# Total system development of magnetic survey by a helicopter with stinger

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We developed a new system of helicopter-borne magnetic survey, in use of a magnetic sensor installed in a nose boom specially equipped to the helicopter (so-called stinger type) and a GPS receiver with differential processing. A magnetic sensor of Cesium optically pumped type is situated at the tip of the nose boom. This location of magnetic sensor cannot escape from the aircraft's magnetic field, and the compensation of its effect is a subject to consider. Our system has no active compensation function, but the software correction scheme is applied. For this correction, it is necessary to get the precise data of the aircraft's attitude. A three-axis fluxgate magnetometer is settled at the middle of the boom, and the data from this fluxgate magnetometer are used to determine the coefficients of compensation. And the procedure was established to determine optimum parameters so as to minimize the coherency between fluxgate data and the corrected cesium data, using test flight data with the maneuvering of the aircraft.

Aeromagnetic survey flights by helicopters are usually made along the topographic surface within some clearance, and especially in case of high-resolution survey the altitudes of observation are often too variable to be regarded as a smooth surface. The reduction procedure for such data was developed using the method of equivalent sources, where the effect of surrounding source is taken into account and three-dimensional random point data are directly inverted. Though the problem is generally underdetermined, the method of conjugate gradients can afford the minimum norm solution. There is a freedom to select harmonic function combining magnetic anomaly with the source. When the upward continuation function operator is selected, the equivalent source is magnetic anomaly itself. If we select the magnetic dipole distribution in the direction of ambient magnetic field as source, we can easily derive the reduction-to-pole anomalies by rotating the direction of magnetic dipoles to vertical. Thus the data reduction/processing software system was also constructed.