

# **Appendix II**

## **Statement of Work**

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## TABLE OF CONTENTS

1	Introduction.....	5
1.1	Purpose .....	5
1.2	Scope .....	5
1.3	Acronyms and Abbreviations .....	5
2	Related Documents .....	6
2.1	Applicable Documents .....	6
2.2	Referenced Documents.....	6
3	Required Equipment .....	7
3.1	Antenna Panel Deployment Mechanism EM.....	7
3.2	Antenna Panel Deployment Mechanism PFM.....	8
3.2.1	Handling illustration .....	9
3.3	Ground Support Equipment-1 (GSE-1).....	9
3.4	Ground Support Equipment-2 (GSE-2).....	11
4	Reporting, Reviews and Meetings .....	12
4.1	Preliminary Design Review (PDR).....	12
4.2	Critical Design Review (CDR).....	13
4.3	Manufacturing Readiness Review (MRR).....	14
4.4	EM Test Readiness Review (EM TRR) .....	14
4.5	EM Consent to Ship Review (EM CSR) .....	14
4.6	PFM1 Test Readiness Review (PFM1 TRR) .....	15
4.7	PFM1 Consent to Ship Review (PFM1 CSR) .....	15
4.8	PFM2 Test Readiness Review (PFM2 TRR) .....	15
4.9	PFM2 Consent to Ship Review (PFM2 CSR) .....	16
4.10	Final Review and Acceptance (FR).....	16
5	Contract Schedule .....	17
6	Required Deliverables.....	20
6.1	Deliverable Equipment .....	20
6.1.1	Destination of Delivery .....	20
6.2	Deliverable Items.....	20
6.3	Deliverable Documents .....	21

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## **1 Introduction**

### **1.1 Purpose**

The purpose of this document is to define the scope of work required for the contractor. In the purpose of this document, the term “[TBR]” means to be reviewed and determined by TASA upon receiving recommendations from the contractor.

### **1.2 Scope**

The contractor shall perform the work as defined in the following items:

1. Antenna Panel Deployment Mechanism Engineering Model (EM)
2. Antenna Panel Deployment Mechanism Proto-flight Model (PFM)
3. Ground Support Equipment (GSE)

### **1.3 Acronyms and Abbreviations**

CDR	Critical Design Review
CLIN	Contract Line Item Number
CSR	Consent to Ship Review
EIDP	End Item Data Package
EM	Engineering Model
ESD	Electrostatic Discharge
FMEA	Failure Mode and Effect Analysis
HDRM	Hold Down and Release Mechanism
ICD	Interface Control Document
MRR	Manufacturing Readiness Review

NEA	Non-Explosive Actuator
PA	Product Assurance
PDR	Preliminary Design Review
PFM	Proto Flight Model
QA	Quality Assurance
SOW	Statement of Work
TASA	Taiwan Space Agency
TBR	To Be Reviewed
TRR	Test Readiness Review

## **2 Related Documents**

### **2.1 Applicable Documents**

ECSS-E-ST-33-01                      Space Engineering Mechanisms

### **2.2 Referenced Documents**

N/A

### 3 Required Equipment

#### Program Management:

The contractor shall provide all the necessary program management services associated with the contract. The contractor is responsible for allocating and managing the appropriate resources in order to effectively support the program. The contractor shall provide the status report every month. As a minimum, the report shall address: the work accomplished, the memorandum or reports delivered, the problems identified, and the recommendations for resolving the identified problems.

#### 3.1 Antenna Panel Deployment Mechanism EM

The purpose of the Antenna Panel Deployment Mechanism EM is to fit check with the antenna panel, to support the functional test and the deployment test, and no environmental tests are required. The contractor shall develop and provide one (1) set of the Antenna Panel Deployment Mechanism EM according to the requirements.

