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STATEMENT OF WORK
for the
100.625 MHz RF Amplifier System

Quality Classification: A-3

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Prepared By:

Signed by: Michael Sowinski E4236AA5C1F345F... Date: 7/1/2026

M. Sowinski, RF Engineer

Reviewed By:

Signed by: Vincent Lodestro 730C17E76C31428... Date: 7/2/2026

V. Lo Destro, RF Engineer / LINAC Operations

DocuSigned by: Alex Zaltsman B3555298D441402... Date: 7/2/2026

A. Zaltsman, RF Engineer

Signed by: Carlos Ramirez Lockward 403860527D874DA... Date: 7/6/2026

C. Ramirez Lockward, RF Engineer

DocuSigned by: Deepak Raparia D5648FB1DAC7454... Date: 7/6/2026

D. Raparia, Head of Preinjector Systems

DocuSigned by: 58350F1D8EB146A... Date: 7/6/2026

M. Okamura, Source Group Leader

Approved By:

Signed by: Freddy Severino 6EF8668D22444EB... Date: 7/6/2026

F. Severino, RF Group Leader

This document contains BNL procurement requirements and specifications for solicitation and technical evaluation. The information is high-level and does not include the detail necessary for 'development' or 'production' as defined under 15 CFR §772.1, 22 CFR §120.33, or 10 CFR Part 810; therefore, it does not constitute export-controlled technology or technical data.

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REVISION HISTORY

Revision #	Effective Date	Summary of Change
00	June 22, 2026	Initial Release
01	July 1, 2026	Technical clarifications, editorial corrections

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LIST OF ACRONYMS

ARO	After Receipt of Order
ASME	American Society of Mechanical Engineers
ATP	Acceptance Test Procedure
BNL	Brookhaven National Laboratory
BOM	Bill of Material
BSA	Brookhaven Science Associates
CDRL	Contract Data Requirements List
EIC	Electron-Ion Collider
ESH	Environment, Safety and Health
ESS	Environmental Stress Screening
FAT	Factory Acceptance Test
FDR	Final Design Review
FRU	Field Replacement Unit
HALT	Highly Accelerated Life Testing
JLAB	Jefferson Laboratory
MRP	Material Requirements Planning
MTBF	Mean Time Between Failures
M&TE	Measuring and Test Equipment
NIST	National Institute of Standards and Technology
NRTL	Nationally Recognized Test Laboratory
PA	Power Amplifier
PDR	Preliminary Design Review
PM	Program Manager
PO	Purchase Order
POC	Point of Contact
QA	Quality Assurance
RF	Radio Frequency
RVM	Requirements Verification Matrix
SOW	Statement of Work
TIM	Technical Interchange Meeting

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GLOSSARY

Demonstrator	The demonstrator should be the largest granularity amplifier sub chassis that when combined with like kind hardware at the system level will provide the full output power. It is considered the fundamental building block of any salable RF amplifier architecture. The demonstrator will be used as proof of concept to qualify that the design typology and critical component margins implemented by the Contractor comply with the technical specification. The demonstrator is defined as an amplifier, the incorporated interlock and monitoring devices, and local control and monitoring interfaces.
RF-PA	An RF-PA is the highest power gain stage and the last gain stage within the RF amplifier chain. It typically contains two devices in push pull or four devices in quadrature.
RF Amplifier System	The RF Amplifier System comprises all components required to bring the RF amplifier to full operation.

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Statement of Work for the 100.625 MHz RF Amplifier System

1 SCOPE

This Statement of Work (SOW) will be the basis for the procurement of 100.625 MHz RF amplifier system to be used by the Electron Beam Ion Source (EBIS) Project managed by Brookhaven Science Associates (BSA). This document outlines the Contractor's responsibilities and obligations necessary for completing the requirements as set forth herein.

The procurement will be executed in phases as follows:

Phase 1: The Contractor shall provide one (1) RF power amplifier unit, including delivery, for initial installation, integration, and performance verification.

Phase 2: Following successful verification and acceptance of the Phase 1 unit, Brookhaven National Laboratory may exercise an option to purchase one (1) additional RF power amplifier unit, subject to availability of funding. The Phase 2 unit shall be provided at the same price, terms, and conditions as the Phase 1 purchase and must be exercised within six (6) months after successful completion of Phase 1 verification.

