dtbird®
BIRD & BAT PROTECTION

DTBird® System Specifications for Wind Turbines

DTBIRD TEAM

Ref.: DTB0516SPWTG

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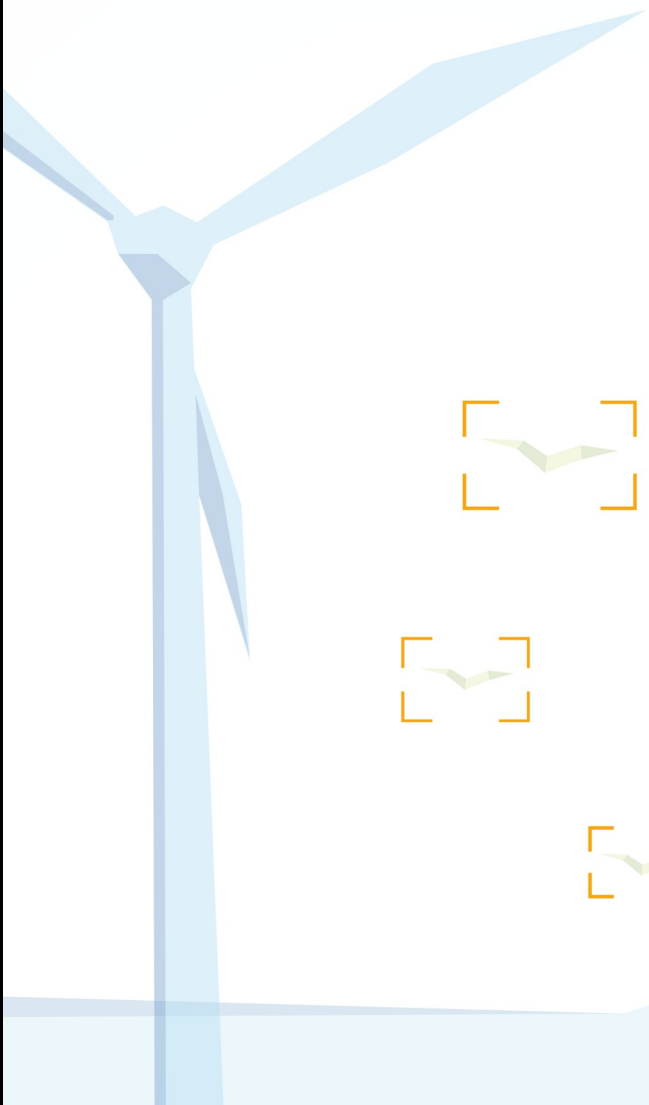

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DTBird® *SYSTEM* SPECIFICATIONS FOR WIND TURBINES

