to the other party by means of a formal change request.

This change request shall include detailed motivation and explanation of the proposed change. It will identify clearly all the documents and products impacted by the change. When issued by the Contractor, it shall also include all potential impacts positive or negative in terms of quality, performance, schedule and cost. When issued by INAF, this information will be given by the Contractor in reply to the change request.

Each Change Request shall be identified by a unique identifier, which shall be used in all subsequent correspondence.

Provided the input is complete, the receiving party shall respond (change approved or rejected) to any such Change Request within 4 weeks of its receipt, or in the case of complex changes inform the other party on the expected completion date within 2 weeks of its receipt. If the input is not complete, the receiving part shall ask for the missing information within two weeks.

If the change of scope is significant an amendment of contract conditions may be agreed.

INAF will provide a template for Change Request at Kick Off Meeting.

9.2 Request for Waiver

A request for waiver is an official request from the Contractor to INAF to release or use a non-compliant product. A request for waiver is limited to specific individual products or limited in time before repair. If this limitation does not apply, a change request shall be issued.

A request for waiver shall include detailed motivation and explanation of the waiver requested. It will identify clearly all the products impacted and if relevant the foreseen date of repair. It shall also include all potential impacts positive or negative in terms of quality, performance, schedule and cost. INAF will pronounce the acceptance decision of the request within 4 weeks after reception of the completed request. If the change of scope is significant an amendment of contract conditions may be agreed.

INAF will provide a template for Request for Waiver at Kick Off Meeting.

9.3 Non-Conformances

In case where a non-conformance or discrepancy of any kind is detected during the project execution, the Contractor shall give notice to INAF by means of a Non-Conformance Report within 1 week after detection. These Reports can refer to any technical, manufacturing, schedule and quality aspect, particularly in cases where a detected non-conformance may lead to a late delivery of products.

9.4 Contract Amendment

In case of a contract amendment consecutive to a change or a waiver, the financial conditions revision will be based on the cost breakdown given at the contract signature.

Art. 10 Obligations of the contractor

- **Appointment and duties of the Contract Manager.** The Contractor shall indicate its own Contract Manager with whom the Contracting Authority will be able to interact, for contractual matters, until the issue of the certificate of conformity (test certificate) of the supply.

- **Appointment and duties of the Project Manager of the supply.** The Contractor shall indicate its own project manager of the supply that will ensure the effective and timely completion of the contract. The Contractor's Project Manager, supported by other internal personnel, as needed, shall coordinate and control the project resources and manage all activities required to successfully complete the Contract. The project manager shall implement a more detailed, product-oriented, Work Breakdown Structure based on the Work Breakdown Structure described in this document. Work Packages shall be clearly identified, with appointed Work Package Managers, Work Package input / output, milestones and timelines.
- **Appointment and duties of the Technical Manager of the supply.** The contractor shall indicate its own Technical Manager of the supply with which the contracting authority will be able to interact, for technical matters, until the issuing of the certificate of conformity of the supply. The figures of Contract Manager, Project Manager and Technical Manager of the supply may coincide.

Appendix A Technological Readiness Level definition (TRL)

TRL	Technology Readiness	Description
1	Basic principles observed and reported	Lowest level of technology readiness. Scientific research begins to be translated into applied research and development. Example might include paper studies of a technology's basic properties.
2	Technology concept and/or application formulated	Invention begins. Once basic principles are observed, practical applications can be invented. The application is speculative and there is no proof or detailed analysis to support the assumption. Examples are still limited to paper studies.
3	Analytical and experimental critical function and/or characteristic proof of concept	Active research and development is initiated. This includes analytical studies and laboratory studies to physically validate analytical predictions of separate elements of the technology. Examples include components that are not yet integrated or representative.
4	Component and/or breadboard validation in laboratory environment	Basic technological components are integrated to establish that the pieces will work together. This is relatively "low fidelity" compared to the eventual system. Examples include integration of 'ad hoc' hardware in a laboratory.
5	Component and/or breadboard validation in relevant environment	Fidelity of breadboard technology increases significantly. The basic technological components are integrated with reasonably realistic supporting elements so that the technology can be tested in a simulated environment. Examples include 'high fidelity' laboratory integration of components.
6	System/subsystem model or prototype demonstration in a relevant environment	Representative model or prototype system, which is well beyond the breadboard tested for TRL 5, is tested in a relevant environment. Represents a major step up in a technology's demonstrated readiness. An example is the testing of a prototype in a high fidelity laboratory environment or in simulated operational environment.
7	System prototype demonstration in an operational environment	Prototype near or at planned operational system. Represents a major step up from TRL 6, requiring the demonstration of an actual system prototype in an operational environment. Examples include testing the prototype in an observatory environment.
8	Actual system completed and qualified through test and demonstration	Technology has been proven to work in its final form and under expected conditions. In almost all cases, this TRL represents the end of true system development. Examples include developmental test and evaluation of the system to determine if it meets design specifications.
9	Actual system proven through successful mission operations	Actual application of the technology in its final form and under mission conditions, such as those encountered in operational test and evaluation. In almost all cases, this is the end of the last "bug fixing" aspects of true system development. Examples include using the system under operational mission conditions.