1.1 Background

The Electron Beam Ion Source, EBIS, is a Preinjector for a new Nuclear Physics Facility , the Electron Ion Collider and the NASA Space Radiation laboratory. The EBIS consists of an ion source designed to deliver milliamps of current of any ion species and charge state from protons to uranium. It is followed by the Radio Frequency Quadrupole, RFQ, accelerator and a Linear Accelerator with a final energy output of 2 MeV/u. This Statement of Work will address the Power Amplifier for these accelerating cavities.

2 APPLICABLE DOCUMENTS

In the event of a conflict between the Technical Documentation and this SOW, the Contractor shall immediately notify the BSA Contractual Representative who shall in each instance determine which document takes precedence and advise the Contractor accordingly. Failure to notify BSA of a document conflict shall not relieve the Contractor's responsibility to ensure full compliance with all requirements.

The following documents are an integral part of the SOW; the applicable revision level will be the latest that is in effect at the time of award:

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Document Number	Document Title
spec_CAD-1376	Specification for the 100.625 MHz RF Amplifier System
ASME Y14.100	Engineering Drawing Practices
AFSC 800-27	Acquisition Management Part Derating Guidelines
MIL-STD-975	NASA Standard Electrical, Electronic and Electromechanical Parts List
IPC-A-610H	Acceptability of Electronic Assemblies
ISO 9001	Quality Management System
29 CFR 1910 Subpart S	Occupational Safety and Health Standards 1910 Subpart S - Electrical
NFPA 70E-2021	Standard for Electrical Safety in the Workplace Articles 340, 350, 360
UL 508	Standard for Industrial Control Equipment

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3 REQUIREMENTS

In accordance with the applicable specifications, referenced documents, and instructions as defined in this Statement of Work, the Contractor shall be responsible for designing, manufacturing, inspecting, testing and delivering the RF amplifier system.

3.1 Contractor Responsibilities

3.1.1 Technical Performance

In accordance with this SOW, BSA technical specification spec_CAD-1376, and all referenced documents, the Contractor shall furnish all equipment, materials, tools, facilities and labor to perform the work necessary to manufacture and test the RF amplifier system. The Contractor shall ensure that the resultant design & finished product meets the performance parameters and criteria in accordance with BSA technical specification spec_CAD-1376 and all other referenced documents.

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3.1.2 Tooling/Fixtures/Test Equipment

The Contractor shall be responsible for supplying all materials, including (but not limited to) the construction of all tools, jigs, fixtures, and test equipment required to meet the requirements of this SOW and the referenced technical drawings and specification(s). This shall include Test fixtures required to operate the demonstrator at BNL.

3.1.3 Consumables and Field-Replaceable Units (FRUs)

The Contractor shall quote consumable replacements and FRUs.

Not taking into account spares, there should be enough RF transistors on hand to allow 2 years of operation of the RF amplifier system. This means that whatever the transistor failure rate, the Contractor shall provide replacement transistors at their expense until completion of two years of operation of the amplifier after BSA's site acceptance test.

3.1.4 Hardware and Data Deliverables

The Contractor shall be responsible for providing documentation as specified in the contract data requirements list (CDRL) presented in §5.

It is of the utmost importance to have a design which is extremely reliable, requires a minimum of maintenance, and enables easy replacement of faulty hardware. Isolated RF combiners are preferred but not required.

3.1.5 Materials

The Contractor shall have an effective storage and age control system for items (such as epoxy), where acceptability is limited by the age or manner of storage of the item.

3.1.6 Demonstrator

To verify the design, characteristics, and operation of the RF amplifier system, a demonstrator shall be delivered to BSA so that site acceptance tests can be carried out. When testing is concluded the demonstrator will be returned to the Contractor.

Production of the RF-PAs shall not start before BSA verifies that the demonstrator complies with all the requirements of the technical specification and has granted formal acceptance of the demonstrator in writing.

In support of the Contractor's work, BSA will use the following material for the site testing of the Demonstrator at BNL:

- Power supplies required to operate the demonstrator;

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- RF drive power required to operate the demonstrator up to full rated power.

3.1.7 Contractor Activities

The Contractor shall execute the following activities:

- Detailed preliminary design review;
- Detailed final design review;
- Design of demonstrator;
- Design of 350kW RF amplifier system;
- Manufacturing of demonstrator;
- Manufacturing of 350kW RF amplifier system;
- Burn-in Tests of 350kW RF amplifier system;
- Factory acceptance test (FAT) of 350kW RF amplifier system.

BSA and its representatives shall have free access during normal working hours to the Contractor's factory during the contract period. BSA will provide a minimal of 1 week notice prior to a Contractor's site visit.

Contractor shall provide the following items:

- Test fixtures required to operate the demonstrator at BNL;
- RF dummy load for Contractor Acceptance Test and FAT at Contractor's facility.

