Underground Scanning Technology

Drone Electromagnetic Survey

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Our Idea: Developing Digital Twin of Underground World

Typical Geotechnical Investigation

Site Boring Investigation → Boring Data → Geotechnical Profile 2D Discontinuous Analog Data

Can we get 3D Digital Data by scanning underground?
Our Solution: Drone Electromagnetic Survey

New Solution: Drone

Typical electromagnetic survey by helicopter
Drone Electromagnetic Survey Advantages

- Has the potential to improve the quantity and quality of geophysical investigations.
- Even in areas where access is difficult, geophysical surveys can be carried out quickly and easily.
- Provide continuous three-dimensional digital data.
Drone Electromagnetic Survey Trial

Our innovation challenge proposal for **a Demonstration of Drone Electromagnetic Surveying in Singapore** was chosen by the Japan External Trade Organization (JETRO)

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<th>Obayashi Corporation</th>
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<td><strong>Targeted economic/social issues</strong></td>
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<td>In the ASEAN region, there are some cases where the geophysical investigations that form the basis of construction projects are not sufficiently executed, or the quality of the investigations is inferior. Lack of ground information can bring about unknown construction risks.</td>
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| Details of demonstration |
| The project will promote improvements in the quantity and quality of geophysical investigations by deploying airborne electromagnetic surveys by drone, recently developed in Japan, to the ASEAN region. |

| Expected outcome of beneficiary effects |
| The introduction of drone-based electromagnetic survey is expected to improve the quantity and quality of geophysical investigations. Furthermore, as an improvement of the construction industry as a whole, it is expected to reduce construction risks due to the poor quality of the geophysical investigation and to reduce environmental impact compared to geophysical surveys. |

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**Outline of the demonstration project**

- Demonstration project of drone electromagnetic survey (geophysical survey) in Singapore

**Cooperation with local companies/governments**

- Local Partner: 
- Details of cooperation and collaboration: Conduct of drone operation certified and approved by local authority, providing equipment, certified drone operators and project management of the operation in Singapore. Assisting data processing for 3D plotting.
We chose the **Ground Loop Source Method** for the trial.
Drone Electromagnetic Survey Trial

Carried out on 24 Nov 2022
A 3D model of the resistivity was created from the surveyed data.
Drone Electromagnetic Survey Data

Cross sections under drone flight route
The resistivity $250\Omega\cdot m$ is matched with the top of rock of boring data.
Drone Electromagnetic Survey can be used for searching fault zones

![Graph showing fault line between Mountainous Area and Sedimentary Fill Area]
Drone Electromagnetic Survey Summary

- The airborne electromagnetic surveys by drone was tested in Singapore first time and it is ready for applying to other projects.
- The airborne electromagnetic surveys by drone can make possible to carry out geophysical survey in areas where access is difficult.
- The airborne electromagnetic survey can provides continuous three-dimensional digital data.
- The airborne electromagnetic surveys can be used for searching fault zones.
- The airborne electromagnetic surveys can save cost and time for detailed geotechnical investigation.