DTBird® *Detection Module*		V4	V8
Service description	Automatic and real-time detection in daylight of bird flights in the airspace surrounding a Wind Turbine (WTG). Video and audio recordings of every bird flight detected uploaded to online Data Analysis Platform with Username and Password protected access, ensuring bird flight traceability.		✓
Installation site	Wind Turbines (WTGs) - On & Offshore.		✓
Module specifications			
Components	HD cameras: 4 units/WTG.	✓	
	8 units/WTG.		✓
	Environmental sensors: Light, Temperature and Humidity. Optional: Rain and Fog. From the WTG: Wind Speed and Wind Direction. Cabinet (1/WTG): Computer, Detection Software, Electrical Protection System, Communications Hardware. Mounting System (not intrusive on WTG). Cables & Connections.		✓
Location on the facility	HD Cameras + Environmental Sensors + Mounting System (patented): outdoors on the WTG tower, from 5 to 80 m height (Project specific). Cabinet: indoors, normally inside the tower. Cables & Connections: outdoors on the WTG tower, and inside the WTG tower.		✓
Cabinet			
Dimensions	51x65x25 cm, WxHxD.	✓	
	51x130x25 cm, WxHxD.		✓
Weight	10 Kg.	✓	
	20 Kg.		✓
Power supply	110-250 AC monophasic 50/60Hz (Power Grid Connection).		✓
Power consumption	55 W.	✓	
	95 W.		✓
Operation conditions	Daylight (>50 lux).		✓
Weatherproof	Outdoor components: IP 66 / -30° to 50° C, protection against lighting and falling ice. Cabinet components: IP 65 / 0° to 40° C (heated cabinet optional).		✓
Communications	Wind Farm Network/Mobile Router 3G/ADSL/Optic Fiber/Satellite Internet.		✓
Service specifications			
Detectable bird Species/Groups	All bird Species/Group.		✓
Bird Species/Group identification	Yes, through the review of bird flight video and audio recordings.		✓
Surveillance area	360° around the WTG.		✓
Radius around the location in the facility	**Bird wingspan** / **Set up range**		
	>150 cm: 200-320 m	✓	
	>150 cm: 350-600 m		✓
	75-150 cm: 100-200 m	✓	
	75-150 cm: 175-350 m		✓
	<75 cm: 25-100 m	✓	
	<75 cm: 25-175 m		✓
Simultaneous detection of multiple bird flights	Yes (360° around WTG), detection of an unlimited nº of flights and birds at the same time.		✓
Bird flight detectability	>80%[1]		✓
Bird flight traceability[2]	Video recordings of every bird flight uploaded in real-time to online Data Analysis Platform, with Username and Password protected access.		✓
False Positive rate (recording with no bird)	0.5 - 4.5 FP/day (yearly average).		✓
Recorded data	Location. Flight ID. Flight time data: Init time and total length. Flight video records, with embedded audio record. Online Snapshots of HD cameras every 10 minutes. Environmental data, and WTG operational parameters during bird flight. Species/group and bird behavior analysis from video and audio recordings.		✓
Online Data Analysis Platform	Video, audio and data storage for 5 years at least, in DTBird® Server with Data Center Classified Tier 4. Flight Analysis tools: review of video and audio records, flight analysis, data export, video download and automatic service reports.		✓
Service Control	Self-checking and daily verification done remotely from DTBird Headquarters.		✓
Warranty	2 years worldwide.		✓

[1] Norwegian Institute for Nature Research (NINA). 2012. Evaluation of the DTBird video-system at the Smola wind-power plant. Detection capabilities for capturing near-turbine avian behavior.

[2] Traceability: Ability to verify bird flights location, time and Species/Group identification by means of recorded video and data.

DTBird® Collision Avoidance Module	
Service description	Automatic emission of Warning/Discouraging sounds from the WTG linked to real-time bird flight detection in collision risk. Video and audio recordings of every bird flight uploaded to an online Data Analysis Platform with Username and Password protected access, that ensure bird flight traceability.
Installation site	Wind Turbines (WTGs) - On & Offshore.
Module specifications	
Components	DTBird® *Detection Module V4 or V8.* 1 Amplifier & 4 – 10 Speakers per WTG. Sound signal: Frequency range: 250-12,500 Hz Maximum Power: 120 W RMS Mounting System (not intrusive for WTG). Cables & Connections.
Location on the facility	Amplifier: in DTBird® Cabinet inside the WTG tower. Speakers: outdoors on the WTG, from 10 to 130 m height (Project specific). Cables & Connections: outdoors on the WTG tower, and inside the WTG tower.
Dimensions	Amplifier 26x43x9 cm, WxHxD Speaker 25x25x35 cm, WxHxD
Weight	20 – 30 Kg.
Power supply	Standard Power Grid Connection: 110-250 AC monophasic 50/60Hz
Power consumption	Including DTBird® Detection Module: 135 – 240 W
Weatherproof	Outdoor components: IP 66 / -30° to 50° C, protection against lightning and falling ice. Cabinet components: IP 65 / 0° to 40° C (heated cabinet optional).
Service specifications	
Sound type:	Adjustable to target Species. Warning sound to bird flights with Potential Collision Risk. Discouraging sound to bird flights in High Collision Risk Area & Rotor Swept Area.
Sound power	Adjusted to legal requirements and bird sensitivity (Project specific). Maximum power location: WTG. Attenuation proportional to distance from the WTG.
Sound coverage	360° around WTG.
Sound trigger	Automatic and in real-time, <2 s after flight detection with Potential Collision Risk.
Sound emission traceability[1]	Sound recordings of every trigger uploaded to online Data Analysis Platform, with Username and Password protected access.
False Positive rate (sound trigger with no bird)	0.2 – 2.9 FP/day, with a total duration of 0.1 - 1.5 min/day (yearly average).
Recorded data	Location. Flight with sound trigger ID. Sound time data: Init time and total length. Flight video records, with embedded audio record. Flight video with environmental data and WTG operational parameters. Species/group and bird behavior analysis from video and audio recordings.
Online Data Analysis Platform	Video, audio and data storage for 5 years at least, in DTBird® Server with Data Center Classified Tier 4. Flight Analysis tools: review of video and audio records, flight analysis, data export, video download and automatic service reports.
Service Control	Self-checking and daily verification done remotely from DTBird Headquarters.
Warranty	2 years worldwide.