3.1.7.1 Activities at BNL Performed by BSA

- Receiving the demonstrator and any required test fixtures;
- Commissioning of the demonstrator up to full power in accordance with BSA's acceptance testing;
- Receiving the 350kW RF amplifier system;
- Commissioning of the 350kW RF amplifier system up to full power in accordance with BSA's acceptance testing.

3.2 Engineering Design and Manufacturing Requirements

3.2.1 Detailed Analysis Requirements

The Contractor shall perform the following analysis to ensure the equipment meets the requirements of BSA specification spec_CAD-1376. Models and results shall be provided electronically in their native ANSYS, or equivalent, format, as well as in hard copy form.

3.2.1.1 Electrical Design

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The Contractor shall present detailed schematics, BOMS, and RF power calculations that support the design approach taken to meet the performance and requirements of the specification.

Compliance with 29 CFR 1910 Subpart S and NFPA 70E-2021 is required.

3.2.1.2 Mechanical Design

The Contractor shall present detailed mechanical design drawings that support the design approach taken to meet the performance and requirements of the specification.

3.2.1.3 Thermal Analysis

The Contractor shall analyze the RF amplifier system for the temperature as defined in the specification with special attention to die temperatures.

3.2.1.4 Test Approach

Approach to Acceptance Testing.

3.2.1.5 Redundant Operation

Output power degradation vs number of RF devices failed/inhibited.

3.2.2 Detailed Design Requirements

3.2.2.1 Preliminary Design Review (PDR) Data Package

The Contractor shall be responsible for providing a PDR data package (CDRL003) that reflects the state of the developed design. The PDR package shall consist of the following items to be addressed in detail and supported by the detailed analysis requirements listed in Section 3.2.1 that shall be presented at the PDR for review and approval.

At a minimum, the design report shall include mechanical and electrical drawings, applicable component datasheets, calculations, test facilities, processes and methods, risks, quality control procedures which are intended to be implemented, and the integrated master schedule.

3.2.2.2 Final Design Review (FDR) Data Package

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The Contractor shall be responsible for providing a FDR data package that reflects the state of the developed design as it evolved from the PDR. The Contractor shall be responsible for developing the overall design of the Equipment in accordance with the applicable specifications and supporting documents as identified herein. The Contractor shall submit an FDR data package (CDRL007) per the Contract Data Requirements List, providing all the items noted in the PDR package and addressing the following items:

- Detailed design of the 350kW RF amplifier system;
- Final interface configuration, complete description and detail of remote communication protocol including every command and expected response;
- MTBF analyses, final BOM;
- Material selection, hazard management analyses;
- Major design changes between the PDR and FDR.

3.2.2.3 Approval to Proceed

BSA must approve in writing the Final Design Review Package, including any modifications introduced at the Final Design Review, before the Contractor proceeds with ordering of material and components. Ordering of long-lead-time materials and components prior to the approval of the Final Design Review Package must be reviewed and approved in writing by BSA.

3.2.3 Acceptance Test Procedures (ATP)

The Contractor shall provide an ATP (CDRL011A) for the demonstrator. The Contractor shall provide ATPs (CDRL011B) for the 350kW RF amplifier system that are in accordance with this SOW, the specification, and all reference documents noted herein. The ATPs must be approved in writing by BSA prior to use. The ATPs shall ensure that all test requirements as defined in the specification are achieved.

3.2.3.1 Acceptance Test Data Sheets

The Contractor shall provide an acceptance test data sheet (CDRL012A) for the demonstrator. The Contractor shall provide acceptance test data sheets for the 350kW RF amplifier system (CDRL012B/CDRL012C) that are in accordance with this SOW, the specification, and all reference documents noted herein. The acceptance test data sheets must be approved in writing by BSA prior to use. The acceptance test data sheets shall ensure that all test requirements as defined in the specification are achieved. All environmental conditions (air temperature, water temperature, etc.) shall be recorded on the acceptance test data sheets. Data plots

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from measurement equipment (network analyzer, spectrum analyzer, oscilloscope, etc.) shall be included in or along with the acceptance test data sheets.

3.2.4 Factory Acceptance Test (FAT)

After the Contractor is finished testing the RF amplifier system in accordance with the ATP, BSA will conduct factory acceptance testing at the Contractor's site. One visit will be required to conduct the FAT. BSA will require the acceptance test data sheets and traceability logs 2-4 weeks prior to the FAT.

