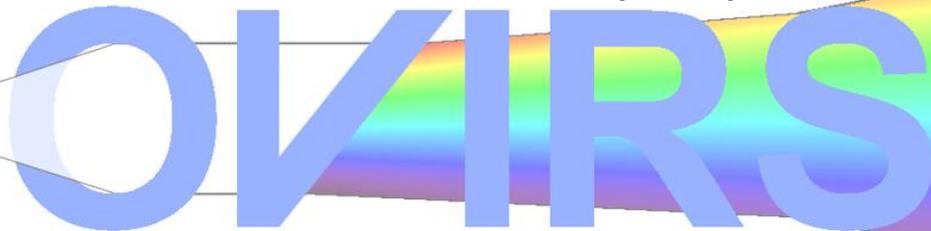


OSIRIS-REx Project

OSIRIS-REx Visible and Infrared Spectrometer (OVIRS)

Primary and Secondary Mirrors

Statement of Work (SOW)



OSIRIS-REx

VISIBLE AND INFRARED SPECTROMETER

OVIRS
CMO
JFA
May 21, 2013
Released



**Goddard Space Flight
Center**

**National Aeronautics and
Space Administration**

CHECK WITH THE OVIRS CM Office @ ehpdmis.gsfc.nasa.gov
TO VERIFY THAT THIS IS THE CORRECT VERSION PRIOR TO USE

CM FOREWORD

This document is an OSIRIS-REx Project controlled document. Changes to this document require prior approval of the OSIRIS-REx Project CCB Chairperson. Proposed changes shall be submitted to the OSIRIS-REx Project Configuration Management Office (CMO), along with supportive material justifying the proposed change.

Questions or comments concerning this document should be addressed to:

OSIRIS-REx Configuration Management Office
Mail Stop 433
Goddard Space Flight Center
Greenbelt, Maryland 20771

Signatures are available on-line at: <https://ehpdmis.gsfc.nasa.gov>

DOCUMENT CHANGE RECORD

REV/ VER LEVEL	DESCRIPTION OF CHANGE	APPROVED BY	DATE APPROVED
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1.0 INTRODUCTION

1.1 Scope

This statement of work (SOW) defines the tasks required to fabricate, test, and deliver the primary and secondary mirrors for use in the OSIRIS-Rex mission OVIRS instrument.

1.2 Terminology

The term "Government" or "OVIRS" will refer to the Goddard Space Flight Center (GSFC) OSIRIS-REx OVIRS instrument.

The term "Contractor" will refer to the mirror vendor.

The term "(TBD)", which means "to be determined", applied to a missing requirement means that the Contractor should determine the missing requirement in coordination with the Government.

The term "(TBS)", which means "to be specified", means that the Government will supply the missing information in the course of the contract. These serve as a placeholder for future requirements. The Contractor is not liable for compliance with these "placeholder" requirements, as insufficient information is provided on which to base a design.

The term "(TBR)", which means "to be reviewed", means that the requirement is subject to review for appropriateness by both Government and Contractor, and subject to revision. The Contractor is liable for compliance with the requirement as if the TBR notation did not exist. The TBR merely provides an indication that the value is more likely to change in a future modification than requirements not accompanied by a TBR.

All revisions, deletions and other changes to the Statement of Work and any referenced documents must be authorized in writing by the Government Contracting Officer or designated representative, and accepted in writing by the Contractor's Contract Manager or designated representative.

1.3 Applicable and Reference Documents

All applicable and reference documentation identified in this document shall apply in the situations where they are specifically referenced.

Table 1-1: Applicable Documents

Document Number	Revision/ Release Date	Document Title
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Document Number	Revision/ Release Date	Document Title
OSIRIS-REx-RQMT-0003	Revision A/October 19, 2012	OSIRIS-REx Mission Assurance Requirements (MAR)
OVIRS-DWG-2187750	Rev.-	OSIRISREx OVIRS Primary Mirror Drawing
OVIRS-DWG-2187751	Rev.-	OSIRIS-REx OVIRS Secondary Mirror Drawing

1.4 Precedence

Conflicts arising between the requirements of this SOW and the requirements of any applicable document referenced herein will be referred to the GSFC contracting official for resolution.

2.0 HARDWARE PRODUCTION

The Contractor shall fabricate, test and deliver flight and flight spare mirrors that meet the specifications defined in the OSIRIS-REx OVIRS mirror drawings. The Contractor shall specify and develop test fixtures and Ground Support Equipment (GSE) to support functional and performance testing in accordance with the specifications defined in the OSIRIS-REx OVIRS mirror drawings. The Contractor shall deliver, at government request, all mirrors created in the performance of this contract regardless of whether or not the mirrors meet the specifications.

