Bird Monitoring & Reduction of Collision Risk with Wind Turbines

DTBIRD® SYSTEM

SEPTEMBER 2017

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BIRD & BAT PROTECTION

Bird Monitoring & Reduction of Collision Risk with Wind Turbines

DTBird® is a self-working system that monitors bird activity in real-time, and detects any bird Species flying during daylight or night, all year round.

DTBird® System can be installed in Wind Turbines (WTGs), Meterological Towers and other facilities (On & Offshore).

In operating Wind Farms, DTBird® System includes specific modules that take automatic actions to reduce the collision risk of birds with the WTGs: DTBird® Collision Avoidance Module, and DTBird® Stop Control Module. In addition, DTBird® Collision Control registers bird collisions.

Overall **Bird Collision Probability** in WTGs installed with DTBird® Collision Avoidance and/or Stop Control Modules is <0.1 ‰ (<1 collision*/ 10,000 birds detected at <300 m to the WTG), with <0.05 collisions*/WTG/Year.

* Collisions monitored by DTBird® Collision Control Module.

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DTBird® has 4 modules available for birds:

Detection

Automatic and real-time detection of birds flying during daylight or night, by high resolution image analysis.

Collision Control

Video and audio recording of high collision risk flights, including bird collisions (with the blades, tower and nacelle), and injured birds that fly away.

Collision Avoidance

Emission of Warning and Discouraging Sounds adjusted to bird collision risk and legal requirements.

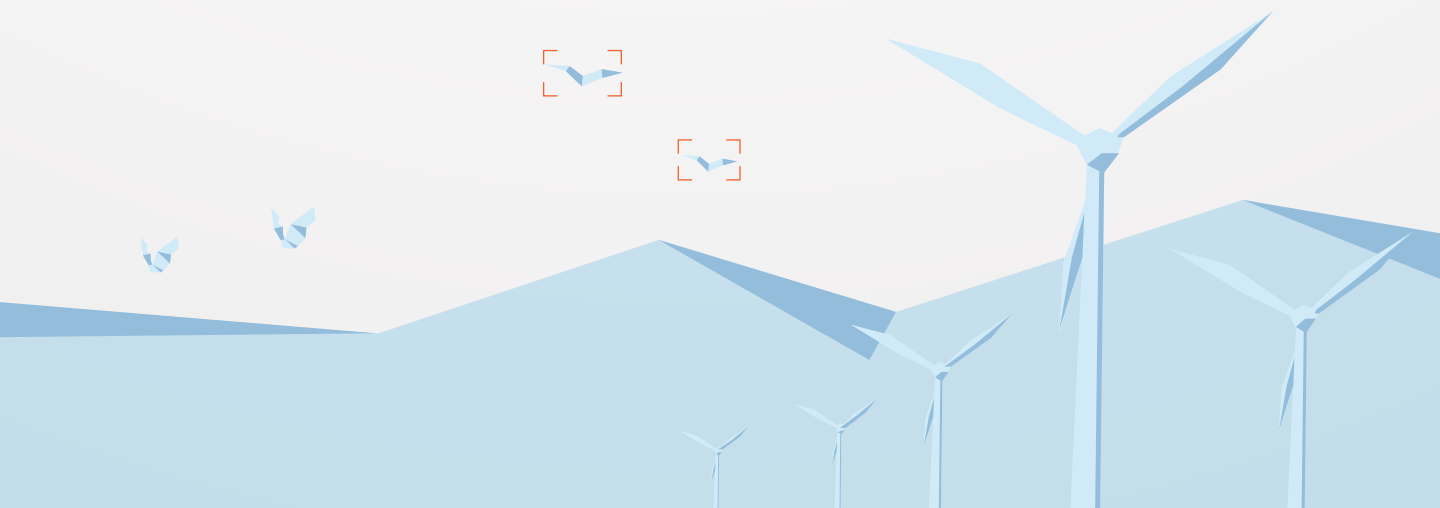
Stop Control

Automatic wind turbine stop trigger and restart, according to real-time collision risk of bird flights detected.

Videos of every bird flight, environmental data, WTG operation parameters and DTBird® actions are recorded and uploaded daily to an online Data Analysis Platform (DAP), available to the Client through the Internet. The DAP also provides Automatic Service reports that summarize service profiles, bird flights, DTBird® actions, and bird collisions detected.

DTBird® Systems are customized for every wind farm depending on wind turbine dimensions, target species, local weather and collision risk mitigation actions selected.

