Our World is Magnetics.

**GEM Systems** - Suspended dIdD Vector Magnetometer System

GEM Systems dIdD system was designed to provide precision measurements of the Earth's magnetic field and its components so that accurate changes in the Declination and Inclination of the field could be monitored.

In the past, magnetic observatories relied on a combination of Overhauser, fluxgate and theodolite instruments for obtaining total field and variability measurements. The dIdD system provides both total field and component fields with accuracy that surpasses the current accepted observatory standards.

The suspended dIdD comprises a small diameter (250 mm), spherical Overhauser sensor with a bi-directional set of bias coils. Data is acquired directly to a GEM Systems magnetometer console.

**Simplifying Magnetic Measurements**

The suspended dIdD simplifies the set-up of magnetic observatory installations by eliminating the need for fluxgate magnetometers and thermally insulating structures. The new system minimizes ongoing system calibrations.

**The Suspended dIdD Measurement**

GEM Systems dIdD employs a mutually orthogonal coil system that measures one unbiased and four biased values of the total magnetic field. The coils are oriented to be perpendicular to the Earth's magnetic field vector, F.

Equal and opposite deflection currents are introduced sequentially in the Inclination (I) coil (i.e. oriented perpendicular to F). The resultant deflected values of F in the geomagnetic meridian plane are called the Ip and Im values. The Overhauser (or Potassium) magnetometer records these values as well as the undeflected value. Then, equal and opposite currents are sequentially introduced into the Declination coil (D) which is also perpendicular to F. The resultant deflected values of F in the geomagnetic East - West direction are called the Dp and Dm values. The Overhauser (or Potassium) magnetometer records these values as well as the undeflected value. A simple algorithm determines the instantaneous angular changes of the direction of the Earth's vector, F. These angular changes are dI and dD.

Adding dI and dD to baseline values of Inclination and Declination gives instantaneous Inclination and Declination values for F (Baseline values (Io and Do) are determined from an absolute measurement).
A Brief history of the development of the dIdD system

The basic concept for these measurements was published by Allredge, L.R. in 1962 with Helmholtz coils. However, practical applications were not implemented. Over the decades the idea was nearly forgotten. Only a few instruments were ever built but all with Helmholtz coils and all with some stability problems. It was not until the early 1990’s thanks to a cooperative project by the USGS (Golden) and ELGI (Hungary) that a compact coil system was designed and built using a simple proton magnetometer.

In the mid 1990’s Dr. Ivan Hrvoić, while visiting the Tihany Geophysical Observatory (Hungary), proposed to use GEM Systems Overhauser magnetometer to improve the sensitivity and the three organizations formed a group to continue the development. Finally several early trials with the Overhauser magnetometer proved very effective, but the platform still lacked stability. ELGI designed and built a new suspension system around 2000. The new system had significantly improved overall characteristics. In 2004 GEM Systems came up with a small size sensor for the Overhauser magnetometer and MinGeo redesigned the coil and suspension system. Subsequently, Potassium technology was also introduced to provide additional sensitivity to the measurements. Since that time over 70 systems have been delivered for commercial use in a cooperative between MinGeo and GEM Systems.