SOLICITATION/CONTRACT/ORDER FOR COMMERCIAL ITEMS
OFFEROR TO COMPLETE BLOCKS 12, 17, 23, 24, & 30

1. REQUISITION NUMBER	PAGE 1 OF 72
NB100000-23-00738	

2. CONTRACT NO.	3. AWARD/EFFECTIVE DATE	4. ORDER NUMBER	5. SOLICITATION NUMBER	6. SOLICITATION ISSUE DATE
			1333ND23RNB680014	APRIL 21, 2023

7. FOR SOLICITATION INFORMATION CALL:	a. NAME	b. TELEPHONE NUMBER *(No collect calls)*	8. OFFER DUE DATE/ LOCAL TIME
	NINA LIN NINA.LIN@NIST.GOV	301-975-6062	MAY 22, 2023 10:00 AM ET

9. ISSUED BY CODE 000SB

NATIONAL INST OF STDS AND TECHNOLOGY
100 BUREAU DRIVE STOP 1640
BUILDING 301 ROOM B129
GAITHERSBURG MD 20899-1640

10. THIS ACQUISITION IS ☒ UNRESTRICTED OR ☐ SET ASIDE: _____ % FOR:

- ☐ SMALL BUSINESS
- ☐ HUBZONE SMALL BUSINESS
- ☐ SERVICE-DISABLED VETERAN-OWNED SMALL BUSINESS
- ☐ WOMEN-OWNED SMALL BUSINESS (WOSB) ELIGIBLE UNDER THE WOMEN-OWNED SMALL BUSINESS PROGRAM
- ☐ EDWOSB
- ☐ 8 (A)

NAICS: 334516

SIZE STANDARD:

11. DELIVERY FOR FOB DESTINATION UNLESS BLOCK IS MARKED	12. DISCOUNT TERMS	13a. THIS CONTRACT IS A RATED ORDER UNDER DPAS (15 CFR 700)	13b. RATING / 14. METHOD OF SOLICITATION
☐ SEE SCHEDULE		☐	☐ RFQ ☐ IFB ☒ RFP

15. DELIVER TO CODE 000004

NATIONAL INST OF STDS AND TECHNOLOGY
BUILDING 301 SHIPPING AND RECEIVING
100 BUREAU DRIVE
GAITHERSBURG MD 20899-0001

16. ADMINISTERED BY CODE

17a. CONTRACTOR/ OFFEROR. CODE _____ FACILITY CODE _____

TELEPHONE NO.

17b. ☐ CHECK IF REMITTANCE IS DIFFERENT AND PUT SUCH ADDRESS IN OFFER

18a. PAYMENT WILL BE MADE BY CODE

18b. SUBMIT INVOICES TO ADDRESS SHOWN IN BLOCK 18a UNLESS BLOCK BELOW IS CHECKED ☐ SEE ADDENDUM

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTITY	22. UNIT	23. UNIT PRICE	24. AMOUNT
Please	see continuation page for line item details. *(Use Reverse and/or Attach Additional Sheets as Necessary)*				

25. ACCOUNTING AND APPROPRIATION DATA

See Schedule

26. TOTAL AWARD AMOUNT *(For Govt. Use Only)*

☐ 27a. SOLICITATION INCORPORATES BY REFERENCE FAR 52.212-1, 52.212-4. FAR 52.212-3 AND 52.212-5 ARE ATTACHED. ADDENDA ☒ ARE ☐ ARE NOT ATTACHED

☐ 27b. CONTRACT/PURCHASE ORDER INCORPORATES BY REFERENCE FAR 52.212-4. FAR 52.212-5 IS ATTACHED. ADDENDA ☐ ARE ☐ ARE NOT ATTACHED

☒ 28. CONTRACTOR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN 1 COPIES TO ISSUING OFFICE. CONTRACTOR AGREES TO FURNISH AND DELIVER ALL ITEMS SET FORTH OR OTHERWISE IDENTIFIED ABOVE AND ON ANY ADDITIONAL SHEETS SUBJECT TO THE TERMS AND CONDITIONS SPECIFIED

☐ 29. AWARD OF CONTRACT: REF. _____ OFFER DATED _____ . YOUR OFFER ON SOLICITATION (BLOCK 5), INCLUDING ANY ADDITIONS OR CHANGES WHICH ARE SET FORTH HEREIN, IS ACCEPTED AS TO ITEMS:

30a. SIGNATURE OF OFFEROR/CONTRACTOR	31a. UNITED STATES OF AMERICA *(SIGNATURE OF CONTRACTING OFFICER)*

30b. NAME AND TITLE OF SIGNER *(Type or print)*	30c. DATE SIGNED	31b. NAME OF CONTRACTING OFFICER *(Type or print)*	31c. DATE SIGNED

19. ITEM NO.	20. SCHEDULE OF SUPPLIES/SERVICES	21. QUANTITY	22. UNIT	23. UNIT PRICE	24. AMOUNT

32a. QUANTITY IN COLUMN 21 HAS BEEN

☐ RECEIVED ☐ INSPECTED ☐ ACCEPTED, AND CONFORMS TO THE CONTRACT, EXCEPT AS NOTED: _____

32b. SIGNATURE OF AUTHORIZED GOVERNMENT REPRESENTATIVE	32c. DATE	32d. PRINTED NAME AND TITLE OF AUTHORIZED GOVERNMENT REPRESENTATIVE

32e. MAILING ADDRESS OF AUTHORIZED GOVERNMENT REPRESENTATIVE	32f. TELPHONE NUMBER OF AUTHORZED GOVERNMENT REPRESENTATIVE 32g. E-MAIL OF AUTHORIZED GOVERNMENT REPRESENTATIVE

33. SHIP NUMBER ☐ PARTIAL ☐ FINAL	34. VOUCHER NUMBER	35. AMOUNT VERIFIED CORRECT FOR	36. PAYMENT ☐ COMPLETE ☐ PARTIAL ☐ FINAL	37. CHECK NUMBER

38. S/R ACCOUNT NO.	39. S/R VOUCHER NUMBER	40. PAID BY

41a. I CERTIFY THIS ACCOUNT IS CORRECT AND PROPER FOR PAYMENT		42a. RECEIVED BY *(Print)*	
41b. SIGNATURE AND TITLE OF CERTIFYING OFFICER	41c. DATE	42b. RECEIVED AT *(Location)*	
		42c. DATE REC'D *(YY/MM/DD)*	42d. TOTAL CONTAINERS

SCHEDULE Continued

ITEM NO.	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
0001	Analytical Scanning/Transmission Electron Microscope (STEM) in accordance with (IAW) the Statement of Work (SOW) to include initial year warranty that begins upon STEM acceptance. Period of Performance: 08/01/2023 to 07/31/2026	**1.00**	EA		
0002	Safety Features and Documentation IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		
0003	Site Preparation IAW the SOW Period of Performance: 08/01/2025 to 10/31/2025	**1.00**	EA		
0004	Training with On-site Application Engineers IAW the SOW Period of Performance: 02/06/2025 to 08/31/2025	**1.00**	EA		
0005	Documentation, Guides, Manuals IAW the SOW Period of Performance: 08/06/2025 to 08/31/2025	**1.00**	EA		
0006	Service Contract (4 years) for STEM IAW SOW to begin after expiration of initial year warranty. Period of Performance: 08/01/2025 to 07/31/2029	**4.00**	YR		
0007	OPTION ITEM: Additional Beam Energy Alignment IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0008	OPTION ITEM: Objective Aperture IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0009	OPTION ITEM: Segmented Sensors IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0010	OPTION ITEM: Euclid GHz Beam Pulser IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0011	OPTION ITEM: Lorentz Microscopy IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0012	OPTION ITEM: Precession Electron Diffraction Capability IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0013	OPTION ITEM: TEM Specimen Holder - Double-tilt Low Background IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0014	OPTION ITEM: TEM Specimen Holder - Double-tilt with Faraday cup IAW the SOW	**1.00**	EA		OPT

SCHEDULE Continued

ITEM NO.	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	Period of Performance: 02/01/2025 to 08/01/2025				
0015	OPTION ITEM: Tomography TEM Specimen Holder IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0016	OPTION ITEM: High-Tilt Tomography TEM Specimen Holder IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0017	OPTION ITEM: Double-tilt Rotate TEM Specimen Holder IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0018	OPTION ITEM: Single-tilt Cryo-transfer TEM Specimen Holder IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0019	OPTION ITEM: Single-tilt Cooling TEM Specimen Holder IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0020	OPTION ITEM: Double-tilt Cooling TEM Specimen Holder IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0021	OPTION ITEM: MEMS-based Double-tilt Heating TEM Specimen Holder IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0022	OPTION ITEM: Double-tilt Heating TEM Specimen Holder IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0023	OPTION ITEM: Single-tilt Biasing TEM Specimen Holder IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0024	OPTION ITEM: Blanking Plug IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0025	OPTION ITEM: High Speed Pre-filter Camera 2: High-speed Monolithic Active Pixel Camera IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0026					OPT

SCHEDULE Continued

ITEM NO.	SUPPLIES/SERVICES	QUANTITY	UNIT	UNIT PRICE	AMOUNT
	OPTION ITEM: High Speed Pre-filter Camera 2: High-speed TimePix-based Hybrid Pixel Detector IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		
0027	OPTION ITEM: 4D-STEM System IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0028	OPTION ITEM: Tomography Capability - Software Functionality IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0029	OPTION ITEM: Electron Counting Camera for Electron Energy Filter IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0030	OPTION ITEM: Additional Training IAW the SOW Period of Performance: 02/01/2025 to 08/01/2025	**1.00**	EA		OPT
0031	OPTION ITEM: Trade-In of existing STEM IAW the SOW Period of Performance: 08/01/2023 to 07/31/2025	**1.00**	EA		OPT

Table of Contents

STATEMENT OF WORK/REQUIREMENTS DOCUMENT
Title: Analytical Scanning/Transmission Electron Microscope
Requesting Lab: CHIPS R&D Program

I. BACKGROUND INFORMATION

In support of the CHIPS Act, the National Institute of Standards and Technology (NIST) is acquiring nano fabrication and nano characterization equipment that will address the major metrology research and development grand challenges for the reliable production of next-generation microelectronic devices.

The NIST Center for Nanoscale Science and Technology NanoFab User Facility intends to procure an analytical scanning/transmission electron microscope (S/TEM).

Purpose/Objective: The NIST NanoFab User Facility intends to procure an analytical scanning/transmission electron microscope to replace their current microscope, which is over 12 years old. The microscope will be sited and used as a shared resource in the CNST NanoFab user facility, which is accessible to researchers from industry, academia, NIST, and other government agencies. The CNST NanoFab User Facility enables science and industry by providing essential measurement methods, instrumentation, and standards to support all phases of nanotechnology development from discovery to production. The analytical S/TEM is an essential tool in the NanoFab, and there is an increasing demand for a S/TEM with updated capabilities.

The NIST CNST NanoFab User Facility is updating electron microscopy instrumentation as part of the CHIPS and Science Act of 2022. As part of this work, NIST is seeking to purchase an aberration-corrected analytical scanning/transmission electron microscope (S/TEM). The microscope shall be designed to provide an optimum combination of capabilities for high spatial resolution imaging, spectroscopy, and microanalysis. The core capabilities required for this microscope are atomic-resolution STEM imaging and atomic-resolution EDX and EELS mapping. In addition to the STEM mode capabilities, high-resolution phase contrast TEM imaging and energy-filtered imaging are also required. Multiple diffraction modes of analysis shall also be provided. These include selected-area and convergent beam diffraction for TEM mode analysis, as well as microbeam and nanobeam diffraction for spatially resolved analysis in STEM mode. Since the microscope will be in a shared use facility, reliability and ease of use are very important.

In addition, several areas of our research would benefit from stroboscopic time-resolved capabilities made possible by the addition of a tunable, gigahertz frequency beam modulator. The addition of this hardware is currently under test, but its inclusion would be highly beneficial if it can be achieved without significant degradation of the core capabilities listed above.

Optionally, there are several other capabilities that we would like to include if they are available and within budget. These optional items include additional and/or upgraded cameras, electron tomography, 4D-STEM, and precession electron diffraction.

Data and Operation Expectations

In the statements below, the word "instrument" may refer to the primary microscope, a camera, a detector, a spectrometer, or a specimen holder. The specific instance of the instrument where these data expectations are applicable are stated with those sections within the Statement of Work.

1. All data and metadata produced by the instrument are required to be saved in a format that is readable using non-proprietary ("open") software (e.g., HDF5, TIFF, etc.). If this is not feasible, detailed specifications of proprietary formats shall be provided without restriction such that file readers may be implemented by NIST and shared publicly. Data may simultaneously be saved in a "closed" native instrument format if required for instrument operation, but the software shall allow automatic export into an open format as previously described.

2. The instrument contractor shall provide application program interface(s) (API) for the control and query of instrument functionalities consistent with expert- and custodian-level access. Note, experts and custodians typically control and query the instrument, whether in-person or remotely, through a combination of hand-panels, displays, graphical user interfaces (GUIs), and disc/network read/write/execute operations. API shall grant all input and output operations described above.

3. The instrument shall be fully remote operable (using both with hardware hand-panels, and software) from Boulder, CO/ Gaithersburg, MD. The exception to remote operation is where specimen and cryogen shall be exchanged or administered or advanced in situ and in-operando specimen holders where the performance cannot be guaranteed without a live operator.

4. (Optional – for the purpose futureproofing) Instrument company shall provide a documented analysis which determines if instrument specific software and hardware interface devices are functional using virtual machine technology. The virtual machine environment and infrastructure shall be compatible with a commonly available commercial product (e.g., VMWare). This analysis shall be performed on all human interface devices specific to the instrument. The results of the analysis shall be presented to the technical point of contact (TPOC). This analysis shall include testing of the hardware and software functionality on a virtual machine. If it is determined that the instrument software and instrument specific human interfaces are compatible and function within a virtual machine environment a separate line item for purchasing this functionality shall be provided. The instrument company shall provide a quote for support of this functionality for a minimum of 5 year after instrument is operational.

Definition of Acronyms

4D-STEM – four-dimensional scanning transmission electron microscopy

ABF – annular bright field

API – application programming interface

BF – bright-field

BSE – backscattered electron

CBED – convergent-beam electron diffraction

DF – dark-field

DPC – differential phase contrast

DT – double-tilt

EDX – energy dispersive x-ray analysis

EELS – electron energy loss spectroscopy

EFTEM – energy-filtered transmission electron microscopy

FPS – frames per second

FWHM – full-width half-maximum

GUI – graphical user interface

HAADF – high-angle annular dark field

HREM – high-resolution electron microscopy

HT – high tension

IL – intermediate lens

NBD – nanobeam diffraction

OL – objective lens

SE – secondary electron

SAED – selected area electron diffraction

SSD – Solid State Drive

ST – single-tilt

STEM – scanning transmission electron microscope (microscopy)

S/TEM – scanning/transmission electron microscope

TEM – transmission electron microscope (microscopy)

UPS – uninterruptable power supply

ZLP – zero-loss peak

II. SCOPE

The Contractor shall deliver a quantity of one (1) analytical scanning/transmission electron microscope (S/TEM), inclusive of FOB Destination delivery, installation, warranty and training, and option line items, if exercised at award.

III. MINIMUM REQUIREMENTS

The S/TEM system and all third-party components shall meet or exceed the minimum requirements identified below. Preference will be given to systems that exceed the minimum requirements. The microscope system and all third-party components of the microscope shall be new, commercially available products. Used or remanufactured equipment will not be considered for award. Experimental, prototype, or custom items will not be considered. The use of "gray market" components not authorized for sale in the U.S. is not acceptable. All line items shall be shipped in the original manufacturer's packaging and include all original documentation and software, when applicable.

Line Item 0001: Analytical Scanning/Transmission Electron Microscope (S/TEM)
Description:
Quantity: 1

A. **Technical Specifications**

1. Electron Gun

1.1. **Source**

1.1.1. The gun shall have a cold field emission source (CFEG source).

1.1.2. Flashing the source

1.1.2.1. The CFEG flash routine shall be controlled by automation software.

1.1.2.2. The emission current of the CFEG shall exhibit very high stability. The current decrease over a period of 2 hours shall be less than 10 %. Stronger consideration will be given to CFEGs that show a 10 % decrease over longer periods of time.

1.1.2.3. Flashing the source shall result in no measurable loss of resolution.

1.1.2.4. The source exchange time shall not exceed 2 weeks, including TEM and STEM alignment at all operating voltages specified in the original installation. Shorter source exchange times are preferred.

1.1.3. The contractor shall provide calculated or measured source brightness value.

1.2. **Beam Current**

1.2.1. The gun shall be sufficiently bright to maximize current in a very small STEM probe.

1.2.2. At an operating voltage of 300 kV, the spatial resolution of a probe containing 100 pA of current shall be ≤ 60 pm or better.

1.2.3. At an operating voltage of 300 kV, the spatial resolution of a probe containing 1 nA of current shall be ≤ 80 pm or better.

1.2.4. The probe current for specification 1.2.2 and 1.2.3 shall be verified using a Faraday cup.

1.3. **Gun Energy Spread**

1.3.1. The energy spread shall be sufficiently small to permit electron energy loss spectroscopy with an energy resolution of less than 0.4 eV full-width half-maximum (FWHM) at all voltages up to the maximum operating voltage. Smaller values of the energy spread are preferred.

