Buyer	Amount	Contract Number
Maile Nichols	**TBD**	**419165**

BROOKHAVEN NATIONAL LABORATORY
Brookhaven Science Associates
P.O. Box 5000
UPTON, L.I., N.Y. 11973-5000

Name and Address of Contractor

CONTRACT

This Contract (the "Contract") is between the party named above (the "Contractor"), and Brookhaven Science Associates, LLC. ("BSA"), the latter acting under a Prime Contract with the United States of America (the "Government") represented by the United States Department of Energy ("DOE").

I. SCOPE OF WORK

The Contractor shall be responsible for the engineering, purchase of all materials, manufacturing, assembly, inspecting, testing, delivering, installing, commissioning, and training on the electron beam lithography (EBL) system for the Center for Integrated Nanotechnologies (CINT) at Sandia National Laboratories (SNL). The lithography system will be procured by Brookhaven Science Associates (BSA) on behalf of the CINT as part of the Nanoscale Science Research Center Recapitalization (NSRC-Recap) project. The lithography system, hereafter referred to as "Instrument", shall be designed to facilitate the fabrication of sub-micron features down to the limits of current photomask materials, currently below 10nm. This new system will enable the innovations and discovery in areas of Quantum Material Systems, Nanomechanics, Nanophotonics and Nanomaterials.

All work shall be conducted in strict accordance with Attachment (1) Brookhaven National Laboratory Statement of Work entitled "Statement of Work (SOW) for Electron Beam Lithography (EBL) System", Version 2 dated July 06, 2023, Attachment (2) Brookhaven National Laboratory Technical Specifications entitled "Technical Specifications for an or Electron Beam Lithography System (EBL)", Version 2 dated May 26, 2023, and Attachment (3) BNL QA-101 dated August 10, 2023, all of which are incorporated herein.

A. **Reports/Deliverables:** The Contractor shall provide the following deliverable(s) to and as directed by BSA's Technical Representative:

Item	Deliverable	Due	BSA Approval
1	Program Plan	2 weeks after award of contract	Yes
2	Technical and Progress Teleconference	2 weeks after award of contract/monthly	No
3	Performance reports	5th of each month after receipt of Program Plan within 2 weeks of key project milestones	No
4	Manufacturing/Inspection/Test Plan	6 weeks after award of contract	Yes
5	Installation Work Plan	26th week after award of contract	Yes
6	Factory acceptance testing	50th week after award of contract	Yes
7	Delivery of the Instrument	52nd week after award of contract	Yes
8	Site Acceptance Test Report	60th week after award of contract	Yes
9	Commissioning Report	62nd week after award of contract	Yes

B. **Key Personnel** The following individual(s) have been designated as "Key Personnel".

Personnel **Title**

Personnel	Title
TBD	TBD

The Contractor agrees to assign such employee(s) or persons to the performance of the work under this contract and shall not reassign or remove the above individual(s) without written justification and prior approval of BSA Contractual Representative.

II. PERIOD OF PERFORMANCE:

This Contract shall be effective as of the date executed by BSA provided that the Contractor executes the Contract without exception or alteration. It shall remain in effect through TBD.

III. FIRM FIXED PRICE AND PAYMENT

A. **Firm Fixed Price:** In full consideration of the Contractor's performance hereunder BSA shall pay the Contractor the firm fixed price of _____ US Dollars ($0.00). The said sum shall constitute full compensation for all services and materials furnished hereunder.

B. **Payment:** Payment will be made upon receipt and approval of properly certified invoices. Payment will be in accordance with the following milestone payment schedule:

Item	Deliverable	Estimated Date	Milestone Payments
1	Approval by BSA of the Program Plan	2 weeks after award of contract	

2	Approval by BSA of Manufacturing/Inspection/Test Plans	6 weeks after award of contract	
3	Approval by BSA of Installation Work Plan	26th week after award of contract	
4	BSA-Witnessed Factory acceptance testing and receipt and approval of test reports	50th week after award of contract	
5	Delivery of the Instrument including Certificates of Conformance	52nd week after award of contract	
6	Completion of Training of Instrument	40th week after award of contract	
7	BSA Receipt and Approval Site Acceptance Test Report	60th week after award of contract	
8	BSA Receipt and Approval Commissioning Report	62nd week after award of contract	

Payment terms are Net TBD.

Invoices shall be directed to BSA's Accounts Payable Section via electronic or regular mail.

Electronic invoice submittal is preferred by BSA. The Contractor shall make every effort to have systems in place that allow for electronic invoice transmittal. Invoices shall be submitted in PDF format, via e-mail, to apinvoices@bnl.gov.

Hard copy invoices, in duplicate, shall be directed to BSA's Accounts Payable Section, Contracts Division, Bldg. No. 400d.

The Contractor shall indicate the final invoice by clearly marking such invoice as "FINAL". A copy of the final invoice must be submitted to BSA's Contractual Representative.

C. **Freight**: Freight terms shall be *(for North American shipments insert:)* FOB Destination Center for Integrated Nanotechnologies, Sandia National Laboratories, 1101 Eubank Blvd SE, Albuquerque, NM 87123 (Freight Prepaid). Freight Prepaid, *(for foreign shipments insert :)* "DAP" Delivered At Place, Center for Integrated Nanotechnologies, Sandia National Laboratories, 1101 Eubank Blvd SE, Albuquerque, NM 87123 (Freight Prepaid).

D. **Shipping and Labeling**:

Two (2) weeks prior to delivery of all items the contractor shall contact BSA as to the type of freight carrier that will be used.

IV. AUTHORIZED REPRESENTATIVES

A. **BSA's Technical Representative:** _____ of the _____, located in Building _____ is BSA's Technical Representative, hereunder. *(He/She)* shall act as liaison between BSA and the Contractor in technical matters only. *(He/She)* can be reached at _____(phone), _____(e-mail).

B. **BSA's Contractual Representative:** Maile Nichols is BSA's Contractual Representative. She can be reached at (631) 344-3936 (phone), mnichols@bnl.gov (e-mail). Any change or modification in the terms and conditions of this contract shall require the written approval of BSA's Procurement and Property Management Division's Manager, or his designee.

C. **Contractor's Technical Representative**: _____ is the Contractor's authorized Technical Representative, hereunder. *(He/She)* shall act as point of contact between BSA and the Contractor in technical matters only. *(He/She)* can be reached at _____(phone), _____(e-mail).

D. **Contractor's Contractual Representative:** _____is the Contractor's authorized Contractual Representative, hereunder. *(He/She)* shall act as liaison between BSA and the Contractor. *(He/She)* can be reached at _____(phone), _____(e-mail).

V. ADDITIONAL TERMS

The provisions of Brookhaven Science Associates, LLC General Terms and Conditions for Commercial Items and Services, (Rev. 22, September 2022) are incorporated herein and made a part hereof.

This Contract is issued pursuant to Brookhaven Science Associates General and/or Supplemental terms and conditions listed above which are incorporated herein by reference. The complete text of these terms and conditions can be viewed via the internet at: http://www.bnl.gov/ppm/T-Cs/t-c.asp. Should the Contractor have any questions and/or not have access to these terms and conditions, contact the buyer or contracts specialist immediately.

The following documents attached hereto and made a part hereof, contain additional provisions of this contract:

- Attachment 1 - Brookhaven National Laboratory Statement of Work entitled "Statement of Work (SOW) for Electron Beam Lithography (EBL) System", Version 2 dated July 06, 2023
- Attachment 2 - Brookhaven National Laboratory Technical Specifications entitled "Technical Specifications for an or Electron Beam Lithography System (EBL)", Version 2 dated May 26, 2023
- Attachment 3 - Attachment (3) BNL QA-101 dated August 10, 2023
- Attachment 4 – Sandia National Laboratory NTESS Site-Specific Clauses
- Attachment 5 – EBL Hazard Assessment

This Contract does not bind nor purport to bind the Government of the United States.

ACCEPTED:

CONTRACTOR	**BROOKHAVENSCIENCE ASSOCIATES, LLC.**
By: _____	**By:** _____
Name: _____	**Name:** _____
Title: _____	**Title:** _____
Date: _____	**Date:** _____

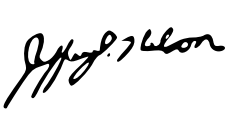
Should you accept this Contract without exception or alteration, one copy of the Contract executed by both parties shall be returned to BSA's Contractual Representative. Should you take **any** exceptions or attempt to alter the Contract in **any** manner, BSA's execution thereof shall be null and void. Should you wish to take exception(s)/alteration(s), you shall notify BSA's Contractual Representative. BSA will consider the requested exception(s)/alteration(s) and notify you accordingly. No Contract shall exist unless and until such differences are resolved.

STATEMENT OF WORK (SOW)

for

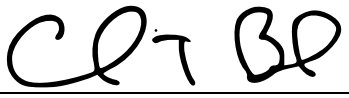
Electron Beam Lithography System

QA Category: **A-2**

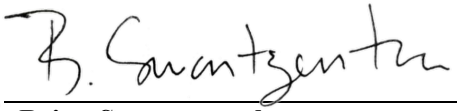


Jeffrey Nelson
Director, Center for Integrated Nanotechnologies
Sandia National Laboratories

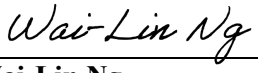
Aaron Stein
Project Manager, NSRC Recap
Technical Representative
Center for Functional Nanomaterials



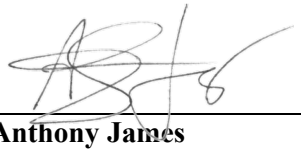
Charles Black
Project Director, NSRC Recap
Director, Center for Functional Nanomaterials



Brian Swartzentruber
Level 3 Controls Account Manager, NSRC Recap
Center for Integrated Nanotechnologies
Sandia National Laboratories



Wai-Lin Ng
ESH Coordinator
Center for Functional Nanomaterials



Anthony James
Author, Process/Equipment Engineer CINT

Shemara Purto
ESH Coordinator, CINT

Charles Weilbrenner
Quality Assurance
Quality Management Office

VERSION CONTROL SHEET

VERSION	DESCRIPTION	DATE	AUTHOR	APPROVED BY
1	First Issue	27JUL22	Anthony James	See cover page.
2	Second issue: trade-in info added	6JUL23	Anthony James	See cover page.

CONTENTS

1 SCOPE

This Statement of Work (SOW) will be the basis for the procurement of an electron beam lithography (EBL) system for the Center for Integrated Nanotechnologies (CINT) at Sandia National Laboratories (SNL). The lithography system will be procured by Brookhaven Science Associates (BSA) on behalf of the CINT as part of the Nanoscale Science Research Center Recapitalization (NSRC-Recap) project. The lithography system, hereafter referred to as "Instrument", shall be designed to facilitate the fabrication of sub-micron features down to the limits of current photomask materials, currently below 10nm. This new system will enable the innovations and discovery in areas of Quantum Material Systems, Nanomechanics, Nanophotonics and Nanomaterials.

1.1. Background

The CINT is a user-oriented research center whose mission is to provide the scientific basis for integration of nanoscale materials and enhanced performance. Research at CINT has an emphasis on exploring the path from scientific discovery to achieving new material properties and functionalities, including the integration of nanostructures into the micro and macro worlds.

1.2 Definitions/Acronyms

AHJ	Authority Having Jurisdiction
ASME	American Society of Mechanical Engineers
ATP	Acceptance Test Procedure
BSA	Brookhaven Science Associates
CFN	Center for Functional Nanomaterials
CINT	Center for Integrated Nanotechnologies
EBL	Electron Beam Lithography
ESH	Environment, Safety, and Health
FAT	Final Acceptance Test
MRB	Material Review Board
MRP	Material Requirements Planning
NFPA	National Fire Protection Association
NRTL	Nationally Recognized Test Laboratory
NSRC	Nanoscale Science Research Center
OEM	Original Equipment Manufacturer
SNL	Sandia National Laboratories
QA	Quality Assurance
SBMS	Standards Based Management System
SNL	Sandia National Laboratories
SOW	Statement of Work
AOA	Automated Objective Aperture

2. APPLICABLE DOCUMENTS

In the event of a conflict between the Technical Specification and the 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 to 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:

Document Number	**Document Title**
10CFR851	DOE Worker Safety and Health Program
BNL QA-101	Supplier Quality Assurance Requirements
ASME B30.26	Rigging Hardware
ASME B31.3	Process Piping -2015 Edition
NFPA 70	National Electrical Code – 2020 Edition http://www.nfpa.org/aboutthecodes/AboutTheCodes.asp?DocNum=70
NFPA 70E	Standard for Electrical Safety in the Workplace – 2021 Edition or the most current version in place
ASMEY14.5M-2008	Dimensioning and Tolerancing
ASME BTH-1	Design of Below-the-Hook Lifting Devices, Design Category "A"
No Doc #	Sandia National Laboratories Job Hazard Analysis Template
No doc #	Specification of existing CINT EBL tool
No Doc #	Relevant BNL SBMS Subject Areas: Cryogen Safety Electrical Safety Lifting Safety Pressure Safety Personal Protective Equipment

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 the engineering, purchase of all materials, manufacturing, assembly, inspecting, testing, delivering, installing, commissioning, and training on the Instrument.