2.1 Fabrication

The Contractor shall fabricate the OSIRIS-REx OVIRS mirrors to meet the design, specifications and tolerances documented in the OVIRS mirror drawings.

The Contractor shall only use traceable materials in the fabrication of the Flight and Flight-Spare mirrors.

Mirror materials and parts used by the Contractor shall have Government approval via the OSIRIS-REx Project Parts and Materials Control Boards prior to the start of mirror manufacturing.

Mirror coating materials, those used for stray light suppression as well as mirror reflectivity enhancement, shall be identified by the Contractor and the materials reviewed and approved by the Government prior to the start of mirror manufacturing.

The Contractor shall stress relieve the OVIRS mirrors such that they will meet their performance requirements at operational temperature after being exposed to survival temperatures ranging from 110 Kelvin to 350 Kelvin . The Contractor shall provide information to the Government on the heritage and expected performance of the mirror stress relief procedure at or before the Manufacturing Readiness Review (MRR).

2.2 Functional and Performance Testing

The Contractor shall provide all GSE necessary for performance testing of the mirrors at room temperature and at operating temperature. The Contractor shall conduct the performance testing of the mirrors by utilizing the three mounting surfaces of the mirrors. The Contractor shall also provide all test, verification, calibration, labor and material necessary to ensure that the OVIRS mirrors meet or exceed the minimum performance specifications, functions and characteristics described in the OVIRS mirror drawing. The Contractor shall provide test plans and procedures for Government approval prior to the start of testing.

The Contractor shall work with the Government to allocate a portion of the mirrors' total surface figure error specified in the mirror drawings to mid-spatial frequency error, based on the Contractor's existing capability to measure mid-spatial frequency error.

All test data shall be archived and delivered in a format that has been mutually agreed upon with the Government. The contractor shall consult with the Government in the ranking and selection of the mirrors for flight. The Government reserves the right of final approval in the selection of mirrors for flight.

PROGRAM MANAGEMENT

2.3 Financial Management

2.4 Performance/Systems Assurance

The Contractor shall meet the requirements specified in the Mission Assurance Requirement (MAR). However, the Government intends to allow the Contractor to use existing processes, standards, guidelines, and procedures tailored to comply with the MAR.

If necessary to review critical issues, the Contractor shall provide five (5) working days advance notice for the Government to provide a QA Representative to witness parts of the hardware fabrication and testing. This will be done on an as-needed basis.

2.5 Meetings and Reviews

The Contractor shall support one weekly status or issue-specific teleconference, as required. The contractor shall also support an initial kick-off meeting, a Manufacturing Readiness Review (MRR) and a Pre-ship Review (PSR). The contractor shall also support one additional technical interchange meeting with the Government and their representatives as required.

2.5.1 Manufacturing Readiness Review

Prior to building flight hardware, the Contractor shall demonstrate that all processes procedures and materials are approved and ready to begin manufacturing.

Prior to building flight hardware, the Contractor shall review the mirror drawings and propose to the Government any design changes that are likely to reduce manufacturing risk and/or increase schedule margin.

2.5.2 Pre-Ship Review (PSR)

The contractor shall prepare and conduct a Pre-Ship Review for the mirrors at the completion of verification tests and prior to shipment to GSFC. The purpose of the PSR is to verify and document that the mirrors are performing in accordance with the OVIRS mirror drawings. The PSR shall be considered complete upon satisfactory closeout of all PSR action items.

3.0 HARDWARE DELIVERY

3.1 Delivery of Samples

The Contractor shall provide witness samples at various phases of fabrication (e.g. before and after deposition of the mirror coatings) to assess mirror reflectivity and contamination control.

3.2 Delivery of Flight Mirrors

The contractor shall deliver one Flight primary mirror and one Flight secondary mirror. Delivery of the Flight hardware is expected within 5 months after receiving the order (ARO).

3.3 Delivery of Flight Spare Mirrors

The contractor shall deliver one Flight Spare primary mirror and one Flight spare secondary mirror. Delivery of the Flight Spare hardware is expected within 6 months after receiving the order (ARO).