1.4. **Accelerating Voltage**

1.4.1. The accelerating voltage shall be variable at least between 60 kV and 300 kV.

1.4.2. The microscope shall be aligned at the following accelerating voltages during installation and after all source changes: 80 kV, 200 kV, and 300 kV.

1.4.3. Within 10 minutes after changing the accelerating voltage, the microscope shall be fully functional, including meeting the spatial resolution and energy resolution specifications for that given voltage.

1.4.4. The operation of the high voltage shall be under computer control, providing automatic control of the startup and operation of the source, including flashing, ramping of the primary voltage, HT conditioning, and the setting of appropriate extraction voltages.

2. Electron Optics

2.1. Illumination system

2.1.1. The microscope illumination system shall be of the three-condenser lens variety to allow the microscope to collect diffraction patterns in nanobeam (convergent probe) as well as microbeam (parallel probe) modes. Both modes shall allow for scanning of the beam in order to collect spatially resolved diffraction data.

2.1.2. The illumination system shall allow for control of the probe convergence angle.

2.1.2.1. For microbeam mode, the convergence angle shall range from a minimum of 0.02 mrad to at least 2 mrad at the sample plane.

2.1.2.2. In nanobeam mode, the convergence angle shall range from a minimum of 1 mrad to at least the maximum angle of aberration free imaging afforded by the probe corrector.

2.1.3. The illumination system shall allow for precession of the electron probe where the beam is tilted off axis and rotated azimuthally resulting in hollow cone illumination. The operator shall be able to define the beam tilt and rate of azimuthal rotation in the microscope control software. The beam tilt shall enable tilting of the beam from 0 degrees to at least 2.0 degree.

2.1.4. Condenser Stigmator Details and Performance Required: An electronic stigmator shall be supplied for the condenser lens system. This stigmators shall have provision for electrostatic alignment with the optical axis to minimize image shift during astigmatism correction.

2.2. Condenser Apertures

2.2.1. Apertures shall be included for all three condenser lenses.

2.2.2. All condenser apertures shall be motorized and controllable through the microscope software.

2.2.3. Aperture position recall shall be included.

2.2.4. First condenser lens: at least three apertures shall be provided with the smallest being less than or equal to 70 μm in diameter.

2.2.5. Second condenser lens: at least 5 apertures shall be provided. The smallest shall be 10 µm or less in diameter. The largest shall be 150 µm or greater in diameter.

2.2.6. Third condenser lens: at least 5 apertures shall be provided. The smallest shall be 10 µm or less in diameter. The largest shall be 150 µm or greater in diameter.

2.3. STEM Capabilities

2.3.1. STEM beam drift during regular microscope operation, after changing electron optical parameters (e.g., spot size, convergence angle, etc.), and after switching microscope modes (e.g., from TEM to STEM modes) shall be 0.5 nm/min or less. Stronger consideration will be given to smaller values.

2.3.2. STEM spatial resolution:

2.3.2.1. With a probe containing at least 100 pA of current, the STEM spatial resolution at 300 keV shall be guaranteed at 50 pm or better.

2.3.2.2. With a probe containing at least 100 pA of current, the STEM spatial resolution at 200 keV shall be guaranteed at 60 pm or better.

2.3.2.3. With a probe containing at least 100 pA of current, the STEM spatial resolution at 80 keV shall be guaranteed at 96 pm or better.

2.3.3. The STEM scan system shall provide for custom-sized image acquisition that are square or rectangular in shape.

2.3.4. The STEM scan system shall allow for collection of images that are 4k x 4k pixels in size or larger.

2.3.5. The STEM scan system shall allow for collection of images that are 64 x 64 pixels in size or smaller.

2.3.6. The STEM scan system shall be capable of collecting images with a per pixel dwell time of 50 nanoseconds or lower.

2.3.7. The STEM scan system shall have an externally accessible pixel or line clock signal that can be used for synchronizing data readout of third-party detectors.

2.4. Aberration Corrector

2.4.1. The microscope shall include an aberration corrector on the probe-forming side (STEM mode) that is capable of fully correcting all aberrations up to the sixth-order astigmatism (A5).

2.4.2. The Contractor shall describe in detail the aberration corrector system to be incorporated into the microscope. This shall include the type of corrector proposed, manufacturer of the aberration corrector, and the general electron-optical design of the corrector (provide references from the literature, if available).

2.4.3. Alignment of the corrector shall be available in fully automated and semi-automated modes at all specified HT. Automated alignment shall result in the correction of all aberrations from first to fourth order.

2.5. Scan Tilt Correction

2.5.1. The microscope shall include a capability to correct for scan-induced tilt of the illumination such that the image of the back focal plane does not shift during scanning.

2.5.2. A method for precisely tuning this tilt correction shall be provided.

2.5.3. The correction shall be able to be activated/deactivated via the microscope control software.

2.6. Objective Lens/Projection System

2.6.1. The information limit for imaging in TEM mode will be 100 pm or better.

2.6.2. The spherical aberration coefficient (Cs) and chromatic aberration coefficient (Cc) of the uncorrected objective lens shall both be at most 1.2 mm.

2.6.3. OL pole piece gap shall be wide enough to allow the use of commercially available liquid-cell holders.

2.6.4. OL and IL Stigmator Details and Performance Required: Electronic stigmators shall be supplied for both the OL and IL. These stigmators shall have provision for electrostatic alignment with the optical axis to minimize image shift during astigmatism correction.

2.6.5. Objective apertures: at least 6 apertures of different sizes shall be provided. The smallest shall be 10 µm in diameter or smaller. Objective apertures in the back focal plane of the OL for optimized TEM bright- and dark-field application work.

2.6.6. Selected-area Diffraction apertures: at least 3 apertures of different sizes shall be provided.

2.6.7. The rotation imparted by switching between imaging and diffraction modes shall be corrected so that the rotation between image and diffraction pattern shall be less than ±2° over all ranges of magnification and camera lengths.

2.6.8. Rotation correction: the microscope shall provide for rotation correction at all magnifications such that the orientation of the image does not vary over the entire magnification range.

2.6.9. TEM mode magnification: the available magnifications shall at least span the range of 50X to 1.5MX.

2.6.10. Magnification calibration will be performed for both TEM and STEM modes using the provided software and can be translated equivalently to all cameras.

2.6.11. Shutter requirements: the microscope shall be equipped with a pre-specimen and a post-specimen shutter.

3. Goniometer and Specimen Stage

3.1. The microscope shall have a side-entry, computerized stage using Piezo technology to control x, y, z, alpha, and beta movements.

3.2. Translation and tilt ranges

3.2.1. Translation shall be at least ±1 mm from the center of the specimen in both X and Y directions and at least ± 0.2 mm in Z direction.

3.2.2. The system shall accommodate ±30 deg tilt around two orthogonal axes over the central region of the sample with a factory double-tilt holder. Biaxial tilts beyond ± 30 deg will be given additional consideration.

3.2.3. The system shall accommodate ±30 deg tilt around the axes of tilt for the factory single-tilt holder.

3.3. Stage drift

3.3.1. The stage shall not drift more than 0.5 nm/min, 30 minutes after specimen exchange.

3.3.2. The stage shall not drift more than 0.1 nm/min, 1 minutes after macroscopic stage movement (i.e., large movements at low-mag mode).

3.3.3. Drift shall not be detectable 1 minute after fine stage movements (e.g., above 100 kX).

3.3.4. Stronger consideration will be given to stages with lower drift rates.

3.4. Stage position indication and position reproducibility

3.4.1. The stage position shall be indicated with a precision of 0.1 μm and 0.1 degree.

3.4.2. The absolute stage position shall be reproducible within 1 μm after specimen re-insertion with a factory holder.

3.5. The microscope shall have a piezo stage with computerized axes:

3.5.1. Allows for accurate recall of stored positions.

3.5.2. Precision of step size of 20 pm in x- and y-directions.

3.5.3. The range of the piezo stage shall be at least 1.0 micrometer in both the x- and y-directions.

3.5.4. The Contractor shall describe in detail the capabilities of the piezo stage motion and range.

4. Specimen Holders: The Contractor shall provide the following TEM specimen holders:

4.1. Single-tilt low background holder compatible with EDX measurements.

4.2. Double-tilt (DT) low background holder, optimized for maximum signal from the EDX detector configuration.

4.3. Specimen rod holders/stands shall be provided with each holder.

4.4. Controllers shall be included with the holders as required by the holder operation.

4.5. Where applicable, logs of all run-time metadata that is already being monitored by the Contractor, when called upon through the GUI or the API (Data and Operation Expectation Statement 2), shall be produced automatically, or for the duration and periodicity specified by the users in accordance with Data and Operation Expectation Statement 1.

4.6. Holders with remote operation capability will be given priority (Data Statement 3).

4.7. Where applicable, metadata containing device operating parameters (e.g., input current to controller) shall be provided for each image acquired.

5. Pre- Electron Energy Loss Filter Cameras

5.1. No prototypes, demonstration models, used or refurbished instruments will be considered for any of the camera systems.

5.2. For all pre-filter cameras, including optional cameras:

5.2.1. Where applicable, logs of all run-time metadata (e.g., sensor temperature) that is already being monitored by the Contractor, when called upon through the GUI or the API (Data and Operation Expectation Statement 2), shall be produced automatically, or for the duration and periodicity specified by the users in accordance with Data and Operation Expectation Statement 1.

5.2.2. Where applicable, metadata containing device operating parameters, imaging and column conditions at the time of acquisition shall be provided for each image acquired.

5.2.3. Camera(s) with remote operation capability will be given priority (Data Statement 3).

5.3. **Large field-of-view camera system** – Camera 1

5.3.1. The camera shall have a CMOS sensor.

5.3.2. The camera shall be compatible with the full operating voltage range of the TEM, at least from 60 kV to 300kV.

5.3.3. The camera shall be capable of imaging the very intense beam at the maximum probe current used during alignments and locating the specimen without damage to the camera sensor (virtually indestructible camera - fit for a multiuser environment).

5.3.4. The camera shall allow for the acquisition of selected-area electron diffraction patterns.

5.3.5. The camera shall be compatible with automated alignment of the probe corrector.

5.3.6. The camera shall be mounted on axis at the bottom of the microscope column, above the post-column electron energy filter.

5.3.7. The retraction mechanism shall ensure no loss of electrons entering the post-column electron energy filter described in item 8.

5.3.8. The camera shall be interlocked to avoid the possibility of collision with any other camera mounted opposite this camera.

5.3.9. The pixel array size shall be at least 4096 x 4096.

5.3.10. The pixels size shall be 14 µm or larger.

5.3.11. The camera shall have high sensitivity for electron counting in both imaging and diffraction modes.

5.3.12. The DQE at half the Nyquist frequency in full 4k x 4k imaging mode shall be greater than 9%.

5.3.13. The dynamic range small be at least 16 bits and shall scale with exposure time.

5.3.14. The full frame readout rate shall be at least 25 frames per second

5.3.15. The reduced frame readout rate shall be at least 300 fps at 512 x 512 resolution.

5.3.16. The camera shall have the ability to acquire both single images and movies.

5.3.17. The camera shall have a buffering capability to record at least 10 seconds of data prior to the onset of data acquisition, especially in movie mode, so that the onset of fast occurring reactions can be recorded.

5.3.18. The camera system shall have a rolling shutter design to give a duty cycle of 100% for movie acquisition.

5.3.19. Data storage capability shall be at least 10TB with storage expansion capability, to enable acquisition of long duration movies at full 4k x 4k readout.

5.3.20. Acquisition software and hardware should be included with the camera.

5.3.21. The software for this camera system shall have the following specifications:

5.3.21.1. Acquisition mode can be specified in the software to select for the single image or movie mode.

5.3.21.2. Live drift correction in all image modes, including at full 4k x 4k resolution.

5.3.21.3. The software controlling this camera shall produce live FFTs of the image.

5.3.21.4. Ability to hardware bin the image at least 2x, 4x, and 8x, in addition to the full 1x binning.

5.3.21.5. Feature tracking during acquisition of in situ data sets to correct for drift or other movement of the feature.
5.3.21.6. Ability to digitally rotate the image live during acquisitions.
5.3.21.7. The post-processing capabilities shall include.
5.3.21.7.1. Ability to align and average frames.
5.3.21.7.2. Ability to crop a segment in time out of the data set or movie.
5.3.21.7.3. Ability to generate a new data set from the original data set in the original data file format for file size reduction.
5.3.21.7.4. Ability to add scale markers and time stamps to all frames of a movie.

6. STEM Detectors

6.1. The STEM detector shall be retractable. Please describe the retraction mechanism.
6.2. The STEM detector shall provide sensors for STEM imaging at the specified operating voltages, at least 60 kV to 300 kV.
6.3. The STEM imaging mode shall include but is not limited to the high-angle annular dark field (HAADF), dark field (DF), bright field (BF), annular bright field (ABF), and differential phase contrast (DPC).
6.4. The detector location and post-specimen lens configurations shall allow for the collection of HAADF images where the inner angle of collection is at least 100 mrads.
6.5. The STEM detector shall have full software support to offer a real-time STEM image of each imaging mode and the respective configuration to set up the segments in a graphical user interface (GUI).
6.6. The STEM detector geometry shall be optimized to perform HAADF imaging whilst maximizing the collection efficiency for electron energy loss spectroscopy (EELS) data.
6.7. STEM detector system shall allow simultaneous acquisition/readout from all STEM detectors.
6.8. Software package for analysis of DPC images from segmented detectors.
6.9. Where applicable, logs of all run-time metadata that is already being monitored by the Contractor, when called upon through the GUI or the API (Data and Operation Expectation Statement 2), shall be produced automatically, or for the duration and periodicity specified by the users in accordance with Data and Operation Expectation Statement 1.
6.10. Where applicable, metadata containing device operating parameters, imaging and column conditions at the time of acquisition shall be provided for each image acquired.
6.11. Detectors(s) with remote operation capability will be given priority (Data Statement 3).

7. Energy Dispersive X-ray Spectroscopy

7.1. Performance

7.1.1. The EDX detector hardware shall comprise retractable, windowless silicon drift detector or detectors.

7.1.2. The instrument shall show an energy resolution of 130 eV or better as measured by the full-width half-maximum of the Mn Ka X-ray line.

7.1.3. The combined solid angle of collection for the X-ray detector(s) shall be greater than 2.0 steradians. The solid angle of collection shall be achieved without shadowing by the specimen holder in the case of at least one of the standard holders provided. High solid angles of collection are a very high priority and stronger consideration will be given to larger values of collection angle.

7.1.4. Drift correction routines for line scans and image mapping shall be included. For image mapping, at least one of two following modes of drift correction shall be available.

7.1.4.1. Drift correction method 1: EDX maps will be acquired in a single pass of the beam. Drift will be measured at regular intervals during the data acquisition by comparison of reference images collected from an area of the specimen that is different from the acquisition area.

7.1.4.2. Drift correction method 2: EDX maps will be acquired in multiple passes of the beam. Drift shall be continuously measured after each frame and corrected by analyzing the image signal directly from the area of analysis.

7.1.5. The EDX system shall be capable of collecting atomically-resolved elemental maps with a spatial resolution of 1 nm or better. Priority will be given to higher EDX spatial resolution.

7.2. Channels Required

7.2.1. The spectrometer shall provide at least 2048 energy channels.

7.2.2. The energy per channel of the collected spectra shall be controlled by the user, and values of 5 eV/channel, 10 eV/channel, and 20 eV/channel shall be available.

7.3. Hardware-Software Integration

7.3.1. The analytical hardware and software shall be integrated with the operating software of the microscope.

7.3.2. The data collection software shall enable spectral acquisition in three ways.

7.3.2.1. Spot mode: spectra are collected from discrete, user-defined points

7.3.2.2. Line profile: spectra are collected serially along a user-defined line

7.3.2.3. Elemental mapping: spectra are collected serially from within a two-dimensional box by scanning the beam in an image raster pattern.

7.3.3. Drift collection shall be provided for all three modes of EDX acquisition (i.e., spot, line profile, and elemental mapping modes)

7.4. Data and Operation Expectations

7.4.1. Where applicable, logs of all run-time metadata that is already being monitored by the Contractor, when called upon through the GUI or the API (Data and Operation Expectation Statement 2), shall be produced automatically, or for the duration and periodicity specified by the users in accordance with Data and Operation Expectation Statement 1.

7.4.2. (Where applicable) Metadata containing device operating parameters, imaging and column conditions at the time of acquisition shall be provided for each image acquired.

7.4.3. Device(s) with remote operation capability will be given priority (Data Statement 3).

8. Electron Energy Filter

8.1. The operating voltage for this electron energy filter shall be at least from 60 kV to 300 kV.

8.2. The electron energy filter shall be a post-column model that can run in both spectroscopy and imaging modes.

8.3. Spectroscopy (EELS)

8.3.1. Energy resolution at the lowest operating voltage depends on the lowest operating voltage allowed. The energy resolution shall be 0.27 eV or better at 60 kV as measured by the FWHM of the zero-loss peak. Smaller values for energy resolution will receive stronger consideration.

8.3.2. Spot and line profile capability shall use a minimum of 1024 channels with variable energy dispersions up to 3 eV/channel for an energy range of 3,000 eV.

8.3.3. Dynamic range shall be at least 16-bit per channel.

8.3.4. Readout speed shall be 3,000 spectra per second or better at 95 % duty cycle.

8.3.5. The ability to simultaneously acquire EELS and EDX spectra at high speed is required.

8.3.6. The spectrometer shall allow for acquisition of spectral data from two energy ranges in a single scan. This shall be accomplished using a fast electrostatic shutter.

