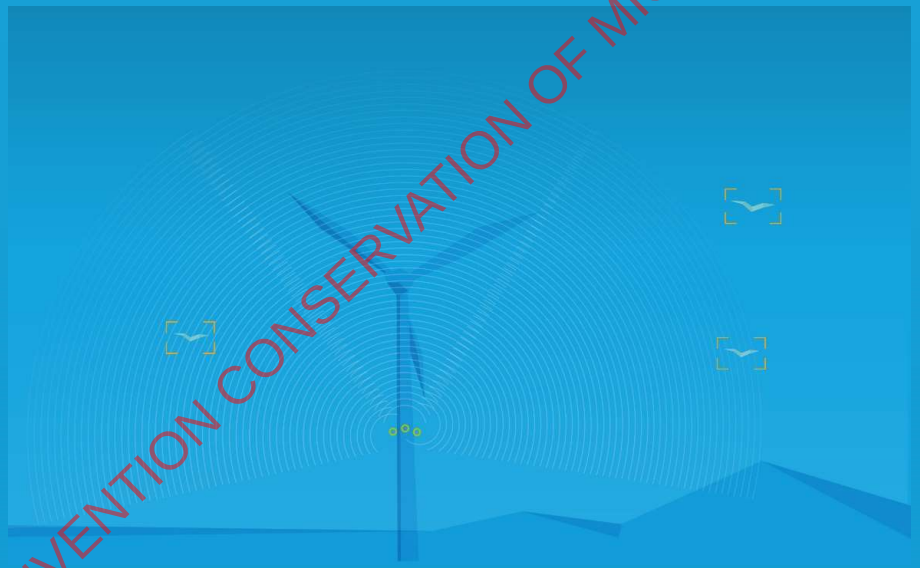
DTBird® & DTBat® Systems

Bird&Bat monitoring and reduction of collision risk with Wind Turbines On&Offshore

Convention on the Conservation of Migratory Species of Wild Animals

September 2017



dtbird®

BIRD & BAT PROTECTION

What is DTBird® System?

- DTBird® is a self working System for Bird Monitoring and Mortality Mitigation at On&Offshore WTGs. Modular design:
  - Detection / Collision Control: Automatic, real-time bird detection based on artificial vision. Collision risk flights and eventual bird collisions are recorded.
    - Day model: light (>50 lux) and surveying 360º around the WTG.
    - Night model: day and night, project specific surveillance areas around the WTG.
  - Collision Avoidance: Automatic emission of Warning and/or Discouraging sounds for birds flying in collision risk.
  - Stop Control: Automatic Stop and Restart of the WTG according to real-time bird collision risk.
- DTBird® Installations and operational settings adapted to any target Species, WTG dimensions and weather conditions.
- DTBird® Online Data Analysis Platforms provide access to: videos with audio; data (flight, environmental, WTG operation); tools to analyze, export and report.

dtbird® BIRD & BAT PROTECTION

What is DTBat® System?

- DTBat® is a self working System for Bat Monitoring and Mortality Mitigation at On&Offshore WTGs. Modular design:
  - Detection: Automatic, real-time bat detection based on ultrasound recognition.
  - Stop Control: Automatic Stop and Restart of the WTG according to bat activity detected in real-time and/or environmental variables.

  DTBat® Online Data Analysis Platforms provide access to: bat passes; data (bat calls, environmental, WTG operation); tools to analyze, export and report.

