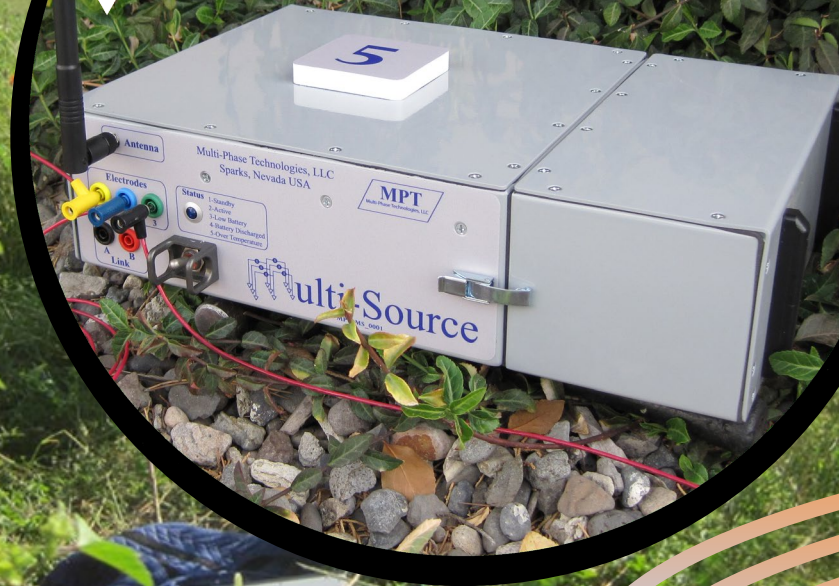


# multi- source



Multi-Source Survey,  
Low Temperature Geothermal  
Pomaranze, Italy



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MPT-IRIS Inc. is proud to announce the next generation electrical resistivity imaging system based on Multi-Source Technology (US Patent US 9151861 B2). The Multi-Source system consists of 2 to 255 transceivers. Each transceiver has two receiver channels and its own 375 watt transmitter powered by an internal 240 watt-hour replaceable battery. Each transceiver can also run on an external 12 volt battery. The transceiver has a GPS module for location and timing and a wireless module for communications.

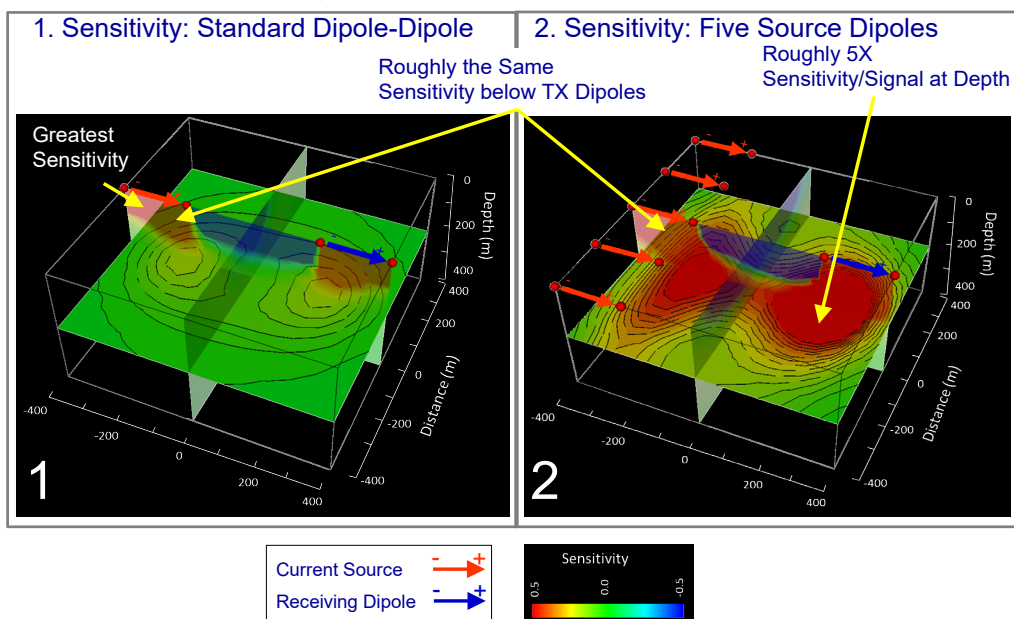
A unique feature is the ability for multiple transceivers to transmit simultaneously. Using this feature, the system can achieve signal levels and depths of penetration comparable with systems that depend on high power motor driven generators. This feature can also be used to optimize the resolution of deep targets.