8.4. Imaging (EFTEM)

8.4.1. EFTEM field of view shall be 36 μm in diagonal or better, and energy-filtered diffraction full azimuth shall be 150 mrad or better.

8.4.2. Non-isochromaticity maximum at 300 kV shall be 2.75 eV pixel-to-pixel or better. The non-isochromaticity maximum at the lowest operating voltage depends on the lowest operating voltage allowed. If the lowest voltage allowed is 60 kV, the non-isochromaticity maximum should be 1.5 eV pixel-to-pixel or better.

8.4.3. Image distortion at the lowest operating voltage depends on the lowest operating voltage allowed. The image distortion shall be 0.75 or better at 60 kV.

8.4.4. Imaging camera shall use a CMOS sensor with a pixel size of 15 μm or smaller and a minimum of 2048 in both dimensions.

8.4.5. Image acquisition speed at the full frame shall be 75 frames per second or better.

8.5. Autonomous energy filter alignment shall be included in the control software.

8.6. The electron energy filter system shall provide the in-situ capability for acquisition and analysis.

8.6.1. The in-situ capability shall enable continuous data streaming for in-situ TEM imaging, EELS, EFTEM.

8.6.2. The in-situ capability shall include high-speed spectrum imaging.

8.6.3. The hardware shall include SSD storage capacity of 36 TB or greater.

8.7. The electron energy filter system shall permit the incorporation of a direct detection camera capable of providing the electron counting mode for TEM imaging, EELS, and EFTEM.

8.8. Data and Operation Expectations (applies to the EELS spectrometer in imaging and spectroscopy modes, and all attached -spectrometer cameras)

8.8.1. Where applicable, logs of all run-time metadata that is already being monitored by the Contractor, when called upon through the GUI or the API (Data and Operation Expectation Statement 2), shall be produced automatically, or for the duration and periodicity specified by the users in accordance with Data and Operation Expectation Statement 1.

8.8.2. Metadata containing device operating parameters, imaging and column conditions at the time of acquisition shall be provided for each image acquired.

8.8.3. Device(s) with remote operation capability will be given priority (Data Statement 3).

9. Computer Hardware

9.1. The Contractor shall provide all required computers and servers for control and operation of the microscope, including all cameras, STEM detectors, the EDX detector, and the electron energy filter system.

9.2. All necessary monitors shall be provided by the Contractor.

9.3. The Contractor shall provide a summary of typical and minimum/maximum bandwidth of all data producing devices, including third-party devices.

9.4. The Contractor shall provide a network computer to connect the microscope PC to the network.

9.4.1. The network computer shall have at least 2 ethernet cards.

9.4.2. At least one of the network cards shall support fiber network connection of at least 10 Gbit/s.

10. Microscope Control Software

10.1. The Contractor shall describe the microscope functionality available at each User level (basic, expert, supervisor).

10.2. The computer interface to the microscope shall include provisions to control the following:

10.2.1. Computer control of all microscope functions, stage positions and tilts, user-required functions, spot and scan functions, aperture positions, image acquisition, and spectra acquisition.

10.2.2. Computer control of all microscope settings: lens currents, aperture positions, deflector currents, etc., including free-lens control.

10.2.3. The microscope software shall include the ability to recall settings for different users, different modes of operation, and different voltages.

10.2.4. Software/control optimized for a user facility environment where there will be many users possessing various levels of skill. The control software shall permit different users to login independently. Different levels of system access shall be assignable to different people (e.g., user, superuser, maintenance and facility management). The settings for any given user shall not affect those of any other.

10.2.5. Focus step size and defocus values shall be available for display to the microscope operator.

10.2.6. The ability to measure the beam current during microscope operation is required at all operating voltages. The Contractor shall specify how the beam current is measured.

10.2.7. The ability for the software to simultaneously acquire EELS and EDX spectra is required.

10.2.8. Compliance with Data and Operation Expectations Statement 2 is required.

10.2.9. Data and Operation Expectation Statement 2 (API required) applies to serve those users wishing to operate the microscopes through the API using Python (for example). This functionality shall be location independent (i.e., operating in the same room as the microscope shall be indistinguishable (apart from the time lag) from operating from an office in Gaithersburg MD or Boulder CO).

10.2.10. Where applicable, logs of all run-time metadata (e.g., vacuum readings) that is already being monitored by the Contractor, when called upon through the GUI or the API (Data and Operation Expectation Statement 2), shall be produced automatically, or for the duration and periodicity specified by the users in accordance with Data and Operation Expectation Statement 1.

10.2.11. Metadata containing device operating parameters, including imaging and column conditions, lenses, and deflector setting, at the time of acquisition shall be provided for each image acquired.

10.3. Live, In Person Operation shall include the following provisions:

10.3.1. GUI and hand-panel operation of all native microscope modes, including free lens control.

10.3.2. Display of focus step size and defocus value.

10.4. Remote and Autonomous (Computer) Operation

10.4.1. Remote operation of the base microscope is required (Data and Operation Expectation Statement 3).

10.4.2. At time of contract award, the Contractor shall provide written documentation of the network and hardware performance required for remote operation of the microscope.

10.4.3. One additional set of hand panels shall be provided for our use from a remote site. Hand panels shall comply with at least the USB 2.0 standard.

10.4.4. Full description of network configuration requirements for remote operation shall be provided in advance of delivery.

10.4.5. While image compression is acceptable, Contractor providing full-resolution streaming capability is preferred.

10.4.6. Two NIST-wide site licenses for remote operation of all native microscope modes, including free lens control. The software solution may be some combination of the data analysis software and the local microscope operation software. If so, please specify how these licenses may be interchangeable. Please provide a quote for each additional network license.

10.5. User Interface and Ease of Use Considerations

10.5.1. Switching between TEM and selected area electron diffraction (SAED) modes, once appropriate initial alignments have been performed, shall require no more than a single step, and stable operation after switching modes shall be achieved after no more than one minute.

10.5.2. Switching between TEM and STEM modes, once appropriate initial alignments have been performed, shall require no more than a single step and stable operation after switching modes shall be achieved after no more than one minute.

10.5.3. Auto alignment procedures for TEM, STEM, probe correction, and the EELS spectrometer shall be provided.

10.5.4. The degree of integration of the microscope control with subcomponents such as EDX, EELS, cameras, the beam pulser, and specimen holders shall be described in the offer.

10.6. For futureproofing purposes, please evaluate the microscope software platform in accordance with Data and Operation Expectations Statement 4. Contractor is not responsible for equipment provided by third-party vendors.

11. Data Analysis Software

11.1. The Contractor shall provide one local copy of data analysis software on the working microscope. This pertains to all software nominally provided by the primary microscope Contractor and all third-party vendors (e.g., spectrometers, cameras, specimen holders) where applicable.

11.2. The Contractor shall provide 2 off-line copies of all software for processing and analyzing the data acquired from the microscope, including (but not limited to) TEM and STEM images, diffraction data, EELS and EDS spectra and spectrum images, EFTEM maps, 4D-STEM data, and tomography reconstruction and visualization. These licenses will be for local, not networked, computers for the NanoFab staff.

11.3. At least 6 NIST sitewide network licenses of data analysis software to enable routine analysis. The software solution may be some combination of the data analysis software and the local microscope operation software. If so, please specify how these licenses may be interchangeable. Please provide quote for each additional network license. This pertains to all software nominally provided by the primary microscope contractor and all third-party vendors (e.g., spectrometers, cameras, specimen holders) where applicable.

11.4. Both the local and the sitewide licenses for the principal microscope software shall be updated to the most recent versions for as long as the maintenance contract for the primary microscope is in place. All copies shall also comply with Data and Operation Expectation Statement 1. Please indicate whether there is a volume discount, and if so, the applicable brackets (e.g., 1-5 copies, 6-10 copies).

11.5. The following features shall be provided with the data analysis software:

11.5.1. Compliance with Data and Operation Expectations Statement 1 is required.

11.5.2. Quantitative data analysis software and common algorithms, including EELS, EFTEM, EDX, and diffraction analyses.

11.5.3. Common and user definable image processing routines.

12. Vacuum System

12.1. The instrument shall have a dry ("oil-free") differential vacuum system capable of maintaining operating system pressures throughout the instrument.

12.2. A cold trap shall be incorporated to minimize specimen contamination.

12.3. Vacuum system monitoring and fail-safe.

12.3.1. The vacuum system shall be integrated into the microscope operating software to enable monitoring during operation.

12.3.2. The vacuum system shall have fail-safe systems to protect against damage or degradation due to power failure, cooling water loss, and other failure modes.

12.4. Specimen contamination shall be minimal and demonstrated as specified in the Acceptance Criteria.

13. Uninterruptible Power Supply

13.1. UPS General Design Requirements

13.1.1. The instrument shall have an uninterruptible power supply to protect the instrument, and third-party attachments essential for the operation of the instrument from unanticipated power fluctuations and outages.

13.1.2. Switching between line power and UPS power shall provide no interruption to regular operation of the instrument.

13.1.3. Remote monitoring software shall be provided so that the UPS condition and performance can be monitored remotely.

13.2. UPS Runtime Requirements

13.2.1. The UPS shall provide sufficient power reserves to maintain the instrument and essential third-party attachments for at least 20 minutes.

13.3. UPS Overcapacity Requirements

13.3.1. The UPS shall be capable of supporting a load equal to or greater than 150 % of the load of the instrument and peripherals to allow additional instrumentation and external options to be powered with the instrument at a later date. Maximum runtime while overloaded in this manner shall be documented in the response.

14. Chiller

14.1. If needed to meet the specifications herein, the instrument shall be provided with a closed loop chiller suitable for meeting the cooling needs of the microscope and all peripherals.

Line Item 0002: Safety
Description:
Quantity: 1

A. **Technical Specifications**

1. Microscope Protection: In the event of loss of power, external chilled water, or ambient lab temperature control, the microscope lenses and vacuum system shall automatically enter a safe interlock state.

2. Emergency off switches (EMOs) shall be provided for the microscope and associated electronics. If EMOs are not already installed on the system, the Contractor will work with NIST to install them.

3. The Contractor shall provide detailed and complete safety documentation.

Line Item 0003: Site Preparation
Description:
Quantity: 1

A. **Technical Specifications**

1. NIST will renovate the laboratory site for installation of the instrument prior to instrument delivery and installation by the contractor.

2. **Facilities Requirements** - The Contractor shall provide a pre-installation guide for the facilities requirements within 5 days of the contract award. The facilities requirements shall specify room size, power, compressed gases, chilled water, environmental requirements, etc. Detailed installation drawings, including clearances, are required. A statement of the minimum facilities needed at the installation site is required.

3. **Site Surveys**

3.1. The contractor shall perform two on-site environmental site surveys.

3.1.1. One site survey shall be performed within 3 months after the contract award.

3.1.2. The other site survey shall be performed at least 3 months prior to instrument delivery so that any room issues can be addressed before the delivery occurs.

3.1.3. The site surveys shall include measurement of acoustics, floor vibration, and AC/DC electromagnetic interference.

3.1.4. The Contractor is required to bring all equipment necessary to conduct the environmental site surveys.

3.2. Collaboration with the Construction Contractor

3.2.1. Prior to installation, the microscope contractor may be required to collaborate with a contractor performing the renovations.

3.2.2. This collaboration may include but is not limited to attending meetings (in person or remotely) and providing information to the general contractor with respect to electrical supply modifications and cooling water connections.

Line Item 0004: Training with On-site Application Engineers
Description:
Quantity: 1

A. **Technical Specifications**

1. The Contractor shall conduct training on-site at NIST Gaithersburg for at least three NIST personnel. This training may commence immediately upon completion of installation and demonstration of specifications.
2. The Contractor shall provide a minimum of 12 days of on-site training by contractor application engineers. Training does not have to be contiguous days; it can be broken into increments as short as 1 day.
3. Training shall include, at a minimum, a thorough demonstration of all equipment functions and equipment operation which will allow NIST personnel to operate the system to its full capabilities and shall include basic troubleshooting.
4. Training shall include the system configuration and supervisor level and user level maintenance routines.
5. Training shall be scheduled, in advance, with the NIST COR and with NanoFab staff.

Line Item 0005: Documentation
Description:
Quantity: 1

A. **Technical Specifications**

1. At the time of delivery, the Contractor shall provide the following documentation in electronic form. Documentation in paper form shall be provided at the Contractor's discretion.

1.1. Comprehensive system description, components, and operating procedure, including third party documentation and manuals.

1.2. Detailed technical description and schematics of the installed system necessary for supervisor level usage and maintenance of the tool.

1.3. General users guide and operation manuals.

2. After acceptance testing, the contractor shall provide Factory and Installation acceptance test reports.

3. The documentation shall include detailed and complete safety documentation.

Line Item 0006: Service Contract

Description:
Quantity: 1

A. Technical Specifications

1. The Contractor shall provide a service contract on the microscope, all third-party components, and options exercised for a period of 4 years at the expiration of the 1-year warranty period, for a total of 4 years of warranty.

2. The Service Contract shall commence at the end of the Warranty period.

3. The service shall be on-site at NIST Gaithersburg during business hours only, 8:00 AM to 5:00 PM Eastern Time. All parts, labor, and travel shall be included.

4. In the event any components need to be returned to the Contractor's (or subcontractor's) facility for repair, the Contractor shall arrange for the shipment, provide all required nomenclature for the shipment, including a shipping account number, assume all costs for shipping, and assume all liability for all shipments to and from NIST.

5. The Contractor shall respond to the Government's request for service, via e-mail or telephone, not later than 48 hours after the request is received.

6. On-site service shall follow not later than 5 days after the telephone or e-mail response is received by NIST. To the maximum extent practicable, all malfunctions shall be remedied not later than 60 days from the date the problem was called into the Contractor.

Line Item 0007: Additional Beam Energy Alignment (OPTION)
Description:
Quantity: 1

A. Technical Specifications

The microscope shall be aligned at an additional beam energy of our choice.

Line Item 0008: Objective Aperture (OPTION)
Description:
Quantity: 1

A. Technical Specifications

A 5-µm diameter objective aperture shall be provided.

Line Item 0009: Segmented Sensors (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

The STEM detector shall provide segmented sensors with at least 10 segments which can be used over an energy range from at least 60 keV to 300 keV. The detector array shall be capable of differential phase contrast imaging.

Line Item 0010: Euclid GHz Beam Pulser (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

1. **The Euclid beam pulser is listed as an option.** However, Contractors who can meet the specifications of the Euclid GHz Beam Pulser without degradation of the core microscope specifications degrading the native resolution of the microscope shall be given priority. If, however, the pulser is funded and the microscope does not perform according to the specs below, the product will be returned to the contractor and no payment will be issued.

2. **General characteristics**

2.1. The beam pulser shall be fully operational without an external laser.

2.2. The beam pulser shall be installed below the gun but above the microscope's condenser lens so that native modalities may be preserved.

2.3. Coupling of the beam through the pulser into the microscope's condenser system shall be the same as the case as if the pulser was absent.

2.4. The beam pulser shall not degrade the performance of the instrument as demonstrated by the factory certified specifications.

2.5. One step beam-chopping aperture insertion and removal shall be required for switching modes between normal and stroboscopic modes.

3. Operational and temporal characteristics

3.1. The repetition rate of the beam shall be continuously adjustable and cover the range from DC to at least 12 GHz.

3.2. At 10 GHz, the pulse width shall be 15 ps or less with the smallest opening aperture.

3.3. Beam duty cycle of 15% shall be maintained at 10 GHz with a temporal resolution of 15 ps.

3.4. Jitter shall be within 10% of the operating beam repetition frequency.

3.5. When activated, the pulser shall not exceed a maximum rms additional energy spread of 0.4 eV (relative to the instrument's native spread at 300 keV).

3.6. The pulser shall not exceed a maximum rms emittance of 0.4 nm x rad.

3.7. Column heating, temperature fluctuations, and vibrations translate to instabilities in microscope measurements. Therefore, the temperature rise on the column surface shall not increase by more than 2 °C, and the total specimen drift at the specimen level for the pulser shall not be exceed 0.5 nm/s.

3.8. The beam coherence shall be maintained in both the beam sweep direction and its orthogonal direction.

3.9. The column vacuum shall remain within microscope vendor specs during operation.

3.10. Contractor shall provide temporal resolution measurements with the smallest beam-chopping aperture:

3.10.1. For RF amplification bands, please provide temporal resolution measurements at band-edge frequencies plus mid-band of each amplification band. For example, for a 1 GHz – 6 GHz amplification band, we require temporal resolution measurements at 1 GHz, 6 GHz, and 2.5 GHz. Additionally, please provide an analytical expression for extrapolating the temporal resolution for all intermediate values within band.

3.10.2. For pulse-picking frequencies, please provide temporal resolution measurements at the upper limit of the pulse generator and an analytical expression for extrapolating the temporal resolution down to the lower limit of the pulse generator. For example, with a DC to 100 MHz pulser generator, we require temporal resolution measurements at 100 MHz and an analytical expression for extrapolating the temporal resolution down to DC.

3.11. Low-loss broadband single-tilt holder (DC to 12 GHz). Holder shall be able to handle 0.5 A DC, and 20 dBm minimum at GHz frequencies (30 dBm preferred). S11 and S12 data with a 50-ohm load shall be provided.

3.12. Data and Operation Expectations

3.12.1. Where applicable, logs of all run-time metadata that is already being monitored by the contractor, when called upon through the GUI or the API (Data and Operation Expectation Statement 2), shall be produced automatically, or for the duration and periodicity specified by the users in accordance with Data and Operation Expectation 1.

