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Multi-sensor monitoring system for determination of bird behaviour in marine wind farms

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Automated monitoring, multi-sensor, avoidance rates, collision risk

Introduction

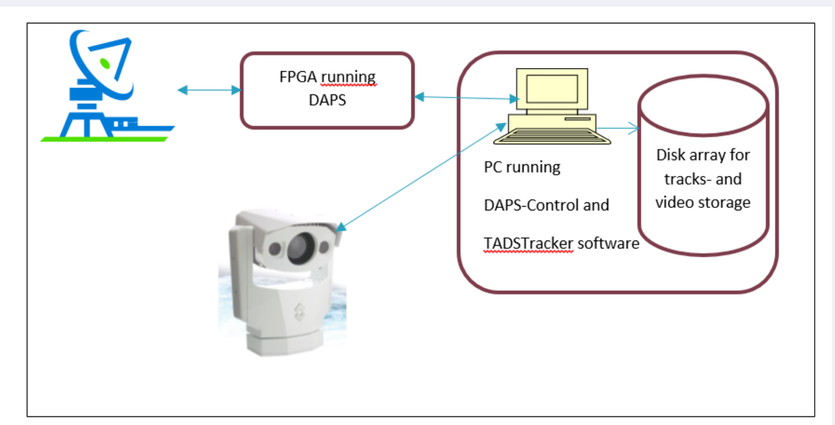
Since summer 2014, a research study designed to provide clear evidence on how birds behave within and around offshore wind farms has been underway at Vattenfall's Thanet Offshore Wind Farm, United Kingdom. This ground breaking research, the largest of its kind in the world, is part of the Offshore Wind, Offshore Renewables Joint Industry Programme (ORJIP) and has been designed to provide the most robust evidence base to date on real life bird behaviour at an offshore wind farm. Using state of the art technology such as high definition radar and thermal and visual imaging cameras, bird behaviour is being monitored at Thanet's one hundred turbine wind farm. Monitoring will last up to 24 months with the final results expected in late 2016.

Objectives

1. Development of multi-sensor system capable of measuring micro, meso and macro avoidance behaviour and collision events at the species level.

2. Measure the level of seabird behaviour at one or more offshore wind farms and provide robust evidence on the rates of avoidance and collision for a number of target species identified as being at risk from collision with offshore wind turbines.

3. Determine how data from this study can be applied to support consenting applications for other sites.



Overview of camera-radar tracking unit

Installation of radar-camera unit on turbine platform

The study, being conducted by NIRAS Consulting Ltd and DHI and hosted by Vattenfall, is focusing on the following species of seabirds: Northern Gannet, Black-legged Kittiwake, Herring Gull, Great Black-backed Gull and Lesser Black-backed Gull.

Based on the data collected during the first year it is clear that ORJIP will provide substantial new information about avoidance behavior of seabirds at offshore wind farms. The macro, meso and micro avoidance data from the monitoring at Thanet provide evidence of behavioural responses from these target species; evidence which was not available prior to this study.

Although avoidance rates within the wind farm for these species have been deduced from radar observations and surveys of collision victims, these are the first detailed accounts of the lateral and vertical responses in their flight behaviour for the entire range of spatial scales relevant for estimating overall avoidance rates.

The next generation TVADS detection system which has been tested during 2015 integrates horizontal and vertical radars and digital cameras and supplements the existing system applied in ORJIP by adding information on flight altitudes of tracked birds.