dtbird® BIRD & BAT PROTECTION

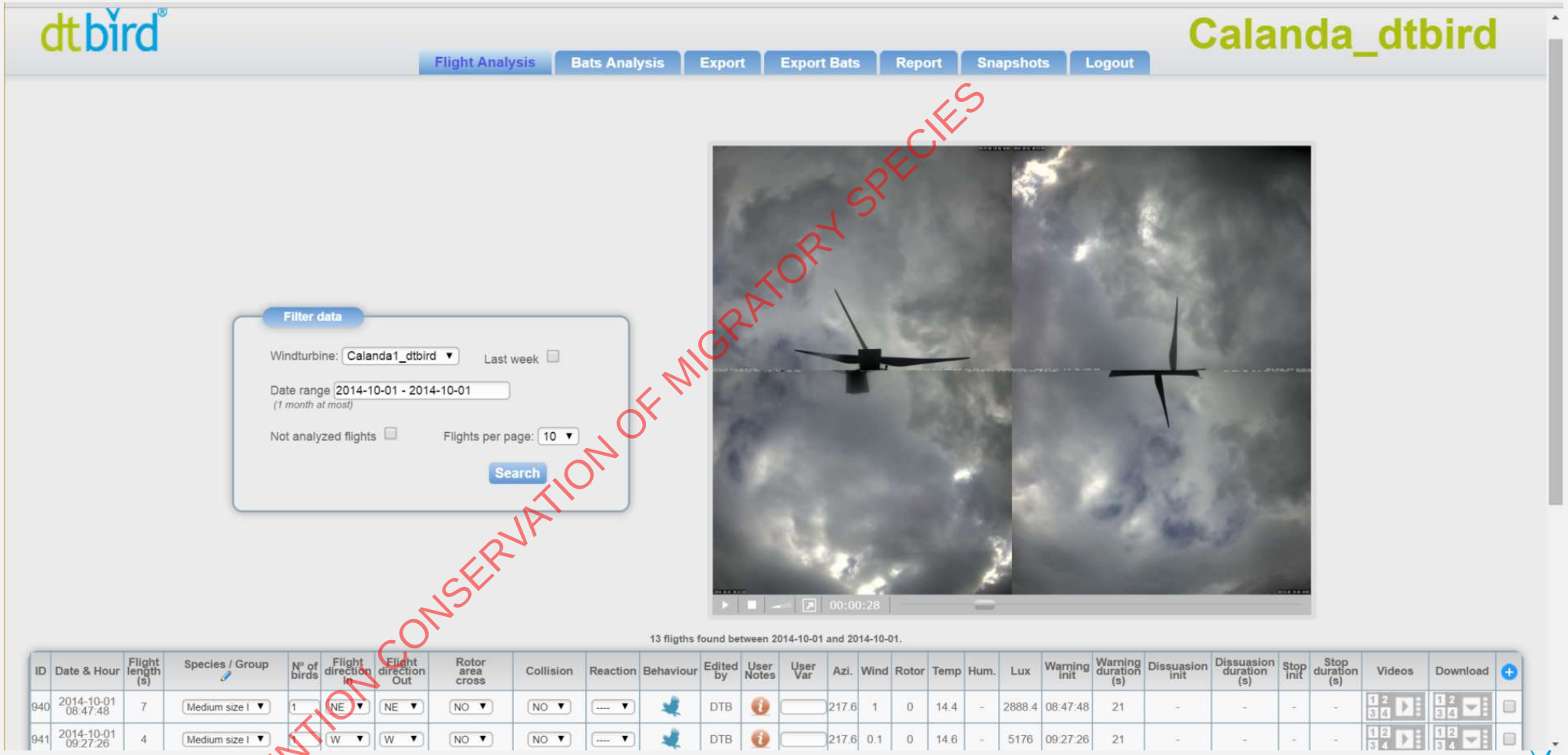
Photos DTBirdV4D4 model 2015 in Sweden

dtbird®
BIRD & BAT PROTECTION

Photos DTBirdV8D10 & DTBatD3 model 2016 in Austria

dtbird®
BIRD & BAT PROTECTION

DTBird® Online Data Analysis Platform Access



dtbird®
BIRD & BAT PROTECTION

DTBird® Detection / Collision Control Module

- DTBird® Detection module has different models customized for every wind farm considering: WTG dimensions, target species, collision risk mitigation actions selected and weather conditions.
- Examples of DTBird® Detection Module models: DTBirdV4, DTBirdV8, DTBirdN2 and DTBirdN4.
- Bird flights are detected within 2 seconds of presence in the cameras´ surveillance area. Detectability > 80% and 0.2 – 5 False Positives/day, project specific features.
- Potential and accidental bird collisions can be recorded and checked in videos with sound through Online access to DTBird® Analysis Platform.

