Statement of Work for a Target Service Shield for the MATERIAL PLASMA EXPOSURE EXPERIMENT (MPEX)

Prepared by

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, TN 37831-6283

Managed by

UT-BATTELLE, LLC

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Statement of Work for a Target Service Shield
for the
Material Plasma Exposure Experiment Project

MPEX-04-SOW-604

Reviewers:

Laura Parmley
Digitally signed by Laura Parmley
Date: 2026.08.20 07:38:07 -04'00'
Laura Parmley, TPO Date

Misty Magill
Digitally signed by Misty Magill
Date: 2026.08.24 08:00:35 -04'00'
Misty Magill, Procurement Officer Date

Milena Keys
Digitally signed by Milena Keys
Date: 2026.08.24 10:12:54 -04'00'
Milena Keys, Quality Assurance Representative Date

Muhammad Aftab Hussain
Digitally signed by Muhammad Aftab Hussain
Date: 2026.08.24 11:41:48 -04'00'
Aftab Hussain, MPEX Lead Engineer Date

Not applicable for this document
Digitally signed by Not applicable for this document
Date: 2026.08.25 02:39:10 -04'00'
Doug Curry, MPEX Operations Lead

Approver:

Digitally signed by Aaron, Adam
Date: 2026.08.25 09:03:32 -04'00'
Adam Aaron, CAM Vacuum Systems, TPO Date

Distribution:
Phil Ferguson, MPEX Project Director
Robyn Rose, MPEX Project Manager

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Revision History

Revision	Date	DESCRIPTION OF CHANGE	REVISION TYPE	
			Major	Minor
0	7/2026	Initial Issue	☒	☐
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ACRONYMS

MPEX	Material Plasma Exposure Experiment
TPO	Technical Project Officer
ISO	International Organization for Standardization
NIST	National Institute of Standards and Technology
NQA	ASME Nuclear Quality Assurance
QAP	Quality Assurance Program
SOW	Statement of Work
STEP	Standard for the Exchange of Product Data
PMI	Plasma Material Interaction
COTS	Commercial Off The Shelf
DAP	Delivered At Place
FAT	Factory Acceptance Test
POC	Point of Contact
PO	Procurement Officer
ORNL	Oak Ridge National Laboratory
CMM	Coordinate Measuring Machine
VCR	Swagelok VCR® Metal Gasket Face Seal Fitting
TEC	Target Exchange Cart or Target Exchange Chamber
S/CI	Suspect/Counterfeit Item
CFE	Company Furnished Equipment

1 INTRODUCTION

The Material Plasma Exposure eXperiment (MPEX), a superconducting magnet, steady-state device, is being constructed at Oak Ridge National Laboratory (ORNL), herein referred to as "the Company", to address the harsh conditions inside a fusion reactor. This device, as designed, will have the unique feature conducting accelerated lifetime tests of plasma-facing components, including those that have experienced neutron damage.

The primary role of the Target Service Shield is to provide a water-cooled barrier to protect the Target Exchange Chart (TEC) components that support the target during plasma exposure in the MPEX device.

2 SCOPE

This Statement of Work (SOW) applies to the fabrication, assembly, testing, inspection, packaging, and delivery of QTY (1) of a Target Service Shield as defined in *MPEX-04-DES-05-A550 REVERSE TARGET SHIELD FULL ASSY* [1]

Table 1 Target Service Shield Definition

Item	Order Qty	Drawing / Description
REVERSE TARGET SHIELD FULL ASSY	1	MPEX-04-DES-05-A550

The following components are being provided by the company in fulfillment of this fabrication:

Table 2 Target Service Shield Company Furnished Equipment

Item	Order Qty	Drawing / Description
TARGET SHIELD EX-BONDED SHORT, COOLING CHANNEL	1	MPEX-04-DES-05-A562

3 APPLICABLE DOCUMENTS

The documents in Table 3 apply to this procurement.

Table 3. Appliable Documents for the Target Service Shield

Document
MPEX-00-ENG-002 MPEX Vacuum Handbook [5]
MPEX-12-PLAN-001 Quality Assurance Plan for the MATERIAL PLASMA EXPOSURE EXPERIMENT [6]

4 PERFORMANCE REQUIREMENTS

4.1 TASK 1: QUALITY PLAN AND PROJECT SCHEDULE

The Seller shall prepare a quality plan and a project schedule for the fabrication, assembly, testing, inspection, packaging, and delivery of the Target Service Shield. The quality plan shall address how the Seller's Quality Program will be applied to the work in this SOW, and identify procedures and other documentation for all special processes, measurements, etc. The quality plan shall also identify the planned work to be outsourced, list the planned or expected subcontractors and Sellers, and address how the quality requirements of this SOW will be flowed down to these subcontractors and Sellers.

