



AIRBORNE VLF SYSTEM

Resistivity Mapping Solutions

Since 1980

Developing Leading Geophysical Technology

GEM Systems is the global leader in the manufacture and sale of high precision magnetometers.

GEM Systems is the only commercial manufacturer of Overhauser magnetometers, that are accepted and used at Magnetic Observatories over the world.

Our Potassium Magnetometers are the most precise magnetometers in the world.

Our Proton sensors are considered the most practical and robust magnetometers for general field use.

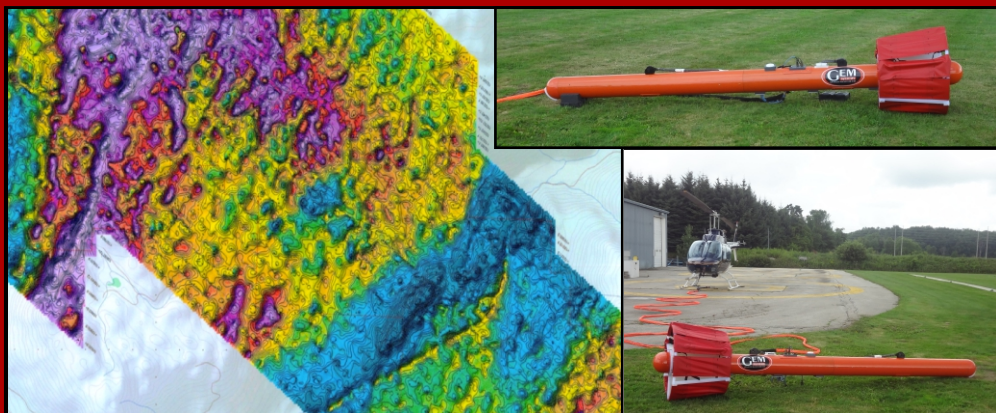
Proven reliability based on R+D since 1980.

We deliver fully integrated systems with GPS and additional survey capability with VLF-EM for convenience and high productivity.

Today we are creating the absolute best in airborne sensors and are leading the way with smaller and lighter sensors for practical UAV applications.

GEM Systems large potassium sensors offer the highest sensitivity (20-50 fT) for use in natural hazard research and global ionospheric studies.

Our Leadership and Success in the World of Magnetics is your key to success in applications from Archeology, Volcanology and UXO detection to Exploration and Magnetic Observations Globally.



Map resistivity contrasts accurately with GEM's Airborne VLF System.

Airborne VLF System

The GEM GSM-90AV airborne VLF system is an excellent mapping tool for environmental and exploration purposes.

Technically Superior

This GSM-90AV VLF System provides **true** measurements of the Vertical in-phase & Out-of-phase components as % of total field within the VLF frequency range of 15 - 30kHz. Many older systems only measure the total field and quadrature components of the field. The airborne system features two 3-coil sensors that acquire data from 2 VLF transmitting stations simultaneously without sensor orientation. Data include in-phase, out-of-phase, horizontal components in x and y and field strength in picoTesla (pT).



2 separate sensors with 3 light weight Orthogonal Air Coils each provide reduced noise and allow true in-phase and quadrature data to be gathered rapidly from 2 stations simultaneously.

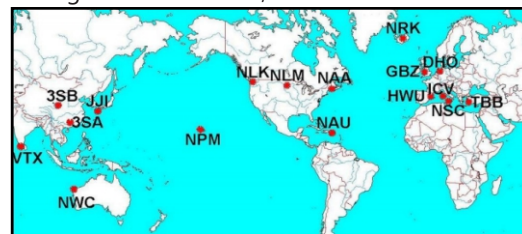
The GSM - 90AV also has a correction for the tilt level of the VLF sensor for up to 25° from the horizontal plane.



Lightweight standalone system for easy installations measures true In-Phase and Quadrature VLF data.

VLF Theory

The VLF-EM survey method is a passive electromagnetic system that utilizes distant, globally positioned, transmitters broadcasting at frequencies in the range of 15kHz and 30kHz. (in some cases a private/custom transmitter may be utilised in regions with sparse transmitters) In a VLF investigation, the magnetic field components of the transmitted signal, which are effected by local ground conditions, are measured.