4.0 DOCUMENTATION

The Contractor shall provide digital copies of an End Item Data Package (EIDP) with the Flight, and Flight Spare hardware delivery. The contents of the (EIDP) shall include the following:

- a. Combined Configuration Item Data and Serialized Items List
- b. Material Certifications
- c. As-Built Summary which includes: surface error data at ambient and operational temperatures; alignment reference locations and orientations with respect to the mirrors' prescriptions at ambient temperature; and the prescription at ambient and operational temperatures.
- d. Manufacturing Milestones
- e. Verification Matrix
- f. Deviations
- g. Non-conformances
- h. Certificate of compliance
- i. Test Data (including reflectivity data), Test reports, Test Flow, and Qualification Status
- j. Inspection reports (including scratch-dig notes)
- k. Source Inspection Records
- l. Manufacturing instructions sign-off sheet
- m. Cleanliness certification
- n. Mirror pictures
- o. Analytical models (CAD models etc.)
- p. Technical memos and notes
- q. All Drawings and Drawing Tree
- r. Schematics
- s. Parts and Material Lists
- t. Drawings of any custom inspection tools (or inspection tools themselves)

The documents shall be provided in their native format (MS Word or Excel are preferred) whenever applicable. Upon request of the Government, the Contractor shall make available a copy of any applicable engineering document. This includes, but is not limited to, analytical models, technical memos, drawings, schematics, studies, analyses and test data.

5.0 SYSTEMS ENGINEERING

5.1 Verification Requirements

5.1.1 Test Plans

The Contractor shall prepare and submit Verification and Acceptance Test Plans and Matrices for approval by the Government.

5.1.2 Verification Test Procedures

In accordance with the test plans, the Contractor shall develop and submit hardware Verification and Acceptance Test Procedures for approval by the Government.

6.0 MISSION ASSURANCE REQUIREMENTS

6.1 Mission Assurance Requirements for Flight Mirrors

Materials used in the mirrors shall meet project outgassing requirements for TML (Total Mass Loss) and CVCM (Collected Volatile Condensable Material) of 1.0% and 0.10% respectively when tested in accordance with ASTM E595. Note: The use of pure tin, pure zinc, or cadmium shall be prohibited as either an external or internal finish.

The Contractor shall provide a Certificate of Conformance that the furnished product meets the requirements specified in The OSIRIS-REx Mission Assurance Requirements (MAR) document and the specifications described in the mirror drawings.

6.2 Reliability Engineering Requirements

6.2.1 FMEA, CIL, & FTA Development

The Contractor shall support GSFC development of Failure Modes and Effect Analysis (FMEA), Critical Item List (CIL), Fault Tree Analysis (FTA), which will be used to identify and evaluate failure modes that could impact both the safety and mission success of the OVIRS instrument.

The Contractor is required to provide all relevant information already in Contractor's possession to allow GSFC to evaluate potential failure modes of the mirrors and their corresponding impact on the OVIRS instrument, any of its subsystems, and any interfaces to spacecraft and ground test/support equipment interfaces.

The Contractor shall also be required to support an initial site visit with GSFC reliability engineer to gather necessary information to perform the FMEA, a telecon to review and update GSFC FMEA analysis, and a final FMEA review to ensure all information generated from the FMEA analysis is complete and accurate. The Contractor's signature approval of the GSFC analysis will be required once the FMEA is completed. As part of this process, GSFC will ensure confidentiality of any proprietary information provided to the government at the written request of the contractor.

6.2.2 Limited Life Items List Development

The Contractor shall support GSFC development of the Limited Life Items List, which will be used to identify and manage limited life items in the mirrors. The Contractor shall provide a Bill of Material (BOM) along with data already in Contractor's possession that provide information such as expected life, required life, and duty cycle of the potential limited life items in the mirrors. The Contractor shall maintain records allowing for evaluation of cumulative stress (time and cycles) for limited life items, starting when

useful life is initiated, and indicating the project activity that stresses the items. The useful life period starts with fabrication and ends with completion of final orbital mission, including the disposal phase.

6.2.3 Reliability Prediction/Assessment and PRA Development

The Contractor shall support GSFC generation of the comparative numerical reliability assessments and reliability prediction of the mirrors to support trade studies. The Contractor shall assist in evaluating alternate designs concepts, redundancy and cross-strapping approaches using numerical reliability prediction.

The Contractor shall support GSFC development of the Probabilistic Risk Assessment (PRA). The Contractor is required to provide all relevant information already in Contractor's possession such as life testing data, failure history, on-orbit performance, and heritage data.

7.0 CONTAMINATION REQUIREMENTS

7.1 General

The Contractor shall identify all sources of contamination that can be emitted from the mirrors and document these sources for GSFC.