The project schedule shall contain sufficient detail so that ORNL may track procurement, fabrication, assembly, testing and shipping activities. The Seller shall propose milestones for tracking progress and payments including at a minimum those listed in Section 5.4.

For this task, the Seller shall provide ORNL with:

- Quality plan
- Project Schedule
- Factory Acceptance Test Plan

4.2 TASK 2: DESIGN REVIEW AND PERFORMANCE SPECIFICATIONS

The Seller shall review the MPEX drawings identified by the drawing package provided to the Seller in Table 1 and the guidelines and requirements outlined in *MPEX-00-ENG-002 Vacuum Handbook* (ORNL, 2021). The Seller can propose deviations or changes to these specifications. ORNL will review these change requests.

Proprietary Seller fabrication processes that are different than drawing specifications or requirements of *MPEX-00-ENG-002 Vacuum Handbook* (ORNL, 2021) shall be identified and reviewed with ORNL. The seller is responsible for documenting any deviation from the MPEX Target Service Shield drawings.

Any deviation request shall be submitted by the Seller and approved by ORNL for all process or specification deviations then must be maintained under revision control after ORNL approval. The seller shall provide ORNL with all released documents.

4.3 TASK 3: MANUFACTURING DESIGN REVIEW

With the completion of Task 2, and with authorization from ORNL, the Seller shall prepare a fabrication plan for the Target Service Shield to demonstrate how the design specifications given in the Engineering Drawing Package (ORNL, 2023)[8] and *MPEX-00-ENG-002 Vacuum Handbook* (ORNL, 2021) will be satisfied. The Seller shall prepare a report and participate in a

fabrication review. The Fabrication review will be held by videoconferencing or at the Seller's site based on agreement between the Seller and ORNL. The Seller shall prepare written meeting minutes and submit them to ORNL for review within 3 working days after the meeting. Completion of the Fabrication review and closure of all action items shall constitute a project milestone.

The Fabrication Review and Report shall include:

- Component fabrication plan, including all purchased and outsourced components
- Review of materials and processes to be used for Target Service Shield fabrication
- A project plan summary of how compliance with all MPEX requirements and specifications will be achieved.

4.4 TASK 4: TARGET SERVICE SHIELD FABRICATION

After completion of Task 3 and with approval of the TPO**,** the Supplier shall provide an updated manufacturing schedule and commence construction. The Supplier and TPO shall establish a recurring fabrication update meeting not to exceed 1 month between meetings. The Supplier shall prepare a current manufacturing status report and identify any fabrication issues or logistics that will affect the agreed upon delivery date. The TPO will review the manufacturing status and identify action items for the the Supplier, TPO, or POC as applicable. Action item status shall be reviewed at each fabrication status meeting. Fabrication status meetings shall be held by videoconference or at the Supplier's site based on agreement between the POC and TPO. The Supplier shall prepare written meeting minutes and submit them to the TPO for review within 3 working days after each meeting. Meeting minutes may be used to supplement the monthly reporting requirements of 5.7

At a minimum, the meeting minutes shall include:

- Project schedule update
    - Component fabrication status
    - Assembly and Weldment fabrication status
    - Delivery status
- Quality Assurance status update
    - Quality Control Inspection reports
    - Non-conformance reports
- Status of action items
- Report any variances or deviations from the agreed upon specifications
- Summary of main discussion topics
- Summary of decisions and agreements between the Supplier, POC, and TPO

Company Furnished Equipment (CFE)

The Supplier shall:

- Inspect the Target Service Shield assembly *MPEX-04-DES-05-A562 TARGET SHIELD EX-BONDED SHORT, COOLING CHANNEL*[9] upon receipt and document incoming receipt inspection for quantity, identification, visible damage, and condition and shall maintain custody control and protection of such material while it is in the Seller's possession. Seller shall provide receipt inspection documentation to ORNL and notify the TPO of any shipping damage or discrepancies.
- Protect and maintain the furnished assembly while in its possession.
- Incorporate the furnished assembly into the completed Target Service Shield in accordance with the approved engineering drawings.
- Return the completed Target Service Shield assembly including this part to ORNL in accordance with the packaging and delivery requirements of this Statement of Work.

4.5 TASK 5: FACTORY ACCEPTANCE TESTING

Upon successful completion of Task 4 and with authorization of the TPO, the Supplier shall perform factory acceptance testing, generate quality plan compliance documentation.