3.12.2. Metadata containing device operating parameters, imaging and column conditions at the time of acquisition shall be provided for each image acquired.

3.12.3. A system with remote operation capability will be given priority (Data and Operation Expectation 3).

Line Item 0011: Lorentz Microscopy (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

1. Lorentz Pole Piece Details Required: If a Lorentz (or low/no magnetic field) capable lens or pole piece is available, its performance and technical details shall be described fully in the bid, including any degradation of performance of other systems or specifications compared to the non-Lorentz configuration.

2. Lorentz Pole Piece Budgetary Quote Required: A budgetary quote for the addition of Lorentz capability to the microscope shall be included in the bid as an option.

3. Lorentz capabilities shall offer field-free or near field-free imaging in TEM Lorentz mode with 2 nm resolution and for Cs-corrected STEM mode with < 1 nm resolution.

4. Residual fields:

4.1. While in Lorentz mode, the Contractor shall provide data showing the residual field experienced by the sample at eucentric height and at the following coordinates (0, 0), (0, 500), (0, -500), (500, 0), (-500, 0), (0, 1000), (0, -1000), (1000, 0), (-1000, 0). All values are in microns.

4.2. The Contractor shall document the circumstances where the residual field at the specimen location may change. The Contractor shall also describe and document how any changes in residual field may be monitored.

4.3. If the residual field does change during typical operation (for example, when voltage/current applied to the Lorentz lens or other lenses in the stack changes), a protocol to reset the field back to zero (or nominal value if the residual field is non-zero) is required.

Line Item 0012: Precession Electron Diffraction Capability (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

1. Integration with cameras: the precession diffraction system shall be capable of synchronization between the beam scan and data readout from the pre-filter imaging camera, the 4D-STEM camera, the EELS camera, and the filter camera.

2. Software: the precession system shall either integrate with the microscope control software or a standalone software package. In either case, the package shall enable user configuration of the precession parameters (beam tilt, rotation frequency, etc.) and setup of precession electron diffraction experiments.

3. The precession diffraction system shall provide orientation and phase mapping capabilities, strain mapping, and diffraction tomography.

Line Item 0013: TEM Specimen Holder - Double-tilt Low Background (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

Double-tilt (DT) low background TEM specimen holder with a hex-screw type specimen clamp.

Line Item 0014: TEM Specimen Holder - Double-tilt with Faraday cup (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

Double-tilt (DT) low background TEM specimen holder with have a Faraday cup for external measurement of the beam current if the microscope does not have an embedded Faraday cup.

Line Item 0015: Tomography TEM Specimen Holder (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

1. A specimen holder shall be provided that enables acquisition of electron tomography tilt series data over a tilt range of at least -70° to +70°.

2. The holder shall be mechanically stable and demonstrate spatial resolution comparable to the standard single tilt holder included with the microscope.

Line Item 0016: High-Tilt Tomography TEM Specimen Holder (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

High-tilt tomography TEM specimen holder with +/- 90 degrees of tilt. The holder tip shall be able to accommodate needle-shaped specimens as well as 3-mm TEM grids and half grids.

Line Item 0017: Double-Tilt Rotate TEM Specimen Holder (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

Low background double-tilt rotate TEM specimen holder with continuous 360-degree rotation and alpha-tilt of at least 45 degrees.

Line Item 0018: Single-tilt Cryo-transfer TEM Specimen Holder (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

1. The cryo-transfer holder liquid nitrogen (LN2) Dewar shall have a minimum of 8 hours of stable high-resolution imaging on one LN2 fill.
2. The operating temperature shall be less than -170 °C.
3. A cryo-transfer loading station shall be included with the holder.

Line Item 0019: Single-tilt Cooling TEM Specimen Holder (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

TEM specimen holder: Single-tilt low background liquid nitrogen cooling holder with an operating temperature less than -170 °C.

Line Item 0020: Double-tilt Cooling TEM Specimen Holder (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

TEM specimen holder: Double-tilt low background liquid nitrogen cooling holder with an operating temperature less than -170 °C.

Line Item 0021: MEMS-based Double-tilt Heating TEM Specimen Holder (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

1. Temperature range of room temperature to 1300 °C.
2. Temperature accuracy ≥ 95%
3. Temperature homogeneity ≥ 99.5 %
4. Closed 4-point probe feedback loop
5. Drift rate ≤ 0.5 nm/min to obtain the same resolution as in TEM and STEM modes acquired by all cameras.

Line Item 0022: Double-tilt Heating TEM Specimen Holder (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

1. The DT heating holder shall be a furnace style, non-MEMs based model, compatible with 3-mm TEM grids and FIB lift-out half grids.
2. The heating holder shall have a temperature range of room temperature to at least 1000 °C.

Line Item 0023: Single-tilt Biasing TEM Specimen Holder (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

1. The holder shall be MEMS-based, with at least 6 contacts directly to the chip, and offer a closed 4-point probe feedback loop.
2. Membrane breakdown voltage shall be at least 150 V at room temperature.
3. Applied electric field shall be at least 300 kV/cm.
4. AC measurement shall be up to 100 Hz.
5. The holder shall offer the attainable spatial resolution of 60 pm or better.
6. Additional simultaneous heating capability is preferred but not required.

Line Item 0024: Blanking Plug (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

A blanking plug shall be provided that allows you to safely get a beam down the column with no holder inserted into the column.

Line Item 0025: High Speed Pre-filter Camera 2: High-speed Monolithic Active Pixel Camera (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

A second pre-filter camera shall be provided as an option. Two sets of performance specifications are being explored for this camera. This optional camera shall be either a high-speed monolithic active pixel detector or a TimePix based hybrid pixel detector. Specifications for the first option are here in CLIN 0025. Only one of the cameras outlined in CLIN's 0025 and 0026 will be part of the final purchased microscope, but the cost of each shall be provided.

1. The camera sensor shall be a direct detection CMOS type.
2. The camera shall be bottom mounted just above the electron energy loss spectrometer.
3. The camera shall be fully retractable so that it does not block any portion of the electron beam when not in use.
4. Retraction shall be interlocked with pre-filter camera 1 insertion to prevent collision.
5. The camera pixel array shall be 1000 pixels x 1000 pixels in size or larger.
6. The size of each pixel shall be 15 microns or greater.
7. Reduced frame readout: The detector shall be capable of recording reduced frame readouts where rectangular or square sub-regions of the full pixel array can be read at increased rates to the full frame readout.
8. Full Frame Readout Rate: 1500 frames/second or greater.
9. Reduced-Frame Readout Rate: 80,000 frames per second with a sub-region size of at least 128 x 64 pixels.
10. Bit depth: the detector shall be 12-bit or higher.

11. Beam energy: the detector shall be capable of collecting data using electrons with energy in the range of 60 keV – 300 keV.
12. Scan synchronization for 4D-STEM acquisition.
13. The data readout system shall enable live virtual image display including:

    13.1. Virtual bright-field and annular dark-field images formed by application of a circular or annular mask.

    13.2. Center of mass image showing the X- and Y-displacement of the pattern at each scan position relative to the center of the detector.

    13.3.Differential phase contrast imaging.
14. In situ TEM capability

    14.1. The data readout system shall enable in situ video display and acquisition using the maximum frame rate at the associated pixel number.

    14.2. The counting signal-to-noise ratio shall be 50 or better.

    14.3. The acquisition capacity shall be at least 20 TB or better.

Line Item 0026: High Speed Pre-filter Camera 2: High-speed TimePix-based Hybrid Pixel Detector (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

A second pre-filter camera shall be provided as an option. Two sets of performance specifications are being explored for this camera. This optional camera shall be either a high-speed monolithic active pixel detector or a TimePix based hybrid pixel detector. Specifications for the second option are here in CLIN 0026. Only one of the cameras outlined in CLIN's 0025 and 0026 will be part of the final purchased microscope, but the cost of each shall be provided.

1. The camera shall be bottom mounted just above the electron energy loss spectrometer.

2. The camera shall be fully retractable so that it does not block any portion of the electron beam when not in use.
3. Retraction shall be interlocked with pre-filter camera 1 insertion to prevent collision.
4. The camera pixel array shall be 512 pixels x 512 pixels in size or larger.
5. The size of each pixel shall be 55 microns or greater.
6. Time resolution: 1.56 ns or better.
7. Bandwidth: 120 MHits/s or greater
8. Beam energy: the detector shall be capable of collecting data using electrons with energy in the range of 60 keV – 300 keV.
9. Scan synchronization for 4D-STEM acquisition
10. Data readout shall include the x-Position, y-Position, Time of Arrival, and Time over Threshold for each detected hit.
11. User shall have control over intensity thresholding in the sensor array.
12. Capable of >= 10 Gb/s data transfer connection.

Line Item 0027: 4D-STEM System (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

1. The system shall provide readout hardware and data storage for 4D-STEM data acquisition.
2. Hardware specifications
    2.1. Sensor size: 128 x 128 pixels or greater
    2.2. Sensor type: Hybrid Pixel CMOS
    2.3. Energy Range: 60 keV – 300 keV
    2.4. Readout Rate: 1000 frames per second or greater
    2.5. Single electron sensitivity
    2.6. Mounting Location: 35 mm/Wide-angle port

2.7. Retractable

3. Software capabilities

3.1. Live virtual image display: The camera control software shall provide several options for live virtual image output during a 4D-STEM scan. These shall include:

3.1.1. Virtual bright-field and annular dark-field images formed by application of a circular or annular mask.

3.1.2. Center of mass image showing the X- and Y-displacement of the pattern at each scan position relative to the center of the detector.

3.1.3. Differential phase contrast imaging.

4. Where applicable, logs of all run-time metadata that is already being monitored by the Contractor, when called upon through the GUI or the API (Data and Operation Expectation Statement 2), shall be produced automatically, or for the duration and periodicity specified by the users in accordance with Data and Operation Expectation Statement 1.

5. Metadata containing device operating parameters, imaging and column conditions at the time of acquisition shall be provided for each image acquired.

6. Device(s) with remote operation capability will be given priority (Data Statement 3).

Line Item 0028: Tomography Capability – Software Functionality (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

1. The software shall provide for automated collection of image tilt series for three-dimensional characterization.
2. Software shall provide for preprocessing, alignment, and GPU-accelerated reconstruction of the tilt series by simple backprojection, weighted backprojection, and simultaneous iterative reconstruction techniques.
3. The software shall enable collection of tilt series data in both TEM and STEM microscope modes.
4. Drift tracking: the software shall track specimen shift at each tilt increment and correct it by stage translation, image shift, or a combination of both.
5. Camera integration: the software shall be fully integrated with the microscope detectors so that data can be automatically read from all imaging cameras and STEM detectors at each tilt.

6. EDS mapping integration: the software shall enable the automated acquisition of EDS maps along with one or more STEM image signals at each specimen tilt.
7. Where applicable, logs of all run-time metadata that is already being monitored by the Contractor, when called upon through the GUI or the API (Data and Operation Expectation Statement 2), shall be produced automatically, or for the duration and periodicity specified by the users in accordance with Data and Operation Expectation Statement 1.
8. The software shall enable the automated acquisition of EELS maps along with one or more STEM image signals at each specimen tilt.
9. The software shall enable the automated acquisition of nanobeam diffraction maps along with one or more STEM image signals at each specimen tilt.
10. The vendor shall provide on-site training of at least 2 days for tomography acquisition (1 day) and data processing (1 day).

Line Item 0029: Electron Counting Camera for Electron Energy Filter (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

In addition to the primary filter camera specified in 8.4.4 and 8.4.5, the filter shall optionally include a direct-detection electron counting camera with the following specifications:

1. The secondary camera shall be provided with direct electron detection capability for spectroscopy and imaging modes.

2. Imaging camera shall use a CMOS sensor with a pixel size of 5 μm or better and a minimum of 3456 pixels in both dimensions.

3. The operating voltage for this camera shall be at least from 80 kV to 300 kV.

Line Item 0030: Additional Training (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

1. The Contractor shall provide an option to purchase additional training to start after completion of the initial training. This may be a mix of on-site and remote training.

2. The Contractor shall specify the minimum number of days or weeks of training that shall be purchased at one time.

Line Item 0031: Trade-In (OPTION)
Description:
Quantity: 1

A. **Technical Specifications**

1. The Contractor shall provide NIST the trade-in option of an existing FEI Titan S/TEM (SN# D3226) that NIST can exercise at the time of the award to provide additional value to the government.

2. This trade-in value will not be taken into account towards the cost of the microscope or for the selection criteria.

IV. DELIVERABLES

Description	*Quantity or Format*	*Due Date*
Line Item 0001: Analytical Scanning/Transmission Electron Microscope (S/TEM)	1	No earlier than 12 months after contract award and not later than 24 months contract award.
Line Item 0002: Safety Documentation	1	Due at time of microscope delivery.
Line Item 0003: Site Survey #1	1	No later than 3 months after contract award.
Line Item 0003: Site survey #2	1	No later than 3 months prior to instrument delivery.
Line Item 0004: Training with On-site Application Engineers	1	Due to begin within 5 days or sooner after microscope acceptance.
Line Item 0005: Documentation	1	Due at the time of microscope delivery

Line Item 0006: Service Contract	1	One year after microscope acceptance.
Line Item 0007: Additional Beam Energy Alignment (OPTION)	1	Due at the time of microscope installation
Line Item 0008: Objective Aperture (OPTION)	1	Due at the time of microscope delivery
Line Item 0009: Segmented Sensors (OPTION)	1	Due at the time of microscope delivery
Line Item 0010: Euclid GHz Beam Pulser (OPTION)	1	Due at the time of microscope delivery
Line Item 0011: Lorentz Microscopy (OPTION)	1	Due at the time of microscope delivery
Line Item 0012: Precession Electron Diffraction Capability (OPTION)	1	Due at the time of microscope installation
Line Item 0013: TEM Specimen Holder – Double-tilt Low Background (OPTION)	1	Due at the time of microscope delivery
Line Item 0014: TEM Specimen Holder – Double-tilt with Faraday Cup (OPTION)	1	Due at the time of microscope delivery
Line Item 0015: Tomography TEM Specimen Holder (OPTION)	1	Due at the time of microscope delivery
Line Item 0016: High-tilt Tomography TEM Specimen Holder –(OPTION)	1	Due at the time of microscope delivery
Line Item 0017: Double-tilt Rotate TEM Specimen Holder (OPTION)	1	Due at the time of microscope delivery
Line Item 0018: Single-tilt Cryo-transfer TEM Specimen Holder (OPTION)	1	Due at the time of microscope delivery
Line Item 0019: Single-tilt Cooling TEM Specimen Holder (OPTION)	1	Due at the time of microscope delivery
Line Item 0020: Double-tilt Cooling TEM specimen holder (OPTION)	1	Due at the time of microscope

		delivery
Line Item 0021: MEMS-based Double-tilt Heating TEM Specimen Holder (OPTION)	1	Due at the time of microscope delivery
Line Item 0022: Double-tilt Heating TEM Specimen Holder (OPTION)	1	Due at the time of microscope delivery
Line Item 0023: Single-tilt Biasing TEM Specimen Holder (OPTION)	1	Due at the time of microscope delivery
Line Item 0024: Blanking Plug (OPTION)	1	Due at the time of microscope delivery
Line Item 0025: High Speed Pre-filter Camera 2: High-speed Monolithic Active Pixel Camera (OPTION)	1	Due at the time of microscope delivery
Line Item 0026: High Speed Pre-filter Camera 2: High-speed TimePix-based Hybrid Pixel Detector (OPTION)	1	Due at the time of microscope delivery
Line Item 0027: 4D-STEM System (OPTION)	1	Due at the time of microscope delivery
Line Item 0028: Tomography Capability – Software Functionality (OPTION)	1	Due at the time of microscope delivery
Line Item 0029: Electron Counting Camera for Electron Energy Filter (OPTION)	1	Due at the time of microscope delivery
Line Item 0030: Additional Training (OPTION)	1	Due after initial training is completed, but within 5 years of acceptance of the microscope
Line Item 0031: Trade-In (OPTION)	1	After final acceptance of the new microscope

Standards of Acceptance: The Contractor shall provide, with the response, a description of test and acceptance criteria for both the factory and installation site inspections that will verify that the system meets the specifications described herein.

v.PLACE OF PERFORMANCE

NIST and Contractor's facility

VI. PERIOD OF PERFORMANCE/LEAD TIME

No less than 12 months and no more than 24 months after date of award for delivery of STEM followed by 5 years of warranty upon acceptance.

VII. DELIVERY TERMS

Delivery shall be F.O.B Destination and shall occur in accordance with the delivery due dates provided in the above table.

FOB Destination means: The contractor shall pack and mark the shipment in conformance with carrier requirements, deliver the shipment in good order and condition to the point of delivery specified in the purchase order, be responsible for any loss of and/or damage to the goods occurring before receipt and acceptance of the shipment by the consignee at the delivery point specified in the purchase order; and pay all charges to the specified point of delivery. The contractor shall deliver all Line Items to:

National Institute of Standards and Technology
Building 216, CNST NanoFab TEM Laboratory
100 Bureau Drive, Building 301Gaithersburg, MD 20899

*****Due to ongoing limited site access of the NIST facilities, the Awardee SHALL confirm with the Designated Government Official and the Contracting Officer prior to ANY shipment to NIST*****

VIII. INSTALLATION

The system shall be installed by the Contractor and meet contract specifications no later than 6-month after delivery. Installation, at a minimum, shall include uncrating/unpackaging of all equipment, rigging, set-up and hook-up of the system, demonstration of all specifications, and removal of trash. Onsite installation and demonstration shall be done at NIST, Gaithersburg, MD- Building 216, CNST NanoFab TEM Laboratory. All installation requirements are identified below:

1. Basic expectations

1.1. The Contractor shall provide an installation kit including the necessary fittings, gas regulators, electrical connection adaptors.

