

2. AMENDMENT/MODIFICATION NO. 0001	3. EFFECTIVE DATE 08/22/12	4. REQUISITION/PURCHASE REQ. NO. 63-5049-12	5. PROJECT NO. (If applicable)
6. ISSUED BY	CODE	7. ADMINISTERED BY (If other than Item 6)	CODE

CONTRACTING OFFICER
 Naval Research Laboratory, Code 3230.SL
 4555 Overlook Ave., SW
 Washington DC 20375-5326

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)	(X)	9A. AMENDMENT OF SOLICITATION NO.
TO ALL OFFERORS	X	N00173-12-R-MI06
		9B. DATED (SEE ITEM 11) 08/10/12
		10A. MODIFICATION OF CONTRACT/ORDER NO.
		10B. DATED (SEE ITEM 11)
CODE	FACILITY CODE	

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers is extended, is not extended.
 Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:
 (a) By completing items 8 and 15, and returning 1 copies of the amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted;
 or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment your desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)

**13. THIS ITEM ONLY APPLIES TO MODIFICATION OF CONTRACTS/ORDERS.
 IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.**

CHECK ONE	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor is not, is required to sign this document and return 1 copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

SEE ATTACHED

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)	16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)		
15B. CONTRACTOR/OFFEROR	15C. DATE SIGNED	16B. UNITED STATES OF AMERICA	16C. DATE SIGNED
(Signature of person authorized to sign)		(Signature of Contracting Officer)	

The purpose of this Amendment is to revise the Specification.

1. The Specification Documentation reads as follows.

The Naval Research Laboratory (NRL) has a requirement for a high resolution scanning electron microscope (SEM) system designed for automatic operation. This system must have a field emission electron source, and must include a high speed Electron Backscattered Diffraction (EBSD) system also designed for automatic operation. Additionally the SEM must be compatible with and configured for future Energy-dispersive X-ray Spectroscopy (EDS) analysis hardware. Specific requirements are as follows:

The Field Emission Scanning Electron Microscope must meet or exceed these requirements:

1. Electron gun and column assembly:

- a.) The microscope must be equipped with a Schottky-type field emission gun.
- b.) A resolution of $\leq 1.2\text{nm}$ at 30kV and $\leq 2.5\text{ nm}$ at 3 kV.
- c.) The probe current range must be from 1 picoAmp to at least 100 nanoAmps.
- d.) The accelerating voltage must include the range 0.2 – 30 kV.
- e.) Electromagnetically controlled final aperture adjustment.
- f.) Fully automated electron optics adjustment.

2. Detectors:

- a.) The system shall include a secondary electron SE detector.
- b.) The system shall include a single-crystal YAG Backscattered Electron (BSE) Detector.
 - I.) The BSE detector shall be retractable and motorized.
 - II.) The position of the BSE detector shall be controllable by an external Application Programming Interface (API).
- c.) Integrated Picoammeter with continuous readout.
- d.) Infrared (IR) chamber camera.

3. Vacuum System:

- a.) Turbomolecular pump with Lubricant Free Dry Scroll backing pump

4. Stage/Chamber:

- a.) Stage must be at least a 5-axis stage (X,Y,Z Translations, Rotation, Tilt).
- b.) Capable of tilting to at least -30° to 90° about the stage axis that is compatible with EBSD analysis.
- c.) Capable of 360° sample rotation; NRL prefers continuous rotation.
- d.) X,Y,Z translations \geq 100mm
- e.) Allow for a maximum sample height of up to 100mm.

5. Chamber:

- a.) The chamber must be compatible with a future addition of a plasma cleaner. Any chamber modifications necessary for an install of a possible plasma cleaner must not require removal from the installation site.
- b.) The chamber must be equipped so as to receive an EBSD detector and also must allow for future upgrades of an simultaneous EDS detector without removal of the system from the installation site.

