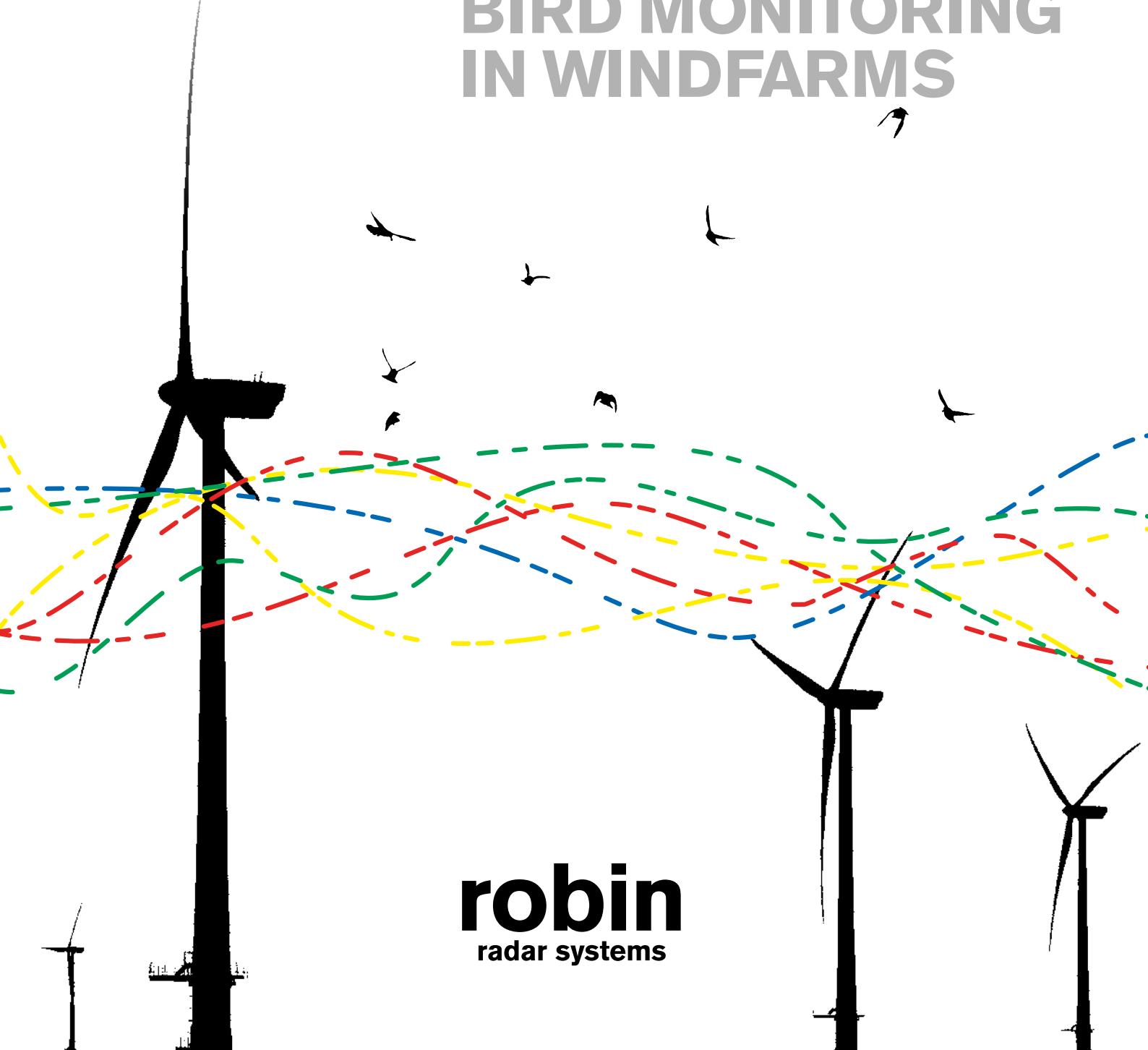


BIRD MONITORING IN WINDFARMS



robin
radar systems



RADAR CAPABILITIES

Radar offers unique complementary potential to human observation.

Radar can detect birds at distances of up to 10 kilometres, all around, day and night. It automatically detects and logs hundreds of birds simultaneously, including their size, speed, direction, flight path and location in accurate metres.

“IN SEARCH FOR THE VERY UNIQUE TECHNOLOGY WE WERE LOOKING FOR, WE LUCKILY FOUND ROBIN RADAR FROM THE NETHERLANDS”

Georg Waldner, MD EVN Naturkraft AG, Austria

NEXT LEVEL OF ENVIRONMENTAL IMPACT ASSESSMENT



Avian radar could be applied during the pre-construction stage as well as the operational stage of a windfarm. During the pre-construction stage, the radar is used as a reliable intelligence tool, gathering data about bird activity at the location of the planned windfarm. This data is a valuable input for any required environmental assessments, as it provides a more detailed insight of flight and behavior patterns of birds and bats in a larger area. Environmental consultants value the ROBIN avian radar for its unprecedented detection and tracking capabilities, its user friendly interface and its high flexibility of the PostGreSQL database, which also facilitates direct integration with GIS applications.

