

**STATEMENT OF WORK ASSOCIATED WITH IMPLEMENTING ARRANGEMENT  
NUMBER 02 DELIVERY AND SUPPORT OF A 10V PROGRAMMABLE JOSEPHSON  
VOLTAGE STANDARD SUBJECT TO THE TECRO-AIT GUIDELINES BETWEEN THE  
TAIPEI ECONOMIC AND CULTURAL REPRESENTATIVE OFFICE IN THE UNITED  
STATES AND THE AMERICAN INSTITUTE IN TAIWAN FOR TECHNICAL  
COOPERATION ASSOCIATED WITH DELIVERY AND SUPPORT OF A 10V  
PROGRAMMABLE JOSEPHSON VOLTAGE STANDARD**

Objectives: AIT's designated representative, NIST, will construct one Programmable Josephson Voltage Standard System (PJVS), provide training on it at NIST in Boulder, and deliver it to TECRO's designated representative, ITRI. NIST has already developed similar prototype systems for its own use. The PJVS constructed for ITRI will be based on the latest NIST system design that is state-of-the-art in 2010. Some components will be fabricated by NIST according to existing and established fabrication protocols, and will meet performance specifications comparable to those expected for the NIST PJVS. Where components are commercially available, NIST will use components that are the same or equivalent to those used in existing NIST systems. Training in the maintenance and use of this PJVS will be on-site at NIST in Boulder. The cost to procure or fabricate components, to assemble and test the completed system, to train a new operator, and to provide consultation and support have been determined by prior experience.

Within 7 months after NIST receives the first payment

- 1) Research and development to improve the chip and system design for improved operating margins and performance.
- 2) Acquisition of commercial instrumentation and construction of custom hardware, including output driver amplifiers and cryoprobe.
- 3) Testing and selection of 10V PJVS chip.
- 4) Cost: \$99,000.

Within 34 months after ITRI receives the invoice from NIST

- 1) Acquire liquid He dewar, flex bond chip and complete system integration, including software user interface. Detailed system description is described below.
- 2) Thirty days training in Boulder, beginning after the system is constructed, as determined through mutual scheduling discussion between ITRI and NIST researchers. Travel costs for this training are not included in this proposal.
- 3) Preparation of 10V PJVS system delivery. ITRI will provide and arrange for "EX-WORKS Boulder" shipping and insurance.
- 4) Technical assistance, consultation and support as needed within 34 months after ITRI receives the invoice from NIST, including up to 3 replacement chips.

Cost: \$125,000.

## Description of delivered system:

## 10 V Programmable Josephson Voltage Standard

The purpose of the PJVS is to generate a set of stable, quantum-accurate, programmable voltages over the range from  $-10\text{ V}$  to  $+10\text{ V}$ . The system will be designed, built, and tested by NIST. The system will include the item description listed below, including operator training to be performed at NIST. NIST will not provide a microwave source (Agilent E8257D) or nanovoltmeter (Agilent 34420), because they both will be provided by ITRI.

Primary technical specifications are:

- 1) Operating voltage range  $-10\text{ V}$  to  $+10\text{ V}$  and  $>1\text{ mA}$  operating margins.
- 2) Operating frequency range DC to 500 Hz.
- 3) Operation in 100 liter liquid helium storage dewar (with 0.5 inch diameter auxiliary fill port and helium level meter).
- 4) Desktop computer controlled automation software for Labview (license not included).

| Item | Major Components  | Qty |
|------|---|-----|
| 01   | Flex-packaged 10 V JJ array chip  | 1   |
| 02   | Cryoprobe   | 1   |
| 03   | DC programmable bias electronics  | 1   |
| 04   | Microwave amplifier   | 1   |
| 05   | Microwave cables and connectors kit   | 1   |
| 06   | Agilent 33250A arbitrary waveform generator   | 1   |
| 07   | Desktop PC with Windows XP  | 1   |
| 08   | 19" Flat Panel LCD Monitor  | 1   |
| 09   | AC-PJVS control software (executable and source-code on CD, does not include Labview license)     | 1   |
| 10   | GPIB-USB-HS, NI-488.2 for Windows Vista/2000/XP   | 1   |
| 11   | 3each-Type X2 double-shielded GPIB cable, (various lengths)                                       | 1   |
| 12   | 100 liter liquid helium dewar, with 0.5 inch diameter auxiliary fill port and helium level meter) | 1   |

Total cost of Research proposal and delivered system: \$224,000 USD

Bill to: ITRI through AIT  
1700 N. Moore Street  
Suite 1700  
Arlington, VA 22209  
Tel: 703-525-8474  
Fax: 703-841-1385

Ship directly to: ITRI  
Center for Measurement Standards  
Industrial Technology Research Institute  
E100, Bldg. 16, No. 321, Section 2, Kuang Fu Road  
Hsinchu, 30011, Taiwan  
Tel: 886-3-573 2114  
Fax: 886-3-572 6445

**Proposed payment and delivery details:**

- **Total Price:** \$224,000 expressed in U.S. Dollars.
- **Shipping Terms:** Net 45 days, EX-WORKS Boulder
- **Payment terms:** Cash in Advance - through TECRO and AIT, wire transfer to NIST, in two payments of \$99,000 and \$125,000. Work cannot commence until first payment is received, which must be within one month after ITRI receives the invoice from NIST to ensure completion of first stage of development. Second payment must be received within 7 months after the first payment in order to begin second development stage.
- **Destination Airport:** In Taiwan, location to be determined.
- **Mode of Transport and Shipment Instructions:** EX-WORKS Boulder. ITRI assumes all shipment responsibilities, including air transportation and insurance, upon pick up at Boulder.
- **Delivery time:** The system construction will be completed within 10 months after the first payment. Training to begin after the system is constructed. System will be ready for pick up in Boulder within 30 days from completion of training. Estimated delivery time (at NIST, Boulder pickup) is one year after the first payment.
- **Technical Assistance:** Training for system operation will be provided in Boulder as well as consultation and support as needed within 34 months after ITRI receives the invoice from NIST.
- **Exporter:** NIST, 325 Broadway, Boulder, CO 80305: Phone: 303 497-3670
- **Quote Expiration Date:** 09/30/2010
- **Period of Performance:** End date is 34 months after ITRI receives the invoice from NIST.