

# Talk on Offshore Geotechnical Investigation Techniques for Shallow and Deep Sea Oil Exploration & Production

ENGINEERING EDUCATION TECHNICAL DIVISION



reported by  
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The successful extraction of oil and gas offshore depends partly on building the right kind of offshore structures. To achieve this, geotechnical investigators must first do their part in collecting subsoil data beneath the seabed for the subsequent design of these offshore structures.

Dato' Ir. Mohd Helmi Zulkawi, founder and Managing Director of Asian Geos Sdn. Bhd., was the speaker at the talk titled Offshore Geotechnical Investigation Techniques for Shallow and Deep Sea Oil Exploration & Production, held on 13 August 2015.

The talk, attended by 55 participants, was a joint effort between the Engineering Education Technical Division of IEM, the Geotechnical Engineering Technical Division, Engineers Australia Malaysia Chapter and the Institution of Mechanical Engineers, Malaysia Branch.

Briefly, the talk covered six areas: Overview, purpose, types of offshore structures, scope of investigation, geotechnical drilling and water depth measurement.

**OVERVIEW:** Dato' Ir. Mohd Helmi introduced the types of vessels and platforms used for geotechnical drilling, sampling and soil testing. He talked about typical industry techniques associated with shallow and deep sea penetration geotechnical investigation, including seabed and surface drilling tools.

**PURPOSE:** The purpose of such an investigation is to collect subsoil data beneath the seabed for the foundation design of offshore structures such as oil platforms, jack-up oil drilling rigs and submarine pipelines. The data is used in the design of the deep foundation to support platforms and well heads, driven piles, drilled and grouted piles, mudmat bearing capacity for temporary support, pile drivability assessment and analysis, and spudcan penetration and analysis for jack-up rigs.



Session Chairman Ir. Chew presenting a memento to Dato' Ir. Mohd Helmi Zulkawi (right).

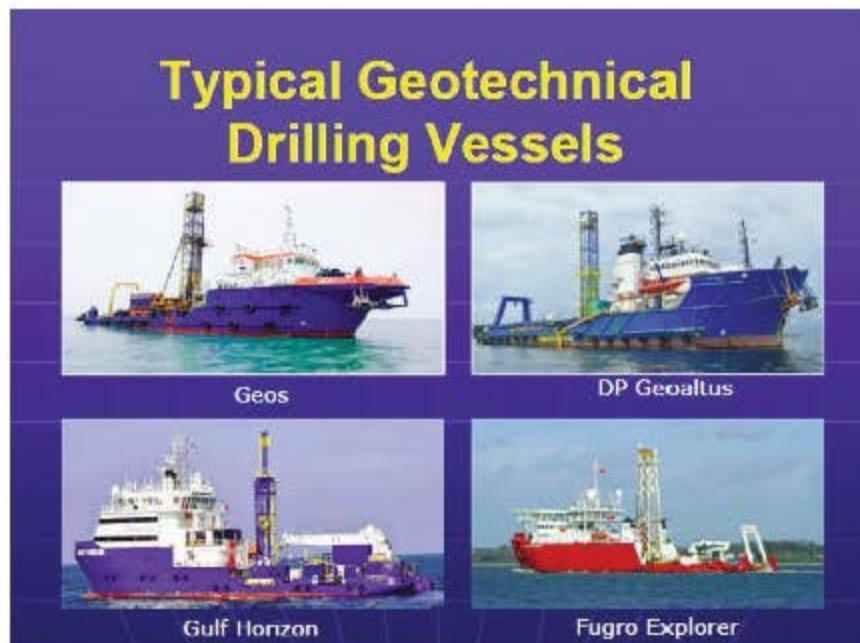
**TYPES OF OFFSHORE STRUCTURES:** These are the jack-up rig, deep-water jacket, gravity-based structure, compliant tower, tension-leg platform, classic spar, and the truss spar. Dato' Ir. Mohd Helmi described the features and use of these structures, particularly the jack-up drilling rig, fixed platform, and the tension-leg platform.

**SCOPE OF INVESTIGATION:** The number of soil boring carried out at any particular location depends on the type and size of the offshore structure, soil condition and the potential variability of lateral soils. Soil boring is normally supplemented by in-situ testing such as cone penetration test (CPT) and remote vane tests.

**GEOTECHNICAL DRILLING:** Most offshore geotechnical investigations are performed from dedicated purpose-built vessels or those converted for this purpose. Since the drilling operations may take several days per borehole,

and the verticality of the drill string is crucial, the use of dynamic positioning or a four-point mooring system is essential in the operation. As for overcoming the choppiness of the seas, a heave-compensated rotary drilling technique is employed, utilising a 5-inch outer diameter API pipe and an open-faced dragbit.

Pictures of the typical geotechnical drilling vessels were shown to the participants. Videos of the vessels taken during drilling operations in the open seas were also shown to illustrate the amount of heaving of the vessels. In fact, Dato' Ir. Mohd Helmi said, heaving of 0.6-3.0 metres is normal in the open seas.



**WATER DEPTH MEASUREMENT:** Dato' Ir. Mohd Helmi explained water depth measurement techniques such as the echo sounder, seabed sensor, CPT, drilled string counts and fishing for mudline. Drilling and sampling procedures were discussed and supplemented with picture slides of the wireline push sampler, seabed CPT and those used for deep water sampling, such as the seabed robotic system.

Before ending the talk, Dato' Ir. Mohd Helmi explained that some 70% of soil testing are performed on the vessels and emphasised on the integrity of the onboard laboratory results to the design engineers.

Lastly, the challenges currently facing the offshore geotechnical investigation industry were discussed and Dato' Ir. Mohd Helmi took several questions from the participants before the talk ended. ■