Global VLF frequency transmitter stations

Applications are many;

- Resistivity imaging and bedrock mapping
- Delineate contrasts in conductivity at depth
- Map geological contacts, faults
- Search for mineralized bodies
- Water exploration

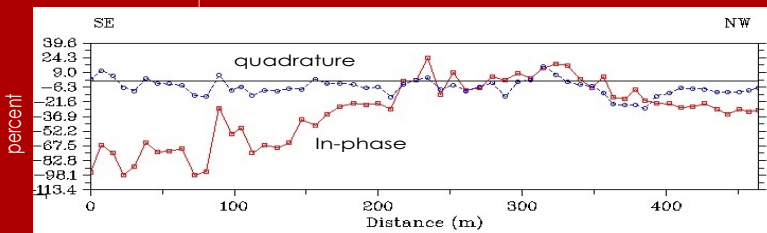
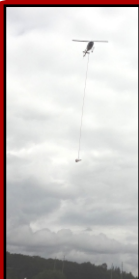
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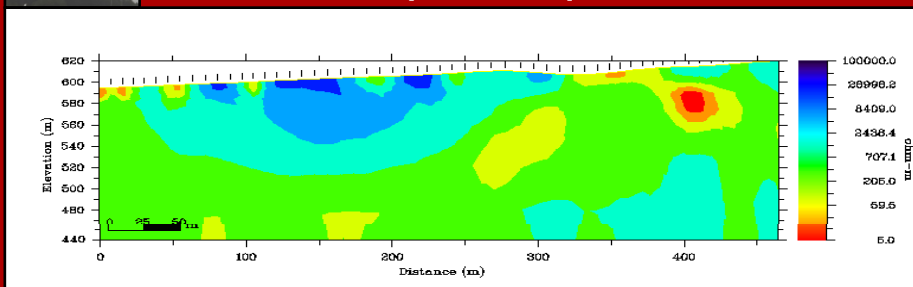
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Our World is Magnetics.



True In-phase and quadrature VLF data



Resistivity Depth Sections derived from VLF data provide quantitative information about the subsurface, applications for resistivity imaging include mineral, environment and water

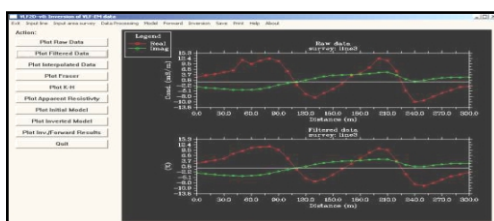
GEM/EMTOMO - VLF Resistivity

GEM uses the **VLF2DMF** Software platform created by EMTOMO™. This program provides **2D inversion of multi-frequency VLF-EM data.**

The package includes a map module for display of the survey, the selection of profiles for inversion and displays the survey results. The program can also be used for modeling studies. The user can build a complex resistivity model and calculate its VLF-EM response. Features include;

- 2d resistivity sections
- Resistivity depth plan slices
- Forward Modeling
- Fraser Filter
- Karous-Hjelt Filter (current density sections)

The inversion procedure used in **VLF2DMF** is two-dimensional (2-D) and is based on the Occam technique (e.g. DeGroot and Constable 1990, Sasaki 1989, Sasaki 2001). The forward modelling of **VLF2DMF** program is based on the finite-element method.



VLF2DMF 2D inversion software interface.

WHY USE VLF

VLF surveying has been utilised since 1964 as a rapid means to find large linear conductive features to provide information about the subsurface for geological mapping. Large area surveys have provided regional structural information but due to a lack of quantitative information such as depth to structure information the method had been marginalised until quite recently. In 2007, the Geological Survey of Sweden demonstrated that not only could VLF data be rapidly and efficiently collected it could provide excellent structure and resistivity information to depths of 100 m and theoretically to over 200 m (Ref. L. Pedersen, 2007, Airborne VLF measurements and mapping of ground conductivity in Sweden.)

Advances in both technology to collect VLF data properly and advances in computer technology and mathematical inversion techniques have provided the industry with a new cost-effective means for imaging the top 100 meters of the earth.

The robust GEM multi frequency GSM-90AV VLF system, provides the user with a practical way to collect meaningful resistivity information in a very cost effective manner. In addition, the VLF system can be easily combined with GEM magnetometers for additional subsurface insight.

Specifications

VLF Frequency

2 user selected stations in a frequency range of
15 & 30.0 kHz with simultaneous reading.

Parameters

Vertical in-phase and out-of-phase components as % of total field. 2 components of horizontal field amplitude and total field strength in pT.

Resolution

0.1% of total field for VLF fields of 5 pT or stronger

Tilt Correction

+/- 25 degrees of horizontal

Performance

Operating Temperature : -40°C to +50°C

Dimensions

Sensor : 14 x 15 x 11 cm. (5.5 x 6 x 5 inches)
Console : 22.3 x 6.9cm x 2.4 cm

Weights

Sensor : 1.0 kg (2.2 lb.)
Console : 2.1 kg (4.63lb.)
Towed Bird : 2.1 kg (4.63lb.)

Power Source

External 22-32V, 18 Ah @24V
12V for VLF Console

Storage

Automatic with: time, coordinates, slope, EM field, frequency, in- and out-of-phase vertical, and both horizontal components for each selected station

Sampling and Data Output

10, 5, 2, 1 Hz with RS-232 output

Data export in standard XYZ (i.e. line-oriented) format for easy use in standard commercial software programs

Options

VLF2DMF software by EMTOMO

The GSM 90AV VLF system comes complete with an industry leading three year warranty



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