3.2.5 BSA Site Acceptance Testing

3.2.5.1 BSA Site Acceptance Testing of Demonstrator

The Contractor shall allow BSA 6 weeks after receiving the demonstrator to perform site installation and BSA acceptance testing. BSA reserves the right to perform an X-ray inspection on the demonstrator.

BSA reserves the right to perform ESS and/or HALT testing on the demonstrator or the demonstrator's sub- assemblies. Stresses of temperature, rapid thermal cycle, and vibration (multi-axis) may be used. BSA reserves the right to remove the lid(s) from the RF devices to take thermal readings.

3.2.5.2 Site Acceptance Testing of RF Amplifier System

The Contractor shall allow BSA 13 weeks or 200 hours of run time, whichever comes first, after installing each RF amplifier system to perform site acceptance testing. BSA will perform tests to verify all the requirements within the specification document are met. If any requirement is not met, the Contractor will be responsible for any upgrading or repairing at its expense.

Site Acceptance Testing of the 350kW RF amplifier system will take place at BNL.

3.3 Management

3.3.1 Program Management

The Contractor shall appoint a program manager (PM) to manage the program and be the functional point of contact (POC) for the program. The Contractor's PM shall be prepared to present and discuss with BSA's PM, or designated

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representative, the most current and practical status of the program. The Contractor's PM shall report all programmatic and technical problems, which will impact the development/delivery schedules and/or equipment performance when and if they occur and shall also document such problems in the next status report.

3.3.2 Technical Point of Contact (POC)

For the period of performance of the contract, the Contractor shall appoint a project engineer who shall be given full technical responsibility and authority to carry out the Contractor's efforts to meet the requirements of this SOW.

3.3.3 Integrated Master Schedule

At the beginning of the contract and before the start of material procurement, the Contractor shall submit for BSA's written approval a detailed initial integrated master schedule (CDRL001A) defining the processes and methods which the Contractor intends to implement. It shall address the Material Requirements Planning (MRP), and at a minimum include manufacturing, inspection, and test steps including identification of critical manufacturing operations and parts/subassemblies showing integrated flow into the end item(s). The integrated master schedule (CDRL001B) shall be included along with each Status Report.

3.3.4 Status Reports

The Contractor shall develop and submit status reports (CDRL002A/ CDRL002B), that provide status against the baseline including work completed and work to complete as required with BSA. The reports shall be sent to the BSA technical representative and contractual representative. Status reports shall be submitted on a biweekly basis. Additionally, these reports shall address significant areas of concern and offer a recommended approach for problem resolution or mitigation by way of a risk register. An action item log shall be maintained by the Contractor and included in the Status Report.

3.3.5 Meetings

Teleconference status meetings shall be scheduled as needed and mutually agreed upon with the appropriate program and engineering personnel.

Technical interchange meetings (TIMs) may be held to review the progress of the design against the specification. Meetings shall be scheduled as required and mutually agreed upon.

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3.4 Design Reviews

3.4.1 Post Award Review / Kick-Off

A program kick-off meeting shall be scheduled no later than 4 weeks ARO via teleconference. The Kick-off meeting agenda shall consist of reviewing the following as a minimum:

- Detailed specification requirements;
- Statement of work;
- Initial integrated master schedule (CDRL001A).

3.4.2 Preliminary Design Review Meeting

A PDR meeting shall be held in accordance with the schedule set forth in section 6 herein, to ensure compliance with this SOW and applicable specifications. The Contractor shall present the preliminary design of the 350kW RF amplifier system, which shall include a compliance matrix against the technical specification and the interface configuration. The Contractor shall provide a PDR data package (CDRL003) that shall consist of the requirements set forth in section 3.2.2.1. The contents of this package shall be reviewed at the PDR to be held at the Contractor's facility. The Contractor shall be responsible for maintaining and submitting the minutes including action items of the PDR (CDRL004).

When all action items that result from the PDR are resolved, written authorization from BSA to the Contractor will be provided to proceed with the design effort through FDR.

3.4.3 Final Design Review Meeting

An FDR meeting shall be held in accordance with the schedule set forth in section 6 herein, to ensure compliance with this SOW, applicable specifications, interface configuration, and to obtain BSA approval to proceed to the production phase. The Contractor shall provide a FDR data package (CDRL007) that shall consist of the requirements set forth in section 3.2.2.2. The findings of the FDR data package shall be reviewed at the FDR to be held at the Contractor's facility and shall cover all pertinent issues relating to the final detailed design of the Equipment. The Contractor shall be responsible for maintaining and submitting minutes including action items of the FDR meeting (CDRL008) and shall also incorporate any agreed-to changes into the final comprehensive FDR package (CDRL009), both of which are to be submitted to BSA for subsequent review and written approval. The Contractor shall provide to BSA electronic copies of the final assembly models (in .stp format) (CDRL010) per the Contract Data Requirements List. When all action

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items that result from the FDR are resolved, written authorization from BSA to the Contractor will be provided to proceed with the fabrication/assembly of the production units.