Safety and code compliance must be paramount at every stage of a project, from the initial concept to the final installation and use. Electrical design and installation must follow the National Electrical Code NFPA 70 and Standard for Electrical Safety in the Workplace NFPA 70E. Contractor must show, in writing, that the equipment functions within the performance parameters specified by the manufacturer(s).

3.1 Contractor Responsibilities

3.1.1 Technical Performance

In accordance with SOW/Technical Specification document and all referenced documents, the Contractor shall engineer, manufacture, and assemble the Instrument. The Contractor shall test the Instrument at the Contractor's facility first, then deliver, test and commission the Instrument at SNL. It is the Contractor's responsibility to ensure that the Instrument complies with all the specification requirements and the safety codes and standards referenced herein.

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 complete the engineering, manufacturing, assembly, inspecting, testing, delivering, and installing the Instrument.

3.1.3 Factory Acceptance Testing

The Instrument shall be tested at the Contractor's facility in the presence of SNL and/or BSA representatives to demonstrate full compliance with the SOW/Technical Specification. The Instrument shall be fully assembled and be representative of the final as-delivered configuration for Final Acceptance Test (FAT). The tests listed in the SOW/ Technical Specification shall be conducted on the Instrument at the Contractor's facility according to the approved Acceptance Test Procedure (ATP), prior to delivery to SNL.

All test data shall be documented in the Acceptance Test reports and sent to BSA prior to the Instrument delivery. Acceptance of the test data is contingent upon data review and written approval by BSA technical representative prior to shipment of the Instrument.

3.1.4 Removal/Installation

3.1.4.1. The Contractor shall be responsible for all Instrument installation. SNL will not supply personnel for installation tasks other than identified herein. Unloading of containers and trucks, and staging of the Instrument at the installation site, shall be performed by SNL riggers. The Contractor shall not be permitted to drive SNL-owned forklifts for any reason. The Contractor shall submit an installation work plan that includes all onsite installation activities in a step-by-step format at least two (2) months before the scheduled start of installation activities. This plan is a necessary prerequisite for obtaining a work permit and must be approved by SNL prior to the start of installation activities. As part of the work planning process, SNL may conduct a pre-job walk through with the Contractor or relevant subcontractor to ensure proper dimensions, approved anchor points for lifting and travel paths are determined before equipment arrives on site. The person (or persons) responsible for all onsite installation activities shall participate in the work planning process for the purpose of obtaining a work permit. The work permit must be completed prior to start of installation activities. This shall be completed during the Technical Review as well as after the Technical Review in video conferencing and/or teleconferences.

3.1.4.2. In the event that the Contractor exercises the trade-in option, the Contractor will be responsible for removal of the existing electron beam lithography system, a JEOL JBX6300-FS.

The Contractor shall submit a decommissioning and removal plan that includes all onsite activities in a step-by-step format at least two (2) months before the schedule work of decommissioning and removal activities. This plan is a necessary prerequisite for obtaining a work permit and must be approved by SNL prior to the start of decommissioning and removal activities. As part of the work planning process, SNL may conduct a pre-job walk through with the Contractor or relevant subcontractor to ensure

proper dimensions, approved anchor points for lifting and travel paths are determined before work begins. The person (or persons) responsible for all onsite decommissioning and removal activities shall participate in the work planning process for the purpose of obtaining a work permit. The work permit must be completed prior to start of work. This shall be completed during the Technical Review as well as after the Technical Review in video conferencing and/or teleconferences.

3.1.4.3. All training and safety requirements identified during the work planning process (or by SNL ES&H/Training staff members) shall be successfully completed by Contractor personnel who are participating in onsite installation work prior to issuance of a work permit and prior to installation.

3.1.4.2.1 Contractor employees, including their subcontractor, and lower tier contractor employees, who may be exposed to an electrical hazard (shock and/or arc flash) must be trained to the appropriate level per SNL's Electrical Safety Subject Area in accordance to their exposure.

3.1.4.2.2 Lockout/tagout (LOTO) training shall be required for all Contractor employees, including their subcontractor, and lower tier contractor employees, who "work on" systems or components requiring protection of personnel from unexpected energization or startup of machinery and equipment, or the release of hazardous energy during installation, demolition, or service and maintenance activities. Hazardous energy includes mechanical (rotational, gravitational), electrical, chemical, pressure or vacuum (hydraulic, pneumatic), ionizing and non-ionizing radiation, thermal and other energies that may cause harm. LOTO Training must be completed in compliance with SNL's LOTO for Installation, Demolition, or Service and Maintenance Subject Area.

3.1.4.4. CINT shall utilize SNL hoisting and rigging personnel to offload and relocate equipment as dictated by SNL work control requirements. Contractors may operate their own rigging/cranes that are installed as part of their equipment, original equipment manufacturer (OEM) components. All rigging equipment, including slings, must first be inspected by SNL. Additionally, any building anchor points intended for use by the contractor for rigging devices such as chain slings or hoists must be approved by SNL beforehand. Contractor shall be responsible for the Instrument until final acceptance.

3.1.4.5. Electrical tools/equipment needed for installation shall be inspected by SNL prior to use at SNL, to ensure compliance with SNL's electrical safety standards referenced herein.

3.1.4.6. The Decommissioning (if applicable) and Installation Work Plan shall include at a minimum:

a. Work instructions/ installation plan: job steps or detailed step-by-step instructions
b. Prerequisites: preparatory actions to be performed before work can be started and any administrative and physical requirements (for example, review/ inspection/ approval of equipment, training, etc.)
c. Precautions: precautions that must be observed during performance of work
d. Identification for hold points and other monitoring
e. Operational limits imposed
f. Coordination of tasks
g. Special conditions for working alone
h. Scheduling, coordination, and notification

i. Changes impacting configuration management

j. Post work testing and acceptance: guidance concerning post work testing to ensure proper completion of work and/or system readiness to return to service

k. ES&H work controls for mitigating identified hazards based on the following hierarchy, as practical:

i) Elimination/substitution of hazards

ii) Engineering controls

iii) Administrative controls and work practices

iv) Personal protective equipment

3.1.4.7. Work involving exposure to an electrical hazard must be planned in accordance with the requirements of SNL's Electrical Safety Subject Area in conjunction with SNL's Work Planning and Controls Subject Area.

3.1.4.8. Work involving controlling hazardous energy sources for installation, demolition, or service and maintenance must be planned in accordance with the requirements of SNL's Lock/Tagout (LOTO) for Installation, Demolition, or Service and Maintenance Subject Area in conjunction with Work Planning and Controls Subject Area.

3.1.4.9. Note that disposal of waste packing material shall be the responsibility of SNL.

3.1.4.10. The Contractor shall supply all bolt-on wheels, transportation carts and custom tooling required for the installation of the Instrument which will remain the property of the Contractor at Contract Completion. The Contractor shall use plywood or similar protective material to prevent damage to flooring.

3.1.4.11. During assembly of all components, proper alignment and tightening shall be assured by the use of appropriate tools (e.g., torque wrenches) and by following the procedures recommended by the manufacturer, including the use of alignment tools and bolt-tightening sequences, etc.

3.1.4.12. Installation includes hardware and software setups for computer-based remote control of the Instrument and data processing and analysis.

3.1.5 Acceptance Testing at SNL

The Instrument shall be tested at SNL by the Contractor to demonstrate full compliance with this SOW/Technical Specification documents. SNL shall witness acceptance testing and shall be given sufficient notice to ensure the appropriate staff are present. The tests listed in the SOW/Technical Specification shall be conducted on the Instrument at SNL according to the ATP, prior to final acceptance.

3.1.6 Commissioning

The Contractor shall be responsible for the commissioning of the Instrument. Commissioning shall be defined as all test and demonstration work performed on site at SNL. SNL shall witness Instrument commissioning and shall be given sufficient notice to ensure the appropriate staff are present.

Commissioning of the Instrument on site in its final configuration shall be performed with samples supplied by SNL. The Instrument shall be able to demonstrate the performance specifications as outlined in the separate Technical Specification document.

3.1.7 Training

During the commissioning phase of the contract, the Contractor shall provide hands-on training at SNL for two (2) SNL scientific and/or technical staff members for the safe operation and maintenance of the Instrument. SNL scientific and/or technical staff will review training plan prior to training and approve during the final acceptance process. This training shall be conducted at SNL for a period of five (5) working days during commissioning for the Instrument. Additionally, the Contractor shall provide two (2) sessions of hands-on user training at SNL for two (2) SNL personnel, each session consisting of five (5) working days, for its operation. These training sessions will be scheduled within two (2) months of SNL approval of the final commissioning report.

3.2 Manufacturing Requirements

3.2.1 Acceptance Test Procedure

The contractor shall provide an ATP that is in accordance with this SOW/Technical Specification and all reference documents noted herein. The ATP must be approved by SNL prior to use. The ATP shall ensure that all test requirements as defined in the safety codes referenced herein are achieved.

3.2.2 Commissioning Reports

A Commissioning report shall be provided by the Contractor. The report shall include, but not limited to, the results of all tests performed including graphs, printouts, drawing updates, calibration data, and control system tuning parameters. The Contractor shall be responsible for remedying any non-compliances in regard to the requirements in this SOW/Technical Specification, subject to BSA approval. A summary sheet including demonstrated remedy of any non-compliances shall be included. Final acceptance is contingent on BSA data review and written approval by BSA.

3.3 Management

3.3.1 Program Plan

The Contractor must deliver a detailed program plan, which includes a milestone schedule defining the design validation, manufacturing, inspection, testing, installation, and commissioning phases in sufficient detail to allow regularly scheduled progress monitoring. The program plan shall list specific intermediate milestones with a clearly defined schedule that will form the basis of the regular progress meetings detailed below. It shall be submitted for review and approval by BSA as per the timeline in section 5.

3.3.2 Progress Teleconference

Monthly program technical and progress teleconferences and/or meetings between the Contractor and SNL shall be held at a mutually scheduled time according to the timeline in section 5. The discussions shall include the Contractor's progress, technical and contractual questions, presentations of analysis or testing results, design reviews, value engineering, trouble shooting, material status, tooling status, resources, and manufacturing issues.

3.3.3 Manufacturing/Inspection/Test Plan

A manufacturing plan shall be developed which identifies the manufacturing processes of work required to complete all efforts as identified in this SOW. It shall be submitted for review and approval by BSA as per the timeline in section 5. The plan may be a single document or may make use of existing travelers or other suitable planning and control documents. 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). If the Contractor does not have an MRP system in

place, then details for purchasing all raw materials, shop loading (by work center), and a schedule for manufacturing all components and assemblies through packaging and shipping shall be provided by the Contractor.

3.3.4 Performance Reporting

Throughout the life of the contract, the Contractor shall supply a written report by the fifth of every month to the SNL technical representative and BSA contractual representative clearly detailing progress through the prior month with respect to the program. This shall include milestone charts, detailed progress, open items, problems, recommended solutions, and risk mitigation.

3.4 Documentation and Data Management

3.4.1 All the documentation provided by the Contractor shall be in English.

3.4.2 All engineering drawings shall:

a. Be formatted in accordance with ASME Y14.5M-2008

b. Have views shown in third angle projection

c. Use English or Metric dimensions and tolerances

d. Have a separate parts list

e. Have part number designations in accordance with LT-ENG-RSI-STD-002

3.4.3 The Contractor shall provide an electronic copy (email, plus either CD ROM or USB data storage device) of all required documentation as noted in this SOW. Manufacturing drawing CAD files of all components and assemblies shall be compatible with Solidworks or Fusion CAD software in these formats: STP or IGS.

3.4.4 **End Item Documentation Package**

The Contractor shall provide an electronic copy of the End Item documentation package in accordance with the schedule set forth in this SOW. The End Item documentation package shall consist of the following documentation:

a. Acceptance Test Reports and copies of test certificates

b. All manuals

c. Completed travelers (documents following instrument throughout manufacturing process)

d. Manufacturing/ Inspection/Test data for inspections performed at incoming inspection or during manufacturing

e. Certificate of Conformance as specified in Section 4

f. Copies of specification/ data sheets for viewports.

g. Copies of the Contractor's (or Subcontractors') weld certification/test reports

h. Documentation of required proof test procedures and results for vacuum vessels

i. Certification that all required pressure relieving devices used are approved by either the ASME or National Board of Boiler Inspectors (NBBI) Acceptance Test Reports and copies of test certificates

3.4.4.1 Documents

The Contractor shall provide an electronic copy (on a USB stick or BSA identified File Transfer Protocol (FTP) site, in Microsoft Office format, or drawing format

described in section 3.4 with formal "controlled copies" in PDF format) of the following documentation:

a. All documentation identified in this SOW

b. All parts and assembly solid models

c. User/operational manual

3.4.4.2 Operation and Maintenance Manuals

The Contractor shall provide the operation and maintenance manual in electronic format with formal PDF format on a USB stick and provide two (2) hardcopies.