### What is Multisource?

The multi-source system represents a new approach for performing mid-to large-scale resistivity and induced polarization surveys. The system uses a series of transceivers each of which contains a pair of receivers and a transmitter/current source. Each transceiver has a global position system (GPS) module used for module timing and for providing location information. The transceivers are connected to a central controller using a wireless communication module. Each transceiver can operate independently, allowing data to be collected in places that would be impossible with older resistivity systems. For example, the transceivers can operate in urban areas, along roads, in medians, or around buildings without running cables across roadways. The units can also be linked together to allow traditional resistivity surveys such as Schlumberger or Wenner arrays.

Our research has shown that manipulating the pattern of current flow from multiple simultaneous transceivers should also allow us to manipulate sensitivity patterns for subsurface targets improving both resolution and depth of penetration. Although this is a cutting-edge technology still in the verification phase, all of the multi-source trials to date appear to show substantial improvements over traditional approaches.

### Why Multiple Sources?





## Previous Projects

### Astor Pass Geothermal Reservoir Northern Pyramid Lake, Nevada, USA

#### Highlights

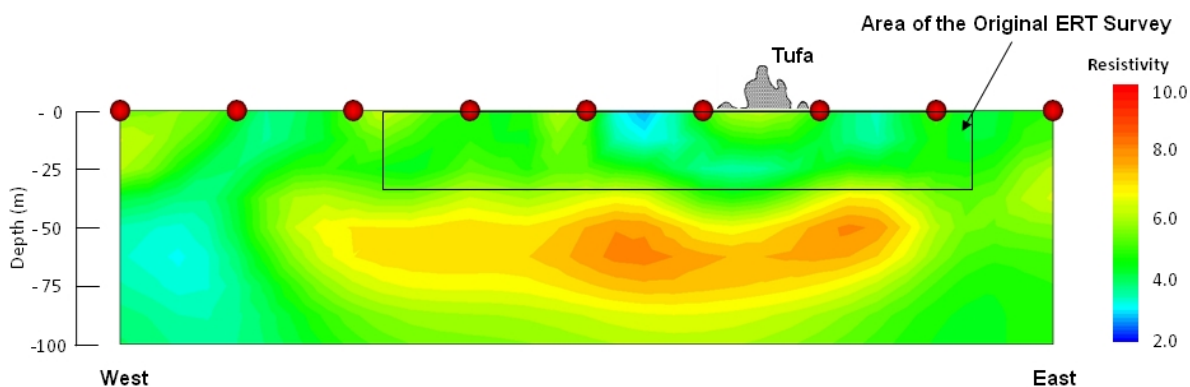
- The Multi-Source system used 8 Multisource units in a grid pattern.
- Multisource units required transceiver-to-transceiver communication to collect data around the large (10 to 20 m height) tufa outcrop.
- Multisource was comparable to standard ERT and seismic refraction geophysical methods.
- Multisource depth resolution was 3 times deeper than standard ERT and 2 times deeper than seismic refraction.



Tufa outcrop partially bisecting the survey site.

#### Background

Staff and geologic consultants from the Pyramid Lake Paiute Tribe, the Desert Research Institute and the University of Nevada, Reno conducted previous geochemical and geophysical surveys including seismic refraction and well sampling at the Astor Pass Geothermal Reservoir site. MPT also conducted a surface ERT survey at the site prior to using the Multisource system. The depth of imaging for the ERT survey reached approximately 35 m depth, while the seismic fraction reached approximately 50 m depth, however, the multi-source system collected resistivity data (then processed to resistivity images) to a depth of 100 m (see figure below). The results of the Multisource system correlated with other geophysical method results.