1.2. If necessary, the microscope shall have an enclosure to dampen acoustic vibrations and reduce temperature variations from the room environment.

2. Installation dates and deadlines

2.1. The Contractor shall schedule and conduct the tool installation/set-up. At a minimum, installation shall include uncrating and unpacking of all equipment, set-up and hook-up of the instrument, and removal of trash. Onsite installation shall be done at NIST, Gaithersburg, MD.

2.2. Installation shall be scheduled, in advance, with the NIST COR and with NanoFab staff.

2.3. The total period of installation and acceptance of the microscope system shall not exceed 6 months after installation begins.

IX. TRAINING

The Contractor shall conduct training session for up to three (3) users at NIST. The training shall provide a thorough demonstration of all system/solution functions, maintenance, data administration, and basic troubleshooting. The training may be completed at NIST Monday – Friday during the operating hours of 8:30 am to 5:00 pm eastern time. Further training requirements are identified below:

1. The Contractor shall conduct training on-site at NIST Gaithersburg for at least three NIST personnel. This training may commence immediately upon completion of installation and demonstration of specifications.

2. The Contractor shall provide a minimum of 12 days of on-site training by contractor application engineers. Training does not have to be contiguous days; it can be broken into increments as short as 1 day.

3. Training shall include, at a minimum, a thorough demonstration of all equipment functions and equipment operation which will allow NIST personnel to operate the system to its full capabilities and shall include basic troubleshooting.

4. Training shall include the system configuration and supervisor level and user level maintenance routines.

5. Training shall be scheduled, in advance, with the NIST COR and with NanoFab staff.

X. INSPECTION & ACCEPTANCE

In addition to the inspection and acceptance terms articulated in 52.212-4, the Government reserves the right to perform such performance tests and evaluations as defined below to verify specified system performance. Such tests and evaluations, if performed, shall be conducted within the environment that the system is to be operated.

The Contractor has the right to be present during the tests and evaluations, if performed, at the Contractor's expense.

1. The Contractor shall provide, with the quote, details of the system test and acceptance criteria for both the factory and installation site inspections that will verify that the system meets the specifications described herein.

2. The acceptance tests shall be performed after all peripherals have been installed on the microscope.

3. **Factory Acceptance Tests:**

3.1. The factory acceptance tests shall cover all the on-site acceptance tests and guarantee that the microscope and all accessories perform according to the specifications described herein. It shall be at NIST's discretion to send staff member(s) to the factory during the factory acceptance test.

3.2. The results and raw data of the factory acceptance tests shall be confirmed by NIST staff at the factory prior to the shipment of the microscope.

3.3. The Contractor shall notify the NIST COR at least 30 days before the factory acceptance test is scheduled.

4. **On-site Acceptance Tests:**

4.1. The Contractor shall provide test strategies for confirming the performance specifications listed herein.

4.2. The Contractor will perform additional tests at the factory and on-site to certify critical resolution and stability, for example:

4.2.1. The HRTEM resolution and information limit shall be confirmed by Young's fringes measurement.

4.2.2. STEM performance: resolution, probe size, and probe current shall be demonstrated.

4.2.3. For stage and goniometer low drift characteristics, drift rates shall be measured after an initial 30-minute equilibration period, and then again immediately after performing a stage move.

4.2.4. The cold trap shall be cold for the specimen contamination tests and shall be repeated at the factory test and NIST acceptance test.

4.2.5. Electron Energy Filter: The Contractor shall demonstrate that the energy and spectral drift specifications are met.

4.3. Data Acquisition Integration:

4.3.1. The simultaneous acquisition of EELS and EDS spectra in the same software package shall be demonstrated.

4.3.2. Atomic resolution EELS and EDS mapping shall be demonstrated.

4.4. Remote Operation: A remote operation test will be conducted by a NIST staff located in Boulder, CO. The second set of microscope hand-panels shall be shipped to and received by a recipient at NIST Boulder prior to the remote test. A specimen will have been pre-loaded by NIST Gaithersburg staff prior to the commencement of the test.

4.5. API – for the microscope, all cameras, EELS and EDS spectrometers, beam pulser, and applicable detectors and specimen holders:

4.5.1. A library of all callable functions shall be provided electronically.

4.5.2. Example API calls shall be provided electronically, preferably in the form of a Python 3.0+ Jupyter notebook.

5. **Optional Euclid Beam Pulser:**

5.1. If the optional Euclid Beam Pulser is purchased, then the specifications listed herein shall be demonstrated after the pulser's integration into the microscope system.

5.2. Prior to pulser installation:

5.2.1. Contractor shall show proof of native instrument resolution in TEM, STEM, and the ZLP in EELS modes.

5.2.2. Contractor shall measure beam current with a Faraday cup immediately below the condenser stack with all apertures retracted, running in TEM and STEM modes.

5.3. Post-column integration, pulser off:

5.3.1. Microscope Contractor shall re-qualify all microscope performance specifications after pulser integration. Deviation of the performance, including spatial resolution, energy resolution, and mechanical stability beyond the factory certified specifications will not be considered.

5.3.2. Loss of beam intensity due to pulser integration is not acceptable. The probe current as measured by the microscope Faraday cup shall show no statistically significant change from that measured under identical optical conditions prior to integration.

5.4. Post-column integration, pulser on:

5.4.1. Beam repetition rate adjustments shall be continuous within a band. For example, continuously tunable between 1 GHz and 12 GHz, 0.1 GHz to 1 GHz, 0.1 MHz to 100 MHz, DC to 100 kHz. Discontinuity in tunability inter-band is acceptable as long as the bands overlap.

5.4.2. Data from the split-beam test shall be supplied and will be used as a demonstration of temporal resolution.

5.4.3. Temperature measurements shall be conducted on the exterior pulser housing during the following periods (a) pulser off, (b) pulser continuously running for 10 minutes, (c) pulser continuously running for 1 hour. The temperature measurements shall be conducted with the pulser running at or below 20% duty cycle.

5.4.4. Column vacuum measurements shall be taken during the following periods (a) pulser off, (b) pulser continuously running for 10 minutes, (c) pulser continuously running for 1 hour. The temperature measurements shall be conducted with the pulser running at or below 20% duty cycle.

XI. WARRANTY

The contractor shall warranty the entire system for a period of a minimum of 1-year after receipt of the equipment and shall be in accordance with terms in FAR 52.212-4. Warranty shall commence upon acceptance of the system by the Government and at a minimum shall include the following:

1. The Contractor shall provide a 1-year warranty on the microscope and all of its components, hardware and software, to commence after final acceptance of the microscope by the Government.

2. The warranty specified in item 1 shall cover the cold field-emission gun unit. Cold field-emission gun warranties that cover longer periods of time will receive stronger consideration.

3. The Contractor shall provide a 1-year warranty on all third-party accessories and their components, to commence after final acceptance of the microscope by the Government.

4. Options exercised, delivered, and installed at a later date shall also be covered by a 1-year warranty which shall commence upon final acceptance of each individual component.

5. The warranty shall be on-site at NIST Gaithersburg during business hours only, 8:00 AM to 5:00 PM Eastern Time. All parts, labor, and travel shall be included.

6. In the event any components need to be returned to the Contractor's (or subcontractor's) facility for repair, the Contractor shall make arrangements for the shipment, provide all required nomenclature for the shipment, including a shipping account number, assume all costs for shipping, and assume all liability for all shipments to and from NIST.

7. The Contractor shall respond to the Government's request for service, via e-mail or telephone, not later than 48 hours after the request is received.

8. On-site service shall follow not later than 5 days after the telephone or e-mail response is received by NIST. To the maximum extent practicable, all malfunctions shall be remedied not later than 60 days from the date the problem was called into the Contractor.

XII. PAYMENT SCHEDULE

Advance payment is not authorized. The Contractor must invoice in arrears according to the payment schedule. The Contractor shall be paid, in accordance with Net 30-day payment terms, upon receipt and acceptance of a proper invoice, in accordance with the following schedule:

1. 100% after installation and acceptance by the TPOC of fully installed system, AND
2. After the successful completion of the testing requirements set forth in this document under section set forth in this document, AND
3. After successful demonstration by the instrumentation that it performs IAW the technical requirements set forth in this document AND
4. After receiving an invoice submitted properly, IAW the purchase order terms and conditions.

NOTE: Partial shipments and partial invoices will not be accepted, unless otherwise requested and accepted by the Contracting Officer prior to award offer.

XIII. MISCELLANEOUS INFORMATION

Safety: The Contractor employee must be responsible for knowing and complying with all installation safety prevention regulations. Such regulations include, but are not limited to, general safety, fire prevention, and waste disposal.

Security: NIST is a restricted campus. An identification badge is required for access for entry into buildings and is shown to the armed Security Police when entering the campus.

Regular Business Hours. Regular business hours are Monday through Friday, 8:00 am to 5:00 pm Eastern Time, excluding Federal holidays and NIST closures.

Identification Badges: Contractor employees must comply with NIST identification and access requirements. Each Contractor employee must wear a visible identification badge provided by the NIST Security Office.

Vehicle Registration: All Contractor employees must register their vehicles with the NIST Security Office to gain access to the campus. A valid driver's license, Government-furnished civilian ID,

proof of insurance and current registration must be presented to the NIST Security Office, at which time a NIST vehicle pass will be issued. The pass must be displayed on the vehicle in accordance with NIST Security Office instructions.

CONTRACT CLAUSES

This acquisition incorporates clauses from the Federal Acquisition Regulation (FAR), Commerce Acquisition Regulation (CAR) as well as NIST local clauses. Clauses incorporated by reference are listed first followed by clauses incorporated by full text. Additionally, the full text of all clauses can be accessed electronically (see FAR Clause 52.252-2 for details.)

52.204-13 SYSTEM FOR AWARD MANAGEMENT MAINTENANCE (OCT 2018)
(Reference 52.204-13)

52.204-18 COMMERCIAL AND GOVERNMENT ENTITY CODE MAINTENANCE (AUG 2020)
(Reference 52.204-18)

52.204-19 INCORPORATION BY REFERENCE OF REPRESENTATIONS AND CERTIFICATIONS (DEC 2014)
(Reference 52.204-19)

52.209-9 UPDATES OF PUBLICLY AVAILABLE INFORMATION REGARDING RESPONSIBILITY MATTERS (OCT 2018)
(Reference 52.209-9)

52.212-4 CONTRACT TERMS AND CONDITIONS--COMMERCIAL PRODUCTS AND COMMERCIAL SERVICES (DEC 2022)
(Reference 52.212-4)

52.217-5 EVALUATION OF OPTIONS (JUL 1990)
(Reference 52.217-5)

52.232-39 UNENFORCEABILITY OF UNAUTHORIZED OBLIGATIONS (JUNE 2013)
(Reference 52.232-39)

52.247-35 F.O.B. DESTINATION, WITHIN CONSIGNEE`s PREMISES (APR 1984)
(Reference 52.247-35)

1352.201-70 CONTRACTING OFFICER?s AUTHORITY (APR 2010)
(Reference 1352.201-70)

1352.201-72 CONTRACTING OFFICER`S REPRESENTATIVE (COR) (APR 2010)
(Reference 1352.201-72)

1352.209-73 COMPLIANCE WITH THE LAWS (APR 2010)
(Reference 1352.209-73)

1352.209-74 ORGANIZATIONAL CONFLICT OF INTEREST (APR 2010)
(Reference 1352.209-74)

52.212-5 CONTRACT TERMS AND CONDITIONS REQUIRED TO IMPLEMENT STATUTES OR EXECUTIVE ORDERS--COMMERCIAL PRODUCTS AND COMMERCIAL SERVICES (MAR 2023)

(a) The Contractor shall comply with the following Federal Acquisition Regulation (FAR) clauses, which are incorporated in this contract by reference, to implement provisions of law or Executive orders applicable to acquisitions of commercial products and commercial services:

(1) 52.203-19, Prohibition on Requiring Certain Internal Confidentiality Agreements or Statements (JAN 2017) (section 743 of Division E, Title VII, of the Consolidated and Further Continuing Appropriations Act, 2015 (Pub. L. 113-235) and its successor provisions in subsequent appropriations acts (and as extended in continuing resolutions)).

(2) 52.204-23, Prohibition on Contracting for Hardware, Software, and Services Developed or Provided by Kaspersky Lab and Other Covered Entities (NOV 2021) (Section 1634 of Pub. L. 115-91).

(3) 52.204-25, Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment. (NOV 2021) (Section 889(a)(1)(A) of Pub. L. 115-232).

(4) 52.209-10, Prohibition on Contracting with Inverted Domestic Corporations (NOV 2015).

(5) 52.232-40, Providing Accelerated Payments to Small Business Subcontractors (MAR 2023) (31 U.S.C. 3903 and 10 U.S.C. 3801).

(6) 52.233-3, Protest After Award (AUG 1996) (31 U.S.C. 3553).

(7) 52.233-4, Applicable Law for Breach of Contract Claim (OCT 2004)(Public Laws 108-77 and 108-78 (19 U.S.C. 3805 note)).

(b) The Contractor shall comply with the FAR clauses in this paragraph (b) that the Contracting Officer has indicated as being incorporated in this contract by reference to implement provisions of law or Executive orders applicable to acquisitions of commercial products and commercial services:

[Contracting Officer check as appropriate.]

XX (1) 52.203-6, Restrictions on Subcontractor Sales to the Government (JUN 2020), with Alternate I (NOV 2021)(41 U.S.C. 4704 and 10 U.S.C. 4655).

XX (2) 52.203-13, Contractor Code of Business Ethics and Conduct (NOV 2021) (41 U.S.C. 3509).

(3) 52.203-15, Whistleblower Protections under the American Recovery and Reinvestment Act of 2009 (JUN 2010) (Section 1553 of Pub. L. 111-5). (Applies to contracts funded by the American Recovery and Reinvestment Act of 2009.)

XX (4) 52.204-10, Reporting Executive Compensation and First-Tier Subcontract Awards (JUN 2020) (Pub. L. 109-282) (31 U.S.C. 6101 note).

(5) [Reserved]

(6) 52.204-14, Service Contract Reporting Requirements (OCT 2016) (Pub. L. 111-117, section 743 of Div. C).

(7) 52.204-15, Service Contract Reporting Requirements for Indefinite-Delivery Contracts (OCT 2016) (Pub. L. 111-117, section 743 of Div. C).

XX (8) 52.209-6, Protecting the Government's Interest When Subcontracting with Contractors Debarred, Suspended, or Proposed for Debarment. (NOV 2021) (31 U.S.C. 6101 note).

XX (9) 52.209-9, Updates of Publicly Available Information Regarding Responsibility Matters (OCT 2018) (41 U.S.C. 2313).

(10) [Reserved]

(11) 52.219-3, Notice of HUBZone Set-Aside or Sole-Source Award (OCT 2022) (15 U.S.C. 657a).

(12) 52.219-4, Notice of Price Evaluation Preference for HUBZone Small Business Concerns (OCT 2022) (if the offeror elects to waive the preference, it shall so indicate in its offer) (15 U.S.C. 657a).

(13) [Reserved]

(14)(i) 52.219-6, Notice of Total Small Business Set-Aside (NOV 2020)) (15 U.S.C. 644).

(ii) Alternate I (MAR 2020) of 52.219-6.

(iii) Alternate II (NOV 2011) of 52.219-6.

(15)(i) 52.219-7, Notice of Partial Small Business Set-Aside (NOV 2020)) (15 U.S.C. 644).

(ii) Alternate I (MAR 2020)) of 52.219-7.

(iii) Alternate II (MAR 2004) of 52.219-7.

XX (16) 52.219-8, Utilization of Small Business Concerns (OCT 2022) (15 U.S.C. 637(d)(2) and (3)).

XX (17)(i) 52.219-9, Small Business Subcontracting Plan (OCT 2022) (15 U.S.C. 637(d)(4)).

(ii) Alternate I (JAN 2017) of 52.219-9.

(iii) Alternate II (NOV 2016) of 52.219-9.

(iv) Alternate III (JUN 2020) of 52.219-9.

(v) Alternate IV (SEP 2021) of 52.219-9.

(18) (i) 52.219-13, Notice of Set-Aside of Orders (MAR 2020) (15 U.S.C. 644(r)).

(ii) Alternate I (MAR 2020) of 52.219-13.

(19) 52.219-14, Limitations on Subcontracting (OCT 2022) (15 U.S.C. 657s).

XX (20) 52.219-16, Liquidated Damages-Subcontracting Plan (SEP 2021) (15 U.S.C. 637(d)(4)(F)(i)).

(21) 52.219-27, Notice of Service-Disabled Veteran-Owned Small Business Set-Aside (OCT 2022) (15 U.S.C. 657f).

XX (22) (i) 52.219-28, Post Award Small Business Program Rerepresentation (MAR 2023) (15 U.S.C. 632(a)(2)).

(ii) Alternate I (MAR 2020) of 52.219-28.

(23) 52.219-29, Notice of Set-Aside for, or Sole Source Award to, Economically Disadvantaged Women-Owned Small Business Concerns (OCT 2022) (15 U.S.C. 637(m)).

(24) 52.219-30, Notice of Set-Aside for, or Sole Source Award to, Women-Owned Small Business Concerns Eligible Under the Women-Owned Small Business Program (OCT 2022) (15 U.S.C. 637(m)).