Upon written approval of the FDR package the design is to be considered "frozen" and no changes are permitted to the design, materials, processes, methods, and tooling, or component-level substitutions, without written approval by BSA.

3.5 Documentation and Data Management

3.5.1 Report/Documentation Format

- All reports submitted shall include an introduction, body of the documents, and a conclusion. Large documents shall include a table of contents. For calculations, equations shall be shown with values defined for each variable so the analysis can be reviewed. Diagrams shall be included for clarity and labels shall be consistent with design drawings for specific items, such as vessel penetrations.
- All documentation provided by the Contractor shall be in English.
- The Contractor shall provide an electronic copy (BSA-identified FTP, DVD or USB data storage device) of all documentation required by this SOW. Contractor manufacturing drawing Computer-Aided Design files of all components and assemblies shall be in one of these formats: STP, SAT, IGES, IAM, or IPT.

3.5.2 Engineering Drawing Practices

All Contractor-generated engineering drawings shall be in accordance with ASME Y14.100, Engineering Drawing Practices. All dimensions and tolerances shall be U.S. Customary units with metric (SI) units as a secondary notation.

3.5.3 End Item Documentation Package

The Contractor shall provide with the end item documentation package an electronic copy and three (3) physical copies of the following documentation in accordance with the schedule set forth in this SOW. The End Item documentation package shall consist of all documentation identified in this SOW and include the following:

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a. De-Rating Analysis Reports: The Contractor shall submit to BSA detailed de-rating analysis reports (CDRL005) for all RF assemblies in the RF chain for the RF amplifier system. The assemblies shall follow the guidelines outlined in document AFSC 800-27 for component stress derating and MIL-STD-975 (para 3.16) for wire and cable current derating. The specific derating limits are subject to the prior written approval of BSA. Applicable electrical schematics and mechanical drawings shall be included with the de-rating analysis reports.

b. Requirements Verification Matrix (RVM): The Contractor shall submit to BSA RVMs (CDRL006) for the 350kW RF amplifier system. The RVMs shall specifically address the details behind how the test methodology will be accomplished for each individual requirement in accordance with the specification. At a minimum, the RVMs shall include the requirement, the document that addresses the requirement, the verification method, and the anticipated compliance result. The verifications methods are test, analysis, and inspection. In the event the verification method is by analysis, a separate analysis report (CDRL017) shall be included with the RVMs. All documents (test procedures, etc.) that address the requirements shall be provided with the RVMs.

c. Operating Manuals: The Contractor shall submit to BSA an operating manual (CDRL018A) for the demonstrator. The Contractor shall submit to BSA operating manual(s) (CDRL018B) for the 350kW RF amplifier system. At a minimum, the operating manual(s) shall contain:
   - General Information – Introduction, cautions, physical description, electrical description, and specifications;
   - Installation – Initial inspection, environmental requirements, mechanical requirements, electrical requirements, and system connections;
   - Operation – Controls and indications, interface configuration, complete description and detail of remote communication protocol including every command and expected response, operating modes, configuration settings;
   - Theory of operation – RF amplification, power supply, metering, cooling, and fault detection;
   - Maintenance – Preventive maintenance, alignment, and troubleshooting;
   - Detailed final schematic diagrams with bias values for all active RF components;
   - All final BOMs with manufacturer part number and reference designators;
   - All final schematics;
   - All final mechanical drawings.

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d. Certificate of Conformance.

3.5.4 Records

The Contractor shall retain objective evidence, including records, of the inspections and tests performed in the course of manufacturing, testing, inspecting, preserving, packaging, and preparation for shipment of procured items. These records shall be made available to BSA for review upon request. These records shall be maintained for a minimum of five (5) years, unless otherwise specified in the procurement documentation, after the completion of the Purchase Order (PO)/Contract.

3.6 Environment, Safety and Health (ESH)

The Contractor shall design and build all Equipment in accordance with ESH requirements in the appropriate specifications, codes, standards, and other documents listed in Section 2 of this SOW.

