

Arizona State University
 Auburn University
 Baylor University
 Binghamton University, State University of New York
 Boise State University
 Boston College
 Boston University
 Brown University
 California Institute of Technology
 California State Polytechnic University, Pomona
 California State University, East Bay
 Carnegie Institution of Washington
 Central Washington University
 Colgate University
 Colorado School of Mines
 Colorado State University
 Columbia University
 Cornell University
 Drexel University
 Duke University
 Florida International University
 Georgia Institute of Technology
 Harvard University
 Idaho State University
 IGPP/Lawrence Livermore National Laboratory
 IGPP/Los Alamos National Laboratory
 Indiana University–Purdue University Fort Wayne
 Indiana University
 James Madison University
 Kansas State University
 Lamar University
 Lawrence Berkeley National Laboratory
 Lehigh University
 Louisiana State University
 Macalester College
 Massachusetts Institute of Technology
 Miami University of Ohio
 Michigan State University
 Michigan Technological University
 Missouri University of Science and Technology
 Montana Tech/University of Montana
 New Mexico State University
 New Mexico Tech
 North Carolina State University
 Northern Arizona University
 Northern Illinois University
 Northwestern University
 Oklahoma State University
 Oregon State University
 Pennsylvania State University
 Princeton University
 Purdue University
 Rensselaer Polytechnic Institute
 Rice University
 Rutgers University
 Saint Louis University
 San Diego State University
 San Jose State University
 South Dakota School of Mines and Technology
 Southern Methodist University
 Stanford University
 Stony Brook University
 Syracuse University
 Texas A&M University
 Texas Tech University
 Tulane University
 Virginia Tech
 Washington University in St. Louis
 West Virginia University
 Western Washington University
 Woods Hole Oceanographic Institution
 Wright State University
 Yale University
 The University of Alabama
 The University of Arizona
 The University of Kansas
 The University of Oklahoma/Energy Center
 The University of Tennessee, Knoxville
 The University of Texas at Arlington
 The University of Texas at Austin
 The University of Texas at Dallas
 The University of Texas at El Paso
 The University of Tulsa
 The University of Utah
 University of Alaska Fairbanks
 University of Arkansas at Little Rock
 University of California, Berkeley
 University of California, Davis
 University of California, Los Angeles
 University of California, Riverside
 University of California, San Diego
 University of California, Santa Barbara
 University of California, Santa Cruz
 University of Colorado Boulder
 University of Connecticut
 University of Delaware
 University of Florida
 University of Georgia
 University of Hawaii at Manoa
 University of Houston
 University of Illinois, Urbana Champaign
 University of Kentucky
 University of Maryland, College Park
 University of Massachusetts Amherst
 University of Memphis
 University of Miami
 University of Michigan
 University of Minnesota
 University of Missouri, Columbia
 University of Nevada, Las Vegas
 University of Nevada, Reno
 University of New Mexico
 University of New Orleans
 University of North Carolina at Chapel Hill
 University of Oregon
 University of Pittsburgh
 University of Puerto Rico
 University of Rochester
 University of South Carolina
 University of South Florida
 University of Southern California
 University of Washington
 University of Wisconsin–Madison
 University of Wisconsin–Milwaukee
 University of Wisconsin Oshkosh
 University of Wyoming



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 Washington, DC 20005
 202-407-7013

July 12, 2019

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](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,

A handwritten signature in blue ink, appearing to read 'Andy Frassetto', is positioned above the printed name.

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
<p>Durable, long-lasting, maintenance free in the field</p> <p>Details on:</p> <ul style="list-style-type: none"> ● 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) 	<p>Customizable connector to different wiring types</p> <p>Electrode and cabling system with resistance to animal disturbance and wind noise</p> <p>Non-toxic, non-aqueous hazard electrode chemistry</p>

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

Wideband System

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

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