(25) 52.219-32, Orders Issued Directly Under Small Business Reserves (MAR 2020) (15 U.S.C. 644(r)).

(26) 52.219-33, Nonmanufacturer Rule (SEP 2021) (15 U.S.C. 637(a)(17)).

XX (27) 52.222-3, Convict Labor (JUN 2003) (E.O. 11755).

XX (28) 52.222-19, Child Labor--Cooperation with Authorities and Remedies (DEC 2022) (E.O. 13126).

XX (29) 52.222-21, Prohibition of Segregated Facilities (APR 2015).

XX (30) (i) 52.222-26, Equal Opportunity (SEP 2016) (E.O. 11246).

(ii) Alternate I (FEB 1999) of 52.222-26.

XX (31) (i) 52.222-35, Equal Opportunity for Veterans (JUN 2020)(38 U.S.C. 4212).

(ii) Alternate I (JUL 2014) of 52.222-35.

XX (32) (i) 52.222-36, Equal Opportunity for Workers with Disabilities (JUN 2020) (29 U.S.C. 793).

(ii) Alternate I (JUL 2014) of 52.222-36.

XX (33) 52.222-37, Employment Reports on Veterans (JUN 2020) (38 U.S.C. 4212).

XX (34) 52.222-40, Notification of Employee Rights Under the National Labor Relations Act (DEC 2010) (E.O. 13496).

XX (35)(i) 52.222-50, Combating Trafficking in Persons (NOV 2021) (22 U.S.C. chapter 78 and E.O. 13627).

(ii) Alternate I (MAR 2015) of 52.222-50 (22 U.S.C. chapter 78 and E.O. 13627).

(36) 52.222-54, Employment Eligibility Verification (MAY 2022). (E. O. 12989). (Not applicable to the acquisition of commercially available off-the-shelf items or certain other types of commercial products or commercial services as prescribed in FAR 22.1803.)

(37) (i) 52.223-9, Estimate of Percentage of Recovered Material Content for EPA-Designated Items (MAY 2008) (42 U.S.C.6962(c)(3)(A)(ii)). (Not applicable to the acquisition of commercially available off-the-shelf items.)

(ii) Alternate I (MAY 2008) of 52.223-9 (42 U.S.C. 6962(i)(2)(C)). (Not applicable to the acquisition of commercially available off-the-shelf items.)

(38) 52.223-11, Ozone-Depleting Substances and High Global Warming Potential Hydrofluorocarbons (JUN, 2016) (E.O. 13693).

(39) 52.223-12, Maintenance, Service, Repair, or Disposal of Refrigeration Equipment and Air Conditioners (JUN, 2016) (E.O. 13693).

(40) (i) 52.223-13, Acquisition of EPEAT(R) -Registered Imaging Equipment(JUN 2014) (E.O.s 13423 and 13514).

(ii) Alternate I (OCT 2015) of 52.223-13.

(41) (i) 52.223-14, Acquisition of EPEAT(R) -Registered Television (JUN 2014) (E.O.s 13423 and 13514).

(ii) Alternate I (JUN 2014) of 52.223-14.

(42) 52.223-15, Energy Efficiency in Energy-Consuming Products(MAY 2020) (42 U.S.C. 8259b).

(43) (i) 52.223-16, Acquisition of EPEAT(R)-Registered Personal Computer Products (OCT 2015) (E.O.s 13423 and 13514).

(ii) Alternate I (JUN 2014) of 52.223-16.

XX (44) 52.223-18, Encouraging Contractor Policies to Ban Text Messaging While Driving (JUN 2020) (E.O. 13513).

(45) 52.223-20, Aerosols (JUN, 2016) (E.O. 13693).

(46) 52.223-21, Foams (JUN, 2016) (E.O. 13693).

(47) (i) 52.224-3, Privacy Training (JAN 2017) (5 U.S.C. 552a).

(ii) Alternate I (JAN 2017) of 52.224-3.

(48) (i) 52.225-1, Buy American--Supplies (OCT 2022) (41 U.S.C. chapter 83).

(ii) Alternate I (OCT 2022) of 52.225-1.

(49) (i) 52.225-3, Buy American--Free Trade Agreements--Israeli Trade Act (DEC 2022) (19 U.S.C. 3301 note, 19 U.S.C. 2112 note, 19 U.S.C. 3805 note, 19 U.S.C. 4001 note, 19 U.S.C. chapter 29 (sections 4501-4732), Public Law 103-182, 108-77, 108-78, 108-286, 108-302, 109-53, 109-169, 109-283, 110-138, 112-41, 112-42, and 112-43.

(ii) Alternate I [Reserved].

(iii) Alternate II (DEC 2022) of 52.225-3.

(iv) Alternate III (JAN 2021) of 52.225-3.

(v) Alternate IV (OCT 2022) of 52.225-3.

XX (50) 52.225-5, Trade Agreements (DEC 2022) (19 U.S.C. 2501, et seq., 19 U.S.C. 3301 note).

XX (51) 52.225-13, Restrictions on Certain Foreign Purchases (FEB 2021) (E.O.'s, proclamations, and statutes administered by the Office of Foreign Assets Control of the Department of the Treasury).

(52) 52.225-26, Contractors Performing Private Security Functions Outside the United States (OCT 2016) (Section 862, as amended, of the National Defense Authorization Act for Fiscal Year 2008; 10 U.S.C. Subtitle A, Part V, Subpart G Note).

(53) 52.226-4, Notice of Disaster or Emergency Area Set-Aside (NOV 2007) (42 U.S.C. 5150).

(54) 52.226-5, Restrictions on Subcontracting Outside Disaster or Emergency Area (NOV 2007) (42 U.S.C. 5150).

XX (55) 52.229-12, Tax on Certain Foreign Procurements (FEB 2021).

(56) 52.232-29, Terms for Financing of Purchases of Commercial Products and Commercial Services (NOV 2021) (41 U.S.C.4505, 10 U.S.C. 3805).

(57) 52.232-30, Installment Payments for Commercial Products and Commercial Services (NOV 2021) (41 U.S.C. 4505, 10 U.S.C. 3805).

XX (58) 52.232-33, Payment by Electronic Funds Transfer--System for Award Management (OCT 2018) (31 U.S.C. 3332).

(59) 52.232-34, Payment by Electronic Funds Transfer - Other Than System for Award Management (JUL 2013) (31 U.S.C. 3332).

(60) 52.232-36, Payment by Third Party (MAY 2014) (31 U.S.C. 3332).

(61) 52.239-1, Privacy or Security Safeguards (AUG 1996) (5 U.S.C. 552a).

(62) 52.242-5, Payments to Small Business Subcontractors (JAN 2017)(15 U.S.C. 637(d)(13)).

(63)(i) 52.247-64, Preference for Privately Owned U.S.-Flag Commercial Vessels (NOV 2021) (46 U.S.C. 55305 and 10 U.S.C. 2631).

(ii) Alternate I (APR 2003) of 52.247-64.

(iii) Alternate II (NOV 2021) of 52.247-64.

(c) The Contractor shall comply with the FAR clauses in this paragraph (c), applicable to commercial services, that the Contracting Officer has indicated as being incorporated in this contract by reference to implement provisions of law or Executive orders applicable to acquisitions of commercial products and commercial services:

[Contracting Officer check as appropriate.]

(1) 52.222-41, Service Contract Labor Standards (AUG 2018) (41 U.S.C. chapter 67).

(2) 52.222-42, Statement of Equivalent Rates for Federal Hires(MAY 2014) (29 U.S.C. 206 and 41 U.S.C. chapter 67).

(3) 52.222-43, Fair Labor Standards Act and Service Contract Labor Standards -Price Adjustment (Multiple Year and Option Contracts) (AUG 2018)(29 U.S.C. 206 and 41 U.S.C. chapter 67).

(4)52.222-44, Fair Labor Standards Act and Service Contract Labor Standards--Price Adjustment (MAY 2014) (29 U.S.C 206 and 41 U.S.C. chapter 67).

XX (5)52.222-51, Exemption from Application of the Service Contract Labor Standards to Contracts for Maintenance, Calibration, or Repair of Certain Equipment--Requirements (MAY 2014) (41 U.S.C. chapter 67).

(6) 52.222-53, Exemption from Application of the Service Contract Labor Standards to Contracts for Certain Services--Requirements (MAY 2014) (41 U.S.C. chapter 67).

(7) 52.222-55, Minimum Wages for Contractor Workers Under Executive Order 14026 (JAN 2022).

(8) 52.222-62, Paid Sick Leave Under Executive Order 13706 (JAN 2022) (E.O. 13706).

(9) 52.226-6, Promoting Excess Food Donation to Nonprofit Organizations (JUN 2020) (42 U.S.C. 1792).

(d) Comptroller General Examination of Record. The Contractor shall comply with the provisions of this paragraph (d) if this contract was awarded using other than sealed bid, is in excess of the simplified acquisition threshold, as defined in FAR 2.101, on the date of award of this contract, and does not contain the clause at 52.215-2, Audit and Records-Negotiation.

(1) The Comptroller General of the United States, or an authorized representative of the Comptroller General, shall have access to and right to examine any of the Contractor?s directly pertinent records involving transactions related to this contract.

(2) The Contractor shall make available at its offices at all reasonable times the records, materials, and other evidence for examination, audit, or reproduction, until 3 years after final payment under this contract or for any shorter period specified in FAR subpart 4.7, Contractor Records Retention, of the other clauses of this contract. If this contract is completely or partially terminated, the records relating to the work terminated shall be made available for 3 years after any resulting final termination settlement. Records relating to appeals under the disputes clause or to litigation or the settlement of claims arising under or relating to this contract shall be made available until such appeals, litigation, or claims are finally resolved.

(3) As used in this clause, records include books, documents, accounting procedures and practices, and other data, regardless of type and regardless of form. This does not require the Contractor to create or maintain any record that the Contractor does not maintain in the ordinary course of business or pursuant to a provision of law.

(e)

(1) Notwithstanding the requirements of the clauses in paragraphs (a), (b), (c), and (d) of this clause, the Contractor is not required to flow down any FAR clause, other than those in this paragraph (e)(1), in a subcontract for commercial products or commercial services. Unless otherwise indicated below, the extent of the flow down shall be as required by the clause-

(i) 52.203-13, Contractor Code of Business Ethics and Conduct (Nov 2021) (41 U.S.C. 3509).

(ii) 52.203-19, Prohibition on Requiring Certain Internal Confidentiality Agreements or Statements (Jan 2017) (section 743 of Division E, Title VII, of the Consolidated and Further Continuing Appropriations Act, 2015 (Pub. L. 113-235) and its successor provisions in subsequent appropriations acts (and as extended in continuing resolutions)).

(iii) 52.204-23, Prohibition on Contracting for Hardware, Software, and Services Developed or Provided by Kaspersky Lab and Other Covered Entities (Nov 2021) (Section 1634 of Pub. L. 115-91).

(iv) 52.204-25, Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment. (Nov 2021) (Section 889(a)(1)(A) of Pub. L. 115-232).

(v) 52.219-8, Utilization of Small Business Concerns (Oct 2022) (15 U.S.C. 637(d)(2) and (3)), in all subcontracts that offer further subcontracting opportunities. If the subcontract (except subcontracts to small business concerns) exceeds the applicable threshold specified in FAR 19.702(a) on the date of subcontract award, the subcontractor must include 52.219-8 in lower tier subcontracts that offer subcontracting opportunities.

(vi) 52.222-21, Prohibition of Segregated Facilities (Apr 2015).

(vii) 52.222-26, Equal Opportunity (Sep 2015) (E.O.11246).

(viii) 52.222-35, Equal Opportunity for Veterans (Jun 2020) (38 U.S.C. 4212).

(ix) 52.222-36, Equal Opportunity for Workers with Disabilities (Jun 2020) (29 U.S.C. 793).

(x) 52.222-37, Employment Reports on Veterans (Jun 2020) (38 U.S.C. 4212).

(xi) 52.222-40, Notification of Employee Rights Under the National Labor Relations Act (Dec 2010) (E.O. 13496). Flow down required in accordance with paragraph (f) of FAR clause 52.222-40.

(xii) 52.222-41, Service Contract Labor Standards (Aug 2018) (41 U.S.C. chapter 67).

(xiii)

(A) 52.222-50, Combating Trafficking in Persons (Nov 2021) (22 U.S.C. chapter 78 and E.O 13627).

(B) Alternate I (Mar 2015) of 52.222-50 (22 U.S.C. chapter 78 and E.O. 13627).

(xiv) 52.222-51, Exemption from Application of the Service Contract Labor Standards to Contracts for Maintenance, Calibration, or Repair of Certain Equipment-Requirements (May 2014) (41 U.S.C. chapter 67).

(xv) 52.222-53, Exemption from Application of the Service Contract Labor Standards to Contracts for Certain Services-Requirements (May 2014) (41 U.S.C. chapter 67).

(xvi) 52.222-54, Employment Eligibility Verification (May 2022) (E.O. 12989).

(xvii) 52.222-55, Minimum Wages for Contractor Workers Under Executive Order 14026 (Jan 2022).

(xviii) 52.222-62, Paid Sick Leave Under Executive Order 13706 (Jan 2022) (E.O. 13706).

(xix)

(A) 52.224-3, Privacy Training (Jan 2017) (5 U.S.C. 552a).

(B) Alternate I (Jan 2017) of 52.224-3.

(xx) 52.225-26, Contractors Performing Private Security Functions Outside the United States (Oct 2016) (Section 862, as amended, of the National Defense Authorization Act for Fiscal Year 2008; 10 U.S.C. 2302 Note).

(xxi) 52.226-6, Promoting Excess Food Donation to Nonprofit Organizations (Jun 2020) (42 U.S.C. 1792). Flow down required in accordance with paragraph (e) of FAR clause 52.226-6.

(xxii) 52.232-40, Providing Accelerated Payments to Small Business Subcontractors (MAR 2023) (31 U.S.C. 3903 and 10 U.S.C. 3801). Flow down required in accordance with paragraph (c) of 52.232-40.

(xxiii) 52.247-64, Preference for Privately Owned U.S.-Flag Commercial Vessels (Nov 2021) (46 U.S.C. 55305 and 10 U.S.C. 2631). Flow down required in accordance with paragraph (d) of FAR clause 52.247-64.

(2) While not required, the Contractor may include in its subcontracts for commercial products and commercial services a minimal number of additional clauses necessary to satisfy its contractual obligations.

(End Of Clause)

52.217-7 OPTION FOR INCREASED QUANTITY--SEPARATELY PRICED LINE ITEM (MAR 1989)

The Government may require the delivery of the numbered line item, identified in the Schedule as an option item, in the quantity and at the price stated in the Schedule. The Contracting Officer may exercise the option by written notice to the Contractor within 5 months from date of award or at award of contract for option line items 0007-0029, anytime after initial training for option line item 0030, and at time of award for option line item 0031. Delivery of added items shall continue at the same rate that like items are called for under the contract, unless the parties otherwise agree.

(End of Clause)

52.252-2 CLAUSES INCORPORATED BY REFERENCE (FEB 1998)

This contract incorporates one or more clauses by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. Also, the full text of a clause may be accessed electronically at this/these address(es):

FAR: https://www.acquisition.gov/browse/index/far
CAR: https://www.acquisition.gov/car

(End of Clause)

1352.233-70 AGENCY PROTESTS (APR 2010)

(a) An agency protest may be filed with either: (1) the contracting officer, or (2) at a level above the contracting officer, with the appropriate agency Protest Decision Authority. See 64 Fed. Reg. 16,651 (April 6, 1999)

(b) Agency protests filed with the Contracting Officer shall be sent to the following address:
NIST/ACQUISITION MANAGEMENT DIVISION
ATTN: Donald Collie, Contracting Officer
100 Bureau Drive, MS 1640
Gaithersburg, MD 20899

(c) Agency protests filed with the agency Protest Decision Authority shall be sent to the following address:

ATTN: Head of the Contracting Office (HCO)
100 Bureau Drive, MS 1640
Gaithersburg, MD 20899

(d) A complete copy of all agency protests, including all attachments, shall be served upon the Contract Law Division of the Office of the General Counsel within one day of filing a protest with either the Contracting Officer or the Protest Decision Authority.

(e) Service upon the Contract Law Division shall be made as follows:

U.S. Department of Commerce
Office of the General Counsel
Chief, Contract Law Division
Room 5893
Herbert C. Hoover Building
14th Street and Constitution Avenue, N.W.
Washington, D.C. 20230.
FAX: (202) 482-5858

(End of clause)

1352.233-71 GAO AND COURT OF FEDERAL CLAIMS PROTESTS (APR 2010)

(a) A protest may be filed with either the Government Accountability Office (GAO) or the Court of Federal Claims unless an agency protest has been filed.

(b) A complete copy of all GAO or Court of Federal Claims protests, including all attachments, shall be served upon (i) the Contracting Officer, and (ii) the Contract Law Division of the Office of the General Counsel, within one day of filing a protest with either GAO or the Court of Federal Claims.

(c) Service upon the Contract Law Division shall be made as follows:

U.S. Department of Commerce
Office of the General Counsel
Chief, Contract Law Division
Room 5893
Herbert C. Hoover Building
14th Street and Constitution Avenue, N.W.
Washington, D.C. 20230.
FAX: (202) 482-5858

(End of clause)

1352.246-70 PLACE OF ACCEPTANCE (APR 2010)

(a) The Contracting Officer or the duly authorized representative will accept supplies and services to be provided under this contract.

