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AUTOMATIC & REAL-TIME PROTECTION



BIRD & BAT MONITORING COLLISION RISK REDUCTION

Onshore & Offshore

Liquen Consultoría Ambiental S.L.



Mission

We develop, manufacture & install technologies to make Wind Energy compatible with Wildlife preservation through automatic & real-time protection.

Vision

Become a global reference in the wind energy sector.

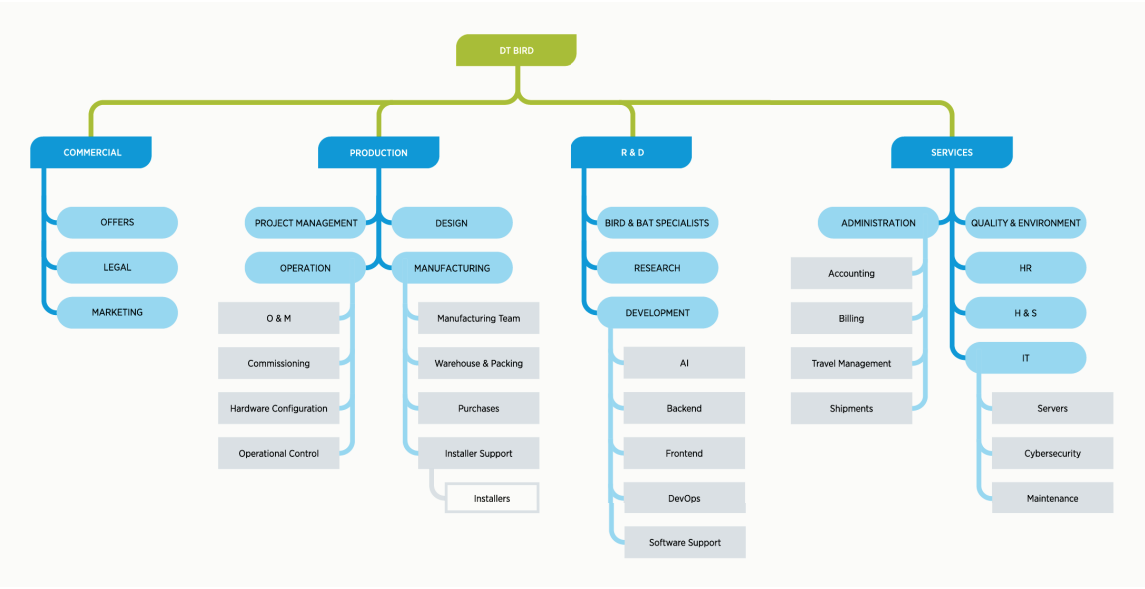
Support the renewable energy transition.

Preserve avian and chiropter wildlife in the long term.

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Organizational Chart

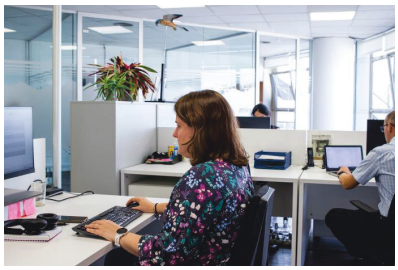


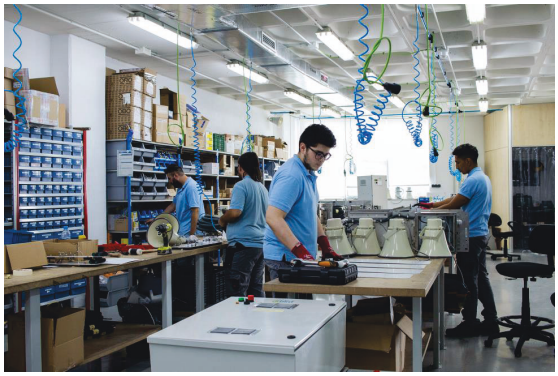
Liquen Team

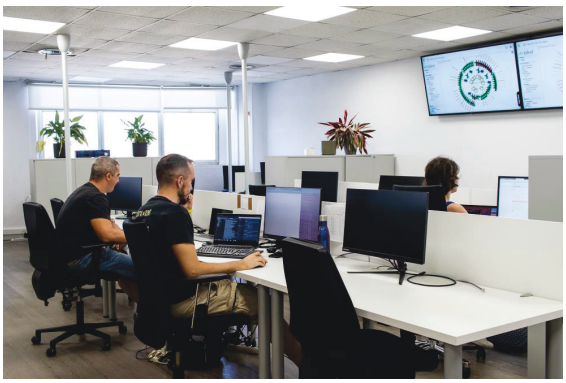
50+ technicians devoted for bird & bat monitoring and mortality mitigation at wind farms.