Operation and maintenance manuals shall include:

a. A title to the front cover, identifying the title of the project and the date of issue

b. A table of contents

c. A general description of the Instrument installation

d. Copies of any permits to use copyrighted material

e. A technical description of each system and subsystem to allow the correct and safe operation, maintenance and repair of all systems and subsystems installed, including:

i. Operating manuals for all modes of operation described in the Technical Specification document

ii. Standard maintenance operations, not limited to beam alignment and adjustment of lens operations

iii. Troubleshooting techniques

iv. Recommendations for preventive maintenance

v. Disassembly, repair, cleaning and adjustment procedures

vi. List of recommended spare parts to keep on hand

vii. Software documentation and source code for open source processing routines

3.5 Configuration Management

The Contractor shall establish and maintain a configuration control system to assure that all end items (including spares) are of the proper configuration, and that all approved configuration changes are incorporated at the specified effectivity points. Records shall be maintained verifying the configuration of each item.

3.6 Software Requirements

The Contractor shall provide and maintain the capability to receive and send CAD files compatible with Solidworks or Fusion CAD software of all components or assemblies in STP or IGS file formats at the request of SNL.

The contractor shall provide a duplicate or back-up of all software and supporting files used to operate the system by means of external hard drive.

3.7 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.

3.7.1 Contractor Work on Site at SNL

SNL will identify and designate space necessary to safely perform staging and installation activities. Any cordons, stanchions, or barriers required to designate and isolate the Contractor's work area will be supplied by SNL.

A Job Safety Analysis (JSA) including a hazard list identifying all hazardous materials associated with the instrument, including Safety Data Sheets (SDS) shall be submitted to SNL for approval with the Installation Work Plan.

3.7.2 Electrical Safety

3.7.2.1 All electrical equipment and components must be in accordance to U.S. standards, must comply with NFPA70 and shall be listed by a Nationally Recognized Testing Laboratory (NRTL) as specified in BNL-QA-101 document, clause 3.10. Note that the CE mark is not a NRTL certification marking. In the case that the instrument is NRTL listed prior to delivery it will be inspected once installed to ensure NRTL listing is still valid. In the case of the instrument that is not NRTL listed as delivered from the vendor/manufacturer, a third-party Field Evaluation Body (FEB), recognized by SNL electrical Authority Having Jurisdiction (AHJ), must perform an evaluation of the equipment. Results of the FEB evaluation must be provided to SNL electrical AHJ and approved before the equipment is to be operated.

All electrical work must be performed only by qualified electrical workers. Contractors who perform electrical work must meet SNL qualification requirements, including submitting proof of training such as for NFPA 70E, OSHA 10-hr, Cardio-Pulmonary Resuscitation/ First Aid, lockout/tagout, depending on the nature of the electrical work.

3.7.2.2 The contractor shall supply the following to BSA and SNL:

3.7.2.2.1 Documentation for the equipment installation, operation, service and maintenance that describes operation, shutdown, safety concerns, and nonstandard installations.

3.7.2.2.2 Schematics, drawings, and bill of materials describing power feeds, voltages, currents and parts used for construction, maintenance, and operation of the equipment.

3.7.2.2.3 Safety Requirements and emergency shutdown procedures of equipment including lockout/tagout (LOTO) requirements.

3.7.2.2.4 Documentation of specific hazards associated with the equipment.

3.7.2.2.5 Documentation shall be provided if special tools, PPEs, or other equipment is necessary for proper maintenance and operation of equipment.

3.7.2.3 The contractor shall include safety-related design concepts for electrical equipment and installations. Following methods can be considered:

3.7.2.3.1 Installing finger-safe components, covers, and insulating barriers to reduce access to exposed energized electrical conductors and circuit part due to inadvertent movement.

3.7.2.3.2 Substituting ≥50 volts control circuit with non-hazardous <50 volt circuits.

3.7.2.3.3 Separate enclosures for hazardous and non-hazardous electrical conductors and circuit parts.

3.7.2.4 Contractor shall mark the equipment which includes the NRTL certification mark/Field Evaluation mark, Manufacturer, model #, manufacturing date, drawing number, current draw, power, frequency voltages entering and leaving the control cabinets, and equipment. Caution, Warning, or Danger labels shall be affixed to the exterior describing specific hazards and safety concerns. Refer to ANSI Z535, Series of Standards for Safety Signs and Tags, for more information on precautionary marking of electrical system or equipment.

3.7.2.5 All exposed electrical connections/terminations ≥50 volts shall be covered so that all non-insulated charged surfaces protect workers from the hazards of electrical shock during operation and when performing service & maintenance. Plexiglas® is not allowed; Lexan® may be used for inadvertent contact. Electrical insulation must be Low Smoke, Zero Halogen (LSZH), Fire Retardant, and rated for its application. Non-LSZH cables shall be permitted in length <50 feet.

3.7.2.6 Electrical wiring must be installed in a neat and workmanlike manner.

3.7.2.7 Teflon® shall be allowed as an insulator in small quantities.

3.7.3 Pressure Safety

3.7.3.1 For process piping requirements, the contractor shall use ASME B31.3 or equivalent approved by BSA or SNL in writing. The gaseous nitrogen and cooling water lines shall be designed to ASME B31.3 requirements. Seamless and welded tubes shall be designed to ASTM A269-69 and A632-69 requirements. In all cases, 100% proof testing shall be completed on each component to 150% of the maximum working pressure for hydrostatic tests, or 110% of the maximum working pressure for pneumatic tests.

3.7.4 Fire Safety

3.7.4.1 The Contractor shall ensure that any electrical equipment or wiring minimizes combustibility by the use of flame-resistant materials.

3.7.4.2 The Contractor shall ensure that any cable tray minimizes the possibility of damaging cables. All cables to be installed in a cable tray shall be rated for Cable Tray use and conform to NFPA 70 requirements. The cable shall have the TC (Tray Cable) marking and be NRTL listed. If the Contractor elects to use a cable not marked for Tray Cable use, the Contractor must justify the election of the conductor in writing. The justification must detail why the requirement cannot be met, describe the proposed alternative, and state how it is equivalent to the requirement. BSA and SNL shall approve the use of all non-NRTL listed tray cables in advance of the Contractor ordering the cable.

3.7.4.3 All other cables shall be Low Smoke Zero Halogen (LSZH). Non-LSZH cables shall be permitted in length <50 feet.

3.7.5 Attachment Points and Lifting Fixtures

3.7.5.1 The Contactor shall provide lifting eyes, either permanent or removable, on each piece of equipment or stand of sufficient capacity and number to allow the equipment to be safely lifted. All lifting fixtures will be inspected and approved by SNL before use.

3.7.5.2 All lifting fixtures must meet the requirements specified in ASME B30.26 (Rigging Hardware) and ASME BTH-1 (Design of Below-the-Hook Lifting Devices, Design Category "A"). Hoist rings must meet ANSI B30.26 requirements.

3.8 Packaging

In preparation for shipping, the Instrument shall be covered or wrapped for protection against weather elements, dust, and damage to projections, shock loads, impacts, and rubbing. The Instrument 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.

3.8.1 After the component or piece of the Instrument has been cleaned and tested, it shall be packed to ensure that it remains clean and free from damage during both storage and shipping. All seal faces and/or knife edges should be protected. Vacuum components shall be back-filled with dry nitrogen gas.

3.8.2 Added protection against contamination and humidity shall be given to the sensors and electrical connections. Durable materials, such as clean wood, bubble wrap, or similar non-contaminating materials, are to be used to support and protect the components from one another during transit and storage. Peanut-type material shall not be used for packaging.

3.8.3 All assemblies or sub-assemblies with *moving* parts shall be secured to prevent damage due to unwanted motion or vibration. The packaging must be designed to withstand acceleration loads in excess of twice the acceleration due to gravity ($>2g_0$).

3.8.4 Each packing crate shall be fitted with Shockwatch and Tipwatch sensors or an *equivalent* approved in writing by BSA.

3.8.5 The container shall be appropriately labeled with the listing of contents, destination, gross weight, location of center of gravity, purchase order number, and contact information.

3.9 Warranty

The Contractor shall provide a one-year warranty on all parts and labor commencing with SNL's acceptance of the installed and tested Instrument. A recommended spare parts list shall be available from the Contractor. Remote diagnosis and troubleshooting from Contractor shall be available upon request within 24 hours during regular workdays.

4 QUALITY ASSURANCE

The Contractor shall maintain and apply an effective QA program for the design, manufacture, and testing of all systems and equipment provided. The system shall meet the requirements of the ISO-9001 Standard, "Quality Management System Requirements." The Contractor shall supply the necessary documentation to demonstrate this compliance. Post-award surveys may be required and shall be supported.

4.1 Quality Assurance Requirements

The QA requirements form part of this SOW, specifically this includes the requirements detailed in Sections 3 and 4.

4.2 Notification of Change to Design, Methods, or Processes

The Supplier shall immediately notify the Buyer of any significant changes (those that may affect form, fit, function, reliability, safety, or interchangeability) in product design, fabrication methods, materials, or processing from those used by the Supplier at time of Supplier's quotation or offer to the Buyer, which resulted in the PO.

4.3 Records

The Supplier 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 the Buyer's representative for review upon request. These records shall be maintained for a minimum of three (3) years, unless otherwise specified in the procurement documentation, after the completion of the PO/contract.

4.4 Franchised / Licensed "Distributor" Traceability

Products that are not purchased directly from the Original Equipment Manufacturer (OEM)/Original Component Manufacturer (OCM) must be purchased only from a franchised/licensed distributor of the product being offered. The distributor shall ensure traceability of all products to the original equipment manufacturer by identifying the original manufacturer for each lot/date code on the Certificate of Conformance. The distributor shall provide a copy of the Manufacturer's certificate for the lot number being supplied, along with their franchised distributor certification. The distributor shall not use unapproved brokers (any company, person, or entity who is not an OEM/OCM) for the purchase of components and parts, unless pre-approval has been granted by Brookhaven Science Associates (BSA).

4.5 Material Review Board (MRB) Authority

4.5.1. Unless, and until, Material Review Board (MRB) authority has been requested and received, the Contractor shall be restricted to dispositions of rework, scrap, and return-to-vendor; i.e., the Contractor shall not use nonconforming materials via unique or standard repair processes, nor via use-as-is-dispositions

4.5.2 The Contractor shall not delegate MRB authority to suppliers without the prior knowledge and written approval of BSA.

4.5.3 BSA may delegate MRB Authority to the Contractor, when requested by the Contractor. Such request shall be accompanied by: 1) the Contractor's procedure for the identification, evaluation, disposition, and control of non-conformances; and 2) the resumes of personnel to be assigned as MRB members.

4.5.4 All non-conformances requiring MRB action shall be documented and sent to the BSA technical representative within five (5) working days of the decision.

4.6 QA Flow-Down

The Contractor shall ensure a proper and complete flow-down of all applicable QA requirements to its suppliers and sub-tier suppliers.

4.7 Certificate of Conformance

With each shipment, the Contractor shall submit a Certificate of Conformance (C of C). In case of drop shipment, a copy of the certificate shall be submitted to BSA at the time of shipment. The certificate shall include the title of and be signed by an authorized representative of the company, and shall constitute a representation by the Contractor that:

A. Materials used are those which have been specified by BSA, and that the items delivered were produced from materials for which the Contractor has on file, reports of chemical or physical analysis, or any other equivalent evidence of conformance of such items to applicable specifications;

B. Processes used in the fabrication of items delivered were in compliance with applicable specifications included as part of the PO/contract, or BSA-approved procedures or specifications;

C. The items as delivered comply with all applicable drawings, specifications, deviations/waivers and other requirements of the procurement documentation; and-

D. When specified, cleaning and cleanliness requirements have been completely satisfied. The C of C shall reference the Contractor's applicable cleaning procedures.

5 DELIVERABLES

The Contractor shall supply the following:

Item	Deliverable	Due	BSA Approval
1	Program Plan	2 weeks after award of contract	Yes
2	Technical and Progress Teleconference	2 weeks after award of contract/weekly	No
3	Performance reports	5th of each month after receipt of Program Plan within 2 weeks of key project milestones	No
4	Manufacturing/Inspection/Test plan	6 weeks after contract award	Yes
5	Installation Work Plan	26th week after award of contract	Yes
6	Factory acceptance testing	50th week after award of contract	Yes
7	Delivery of the Instrument	52nd week after award of contract	Yes
8	Site Acceptance Test Report	60th week after award of contract	Yes
9	Commissioning Report	62nd week after award of contract	Yes

6 SCHEDULE/ MILESTONES

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

Milestone	**Calendar weeks after award**
Delivery to NL	52nd week
Commissioning of instrument	60th week
Training of instrument	60th week
Delivery of End Item Documentation Package	62nd week

7 VALUE ENGINEERING

7.1 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.

