# STATEMENT OF WORK FORMAT

## Flying Probe Tester

## September 2014

**Background**

- The Detector Systems Branch needs a Flying-Probe Test System for testing wafers with microelectronic circuits
- The flying-probe tester is an automated circuit tester for verifying the continuity and isolation of microelectronic circuits on semiconductor wafers
- The Flying-Probe Tester is necessary because previously used systems designed for circuit board testing and adapted to testing semiconductor wafers resulted in inaccurate probe placement and damage to tested wafers.
- This Flying probe Tester will be used for testing circuits for continuity and isolation on all projects requiring such capability

**Scope**

- The contractor shall deliver a Flying Probe Test System for semiconductor wafer and ceramic circuit testing. Initial installation and training shall be included.
- Packaging and Shipping costs shall also be included.

**Requirements**

- **Acknowledgement of purchase order**
    - The contractor shall confirm the flying probe system configuration with the NASA\GSFC technical representative within ten days after acceptance of the order.
- **The contractor shall deliver a Single-sided Flying Probe Test System with the following specifications:**
- **Configuration**
    - The wafers shall be manually loaded, tested, and unloaded in the horizontal position with four probes on the top side.
    - Vacuum chuck for up to 150mm (6”) semiconductor wafers or ceramic circuits with future upgrade capability to 200mm (8”)
    - A connection shall be provided for direct contact to the chuck for measurements relative to the chuck (test substrate)
    - Four moving probe heads equipped with MicroProbe probing needles

- Digital Signal Processor (DSP) for each test head for improved evaluation of position and measured values
- Automatic optical alignment of the probe tips to the test device
- Two High Resolution Cameras 1024 X 768 pixels; 5 micron/pixel, attached to two of the probe heads
- Operating System(OS): Win7 with capability for future OS and Software upgrades

- Multi-image operation – test of different layouts in one panel
- Lowest contact pressure 0.2 grams using MicroProbes probing needles
- Test Parameter Specifications
  - Continuity test: 1 ohm -10k ohm
  - Isolation
  - Micro-short detection up to 250 V
  - High Voltage Test up to 500 V
  - Isolation up to 25 M ohm (FM)
  - Isolation up to 10 G ohm (ohmic); 500V HV test
  - Four-probe (Kelvin) test capability

- **Performance Specifications**
  - Wafer Thickness: 0.020 mm to 5 mm
  - Minimum test device size 10mm X 10mm
  - Maximum test device size 330mm X 610mm
  - Smallest Pad Size: 10um
  - Smallest Testable Pitch: 30um
  - Probe Positioning Resolution: +/- 0.5 um
  - Repeatable Accuracy: +/- 3um
  - "No Damage" specification is defined as maximum of 1000 nm deep indentation with 1000 hits in the same location

- **Software Environment**
  - <u>General Requirements</u>
    - Shall be Windows 7 compatible and allow tester system user accounts.
    - Shall have compatible Ethernet, TCP/IP network connection to be able to have access to files on other computer systems.
    - Accepts IPC-D-356A format circuit layout/netlist description data in either English or Metric Units.
    - Shall be menu and mouse driven interactive software interface providing graphical viewing and editing of netlist and probe points including adding or deleting probe point locations to the circuit database.
    - Shall allow user to switch between English or Metric Units when processing the circuit data for parts to be tested, without having to reload the IPC circuit description file.
    - Ability to measure distances of design layout elements in the user set units (English or Metric).

- Ability to automatically stagger a group of linear probe point coordinates.