Cross section of the 3-D image created by the Multisource and compared to the maximum depth of the previous standard ERT survey.



## Previous Projects

### Golden Hope Mine

St-Magloire, Beauce, Québec, Canada

#### Highlights

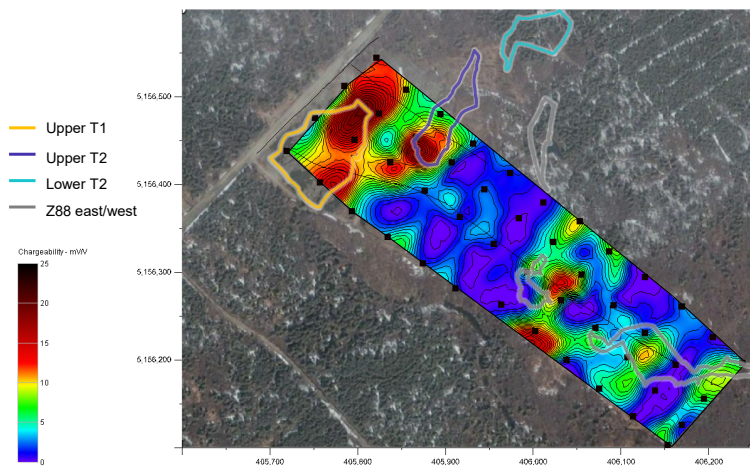
- A comparison using standard surface roll-along ERT and the multi-source ERT proved that the multi-source approach was able to provide a deeper and more comprehensive view of the site.
- The Multisource system was able to provide chargeability images to a depth of 100 m.
- The IP data correlated very well with known gold bearing zones.
- Further investigations and knowledge of the site could feasibly provide data to depths of 200 m.

#### Background

MPT-IRIS Inc (MPT) and Geostudi Astier srl. (Geostudi) worked closely with MicroMentis staff to conduct roll-along electrical resistivity tomography (ERT) and multi-source wireless surveys at the Golden Hope Mine site, Bellechasse-Timmins Gold Deposit, St-Magloire, Beauce, Québec. The relatively high contact resistance on the site, often greater than 20,000 Ohms, limited current flow to a few milliamps for much of the survey.



The map view of the surveyed area (in red). Map adapted from Google earth.



The map view of the wireless multi-source survey showing the chargeability of the Golden Hope Mine site at a depth of 25 m.

For this survey, each unit operated independently and the three electrodes were placed as a pair of co-linear 50 m dipoles. The units were placed in a grid-like pattern along four northwest-southeast lines (see figure above).



## Previous Projects

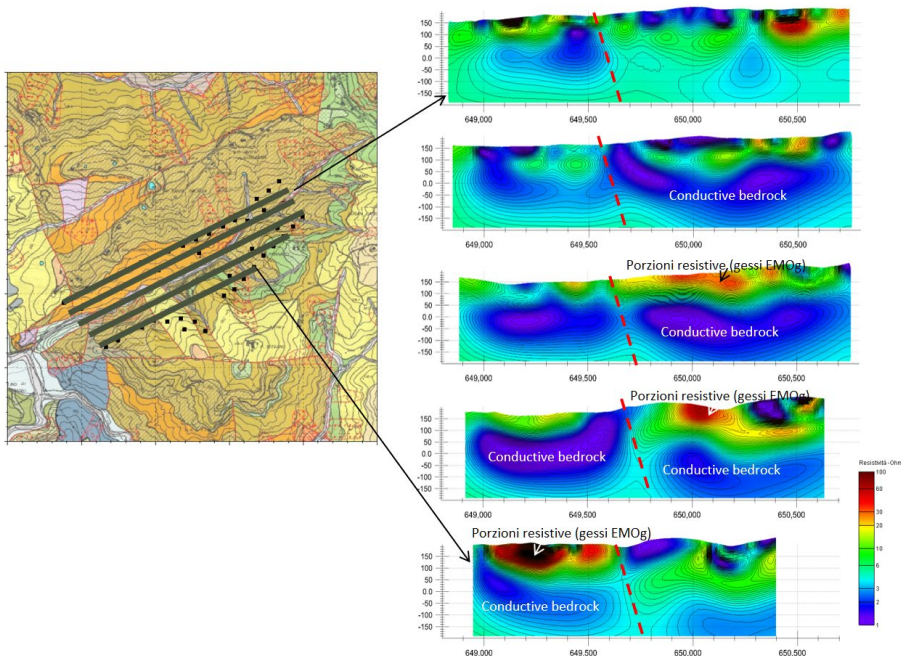
### Low-Temperature Geothermal Pomarance, Tuscany, Italy