8 TRADE-IN OPTION

The Contractor may optionally offer discounted pricing for a trade in of the existing EBL tool at CINT, described in the attached specification document. This option would require complete decommissioning and removal of the existing instrument before installation as described in section 3.1.4.

TECHNICAL SPECIFICATIONS
FOR AN ELECTRON-BEAM LITHOGRAPHY SYSTEM
(EBL)

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Rev 2.0

Center for Integrated Nanotechnologies
Sandia National Laboratories

VERSION CONTROL SHEET

VERSION	DESCRIPTION	DATE	AUTHOR	APPROVED BY
1	First Issue	4/29/22	Anthony James	See cover page.
2	Revision of technical requirements	05/26/23	Anthony James	See cover page.
3				
4				

Contents

1. General

1.1. This specification describes the requirements for an Electron Beam Lithography (EBL) System for the Center for Integrated Nanotechnologies (CINT) at Sandia National Laboratories (SNL). EBL uses precision sample and electron beam placement to facilitate fabrication of optical, fluidic, MEMS, electronic, and quantum devices from micron-plus dimensions to the limits of the tool, and related processes which aid research and discovery platforms of physics, material science, electronics, computing, and biology. Research at CINT will utilize the EBL system flexibility to operate with current fabrication processes and explore new, technologically advanced operations and processes to discover new fabrication techniques or applications.

1.2. The EBL shall include all common elements of EBL systems, including an electron optics column and emitter, a substrate positioning system capable of highly accurate write placement/overlay, an assortment of substrate holders, and a well-tested operating system.

1.3. The principal capabilities of the electron-beam lithography system shall provide: an electron beam with a range of operating currents that can be set as User-definable conditions; write-field areas optimized for bulk and precision patterning; and the ability to perform multiple runs without the need to re-qualify or re-align the column at every beam condition change.

1.4. All available options will be considered for expansion of the EBL's fundamental capabilities.

2. Principal Configuration of the Lithography System

2.1. The system shall have all dry vacuum pumps, typically any combination of roughing, turbomolecular, and ion pumps.

2.2. The tool shall have shielding or a shielding enclosure to provide extra insulation or shielding against x-ray, stray magnetic fields, acoustic noise, temperature changes, and other disturbances that affect the operation of the tool.

2.3. The system shall be properly interlocked to minimize system damage resulting from facilities failure (electrical power, cooling water, vacuum system, etc.).

2.3.1. Active and passive interlocks to protect the system from damage due to facilities related issues and to protect operators from electrical, thermal, pressure, vacuum, and radiological hazards.

2.3.2. The system shall operate in a failsafe mode such that the system shall automatically execute a power down to a safe state or enter a safe state such that restoration of failed facilities does not result in system damage.

2.4. An option for an enclosure and environmental control system to maintain a stable environmental temperature at 20°C +/-0.1°C is preferred.

2.4.1. Energy consumption/operation requirements shall allow the primary EBL system and optional environmental control enclosure to be powered from separate power facilities power sources.

2.5. The system shall include an active temperature management system to directly maintain column, exposure chamber temperatures, and accessories or components that will be used within the exposure chamber.

2.6. The system shall have a field emission source and optics column capable of running an emitter/source at two (2) or three (3), user selectable acceleration voltages beginning with a nominal acceleration voltage of 100kV.

2.6.1. An option to operate the emitter at acceleration voltages above and below 100kV is preferred.

2.7. The system shall include a sample stage capable of positioning samples using laser interferometer positioning or equivalent.

2.8. An optional loadlock/exchange chamber capable of handling at least one (1) sample holder with the capability of storing additional sample holders (cassettes) in a standby/reserve chamber is preferred.

2.9. The system shall include sample holders able to accommodate wafers ranging from two (2) to six (6) inches in diameter and mask plates up to six (6) inches.

2.9.1. An option for piece-part holders for small samples $3mm^2$ to $25mm^2$ is preferred.

2.10. The tool shall have an incorporated system of setting or determining the surface height of a sample.

2.10.1. An option of an integrated height detection system that detects surfaces of opaque, reflective, and optically transparent substrates is preferred.

2.11. An optional optical microscope system (with digital camera) for coarse position correction and alignment of substrates is preferred.

2.11.1. The optional microscope system should be integrated with the lithography system for position data transfer.

2.12. The column shall include at least one (1) SEM detector for locating alignment marks.

2.12.1. The tool shall be capable of functioning as a scanning electron microscope for alignment mark or feature location.

2.12.1.1. SEM image resolution at highest magnification to image 100nm features or smaller.

2.12.1.2. The video display mode shall be adjustable for scan rate, scan width, brightness, and contrast.

2.12.2. A two-detector system is preferred.

2.12.3. Detection types:

2.12.3.1. A secondary electron detector for detecting topographical differences is the preferred primary detector.

2.12.3.2. A backscatter electron detector for the purpose of locating atomic number contrast alignment marks (e.g., gold on gallium arsenide) and topographic marks (e.g., etched features).

2.13. The system shall have a manual and automated mark-finding algorithm that operates across the current range of the system.

2.14. The system control computer, peripherals, and system software shall provide capabilities and performance consistent with the manufacturer's specifications and descriptions.

2.14.1. The operating software shall be operable in a Multi-User-Facility environment having the capability of storing writes files in individual directories.

3. Performance Requirement

3.1. **Write performance**

3.1.1. Demonstrated vertical sidewall angle in thick resist target less than 3.5 degrees in 20um PMMA is preferred.

3.1.2. Demonstrated grayscale write of holographic grating or Fresnel lens preferred.

3.1.3. Demonstrated smallest features:

3.1.3.1. ≤8nm line grating at fifty percent duty cycle.

3.1.3.2. ≤8nm gap in metal contact leads

3.2. **Electron emitter and column**

3.2.1. The lithography tool shall have a ZrO/W emitter with a nominal 100kV acceleration voltage.

3.2.1.1. The emitter shall be capable of switching between at least two (2), or up to three (3), User-selectable acceleration voltages using the tool's operation software.

3.2.1.1.1. Option to operate the emitter at 50kV is preferred.

3.2.1.1.2. Option to operate the emitter at 200kV is preferred.

3.2.1.2. The emission stability shall be ≤0.2% peak-to-peak per hour with the emitter at 100kV acceleration voltage, and the beam running at 1nA.

3.2.1.3. The emitter shall have a lifetime of more than 12 months under normal operating conditions; 24 months preferred.

3.2.2. The column shall produce a Gaussian beam of electrons of variable beam size covering the tool's range of manufacturer's stated beam diameters, assuming use of appropriate apertures from a thermal field-emission source.

3.2.3. Maintaining a beam diameter of less than 2.0nm over the range of operating conditions is preferred. The beam current shall be User-adjustable over a range of the tool's lowest useful beam current to the highest useful beam current.

3.2.4. The scan rate shall be a minimum of 125MHz.

3.2.4.1. A higher scan rate, or a future upgrade path to a higher scan rate is preferred.

3.2.5. The overlay accuracy shall be equal to or less than +/-10nm for the highest precision writes.

3.2.5.1. The overlay accuracy for all conditions shall not exceed +/-20nm.

3.2.6. The column shall include an automatic, operator-selectable objective aperture.

3.2.6.1. The manufacturer shall provide column tuning, alignment, or optimization schedules for times between emitter changes.

3.2.7. The beam positioning digital-to-analog converter (DAC) minimum shall be 20 bits.

3.2.8. All beam currents corresponding to the tool's beam size range shall have current distributions across scan fields (determined by the set combination of the emitter, acceleration voltage, and objective aperture) with less than or equal to one (1) percent variation relative to the current in the undeflected beam at the center of the field.

3.2.9. The open-loop beam position stability for beams in the size range and precision write conditions shall be better than or equal to 0.01 microns per hour after no more than two (2) hours of warm-up time.

3.2.10. The open-loop beam position stability for beams for all write conditions shall be better than or equal to 0.06 microns per hour after no more than two (2) hours of warm-up time.

3.2.11. The system shall have a manual and automated mark-finding algorithm that correctly locates marks across the entire operable beam condition range.

3.2.12. Column calibration shall be under computer control over the full range of beam currents.

3.2.12.1. Set up of column operating conditions shall be under computer control either interactively with the operator or by recall of stored operating parameters.

3.2.12.2. The system shall be able to store in memory no less than twenty sets of column parameters.

3.2.12.3. These parameters shall include lens values, gun alignment, beam current, stigmation, focus, and all calibration related parameters.

3.2.12.4. The system shall also allow full manual control of these parameters.

3.2.12.5. Tool Operators shall be able to monitor all parameters from a central control console.

3.3. **Stage, Exposure chamber, and Cassette Loader**

3.3.1. The exposure chamber shall be able to achieve a base pressure of less than or equal to 5 x 10-7 torr.

3.3.1.1. Expose chamber stage shall be capable of holding a cassette (sample holder) with substrates or wafers 6 inches in diameter or smaller.

3.3.2. The loadlock pump down time shall be less than or equal to ten minutes for a single cassette assuming good vacuum practice is followed during sample holder loading.

3.3.2.1. The multi-cassette loader shall have temperature control allowing stored cassette/holders to be within +/-0.1C of the stage/exposure chamber to limit "begin-of-write" warm-up delays to 30 minutes or less.

3.3.2.2. The multi-cassette loader storage chamber shall be under vacuum except for exchange of holders/cassettes.

3.3.2.3. The EBL shall allow uninterrupted write cycle or pause of write to load and queue new write sequence.

3.3.2.4. Interruption or pause of a write sequence shall not cause a placement deviation greater than the EBL manufacturer specifications.

3.3.3. The system shall use computer-control to automate transfer of cassettes to and from the exposure chamber and cassette loader.

3.3.4. The stage shall use laser-interferometer positioning with an accuracy of 0.6nm or less.

3.3.4.1. Option for higher stage position accuracy is preferred.

3.3.4.2. Performance for field stitch, placement, or overlay accuracy; maximum allowable:

3.3.4.2.1. +/-10nm for precision writes or smaller write field dimensions.

3.3.4.2.2. +/-20nm for fast writes or the larger field dimensions.

3.3.4.2.3. The stage shall have a fixed or static z-axis position.

3.3.5. An auto-height detection system that can detect the top facing surface of opaque and transparent substrates and map heights across the substrate at User-definable positions is preferred.

3.3.6. An optional optical microscope system for sample pre-alignment integrated with the EBL for alignment mark detection is preferred.

3.3.7. Options for theta/rotational correction of samples by mechanical rotation of the holder, rotation of the stage, or by software, or any combination of the three methods is preferred.

3.4. **Vacuum system**

3.4.1. The electron beam lithography system shall have a UHV system that reflects the latest vacuum technologies to minimize sample contamination during operation.

3.4.2. The entire vacuum system shall be essentially free of hydrocarbons and water vapor.

3.4.3. An oil free, differentially pumped gun, column, and specimen chamber vacuum system using multiple ion, turbo, and scroll pumps shall be included.

3.4.4. An optional multi-cassette loader shall operate nominally under a vacuum compatible with transfer to/from and exposure or exchange chamber.

3.4.4.1. The optional multi-cassette loader may be opened to load/unload cassettes without detriment of an active write.

3.5. **Software and automation**

3.5.1. The operating software shall be operable in a Multi-User-Facility environment having the capability of storing writes files in individual directories.
3.5.2. Routine operation shall be automated/embedded within the write sequence, e.g., pre-exposure calibrations, but with the option to be run manually if necessary.
3.5.2.1. Column calibration shall be under computer control over the range of beam currents specified by the manufacturer.
3.5.2.2. Set up of column operating conditions shall be under computer control either interactively with the operator or by recall of stored operating parameters.
3.5.2.3. The system shall be able to store in memory no less than twenty (20) sets of column parameters.
3.5.2.4. The column parameters shall include lens values, gun/optics alignment, beam current, stigmation, focus, and all calibration-related parameters.
3.5.2.5. The system shall also allow full manual control of these parameters.
3.5.3. All parameters shall be monitored from the central control console.
3.5.4. Scanning electron imaging operations and optical microscope operations shall be controlled from the systems main workstation computer.
3.5.5. The EBL computer system shall be able to be locally networked to an external (remote) PC computer station, allowing file transfers and write scheduling between the two (2) stations.

4. Optional Items

4.1. Option for additional shielding to protect from environmental electro-magnetic interference.

5. Power, Environment, and Safety

5.1. The electron beam lithography shall fail to generate any detectable, ionizing radiation upon defeat of interlocks, removing shielding, loss of vacuum, etc.

5.2. Primary electrical power for the electron beam lithography system shall be compatible with standard, North American 208 VAC, 3 Phase, Neutral+Ground (5-wire), 60 Hz commercial power, If the main power requirement is not common to North American, the equipment supplier must specify and supply the necessary UL compliant transformer with associate short circuit protection to meet this standard.