4.6 TASK 5: DELIVER TARGET SERVICE SHIELD

Deliver the Target Service Shield in accordance with approved design from Task 3 meeting the specifications in [1] and [5] and according to an approved shipping plan. The Supplier shall provide support either remotely or at the Company's site for the site acceptance testing. Final acceptance of the Target Service Shield will occur upon successful completion of the site acceptance tests at the Company's facility.

5 PROJECT MANAGEMENT

5.1 LANGUAGE

All communications and documentation shall be in English.

5.2 COMMUNICATIONS PROTOCOL

The Supplier shall designate an official single POC to interface with the Company's TPO. Only the Company's Procurement Officer (PO) can authorize changes to the price or work scope. SOW or Technical Specification updates will only be issued to the Supplier by the Company's PO.

Problems encountered or anticipated shall be communicated as soon as practical.

5.3 KICKOFF MEETING

The kickoff meeting will be scheduled at a mutually agreeable time as soon as practical after award of the subcontract. The Supplier is responsible for recording meeting minutes and submitting them to the TPO within 3 working days after the meeting.

The primary purpose for the kickoff meeting is to confirm that the project participants understand the terms and conditions of the subcontract, SOW, specifications, and work activities.

The following topics will be discussed:

1. Flow down of requirements, including flow down to outsourced suppliers.
2. Work activities, schedules, and deliverables
3. Expectations for satisfying quality standards and documentation

The Supplier shall be prepared to review Tasks 1 and 2 during the kickoff meeting.

5.4 SCHEDULE AND MILESTONES

At a minimum, the schedule shall include the following activities or milestones:

- Kickoff meeting
- Manufacturing Design Review
- Resolution of issues or concerns and approval for construction
- Materials ordered or fabrication commenced
- Factory Acceptance Tests
- Preparation for shipment
- Complete assembly at customer site
- Customer site final acceptance tests
- Complete final documentation

5.5 VARIANCE REPORTING

The Supplier shall notify the TPO and the PO immediately in writing when it is determined the actual cost may exceed the Agreement price. In no case shall the Supplier continue work without authorized funding if it is determined that actual cost may exceed the Agreement price.

5.6 PERIODIC COMMUNICATIONS

The Supplier shall participate in a bi-weekly (every other week) meeting to be held with the Company's TPO to discuss any technical issues and schedule, personnel, and any other items pertinent to the work activities. The bi-weekly phone conference will serve as a mechanism to get early visibility of potential problems and issues arising during the performance of this subcontract. The Supplier shall prepare written meeting minutes and submit these to the TPO within 3 working days after the meeting.

5.7 MONTHLY REPORTS

Monthly reports shall be submitted by the third calendar day of each month or on the Supplier's usual reporting schedule as mutually agreed between the TPO and the Supplier's designated POC.

Monthly report data shall include actual schedule progress, milestones reached, corrective actions needed, display of the present critical path for the Supplier's work, and a brief narrative describing the status of work, significant accomplishments, actual and potential problems and risk mitigations or corrective actions.

6 QUALITY ASSURANCE

6.1 QUALITY PROGRAM

The Supplier shall have an established and effectively implemented Quality Assurance Program (QAP) that, at a minimum, is ISO 9001 certified, but preferably compliant with NQA-1 2008/2009a or equivalent. The Supplier shall be able to demonstrate that it can fulfill the quality assurance requirements in this Statement of Work.

At a minimum, the prospective supplier shall have an established, documented, and effectively implemented quality assurance program describing controls for: work processes (controlled by instructions/procedures), personnel training and qualification, document and records control, design, procurement, inspection, and testing; including the use of measuring and test equipment when used, corrective action, and assessments (audits).

The Seller's QAP will be evaluated to determine the degree of effective implementation of the quality program. Deficiencies, if any, identified during the evaluation shall be addressed and corrected to the satisfaction of ORNL. The QAP shall be approved prior to procurement of items.

All suppliers/sub-suppliers, subcontractors, and fabricators (as applicable) shall have a Quality Assurance Program that meets or exceeds the requirements described above.

All work at Supplier's facility shall comply with the accepted industrial standards and codes and *Quality Assurance Plan for the MPEX-12-Plan-001 MATERIAL PLASMA EXPOSURE EXPERIMENT* [6].

When a nonconformance is identified, the Supplier shall document and report the condition to the Company in a Non-Conformance Report (via email, copy of internal NCR Form, Or Supplier's NCR form partially completed) to the TPO, with a copy to the Procurement Officer (PO) and MPEX Quality Representative (QR), as soon as reasonably possible.

Items that do not conform to specified requirements shall be controlled to prevent inadvertent installation or use. The Non-Conformance Report should contain or refer to all relevant material available to enable an informed decision on the definite course of action to be taken. At a minimum, this report shall describe the issue, provide details on how it could or could not affect the performance, safety, reliability, operability, traceability, interchangeability, or regulatory requirements, and provide disposition of the issue as applicable.