(b) The place of acceptance will be:

100 Bureau Drive
Gaithersburg, MD 20899

(End of clause)

NIST LOCAL-53 CONTRACT PERFORMANCE DURING CHANGES IN NIST OPERATING STATUS

All contractors performing work on active contracts at the U.S. Department of Commerce(DOC), National Institute of Standards and Technology (NIST) campuses and/or working in NIST workspaces should go to the www.nist.gov website and under the "About NIST" tab click on "Visit". This site includes information about campus access and security information; identification requirements; parking information and more.

Contractor personnel are required to check the appropriate campus operating status and personnel requirements at https://www.nist.gov/campus-status daily prior to arriving on site. All personnel must adhere to the requirements set forth in the operating status.

Unless otherwise stated in the contract terms and conditions, normal days of business operation are Monday through Friday, excluding Federal Holidays. However, throughout the contract period of performance, there may be circumstances beyond the control of NIST that will impact normal days of business operation such as inclement weather, power outages, etc. In circumstances such as these, the Contractor must call the appropriate NIST campus status line to verify the operating status:

Gaithersburg Campus Operating Status Line:
(301) 975-8000
(800) 437-4385 x8000 (toll free)

Boulder Campus Operating Status Line:
(303) 497-4000
(303) 497-3000 option 2

In the event of a lapse in appropriation, access to Government facilities and resources, including equipment and systems will be limited to excepted personnel for both Federal employees and contractor personnel. If performance of the contract is onsite and/or requires Government interaction, unless the contractor has been, or is notified that it is required to work under an excepted status, the contractor must stop work. The work stoppage shall remain in effect until the lapse is resolved and notification is provided via the NIST website at www.nist.gov (banner on front page) and/or the NIST operating status line(s). Additionally, contractors are encouraged to monitor public broadcasts or the Office of Personnel Management's website at www.opm.gov for the Federal Government operating status.

NIST will provide notification to all contractors that are determined to have excepted status. All excepted contractors are required to continue performance and communicate with the appointed Contracting Officer's Representative (COR) for further guidance, or NIST Contracting Officer if a COR is not appointed.

Contractors with active supply or service contracts that are fully funded at the time of contract award and do not require access to Government facilities, resources, or active administration by Government personnel in a manner that would not cause the Government to incur additional obligations during the lapse in appropriation may continue performance.

Please note that in all circumstances that impact operations on the NIST campuses, contractors are expected to follow all direction and guidance provided by NIST authorities.

NIST LOCAL-54 ELECTRONIC BILLING INSTRUCTIONS
NIST requires that Invoice/Voucher submissions are sent electronically via email to INVOICE@NIST.GOV. Each Invoice or Voucher submitted shall include the following:
(1) Contract number;
(2) Contractor name and address;
(3) Unique entity identifier (see www.sam.gov for the designated entity for establishing unique entity identifiers);
(4) Date of invoice;
(5) Invoice number;
(6) Amount of invoice and cumulative amount invoiced to-date;
(7) Contract Line Item Number (CLIN);
(8) Description, quantity, unit of measure, unit price, and extended price of supplies/services delivered;
(9) Prompt payment discount terms, if offered; and
(10) Any other information or documentation required by the contract.

NIST LOCAL-56 INVOICING PROCESSING PLATFORM-ALTERNATE I (DEC 2022)
Upon written notice from the contracting officer the following supersedes all other instructions for the submission of payment requests. Accordingly, following written notice payment requests must be submitted electronically through the U.S. Department of the Treasury's Invoice Processing Platform System (IPP).

"Payment request" means any request for contract financing payment or invoice payment by the Contractor. To constitute a proper invoice, the payment request must comply with the requirements identified in the applicable payment request or invoicing instructions, Prompt Payment clause

included in the contract, or the clause 52.212-4 Contract Terms and Conditions - Commercial Items included in commercial item contracts. The IPP website address is https://www.ipp.gov.

Under this contract, the following documents are required to be submitted as an attachment to the IPP invoice:

The Contractor must use the IPP website to register, access, and use IPP for submitting payment requests. If not already enrolled, the Contractor Government Business Point of Contact (as listed in SAM) will receive enrollment instructions via email within three to five business days of the addition of the contract award to IPP. Contractor assistance with enrollment can be obtained by contacting the IPP Production Helpdesk via email: IPPCustomerSupport@fiscal.treasury.gov or phone (866) 973-3131.

If the Contractor is unable to comply with the requirement to use IPP for submitting payment requests, the Contractor must submit a waiver request in writing to the Contracting Officer with its proposal or quotation. Contact the contracting officer for more information on submitting a waiver request.

SOLICITATION PROVISIONS

This solicitation incorporates provisions from the Federal Acquisition Regulation (FAR) and Commerce Acquisition Regulation (CAR). Provisions incorporated by reference are listed first, followed by provisions incorporated by full text. Some full text provisions are required to be completed by the offeror in accordance with the solicitation Addendum to 52.212-1, Instructions to Offerors.

52.203-18 PROHIBITION ON CONTRACTING WITH ENTITIES THAT REQUIRE CERTAIN INTERNAL CONFIDENTIALITY AGREEMENTS OR STATEMENTS--REPRESENTATION (JAN 2017)
(Reference 52.203-18)

52.204-7 SYSTEM FOR AWARD MANAGEMENT (OCT 2018)
(Reference 52.204-7)

52.204-16 COMMERCIAL AND GOVERNMENT ENTITY CODE REPORTING (AUG 2020)
(Reference 52.204-16)

52.204-20 PREDECESSOR OF OFFEROR (AUG 2020)
(Reference 52.204-20)

52.204-24 REPRESENTATION REGARDING CERTAIN TELECOMMUNICATIONS AND VIDEO SURVEILLANCE SERVICES OR EQUIPMENT (NOV 2021)
(Reference 52.204-24)

52.212-1 INSTRUCTIONS TO OFFERORS--COMMERCIAL PRODUCTS AND COMMERCIAL SERVICES (MAR 2023)
(Reference 52.212-1)

52.212-2 EVALUATION--COMMERCIAL PRODUCTS AND COMMERCIAL SERVICES (NOV 2021)
(Reference 52.212-2)

52.212-3 OFFEROR REPRESENTATIONS AND CERTIFICATIONS--COMMERCIAL PRODUCTS AND COMMERCIAL SERVICES (DEC 2022)
(Reference 52.212-3)

52.225-25 PROHIBITION ON CONTRACTING WITH ENTITIES ENGAGING IN CERTAIN ACTIVITIES OR TRANSACTIONS RELATING TO IRAN--REPRESENTATION AND CERTIFICATIONS (JUN 2020)
(Reference 52.225-25)

52.204-17 OWNERSHIP OR CONTROL OF OFFEROR (AUG 2020)

(a) Definitions. As used in this provision--

Commercial and Government Entity (CAGE) code means--

(1) An identifier assigned to entities located in the United States or its outlying areas by the Defense Logistics Agency (DLA) Commercial and Government Entity (CAGE) Branch to identify a commercial or government entity by unique location; or

(2) An identifier assigned by a member of the North Atlantic Treaty Organization (NATO) or by the NATO Support and Procurement Agency (NSPA) to entities located outside the United States and its outlying areas that the DLA Commercial and Government Entity (CAGE) Branch records and maintains in the CAGE master file. This type of code is known as a NATO CAGE (NCAGE) code.

Highest-level owner means the entity that owns or controls an immediate owner of the offeror, or that owns or controls one or more entities that control an immediate owner of the offeror. No entity owns or exercises control of the highest level owner.

Immediate owner means an entity, other than the offeror, that has direct control of the offeror. Indicators of control include, but are not limited to, one or more of the following: Ownership or interlocking management, identity of interests among family members, shared facilities and equipment, and the common use of employees.

(b) The Offeror represents that it has or does not have an immediate owner. If the Offeror has more than one immediate owner (such as a joint venture), then the Offeror shall respond to paragraph (c) and if applicable, paragraph (d) of this provision for each participant in the joint venture.

(c) If the Offeror indicates has in paragraph (b) of this provision, enter the following information:

Immediate owner CAGE code:

Immediate owner legal name:

(Do not use a doing business as name)

Is the immediate owner owned or controlled by another entity?:

[--] Yes or [--] No.

(d) If the Offeror indicates yes in paragraph (c) of this provision, indicating that the immediate owner is owned or controlled by another entity, then enter the following information:

Highest-level owner CAGE code:

Highest-level owner legal name:

(Do not use a doing business as name)

(End of provision)

52.204-26 COVERED TELECOMMUNICATIONS EQUIPMENT OR SERVICES--REPRESENTATION (OCT 2020)
(a) Definitions. As used in this provision, "covered telecommunications equipment or services" and "reasonable inquiry'' have the meaning provided in the clause 52.204-25, Prohibition on Contracting for Certain Telecommunications and Video Surveillance Services or Equipment.
(b) Procedures. The Offeror shall review the list of excluded parties in the System for Award Management (SAM) (https://www.sam.gov) for entities excluded from receiving federal awards for "covered telecommunications equipment or services".
(c) Representations. (1) The Offeror represents that it [ ] does, [ ] does not provide covered telecommunications equipment or services as a part of its offered products or services to the Government in the performance of any contract, subcontract, or other contractual instrument.
(2) After conducting a reasonable inquiry for purposes of this representation, the offeror represents that it [ ] does, [ ] does not use covered telecommunications equipment or services, or any equipment, system, or service that uses covered telecommunications equipment or services.
(End Of Provision)

52.209-2 PROHIBITION ON CONTRACTING WITH INVERTED DOMESTIC CORPORATIONS-REPRESENTATION (NOV 2015)

(a) Definitions. Inverted domestic corporation and subsidiary have the meaning given in the clause of this contract entitled Prohibition on Contracting with Inverted Domestic Corporations (52.209-10).
(b) Government agencies are not permitted to use appropriated (or otherwise made available) funds for contracts with either an inverted domestic corporation, or a subsidiary of an inverted domestic corporation, unless the exception at 9.108-2(b) applies or the requirement is waived in accordance with the procedures at 9.108-4.
(c) Representation. The Offeror represents that--
(1) It [ ] is, [ ] is not an inverted domestic corporation; and
(2) It [ ] is, [ ] is not a subsidiary of an inverted domestic corporation.

(End of provision)

52.209-5 CERTIFICATION REGARDING RESPONSIBILITY MATTERS (AUG 2020)
(a)
(1) The Offeror certifies, to the best of its knowledge and belief, that--
(i) The Offeror and/or any of its Principals--
(A) Are /_/ are not /_/ presently debarred, suspended, proposed for debarment, or declared ineligible for the award of contracts by any Federal agency;
(B) Have /_/ have not /_/, within a three-year period preceding this offer, been convicted of or had a civil judgment rendered against them for: commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) contract or subcontract; violation of Federal or State antitrust statutes relating to the submission of offers; or commission of embezzlement, theft, forgery, bribery,falsification or destruction of records, making false statements, tax evasion, violating Federal criminal tax laws, or receiving stolen property (if offeror checks ''have'', the offeror shall also see 52.209-7, if included in this solicitation);
(C) Are /_/ are not /_/ presently indicted for, or otherwise criminally or civilly charged by a governmental entity with, commission of any of the offenses enumerated in paragraph (a)(1)(i)(B) of this provision.
(D) Have /_/, have not /_/, within a three-year period preceding this offer, been notified of any delinquent Federal taxes in an amount that exceeds the threshold at 9.104-5(a)(2) for which the liability remains unsatisfied.
(1) Federal taxes are considered delinquent if both of the following criteria apply:
(i) The tax liability is finally determined. The liability is finally determined if it has been assessed. A liability is not finally determined if there is a pending administrative or judicial challenge. In the case of a judicial challenge to the liability, the liability is not finally determined until all judicial appeal rights have been exhausted.

(ii) The taxpayer is delinquent in making payment. A taxpayer is delinquent if the taxpayer has failed to pay the tax liability when full payment was due and required. A taxpayer is not delinquent in cases where enforced collection action is precluded.

(2) Examples.

(i) The taxpayer has received a statutory notice of deficiency, under I.R.C. 6212, which entitles the taxpayer to seek Tax Court review of a proposed tax deficiency. This is not a delinquent tax because it is not a final tax liability. Should the taxpayer seek Tax Court review, this will not be a final tax liability until the taxpayer has exercised all judicial appeal rights.

(ii) The IRS has filed a notice of Federal tax lien with respect to an assessed tax liability, and the taxpayer has been issued a notice under I.R.C. 6320 entitling the taxpayer to request a hearing with the IRS Office of Appeals contesting the lien filing, and to further appeal to the Tax Court if the IRS determines to sustain the lien filing. In the course of the hearing, the taxpayer is entitled to contest the underlying tax liability because the taxpayer has had no prior opportunity to contest the liability. This is not a delinquent tax because it is not a final tax liability. Should the taxpayer seek tax court review, this will not be a final tax liability until the taxpayer has exercised all judicial appeal rights.

(iii) The taxpayer has entered into an installment agreement pursuant to I.R.C. 6159. The taxpayer is making timely payments and is in full compliance with the agreement terms. The taxpayer is not delinquent because the taxpayer is not currently required to make full payment.

(iv) The taxpayer has filed for bankruptcy protection. The taxpayer is not delinquent because enforced collection action is stayed under 11 U.S.C. 362 (the Bankruptcy Code).

(ii) The Offeror has /_/ has not /_/, within a three-year period preceding this offer, had one or more contracts terminated for default by any Federal agency.

(2) "Principal," for the purposes of this certification, means an officer, director, owner, partner, or a person having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a division or business segment; and similar positions).

This Certification Concerns a Matter Within the Jurisdiction of an Agency of the United States and the Making of a False, Fictitious, or Fraudulent Certification May Render the Maker Subject to Prosecution Under Section 1001, Title 18, United States Code.

(b) The Offeror shall provide immediate written notice to the Contracting Officer if, at any time prior to contract award, the Offeror learns that its certification was erroneous when submitted or has become erroneous by reason of changed circumstances.

(c) A certification that any of the items in paragraph (a) of this provision exists will not necessarily result in withholding of an award under this solicitation. However, the certification will be considered in connection with a determination of the Offeror's responsibility. Failure of the Offeror to furnish a certification or provide such additional information as requested by the Contracting Officer may render the Offeror nonresponsible.

(d) Nothing contained in the foregoing shall be construed to require establishment of a system of records in order to render, in good faith, the certification required by paragraph (a) of this provision. The knowledge and information of an Offeror is not required to exceed that which is normally possessed by a prudent person in the ordinary course of business dealings.

(e) The certification in paragraph (a) of this provision is a material representation of fact upon which reliance was placed when making award. If it is later determined that the Offeror knowingly rendered an erroneous certification, in addition to other remedies available to the Government, the Contracting Officer may terminate the contract resulting from this solicitation for default.

(End of Provision)

52.209-7 INFORMATION REGARDING RESPONSIBILITY MATTERS (OCT 2018)

(a) Definitions. As used in this provision--

"Administrative proceeding" means a non-judicial process that is adjudicatory in nature in order to make a determination of fault or liability (e.g., Securities and Exchange Commission Administrative Proceedings, Civilian Board of Contract Appeals Proceedings, and Armed Services Board of Contract Appeals Proceedings). This includes administrative proceedings at the Federal and State level but only in connection with performance of a Federal contract or grant. It does not include agency actions such as contract audits, site visits, corrective plans, or inspection of deliverables.

"Federal contracts and grants with total value greater than $10,000,000" means--

(1) The total value of all current, active contracts and grants, including all priced options; and

(2) The total value of all current, active orders including all priced options under indefinite-delivery, indefinite-quantity, 8(a), or requirements contracts (including task and delivery and multiple-award Schedules).

"Principal" means an officer, director, owner, partner, or a person having primary management or supervisory responsibilities within a business entity (e.g., general manager; plant manager; head of a division or business segment; and similar positions).

(b) The offeror [ ] has [ ] does not have current active Federal contracts and grants with total value greater than $10,000,000.

(c) If the offeror checked "has" in paragraph (b) of this provision, the offeror represents, by submission of this offer, that the information it has entered in the Federal Awardee Performance and Integrity Information System (FAPIIS) is current, accurate, and complete as of the date of submission of this offer with regard to the following information:

(1) Whether the offeror, and/or any of its principals, has or has not, within the last five years, in connection with the award to or performance by the offeror of a Federal contract or grant, been the subject of a proceeding, at the Federal or State level that resulted in any of the following dispositions:

(i) In a criminal proceeding, a conviction.

(ii) In a civil proceeding, a finding of fault and liability that results in the payment of a monetary fine, penalty, reimbursement, restitution, or damages of $5,000 or more.

(iii) In an administrative proceeding, a finding of fault and liability that results in--

(A) The payment of a monetary fine or penalty of $5,000 or more; or

(B) The payment of a reimbursement, restitution, or damages in excess of $100,000.

(iv) In a criminal, civil, or administrative proceeding, a disposition of the matter by consent or compromise with an acknowledgment of fault by the Contractor if the proceeding could have led to any of the outcomes specified in paragraphs (c)(1)(i), (c)(1)(ii), or (c)(1)(iii) of this provision.

(2) If the offeror has been involved in the last five years in any of the occurrences listed in (c)(1) of this provision, whether the offeror has provided the requested information with regard to each occurrence.

(d) The offeror shall post the information in paragraphs (c)(1)(i) through (c)(1)(iv) of this provision in FAPIIS as required through maintaining an active registration in the System for Award Management, which can be accessed via https://www.sam.gov (see 52.204-7).