5.3. Electrical power for the optional environmental control system shall be separate from the lithography tool's primary power distribution scheme. Electrical power requirements for the environmental controller must also meet North American commercial power standards, either 208V single or three phase, 60 Hz.

5.4. Contractor shall be responsible for installation of all components and provision of all interconnecting power, communication, control, and instrument cabling, and all liquid and gas piping, and tubing between components.

5.5. The lithography system will be connected to a facility equipment cooling water loop, located at CINT and owned by SNL, supporting the tool's cooling unit(s).

6. CINT/SNL site-specific requirements

6.1. The system will be installed in a cleanroom bay that is expected to have environmental conditions consistent with an electron beam lithography system.

6.1.1. The design level of floor vibration is to be determined by the manufacturer.

6.1.2. Known environmental conditions for the intended site include the following: class 1000 workspace, nominal room temperature of 20±1°C, and relative humidity in the range 40-50%. The floor of the cleanroom bay is a linoleum-covered slab. The nominal available floor space for the system is approximately 21 feet by 12 feet, inclusive of space that will be necessary for passage within the bay, within an overall bay that is 35.8 feet by 15.8 feet. The nominal ceiling height is 9.9 feet. Additional space of up to 7.5 feet by 25 feet is available in an adjacent chase, within an overall chase that is 7.5 feet by 35 feet. All areas will include restriction by door height/wide restriction. The Contractor shall perform a site survey prior to installation to verify the appropriateness of the environmental conditions. Sandia will be responsible for providing electrical power (U.S.-standard), chilled water (including drains), compressed gases, and exhaust ports. System installation by the contractor shall include hook-up to these facilities. The Contractor shall provide Sandia with a detailed list of the number, type, and preferred location of required power circuits, water and drain connections, compressed gas connections, and exhaust ports, when the layout has been finalized

6.2. With this proposal, written documentation shall be provided verifying that the products ordered by the Company based on the stated specifications, product descriptions, and performance statements, or associated supplier quotes meet ISO9000 certification.

6.3. The items shall be provided with all needed installation requirements and instructions, and operating and maintenance instructions to ensure correct installation, usage, and maintenance. All documentation shall be provided in English.

6.4. Where applicable, documentation shall include the rated capacities and capabilities, accuracy, and uncertainty performance specifications of each device.

6.5. The Seller shall furnish with each system a replacement parts listing giving the part number and serial or lot control number of each replacement part that may be necessary to maintain the system in a fully functioning condition.

6.6. It is the Seller's responsibility to meet all applicable US electrical and associated safety and health code requirements relative to the described equipment as per the NRTL certification requirement.

6.7. The system shall be tested/inspected at the Seller's site, or virtual source inspection, to ensure that all technical requirements of the product specification have been met. The Company reserves the right to have a representative present during any manufacturing, assembly, test, inspection, or other activities associated with this system. Test/inspection results shall be documented and provided to the Company's representative prior to shipment of the system. The Company's representative shall be notified of planned testing at least ten (10) working days prior to commencement.

6.8. Associated computer software/operation shall be validated and verified for correctness prior to release to the customer.

6.9. All deviations from the technical specification that were not approved prior to conduct of activities associated with these deviating conditions shall be classified as nonconformances. All nonconformance documentation shall be provided to the Company's representative two (2) weeks prior to shipment of the system. Shipment shall not take place until all nonconformances have been approved by the Company's representative.

6.10. Where applicable, documentation shall include the calibration status (calibrated or not calibrated) of each device and - if shipped in a calibrated condition - a description or reference to the method used to perform the calibrations at the time of shipment including the reference standard(s) used for this purpose.
6.11. Where applicable, documentation shall include instructions concerning the calibration of associated devices, instruments, or components to fully ensure the stated operating capabilities based on methods traceable to the US National Institutes for Standards and Technology.
6.12. The Seller is responsible for all packing and shipping provisions to ensure that the products in this order arrive at the Company's site in an undamaged, working condition.
6.13. Final acceptance of the described equipment shall be based on testing to the technical requirements of the specifications after completion of installation at the Company's site.

BROOKHAVEN NATIONAL LABORATORY
SUPPLIER QUALITY ASSURANCE REQUIREMENTS
(BNL-QA-101)

PO/Contract No.: 419165 **Date: 08/10/2023**

INSTRUCTIONS: At least one sub-clause in Clause 3.1 must be selected which will automatically invoke Clauses 3.2 through 3.22 collectively on purchase orders. If applicable, the Special Requirements of Section 4.0 need to be individually selected and can be modified as required.
(NOTE: Save this form to your desktop and select the appropriate clauses by clicking on the boxes☐).

1.0 PURPOSE & SCOPE

1.1 This document establishes quality assurance requirements to which Suppliers to Brookhaven Science Associates (BSA) shall conform when specified in the procurement documentation.

1.2 This document contains two main sections. Section 3.0 covers the general requirements that are applicable to all Suppliers. Section 4.0 contains special quality requirements that are applicable only when specifically invoked in the procurement documentation.

2.0 DEFINITIONS

2.1 The term Procurement documentation means the purchase order (PO), contract, subcontract, Request for Proposal (RFP), Request for Quotation (RFQ) or other written agreement with the Supplier (seller) in which the requirements of BSA are incorporated.

2.2 The term Buyer means BSA operating Brookhaven National Laboratory, acting by and through its Procurement & Property Management Division (PPM) issuing the PO/contract.

2.3 The term Supplier (seller) means the legal entity, which is the contracting party, with the Buyer with respect to the procurement documentation.

2.4 The term article or item means a product and/or a service.

3.0 GENERAL REQUIREMENTS

Unless otherwise specified in the procurement documentation, the following General Requirements apply:

3.1 Supplier's Quality System and Quality Requirements

The Supplier shall have and maintain an effective quality system that will, as a minimum, comply with all of the requirements as designated by the following:

☐ **3.1.1** A quality system certified/registered to the ISO 9001 standard: (latest revision as of the date of issuing the procurement documentation).

☐ **3.1.2** A quality system that meets the requirements of the ISO 9001 standard: "Quality Management Systems – Requirements" (latest revision as of the date of issuing the procurement documentation).

☐ **3.1.3** Conformance to Supplier's/Manufacturer's quality program or system.

☒ **3.1.4** Other: Refer to procurement documentation, (e.g. PO, Statement of Work [SOW], specifications, drawings) for quality requirements.

NOTE: Clauses 3.2 through 3.22 apply to all POs and will be included collectively in other procurement documentation when required/specified.

3.2 Assessment by Buyer

The Supplier's quality system is subject to assessments by the Buyer's Representative(s) for conformance with the requirements of the PO. Supplier or Distributor shall allow BSA representatives, BSA customers, and regulatory agencies right of entry into the Supplier's facilities to determine and verify product, processes, records, personnel, material, procedures, and systems.

3.3 Change Approval

No change(s) shall be made to any Buyer requirements, (e.g. part number, model number, etc.) without the prior written approval of the Buyer.

3.4 Responsibility for Subcontractors

It is the responsibility of the Supplier to impose applicable requirements from this document upon their subcontractors. Additionally, the Buyer reserves the right to disapprove, in writing, any subcontractor**.**

3.5 Responsibility for Conformance

The Supplier is responsible to provide items that conform to the requirements of the PO regardless of any assessments, surveillances, inspections and/or tests by the Buyer or its representatives at either the Supplier' or Buyer's facility. The Buyer reserves the right to request failure analysis and corrective action for non-conforming articles or items submitted or supplied to the Buyer. The Supplier is responsible for notifying the Buyer of any recalls or alerts associated with this PO.

3.6 Protection of Material and Equipment

The Supplier shall employ procedures that assure adequate protection of material and equipment during shipment and while in storage. Such protection shall include special environmental packaging, as necessary. All items shipped (originally packaged or repackaged) to BNL or other locations cited in the PO or contract, shall comply with the requirements for preservation, packaging and marking as stated in the latest revision of ASTM Standard D 3951 Standard Practice for Commercial Packaging.

3.7 Measuring and Test Equipment (M&TE) Calibration

The Supplier shall calibrate any M&TE used in the fulfillment of the PO requirements against certified standards that are traceable to the National Institute of Standards and Technology (NIST), or some other recognized national or international standard, or physical constant. The Supplier shall notify the Buyer of any condition found during the calibration, servicing or repair of measuring and test equipment that can affect the end item requirements.

3.8 Suspect Counterfeit Parts

- The Supplier shall verify the procurement source and associated certifying paperwork.
- Appropriate incoming inspection test methods shall be used to detect potential counterfeit parts and materials.
- The Supplier shall flow this requirement down to all sub-tier suppliers to prevent the inadvertent use of counterfeit parts and materials.
- Distributors shall not modify, rework or repair material shipped on this order.

* For more information refer to the following Department of Energy website: https://www.energy.gov/ehss/corporate-reporting-analysis/databases/suspectcounterfeit-and-defective-items

3.9 Electrostatic Discharge Control

Items that are susceptible/sensitive to electrostatic discharge (ESDS) shall be handled and packaged to protect them from damage. Items and/or packages shall be labeled to indicate the susceptibility to electrostatic discharge.

3.10 Electrical or Fire Protection Equipment, Material, and Systems

All electrical or fire protection equipment, material, and systems 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 or fire protection equipment, material, and systems which no NRTL accepts, certifies, lists, labels, or otherwise determined to be safe, the Supplier shall determine the equipment to be safe for its intended use. 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 or upon delivery for review and acceptance by the applicable BSA Authority Having Jurisdiction (AHJ).

In accordance with 29 CFR 1910.147(c)(2)(iii) whenever new machines or equipment are provided with energy isolating devices, those devices shall be designed to accept a lockout device.

3.11 Hoisting & Rigging Equipment

All hoisting & rigging equipment used at BNL shall meet the requirements of the latest applicable OSHA Regulations and ASME B30 Series standards for design, construction, markings, and proof load testing**.**

When proof load testing is required by the standards, a certificate shall be provided upon delivery documenting the proof test.

3.12 Deleted

3.13 Powered Machine Shop Equipment

All powered machine shop equipment (e.g., lathe) delivered to BNL shall meet the requirements of the latest applicable OSHA 1910 Regulations (e.g., part subpart O). Equipment purchased must include an integrated NFPA 79 compliant emergency stop and an anti-restart device.

3.14 Vehicle-Mounted Elevating and Rotating Aerial Devices

All vehicle-mounted and rotating aerial devices equipment used at BNL shall meet the requirements of ANSI A92.2.

3.15 Self-propelled Elevating Work Platform Equipment

All self-propelled elevating work platform equipment (e.g., scissor lift) used at BNL shall meet the requirements of ANSI A92.6.

3.16 Manually Propelled Elevating Aerial Platform Equipment

All manually propelled elevating aerial platform equipment used at BNL shall meet the requirements of ANSI 92.3.

3.17 Boom Supported Elevating Work Platform Equipment

All boom supported elevating work platform equipment used at BNL shall meet the requirements of ANSI 92.5.

3.18 Powered Industrial Trucks and Attachments

Powered industrial trucks (e.g. forklifts, hi-lows) shall meet the requirements of the ANSI/ITSDF B56 series for design, construction, markings, and test loading. Industrial truck attachments shall be approved by the truck manufacturer and supplied with an attachment data plate indicating the new truck capacities.

3.19 Used Industrial Equipment

For used industrial equipment (e.g. scissor lifts, fork lifts, etc.), a Certificate of Conformance as defined in clause 4.16, must be provided as objective evidence and must additionally state that all maintenance and manufacturing alerts have been screened and all required repairs and improvements have been completed. The Supplier shall provide records of the last year of maintenance.

3.20 Global Harmonized System Compliance

The supplier of chemicals shall deliver the chemical in full compliance with the Department of Labor, Occupational Safety & Health Administration (OSHA)'s Globally Harmonized System (GHS) Hazard Communication Standard (29CFR1910.1200), available at:
https://www.osha.gov/dsg/hazcom/HCSFinalRegTxt.html

All hazardous chemicals delivered to BNL shall be accompanied by an GHS Safety Data Sheets (SDS) with the format and content specified in 29CFR1910.1200. For information on the GHS SDS see OSHA Brief- Hazard Communication Standard: Safety Data Sheets Publication 3514 available at:
https://www.osha.gov/Publications/OSHA3514.pdf

All hazardous chemicals delivered to BNL after 12/01/2015 shall have a label with the elements specified in 29CFR1910.1200 [product identifier; pictograms; signal words; hazard statement(s); precautionary statement(s); and manufacturer, importer, or distributor's name, address, and telephone number]. For information on the GHS label, see OSHA Brief- Hazard Communication Standard: Labels and Pictograms Publication 3636 available at:
https://www.osha.gov/Publications/OSHA3636.pdf

3.21 Age/Shelf Life and Storage Control

The Supplier shall have an effective storage and age control system for items where acceptability is limited by the age or manner of storage of the item. The system must include a method of identifying the expiration date on the containers in which material is delivered to the Buyer. Special handling conditions shall be recorded on certifications and shipping documents covering the material delivered to the Buyer. At the time of receipt, the material shall not have less than three-quarters of its shelf life remaining, without prior written approval from the Buyer for each shipment.