- <u>Test Set-Up Designation:</u>
  - User shall be able to define and identify nets by type (ex: power, ground, signal, etc.), as well as create definitions of embedded resistor, capacitor, inductor, or diode components to be electrically characterized by the tester.
  - Ability to graphically select or unselect desired probe points or net types in the circuit database, to be used in electrical isolation and continuity testing.
  - Allows the user to identify which physical layout features (minimum capability of ten) should be used as fiducials for automatic optical scan alignment.
  - Ability to set test parameters for a test run (type of test, voltage or current levels, measurement ranges/thresholds, whether to have and number of retests, etc.)
  - Ability to set up an isolation (shorts) test to allow certain nets (such as a ground plane) to be tested against all other nets being tested.
  - A method to minimize the number of probe hits to frequently probed test pad locations.
  - Ability to set probe contact force (down to 200mg) and z-direction approach speed (down to 10 mm/sec).
  - Ability to set a number of errors threshold level after which a test program will abort a test.
  - Once a test program has been created, but before the test program is run, the user shall be able to print out the test set-up parameters including a list of all net(s) being tested, probe point locations to be probed, type of test to be performed (isolation, continuity, etc.), and electrical settings pertaining to the test.
  - Ability to send a probe (with camera video image) to a location specified as either a probe point location which is already part of the circuit database, or a new location specified with X/Y coordinates.

- <u>Adjacency Definition for Isolation (Shorts) Testing:</u>
  - Allows the use of an external CAD software created adjacency file for isolation testing to be enabled or disabled.
  - Without an external adjacency input file, the software shall have the ability to calculate adjacency parameters to create an adjacency-based isolation test program which may be done within the same layer, or in a 3D profile (z-direction), or both, using an adjacency distance setting between 1 micron and the extents of the wafer being tested.

- Test Procedure:
    - Displays real-time test results either graphically or in list format.
    - Ability to step through a test program measurement-by-measurement (as in a "debug" mode) with actual measurements.
    - Ability to pause a test program as it is running and to resume running the test program after the pause.
    - Ability to stop and cancel (abort) a test program while it is running.

- Test Results and Reporting, and Miscellaneous Functions:
    - Ability to create test result files in either an MS Excel file format or as a text file that could easily be loaded into MS Excel. (This includes the ability to save all test parameters and test results in a single retrievable file as well as the ability to save only parameters specified by the user to a file.)
    - Allows the user to specify which test parameters to be listed graphically as well as in the Excel or text file format.
    - Ability to graphically display (within an image of the circuit layout) errors found from a test run.
    - Self-Diagnostic software routines must be included for trouble-shooting minor issues with the tester system.

- **Calibration Standard**
    - Standard Board (FR4 or equivalent) for alignment and calibration of the flying probe tester

- **Source Inspection**
    - NASA\GSFC will provide two types of sample wafers to be tested at the contractor's site prior to shipping the flying probe tester.
        - Wafers with 10um minimum pad size with a pitch of 30um to demonstrate the accuracy and pad size requirement
        - Wafers with a typical type of test pattern will be tested to demonstrate the "no damage" requirement
        - Four-probe (Kelvin) measurement demonstration
    - The samples will be evaluated for repeatable accuracy and damage to the pads.

- **Installation and Training**
    - The contractor shall assist NASA\GSFC personnel with the installation and initial start-up of the flying probe tester as required
    - The contractor shall train at least two NASA\GSFC on the operation and maintenance of the flying probe tester

- **Documentation**
    - Contractor shall provide technical support (normal business hours EST/EDT), training on the use of the software and hardware systems and a soft copy of all applicable Operating, Technical and Maintenance manuals. A hard copy on cleanroom paper is optional.

**Deliverables or Delivery Schedule**

- The contractor shall deliver a Single-sided Flying Probe Test System with four probes on the top side with a vacuum chuck for holding up to 150mm (6”) semiconductor wafers or ceramic circuits with upgrade capability to 200mm (8”) wafers. Delivery shall be to NASA\Goddard Space Flight Center (GSFC) within 16 weeks after acceptance of order.
- Delivery of the Flying Probe Tester shall be within 120 days of acceptance of order. Initial set-up and training shall be completed within 30 days after system is installed at NASA\GSFC.
- A soft copy of all applicable Operating, Technical and Maintenance manuals shall be provided. A hard copy on cleanroom paper is optional.
- A minimum one year warranty shall be included

**Government-Furnished Equipment and Government-Furnished Information**

- Government-furnished equipment (GPE) and Government-furnished information (GFI) is not anticipated

**Place of Performance**

- The fabrication of the flying probe tester is to be performed at the contractor’s site and the installation and training is to be performed at NASA\GSFC.

**Period of Performance**

- **The performance period shall be completed within 150 days including initial setup and training.**