For offshore applications, ROBIN has developed a specific configuration to cope with the challenges of sea clutter.



Picture courtesy of NINA, Norway

MITIGATE IMPACT WITH AUTOMATIC TURBINE SHUTDOWN

ROBIN has developed a module that enables the radar to switch turbine states based on live bird information. This can be done for single turbines as well as for clusters. The module has three operating modes that can run either separately or in parallel:

TEMPORARY WINDTURBINE SHUTDOWN (turbine start-stop module)



1. The first mode continuously measures the number of birds per minute that enters a specific radius of the wind turbines. When this number passes a pre-defined threshold over a fixed time-frame, the system generates a shutdown command for a cluster of turbines. The definition of this threshold is often the result of local surveys and requires fine-tuning after installation.

2. The second mode detects the start of overnight migration during adverse weather conditions. It generates a density grid

and is able to distinguish between single birds, local migration and overnight mass-migration. After detecting an overnight mass migration event, the system can shut down the wind farm automatically.

3. The third mode works similar to the first mode, with the difference that it looks at specific flocking behaviour close to individual turbines. When flocks of birds exceed a pre-defined threshold (area), individual turbines can switch state temporarily.

From a technical point of view, the wind turbine shutdown module is a plug-in to the core ROBIN software. This plug-in feeds a PLC that delivers a dedicated active/shutdown (high/low) signal for each turbine. It also provides a 'heart beat' signal to confirm that the radar is active and connected. This PLC is part of the ROBIN delivery and interfaces with the wind farm SCADA system.



UNIQUE TOOLS & BENEFITS

Bird radar information is logged in real time and is used for data analysis over a given period of time. ROBIN specific software applications, created in close harmony with it's users, are described below.

SEE BIRD MOVEMENTS IN REAL TIME

(The “Visualiser”)



The “Visualiser” displays bird movements on a map in real time. Users can orientate by using a Google background or a customised map with important landmarks and are able to zoom in on a specific bird track representing its flight path.

These tracks have different colours to distinguish high risk birds from low(er)- risk birds. The circle at the end of the track is the birds' present location, with the size of the circle reflecting the size of the bird. The figures next to the circle show the birds speed, height and exact distance from the radar. All this information is provided accurately in meters and is continuously logged in a database to facilitate analysis. (see also “Report Viewer”) The Visualiser contains a playback-mode that allows you to browse through the entire database and review earlier events.

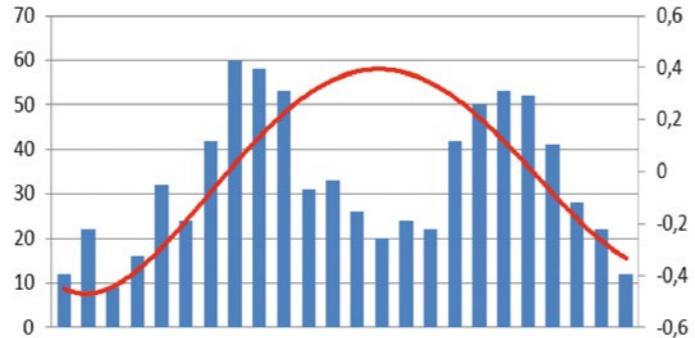
Field observations:
It is possible to add field observations of birds within the Visualiser software and



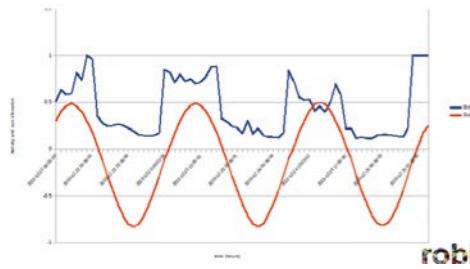
link detected bird tracks to a visual confirmation of particular bird species. This functionality enables ornithologists to link field observations with radar observations and store this information in the same database. Observations can be logged manually or automatically using a laptop or a tablet.



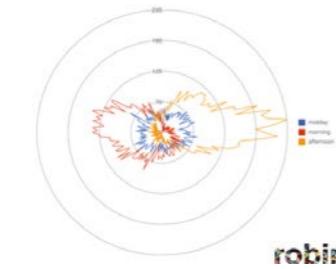
Hotspot identification



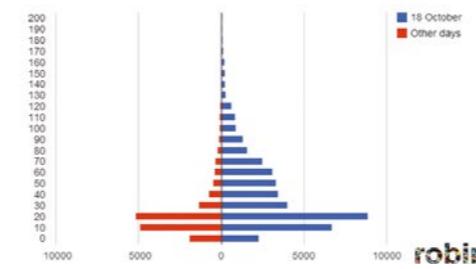
Number of bird movements in a given time



Bird activity versus sun elevation



Flight directions



Height distribution

CONVERT DATA INTO GRAPHS

(The "Report Viewer")



Bird monitoring with radar is not a goal on its own. Customers need to convert the information into periodic reports. This is one of the reasons why measuring, logging and reporting are important. To support this, Robin has developed a unique tool, called the 'Report Viewer'

All track data is stored in the PostgreSQL database. The tool generates basic graphs from the database. This not only involves track information, but also system uptime graphs and weather information. Furthermore the tool enables database snapshotting for export to advanced COTS database analysis tools.