3.22 Product Recalls/Product Bulletins/Safety Alerts

Any and all product recall alerts, product bulletins, or safety alerts should be communicated by email directly to ProductRecallAlert@BNL.gov. Provide the Purchase Order Number(s) and names of purchasers with notification to assist BNL in locating and identifying the subject material.

4.0 SPECIAL REQUIREMENTS
The following Special Requirements are applicable only when specified in the procurement documentation or as indicated by check mark hereon. These Requirements can be modified as required.

INSTRUCTIONS: Since sub-clauses (e.g., 4.4.1) are tied to the main clause (e.g., 4.4), the requirements of the main clause will apply by default whenever any sub-clause is selected (regardless of whether the main clause was selected/checked).

☐ **4.1 Quality Assurance Program or Manual**
The Supplier shall submit a copy of their Quality Assurance Program or Manual with their proposal for review and evaluation.

☐ **4.2Configuration Control System**
The Supplier shall establish and maintain a system to assure that all end items (including spares) are of the proper configuration, and that all approved configuration changes are incorporated at the specified effectivity points. Records shall be maintained to verify the configuration of each item.

☐ **4.3 Process Sheets, Travelers, etc.**
The Supplier shall maintain a system of process sheets, shop travelers, or equivalent means to define the sequence of manufacturing, inspection, installation and test activities to be performed. Flow sheets, or equivalent, shall be provided for sign-off by designated inspection personnel at specified inspection and test points, including, as required, re-inspection and re-test points, to assure completion as well as proper sequencing of required operations.

☐ **4.4 Manufacturing/Inspection/Test Plan**
Sixty (60) calendar days prior to performance of work, the Supplier shall submit for the Buyer's approval a Manufacturing/Inspection/ Test Plan for the item(s) to be produced. Once approved, changes/ revisions must be approved by the Buyer prior to implementation. The Plan shall satisfy one or more of the following as selected:

☐ **4.4.1** Identification of parts and subassemblies showing integrated flow into end item(s).

☐ **4.4.2** Identification of critical manufacturing operations, as well as inspection and test checkpoints.

☐ **4.4.3** The Plan may be a single document, or may make use of existing "travelers," or other suitable planning and control documents.

☐ **4.5 "Witness" Points**
The Buyer reserves the right to designate selected manufacturing, inspection, and/or test operations as "witness" points. The Supplier shall provide the Buyer with five (5) working days notice in advance of reaching such witness points during the manufacturing and test cycle of each item.

☐ **4.6 Test and Inspection Procedures**
Test and inspection procedures required to demonstrate satisfactory completion of requirements shall be prepared by the Supplier and submitted to the Buyer for approval sixty (60) calendar days prior to use of such procedures. Once approved, changes/revisions must be approved in writing by the Buyer prior to implementation.

☐ **4.7 Special Processes**
Processes (e.g., welding, brazing, bonding, plating, chemical machining, chemical coating, chemical cleaning, precision cleaning, heat treating, or waste processing) that either cannot be verified non-destructively or require a unique (special) non-destructive test / inspection (e.g., radiographic inspection, ultrasonic testing, pressure leak testing) shall be performed in accordance with detailed written procedures. These procedures shall specifically describe the exact manner in which the processes are to be performed. Additionally, the following requirements apply as selected:

☐ **4.7.1** Copies of special process procedures shall be made available on request for review by the Buyer's representative.

☐ **4.7.2** At least sixty (60) calendar days prior to use on items deliverable to the Buyer, the Supplier shall submit to the Buyer copies of all applicable process procedures for review and approval. Revisions or changes to Buyer-approved special process procedures must be submitted to the Buyer for review and approval prior to implementation.

☐ **4.7.3 Qualification of Procedures, Facilities, Equipment and Personnel**
The Supplier shall, prior to use, qualify the procedures / specifications, facilities, equipment and personnel that will be used for the performance of special processes. Only those personnel who have been qualified to perform a specific special process shall be used to perform that process. Records of such qualification shall be available to the Buyer's representative upon request.

4.8 Qualification of Procedures, Facilities, Equipment
Superseded by Sub-clause 4.7.3

4.9 Qualification of Special Process Personnel
Superseded by Sub-clause 4.7.3

☐ **4.10 End-Item Documentation Package**
The Supplier shall provide a documentation package for each shipment of the item(s) supplied, which consists of objective evidence of compliance with PO requirements. This documentation package shall be complete, legible, indexed, and traceable to the item supplied. Additionally, the following requirements apply as selected:

☐ **4.10.1** Copies of reports of all required or necessary inspections, examinations and tests, properly validated by the Supplier's authorized personnel.

☐ **4.10.2** A listing of the as-built configuration of each delivered item; this may be defined by the use of drawing numbers and revisions, unique parts lists or other such means of positive identification.

☐ **4.10.3** Copies of nonconformance reports dispositioned as "rework / repair" or "use-as-is", and all BSA approved deviation/waivers.

☐ **4.10.4** Copies of material test certificates for specified materials, showing physical and chemical properties.

4.10.5 – Superseded by Clause 4.16

☐ **4.11 Release for Shipment**
The documentation package required in Clause 4.10 shall be approved by the Buyer's representative prior to release of the item for shipment.

☐ **4.12 Shipment of Documentation Package to Buyer**
Three (3) copies of the documentation package required in Clause 4.10 shall be shipped to the Buyer with or prior to each shipment of the purchased items.

☐ **4.13 Failure Reporting, Analysis and Corrective Action**
The Supplier shall maintain a failure reporting, analysis and corrective action system that shall, as a minimum, evaluate, analyze and correct failures occurring during qualification, first article and end-item acceptance testing and inspection. The results of all failure evaluations and analyses shall be documented and available for review by the Buyer.

☐ **4.14 Source Inspection/Surveillance**
Items to be delivered require inspection, tests or surveillance by the Buyer's representative at the Supplier's facility. Five (5) working days advance notice, for acceptance inspections and tests, shall be provided by the Supplier to the Buyer to permit scheduling of source inspection.

☐ **4.15 Chemical and Physical Test Report**
One copy of the actual chemical and physical test report(s) for each heat, batch or lot shall accompany each shipment. Test reports shall list the actual parameters tested, the acceptable limits for each parameter, and shall contain the actual readings taken during test.

☒ **4.16 Certificate of Conformance (C of C)**
With each shipment, per the procurement documentation, the Supplier shall submit a Certificate of Conformance (C of C). In case of drop shipment, a copy of the certificate shall be submitted to the Buyer at the time of shipment. The certificate shall include the title of and be signed by an authorized representative of the company, and shall constitute a representation by the Supplier that:

A. Materials used are those which have been specified by the Buyer, and that the items delivered were produced from materials for which the Supplier has on file, reports of chemical or physical analysis, or any other equivalent evidence of conformance of such items to applicable specifications;

B. Processes used in the fabrication of items delivered were in compliance with applicable specifications included as part of the PO/contract, or Buyer-approved procedures or specifications;

C. The items as delivered comply with all applicable drawings, specifications, deviations/waivers and other requirements of the procurement documentation; and-

D. When specified, cleaning and cleanliness requirements have been completely satisfied. The C of C shall reference the Supplier's applicable cleaning procedures.

4.17 Report with Each Shipment
Superseded by Clause 4.10

☐ **4.18 First Article Acceptance**
Buyer acceptance of first article(s) is required prior to the production run. The first article(s) shall be identified as such, including the PO number/contract, part number, and part name. The Supplier is required to:

☐ **4.18.1** Submit the first article(s) to the Buyer's representative for test/inspection to be conducted at the Supplier's facility by the Buyer's representative.

☐ **4.18.2** Submit the first article(s) to the Buyer for test / inspection by the Buyer at the Buyer's facility.

☐ **4.18.3** Submit the first article(s) to the Buyer together with documents showing data representing results of the Supplier's first article(s) test/inspection, including the actual dimension or value for each specified characteristic.

☐ **4.18.4** After Buyer acceptance of first article(s), all of the remaining units required by the PO/contract shall be produced by the Supplier and the Supplier's suppliers using the same design, materials, processes, methods and tooling that were used to manufacture the approved first article(s). Any changes must have prior written approval from the Buyer.

☐ **4.19 Notification of Change to Design, Methods, or Processes**
The Supplier shall immediately notify the Buyer of any significant changes (those that may affect form, fit, function, reliability, safety, or interchangeability) in product design, fabrication methods, materials, or processing from those used by the Supplier at time of Supplier's quotation or offer to the Buyer, which resulted in the PO.

4.20 Age/Shelf Life and Storage Control
Superseded by Clause 3.21

☐ **4.21 Serial Numbers**
The Supplier shall assign/mark a separate and distinct serial number to each end-item in accordance with the procurement documentation. A record of the serial number, for each part number, shall be maintained by the Supplier.

☐ **4.22 Lot or Batch Numbers**
For items furnished in accordance with the procurement documentation, the manufacturing lot or batch number shall be indicated on the packing list, certifications and other applicable documents. Where impractical to mark individual parts due to size or shape, the lot or batch number shall be marked on identifying tags or the smallest unit package.

☐ **4.23 Material Traceability**
Materials used must be identified by material type, applicable specification and revision number, and be traceable to their lot and/or heat number(s). Traceability records shall be available for review by the Buyer's representative.

☐ **4.24 Shipment Destination Other than BNL**
The material ordered is to be shipped to other than the Buyer's facilities. Copies of the data required in accordance with the procurement documentation shall accompany the shipment; in addition, one copy of such data shall be mailed to the Buyer on the same day that shipment is made.

4.25 Heat Treat Bars
Superseded by Clause 4.7

☐ **4.26 Burn-in**
Burn-in shall be performed on each completed item, per the procurement specification or Supplier's Burn-In process approved by the Buyer. Records of burn-in testing, repairs and test results shall be maintained and shall be available to the Buyer's representative upon request.

4.27 Welding Procedures
Superseded by Clause 4.7

☐ **4.28 Weld/Braze Inspection Report**
A report(s) shall be submitted that indicates the complete inspection of welds or brazes from the initial fit-up stage through final inspection. Inspection reports shall be accompanied by all radiographic films, filler metal reports etc. The reports shall contain the signature or stamp, and title of an authorized Supplier representative.

☐ **4.29 Radiographic Quality Requirements**
Items requiring radiographic inspection shall be radiographed and processed in accordance with the Supplier's special process

procedures that satisfy design specifications, standards or other procurement documentation requirements. Personnel reading and interpreting film shall have been examined and certified. Responsibility for this certification shall rest with the Supplier, whether the Supplier does the work or subcontracts to a specialized laboratory. A report of the findings shall include the name of the reader and the signature and title of a responsible representative. The radiographic film and a reproducible copy of the report shall accompany each shipment. An adequate method of identifying and cross-referencing each film exposure, report, and item shall be provided. When parts are serialized, serial numbers shall appear on the report and the film.

☐ **4.30 Nondestructive Test Reports**
All nondestructive testing shall be conducted in compliance with the Supplier's special process procedures that satisfy the applicable provisions of the design specifications, or other procurement documentation requirements. Personnel and equipment utilized in performance of such tests shall be qualified for the type of test performed. The Supplier shall furnish with, or prior to, each shipment reports of such nondestructive examination of material or items furnished. These reports shall be identifiable to the respective item or material including the specific section, joints or views of the item furnished. These reports shall contain the signature and title of an authorized Supplier representative. When items are serialized, the serial numbers shall appear on the reports.

☐ **4.31 Pressure or Leak Test Reports**
Test reports shall be prepared for all pressure and leak tests. Such reports shall state the requirement, the Supplier's test procedure number, and the observed result for each item, joint or connection tested. When items are serialized, the serial numbers shall appear on the report. Reports shall contain the signature/title of an authorized Supplier representative and shall accompany each shipment.

4.32 Cleaning Certification
Superseded by Clause 4.16 D

☐ **4.33 Calibration Certification**
The Supplier shall submit with each instrument/system a certification that the instrument/ system has been calibrated and is ready for use. The certification shall contain, as a minimum, the identity of the instrument/system, identification of the calibration procedure used, identification of the standards and/or equipment utilized for the calibration, and a statement that the calibration of the standards and/or equipment used is traceable to the NIST or some other recognized national or international standard, or physical constant. Unless otherwise specified, detailed support data shall remain on file for minimum of three (3) years with the Supplier and shall be available for review by the Buyer. The certification shall also contain the signature and title of an authorized Supplier representative.

☐ **4.33.1** The Supplier will provide "As Found" (i.e., before) and "As Left" (i.e., after) measurements with the certification.