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Office and Manufacturing area

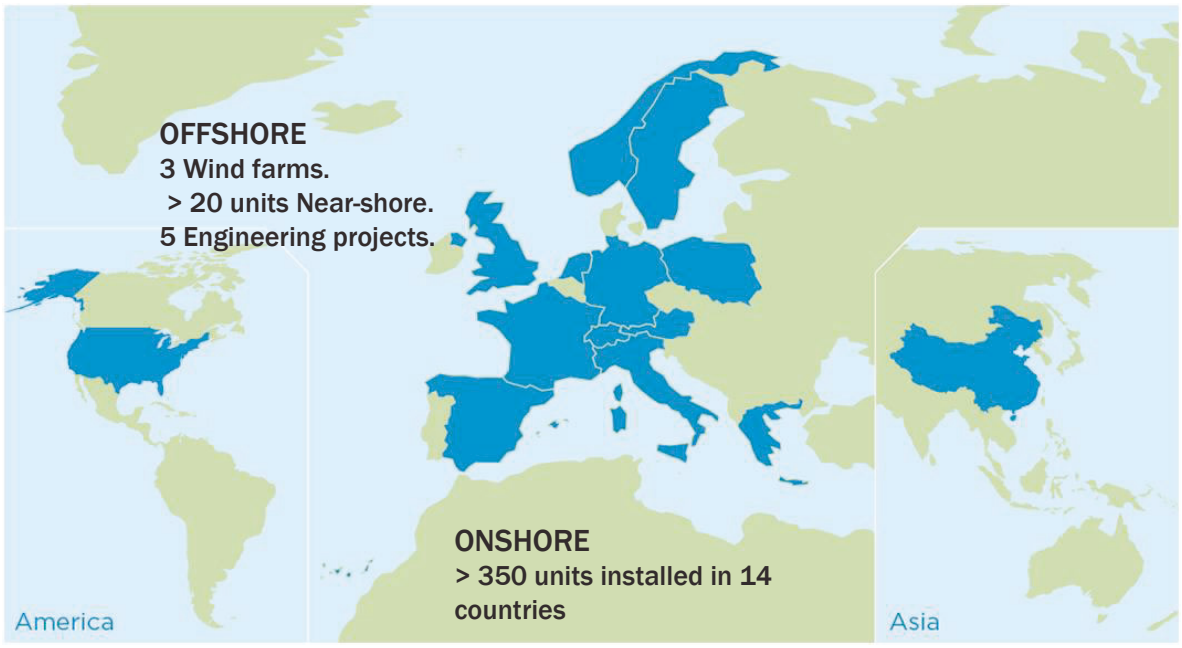






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DTBird® & DTBat® installations



Operating onshore

2009

Current day

Operating offshore

2016

Current day

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EU Declaration of Conformity (ISO/IEC 17050-1:2004)

CE

DECLARACIÓN DE CONFORMIDAD UE
(de acuerdo con la norma ISO/IEC 17050-1:2004)
EU DECLARATION OF CONFORMITY
(according to ISO/IEC 17050-1:2004)

Fabricante del producto: LIQUEN CONSULTORÍA AMBIENTAL S.L.
Product manufacturer

Dirección: Av. De la Democracia, 7, nave 406, 28031, MADRID
Address

Modelo/Referencia: DTBird & DTBat
Model/Reference

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CUMPLE LOS REQUISITOS DE LAS DIRECTIVAS:
CONFORMS WITH THE REQUISITES OF THE DIRECTIVE

Directiva 2014/30/UE de Compatibilidad Electromagnética
Directiva 2014/35/UE de Baja Tensión
Directiva 2011/65/UE sobre RoHS
Directive 2014/30/EU relating Electromagnetic Compatibility
Directive 2014/35/EU relating LVD
Directive 2011/65/EU relating RoHS

NORMATIVA APLICABLE:
APPLICABLE STANDARDS:

UNE-EN 55032:2016	*UNE-EN 55035:2017*	*UNE-EN 61000-3-2:2014*	*UNE-EN 61000-3-3:2013*
UNE-EN 62233:2008 + AC:2008	*UNE-EN 62368-1:2018*		

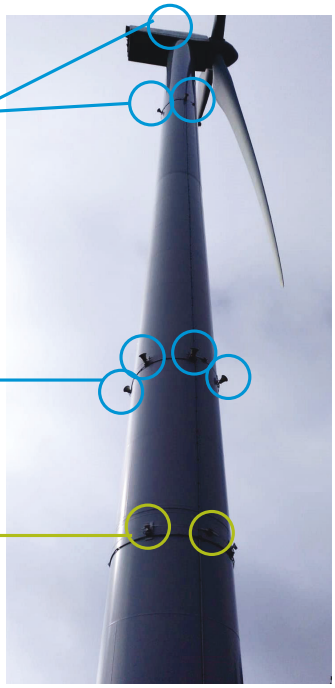
LIQUEN Consultoría Ambiental
Avda. de la Democracia, 7 - 28031 Madrid - Spain
Tel: +34 91 3[illegible] - CIF: ESB83521732

Fecha: Diciembre 2019
Date: December 2019

Javier Díaz (Technical Manager)
Nombre, cargo y firma
Name, position and signature