The first installation of DTBird® in a WTG was set up in March 2009 in Spain. DTBird® has been installed in Austria, France, Germany, Greece, Italy, Poland, Spain, Sweden, Switzerland, Norway and the USA, in On & Offshore projects.



Detection Module

Features

- **Installation sites**: WTGs, Meteorological Towers and other facilities (On & Offshore).
- **Detection sensors**: 4 to 8 Daylight HD Cameras, and/or 2 to 8 Night Vision Thermal Cameras per WTG.
- **Surveillance area**: 360° around the installation site.
- **Detection distance**:

BIRD WINGSPAN	SET UP RANGE	
	DAYLIGHT	NIGHT
> 150 cm	200 - 600 m	140 - 230 m
75 - 150 cm	100 - 350 m	70 - 140 m
< 75 cm	25 - 175 m	20 - 70 m

- **Daily service period**: Continuous monitoring during daylight (light > 50 lux), and night.
- **Bird Detectability**: > 80 %.**

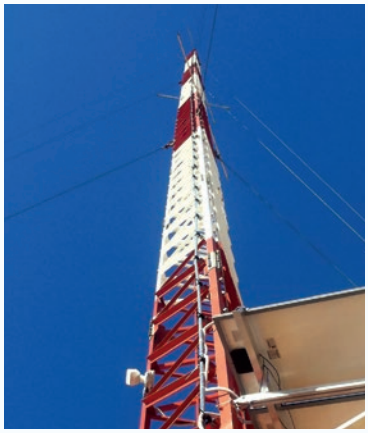
Observations:

* Environmental variables include, at least: temperature, rain, wind speed, wind direction and light.

** DTBird® daylight detectability reported by the *Norwegian Institute for Nature Research* (NINA) in December 2012 for all bird species, in an area where the most frequent species are eagles, was 86 – 96% of all birds in a radius of 150 m to the WTG and 76 – 92% in a radius of 300 m. DTBird® detectability has been improved since 2012, and detection distances have increased to the present figures in the table.

Recorded Data

- Video and sound recordings of every flight.
- Flight time data: Init time and total length.
- Environmental data*, and WTG operational parameters.
- Species/group and bird behaviour review from video recordings.



DTBird® Detection Module installed in a meteorological tower. 2 to 8 HD Cameras can be installed per tower.

Collision Avoidance Module

Features

- **Installation sites**: WTGs.
- **Dissuasion units**: 4 to 10 Speakers per WTG.
- **Sound features**:
  - Warning Sounds to bird flights with Potential Collision Risk.
  - Discouraging Sounds to bird flights in High Collision Risk Area/Rotor Swept Area.
  - Trigger in real time: < 2 s after flight detection in collision risk.
  - Power adjusted to legal requirements and bird sensitivity.
  - Sound emission projected to the Rotor Swept Area.
- **Collision risk reduction:** Already reported.*

Observations:

The Collision Avoidance Module can reduce the number and length of flights within the collision risk area around a WTG. This results in the reduction of the number and length of WTG Stops, which are triggered by the Stop Control Module.

*Reported by ECOCOM, Sweden, 2016: Pilotinstallation av DTBird-systemet i Sverige. (Summary translated to English available in Downloads section of www.dtbird.com).

Recorded Data

- Warning/Discouraging Sounds time data: Init time and total length.
- Video and sound recordings of bird flights and Warning/Discouraging Sounds.

DTBird® Collision Avoidance Module Speakers installed on the WTG tower. 4 to 10 Speakers can be installed per WTG.

Stop Control Module

Features

- **Interface with WTG**: DTBird® system hardware and software compatible with all WTG manufacturers.
- **Automatic Stop trigger**: Linked to real-time flight detection at the collision risk distance.
- **Collision risk distance**: Configured according to WTG complete rotor Stop time and Target Species flight features in the installation site.
- **Rotor Stop init time**: Depending on WTG manufacturer, 2 - 18 s after DTBird® stop trigger.
- **Complete rotor Stop**: Depending on WTG manufacturer, 15 - 35 s after WTG stop init.
- **Stop length:** Linked to real-time flight detection in collision risk.
- **Automatic restart** of the WTG when the collision risk disappears.
- Automatic **email notification** of every Stop: Trigger time (first email), end time and duration (second email).
- Stop adjustment to legal requirements.

Recorded Data

- Stop time data: Init time, end time and total length.
- Video recordings of bird flight and the whole Stop.

DTBird® installation in a 119 m tower height WTG.