dtbird®
BIRD & BAT PROTECTION

DTBird® Stop Control Module - EFFICIENCY

- DTBird® Stop Control module performs Automatic wind turbine stop and restart according to real-time bird collision risk evaluation.
- Stop control protocols are customized for every wind farm. Two main stop control protocols can be implemented: Stop triggered by any individual bird or flock approaching to the WTG and/or stop triggered by thresholds of bird activity.
- Depending on bird activity and the stop protocol applied, the estimated total stop duration produced by DTBird® Stop Control is in the range 10-130 hours (with wind speed above 3 m/s)/year. FP stops/year 0.5-10 hours, project specific features.
- DTBird® Stop Control Module´s efficiency in reducing bird collision risk varies from 10 to 80 % of detected bird flights depending on 4 parameters:
  - DTBird® model detection distance for the target species: 100-600 m.
  - DTBird® stop control protocol: individual flights or thresholds.
  - WTG communications protocols: time needed to start WTG stop: 2-15 s.
  - WTG stopping time: 15-35 s.

dtbird
BIRD & BAT PROTECTION

DTBird® Collision Avoidance Module

- DTBird® Collision Avoidance module has different models customized for every wind farm considering WTG dimensions.
- Examples of DTBird® Collision Avoidance Module models: DTBirdD4, DTBirdD8 and DTBirdD10.
- Sound type, emission levels and operational settings can be adjusted to: target species, WTG dimensions, local sound regulations and sound sensitive sites.
- Sounds are triggered only with the WTG operating. There are two different sound types: Warning sound: triggered by birds detected in Potential Collision Risk; Discouraging sound: triggered by birds detected in High Collision Risk/Rotor Swept Area. False Positives/day 0.2-4.5 (0.1-2.5 min/day), project specific features.

dtbird®
BIRD & BAT PROTECTION

EFFICIENCY DTBird® Collision Avoidance Module: Public Evaluations of DTBirdV4D4 model 2015. Results by Swedish independent firm

- The system is viable for bird detection and enables species identification of large and medium-sized birds.
- The system offers effective protection above all for large birds by reducing their dwell time in the risk area between 61-87%.
- The system triggers avoidance behavior in 88% of cases where the bird is on a collision course with the wind turbine.

dtbird®
BIRD & BAT PROTECTION

EFFICIENCY DTBird® Collision Avoidance and/or Stop Control Modules: Calculated Bird Collision Probability in WTGs equipped with DTBird®

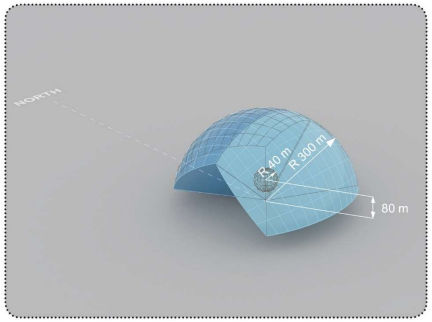
Collision Probability in WTGs equipped with DTBird® Collision Avoidance and/or Stop Control Modules Onshore		
Study Period:	January 2013 - June 2015	
Study Area:	All Wind Farms equipped with DTBird® Collision Avoidance and/or Stop Control Modules, located in: France, Greece, Italy, Poland, Spain, Sweden, Switzerland and the USA.	
Wind Turbine Generators (WTGs) Studied:	All WTGs equipped with DTBird® Collision Avoidance and/or Stop Control Modules (>40 WTGs)	
Radius of the Surveillance area around the WTG:	**Bird wingspan**	**Radius**
	>150 cm	150-250 m
	75-150 cm	75-150 m
	<75 cm	25-75 m
Service Period:	Daylight (>50 lux)	
Collision probability for a bird detected within the Surveillance area	<0.1 ‰ (<1 collision / 10,000 birds)	
Mean Nº Bird Collisions	<0.05 collisions/WTG/Year	

dtbird® BIRD & BAT PROTECTION

DTBirdV4 & V8 Detection Module Surveillance Areas
Golden Eagle (*Aquila chrisaetos*)

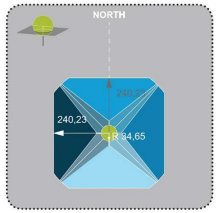
DTBird Detection Module V4
WTG: Tower height 80 m, Rotor diameter 80 m.
Projection of the Surveillance Area at the Maximum Detection Distance.
Target Species: *Aquila Chrysaetos*

