

Request for Quotation for Long-period MagnetoTelluric (MT) Instruments

EarthScope is a set of integrated and distributed multi-purpose geophysical instrumentation that will provide the observational data needed to significantly advance our knowledge and understanding of the structure and dynamics of the North American continent. Additional information can be found at the EarthScope web site, <http://www.earthscope.org/>.

The Incorporated Research Institutions for Seismology (IRIS) invites manufacturers to submit bids for long period (1-100,000 s) magnetotelluric (MT) instruments to be used over the next decade in the US Array component of Earthscope. Thirty of these instruments are planned for use in a campaign mode to provide MT responses across the United States with a site spacing of approximately 70 km. The remaining ten instruments are planned for installation as permanent MT stations for the duration of the project. Despite the different uses, a common instrument design is sought for all EarthScope MT instruments. Single unit pricing is required, as is pricing for quantities of 30, 35 and 40 units.

SENSORS:

1. 3 component magnetometer in integral, waterproof housing (waterproof at 3 m depth) designed to record periods from 1 sec to dc. Single cable from sensor to recording unit with waterproof connectors. Desirable features: Noise level of 10 pT/ Hz, or lower, at 1 Hz; long term drift of no more than 10 pT/day; least count resolution of 10^{-2} nT or smaller; temperature stability <0.1 nT/ $^{\circ}$ C. Required minimum specifications: Acceptable instruments cannot have noise levels higher than 20 pT/ Hz over entire frequency range; drift must be less than 10 nT per year; least count resolution of 2.5×10^{-2} nT (with the stated noise specification, the noise at 10 sec period will be larger than the least count resolution); orthogonality error <0.1 angular degree; temperature stability <0.15 nT/ $^{\circ}$ C.
2. Minimum of 2 telluric channels designed to record periods from 1 sec to dc (with external waterproof connectors for user supplied dipoles and electrodes). Desirable features: high input impedance of at least 10^{14} ohms, additional, third telluric channel; long-term drift when input to amplifiers shorted across precision 100 Ω resistor of no more than 0.1 μ V/day at room temperatures (15-25 $^{\circ}$ C); least count resolution of 1 μ V or smaller. Required minimum specifications: Input input impedance of at least 10^9 ohms; electric noise in band from 0.1-10 sec of less than 0.6 μ V p-p and noise current of less than 30 pA p-p; lightning protection on input to telluric amplifiers sufficient to prevent system damage in event of lightning strike on or near telluric lines (Note: vendor may choose method of lightning protection, although spark arrestors followed by banks of diodes may be

considered as one approach, wired in series ahead of the input to the telluric amplifiers).

DATA ACQUISITION MODULE:

24 bit A/D (minimum resolution)

Stability: typical 2 ppm/deg, less than 10 ppm/deg

Timing accuracy: error less than 1 millisecond, GPS disciplined

Data collection rate: 5-6 channels sampled at minimum of 1 sample/sec

Data storage: serial output AND onboard storage of at least 2 months of 1 Hz data on removable non-volatile memory module (256 MB modules or larger preferred). Vendor may specify choice of SD, CF or similar COTS devices. FAT file system on memory devices is strongly preferred.

Power requirement: 11-18 vdc, less than 1.3w, average power consumption. Battery may be internal, but waterproof connector for external battery and solar panel must be provided. Systems operating at lower voltages may be acceptable.

Environmental: watertight case to 3 m depth water is desirable, watertight case to 1 m is minimum required; operating temperature: -10-40 deg C

Instrument response must be provided as poles, zeros, or table of responses (f,amp,phase)

Noise spectrum from data acquisition module with shorted inputs must be provided

Vendors will supply estimate of mean time between failures for instruments.

DATA FORMAT:

Vendor to specify data format, although mini-SEED format is preferred. In order to facilitate testing by IRIS, vendor must supply simple, portable Fortran or C code to convert vendor format to ASCII data files in order to facilitate robust processing by IRIS

COMMUNICATION:

Required minimum specification: Serial communications protocol using RS-232 or USB.

Highly desirable feature: TCP/IP module using Ethernet hardware interface (unit will be plugged into local router for data transfer to an IP address; system cannot use UDP).

FIELD TEST:

Vendors responding to this RFQ are required to provide an instrument on loan to IRIS for a field test to be run by IRIS and EMSOC (Consortium for Electromagnetic Study of the Continents) personnel. The test will involve simultaneous, parallel operation of

candidate instruments for one month in a low noise environment to be chosen by IRIS. Time series data and instrument responses must be provided so that all data can be processed by IRIS and EMSOC personnel using software of their choice. EMSOC will provide electric dipoles, electrodes, solar panels, and any needed external batteries. Manufacturers are permitted to send a representative, but manuals provided with instruments must be sufficiently detailed that experienced MT personnel can operate station without assistance in the field.

Required: Communication will be tested by connecting candidate instruments to a portable computer via RS232 or USB and operating in a data logging mode while transferring serial data via a terminal emulation program such as *ProcommPlus*.

Highly Desirable: Communications will be tested by connecting candidate instruments to a LAN via a router, in which case they must transfer data successfully via TCP/IP. In the event that multiple vendors produce instruments of similar sensor noise and stability specification, instruments with TCP/IP and Ethernet functionality will be preferred over those without these capabilities.

WARRANTY AND SERVICE AGREEMENT:

Vendors are encouraged, but not required, to warranty the instruments for manufacturing defects for one year. Vendors are also encouraged, but not required, to include multiyear service agreements in bids. The lack of a service agreement in the bid will not influence evaluations.

SCHEDULE:

Dec 1, 2004: Completed bids are due at IRIS.

January 1, 2005: The evaluation committee will review the bids and select up to 4 instruments for field testing.

February 28, 2005: Selected instruments must be delivered to U.C. Riverside or vendor must supply reason why this date cannot be met.

March 21-25, 2005: Field installation in eastern California.

March 26-May 1: Field test

May 1-May 31: Analysis of data

June 1: The evaluation committee makes its final decision and notifies vendors.

Oct 3, 2005 : Delivery of 10 instruments due.

Oct 2, 2006: Delivery of 20 instruments due.

Oct 1, 2007: Delivery of up to 10 instruments due.

EVALUATION CRITERIA:

Manufacturers shall provide their own acceptance test results. Production units must also comply with these specifications and will be spot-checked at random to assure compliance (using a subset of the acceptance tests).

Instruments will be evaluated on the basis of meeting required specifications, technical performance (how well instruments adhere to vendor stated specifications and quality of impedance estimates derived from processing), reliability, ruggedness, ease of use, warranty, price and manufacturers history with similar contracts. Additional factors will include desirable specifications listed in this RFQ and the ability of the vendor to meet the delivery schedule.

All questions materially relating to this RFQ will be answered and copies of the questions and responses will be distributed to all manufacturers participating in this RFQ without identification of the source of the questions. Questions must be received no later than November 12, 2004.

All quotations will include any special gear necessary to install and set-up the stations in the field and upload data from the instruments.

All quotes should be valid for 180 days.

Electronic copies of all quotations are to be sent in Microsoft Word or PDF format to Jim Fowler at jim@iris.edu by close of business November 5, 2004. Materials that do not lend themselves to electronic transmission can be sent by regular mail to:

Jim Fowler
IRIS/PASSCAL – NMT
100 East Road
Socorro, NM 87801

Any questions should be addressed to Jim Fowler at the above email address (preferred) or by phone to (505) 835-5072.