Geometrics Knowledgebase

Thoughts about attaching a magnetometer to a non-ferrous sled or frame.

Regarding deployment of magnetometers on conductive sleds or carts near power lines: we expect that the elevated field readings you may observe under power lines are a result of AC induction in the aluminum sledge you are using as the tow vehicle. The reason that you see a DC effect from an AC source is due to 1) the strength and proximity of the induced AC source and 2) the orientation of the induced AC field relative to the Earth's field (DC).

Our cesium-vapor magnetometers measure the total local field continuously but report these measurements periodically, e.g at 10 times per second. For each reporting period, both the AC and DC components of the total field are integrated to produce the measurement result as a time average over the measurement cycle. If your measurements are being reported 10 times per second (10 hz sample rate) and the AC component of the field is 50 hz, then each measurement will include exactly 5 AC cycles. This AC component will add to the DC component as a vector sum and the magnetometer will measure the magnitude of the resultant vector. Note that the vector component of the 50 hz AC field that is parallel to the DC component will not contribute to measurement results: for half of each AC cycle this field is greater than the DC field and for the other half of the cycle it is less than the DC field by an equal value. This is not the case for the AC vector component that is perpendicular to the DC field: it will be adding magnitude to the DC field on each 1/2 cycle to produce a half-wave-rectified wave form. Specifically, this rectified field will add to the DC field by an amount equal to about 35% of its peak-to-peak field strength in the direction perpendicular to the DC component.

The AC rectification described above is only seen on close approach to very strong AC sources (high tension power lines). The question is, why did your G-882 exhibit this effect while the G-858 did not - even though the G-858 was closer to the power lines? We think that the answer is that the aluminum sledge is acting as the indirect source of the AC fields: the radiated 50 hz field from the power lines is inducing 50 hz eddy currents in the sledge and, because of the close proximity of the sledge's aluminum plates to the G-882 sensor, it is detecting large AC field values. The nominal strength of the Earth's field in your survey area is 49,000 nT and so, if you are seeing 4000 nT of anomalous signal under the power lines, this means that about 56,000 nT (peak to peak) of AC field are being added to the Earths field in a direction perpendicular to the Earth's field. Note that surveying near other large, planar conductors under the high tension power line can produce a similar effect. These would include metal buildings, metal fences, and pipelines.

We recommend constructing the sledge of non-conductive material. If this is cannot be done, then conducive materials should be kept as far from the sensor as is practical and the sledge's construction should not include sheets of conductive materials. Any joints between conductive structural elements should be insulated as well. You can use the magnetometer itself to measure the effect of the sledge an