Remote sensing drives down offshore wind costs

Baker Consultants, an ecological consultancy working on various offshore projects including wind developments in the North Sea and the Baltic, has gained a deserved reputation for innovation. PES asked them to expand on the latest in remote sensing technology and how they have developed this into a new ecological surveying service that could aid the offshore wind sector in better meeting environmental consents and driving down offshore wind costs.

The cost of offshore wind development is continually falling; often as a result of technological advances. With new technology being implemented across the sector, from engineering to environmental management, health and safety to O and M, the offshore wind industry is becoming ever more sophisticated. Businesses working within the sector must lead this innovation, continually developing new and improved methods of working.

Ecology and offshore wind

Most countries recognise the importance of protecting the marine environment and have introduced legislation to ensure its safeguarding. In Europe, for example, the Marine Strategy Framework Directive (MSFD) requires EU member states to maintain Good Environmental Status (GES) of their seas. This has put pressure on the offshore wind industry, alongside other offshore industries, to minimise the impacts of its operations on the physical and biological marine environments. Many EU countries have now introduced regulations and guidance to meet MSFD criteria, including restricting the generation of noise within the marine environment.

Also, within the EU, both Habitats and Birds Directives protect a wide range of species and habitats. Species such as seabirds, whales and dolphins and migratory bats must be considered for most large scale marine projects.

Efficient data collection

Prior to any project getting under way, it is usually necessary to collect comprehensive baseline data to establish the species that are present within the locality and may be affected by the project. Accurate baseline data is critical both in assessing potential impacts on species and in putting together mitigation packages that will be enforced throughout the consents process.

During construction, the German government requires constant monitoring of noise generation throughout piling operations to ensure that permitted noise levels are not exceeded. At the same time, populations of whales and dolphins must be monitored to assess whether they are being affected by the works.

This requirement for comprehensive and defendable data is now increasingly being met by the use of new remote sensing technologies that can often provide data in real-time, allowing operations to be monitored and adjusted to ensure compliance with consents.

Why remote sensing?

Remote sensing (which is acquiring information about something without the need for physical contact with it) allows ecologists to collect data efficiently and cost-effectively. This contrasts with traditional ecological surveying techniques, which require a surveyor to be out in the field directly observing the natural environment and reporting on those observations. Such traditional techniques have a number of disadvantages, such as...
surveyor fatigue, observer bias, high cost and, often, a high health and safety overhead.

Remote sensing, by comparison, employs a variety of automated sensors that provide consistent data, which is recorded and can then be analysed post-capture, either automatically or by trained analysts. As well as being more reliable, the data is defensible and can be checked by third parties.

The rise of remote sensing as an everyday tool in ecological data capture has been enabled by a continued reduction in the cost of sensor technology. Take cameras used for aerial photography of seabirds and cetaceans, for example. In only a few years, the cost of cameras of sufficient quality to provide photographs with a Ground Sampling Distance (GSD) of less than 3cm (at 350m flight height) has been reduced by a factor of ten, making such high quality equipment affordable.

Bioacoustics provides another example of how the reduced cost of sensors and monitoring equipment has opened the door to improved data quality. In the past, cetaceans were surveyed solely by marine mammal observers from a boat. Not only does this high-cost method lead to surveyor fatigue and observer bias, but poor weather conditions cause observation efficacy to drop. Alternatively, it is now possible to deploy bioacoustic recorders into the survey area and leave these unattended for several months while they log bioacoustic activity in the locality. This can generate comprehensive data sets that provide a much more complete picture of marine mammal activity.

A new ecology survey approach for offshore wind development

Access to remote sensing technology is allowing new and innovative approaches to be developed to aid biological recording. Of particular interest to us is the potential to combine multiple datasets to provide corroboration of data.

Baker Consultants has developed an Unmanned Aerial Vehicle (UAV) to collect high definition aerial photographs of seabirds and cetaceans. The UAV methodology is based upon the accepted standard for aerial survey effort (see Camphuysen et al, 2004) working under extended visual line of site (EVLOS) and can cover large survey areas in a single day. A ground control station based on a survey vessel at least a kilometre away is in constant contact with the UAV, but positioned so as to minimise disturbance to birds or marine mammals. Data gathered can then be combined with contemporaneous marine bioacoustic recordings to give comprehensive understanding of the use of a site by these species.

Flexibility is built in to the process and the fixed-wing long-range UAV can be sea-launched and sea-recovered and carry a variety of payloads, including LiDAR and a high-definition camera.

Advantages of combining these approaches

Remote sensing offers many advantages over conventional survey techniques. It gives greater accuracy, enhances repeatability (survey transects can be re-flown following precise flight paths) and generates defensible data (results are less prone to surveyor bias). The technology is also more time-efficient and hence cost-effective, covering large areas in a short space of time, and can be used to generate 3D models where appropriate.

Of particular relevance to ecology, using remote sensing technology can be less intrusive and reduce disturbance to marine mammals and seabirds when compared to traditional surveys (as shown by Hodgson et al, 2016). This has a double benefit in also reducing disturbance bias within the results.

For instance, Hodgson et al (2016) concluded that UAVs are much more
effective at monitoring seabird colonies than traditional ground-counting methods. Use of ‘drones’ achieved a very high degree of precision, was less disruptive to the seabirds and captured clearer images.

Additionally, this new approach is more comprehensive than other existing survey techniques and, crucially, safer. Manned aircraft flying at low altitudes (such as those traditionally used for aerial surveys of sea birds, whales, dolphins, seals and other marine megafauna) have a considerable safety overhead, as flying a plane at low altitude leaves little margin for error should a problem occur. We developed our approach to reduce that risk and, at the same time, improve the quality of the data”.

The deployment of full spectrum bioacoustic recorders (either towed behind a boat or deployed remotely) is a key element of the service and further enhances the reliability of the survey results. A combination of bioacoustics and aerial surveys has been found to provide reliable data on the density of marine mammals and reduce availability bias of aerial surveys, which can only detect marine fauna when they are at the surface (e.g. Williamson et al, 2016).

“Combined, contemporaneous data is so much more powerful,” states Andrew. “With many bird species, identification from aerial photographs can be problematic. But, when combined with sea-level observations, we get a much better understanding of the species present. Likewise, using traditional survey methods, cetaceans can only be seen from the air when the surface is clear, whereas our complementary use of bioacoustic recorders allows us to collect much more reliable data in a greater range of weather conditions.”

Conclusion

Taking advantage of technological developments allows those working within the offshore wind industry to better meet a range of legislative requirements, including ecological requirements. Our recently developed ecology survey methodology uses remote sensing technology such as photogrammetry, high-definition photography and UAVs. This allows us to gather more reliable, robust, defensible, cost-effective and time-efficient data for our clients, enabling them to better meet their ecological legislative requirements. This helps minimise the impact of offshore wind developments on marine mammals, fish, seabirds and migratory birds and bats. ■

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About Baker Consultants

Baker Consultants is an experienced ecological consultancy well-known for its innovative use of technology within the marine sector. They have recently complemented their dedicated bioacoustics department by developing UAVs. Their new remote sensing service has been specifically designed to build on their marine ecological surveying and bioacoustics experience, adding in new technology in the shape of several UAVs, photogrammetry and high-definition cameras.