[1] Traceability: Ability to verify location, time and sound emission by means of recorded sound, video and data.

DTBird® Stop Control Module	
Service description	Automatic and real-time WTG Stop triggered by bird flights detected with Collision Risk. Whole Stop video recordings uploaded to an online Data Analysis Platform, with Username and Password protected access, that ensure bird flight and Stop traceability
Installation site	WTGs (On & Offshore).
Module specifications	
Components & Location	DTBird® Detection Module V4 or V8 + Stop Control Software installed within DTBat® cabinet.
Dimensions/Weight/Power supply/Power consumption/Operation conditions/Weatherproof	Within DTBird® *Detection Module* specifications for WTG (Stop hardware installed inside DTBird® Cabinet).
Communications	Connection with WTG PLC/Scada.
Service specifications	
Species/Group Stop trigger sensitivity (true positives) and specificity (true negatives)	Variable, depending on target Species/Group and bird community inhabiting the installation site.
Surveillance area	360° around WTG.
Radius of the Surveillance area around the location in the facility	DTBird® Detection Module V4 or V8.
Simultaneous detection of multiple bird flights	Yes (360° around WTG/MT), detection of an unlimited nº of flights and birds at the same time.
Bird flight detectability	>80%[1]
Stop trigger	Automatic and linked to real-time bird flight detection with collision risk. Collision risk calculation according to bird flight features.
Rotor Stop init time	2 – 10 s after DTBird® stop trigger, depending on WTG manufacturer.
Complete rotor Stop	10 – 25 s after WTG Stop init.
Stop length	Linked to real-time bird flight detection in collision risk. Automatic restart of WTG when the collision risk disappears.
Stop & bird flight traceability[1]	Video recordings of every Stop & bird flight uploaded to online Data Analysis Platform with Username and Password protected access. Automatic email notification of every Stop: trigger time (first email), end time and duration (second email).
False Positive rate (Stops with no bird)	0.5 – 5 hours/year/WTG
Recorded data	Flight with Stop trigger ID. WTG Stopped. Stop time data: Init time and total length. Stop video records, with embedded audio record. Environmental data and WTG operational parameters of evert stop event. Species/group, bird behavior and Stop analysis from video and audio recordings.
Online Data Analysis Platform	Video, audio and data storage for 5 years at least, in DTBird® Server with Data Center Classified Tier 4. Flight Analysis tools: review of video and audio records, flight analysis, data export, video download and automatic service reports.
Service Control	Self-checking and daily verification done remotely from DTBird Headquarters.
Warranty	2 years worldwide.