☐ **4.34 Operating-Maintenance Manual**
Documentation containing operating procedures, maintenance instructions, spare parts lists, and handling procedures shall be submitted with the shipment of the first item.

☐ **4.35 Computer Software Configuration Management**
The Supplier shall have and maintain an effective software configuration management system. The Supplier's system shall establish requirements for placing software under configuration control, provide for the positive identification of software, and the control of all software baseline changes.

☐ **4.35.1** The Supplier shall submit a copy of their software configuration management procedure(s) with their proposal for review and evaluation.

4.35.2 Superseded by Sub-clause 4.35.1

☐ **4.36 Computer Software Validation**
The Supplier shall develop written procedures describing the controls applied to the design of software and the validation of the design through independent technical review. The procedures shall provide for documentation of review activities, including requirements for documenting comments and resolution of comments. Supplier software designs and review documentation shall be subject to review and approval by the Buyer.

☐ **4.37 Computer Software Verification Testing**
The Supplier shall test and verify computer software developed or modified to fulfill the requirements in the procurement documentation. The verification testing shall be accomplished by a comparison of test results with those from other verified software, or by a comparison with results from analytical solutions or Buyer-approved alternatives.

4.38 Electrostatic Discharge Control
Superseded by Clause 3.9

☐ **4.39 Records**
The Supplier 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 the Buyer's representative for review upon request. These records shall be maintained for a minimum of three (3) years, unless otherwise specified in the procurement documentation, after the completion of the PO/contract.

4.40 Electrical, Fire Protection, or Scaffolding Equipment, Material, and Systems
Superseded by Clause 3.10

4.41 Hoisting & Rigging Equipment
Superseded by Clause 3.11

4.41.1 Powered Industrial Truck Attachments
Superseded by Clause 3.18

4.41.2 Custom-made Equipment
Superseded by Clause 3.11

4.41.3 Critical Lifts
Superseded by Clause 3.11

4.42 Marking of Outer Package and Hoisting & Rigging Services
Superseded by Clause 3.12

☒ **4.43 Franchised / Licensed "Distributor" Traceability**
Products that are not purchased directly from the Original Equipment Manufacturer (OEM)/Original Component Manufacturer (OCM) must be purchased only from a franchised/licensed distributor of the product being offered. The distributor shall ensure traceability of all products to the original equipment manufacturer by identifying the original manufacturer for each lot/date code on the Certificate of Conformance. The distributor shall provide a copy of the Manufacturer's certificate for the lot number being supplied, along with their franchised distributor certification. The distributor shall not use unapproved brokers (any company, person, or entity who is not an OEM/OCM) for the purchase of components and parts, unless

pre-approval has been granted by Brookhaven Science Associates (BSA).

4.44 Power Machine Shop Equipment
Superseded by Clause 3.13

4.45 Aerial Lifts Equipment
Superseded by Clause 3.14

4.46 Self-propelled Elevating Work Platform Equipment
Superseded by Clause 3.15

Subcontract Terms and Conditions

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Terms and Conditions

A. SECTION I CLAUSES

1. DELEGATION OF AUTHORITY - 404KDB (04-21)

The following NTESS personnel are hereby authorized to act as Sandia Delegated Representatives (SDRs) for the specific purpose(s) shown below, subject to the Section II limitations as authorized. SDRs shall exercise no supervision over the Subcontractor's employees.

SDR(s):

Name/Org No/Phone Number

_____

_____

_____

DUTIES DELEGATED:

Act as the technical liaison; inspect and accept deliverables; ensure safety in accordance with NTESS'sEnvironment, Safety, and Health (ES&H) Laboratory Policy System (LPS) which includes obtaining management approval of the Contract Specific Safety Plans (CSSP), and retain a copy of the approved CSSP; track subcontractor compliance to all required safety and security requirements; track all required training for subcontractor personnel.

For the purpose of adding/modifying the SDR the revision may occur via an email notification reflecting the change to the clause. A subcontract revision is not required if this notification is issued. A copy of the email notification shall be part of the subcontract file and shall be legally binding on the parties.

NOTE: The Subcontracting Professional (SP) is the only person who can legally obligate NTESS for the expenditure of funds, change scope and/or level of effort and/or terms and conditions, negotiate, and sign documents legally binding Sandia. COMMITMENTS, OBLIGATIONS OR PROMISES, IMPLIED OR EXPRESSED, BY NTESS PERSONNEL OTHER THAN THE SP DO NOT BIND NTESS IN ANY MANNER.

2. PERSONAL IDENTITY VERIFICATION FOR EXTENDED PHYSICAL AND CYBER ACCESS – 600ACC (11-20)

In accordance with NNSA SD 206.2, *Implementation of Personal Identity Verification (PIV) for Uncleared Contractors*, background investigations may be required for uncleared subcontractor and lower-tier subcontractor employee(s) requiring physical or cyber access to NTESS/SNL or DOE/NNSA owned or leased facilities and/or designated Information Technology (IT) systems for more than 179 calendar days. This includes any physical and cyber access combinations that exceed 179 days.

The Subcontractor will be notified by SNL Personnel Security when the uncleared Personal Identity Verification (PIV) background investigation process is required. The Subcontractor shall ensure eligible employee(s) and lower-tier Subcontractor employees comply with the PIV process which includes:

A. Electronic fingerprinting,
B. Two forms of identification and having a photo taken, and

C. Completion of SF85, Questionnaire for Non-Sensitive Positions and OF306, Declaration for Federal Employment.

Unfavorable PIV determinations will result in immediate revocation of physical and/or cyber access, and may result in the Subcontractor and lower-tier Subcontractor employee(s) removal from performance of work under this agreement. Uncleared Subcontractor and lower-tier Subcontractor employee(s) may appeal unfavorable PIV determinations to DOE/NNSA.

Compliance with PIV procedures is required for Subcontractor and lower-tier Subcontractor employee(s) continued authorization to perform work and access to NTESS/SNL and DOE/NNSA sites and IT systems.

For any additional questions, contact SNL Security Connection at (505) 845-1321 or security@sandia.gov.

RESOURCES
FSO Toolcart (https://www.sandia.gov/FSO/index.htm), NTESS resource for badging, access, and security information.

3. HOMELAND SECURITY - 600HLS (3-21)

Performance of this subcontract requires physical access to facilities owned or leased by NTESS and/or Department of Energy/ National Nuclear Security Administration (DOE/NNSA).

A. Subcontractor shall ensure employees' and lower-tier Subcontractor employees' compliance with NTESS/DOE/NNSA procedures for obtaining physical access and provide accurate information on forms submitted.

B. Foreign Government-Sponsored Talent Recruitment Programs

1. Subcontractor shall affirmatively disclose employee participation in any Foreign Government-Sponsored Talent Recruitment Programs (as defined in DOE Order 486.1A) for all individuals requiring physical access to NTESS or DOE/NNSA facilities.

2. Subcontractor shall notify NTESS within seventy-two (72) hours if any employees (or lower-tier subcontractor employees) with physical access to NTESS or DOE/NNSA facilities are, or are reasonably believed to be, participants in a Foreign Government-Sponsored Talent Recruitment Program during performance of this subcontract. Notifications to ContractNotification@sandia.gov.

3. Subcontractor shall include this clause in its entirety in any lower-tier subcontracts where individuals will require physical access to NTESS and/or DOE/NNSA facilities.

4. Subcontractor employee and lower-tier employee participation in any Foreign Government-Sponsored Talent Recruitment Program of a Foreign Country of Risk (as defined in DOE Order 486.1A) is prohibited while performing work under this subcontract. Upon NTESS direction, Subcontractor shall remove any individual participating in Foreign Government-Sponsored Talent Recruitment Programs from work under this subcontract.

C. Subcontractor shall return the badge(s) or other credential(s) provided by NTESS or DOE/NNSA pursuant to this clause, granting physical access to DOE/NNSA-owned or leased facilities by Subcontractor's employee(s), upon:

1. The termination of this subcontract

2. The expiration of this subcontract

3. The removal of an individual performing work under this subcontract or any subcontractor employees performing work under this subcontract; or

4. NTESS or DOE/NNSA direction.

RESOURCE(S)

Security Toolcart (https://www.sandia.gov/security/), NTESS resource for badging, access, and security information.

DOE Order 486.1A (https://www.directives.doe.gov/directives)

4. CONTRACT SPECIFIC SAFETY - 603CSS (04-21)

In performing work under this subcontract, Subcontractor and their lower-tier subcontractors, if any, shall perform work safely, in a manner that ensures adequate protection for employees, the public, and the environment, and shall be accountable for the safe performance of work in accordance with DEAR970.5223-1, *Integration of Environment, Safety, and Health (ES&H)Into Work Planning and Execution*. Furthermore, Subcontractor shall manage and perform work in accordance with 10 CFR 851, *Worker Safety and Health Program*. These requirements operate in addition to any other specifications or requirements included elsewhere in this subcontract. NTESS is required to flow these requirements to Subcontractors at any tier.

Subcontractor shall follow the NTESS-approved Contract Specific Safety Plan (CSSP) it submitted that addresses and mitigates hazards identified by NTESS and any other hazards the Subcontractor may have determined as inherent to the statement of work (SOW). Subcontractor shall not begin any onsite work until a Pre-Job Briefing has been performed and documented, and authorization to proceed has been provided by the SDR.

Any Sandia-controlled premises work that includes installation, inspection, testing, maintenance, operating, or decommission of electronic equipment or systems requires that the Subcontractor provide current evidence (training, certifications, licensing) that the Subcontractor employees performing the electrical work are qualified. Subcontractor shall also include a statement confirming that any Subcontractor personnel performing the onsite electrical work are qualified electrical workers per the definition in NFPA70E, *Standard for Electrical Safety in the Workplace*. These documents shall be included in the CSSP.

DECLARATION OF OCCUPATIONAL MEDICINE PROVIDER

Subcontractors shall establish and provide comprehensive occupational medicine services to workers meeting the applicability criteria noted below, in accordance with 10CFR 851, *Worker Safety and Health Program*. Subcontractors that will perform any work on a Sandia-controlled premises, and that meet the applicability criteria below, shall provide the SDR a written declaration by completing form SF 4040-DOP, located at http://www.sandia.gov/resources/employees/corporate_forms/. The declaration must be completed and provided to the SDR prior to performing work. The Subcontractor shall maintain a copy of the completed declaration.

Applicability Criteria:

1.Work on a Sandia-controlled premises for more than thirty (30) days in a12-month period

OR

2. Are enrolled for any length of time in a medical or exposure monitoring program required by the 10 CFR 851 and/or any other applicable Federal, State or local regulation, or other obligation.

EMERGENCIES

If an accident occurs on a Sandia-controlled premises that causes injury or that could adversely affect personnel or the environment during the performance of this work, the Subcontractor shall render aid and remain at the site if it is safe to do so, or evacuate if necessary to protect personnel, then report the accident immediately to SNL Emergency Management at the numbers listed below. Examples of such accidents may include injury beyond first aid, release of and exposure to hazardous gases or vapors, release of hazardous materials to floor drains or the soil, property damage.

- Sandia National Laboratories/New Mexico (SNL/NM) call 911 from a landline, or (505)844-0911from mobile phone;
- Sandia National Laboratories/California (SNL/CA) call 911 from a landline, or (925)294-2222from mobile phone;
- Other U.S. locations call 911.

For non-emergencies:

- At SNL/NM call 311 from a landline, or (505) 845-0311 from mobile phone;
- At SNL/CA call 311 from a landline, or (925) 294-2300 from mobile phone.

Subcontractor shall notify the SDR as soon as appropriate after emergency personnel have been notified. The SDR will notify appropriate parties, such as the responsible manager, ES&H Coordinator, project PIs, other critical project parties.

5. TOBACCO-FREE WORKPLACE - 613TFW (05-17)

NTESS is a tobacco-free workplace. This policy applies to all Members of the Workforce (MOW), and includes all NTESS employees, subcontractor and subcontractor employees at any tier, government employees, and visitors.

The use of all tobacco products, including cigarettes, cigars, cigarillos, pipes, chewing tobacco, snuff, and electronic cigarettes, is prohibited on all SNL property. SNL property includes SNL vehicles, building interiors, exteriors, entryways, walkways, parking lots, fenced areas and portions of buildings controlled by NTESS. Additionally, the policy is applicable to the interiors of personal vehicles parked on NTESS controlled property.