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DTBird® System modules



- Bird Monitoring
- Mortality Mitigation

- Target Species
- WTG Dimensions
- Weather Conditions

Detection/Collision Control Module

Collision Avoidance Module

Stop Control Module

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DTBat® System modules

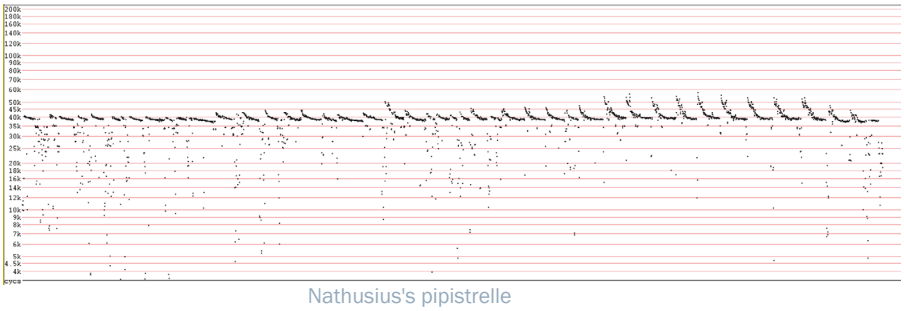


- Bat Monitoring
- Mortality Mitigation

- Target Species
- WTG Dimensions
- Weather Conditions

Detection Module

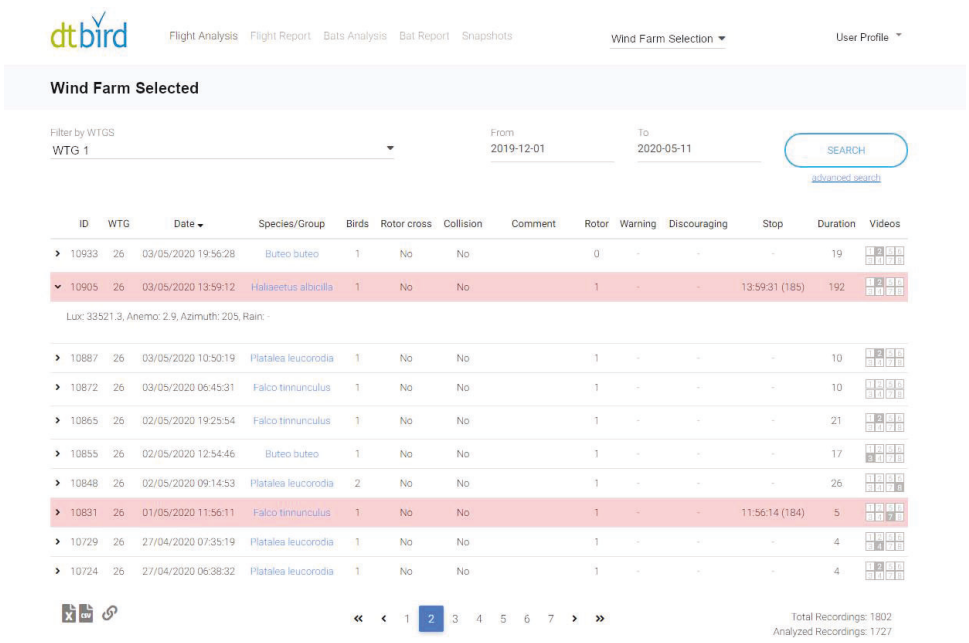
Stop Control Module



Nathusius's pipistrelle
(*Pipistrellus nathusii*)

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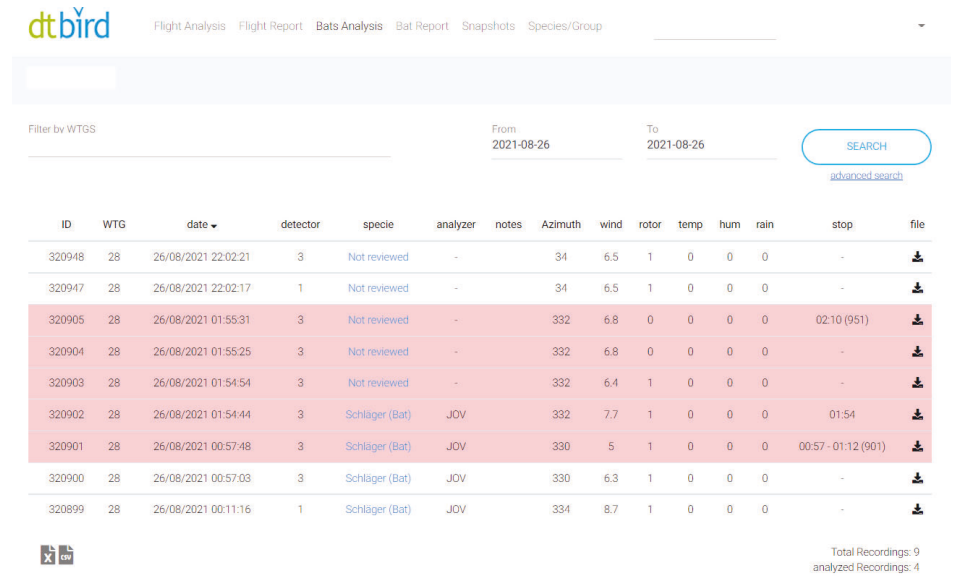
DTBird Online Data Analysis Platform Access



- Available remotely.
- 2 access levels.
- WTG operational parameters.
- Bird flight data.
- Videos with sound recorded (DTBird).

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AUTOMATIC & REAL-TIME PROTECTION

DTBat Online Data Analysis Platform Access



- Available remotely.
- 2 access levels.
- WTG operational parameters.
- Bat flight data.
- Sonograms (DTBat).