[1] Traceability: Ability to verify location, time and Stop of the rotor/blades by means of recorded documented identification.

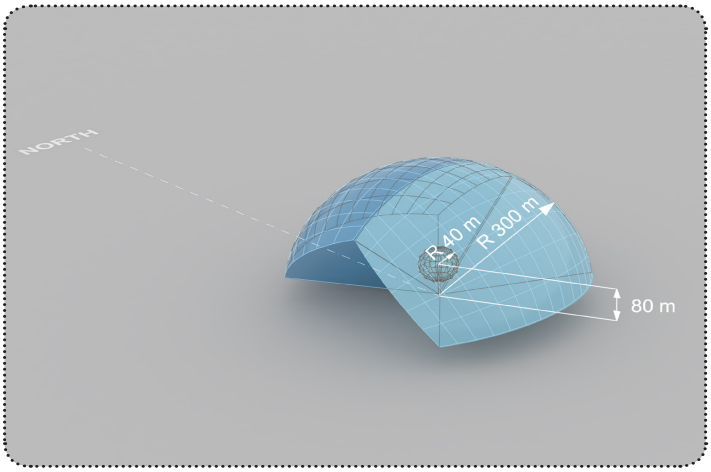
DTBird® Collision Control Module	
Service description	Automatic and real-time detection of bird flights in Collision Risk Areas, and collision check from video and sound recordings, including birds potentially injured that fly away. Video and audio recordings uploaded to an online Data Analysis Platform, with Username and Password protected access, that ensure bird flight and collision traceability.
Installation site	WTGs - On & Offshore.
Module specifications	Equal components and specifications of DTBird® *Detection Module V4 or V8, but with 2 – 4 HD Cameras per WTG*. Recordings of bird flights detected + storage of continuous video recording (the previous 10 days are stored). Optional continuous video recording during night with >0.5 lux.
Service specifications	
Detectable bird Species/Groups	All bird Species/Groups.
Bird Species/Group identification	Yes, through the review of bird flight video and audio recordings.
Surveillance area	Whole WTG (including blades, nacelle and tower).
Multiple bird flights track & detection	Yes.
Nº of bird collisions simultaneously recorded	Unlimited.
Bird flights detectability	>80%[1]
Bird collision detectability in video recordings	>96% (within the bird flights detected).
Overall Bird collision detectability	>77% 0.8 (bird flight detectability) x 0.96 (collision detectability in video recordings) = 0.77
Collision traceability[1]	Video with audio recordings of every bird flight and potential collision uploaded in real-time to online Data Analysis Platform, with Username and Password protected access.
Request of in situ inspection to verify a potential collision and/or to recover a potentially injured bird	Automatic by email, including online video recordings for verification.
Recorded data	Location. Collision ID. Collision time data: Init time and total length. Collision video records, with embedded audio record. Environmental data, and WTG operational parameters of the collision event. Species/group, bird behavior and collision event analysis from video and sound recordings.
Online Data Analysis Platform	Video, audio and data storage for 5 years at least, in DTBird® Server with Data Center Classified Tier 4. Flight Analysis tools: review of video and audio records, flight analysis, data export, video download and automatic service reports.
Service Control	Self-checking and daily verification done remotely from DTBird® Headquarters.
Warranty	2 years worldwide.

[1] Traceability: Ability to verify bird flight collision events, time and Species/Group identification by means of recorded video and sound.