(End of provision)

52.209-11 REPRESENTATION BY CORPORATIONS REGARDING DELINQUENT TAX LIABILITY OR A FELONY CONVICTION UNDER ANY FEDERAL LAW (FEB 2016)

(a) As required by sections 744 and 745 of Division E of the Consolidated and Further Continuing Appropriations Act, 2015 (Pub. L. 113-235), and similar provisions, if contained in subsequent appropriations acts, the Government will not enter into a contract with any corporation that--

(1) Has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability, where the awarding agency is aware of the unpaid tax liability, unless an agency has considered suspension or debarment of the corporation and made a determination that suspension or debarment is not necessary to protect the interests of the Government; or

(2) Was convicted of a felony criminal violation under any Federal law within the preceding 24 months, where the awarding agency is aware of the conviction, unless an agency has considered suspension or debarment of the corporation and made a determination that this action is not necessary to protect the interests of the Government.

(b) The Offeror represents that--

(1) It is [ ] is not [ ] a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability; and

(2) It is [ ] is not [ ] a corporation that was convicted of a felony criminal violation under a Federal law within the preceding 24 months.

(End of provision)

52.225-6 TRADE AGREEMENTS CERTIFICATE (FEB 2021)

(a) The offeror certifies that each end product, except those listed in paragraph (b) of this provision, is a U.S.-made or designated country end product, as defined in the clause of this solicitation entitled Trade Agreements.

(b) The offeror shall list as other end products those supplies that are not U.S.-made or designated country end products.

Other End Products:

Line item No.	Country of origin

[List as necessary]

(c) The Government will evaluate offers in accordance with the policies and procedures of Part 25 of the Federal Acquisition Regulation. For line items covered by the WTO GPA, the Government will evaluate offers of U.S.-made or designated country end products without regard to the restrictions of the Buy American statute. The Government will consider for award only offers of U.S.-made or designated country end products unless the Contracting Officer determines that there are no offers for such products or that the offers for those products are insufficient to fulfill the requirements of this solicitation.

(End Of Provision)

52.225-18 PLACE OF MANUFACTURE (AUG 2018)

(a) Definitions. As used in this provision;

"Manufactured end product" means any end product in product and service codes (PSCs) 1000-9999, except--

(1) PSC 5510, Lumber and Related Basic Wood Materials;
(2) Product or Service Group (PSG) 87, Agricultural Supplies;
(3) PSG 88, Live Animals;
(4) PSG 89, Subsistence;
(5) PSC 9410, Crude Grades of Plant Materials;
(6) PSC 9430, Miscellaneous Crude Animal Products, Inedible;
(7) PSC 9440, Miscellaneous Crude Agricultural and Forestry Products;
(8) PSC 9610, Ores;
(9) PSC 9620, Minerals, Natural and Synthetic; and
(10) PSC 9630, Additive Metal Materials.

"Place of manufacture" means the place where an endproduct is assembled out of components, or otherwise madeor processed from raw materials into the finished product thatis to be provided to the Government. If a product is disassembledand reassembled, the place of reassembly is not the placeof manufacture.

(b) For statistical purposes only, the offeror shall indicatewhether the place of manufacture of the end products itexpects to provide in response to this solicitation is predominantly##

[ ] (1) In the United States (Check this box if the totalanticipated price of offered end products manufactured in theUnited States exceeds the total anticipated price of offered endproducts manufactured outside the United States); or

[ ] (2) Outside the United States.

(End of provision)

52.252-1 SOLICITATION PROVISIONS INCORPORATED BY REFERENCE (FEB 1998)

This solicitation incorporates one or more solicitation provisions by reference, with the same force and effect as if they were given in full text. Upon request, the Contracting Officer will make their full text available. The offeror is cautioned that the listed provisions may include blocks that must be completed by the offeror and submitted with its quotation or offer. In lieu of submitting the full text of those provisions, the offeror may identify the provision by paragraph identifier and provide the appropriate information with its quotation or offer. Also, the full text of a solicitation provision may be accessed electronically at this/these address(es):

FAR: https://www.acquisition.gov/browse/index/far
CAR: https://www.acquisition.gov/car

(End of Provision)

ADDENDUM to 52.212-1, INSTRUCTION TO OFFERORS - COMMERCIAL PRODUCTS AND COMMERCIAL SERVICES

The solicitation is a Request for Proposal (RFP). The solicitation document and incorporated provisions and clauses are those in effect through Federal Acquisition Circular (FAC) 2023-02 dated March 16, 2023. This acquisition is being solicited as full and open for commercial items and services as defined in FAR Subpart 2.101. Interested parties shall respond by submitting a proposal accordingly.

A. Period for Acceptance of Offers. Proposals shall remain valid for acceptance for a minimum of 90 days from receipt of proposal.

B. Inquiries: All questions concerning this solicitation shall be submitted via email to the Contract Specialist Nina Lin at nina.lin@nist.gov and the Contracting Officer Donald Collie at donald.collie@nist.gov. Questions should be received no later than seven (7) calendar days after the issuance date of this solicitation. All responses to the questions will be made without identification of the questioner and will be posted on SAM.gov as an amendment to the solicitation on a Standard Form (SF) 30.

C. Proposals are expected to conform to solicitation provisions.

D. Due Date For Offers: Proposals shall be submitted by the due date and time specified in the SAM.gov announcement via email to the Contract Specialist, Nina Lin, at nina.lin@nist.gov and the Contracting Officer, Donald Collie, at donald.collie@nist.gov. The solicitation number shall be referenced in the subject line of email. Fax, postal, or hand-delivery submissions will **NOT** be accepted. Proposals received after this date and time are late and will not be accepted.

PROPOSAL CONTENT:

Each proposal shall consist of three separate electronic files with the following content:

Volume I – Technical Proposal
Volume II – Experience and Past Performance
Volume III – Price Proposal and Terms and Conditions

Volume I - Technical Proposal: No pricing information shall be included in this volume. It shall consist of technical descriptions and product literature for the proposed products and services. The submission must demonstrate how the proposed products and services meet or exceed each requirement described in the Statement of Work (SOW) by providing a citation to the relevant section of its technical description or product literature. The offeror shall complete a line-by-line response to each requirement set forth in the Statement of Work. The Contractor shall respond as “exceed”, "meets” or “does not meet”. “Exceeds” means the Contractor meets every aspect of the required specification and exceeds one or more aspects of the required specification. The exceedance shall be clearly documented in the quotation; “Meets” means the Contractor meets every aspect of the required specification as stated in the solicitation. “Does Not Meet” means the Contractor does not meet one or more aspects of the required specification. Those aspects that do not meet shall be clearly documented in the quotation. The offeror shall also provide a reference to where its technical description of product literature supports the selection of “meets” or “exceeds.”

The offeror shall also provide lead times, from the date of award, for delivery of all line items listed in the Schedule and a milestone schedule indicating dates for the delivery of the equipment, installation of the equipment, and training. The milestone schedule shall adhere to the following:

- Delivery: No earlier than 12 months after receipt of order and no later than 24 months after delivery.
- Installation of the instrument shall be completed on site not later than 6 months after delivery.
- The system shall be ready for final acceptance testing not later than 6 months after installation begins.

- Training: Shall be scheduled at acceptance of the instrument. Scheduling of training shall be coordinated with NIST's technical contact.

Volume II – Experience and Past Performance:

Experience: Offerors shall provide evidence of corporate experience (either as a prime contractor or as a significant subcontractor) completing similar scoped contracts. Submit up to three examples via Attachment A-Experience Project Data Sheet. Offerors shall also provide resumes and discussion that explains the level of experience in similar projects and expertise in the areas of TEMs of key service personnel proposed.

Past Performance: Offerors shall provide past performance information regarding relevant contracts over the past three (3) years with Federal, state, or local governments, or commercial customers. At least one (1) of these references shall be for an experience used by the offeror in its above Experience submission. If the offeror intends to subcontract with another firm(s) for part of this requirement, that firm's past performance information shall also be provided. If the offeror has no relevant past performance, it may include a statement to that effect in its proposal. The government reserves the right to consider data obtained from sources other than those described by the offeror in its proposal. It is recommended that up to three contracts be referenced.

The description of each contract/order described in this section shall not exceed one half page in length. For each contract/order, the offeror shall provide the following information:

1. Contract number;
2. Product Number or Service provided.
3. Description and relevance to solicitation requirements including dollar value and ability to meet similar SOW requirements.
4. Period of Performance – indicate by month and year the state and completion (or "ongoing") dates for the contract;
5. Reference Contact – If a non-Government contract, identify the name and address of the client with current telephone number and email address of a point of contact of the client responsible for the contract;
6. Contracting Office – If a Government contract (Federal or state), identify the Contracting Officer (CO), and Contracting Officer's Representative (COR), and their names, current telephone numbers and email addresses.
7. Problems Encountered – include information regarding information regarding any problems encountered on the contracts described above and corrective actions taken to resolve those problems.

Volume III - Price Proposal and Terms and Conditions:

1. Completed price schedule (SF 1449 pages 3-4) to include a firm-fixed price for each line item and the total offer amount for all line items. Information concerning discounts shall also be included.

2. **Completed SF 1449 including Offeror's SAM UEI Number, point of contact information with name, telephone number, and email address.** The person signing the SF 1449 shall have the authority to commit the Offeror to all of the provisions of the proposal, fully recognizing that the Government has the right, by the terms of the solicitation, to make an award without further discussion if it so elects.

3. **Signed SF 30 amendments to the solicitation**, if any are issued.

4. **Completed Offeror Representations and Certifications**, which can be referenced in the Offerors SAM registration at www.SAM.gov.

5. Completed copy of all FAR provisions listed below, which are highlighted and listed in full text within this solicitation withing the section for Solicitation Provisions.

a) 52.204-17, Ownership or Control of Offeror (Aug 2020)
b) 52.204-26, Covered Telecommunications Equipment or Services - Representation (Oct 2020)
c) 52.209-2, Prohibition on Contracting With Inverted Domestic Corporations-Representation (Nov 2015)

d) 52.209-5 Certification Regarding Responsibility Matters. (Aug 2020)
e) 52.209-7 Information Regarding Responsibility Matters. (Oct 2018)
f) 52.209-11 Representation by Corporations Regarding Delinquent Tax Liability or a Felony Conviction under any Federal Law (Feb 2016)
g) 52.225-6, Trade Agreements Certificate (Feb 2021)
h) 52.225-18, Place Of Manufacture (Aug 2018)

6. **Acceptance of terms:** This is an Open-Market Solicitation for products and services as defined herein. The Government intends to award a single award contract as a result of this solicitation that will include the terms and conditions that are set forth herein.

Acceptance of Terms and Conditions (Addendum to FAR 52.212-1(b) (11)):

If the contractor objects to any of the terms and conditions contained in this solicitation, the contractor shall state **"The terms and conditions in the solicitation are acceptable to be included in the award document with the exception, deletion, or addition of the following:"** *[Contractor shall list exception(s) and rationale for the exception(s)].* It is the sole responsibility of the contractor to identify in their quote any exceptions to the terms and conditions of the solicitation. If the contractor does not include such a statement, the submission of a proposal in response to this solicitation will be regarded as the Contractor's acceptance of the Government's terms and conditions for inclusion into the resultant purchase order.

Note: This procurement is not being conducted under the GSA Federal Supply Schedule (FSS) program or another Government-Wide Area Contract (GWAC). If an Offeror submits a proposal based upon an FSS or GWAC contract, the Government will accept the proposed price. However, the terms and conditions stated herein will be included in any resultant contract, not the terms and conditions of the Offeror's FSS or GWAC contract, and the statement required above shall be included in the proposal.

LIST OF ATTACHMENTS:

Attachment A: Experience Project Data Sheet

(End of Addendum to Provision)

ADDENDUM to 52.212-2, EVALUATION - COMMERCIAL PRODUCTS AND COMMERCIAL SERVICES

Evaluation Criteria

A. **Basis of Award**

This contract is to be awarded to the most highly qualified offeror based on the selection criteria. The Government intends to use a price/non-price tradeoff process to award a contract to the responsible Offeror whose proposal represents the best value to the Government, evaluated price and other factors considered. The Government reserves the right to make an award to other than the lowest-priced Offeror or to the Offeror with the highest technical rating if the Contracting Officer determines that to do so would result in the best value to the Government. The Contracting Officer intends to award without discussions but reserves the right to initiate discussions if necessary. The following factors will be used to evaluate offers:

Factor 1 – Technical
Factor 2 – Experience
Factor 3 – Past Performance
Factor 4 – Evaluated Price

In determining best value, non-price factors 1 through 3, when combined, shall be more important than factor 4 evaluated price. The Non-Price Factors 1, 2, and 3 are considered equally important, while Factor 4 is considered less important than each of Factors 1, 2, and 3. Upon evaluation, if a proposal is deemed Unacceptable on any given non-price factor, that proposal may not be evaluated further by the Government.

B. **Evaluation**

Offerors will be evaluated using the following evaluation criteria. To be considered for award, offerors must be technically acceptable in all evaluated areas.

Factor 1: Technical

The Government will evaluate the adequacy of the proposed solution to meet solicitation requirements. This includes the nature and duration of proposed warranty(ies). Stronger preference may be given in the following SOW areas:

1.1. CLIN 0001, Specification 1.1.2.2: the ability to provide increased CFEG emission current stability than the required specification of a 10 % decrease over 2 hours. Stronger consideration will be given to a longer duration over which the 10 % decrease occurs.
1.2. CLIN 0001, Specification 1.1.2.4: the ability to provide shorter source exchange times than the required specification of 2 weeks.
1.3. CLIN 0001, Specification 1.3.1: the ability to provide a smaller energy spread of the CFEG than the required specification of 0.4 eV FWHM. Smaller values will receive greater consideration.
1.4. CLIN 0001, Specification 2.3.1: the ability to provide smaller values of STEM beam drift than the required specification of 0.5 nm/min
1.5. CLIN 0001, Specifications 2.3.2.1, 2.3.2.2, and 2.3.2.3: The specified STEM resolution for a 100 pA of probe current is: 50 pm at 300 keV, 60 pm at 200 keV, and 96 pm at 80 keV. Stronger consideration will be given to smaller values of STEM resolution larger currents.
1.6. CLIN 0001, Specifications 3.3.1 and 3.3.2: the ability to provide smaller values of stage drift than the required specifications of 0.5 nm/min (30 minutes after specimen exchange) and 0.1 nm/min (1 minute after macroscopic stage movement. Stronger consideration will be given to lower rates of stage drift.
1.7. CLIN 0001, Specification 7.1.3: the ability to provide greater values of solid angle of collection for EDX than the required specification of 2.0 steradians. Larger values of collection angle will receive stronger consideration.

1.8. CLIN 0001, Specification 8.3.1: the ability to provide improved energy resolution for EELS than the required specification of 0.27 eV at 60 keV beam energy. Smaller values will receive greater consideration.
1.9. CLIN 0001, Specification 10.4.5: the ability to provide full-resolution streaming during remote operation.
1.10. Warranty, Specification 2: the ability to provide a longer-term warranty for the cold field emission gun than the required specification of 1 year.

Factor 2: Experience

The Government will evaluate the Offeror's previous experience to determine the level of experience the Offeror possesses in providing the requirements as defined in the SOW. The Government will consider the experience of the prime contractor and any of the prime contractor's key subcontractors. The Government will only evaluate the descriptions of the previous experience that is provided in the Offeror's proposal. The degree of relevance between the projects submitted and the work required in the SOW shall be considered. Furthermore, NIST will evaluate service personnel experience, specifically the number of years working with TEMs, and knowledge and expertise in the field of TEMs.

Factor 3: Past Performance

The evaluation of past performance information will consider the extent to which the Offeror's past performance demonstrates the capability and capacity to meet requirement of the SOW. Offerors will be evaluated on the responses and feedback received to a government-requested survey sent to their identified previous customers for similar projects/contracts. Scoring will be made on the basis of the level of similarity and complexity of the work performed and survey respondents' satisfaction level of the offeror's quality of products/deliverables, timeliness of delivery, responsiveness/communication, and overall satisfaction with the offeror's performance.

Note: Offerors without a record of relevant past performance or for whom information on past performance is not available, will be not be evaluated favorably or unfavorably on Past Performance, and will be assigned a Neutral rating.

Factor 4: Evaluated Price

Price will be evaluated on proposals that are acceptable in the non-price factors within the solicitation. The price proposal will be evaluated to determine price fairness and reasonableness. The Government will determine the evaluated price by adding the total of all proposed CLINs for each year, including options. If an offer is for a foreign end product, NIST will follow the requirements of FAR Part 25 to make any appropriate adjustments to the proposed price to derive the evaluated price for that offer.

Adjectival Ratings

Where applicable, the Government will evaluate the Technical Proposal using the following adjectival ratings:

Adjective	Description
Exceptional	Greatly exceeds minimum requirements of the criteria; has a high probability of success; contains no weaknesses or deficiencies.
Good	Exceeds the minimum requirements of the criteria; has an above average probability of success; contains no significant weaknesses and only minor, correctable weaknesses exist.
Acceptable	Meets the minimum requirements of the criteria; has an average probability of success; no significant weaknesses and deficiencies can be readily corrected.
Marginal	Fails to meet one or more of the minimum requirements of the criteria; low probability of

	success; major weaknesses and/or significant number of deficiencies exist.
Unacceptable	Fails to meet the minimum requirements of the criteria; proposal needs major revisions; very low probability of success.

Please note: any proposal that receives a 'marginal' or lower rating, in any category, will not be considered for award.