Project Green Blade tests new wind turbine mitigation capability

The latest tests in the UK are pushing the boundaries to deal with how wind farms affect ATC

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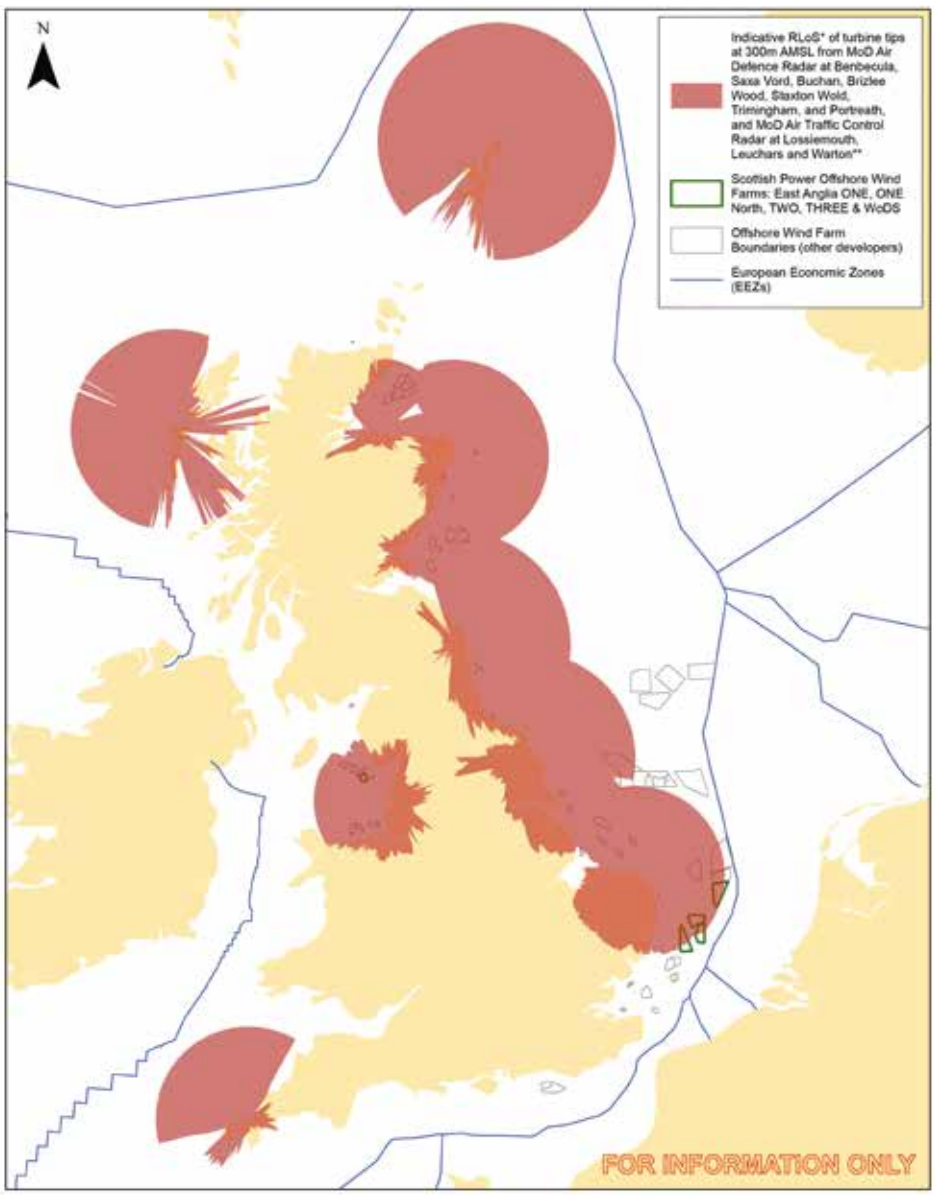
Under UK government proposals, offshore wind projects could reach 30 GW capacity by 2030 compared with just over 7 GW today – equivalent to about one-third of overall national electricity requirements, according to the UK Offshore Wind Industry Council.

Wind energy provides some of the cheapest clean energy generation in the UK. However, wind turbines can clutter air traffic control and air defence radar displays when turbine blades become confused with aircraft returns, so additional surveillance is required for safe airspace management. As more than two-thirds of planned generating capacity will be within range of civil or military radar installations, the industry needs an effective solution for the next decade.

A large share of offshore wind farm development is planned along the east coast of England and Scotland, prompting a new initiative led by ScottishPower Renewables (SPR) in partnership with Thales, radar manufacturer Aveillant (part of the Thales group), and Cyrrus. In July 2018 these companies came together to work on a solution to mitigate against radar interference from wind turbines in a programme called Project Green Blade.

"If we can demonstrate that we can mitigate the impact of the latest generation turbines, this would release all our windfarms," SPR Aviation Manager Anne Mackenzie told *Jane's*. Green Blade aims to demonstrate compliance of Aveillant holographic radar with military and civil aviation standards, particularly CAP 670 and DEFSTAN 972 air traffic services safety requirements, to enable multiple sites to benefit from the development work. This is a departure from mitigation work to date, which has tended to be specific to wind farm and radar installations.

