MARCH / APRIL 2020

ecomagazine.com

eco

environment coastal & offshore

SCIENCE | REGULATION | ASSESSMENT | MITIGATION | RESTORATION

Case Study:
Sounding Out Offshore Drilling

By Seiche Ltd

As marine activities continue in our ocean and along our coasts, there is an ever-growing need for a detailed understanding of how such activities contribute to ambient sound levels in the marine environment.

While data is available relating to a wide variety of sources of human-derived underwater sound, including geophysical sound sources and construction piling, there has been, up to now, little data relating to modern offshore drilling facilities.

Thanks to a study undertaken for a multinational oil and gas company, we now have a better understanding of underwater sound produced by a modern, 6th generation mobile offshore drilling unit (MODU). Using a combination of drift buoys and an unmanned surface vehicle (USV) the outcomes of the study fill a significant gap in the understanding of sound levels around a large submersible facility in the marine environment.

Undertaken by Seiche Ltd, the comprehensive study of the offshore operation took place in December 2017. Over seven days in the field, a total of 117 hours of valid continuous audio was collected. Utilizing the USV, Seiche conducted comprehensive sound field mapping within the 500 meter exclusion zone of the MODU — a first — and undertook an analysis of the measured sound levels of the MODU operations.

Before the groundbreaking project, data harvesting from within the 500 meter exclusion zone of any MODU had been a significant challenge as access to this area is limited. Now, through the use of Seiche's AutoNaut USV, data could be captured using a small autonomously controlled platform adding to the overall understanding of the underwater sound field generated by such offshore activities.

The Technology

To provide a clear picture and accurately map the acoustic footprint of drilling units within and outside nominal asset exclusion zones, Seiche adopted a dual solution pairing its near-silent AutoNaut USV with a drift buoy array solution. Developed by Seiche and AutoNaut (a Seiche Water Technology Group company) these low self-noise recording platforms collected data from medium ranges via a fleet of five drift buoys equipped with 60 meter vertical 4-channel hydrophone arrays.

Data from within the exclusion zone of the MODU as well as the wider area was acquired using the *AutoNaut* USV. The five-meter USV was equipped with a 1,800 meter line of sight control and iridium communications system, a Seiche µPAM system, and a 25 meter two-channel towed hydrophone array for acoustic recordings with WiFi data access for wireless data transfer at sea in a range of weather conditions and sea states.

Operations

To work within the 500 meter exclusion zone, the Seiche activity followed a simultaneous operations (SIMOPS) plan, including pre-mobilization planning, daily briefing calls during the operations and 24-hour lookaheads. This approach enabled the USV to safely integrate the acoustic data acquisition activity within a busy operational environment, where eight to ten vessels worked regularly in the field.

During daylight hours, AutoNaut operated within the exclusion zone, remaining within radio-communication distance *during close pass maneuvers*, coordinated by the field team located onboard the study support vessel. The AutoNaut USV conducted unmanned operations outside the 500 meter zone (at night), monitored and controlled over iridium satellite continuously whilst recording acoustic data.

During the operation, measurements were taken from all azimuths and at three recording depths (25, 30 and 60 meters), at ranges from 140 meters to 5,500 meters, resulting in a highly detailed dataset, but with an eastern bias (as shown in Figure 1) due to SIMOPS constraints.

Data Analysis

Utilizing Seiche's bespoke software developed for the project, audio data and navigational recordings were isolated, extracted, processed and analyzed. The software combined the geographical and audio data to isolate sources within the busy soundscape and presents changes in time, recording distance and the spectrum associated with the MODU.