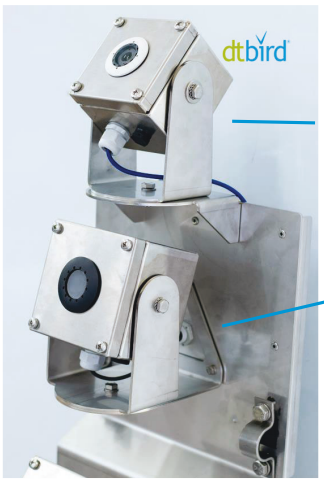
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DTBird® Detection / Collision Control Module. Models



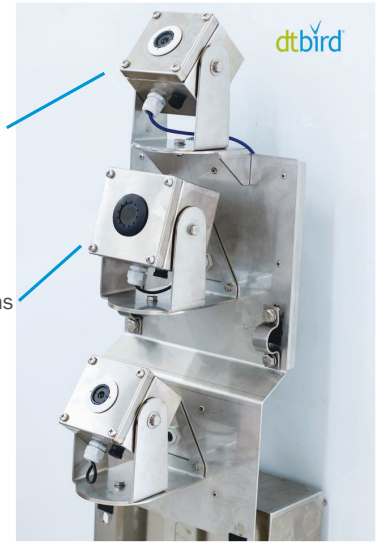
- Models: Day (360º surveillance): DTBirdV4 / V8
  Night: DTBirdN2 / N6
- Bird Flight Detectability > 80% at ½ of MDD.
- FP rate/day: 0,2 – 5,5 DTBirdV4 // 2 - 9 DTBirdV8
- Ornithologists, through video review, can note: Species/groups, high collision risk flights or collisions.