3D Projection
Cameras 1 & 3

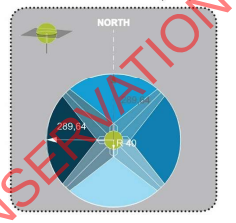


2D Sections
At ¼, ½ and ¾ of the Rotor Swept Area height (RSA)

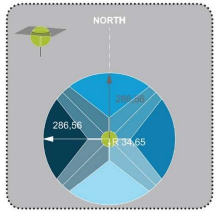
2D Section at ¼ RSA (60m)



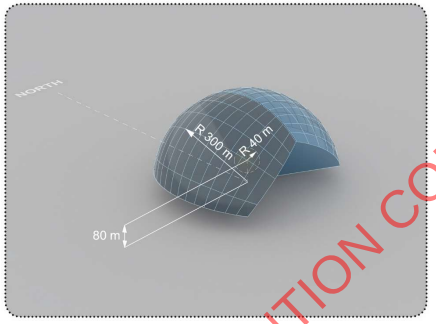
2D Section at ½ RSA (80m)



2D Section at 3/4 RSA (100m)



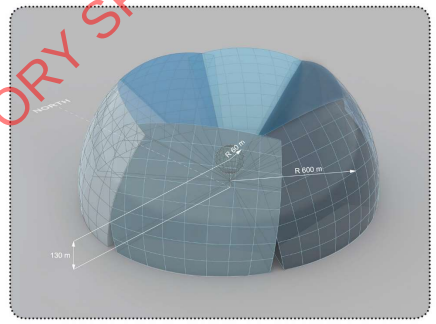
3D Projection
Cameras 2 & 4



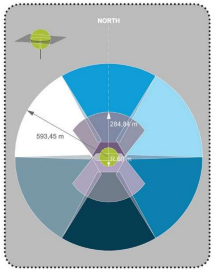
Camera 1 Camera 2 Camera 3 Camera 4
Rotor Swept Area (RSA)

DTBird Stop Control Module (Automatic and in realtime)
WTG: Tower height 130 m, Rotor diameter 120 m.
Projection of the Surveillance Area.
Target Species: . Golden Eagle *(Aquila chrysaetos)*
. WTE *(Haliaeetus albicilla)*

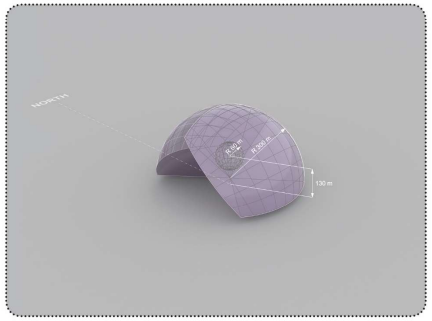
3D Projection
Long Distance Cameras 1-2-3-4-5 & 6



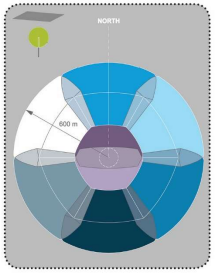
2D Sections
At ½ of the Rotor Swept Area height (RSA)



3D Projection
Medium to Short Distance Cameras 7 & 8



2D Plan projection



Camera 1 Camera 2 Camera 3 Camera 4
Camera 5 Camera 6 Camera 7 Camera 8
Rotor Swept Area (RSA)

dtbird®
BIRD & BAT PROTECTION

Highlights

- Efficiency tested by independent sources.
- Continuous upgrades and improvements are implemented.
- Adaptive management: Stop Control Protocol, Collision Avoidance set up, sound type, etc.
- Cost 0.5-2 % of the project investment and 0.5-2 % of the annual turnover, when installed in all WTG.
- Operating at wind turbines since 2009. Over 105 units installed. Worldwide availability.
- Requested by Environmental Authorities and recommended by Bird Protection NGOs in an increasing number of countries.
- Objective and transparent data traceability, with online access for the interested parties (wind farm owner, Environmental Authorities, others).

dtbird
BIRD & BAT PROTECTION

Barriers for DTBird® & DTBat® Systems implementation in highly migratory locations