- ***Electrical safety***
  All electrical equipment, material, and system delivered to BNL shall be certified, listed, or labeled by a Nationally Recognized Testing Laboratory (NRTL). The CE mark is NOT a recognized NRTL certification mark. (For a listing of OSHA-recognized NRTLs, refer to http://www.osha.gov/)

  For electrical equipment, material, and system which are not NRTL listed, the Supplier shall determine the equipment to be safe for its intended use and shall receive a field evaluation from a Nationally Recognized Testing Laboratory. The determination must be made on the basis of test data. The determination and test data documents shall be made available to BSA prior to the FDR for review and acceptance by the applicable BSA Authority Having Jurisdiction (AHJ).

  High voltage connectors, wiring terminations, or any other component shall be physically separated from low voltage control circuits. All electrical connections ≥50 volts shall be covered to comply with UL 508 so that all uninsulated charged surfaces protect workers from the hazards of electrical shock. Plexiglas® is not allowed; Lexan® may be used. Enclosure covers shall only be removable with the use of tools.

  Mechanical interlocks shall be present on rack doors to prohibit exposure to voltages within the rack ≥50 volts.

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If the stored energy exceeds 100 joules and/or exposed voltage exceeds 50 volts, there shall be an appropriate discharge mechanism to bring it to a safe working condition.

- ***Hazard Management***
  Hazard management techniques shall be applied to reduce the risk of personnel becoming injured as a result of interaction with the equipment. Consideration shall be made of hazards during all stages of the life of the equipment including preliminary component selection, installation, commissioning, operation, maintenance, repair, decommissioning and disposal. The analyses shall include hazards that may occur during fault conditions and shall include all potentially hazardous materials. The analyses and any findings shall be discussed during the FDR.

  The hazard management system shall:

  - Identify hazards;
  - Reduce severity;
  - Mitigate likely hazards.

- ***Materials***
  All materials shall be self-extinguishing, zero halogen and shall not release any toxic or corrosive products when subjected to fire. The demonstrator and 350kW RF amplifier system case and all metal parts used inside shall be corrosion resistant and all surfaces treated accordingly. Final material selection is subject to the prior written approval of BSA.

3.7 Marking and Serialization

Where labeling is required, the position of serialization and/or labeling of the identification number/nameplate shall be agreed upon between the Contractor and BSA prior to acceptance of final design.

3.8 Warranty

The RF amplifier system shall have a 2-year warranty. The Warranty shall start after successful BSA Site Acceptance Testing. The warranty shall cover the RF amplifier system's normal operation into a properly terminated RF output.

3.9 Packaging

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In preparation for shipping, the RF amplifier system shall be covered or wrapped for protection against weather elements, dust, and damage to projections, shock loads, impacts, and rubbing. The RF amplifier system shall be properly braced and cushioned within the packing so that it will not shift during handling and shipment. The method of shipping will be specified by BSA one month prior to delivery. The container shall be appropriately labeled with the listing of contents, destination, gross weight, location of center of gravity, purchase order/Contract number, and contact information. Each container shall have G-force shock indicators. Each container shall be palletized and include provisions to permit access for a forklift to lift the container.

The Contractor shall ensure that the equipment is delivered without damage and any possible deterioration in performance due to transport conditions.

3.10 Maintenance

All preventative and corrective maintenance required to maintain the RF amplifier system 100 % operational status will be performed by BSA personnel, this shall not void the warranty. RF amplifier system or parts under warranty shall be sent for repair to the Contractor or replaced by the Contractor at its expense.

4 QUALITY ASSURANCE

4.1 Quality System and Facility Access

The Contractor shall maintain and apply an effective and documented quality assurance system for the design, manufacture, and testing of all equipment provided. The system shall meet the requirements of the ISO-9001 Standard, "Quality Management Systems Requirements", and shall provide the processes to ensure that each component produced for acceptance conforms to the requirements of this document and the applicable technical documentation. The Contractor shall supply the necessary documentation to demonstrate this compliance. Post-award surveys may be required and shall be supported by the Contractor. In addition, BSA representatives shall have access to the Contractor's facility during agreed-upon fabrication, inspection and testing processes. The Contractor shall provide ten (10) working days' notice in advance of the agreed-upon witness points.

As set forth in BSA Form BNL-QA-101, "Brookhaven National Laboratory Supplier Quality Assurance Requirements," as amended herein, forms a part of this statement of work. Specifically, this includes the following sections:
1, 2, 3, 3.1, 3.1.2, 3.2–3.22, 4.0, 4.1, 4.2, 4.3, 4.4, 4.4.1–4.4.3, 4.5 as modified below, 4.6, 4.7, 4.7.1, 4.7.3, 4.10, 4.10.1, 4.10.2, 4.10.4, 4.13, 4.14 as modified below, 4.16, 4.19, 4.21, 4.24, 4.31, 4.34,

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and 4.39. With each Component delivered, the Contractor shall supply to BSA a Certificate of Conformance, in accordance with Section 4.16 of BNL QA-101.