DTBird® Detection / Collision Control Module. Models



Daylight Cameras

Thermal Cameras

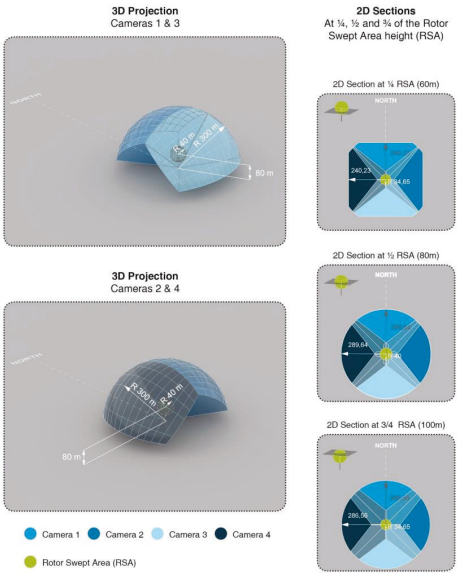


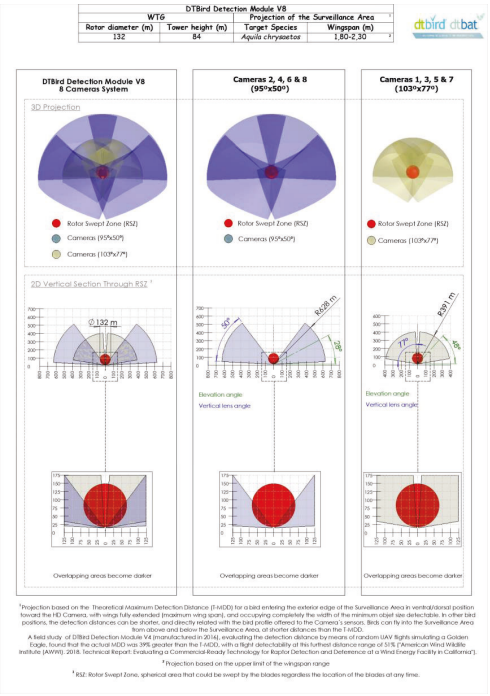
Main Cabinet



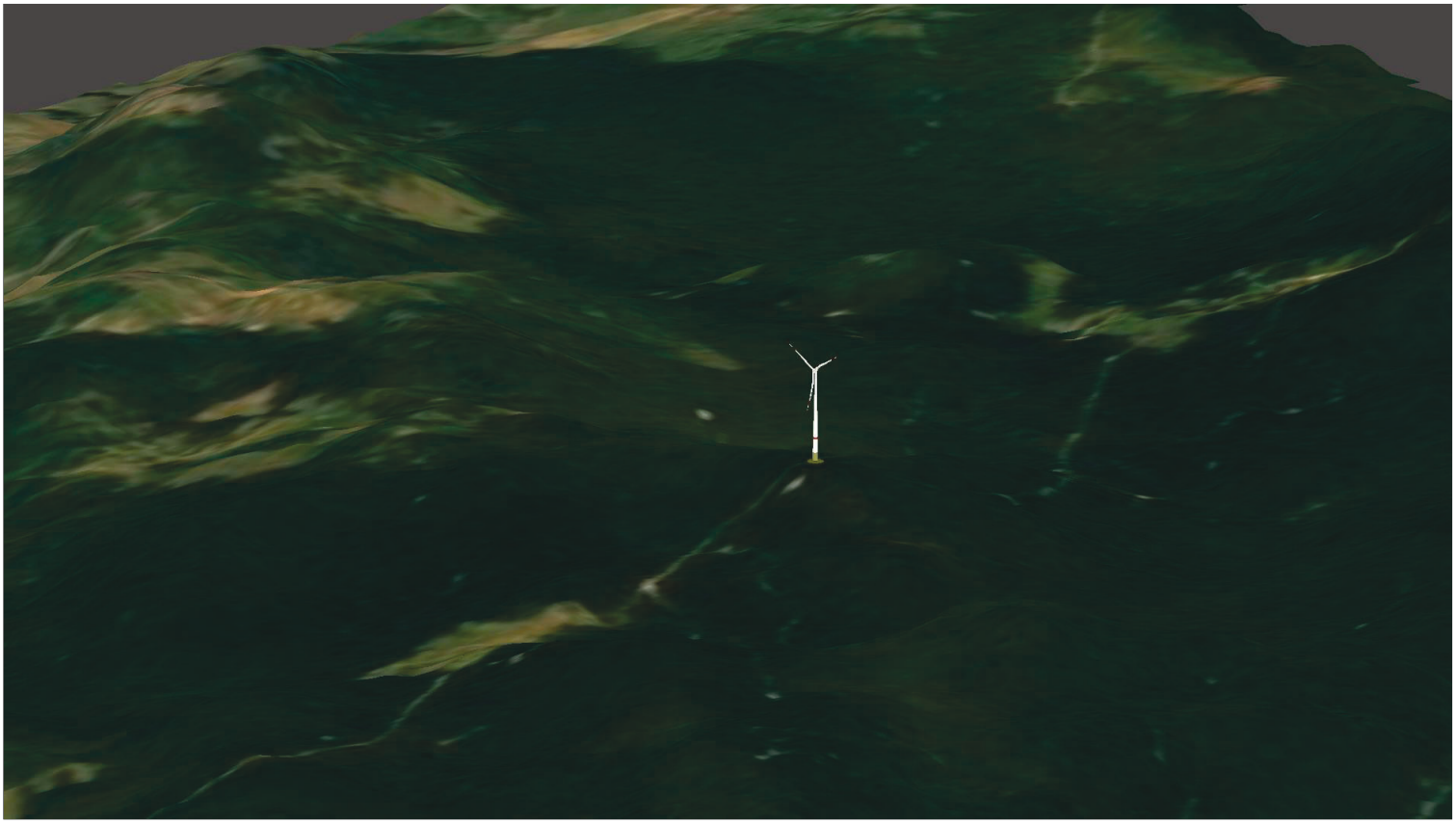
Collision Avoidance Cabinet

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



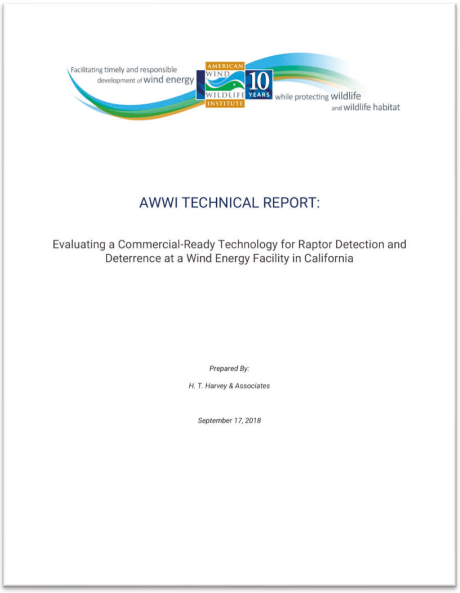


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DTBird® Detection / Collision Control Module. Evaluation

DTBirdV4 Model of 2016



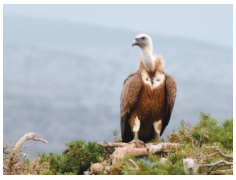
- 63% Mean Detection Rate per distance band (7 distance bands established: >230; 230-200; 200-170; 170-140; 140-110; 110-80; <80 m to the RSA).
- Cumulative Detectability > 80 % in 2 distance bands and > 90 % in 3 distance bands.
- 169 and 179 m average distances for detection and warning respectively.
- 375 m Maximum Detection Distance (MDD). DTBird Theoretical MDD 270 m.

Ongoing evaluation DTBirdV4 Model of 2019.

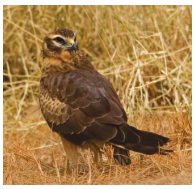
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Maximum Detection Distances – Models 2021

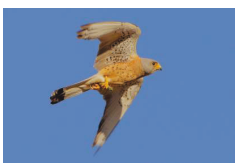
MODEL	V4 103°X77° LUZ >50 LUX	V8 95°X50° LUZ >50 LUX	N 56°X42° 24/7	WINGSPAN (M)
Maximum Detection Distances (m)	391 - 450	628 - 724	355 - 409	2,30 - 2,65
	163 - 197	262 - 317	148 - 179	0,96 - 1,16
	112 - 122	180 - 197	102 - 111	0,66 – 0,72



Griffon Vulture (*Gyps fulvus*)