6. PERFORMANCE OF WORK ON GOVERNMENT OR NTESS SITE - 706PGS (04-23)

THE REMAINING CLAUSES APPLY TO SUBCONTRACTS WHERE ANY WORK WILL PERFORMED ON A GOVERNMENT OR NTESS SITE

DEAR 952.203-70 Whistleblower Protection for Contractor Employees

DEAR 970.5222-1 Collective Bargaining Agreements-Management and Operating Contracts

DEAR 970.5223-1 Integration of Environment, Safety, and Health into Work planning and Execution

CERTIFICATE OF INSURANCE

(a) For all subcontracts where some portion of the work is to be conducted on a government site, and subcontract value including the sum of any options or releases equals or exceeds $150,000, the Subcontractor shall provide a Certificate of Insurance evidencing the following insurance coverage that will be provided to the SP prior to the commencement of work:

1. Commercial General Liability Insurance (ISO policy form or equivalent) with limits of liability of not less than $1,000,000 each occurrence and in the aggregate for bodily injury, property damage, personal injury and contractual liability and will include NTESS as an additional insured.
2. Workers' Compensation and Employers' Liability Insurance covering all employees performing work on the government site with Employers' Liability limits not less than $1,000,000.
3. Business Automobile Liability Insurance (ISO policy form or equivalent) with coverage for owned, leased and hired autos) with limits of not less than $1,000,000 each accident for bodily injury and property damage if the on-site work contemplates the use of automobiles.

(b) Onsite visits for deliveries and status meetings are exempt from this requirement.
(c) NTESS reserves the right to amend these insurance requirements which may include, but not be limited to, requiring additional limits and or coverages depending on the nature and scope of work being performed.

ENVIRONMENTAL, SAFETY, AND HEALTH (ES&H) REQUIREMENTS

(a) Service Providers - NTESS-directed work. NTESS shall provide those workers with any and all necessary safety authorization documents, personal protective equipment, industrial hygiene monitoring, medical surveillance, and radiation protection services.
(b) Service Providers - Subcontractor-directed work. Subcontractor shall provide its workers with all ES&H services, with the exception of Subcontractor employees performing Subcontractor-directed work on government sites for whom NTESS shall provide radiation dosimetry services and survey of record, as appropriate.
(c) Training Requirements. Any Subcontractor personnel who will enter a government site to perform work shall have completed all of the ES&H training required by the SOW prior to any attempts to enter a government site as shown by written records of such training furnished to the SDR or to the Requester if no SDR is named in Section I of this subcontract. Subcontractor shall certify to NTESS completion of all required training on the Completion Record for Subcontractor Administered Training form. This form is located on the Web at http://www.sandia.gov/working_with_sandia/current_suppliers/contract_information/index.html under the "Forms" tab, or obtained from the SDR. EXCEPT FOR SUBCONTRACTORS WORKING UNDER AN APPROVED CONTRACT SPECIFIC SAFETY PLAN (CSSP), the subcontractor shall provide the completion record form for the initial ESH100 training to the SDR on the first day of work. Subcontractor shall provide the completion records for any other training required above to the SDR before starting the affected work activity. Any person not having completed all ES&H training requirements outside of the CSSP (if any) may be denied access to any government site and Subcontractor may be terminated for default of this subcontract as well as every other subcontract the Subcontractor has with NTESS.

HAZARDOUS MATERIALS

(a) Handling Requirements.
1. For subcontracts that require the performance of work on government sites, the Subcontractor shall coordinate with the SDR all activities associated with the acquisition (including reporting hazardous materials used on government sites), handling, storage, accidental spills, and/or disposal of hazardous materials and/or waste.
2. The Subcontractor shall notify the SDR of all hazardous and/or radioactive waste generated during performance of work.
3. Such materials become NTESS-owned waste and the Subcontractor shall notify the SDR for proper disposal by NTESS.
4. Subcontractor's assistance in disposal may be required by NTESS.

(b) Removal Requirements.
1. Those hazardous materials brought onto NTESS-controlled premises by the Subcontractor which are job-related consumables and have not been removed from their original packaging and which have not been purchased by NTESS, shall remain the property of the Subcontractor and shall be removed from NTESS after completion of the work.
2. Hazardous materials in the original, labeled container are not hazardous waste if the material is usable and the full or partially full container is intact and properly closed. Those scrap items which are not hazardous and which have not become hazardous through co-mingling with hazardous items are owned by the Subcontractor and shall also be removed.

SUBCONTRACTOR OR LOWER-TIER SUBCONTRACTOR USE OF GOVERNMENT-OWNED VEHICLES

The following provisions apply if work under this subcontract requires Subcontractor or lower-tier subcontractor personnel to operate government-owned vehicles either on or off government sites.

(a) Subcontractor shall maintain, at Subcontractor's expense, during the period of performance of work under this subcontract, third-party vehicle liability insurance which shall cover:
1. The use of such government-owned vehicles with limits of at least $200,000/$500,000 public liability and $20,000 property damage.
2. Medical payments coverage, comprehensive and collision insurance, uninsured motorist, and personal injury protection will not be required under this clause unless required by state statute.

(b) All Subcontractor's agents, employees and subcontractors of any tier shall obey all rules and regulations pertaining to the use of government-owned vehicles.
(c) In the event of a motor vehicle accident, the Subcontractor shall submit a completed Motor Vehicle Accident Reporting Form SF 91 to the SP together with any additional supplemental forms required by instructions given on the General Services Agreement (GSA) Form Packet 1627. A GSA Form Packet 1627 normally is located either in the headliner or glove box of the GSA vehicle.
(d) Subcontractor's personnel shall ensure that a GSA Form Packet 1627 is available in a GSA vehicle prior to accepting and driving a GSA vehicle.

SUBCONTRACTOR, LOWER-TIER SUBCONTRACTOR, AND VISITOR ACCESS REQUIREMENTS

(a) Government-Controlled and Government-Owned sites. The Subcontractor agrees and shall ensure that Subcontractor and lower-tier subcontractor personnel entering government-controlled and government-owned sites for any activity related to this subcontract shall at all times be subject to and shall comply with all laws, regulations, policies, and site access rules for the site including, but not limited, to all ES&H and Security requirements. For work performed at government-controlled and government-owned sites, the Security and ES&H requirements can be obtained by contacting the SDR. The government requirements include, but are not limited to, those set forth in this clause for any work to be performed on a government-controlled or government-owned site.
   1. To obtain access to government-controlled or government-owned site, the Subcontractor shall submit and email request to the SDR or SP stating the company designation to be used by the Subcontractor and each lower-tier subcontractor and furnishing the following information on each Subcontractor and lower-tier subcontractor personnel requiring access to the government-controlled and government-owned site:
      i. Name
      ii. Date of birth
      iii. Citizenship status
      iv. Completed ES&H training requirements set forth in the SOW of this subcontract
   2. Access will be granted for the period of performance as stated in Section I of this subcontract.
   3. Subcontractor shall withdraw and replace any Subcontractor or lower-tier subcontractor personnel, assigned to perform work under this subcontract, who in the judgment of NTESS or DOE/NNSA, is to be denied access to any government-controlled or government-owned site.
   4. Subcontractor shall submit to the SDR any proposed working schedules for its personnel and that of each lower-tier subcontractor that deviate from NTESS' normal workday or work week schedule as noted in Section I of this subcontract. The schedules shall show proposed daily working hours and proposed work weeks. Schedules that deviate from NTESS' normal work day or work week must be approved by the SDR.
   5. In the absence of a written authorization from the SP or SDR, use of government-controlled or government-owned sites by the Subcontractor and its lower-tier subcontractors, pursuant to access granted under this clause, shall be limited to work as set forth in the SOW of this subcontract to be performed on government-controlled or government-owned.
   6. THE USE OF THE ACCESS PRIVILEGE FOR ANY PURPOSE OTHER THAN TO PERFORM WORK AS SET FORTH IN THE SOW OF THIS SUBCONTRACT IS PROHIBITED AND MAY BE GROUNDS FOR TERMINATING THIS SUBCONTRACT FOR DEFAULT OR DENYING ACCESS TO ANY SUBCONTRACTOR OR LOWER-TIER SUBCONTRACTOR PERSONNEL.

(b) SNL Site Access. The organizations listed below are responsible for coordinating and administering the provisions of visitor access and control for the sites as listed.
   1. Sandia National Laboratories, Albuquerque, New Mexico - Badge Office, NTESS, Innovation Parkway Office Complex (IPOC).
   2. Sandia National Laboratories, Livermore, California - Visitor Control and Administration Section, NTESS, Building 911.
   3. Tonopah Test Range, Tonopah, Nevada - Office of the Tonopah Test Range Manager.

(c) Subcontractor shall ensure that its and its lower-tier subcontractor personnel assigned to work on government-controlled or government-owned sites comply with all applicable site access requirements. In addition, the Subcontractor and its lower-tier subcontractor personnel, shall:
   1. Not bring weapons of any kind onto government-controlled or government-owned sites
   2. Not manufacture, sell, distribute, possess, use or be under the influence of controlled substances or alcoholic beverages while on government-controlled or government-owned
   3. Not possess hazardous materials of any kind on government-controlled or government-owned sites without SP or

SDR authorization or as stated in the SOW of this subcontract

4. Not venture into unauthorized/restricted areas

(d) All persons, property, and vehicles entering or leaving government-controlled or government-owned sites are subject to search by site Security Policy Officers.

VEHICLE INSURANCE

All vehicles owned or operated by the Subcontractor, lower-tier subcontractors or their agents and employees, having access to government sites shall be covered by at least $200,000/$500,000 public liability and $20,000 property damage insurance.

VEHICLE MARKINGS

All vehicles used by either the Subcontractor or its lower-tier subcontractors shall be marked clearly to indicate company name of user. Vehicles which do not bear permanent markings may be temporarily marked as follows:

(a) Signs shall be no longer than the vehicle door is wide, with a white or lighter background, showing the Subcontractor's name in one-inch-high, or larger, machine generated, dark colored letters, may be made from sheet metal, vinyl or other suitable material and temporarily attached to the vehicle's front door panels so that the signs appear in the approximate center of each door panel. Words such as "Company," "Corporation" or "Division" may be abbreviated.
(b) No signs shall be attached to the vehicle's glass area for safety reasons.
(c) Non-government commercial vehicles must be marked in accordance with Department of Transportation regulations.
(d) Personally-owned vehicles must be marked in accordance with Department of Transportation regulations. Operators of all vehicles must have, in their possession, valid registration, insurance, licensing and related documentation applicable to the vehicle.

Operators of all vehicles must have, in their possession, valid registration, insurance, licensing and related documentation applicable to the vehicle.

7. NTESS NORMAL WORKWEEK, WORK HOURS AND HOLIDAYS - 921SWH (12-21)

NTESS normal work hours are:

SNL, Albuquerque, NM, normal work hours are:

8:00 AM to 4:30 PM Mountain Standard Time (MST), Monday through Friday

SNL, Livermore, CA, normal work hours are:

7:30 AM to 4:00 PM Pacific Standard Time (PST), Monday through Friday

NTESS also permits its employees to work a compressed workweek schedule, or 9/80 schedule, which is a work schedule involving 80 hours of work in 9 workdays. A second but less common compressed workweek permits 40 hours in 4 workdays. At the request of the SDR, and with the approval of the Subcontractor, any Subcontractor employee(s) who work onsite at SNL may work one of the above compressed workweek schedules as necessary to facilitate the performance of the subcontract requirements. NTESS shall not be responsible (or liable) for overtime premium payments incurred as a result of Subcontractor employee(s) working a compressed work schedule. In the absence of such a request from the SDR and Subcontractor approval, the normal work hours shall apply.

Per the Fair Labor Standards Act, the Subcontractor shall be cognizant that if their employees work a 9/80 or other non-standard schedule that they must abide by overtime laws designated in the state where work is performed.

Due to NTESS' observance of the below listed holidays, no work will be available onsite at SNL for the Subcontractor's employees under this subcontract on those days:

1. Memorial Day
2. Juneteenth
3. Independence Day
4. Labor Day
5. Thanksgiving Day
6. The six working days encompassing Christmas/New Year holidays

Normally, when a holiday falls on a scheduled day off it is observed on the nearest scheduled workday.

Hazard Assessment

Summary: Set-up and installation of the Electron Beam Lithography (EBL) system will occur at the Center for Integrated Nanotechnologies (CINT), room 1501. The CINT is a property protection area. Properly badged US persons can perform installation tasks without the need of an L or Q cleared escort.

Description of on-site work: This subcontract outlines installation and training activities that shall be provided by the Subcontractor of the EBL system. The duration of the work is anticipated to take XX? business days. Utility connections will be in place and facilities modification are not required of the Subcontractor. Facilities will be prepared according to the Subcontractors site preparation instructions. Original Equipment Manufacturer (OEM) field engineers shall supply their own tools. Hot work (welding/cutting/grinding) will not need to take place. Energized electrical work (open access/modification/troubleshooting) or circuits above 49V is not permitted without NTESS Senior Manager approval.

Summary of lab hazards and mitigations: Hazards present in the lab include chemical, pressure, electrical, and thermal hazards. During the installation of the EBL system, work in the rest of the lab will be paused. Systems will be maintained in standard configurations so hazards will not impact the work described here. A pre-job brief with the on-site ES&H Coordinator and tool owner will take place prior to installation. Subcontract personnel will be informed of actual near-by hazards on the day(s) of installation and will be required to detail the activities they plan to perform to the ES&H coordinator and tool owner.