Conclusions

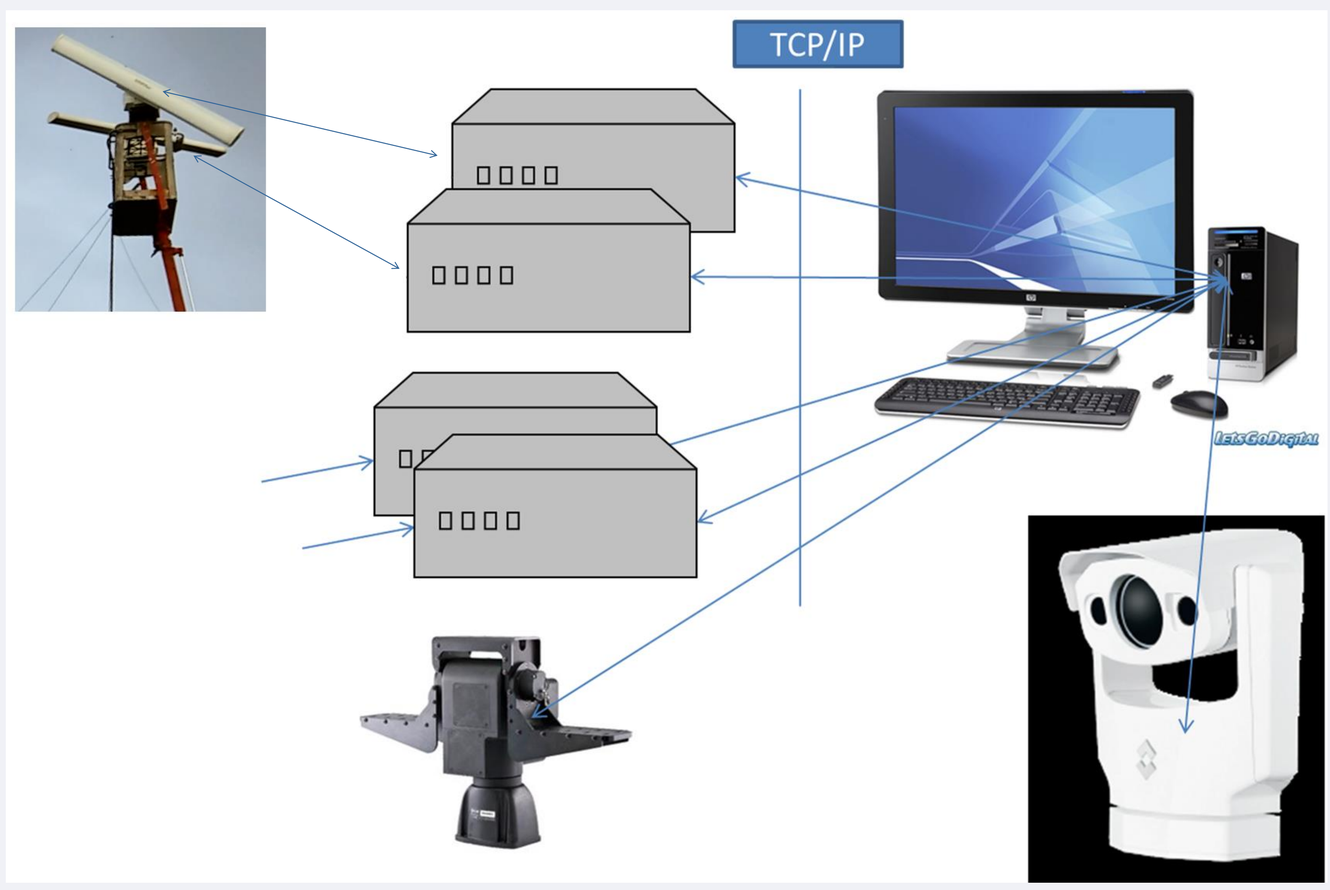
Data collection during the ORJIP Bird Collision Avoidance Study will continue until the end of 2016, and will improve the evidence on seabird collision risks by providing more detailed and reliable information, particularly regarding micro and meso avoidance rates for a range of seabird species.

Following ORJIP, the next generation TVADS detection system will pave the way for more efficient monitoring of bird movements in marine wind farms by providing automatic recordings of 3-dimensional track data at species level.

Methods

The novel aspect of the project has been the development and application of a TVADS (Thermal & Visual Animal Detection System) camera system applied in digital communication with surveillance radars within the Thanet offshore wind farm. The digital communication, which allows coverage and species identification day and night in larger zones of the wind farm is controlled by a FPGA based Data Aqusition and Preprocessing System (DAPS) and a software package DAPSControl, for controlling the DAPS. Detection data (blips) are sent directly (using TCPIP communication) from the DAPS to the TVADSTracker, the software for automated tracking and geo-referencing of species-specific track data and for storage of recorded tracks and videos.

The DAPS samples at 100 Mhz and performs real time target identification using cross-correlation to known bird-echo-returns on data from the radar. The TVADSTracker is capable of concurrently receiving Blips from multiple radars scanning in horizontal or vertical mode. The camera records videos in visual and IR mode.



Application of the TVADS camera-radar system for 3D-tracking using a combination of horizontal/vertical radars and camera