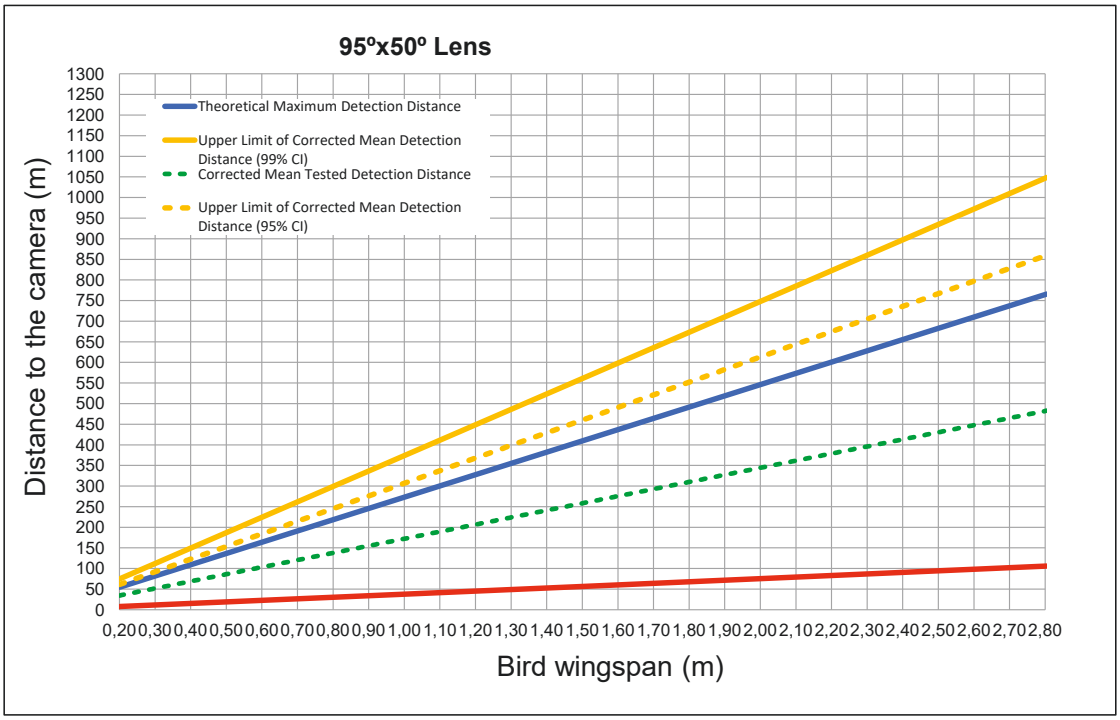
Montagu's harrier (*Circus pygargus*)



Lesser Kestrel (*Falco naumanni*)

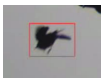
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Maximum Detection Distances – Models 2021



Examples of Detected Bird Species

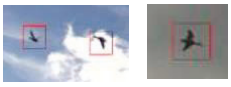
Daylight images



European Robin
(Erithacus rubecula)



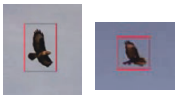
Barn Swallow
(Hirundo rustica)



Ducks
(Anas sp.)



Common Kestrel
(Falco tinnunculus)



Common buzzard
(Buteo buteo)

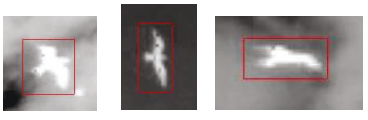


Red Kite
(Milvus milvus)



Griffon Vulture
(Gyps fulvus)

Thermal images



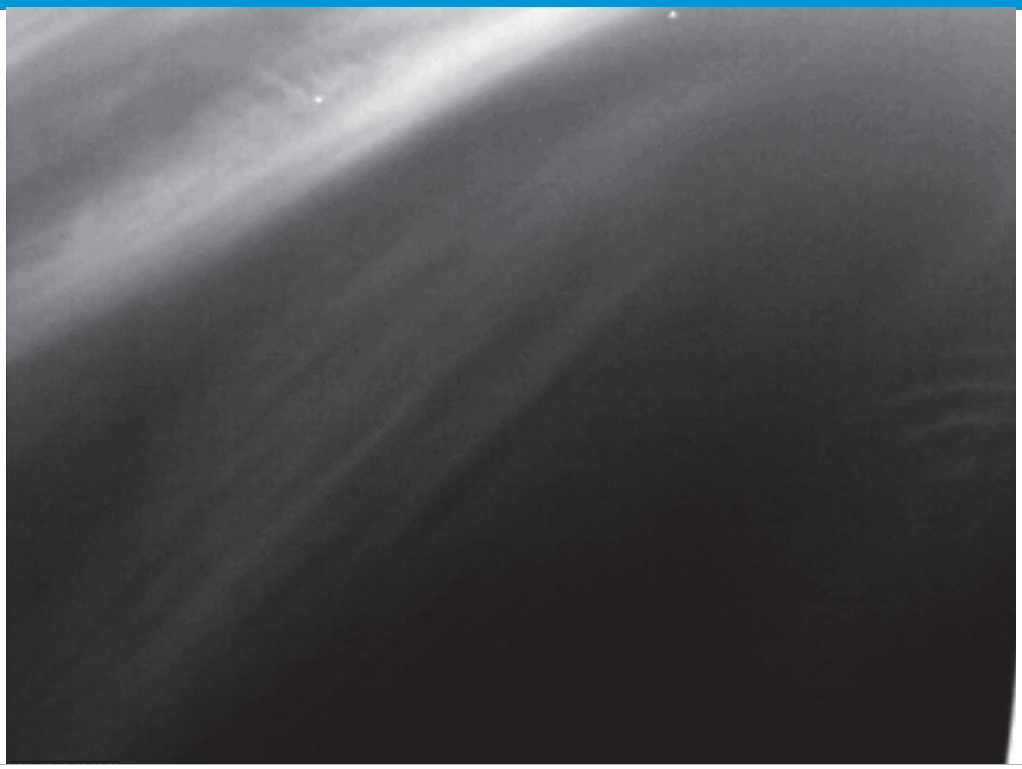
Gull
(Larus sp.)