The report Viewer is web-based which means that the tool can be used remotely on a desktop in a comfortable office environment. The possibilities are numerous. A couple of examples of generated graphs are shown on the left page.

CONTROL THE RADAR FROM A DISTANCE

(The "Remote Monitor")



The Remote Monitor is used to monitor the current state of the system. It automatically performs checks on various components of the system and shows the results in a graphical user interface.

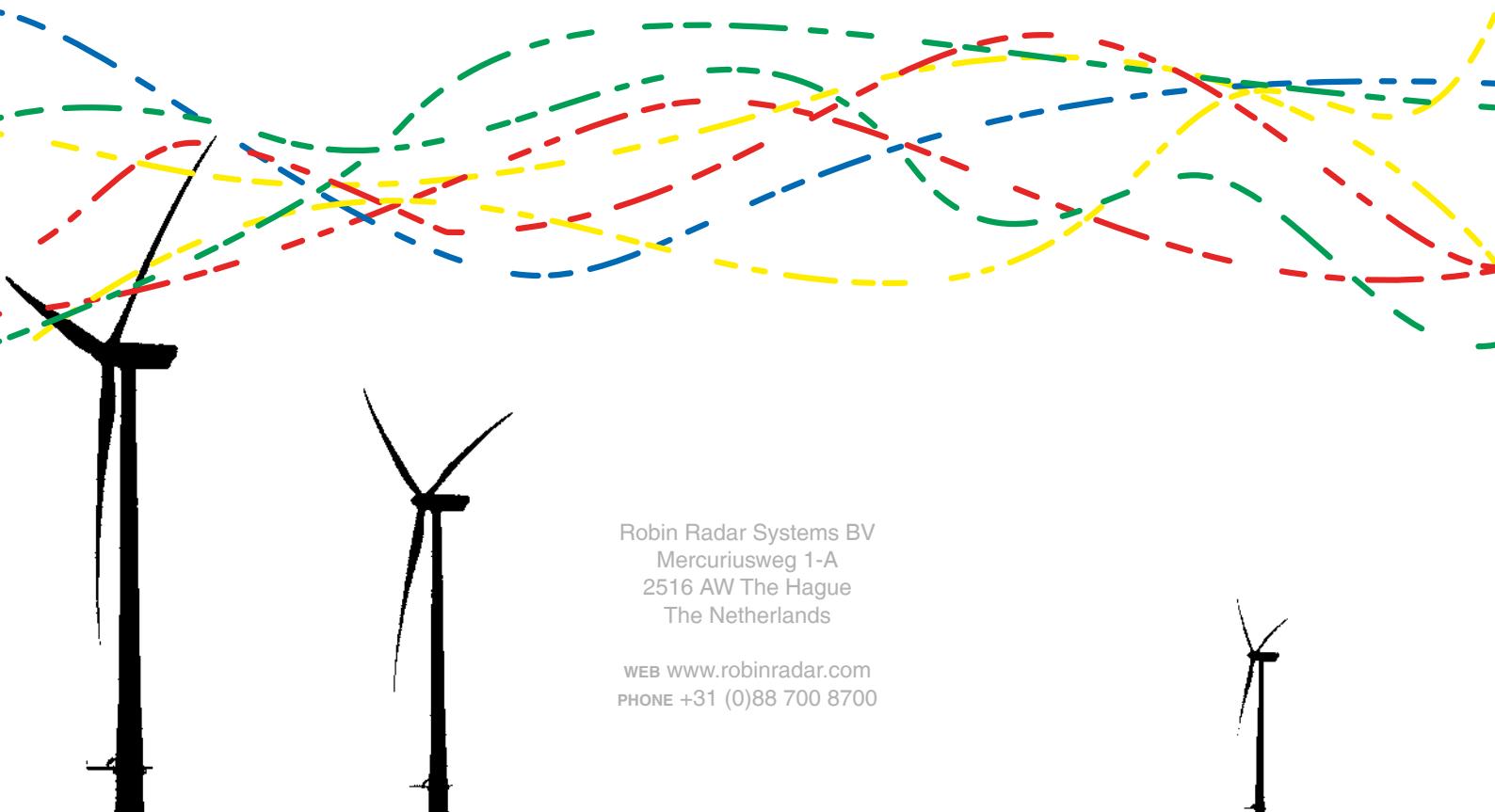
The tool is used to recover from minor system failures by restarting the applicable (sub-) system or even by remotely rebooting a server.



“ROBIN’S CURRENT STATE OF THE ART BIRD RADAR WITH 24/7 HIGH RESOLUTION BIRD DETECTION, IS A MUST FOR ACCESSING AND MITIGATING THE RISK IN ANY LARGE SCALE WINDFARM DEVELOPMENT...”

Mati Kose, Ornithologist, conservation and EIA expert University of Tartu, Estonia





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