Under Phase 1 of the project, Aveillant is using its Deenethorpe test site to develop its Theia non-rotating radar to meet the requirements of latest-generation wind turbines. The company is extending the instrumented range of the 3D staring array radar from 40 n miles to at least 54 n miles, sufficient to cover SPR projects in East Anglia that will be equipped with the newest wind turbines. In the longer term the target range is 60 n miles. "We are working on the range and wind farm tolerance in the first phase," said Aveillant CEO Dominic Walker. "Then we will look at turning that into a fully deployed product that is acceptable to civil air traffic control, military, and air defence radar."



ScottishPower Renewables: 1735930

This map depicts the effect of new-generation offshore wind turbines on existing UK Ministry of Defence conventional rotating radar sites, and where mitigation would be required.

The increase in range is a response to the larger footprint of turbine blades and a greater separation distance between each tower. Blade heights have doubled from 90 m (to tip) to more than 180 m in the last decade, and the next wave of installations are due to reach 220 m blade height to tip. These will be accompanied by 12 MW rotor turbine capacity, up from 3 MW less than 10 years ago. Building fewer and larger units requires shallower foundations and generates more power with less infrastructure.

In Phase 2 of Project Green Blade, tests move to the radar site at Muckleburgh overlooking the Greater Wash wind farms off the Norfolk coast. Aveillant data will be fed to a third-party display (for example, Aerium from Cyrrus) along with primary radar data, to provide a combined data stream displaying aircraft returns without wind turbine clutter. The partners aim to field a prototype within two years that is capable of supporting a safety case.

Ultimately, according to Aveillant, an entire chain of 3D radars could be sited at strategic positions along the coast, and networked together to provide a complete infill capability for civil and military users covering all the offshore wind farms in the North Sea.

Aveillant: 1735931

The Aveillant Theia holographic radar is a 3D sequential-scan unit that acquires continuous detail about every object, including all fine-motion detail in the Doppler spectrum.

Evolving technology

The Aveillant solution is the latest in a series of mitigation efforts in the UK involving different radar suppliers. The research, funded mainly by wind developers, has led to the release of several gigawatts of onshore and offshore green energy production. More than 10 years ago, a terrain-shielded hybrid solution from Sensis and Easat was installed at Kincardine to mitigate the impacts of wind farms on Glasgow and Edinburgh airports and NATS radar at Lowther Hill. Since then, Danish manufacturer Terma has supplied its SCANTER 4002 radar to five UK sites. A system selected in 2015 at Hawarden mitigates the impact of Frodsham wind farm on Chester Harwarden and Liverpool John Lennon airports, and Newcastle Airport selected a similar infill solution in 2016. The same year, NATS selected SCANTER 4002 for Edinburgh, followed by a contract from Glasgow to support development of Kype Muir Wind Farm. Glasgow Prestwick has also selected a Terma solution to operate its primary surveillance radar in the future.

In separate developments, C Speed successfully demonstrated its LightWave S-band radar at Manston Airport, Kent, more than five years ago, and the US company secured a contract in 2018 to support wind farm development in Texas. Lockheed Martin supplied three AN/TPS-77 Air Defence L-band radar to MoD sites along the east coast at Trimingham, Saxa Vord, and Brizlee Wood under a 2011 contract with an initial value of USD30 million, and it upgraded the T92 (also known as the AN/FPS-117 radar) at Buchan to a similar specification, as part of a trial programme to mitigate wind turbine returns.

The move away from conventional rotating radar came in 2015, when Severn Trent Water selected the Aveillant Theia 16A to mitigate a new turbine installation nearby. Attention now focuses on demonstrating that the technology can provide a high-resolution detection capability with the latest-generation wind farms. This also opens up the opportunity to use the Aveillant solution in combination with conventional radar such as the AN/TPS-77 or the Thales STAR NG, to provide up to 250 n miles range for homeland security, military, and non-co-operative air traffic services.

The introduction of a CAP 670-compliant mitigation solution in the UK would also help the industry shift to a different funding mechanism. There is a groundswell of opinion that supports increased contribution by the aviation industry as part of its commitment to de-carbonisation. The 2017 onshore wind policy statement from the Scottish Government, for instance, expects "a move on the part of the air navigation industry towards self-management of this issue. This could be achieved through the deployment of wind farm tolerant radar, or other technical solutions". The UK Department for Business, Energy and Industrial Strategy (BEIS) is moving in the same direction.

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Mackenzie of SPR believes there is an opportunity for aviation to invest in its green credentials. "If aviation is going from 5% to 25% of UK emissions between 2005 and 2050, then it needs to find other areas to introduce de-carbonisation," she said, adding that the next 10 years provide a window of opportunity to put in place the infrastructure that will support the green energy agenda from 2030 to 2050. "We are looking to move from mitigation to management." ■