Examples of bird flights detected – V8 Model



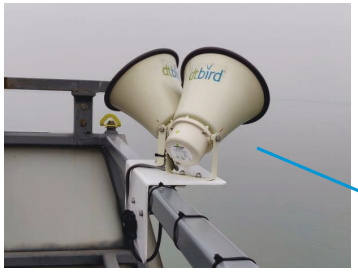
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Examples of bird flights detected - Night

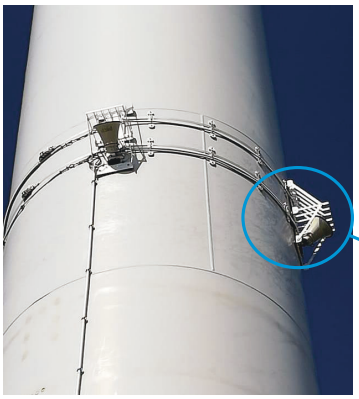


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DTBird® Collision Avoidance Module



Nacelle speakers



Speakers with ice protection

Sound Types
- Warning
- Discouraging

Customization
- DTBirdD4
- DTBirdD8
- DTBird10

FP / Day
- 0.2- 5.5

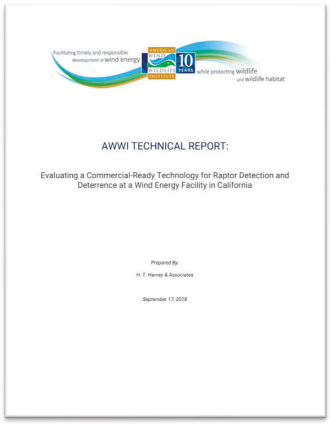
(0.1 – 2.5 min/day)

Adjustable settings
- Sound Type
- Emission Levels
- Operations

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DTBird® Collision Avoidance Module. Evaluation

DTBirdV4D4 Model from 2016



AWWI TECHNICAL REPORT:

Evaluating a Commercial-Ready Technology for Raptor Detection and Deterrence at a Wind Energy Facility in California

Deterrence Response Rate
- Golden Eagles: 52-83%
- Buteos: 36-76%
- All raptors: 39-78%

Bird Avoidance Behavior
- Reduction Flight Time in Risk Area: 61-87%
- Increase in Bird Avoidance Behavior: 42% (From 46 to 88%)
- Bird Avoidance Behavior: 1.9 times higher (88 / 46%)

DTBirdV4D4 Model from 2015

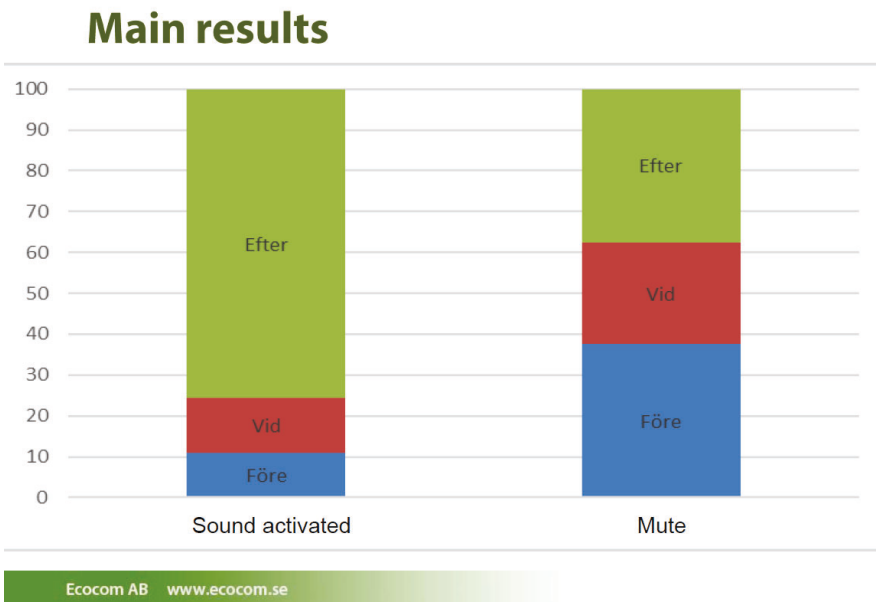


Ongoing evaluation DTBirdV4D8 Model of 2019.

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DTBird® Collision Avoidance Module. Evaluation

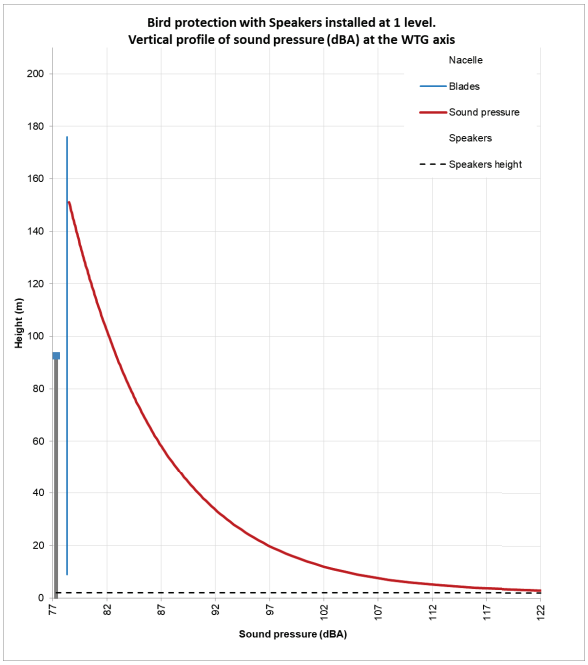
Distribution of bird flight avoidance behaviors with the sound muted and activated.

