the IRIS CONSORTIUM

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This letter is being sent directly to various geophysical instrument manufacturers and will also be available on the IRIS webpage (www.iris.edu/hq).

To Whom This May Concern,

The Incorporated Research Institutions for Seismology (IRIS) is a consortium of over one hundred U.S. universities dedicated to the operation of science facilities for the acquisition, management, and distribution of seismological data. IRIS programs contribute to scholarly research, education, earthquake hazard mitigation, and the verification of the Comprehensive Test Ban Treaty, in addition to the long-term stewardship of collected data. Primary support for IRIS comes from the National Science Foundation (NSF) through cooperative agreements and grants. Other sources of funding may include federal agencies, universities, private foundations, and individual donations.

IRIS is currently establishing a new pool of portable instrumentation for magnetotelluric (MT) studies at the PASSCAL Instrument Center (PIC, https://www.passcal.nmt.edu/) as part of the NSF-funded SAGE facility. More information on this activity can be found here: https://www.iris.edu/hq/programs/passcal/magnetotelluric_instrumentation

The MT instruments at the PIC will be used by Principal Investigators (PIs) to perform geophysical surveys in a variety of environments. We expect most PIs will be funded by the National Science Foundation and other national and international funding agencies. Specifically, IRIS will facilitate community access to:

- Magnetotelluric data loggers
- Magnetic field sensors, e.g. fluxgates and/or induction coils
- Electric-dipole receivers, e.g. electrodes and cabling
- Comprehensive PI training and dirt-to-desktop dataflow tools enabling the acquisition, processing, and archival of MT data and data products

IRIS plans to procure prototype units in the second half of 2019, perform testing and evaluation through early 2020, and procure an initial pool of instruments from 2020-2023. We would like to maximize the size of the PASSCAL MT pool for a variety of applications and are targeting a procurement size of 25-35 complete MT systems. IRIS is particularly interested in hardware and instrumentation that may be interoperable between manufacturers.

The following tables outline the required and desired characteristics for the various MT instruments we seek, grouped by subsystems. IRIS welcomes responses from vendors on what offerings are suitable in terms of performance

and availability. Vendors should also respond if there is a specific instrument solution that is not fully captured by the proposed characteristics or does not meet all desired specifications. All responses will remain confidential with IRIS and the subaward facility staff and MT governance.

Please send responses and questions to Andrew Frassetto (andy.frassetto@iris.edu). Responses are due by **August 16, 2019**.

Sincerely,

Andrew (Andy) M. Frassetto

Proposed General Features and Capabilities of PASSCAL MT Systems

	Required	Desired
Design	Compact, lightweight, ruggedized, with non-corrosive connectors	Water resistant standards equivalent to IP67
Data	Easily convertible timeseries format with documentation for conversion	HDF5 compatible format Embedded system (hardware) and station (installation) metadata State-of-health (e.g. system voltage) and environmental (e.g. temperature) logging
Communications	Real-time streaming for onsite quality assessment	Wifi connectivity (cableless) Telemetry capable
Temperature	-20 to 40 °C	-40 to 60 °C
Humidity		100%, non-condensing
Interoperability		Non-proprietary interfaces that are described in the spec-sheet with support available to facilitate cross-compatibility.
Dynamic Range	Specify dynamic range in effective number of bits for range of frequencies and/or sample rates (0.0001 Hz, 0.01 Hz, 1 Hz, 100 Hz, 10,000 Hz), when applicable	

Electrodes/Electric Dipole Receivers

Required	Desired
Durable, long-lasting, maintenance free in the field Details on: ● Chemistry ● Supporting electrolyte ● Form factor (size, weight, etc.) ● Recommended storage and maintenance procedure ● Recommended deployment procedure ● Expected lifetime ● Verifying sensor health (e.g. expected potential range and zero-offset contact resistance between two electrodes of same make and model) ● Thermal coefficient ● Usage in regions with high contact resistance* (e.g. polar applications) ● Minimum cable/wiring requirements ● Pricing with and without a custom wiring solution (if applicable)	Customizable connector to different wiring types Electrode and cabling system with resistance to animal disturbance and wind noise Non-toxic, non-aqueous hazard electrode chemistry

*We are interested in optional configurations that include buffer-amplifiers or other systems for making electric field observations in environments with high contact resistances.

Long Period System

	Required	**Desired**
Magnetic Field Sensor(s)	Vector magnetometer Specifications: Frequency range, dimensions, weight, power source (internal vs. external) Power budget (or include in system power requirement requested below) Instrument noise spectra between 0.0001 Hz to 10 Hz. Instrument calibration response, including method, error estimates for phase and amplitude, and description of how error was obtained Measured thermal stability	Noise level of <5 pT/√Hz at 1 Hz Temperature stability <0.1 nT/°C Specifications on instrument drift
Data Acquisition Unit/Data logger	Fully documented; simple to program, start/end data acquisition, and access/download Specify sampling rate Channels: 5 (Ex, Ey, Hx, Hy, Hz) Specify power requirements for 5 channel operation Define satellite timekeeping/location service Provide information on internal clock accuracy	Channels - 6 (Ex, Ey, Hx, Hy, Hz + additional input) Overall system power requirement <0.5 W GPS/GNSS capable

Wideband System

	Required	**Desired**
Magnetic Field Sensor(s)	Vector magnetometer Specifications: Frequency range, dimensions, weight, power source (internal vs. external) Power budget (or include in system power requirement requested below) Instrument noise spectra between 0.2 Hz to 5 Hz. Instrument calibration response, including method, error estimates for phase and amplitude, and description of how error was obtained Measured thermal stability	Noise level of <0.2 pT/√Hz at 1 Hz, and specify noise levels at the upper and lower operating bands Temperature stability <0.1 nT/°C Specifications on instrument drift
Data Acquisition Unit/Data logger	Fully documented; simple to program, start/end data acquisition, and access/download Specify acquisition and sampling structure Channels: 5 (Ex, Ey, Hx, Hy, Hz) Specify power requirements for 5 channel operation Define satellite timekeeping/location service Provide information on internal clock accuracy	Channels - 6 (Ex, Ey, Hx, Hy, Hz + additional input) Overall system power requirement <6W GPS/GNSS capable

IRIS also requests the following information:

- Terms for loan and/or lease of instruments for testing and evaluation
- Price points for:
    - 1, 5, 10, 15, 20 long-period data loggers
    - 1, 5, 10, 15, 20 wideband data loggers
    - 1, 5, 10, 15, 20 three-component magnetic field sensors
    - 3, 15, 30, 45, 60 single component magnetic field sensors
    - 5, 25, 50, 75, 100 electrodes/electric dipole receivers
- Units deliverable per year
- Service and support models
- Lead times for purchasing and servicing
- Mean time between failures
- Process to document and share problem reports and firmware updates with users
- Scope of instrument interface and data processing software
- Description of software licensing models and their flexibility
- System tolerances for surges/lightning
- Range of supply voltage