- Lack of public information/research programs including the use of this technology in highly migratory locations.
- Decision makers, NGO´s and prescriptors are not aware of the system capabilities.
- Environmental Decisions/Wind farm authorizations request radar studies, instead of: bird detection technologies with specification regarding features, actions to mitigate the collision risk, adaptive management, data storage, access and traceability.
- DTBird® and Radar technologies are considered exclusive one from the other, but the information/actions that each one provides are mostly different. Rather than excluding, they complement each other. The exclusion of one of these technologies in highly migratory locations is leading to a lack of information today and affecting the future.
- In order to implement and operate the monitoring and mitigation actions including adaptive management, a budget for the life of the Wind Farm should be requested. Who controls the monitoring and mitigation actions? What to do if they are not implemented or operating properly?

dtbird®
BIRD & BAT PROTECTION

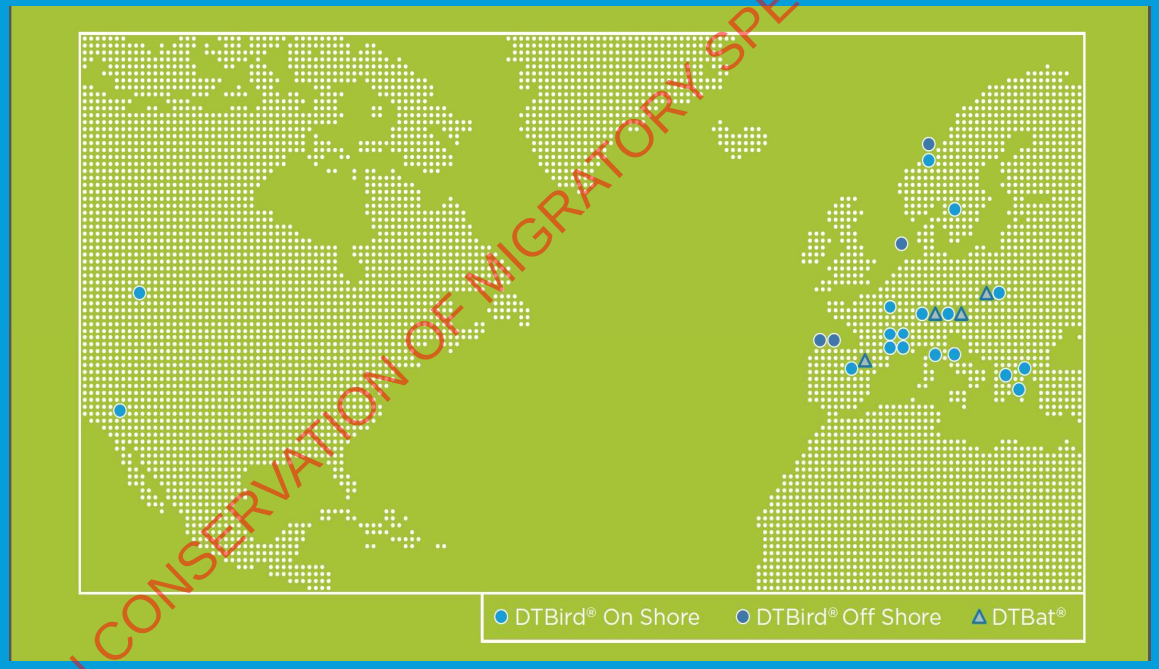
What can DTBird&DTBat contribute to migratory regions

- Reduction of bird&bat collision risk with WTGs, by both Collision Avoidance for birds (sound emission) or WTG shutdown.
- Bird´s flight videos with objective and traceability data showing bird migrations, species, efficiency of the mortality mitigation actions. Needed information to understand high collision risk flights, collisions, and then improvement of mitigation actions (adaptive management).
- Online raw data and reporting tools availability worldwide.
- Some locations with high collision risk for birds or bats should be excluded from wind energy developments independently of the technology proposed to mitigate the collisions.

  But the question is if other wind farm locations with moderate, uncertain or expected collision risk to vary among years, should request technology to automatically detect birds/bats and to trigger collision risk mitigation actions in order to reduce the collision risk, improve scientific knowledge, allow adaptive management, and to provide objective data traceability along year(s)?

dtbird
BIRD & BAT PROTECTION

Thank you for your attention!



Over 105 units installed in 11 countries
Over 50 units schedule to be installed On&Offshore in America, Europe and Asia