Variation over time was observed, with short-term increases and decreases in SPL_{rms} of 3–8 dB. These appeared to be independent of vessel movements, despite proximity to the receivers, and could likely be attributed to the MODU's operational conditions, directivity, and thruster depth, as well as changing propagation conditions. The sound field itself lacked directivity, even at close ranges to

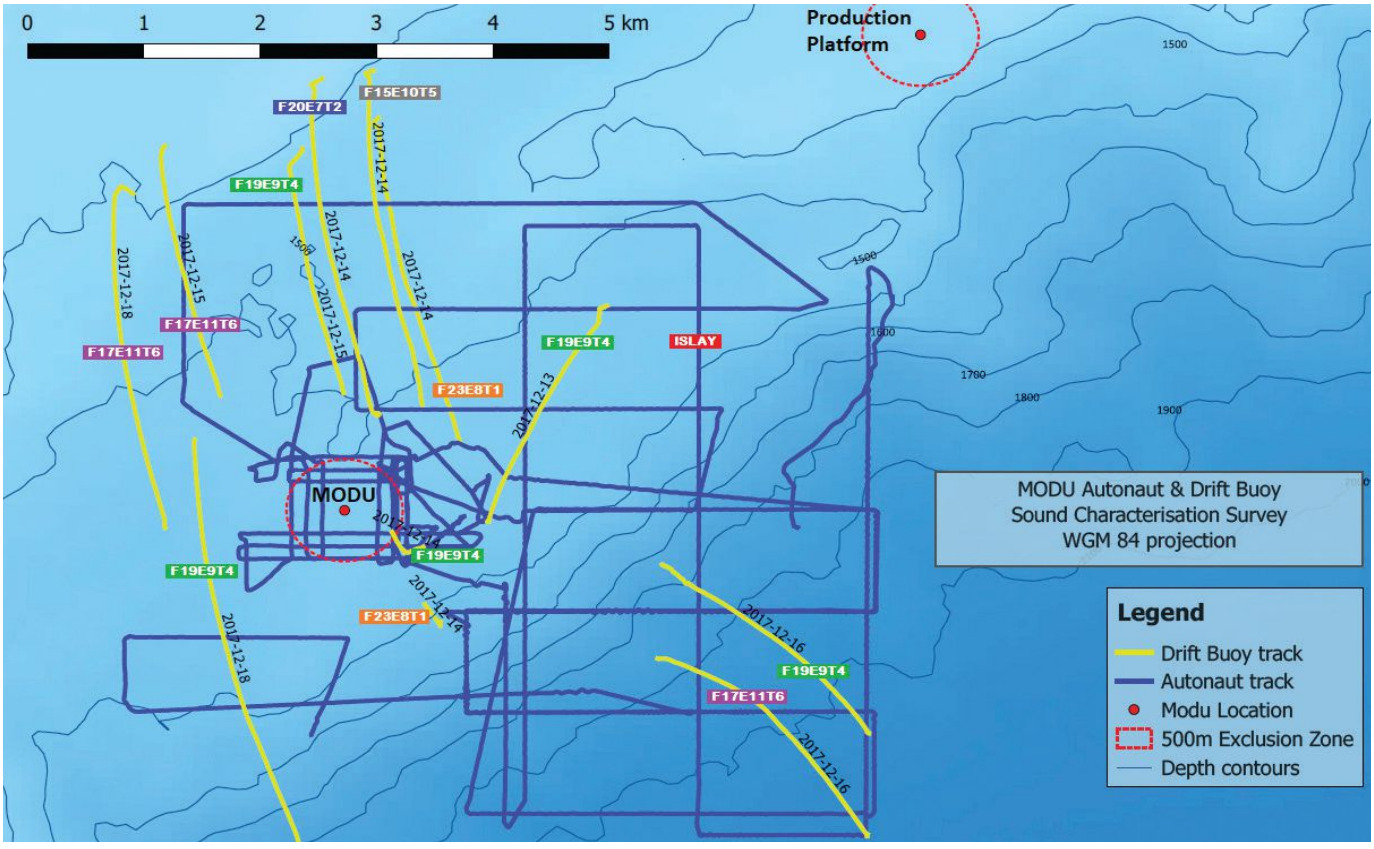
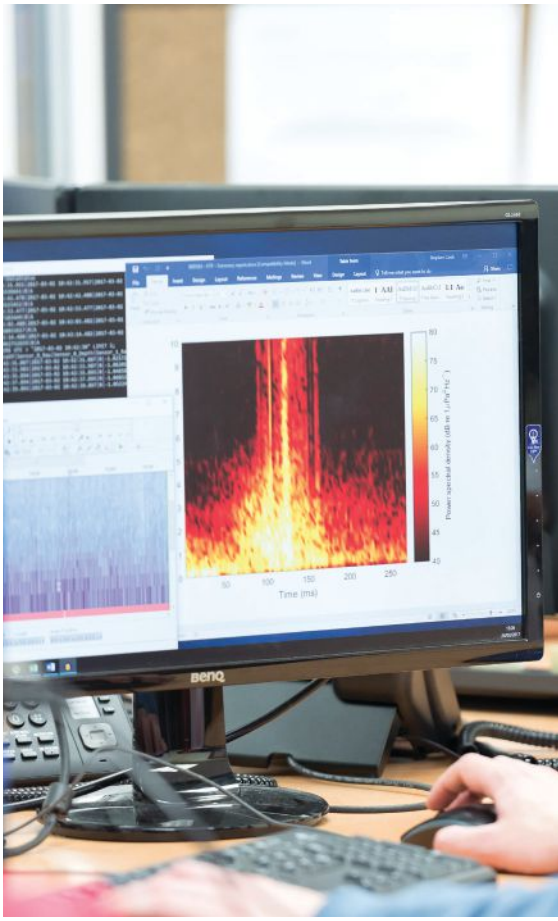
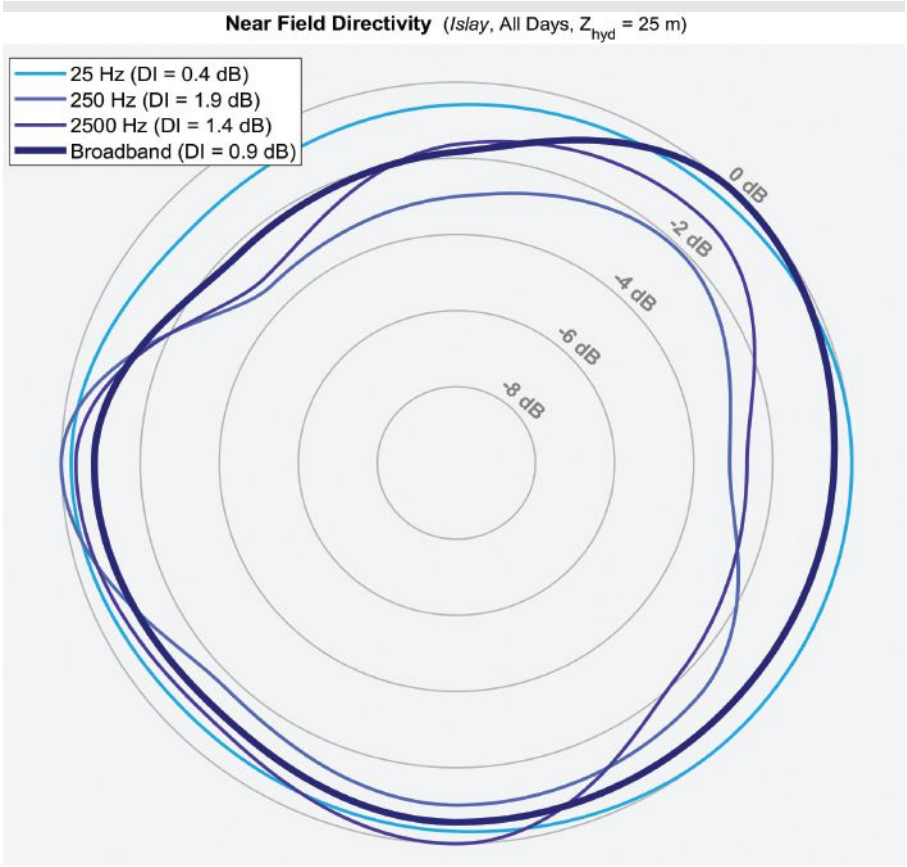


Figure 1; Map highlighting the tracks of the drift buoys and the USV over the area of operations.





the MODU where near-field interference from individual sources such as thrusters occurred. Therefore, the broadband sound emissions from the MODU were concluded to be omnidirectional, as shown in Figure 2.

