

Development of frequency domain electromagnetic exploration system using unmanned aerial vehicle (UAV/drone)

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In recent years, industrial activities using unmanned vehicles, especially small unmanned aerial vehicles (UAVs, drones), have become extremely common globally in various fields (environment, infrastructure, agriculture, logistics, security, etc.). There has also been rapidly growing interest in the development of the geophysical exploration method for subsurface visualization by UAV. However, the necessary technology for geophysical exploration has yet to be established compared with optical measurement from the air to acquire surface information, which has already been advanced in terms of technology. This is mainly due to size and weight of geophysical equipments, measured signal strength, data quality and difficulty of stable flight.

Traditionally, for efficient exploration of a wide area and of inaccessible areas, conventional gravity/magnetic and electromagnetic (EM) exploration using a helicopter or a fixed-wing aircraft have been developed and used. However, applicable targets have been limited because of the difficulty of operations to meet regulations such as airframe remodeling and flight altitude control, particularly in a densely inhabited district (DID), and limitations and restrictions of exploration specifications (depth and resolution of investigation).

On the other hand, the existing traditional ground survey method using manpower has faced various problems such as a reduction in exploration efficiency for surface conditions (topography, vegetation, accessibility, etc.), survey costs, and others. Therefore, as a new exploration method for filling the gap between conventional airborne and ground surveys, there are high expectations for geophysical exploration using UAVs (drones).

In addition, considering the current situation of Japan, where there have been natural disasters such as the landslide disaster caused by heavy rain in Hiroshima, the Ontake volcanic disaster in 2014, and the 2016 Kumamoto earthquake, there is an urgent need to establish not only UAV techniques to obtain information about the surface but also methods for conducting underground surveying quickly, safely, and more accurately in inaccessible areas.

Therefore, in this research, we have been working to develop a new method that uses existing portable EM survey equipment with frequency domain electromagnetic methods, suspended by drone, to obtain geo-electrical information. In this presentation, we introduce the progress and details of the development of the drone-suspended electromagnetic survey system, including results of field experiments.

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