Clause 4.5: "Witness" Points, is modified as follows: The supplier shall provide BNL with sixty (60) days' notice in advance of reaching such witness points during the manufacturing and test cycle of each item.

Clause 4.14: Source Inspection/Surveillance, is modified as follows: Items to be delivered require inspection, test, or surveillance by the Buyer's representative at the Suppliers facility. Sixty (60) days' notice, for acceptance inspections and tests, shall be given by the Supplier to the Buyer to permit scheduling of source inspection.

4.2 Configuration Management

The Contractor shall establish and maintain a configuration control system to assure that all end items are of the proper configuration, and that all approved configuration changes are incorporated at the specified effectivity points. Records verifying the configuration of each item shall be maintained for a minimum of five (5) years from the date of acceptance of the equipment by BSA. The Contractor shall immediately notify the BSA Contractual Representative of any significant changes (those that may affect form, fit, function, reliability, safety, or interchangeability) in design, fabrication methods, material or processing.

For changes in configuration, a request for change approval (CDRL019) shall be submitted to BSA for consideration. Changes in configuration may be made by the Contractor only with the written approval of BSA.

4.3 Responsibility for Subcontractor

It is the responsibility of the Contractor to flow down and impose applicable technical and quality assurance requirements upon their contractors and subcontractors. BSA reserves the right to disapprove, in writing, any contractor or subcontractor.

4.4 Responsibility for Conformance

The Contractor is responsible to provide items which conform to the requirements of the PO/Contract regardless of any assessments, surveillances, inspections and/or tests by BSA or its representatives at either the Contractor's or BSA's facility. The Contractor is responsible for notifying the BSA Contractual Representative of any recalls, obsolescence, or alerts associated with this PO/Contract.

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4.5 Measuring and Test Equipment (M&TE) Calibration

The Contractor shall calibrate all M&TE used in the fulfillment of the PO/Contract requirements against certified standards that are traceable to national standards such as the National Institute of Standards and Technology (NIST), or an international standard, or a physical constant. The Contractor shall notify BSA of any condition found during the calibration, servicing or repair of measuring and test equipment that can affect the end item requirements. A traceability log (CDRL013) shall be included with the acceptance test data sheet for each RF amplifier system. The traceability log shall include the type of instrument, manufacture, part number w/ options, serial number, the date of last calibration, and the calibration due date.

4.6 Inspections and Test Requirements

Unless otherwise specified in the PO/Contract, the Contractor shall be responsible for the performance of all inspections and tests specified herein. Except as otherwise specified in the PO/Contract, the Contractor shall utilize facilities suitable for the performance of the inspection and test requirements, specified herein, which are acceptable to BSA. BSA reserves the right to re-perform any of the inspections and/or tests set forth in this document or referenced specifications where deemed necessary to assure that Equipment conforms to prescribed requirements at no cost to the Contractor. BSA and/or their representative shall have the option to witness all of the tests defined in this SOW.

4.6.1 The system shall be tested by the Contractor at the Contractor's facility, the Contractor's subcontractor's facility, or a pre-approved BSA collaborator prior to shipment, using an ATP (as noted in Section 3.2.3) generated by the Contractor and approved in writing by BSA. BSA or its designee retains the right to witness all testing. Final acceptance of the units shall take place following the successful completion of final testing at BNL.

4.6.2 Assembly Standard: IPC-A-610H, Acceptability of Electronic Assemblies, shall be used as a reference to ensure all assemblies meet acceptance requirements.

4.7 Repairs

If failures occur or repairs are required to an assembly or any component during manufacturing or testing that affects form, fit, function, reliability, safety, or interchangeability the process shall stop and BSA shall be immediately notified in writing (CDRL014). BSA at their discretion may ask for retesting, additional review and evaluation to determine root causes, analyses of failure modes(s) or proposals for repair. Proposals for repair shall include adequate information for evaluating the repair, testing the effectiveness of the repair, and methods to prevent damage to the existing work. No proposed repair shall be initiated without written approval of BSA. No repair shall be considered successfully accomplished without inspection and written approval by BSA.

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All repairs shall be at the expense of the Contractor. In addition, the Contractor shall not use nonconforming materials via use-as-is disposition without written approval of BSA.