#### Highlights

- Rugged Terrain
- 3-D Survey deploying multi-source units along two roughly parallel lines.
- Successful mapping of structural features and strongly conductive zones to 450 m.
- The survey mapped the geothermal area by applying only two lines of electrodes using the Multi-Source system.

#### Background

Staff from MPT and Geostudi Astier, srl carried out surveys near the town Pomarance in Tuscany, Italy. The goal was to locate structural controls for low-temperature geothermal resources. The biggest challenge was the rugged terrain of the site. The multi-source results allowed us to identify fault controlled structures to depths greater than 400 m. This was accomplished using handheld equipment with a four person crew.



The map view of the surveyed area with survey lines (black dots) using Multisource and the resultant resistivity cross-sections.



### *Transceiver Specifications*

<b>User Interface</b>	<i>Windows compatible computer with a USB port</i>
<b>System Weight</b>	<i>Transceiver 18.6 lbs (8.5 kg) with 240 watt hour battery</i>
<b>Dimensions</b>	<i>10.25 x 16 x 4.5 inches (26 x 40.6 x 11.4 cm)</i>
<b>Timing</b>	<i>GPS: approximately 100 nanoseconds</i>
<b>Minimum Configuration</b>	<i>2 transceivers</i>
<b>Maximum Configuration</b>	<i>up to 255 transceivers</i>
<b>GPS</b>	<i>7 ft (2 m) (clear sky view)</i>
<b>Receiver Channels</b>	<i>2 Channels each with its own 24 bit A to D and microprocessor</i>
<b>Input Voltage</b>	<i>Auto gain range with manual override with four ranges: +/- 10.0, 2.0, 0.40 and 0.08 volts</i>
<b>Signal Averaging</b>	<i>Proprietary noise removal stacking routine with 2 to 255 stacks</i>
<b>Battery</b>	<i>Replaceable 240 watt hour (standard) nickel metal hydride or external 12V</i>
<b>Maximum Output Power</b>	<i>350 Watts</i>
<b>Maximum Output Current</b>	<i>2.5 amps (standard)</i>
<b>Measurement Precision</b>	<i>0.10%</i>
<b>Measurement Accuracy</b>	<i>0.20%</i>
<b>Communications</b>	<i>900 Mhz (US) or 868 Mhz (Europe) networkable 1800m/9km line of site</i>
<b>Internal Multiplexer</b>	<i>3 Outputs, 2 Inputs</i>
<b>Transmitter</b>	<i>Maximum power 350 watts, maximum current 2. Constant current: typical current control precision 0.1% or 100 microamps with auto calibrate</i>
<b>Resistivity/ TDIP Mode</b>	<i>13.5 (resistivity only), 7.5, 5, 4, 3, 2, 1.5, 1.0, 0.5, 0.25, 0.125, 0.0625, 0.03125 and 0.01562 Hz. Six pre-assigned window sequences plus one custom user window sequence with a maximum of 16 windows.</i>
<b>FDIP Measurements</b>	<i>Amplitude and Phase, 225, 112.5, 75, 37.5, 25, 15, 7.5, 5, 3, 2.5, 1.5, 1.0, 0.5, 0.25, 0.125, 0.0625, 0.03125 and 0.01562 Hz.</i>



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