The Company TPO will review and discuss the Non-Conformance Report with the Supplier and based on the review, either return the Non-Conformance to the Seller POC with approval to provide any additional details, action items, proposed dispositions, and justifications with resolution for the Supplier to implement prior to resuming work.

The Supplier's QAP shall include a S/CI Program that is compliant with DOE O 414.1D, Quality Assurance (https://www.directives.doe.gov/), or an approved equivalent.

6.2 ACCESS FOR SOURCE SURVEILLANCE INSPECTION

As part of the Company's quality assurance program, the Company reserves the right to perform source surveillance/inspection activities at the Supplier's facility or any sub-tier Supplier facility that the Company determines necessary to ensure that quality requirements are met.

The Company reserves the right to schedule all critical operations (to be determined by the Company) for the convenience to supervise and witness these operations.

6.3 SUPPLIER REQUESTED DEVIATIONS

The Supplier shall propose any deviations to the specifications, drawings, or other technical requirements and obtain the Company's approval prior to invoking the deviation. Any Deviation Requests arising from the fabrication phase shall adhere to the Supplier's Quality Program procedure and must be approved by the Technical Project Officer (TPO).

6.4 MEASUREMENT AND TEST EQUIPMENT

Tools, gages, instruments, and other measuring and test equipment used for activities affecting quality shall be controlled, calibrated at specified periods, adjusted, and maintained to required accuracy limits. Records shall be provided to ORNL prior to onset of activities.

Measuring and test equipment used by the Supplier to perform work under this Statement of Work shall be calibrated and traceable to NIST standards. Calibrations shall be current. Calibration records shall be provided to the Company.

6.5 MEASURING AND TEST MILESTONES

- CMM inspection required after completion of machining of Target Service Shield
- Vacuum and hydrostatic leak testing required for welds of complete assembly after completion of final welding of full assembly of Target Service Shield

7 TRANSPORTATION

ORNL will ship the Company Furnished Target Service Shield assembly to the Supplier following subcontract award.

The completed Target Service Shield shall be packaged in a manner that protects the equipment from damage, indicates exposure to shock during handling, and facilitates movement, loading, and unloading by fork truck or crane. Delivered at Place (DAP) (ORNL Facility – Oak Ridge TN).

8 VACUUM INTEGRITY

- All stainless-steel vacuum components exposed to vacuum shall be electropolished per ASTM B912, passivation of stainless steels using electropolishing.
  - Passivate *MPEX-04-DES-05-A549*. ~~[6]~~
  - Do **NOT** passivate *MPEX-04-DES-05-A548* ~~[6]~~or *MPEX-04-DES-05-A550*. ~~[6]~~
- VCR fittings shall incorporate appropriate VCR caps.

9 DELIVERABLES

The Supplier shall deliver:

- Target Service Shield meeting the requirements of the referenced documents.
- Calibration records for measurement and test equipment
- Welder qualification documents
- Inspector qualification documents
- Test and Inspection results
- Material Mill Test Report
- Cleaning Certification
- Certificates of Compliance for all purchased components and materials
- Final report documenting any non-conformances
- Shipping plan compliant with MPEX Vacuum Handbook ~~[6]~~
- Any documentation otherwise identified above but not part of this list.

Completed factory acceptance test report shall include as a minimum:

- Vacuum Leak Checking Report (Water passages must be vacuum tight since assembly operates in vacuum chamber.)
- Hydrostatic Testing Report
- Magnetic Permeability Verification Report
- Material Certifications
- Weld Certifications and Weld Inspections
- Dimensional Inspection Report

10 REFERENCES

[1] MPEX-04-DES-05-A550 *REVERSE TARGET SHIELD FULL ASSY*
[2] MPEX-04-DES-05-A550 *REVERSE TARGET SHIELD FULL ASSY.STEP*
[3] MPEX-04-DES-05-A548 *TARGET SERVICE SHIELD SHORT, WELDMENT*
[4] MPEX-04-DES-05-A549 *TARGET SHIELD SUPPORT REVERSE ASSY*
[5] MPEX-00-ENG-002 *Vacuum Handbook*
[6] MPEX-12-PLAN-001 *Quality Assurance Plan for the MATERIAL PLASMA EXPOSURE EXPERIMENT*
[7] ASME Boiler and Pressure Vessel Code (BPVC)
[8] Engineering Drawing Package (ORNL, 2023)
[9] MPEX04-DES-05-A562 *TARGET SHIELD EX-BONDED SHORT, COOLING CHANNEL*