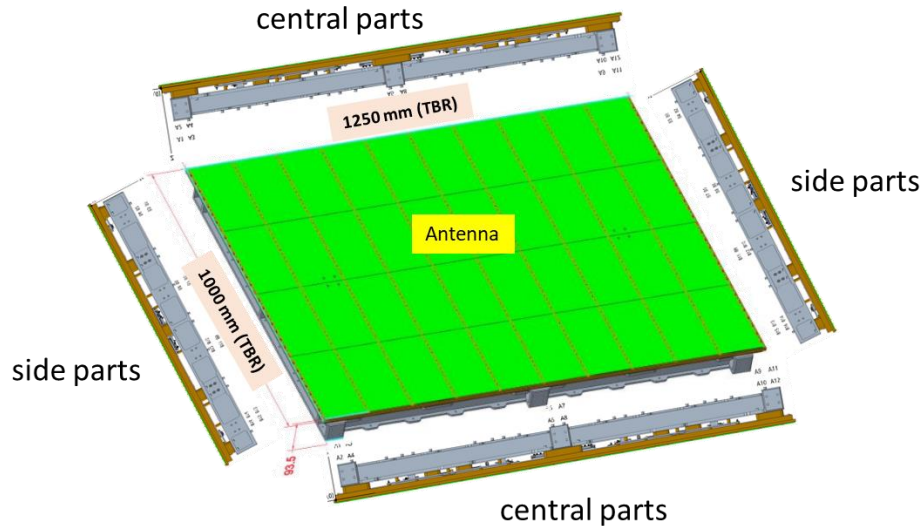


Figure 1. Antenna Panel Configuration

The Antenna Panel Deployment Mechanism EM shall include all the required ground support equipment and test jigs to support the antenna panel functional test and the deployment test in zero gravity condition. The hardware consists of:

- One (1) set of antenna panel mechanical supporting frame to the satellite;

- One (1) support structure for the central part of the antenna panel to the S/C structure.
- One (1) structure frame for the side part of the antenna panel.
- One (1) set of Hold Down and Release Mechanism (HDRM), including Non-Explosive Actuators (NEA):
  - Two (2) hold down points per side at the lower position.
  - Two (2) hold down points per side at the higher position.
- One (1) set of Deployment Hinge Mechanism and latches;
- All fixings, thermal spacers for the hold downs to the antenna panel and to the S/C;

The contractor shall deliver the hardware defined in Section 6 and shall comply with the delivery schedule in section 5.

The contractor shall provide the detail information, regarding the flight heritage or the qualification status of the proposed antenna panel deployment mechanism.

### **3.2 Antenna Panel Deployment Mechanism PFM**

The contractor shall develop and provide two (2) sets of the Antenna Panel Deployment Mechanism PFM according to the requirement.

The Antenna Panel Deployment Mechanism PFM shall include all required ground support equipment and test jigs to support the antenna panel functional test, environmental tests in proto-flight level, and the deployment test in zero gravity condition. As a minimum, one (1) set of the hardware consists of:

- One (1) set of antenna panel mechanical supporting frame to the satellite including:
  - One (1) support structure for the central part of the antenna panel to the S/C structure.
  - Two (2) structure frames for the side parts of the antenna panel.
- Two (2) sets of Hold Down and Release Mechanism (HDRM), including Non-Explosive Actuators (NEA):
  - Two (2) hold down points per side at the lower position.
  - Two (2) hold down points per side at the higher position.
- Two (2) sets of Deployment Hinge Mechanism and latches, one (1) set per side;



- All fixings, thermal spacers for the hold downs to the antenna panel and to the S/C;
- One (1) spare NEA per model for HDRM.

The contractor shall deliver the hardware defined in Section 6 and shall comply with the schedule in section 5.

The contractor shall provide the detail information, regarding the flight heritage or the qualification status of the proposed antenna panel deployment mechanism.

The contractor shall provide the requirements compliance matrix. The requirements compliance matrix shall include the proposed verification method and justification for each requirement.

### **3.2.1 Handling illustration**

The contractor shall provide handling illustration at contractor's site for TASA's personnel (3 persons in maximum).

The training shall include the following as a minimum:

- Assembly and integration of antenna panel with deployment mechanism;
- Functional and deployment test of the deployment mechanism
- Refurbish of the HDRM
- Answer and response to any questions that TASA has in the use and interfacing of the supplied items;
- Review of how TASA are integrating the supplied items to allow them to make suggestions;
- Suggested methods of testing and integrations of supplied product.
- User operating manual.

It is envisaged that the training will take place around the time frame of the deployment test of the antenna panel deployment mechanism at contractor's site.

### **3.3 Ground Support Equipment-1 (GSE-1)**

The contractor shall provide the Ground Support Equipment 1 (GSE-1) for antenna panel deployment mechanism functional test (EM).

The contractor shall deliver the ground support equipment and test jigs required to integrate the antenna panel on the satellite, to perform the deployment test in horizontal orientations to check mechanical functions of the antenna panel on the satellite, and to reset any hold downs. The contractor shall comply with the delivery schedule defined in section 5.