The contractor shall be responsible for cleaning all hardware prior to delivery to the Government.

The mirror exterior surfaces shall have a surface particulate contamination Level 300 and surface molecular contamination Level A/2 per IEST-STD-CC1246D.

The mirror materials shall have a maximum Total Mass Loss (TML) of 1.0% and a maximum Collected Volatile Condensable Material (CVCM) of less than 0.1% respectively.

The mirror materials shall meet the minimum outgassing screening criteria as tested according to ASTM E595-93 or equivalent method.

7.2 External Cleanliness Verification

External cleanliness requirements must be verified prior to delivery to Goddard. Verification and inspection paperwork must be received upon delivery of flight hardware. If the external cleanliness requirement is not met, the vendor is responsible for cleaning the h/w.

7.3 Handling, Storage, Packaging, Preservation, and Delivery

Products shall be stored, preserved, marked, labeled, packaged, and packed to prevent loss of marking, deterioration, contamination, excessive condensation and moisture, or damage during all phases of the program. Stored and stocked items shall be controlled in accordance with documented procedures and be subject to quality surveillance.

The Contractor is responsible for providing an acceptable shipping container that protects the hardware appropriately.

The shipping container shall include shock and humidity indicators and shall be capable of prolonged shipping conditions. The Contractor shall document what action NASA GSFC is to take if the sensors are tripped when hardware arrives at the NASA GSFC receiving area. A copy of this document shall be included with shipping documentation.

Specific exceptions to the shipping requirements may be negotiated between the Contractor and Government when necessary.

The Flight and Flight Spare mirrors shall be delivered to GSFC.

By executing the act of product shipment, the Contractor certifies that the product complies with all contract requirements. Prior to shipping, quality assurance personnel shall ensure that:

- Fabrication, inspection, and test operations have been completed and accepted.
- All products are identified and marked in accordance with requirements.
- The accompanying documentation (Contractor's shipping and property form) has been reviewed for completeness, identification, and quality approvals.
- Evidence exists that preservation and packaging are in compliance with requirements.
- Packaging and marking of products, as a minimum, comply with Interstate Commerce Commission rules and regulations and are adequate to ensure safe arrival and ready identification at their destinations.
- The loading and transporting methods are in compliance with those designated in the shipping documents.
- Integrity seals are on shipping containers and externally observable shock or humidity monitors do not show excessive environmental exposure.
- In the event of unscheduled removal of a product from its container, the extent of re-inspection and retest shall be as authorized by NASA or its representative.
- Special handling instructions for receiving activities, including observation and recording requirements for shipping-environment monitors are provided where appropriate.

The Contractor's quality assurance organization shall verify prior to shipment that the above requirements have been met and shall sign off appropriate shipping documents to provide evidence of this verification.

APPENDIX A: ABBREVIATION AND ACRONYM LIST

Abbreviation/ Acronym	Definition
ABPL	As Built Parts List
ADPL	As Designed Parts List
ANSI	American National Standards Institute
BBU	Breadboard Unit
BSP	Board Support Package
C&DH	Command and Data Handling
CDR	Critical Design Review
CDRL	Contract Data Requirement List
CM	Configuration Management
CO	Contracting Officer
COTR	Contracting Officer's Technical Representative
CVCM	Collected Volatile Condensable Mass
DCR	Design Conformance Review
DPA	Destructive Physical Analysis
ESD	Electrostatic-Discharge
FMEA	Failure Modes and Effects Analysis
FRB	Failure Review Board
GIDEP	Government Industry Data Exchange Program
GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
ICD	Interface Control Document
MIP	Mandatory Inspection Point
MRB	Material Review Board
MUA	Materials Usage Agreement
PAPL	Project Approved Parts List
PCB	Parts Control Board
PERPEM	Pre-Environmental Review Plastic Encapsulated Microcircuit
PILPER	Parts Identification List Pre-Environmental Review
PIL	Parts Identification List
PPE	Project Parts Engineer
PRE	Project Radiation Engineer
PSR	Pre-Ship Review
PWB	Printed Wiring Board
QA	Quality Assurance
RDM	Radiation Design Margin
RLAT	Radiation Lot Acceptance Test
SCC	Stress Corrosion Cracking
S/C	Spacecraft
SOW	Statement of Work
TML	Total Mass Loss

Abbreviation/ Acronym	Definition
TID	Total Ionizing Dose
TIM	Technical Interchange Meeting
TPL	Trended Parameters List
WVR	Waiver