



Gemini SeaTec

Tritech's Marine Mammal Detection System, provides an early warning of the presence of sea mammals, in the vicinity of marine current turbine structures.

The Gemini SeaTec system uses the industry-standard Tritech Gemini 720id multibeam sonar and its own bespoke movement detection software to provide a valuable tool for the tracking of marine life around subsea turbine structures.

Customer Background

Marine Current Turbines (MCT) Ltd are a tidal energy company involved in the development of large-scale tidal current power generation technology.

The Sea Mammal Research Unit (SMRU) Ltd has world class expertise in marine mammal science with the proven ability to deliver innovative, robust and environmentally sound solutions for clients active in the marine environment. This is underpinned by the cutting edge academic research undertaken at the University of St Andrews.

MCT's SeaGen is a large commercial, tidal energy converter and is located in Northern Ireland's Strangford Lough.



The Need for Mammal Detection

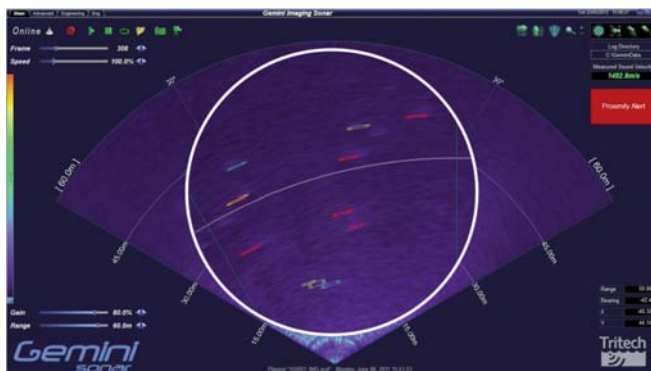
SeaGen is a clean, sustainable alternative to fossil fuels and consequently it needs to have minimal environmental impact in the local area. As Strangford Lough is an environmentally sensitive area, MCT monitor the turbine's operational period continuously to protect wildlife in the surrounding area.

The Challenge

The Sea Mammal Research Unit Ltd (SMRU) conducted trials of commercially available sonars to determine their potential to detect and track marine mammals around offshore renewable developments such as tidal turbines. The testing process involved trials of several sonar products with Tritech's sonar producing the best results [Hastie et al; 2012].

Tritech has since worked closely with SMRU Ltd at the St. Andrews University to develop the Gemini SeaTec system, which was installed on SeaGen to trial its capabilities as a marine mammal behavioural monitoring system.

Originally the SeaTec system only detected movement with no classification of marine life or alarms triggered. Following consultation with SMRU Ltd the Gemini SeaTec software has been developed to improve the algorithms to identify marine mammals and reduce the rate of false positives.



Gemini SeaTec software showing visible moving targets as red alerts: denoting the probability of targets being marine mammals. Here the targets were seals.

How it Works

The Gemini SeaTec system uses Trittech's industry standard Gemini 720id multibeam sonar and its bespoke movement detection software. This innovative software provides real-time monitoring of marine environments allowing both an early warning for an operator to take immediate corrective action and also data to allow detailed post hoc analysis of log and target data for analysis of marine mammal behaviour to inform future environmental impact assessments.

1. Identification

At operating distances of approx 40 metres mammals are challenging to identify in any sonar data. Therefore, the SeaTec target detection and classification algorithms were developed using trials where marine mammals (seals, dolphins and porpoises) could be validated using visual observations. Size, shape and swimming behaviour are used to determine the likelihood that a moving target is a marine mammal.

a. Size: filter out marine life such as fish

b. Shape: a mammal in water will have a particular sonar pattern due to the shape of its body and location of the lungs

c. Behaviour: objects in the water that are moving with the tide can be filtered out to leave targets that appear to have their own source of propulsion; thus having a high probability of being a marine mammal

2. Simple Traffic Light Classification of Targets

a. Possible: Targets with size and shape consistent with a marine mammal.

b. Potential: Possible (above) targets are reclassified when their path is identified to be inconsistent with an object drifting with the tide.

c. Probable: A potential target is upgraded when it has a longer path and more stable measurements. This identifies the target as having a high probability of being self-propelled rather than drifting with the tide.

3. Precautionary Shutdowns

A visual proximity alarm can be used to alert an operator of a valid target in the structure's vicinity. In Strangford Lough, the SeaGen system currently has a 6 second shutdown time that equates to a 30m exclusion zone directly in front of the turbines. Precautionary shutdowns can be performed in such situations.

4. Detecting Movement

Reports describing Probable targets' movements and their paths through the water can be generated and cross-referenced with log files.

5. Excludes False Positives

Using this scheme also allows the software to eliminate a large number of false targets: for example marine debris that moves with the tide; and fish, which are both too small and are identified to move in groups.

Dr Carol Sparling, SMRU Ltd, comments on the Gemini SeaTec's performance:

"The Gemini SeaTec system provides us with the capability to detect and track marine mammals around renewable energy devices in a way that has not been previously possible and we are excited about working with Trittech on a number of tidal energy projects."

Measuring Success

The SeaGen system has historically used human observers watching the water itself and also uses (as standard) a more traditional mechanical scanner, Trittech's Super SeaKing sonar with standard SeaNet software. Human operators observed the sonar data to detect marine life and perform precautionary shutdowns where deemed necessary.

The Gemini SeaTec system was deployed for 3 months in Strangford Lough, alongside the SeaKing to evaluate the new system's imaging and detection capabilities. Due to the high-resolution imaging and automated target detection, analysis of the environment was more efficient with the Gemini SeaTec and provided encouraging results compared to the previous system. Some targets could be more reliably classified as tidal debris and others were determined to have a high probability of being a marine mammal. Furthermore, tracking of the probable targets allows analysis of the behaviour of 'marine mammals' in the vicinity of the turbine.

References

Sonar as a tool to monitor interactions between marine mammals and tidal turbines; pitfalls and possibilities. Hastie, Sparling and Murray; Environmental Interactions of Marine Renewable Energy Technologies 2012.

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