As a minimum, the Ground Support Equipment-1 (GSE-1) for the antenna panel deployment mechanism shall include the following items:

- The functional test of the deployment mechanism;
- Supporting fixture for the assembly and integration of antenna panel with deployment mechanism;
- Installation devices specific for the antenna panel and HDRM;
- Handling and support fixtures for the installation and the deployment test at satellite level;
- Transportation and storage containers;
- Zero-g kit for the antenna panel and the deployment mechanism integrated in the S/C in horizontal positions of the deployment axes.

### **3.4 Ground Support Equipment-2 (GSE-2)**

The contractor shall provide the Ground Support Equipment (GSE-2) for antenna panel deployment mechanism functional test, environmental tests, and assembly & integrations with the antenna panel according to the requirements in Appendix IV.

The contractor shall deliver the ground support equipment and test jigs required to integrate the antenna panel on the satellite, to perform the deployment test in two orientations to check mechanical functions of the antenna panel on the satellite, and to reset any hold downs. The contractor shall comply with the delivery schedule defined in section 5.

As a minimum, the Ground Support Equipment-2 (GSE-2) for the antenna panel deployment mechanism shall include the following items:

- The functional and deployment test of the deployment mechanism;
- Supporting fixture for the assembly and integration of antenna panel with deployment mechanism;
- Installation devices specific for the antenna panel and HDRM;
- Handling and support fixtures for the installation and the deployment test at satellite level;
- Transportation and storage containers;
- Assembly and integration service of antenna panel with deployment mechanism at S/C level for PFM1;

Zero-g kit for the antenna panel and the deployment mechanism integrated in the S/C in both vertical and horizontal positions of the deployment axes

## 4 Reporting, Reviews and Meetings

During the course of the design and the development the contractor shall prepare and conduct the following technical and review meetings:

- Preliminary Design Review (PDR)
- Critical Design Review (CDR)
- Manufacturing Readiness Review (MRR)
- EM Test Readiness Review (EM TRR)
- EM Consent to Ship Review (EM CSR)
- PFM1 Test Readiness Review (PFM1 TRR)
- PFM1 Consent to Ship Review (PFM1 CSR)
- PFM2 Test Readiness Review (PFM2 TRR)
- PFM2 Consent to Ship Review (PFM2 CSR)
- Final Review and Acceptance (FR)

### 4.1 Preliminary Design Review (PDR)

A Preliminary Design Review (PDR) meeting shall be held by the contractor. The purpose of the PDR shall be formally agreed the preliminary design of the unit. The selected design concept and its feasibility shall be presented, together with the trade-off analyses performed in the design selection process. External interfaces of the unit shall be reviewed for compatibility with the system design and frozen at this stage.

The harness for the deployable panels shall be defined and a preliminary design of the routing will be agreed for the performance of functional tests on flight representative harness provided by the Customer. This functional test at harness level will be performed by the Contractor under representative thermal conditions to determine the harness resistance torque to be considered for the deployment mechanism.

As a minimum, the PDR should address the following items:

- Interface drawings
- Preliminary assembly drawings.
- Review harness resistance torque test report
- Completed tradeoffs, feasibility, analysis, and preliminary design;

- Preliminary Analyses:
  - Mass properties,
  - Mechanical, thermal design and analyses,
  - Failure Mode Effects Analysis (FMEA);
- Hazard analysis, safety requirements if any;
- Risk management plan;
- Contamination and control plan;
- Parts selection and qualification status list;
- Materials and processes.

In preparation for the review, the contractor shall submit data copies of the PDR Report in electronic form to TASA at least two (2) weeks prior to the review.

## 4.2 Critical Design Review (CDR)

A Critical Design Review (CDR) meeting shall be held by the contractor. The purpose of the CDR shall be to close the critical design phase of the project and establish the initial product baseline. The CDR shall present all the same basic subjects as the PDR, but in the final designs through completed analyses, simulations, schematics, software code, and test results.

As a minimum, the CDR should address the following items:

- Closure of action items, anomalies, deviations, waivers, and their resolution following the PDR;
- Assembly and interface drawings;
- Final parts list;
- Assembly Integration and Verification plan (AIV plan) including EM, PFM, and spares;
- Functional, structural and thermal analysis. Budgets and design margins;
- Preliminary User manual including;
- Hazard analysis, safety requirements if any;
- Manufacturing Assembly Integration and Test (MAIT) flow of the hardware,
- Completed support equipment and test jigs;
- Verification plans,
- Schedule;
- Documentation status;
- Product assurance;

- **Identification of residual risk items.**

In preparation for the review, the contractor shall submit data copies of the CDR Report in electronic form to TASA at least two (2) weeks prior to the review.