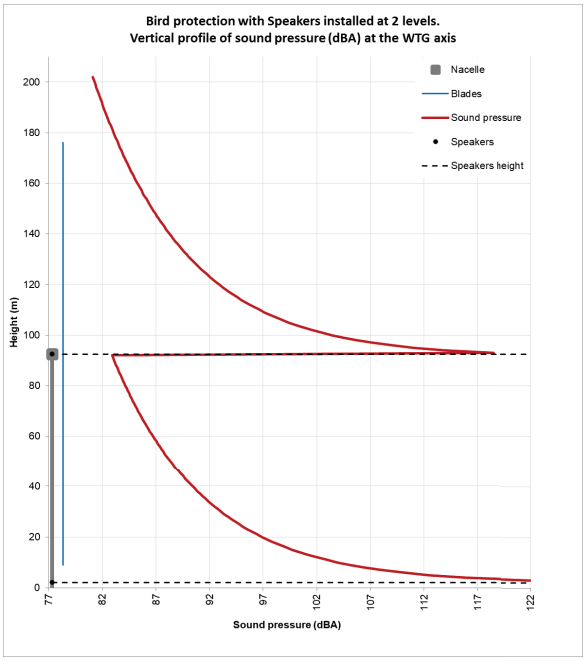


Examples of White-tailed Eagle showing avoidance behavior after DTBird® Collision Avoidance Module sound emissions



DTBird Collision Avoidance Module. Speakers' location and Sound Pressure





- **Sound Pressure:**

  Sound pressure (dB) from a source is reduced by ½ as the distance is doubled.

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DTBird Collision Avoidance Module. Technical proposals on the market

- **1 unique ring of Speakers at low height:**

  Damage to bird's hearing > 120 dBA

  Lack of efficiency < 120 dBA

versus

- **2 rings or more of Speakers**

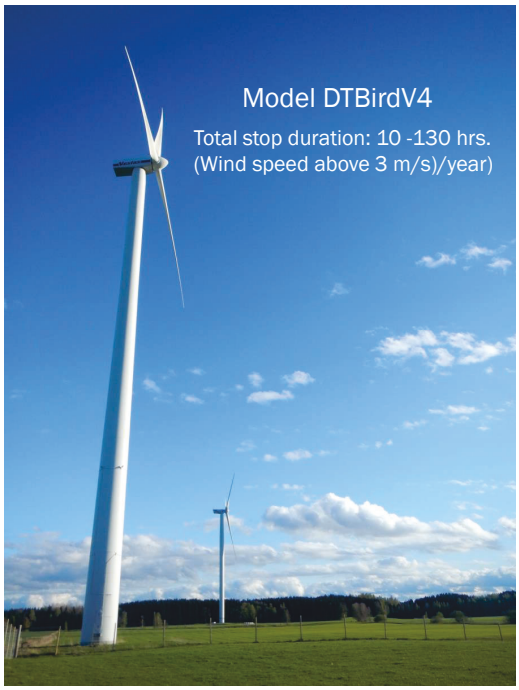
To Highlight

For large WTGs, technical proposals with 1 unique ring of speakers do not fulfill minimum scientific requirements.



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DTBird® Stop Control Module



- Automatic Stop & Restart
- Stop Control Protocols Customization
- FP rate/day: <0,25
- Efficiency Bird Collision Risk Reduction: 10 - 80%
  - WTG Communications protocols
  - WTG Stopping time
  - DTBird® Stop Control Protocol
  - DTBird® Model Detection Distance for Target species

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Example of WTG Stop with DTBird® Stop Control



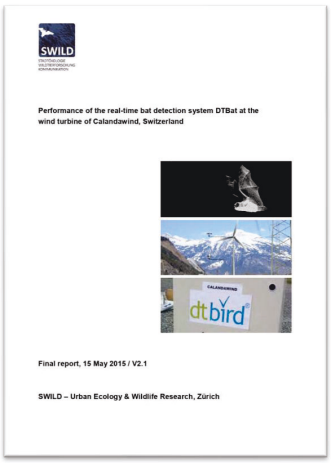
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DTBat® Stop Control Module. Evaluation



- 89,2 – 92,1% Bat activity within the Automatic Stops

DTBatD2 Model from 2014


SWILD

Performance of the real-time bat detection system DTBat at the wind turbine of Calandawind, Switzerland

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Final report, 15 May 2015 / V2.1

SWILD – Urban Ecology & Wildlife Research, Zürich

Upgrades

- Dynamic stop time: eg. >1 Detection in last 15 min
- FP Detection rate: <4%

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Latest Upgrades

- 300% increase in MDD
- 200% increase in videos quality in DAP
- Species identification improvement in video review up to 85%
- New housing for cameras
- 24/7 Thermal cameras
- <0,25 False Positives Shutdowns per day < 3min/stop
- Cybersecurity standard IEC-62443
- Improvement of Automatic failure alerts system

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Coming in 2022

Detectability



Reduction of False Positives



Detection pictures. Height and distance estimation

Automatic species/group identification

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Thank you for your attention

Contact: arioperez@dtbird.com

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