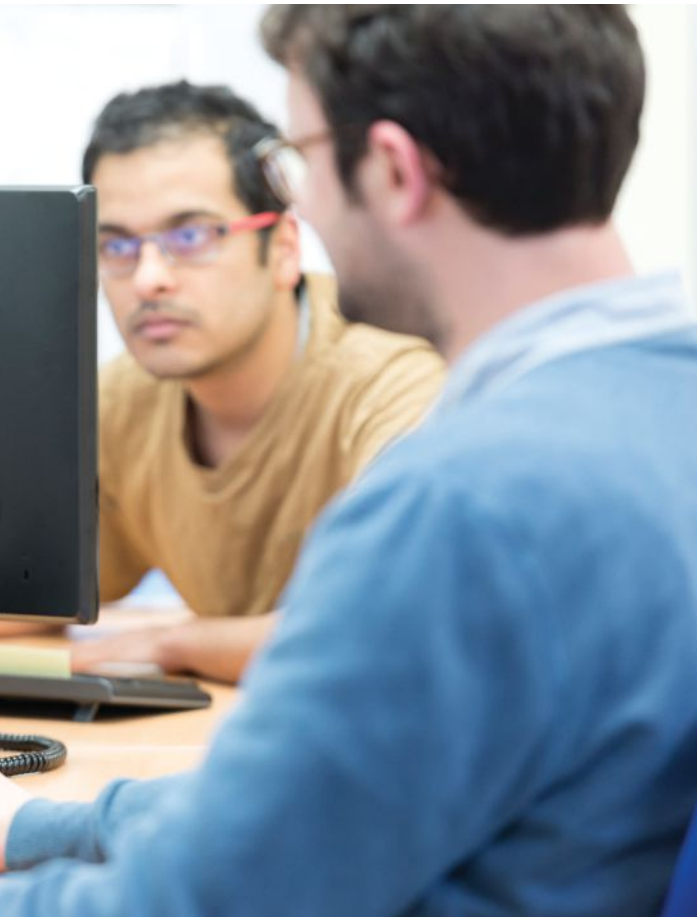
A comparison of modeled transmission loss data with the measured data highlighted that the sound levels generated by the MODU were significantly lower than predicted by models (between 5 and 20 dB within one kilometer).

