STATEMENT OF WORK FORMAT
X-RAY DIFFRACTOMETER SYSTEM

PCN: 4200504126

Background
NASA Goddard Space Flight Center's (GSFC) Detector Development Laboratory (DDL) produces metallic thin film circuits on semiconductor wafers for technology demonstrations and flight hardware of detector focal planes and other components. An essential tool required for verifying the stoichiometry (chemical composition), crystal structure, thin film stress, and crystallite grain size of these thin metallic films is an X-ray Diffractometer System. Knowledge of the composition and crystallinity of thin metallic films used to produce ultrasensitive detector technologies is critical for their quality control. Consequently, an X-ray Diffractometer System is an integral component in any laboratory producing such components.

An alternative to procuring an X-ray Diffractometer System has been to go outside of NASA to use other facilities capable of X-ray Diffractometry, which results in throughput reduction and logistical difficulties.

Objectives
The objective of this project is to procure an X-ray Diffractometer System, which consists of an X-ray Diffractometer and a workstation required to operate the X-ray Diffractometer.

No prototypes or one-of-a-kind systems will be considered. The unit must be a production model with at least 5 similar units working in the field.

Scope
The scope of this work includes production and delivery of an X-ray Diffractometer System capable of analyzing thin metallic films on Si wafers in the GSFC DDL. This includes the following:

a) Design of the X-ray Diffractometer System at the vendor location.
b) Approval of the design by the GSFC technical representative, communicating requirements to GSFC for installation including electrical power needs, gasses vacuum and other utilities as required.
c) Construction of X-ray Diffractometer System at the vendor facility.
d) Phase I testing of the X-ray Diffractometer System at the vendor facility by NASA, which will consist of vendor demonstrating basic operation of system.
e) Crating and Shipping the unit to GSFC where the vendor's personnel shall install it in the DDL.

f) Installing, demonstrating, and training, of approximately three GSFC personnel, on the X-ray Diffractometer System at GSFC.
g) Phase II/acceptance testing of the X-ray Diffractometer System at NASA.

Tasks or Requirements

The Supplier shall provide a new X-ray Diffractometer System. The Supplier shall insure that the X-ray Diffractometer System is equipped with the following equipment and meet the following requirements prior to Acceptance of System:

X-ray Diffractometer System

A brand new unit is required; no used equipment or accessories, listed below, are acceptable.

Exterior surface parts shall be clean and free of grease or dust and compatible with operation in a Class 100 cleanroom environment. The system frame and covers shall be clean, and free of rust.

Has the ability to meet current industry standard requirements for safety including the use of Emergency Off (EMO) panic buttons, shielding, and interlocks for hazardous areas including high voltages and moving parts.

- X-ray Diffractometer
  - Enclosed in an interlock-secured radiation-safe protection box.
  - "X-rays On" indicator lamp.
  - Goniometer and/or detector on status indicator.
  - Power generator capable of accelerating electrons to a minimum of 40kV.
  - Appropriate plumbing required for power generator cooling.
  - Appropriate external chiller unit (if required) for power generator cooling.
  - Capable of producing Cu K-alpha x-rays (i.e., possessing, at a minimum, a Cu x-ray tube).
  - Theta-2 theta data acquisition, with goniometer arm having a 2 theta range: $4^{o} \leq 2\text{theta} \leq 100^{o}$ *or* having a fixed-position goniometer arm with a curved detector that subtends 2 theta$\geq 100^{o}$.

- Goniometer arm speed $0.1^{o} \leq 2theta/min \leq 50^{o}$ *or* having a fixed-position goniometer arm with a curved detector that subtends 2 theta$\geq 100^{o}$.

- Slit assembly for collimating x-ray beam; maximum admittance angle = 3°.

- Diffracted beam monochrometer *or* a diffracted *or* an incident beam optic for Cu K-alpha radiation.

- Maximum count rate of at least 10^{3}cps.

- Sample stage which can accommodate sample holder(s).

- Sample holder(s) which can accommodate thin metallic films on Si substrates (0.3-2 mm thick).

- At least one (1) material reference standard for X-ray diffractometry.

o Computer workstation

- PC, running Windows 7 ™ or higher with a color monitor and printer with all appropriate cables and ancillary hardware (e.g., keyboard, mouse, CD reader/writer, USB ports, Ethernet ports, and PCI cards as required).

- Operating software for safe X-ray diffractometer operation/control, and manual measurement and automated measurement modes for data collection.

- Analysis software which allows user to:
  - Overlay multiple x-ray scans.
  - Identify x-ray peak positions
  - Copy and paste scans into other applications and/or exporting of scan image to .bmp, .jpg, or .png file formats.
  - Access to raw (tab, comma, or space delimited) x-ray scan data.
  - Remove/eliminate background radiation.
  - Remove/eliminate Cu K-alpha 2 peaks.
  - Fit X-ray patterns to a library of known materials.
  - Determine crystallite size and lattice strain.

- Supplier shall provide Crating and Shipping.

The Government Technical Representative reserves the right to witness the acceptance testing procedure at the Contractor's site. The Contractor shall notify the Government Technical Representative within one (1) month of the pre-installation acceptance testing date.

The Supplier shall install the system on-site at GSFC's Detector Development Laboratory (DDL) or another, designated, laboratory in NASA/GSFC's Building 11 and provides operator training of the system. Together with GSFC technical personnel, the Supplier shall review the system, demonstrate and confirm that the system functions properly based on the processes outlined below.

At GSFC, the Supplier shall demonstrate the following:

- Operation of the X-ray diffractometer via the use of the operating software and acquisition of a diffractometry scan with the reference standard installed.
- Operation of the X-ray diffractometer via the use of the operating software and acquisition of a diffractometry scan with a Government-supplied sample (a Si substrate with a metallic thin film).
- X-ray peak analysis using the supplied software of the reference standard and Government-supplied sample scans.

Supplier shall provide an Operations Manual printed in clean room paper and full Documentation (One set of Hard Copy Manuals and Documentation).

Supplier shall provide a Warranty of at least 12 Months (Parts and Labor), guaranteed to meet factory specifications.

Installation and training shall be performed by a factory trained technician at NASA/GSFC.

Supplier shall provide references of users of similar X-ray Diffractometer Systems in a laboratory environment.

The technical merit of the Suppliers' proposal will be evaluated in terms of by how much they exceed the technical specifications listed in this statement of work in the following technical areas:

- X-ray count rate for a thin film sample.
- Goniometer angular scan range/Detector angular range.
- X-ray count rate for a powder sample.
- Number of distinct material reference standards for X-ray diffractometry.

Deliverables or Delivery Schedule
Deliver complete specified (as described above) system. Set up and install all components at GSFC (in B11 or in the DDL).

1. Demonstrate system with specified performance/acceptance criteria (described above). Acceptance of system will be conditional upon successful demonstration of functions.
2. Provide user training for equipment operation.
3. Equipment warranty on parts and labor for at least one year.
4. Operational manuals.
5. Spare parts kit.

Delivery Schedule
Within 22 weeks after receipt of order.

Government-Furnished Equipment and Government-Furnished Information
No Government-furnished equipment (GPE) and Government-furnished information (GFI) will be required

Security
The Supplier Representative who will be installing the X-ray Diffractometer System and Training NASA personnel must be a US Citizen

Place of Performance
The Construction of the X-ray Diffractometer System shall be performed at the Supplier's facilities

The Installation and Training shall be performed at NASA/GSFC, Greenbelt, Maryland.