6. Specimen exchange:

- a.) The system shall be equipped with an automatic load lock. The load lock sample exchange must be fully automatic including:
 - I.) The sample can be placed on the exchange mechanism without additional screws or clamping
 - II.) The system will then automatically bring the sample into the vacuum chamber, place the sample on the SEM stage, and bring the chamber to the proper vacuum automatically
 - III.) All of these functions must be able to be executed through an API calls to external software.
- b.) The accuracy of the loading of the system must be equal to or less than +/- 0.25mm and a angular accuracy of +/- 0.25 degrees rotation.

7. Scanning/imaging:

- a.) The system must be able to collect and save images from built in detectors at least 8k x 8k pixels at 16bit/pixel.
- b.) Multiple scanning speeds must be selectable by the user, and the option of a reduced-screen scanning mode as well as a point mode are required.
- c.) Dynamic Focus correction must be included.
- d.) NRL prefers that scan tilt correction be included.

8. SEM Automated Control:

- a.) Besides the API functions already discussed, the system shall be able to be controlled through a user designed external program through OEM supplied API that includes control of:

Beam voltage, current, working distance

Scanning parameters including magnification, scan speed, image pixel size, and switching to and from external scan control.

Stage control including getting/setting stage position for all five axis.

Additionally this remote capability must be addressable through TCP/IP protocols.

9. Future compatibility:

- a.) The SEM system must be designed so that in the future, a EDS system can be added to the SEM that and position must be compatible with simultaneous EBSD/EDS data collection.
- b.) The SEM must be designed so that in the future an in-situ plasma cleaner could be added to the system.

EBSD System:

10. EBSD Camera:

- a.) The EBSD camera must be capable of collecting EBSD patterns at least 640 x 480 pixels with no applied pixel binning.

- b.) The collection rate must be at least 630 patterns per second at 4 x 4 pixel binning.
- c.) The insertion of the EBSD camera must be motorized and vacuum integrity must be maintained during detector insertion and retraction.
- d.) The face of the camera must have tilt adjustment to maximize EBSD pattern quality at small to large working distances. This adjustment must be accessible while in the camera is inserted in the chamber without breaking vacuum.

11. EBSD control computer/software:

a.) All computers, monitors, and other hardware accessories necessary for the operation of the EBSD software and hardware must be included. Any additional hardware, such as beam control or camera position control hardware, must be included. Software for both the collection and the processing of EBSD data must be provided:

- A workstation computer and applicable software must be supplied with the system to control the EBSD system and data collection and processing, and saving data to disk (≥ 1 TB drive preferred).

- The software shall perform automated indexing of the EBSD patterns collected. The indexing must be able to be performed as the patterns are collected, or off-line as a post collection process.

- The EBSD analysis software must be able to create IPF, Euler, Grain boundary and Phase Maps, Pole figures, and Orientation densities. Also analyze Schmid factor, and misorientation kernel.

12. EBSD automation:

a.) The system shall include a OEM provided Application Program Interface (API) that allows an external, user-written program to control the EBSD collection system including:

- The insertion and retraction of the EBSD camera.
- Reading and exporting individual EBSD patterns from the camera
- Setting up scan areas and parameters, starting these scans and saving the data to disk.
- Exporting the data from the file to common text/image formats.

13. Future compatibility:

a.) The EBSD system must be designed so that in the future, a EDS system can be added the SEM that allows for simultaneous EBSD/EDS data collection.

14. Delivery Date:

Delivery shall be no later than 150 days from the date of award.

15. Warranty:

- A minimum, a warranty of twelve months from receipt of equipment including mechanical, optical and electrical parts and labor on defects in the system and on the specifications of the system is required.

16. Documentation (manuals):

- NRL requires (1) electronic copy in either PDF or Microsoft Word format of the following documents: the Operation and Maintenance Manuals, the Interface Control Document (ICD), the Installation Manuals, and the Documentation for the API functions.

17. Optional features that should be priced separately:

SEM Control knob board

Integrated Plasma Cleaner for SEM chamber

Forward/Backscatter solid state detectors integrated with EBSD system

2. All other terms and conditions remain unchanged.