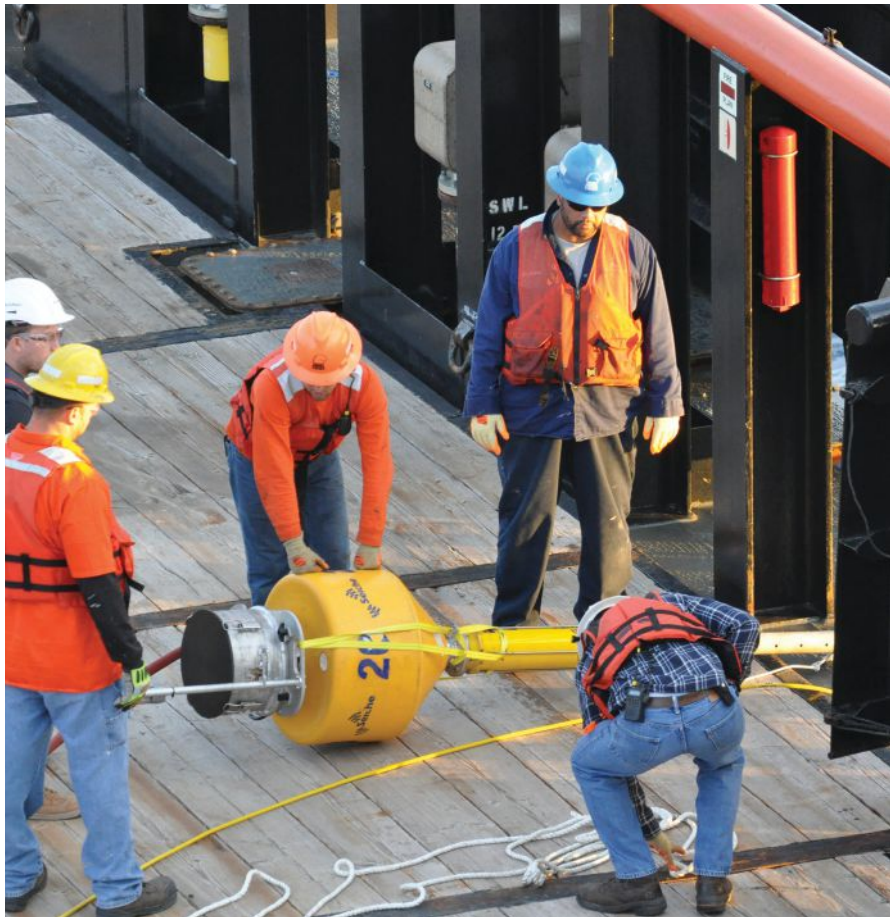
Top L to R:
AutoNaut five-meter USV

Seiche PAM and data analysis

Drift buoy deployment

Bottom:
Figure 2; Near-field directivity of the MODU at various frequencies from measurements taken by Islay at ranges of 200–400 m.





Summary

In addition to comprehensively studying underwater sound produced by the MODU during operations, with measures taken at depths of 25 meters, 30 meters, and 60 meters, at ranges from 140 to 5,500 meters, Seiche proved the safe and highly effective deployment of its AutoNaut USV close to and around a working offshore facility. This enabled the delivery of a high-quality, large and uniformly distributed dataset that has not previously been possible, during different operational phases in an environment that was challenging both operationally and acoustically. The successful use of AutoNaut, demonstrates its ability for future projects to collect acoustic and other types of data associated with activities in the offshore environment.

The solution offered by Seiche provided a full turn-key offering, including the delivery of field recording equipment, in-field technicians, specialized software, data analysis, and reporting, as well as project management throughout.

Commenting on Seiche's ability to provide comprehensive sound mapping through the use of marine autonomous systems Mark Burnett, CEO of Seiche, said: "Previously, relatively little data could be captured relating to drilling operations, limiting the understanding of ambient sound levels within a busy operational marine environment, but these new technologies are now proven as safe and cost-effective methods for the acquisition of passive acoustic data."

Burnett added, "AutoNaut's ability to be tasked onto a pre-determined and controllable survey grid under local control during daylight hours, enabled our USV to operate safely and with certainty within the exclusion zone. For us, it was a hugely exciting project providing a proven model for use with MODUs globally."

Having proved its ability to operate within the 500 meter exclusion zone and having operated in geographic regions across the world, AutoNaut's close-pass collection data platform is now being made available to other operators wishing to understand the underwater sound profile of their offshore activities.

Ideally suited to collecting data in the operational environment of the MODU, both the AutoNaut and drift buoys are extremely quiet, allowing for high quality recordings of the sound field.

AutoNaut's wave propulsion system is virtually silent offering significant advantages over conventional propeller or thruster powered USVs.

Light, easily launched and recovered by deck crane from a single vessel, the use of multiple unmanned instruments allows for maximum data collection with minimum field crew, minimizing vessel time, risk to personnel and operational costs. Crucially, AutoNaut can be tasked onto a pre-determined and controllable survey grid making it safe to work within exclusion zones and in close proximity to varying operations.