### **4.3 Manufacturing Readiness Review (MRR)**

A Manufacturing Readiness Review (MRR) shall be held by the contractor. The aim of this meeting is to verify that all activities necessary prior to the start of manufacture of qualification, proto-flight model are complete and all the necessary documentation and resources are in place to enable manufacture to commence. If some activities are not completed at the time of the MRR, it is part of the review to assess the open issue and to decide if manufacturing may commence concurrently to the closure of the open issue action items.

In preparation for the review, the contractor shall submit data copies of the MRR Report in electronic form to TASA at least two (2) weeks prior to the review.

### **4.4 EM Test Readiness Review (EM TRR)**

An EM Test Readiness Review (EM TRR) shall be held by the contractor. The purpose of the TRR is to review the readiness of the unit to be tested, and the readiness of test documentation, test procedures, test software, test facilities, test equipment, test harness, test aids and test personnel. The TRR shall be held before performing acceptable, qualification, proto-flight and environmental tests on the unit.

The test items, equipment, protective devices, test aids, cabling, procedures and supporting documentation have been reviewed and found to be complete and adequate prior to the application of power and initiation of environmental testing.

In preparation for the review, the contractor shall submit data copies of the EM TRR Report in electronic form to TASA at least two (2) weeks prior to the review.

### **4.5 EM Consent to Ship Review (EM CSR)**

An EM Consent to Ship Review (EM CSR) shall be held by the contractor. The aim of the CSR is to review that the equipment (as per the baseline design agreed) and EIDP.

Upon receipt of the EIDP, TASA will review the delivered documents in order to allow the consent to ship. The EIDP shall be arrived at TASA's site for review at least two (2) weeks before the scheduled shipment. After EM being received by TASA, an acceptance process will be performed. After acceptance process successfully completed, the meeting will be held at TASA site to present and demonstrate the contract items are

accepted. If necessary, the contractor will be invited to attend the meeting via videoconferences, or teleconferences.

#### **4.6 PFM1 Test Readiness Review (PFM1 TRR)**

An PFM1 Test Readiness Review (PFM1 TRR) shall be held by the contractor. The purpose of the TRR is to review the readiness of the unit to be tested, and the readiness of test documentation, test procedures, test software, test facilities, test equipment, test harness, test aids and test personnel. The TRR shall be held before performing acceptance, qualification, proto-flight and environmental tests on the unit.

The test items, equipment, protective devices, test aids, cabling, procedures and supporting documentation have been reviewed and found to be complete and adequate prior to the application of power and initiation of environmental testing.

In preparation for the review, the contractor shall submit data copies of the PFM1 TRR Report in electronic form to TASA at least two (2) weeks prior to the review.

#### **4.7 PFM1 Consent to Ship Review (PFM1 CSR)**

A PFM1 Consent to Ship Review (PFM1 CSR) shall be held by the contractor. The aim of the CSR is to review that the equipment (as per the baseline design agreed) and EIDP.

Upon receipt of the EIDP, TASA will review the delivered documents in order to allow the consent to ship. The EIDP shall be arrived at TASA's site for review at least two (2) weeks before the scheduled shipment. After PFM1 being received by TASA, an acceptance process will be performed. After acceptance process successfully completed, the meeting will be held at TASA site to present and demonstrate the contract items are accepted. If necessary, the contractor will be invited to attend the meeting via videoconferences, or teleconferences.

#### **4.8 PFM2 Test Readiness Review (PFM2 TRR)**

An PFM2 Test Readiness Review (PFM2 TRR) shall be held by the contractor. The purpose of the TRR is to review the readiness of the unit to be tested, and the readiness of test documentation, test procedures, test software, test facilities, test equipment, test harness, test aids and test personnel. The TRR shall be held before performing acceptable, qualification, proto-flight and environmental tests on the unit.

The test items, equipment, protective devices, test aids, cabling, procedures and supporting documentation have been reviewed and found to be complete and adequate prior to the application of power and initiation of environmental testing.

In preparation for the review, the contractor shall submit data copies of the PFM2 TRR Report in electronic form to TASA at least two (2) weeks prior to the review.

#### **4.9 PFM2 Consent to Ship Review (PFM2 CSR)**

A PFM2 Consent to Ship Review (PFM2 CSR) shall be held by the contractor. The aim of the CSR is to review that the equipment (as per the baseline design agreed) and EIDP.