4.8 Failure Reporting, Analysis and Corrective Action

The Contractor shall maintain a failure reporting, analysis, and corrective action system which shall, as a minimum, evaluate, analyze, and correct failures occurring during end-item acceptance testing and inspection. Failures during acceptance testing shall require a cause and corrective action analysis to be provided by the Contractor to BSA (CDRL015). Disposition of failures during acceptance testing shall require the BSA written approval.

4.9 Deviations and Waivers

Deviations from compliance and deviations from documents referenced herein require specific written approval by BSA. A request must be submitted in writing (CDRL016) when the Contractor determines that an item is nonconforming and would like to seek relief from BSA for the specific requirement.

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5 CONTRACT DATA REQUIREMENTS LIST (CDRL)

This section contains the Contract Data Requirements List (CDRL). Submittal of data items may be in Contractor's format, unless otherwise noted. All data items shall be delivered electronically in a Microsoft Office document, unless otherwise noted. All documentation shall be in English.

CDRL	SOW Para #	Deliverable	Due Date	Review / Approval
001A	3.3.3	Initial Integrated Master Schedule	4 weeks ARO	Approval
001B	3.3.3	Integrated Master Schedule	1 week after months end	Review
002A	3.3.4	Initial Status Report	4 weeks ARO	Review
002B	3.3.4	Status Report	1 week after months end	Review
003	3.2.2.1 3.4.2	Preliminary Design Review Package	1 week prior to PDR	Approval
004	3.4.2	PDR Meeting Minutes and Action Items	1 week after PDR	Approval
005	3.5.3	De-Rating Analysis Reports	4 weeks prior to FDR	Approval
006	3.5.3	Requirements Verification Matrix	4 weeks prior to FDR	Approval
007	3.2.2.2 3.4.3	FDR Review Package	1 week prior to FDR	Approval
008	3.4.3	FDR Meeting Minutes & Action Items	1 week after FDR	Approval
009	3.4.3	Updated FDR Package	1 week after FDR	Approval
010	3.4.3	Final Assembly Models	1 week after FDR	Approval
011A	3.2.3	Acceptance Test Procedure (Demonstrator)	Prior to shipment	Approval
011B	3.2.3	Acceptance Test Procedure (RF amplifier system)	4 weeks prior to FDR	Approval
012A	3.2.3.1	Acceptance Test Data Sheet (Demonstrator)	Prior to shipment	Approval
012B	3.2.3.1	Acceptance Test Data Sheets (RF amplifier system) – Blank	4 weeks prior to FDR	Approval
012C	3.2.3.1	Acceptance Test Data Sheet (RF amplifier system)	2-4 weeks prior to FAT	Approval
013	4.5	Traceability Log	2-4 weeks prior to FAT	Approval
014	4.7	Rework and Repairs	Prior to rework/repair	Approval
015	4.8	Failure Reporting	2 weeks after failure	Approval
016	4.9	Deviations and Waivers	As necessary	Approval
017	3.5.3	Analysis Report	As necessary	Approval
018A	3.5.3	Operating Manual (Demonstrator)	With shipment	Approval
018B	3.5.3	Operating Manual (RF amplifier system)	With shipment	Approval
019	4.2	Configuration Changes	As necessary	Approval

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6 SCHEDULE

The following schedules are for planning purposes only. Schedule requirements set forth in the contract will take precedence.

Milestone	Due Date
Post Award Review / Kick-off	4 weeks ARO
Preliminary Design Review	22 weeks ARO
Delivery of Demonstrator	24 weeks ARO
Final Design Review of 350kW RF amplifier system	30 weeks ARO
Factory Acceptance Testing of 350kW RF amplifier system	98 weeks ARO
Delivery of 350kW RF amplifier system to BNL	104 weeks ARO
BSA Site Acceptance Testing of 350kW RF amplifier system at BNL	117 weeks ARO

7 VALUE ENGINEERING

The Contractor is encouraged to make recommendations for changes that might lead to an improvement in performance, reliability, quality, safety, or reduction in cost. Simplicity in operation, ease of maintenance, and an improvement in the performance and reliability of the specific functions beyond the requirements of this specification are objectives which shall be considered in the production. Where it appears a substantial improvement in simplicity of design, performance, ease of maintenance or reliability will result from the use of materials, parts and processes other than those specified, it is desirable that their use be investigated. When investigations point to advantages that may be realized, the recommendation for change shall be presented to BSA for review and, if approved, authorized in writing. An equitable agreement will be negotiated between BSA and the Contractor to share the savings of any recommended change that is approved and implemented.

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