Preliminary Experiments of a Drone Magnetic Survey System for Geophysical Mapping

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Unmanned Autonomous Vehicle (UAV) has been attracting more attention than ever and is treated as a promising way to geophysical mapping especially in areas hard to access. The Geological Survey of Japan (GSJ), AIST installed an ordinary Cs magnetometer onto a rotary-wing UAV (drone) and conducted some experiments about noises which originate from the drone.

We employed a hexacopter drone, enRoute ZION CH940 with a rotor distance of 940 mm and a payload of 6.6 kg except batteries, as a base aircraft. We installed a Geometrics G-858 Cesium magnetometer on the drone and suspended its sensor by string. A NovAtel GNSS receiver (OEM 650) and its antenna as well as a GNSS logger (Acumen DataBridge SDR-CF) were also installed on the drone. Magnetic data were measured at 10 Hz and recorded with GNSS signals into the internal memory. Differential GNSS data were also recorded in compact flash by the GNSS logger.

We conducted some experiments using this drone magnetic survey system on a test site, Chiba Japan. First we flied the drone without the survey system over a magnetometer fixed on ground. We lowered the flight altitude of the drone from 10 m to 2 m above the magnetometer. Generally, no magnetic changes were observed except a case at an altitude of 2 m with a change of a few nT. As a result, it is recommended to keep the magnetic sensor at least 2 m away from the drone. However the sensor cable of the magnetometer was 1.8 m at the maximum then and magnetic noise from the drone was obvious. Magnetic noises with amplitude from 5 to 10 nT were observed along test flight lines at altitudes of 30 m and 60 m above ground. The noises were periodic and correspond to periods of swinging of the sensor cable because of a strong wind. These magnetic noises are not acceptable for magnetic surveys over magnetically calm areas but might be neglectable for surveys over large magnetic anomaly areas such as volcanic regions and/or accretionary prisms where magnetic rocks like serpentinites are exposed.

Keywords: drone, UAV, UAS, magnetic survey , Cesium magnetometer

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