Observations:

Depending on bird activity, DTBird® model and the stop protocol applied, the total stop duration produced by DTBird® is estimated in the range of 10 - 130 hours/year (with wind speed above 3 m/second).

Collision Control Module

Features

- **Installation sites**: WTGs and Meteorological Towers.
- **Detection sensors**: 2 to 8 Daylight HD Cameras, and/or 2 to 8 Night Vision Thermal Cameras per WTG.
- **Daily service period**: Continuous monitoring during daylight (light > 50 lux), and night.
- **Surveillance area**: The whole rotor swept area.
- **Register of potential collisions in > 96% of flights detected** (360° bird monitoring around the rotor swept area).

Observations:

Currently, the capability to register potential collisions in flights detected during daylight, for all bird species and in all DTBird® Systems operating worldwide, vary from 96 to 100%.

Recorded Data

- Collision check from video and sound recordings, including birds potentially injured that fly away.
- Video and sound recordings of bird collisions.
- Continuous video recording of the previous 10 days.

DTBird® video image with a White-Tailed Eagle in collision risk.

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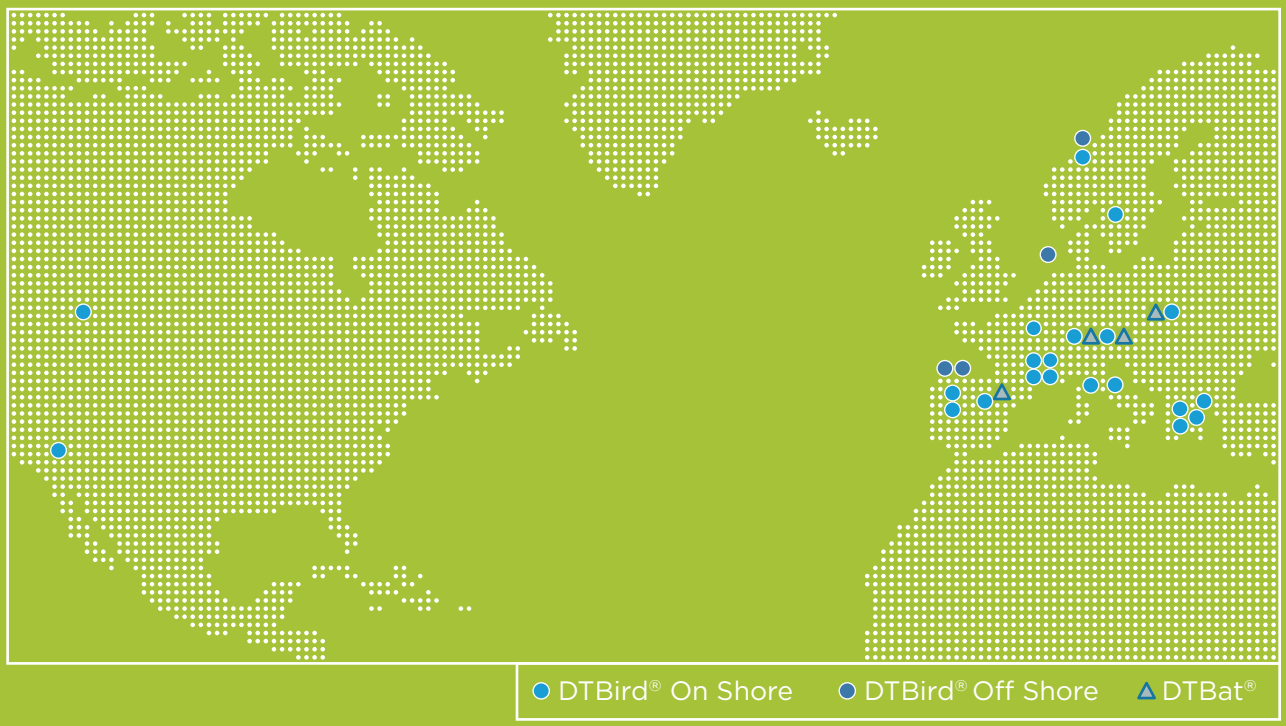
DTBird® System: a world wide reference for bird protection at wind farms

DTBird® features are being requested by Environmental Agencies in an increasing number of countries.



108 DTBird® & DTBat® units installed in 25 existing / projected, onshore & offshore wind farms in 11 countries:

- Austria
- France
- Germany
- Greece
- Italy
- Norway
- Poland
- Spain
- Sweden
- Switzerland
- USA

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