Upon receipt of the EIDP, TASA will review the delivered documents in order to allow the consent to ship. The EIDP shall be arrived at TASA's site for review at least two (2) weeks before the scheduled shipment. After PFM2 being received by TASA, an acceptance process will be performed. After acceptance process successfully completed, the meeting will be held at TASA site to present and demonstrate the contract items are accepted. If necessary, the contractor will be invited to attend the meeting via videoconferences, or teleconferences.

#### **4.10 Final Review and Acceptance (FR)**

After PFM and GSE being received by TASA, an acceptance process will be performed. After acceptance process successfully completed, Final Review (FR) meeting will be held at TASA site to present and demonstrate all the contract items are accepted. If necessary, the contractor will be invited to attend the meeting via videoconferences, or teleconferences.



## 5 Contract Schedule

The current milestones are shown in Table 5-1.

Table 5-1: Program Reviews Schedule (2024/18%, 2025/36%, 2026/46%)

Milestone	Document Delivered	Date	Location	Payment
PDR	CDRL-1001 CDRL-1005 CDRL-1007 CDRL-1009 CDRL-1010 CDRL-1011 CDRL-1013	CED + 3M	Contractor's site	18%
CDR	CDRL-1002 CDRL-1005 CDRL-1006 CDRL-1007 CDRL-1008 CDRL-1010 CDRL-1011 CDRL-1013	CED + 6M	Telecom	9%
MRR	CDRL-1003	CED + 10M	Telecom	9%
EM TRR	CDRL-1014, CDRL-1015	CED + 12M	Contractor's site or Telecom	9%
EM CSR	CDRL-1004 CDRL-1012 CDRL-1017 CDRL-1019	CED + 13M	Contractor's site or Telecom	0%

Delivery_1	CDRL-1016a CLIN 1 CLIN 2	CED + 14M	Telecom	0%
PFM1 TRR	CDRL-1014 CDRL-1015	CED + 16M	Telecom	9%
PFM1 CSR	CDRL-1004 CDRL-1012 CDRL-1017 CDRL-1019	CED + 20M	Contractor's site or Telecom	0%
Delivery_2	CDRL-1016b CDRL-1016c CLIN 3 CLIN 4	CED + 21M	Telecom	0%
PFM2 TRR	CDRL-1014 CDRL-1015	CED + 24M	Telecom	26%
PFM2 CSR	CDRL-1004 CDRL-1012 CDRL-1017	CED + 28M	Contractor's site or Telecom	0%
FR	CDRL-1016d, CDRL-1018 CLIN 5	CED + 32M	Telecom	20%

- The TBR item shall be confirmed as completed before the MRR phase, followed by contract amendments regarding the TBR content, which shall be mutually agreed upon and signed by both parties.

The Contractor shall delivery the required equipment no later than the schedule shown in Table 5-2.

Table 5-2 Required Equipment Delivery Schedule

	ITEM	Delivery Date
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CLIN 1	GSE-1	CED + 14Months
CLIN 2	EM	CED + 14Months
CLIN 3	PFM-1	CED + 21Months
CLIN 4	GSE-2	CED + 21Months
CLIN 5	PFM-2	CED + 32Months

## **6 Required Deliverables**

### **6.1 Deliverable Equipment**

#### **6.1.1 Destination of Delivery**

All equipment shall be delivered to the following address:

Attention: Mr. Benson Tung , Contract Manager  
General Affairs Division, Taiwan Space Agency  
8 F, 9 Prosperity 1st Road, Hsinchu Science Park, Hsinchu 30078, Taiwan, R.O.C.

### **6.2 Deliverable Items**

The contractor shall deliver the following items before the delivery date list in Section 5.

Item:

- CLIN 1: One (1) set of Ground Support Equipment-1 (GSE-1)
  - As defined in section 3.1
- CLIN 2: One (1) set of Antenna Panel Deployment Mechanism Engineering Model (EM)
  - As defined in section 3.2
- CLIN 3: One (1) set of Antenna Panel Deployment Mechanism Proto-flight Model 1 (PFM1)
  - As defined in section 3.3
- CLIN 4: One (1) set of Ground Support Equipment-2 (GSE-2)
  - As defined in section 3.2
- CLIN 5: One (1) set of Antenna Panel Deployment Mechanism Proto-flight Model 2 (PFM2)
  - As defined in section 3.3

### **6.3 Deliverable Documents**

The contractor shall deliver the documents as specified in Appendix III.