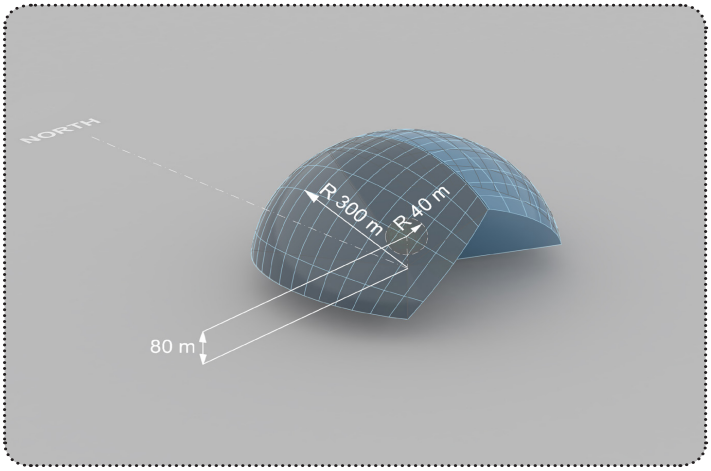
Annex. DTBird Detection Module. Examples of the Surveillance Area in WTGs.

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



3D Projection
Cameras 2 & 4

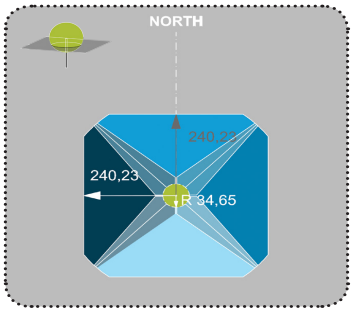


Camera 1 Camera 2 Camera 3 Camera 4

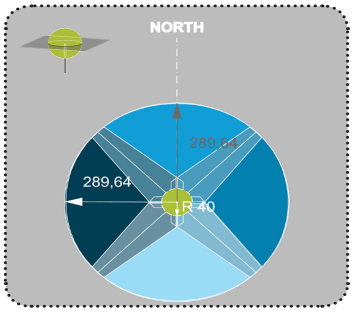
Rotor Swept Area (RSA)

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

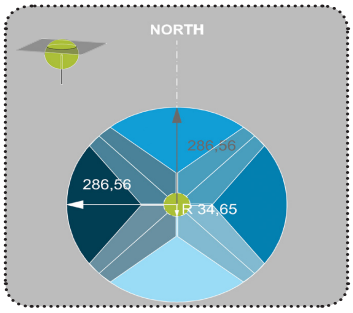
2D Section at ¼ RSA (60m)



2D Section at ½ RSA (80m)

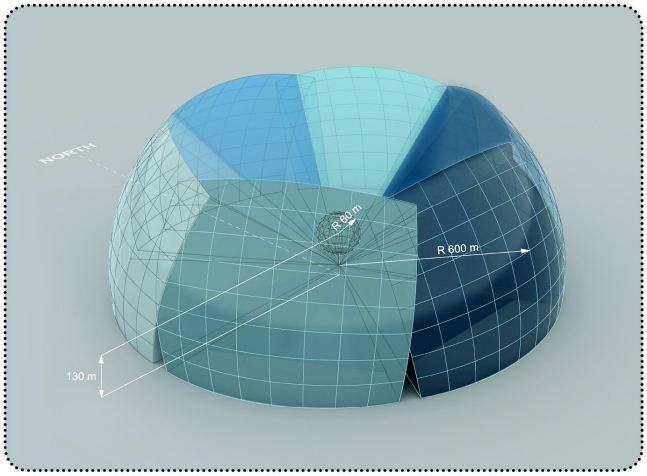


2D Section at 3/4 RSA (100m)

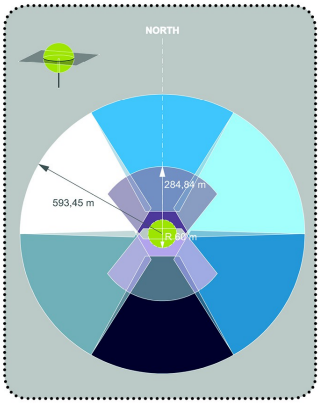


DTBird Detection Module V8
WTG: Tower height 130 m, Rotor diameter 120 m.
Projection of the Surveillance Area.
Target Species: . Golden Eagle *(Aquila chrysaetos)*
. WTE *(Haliaeetus albicilla)*

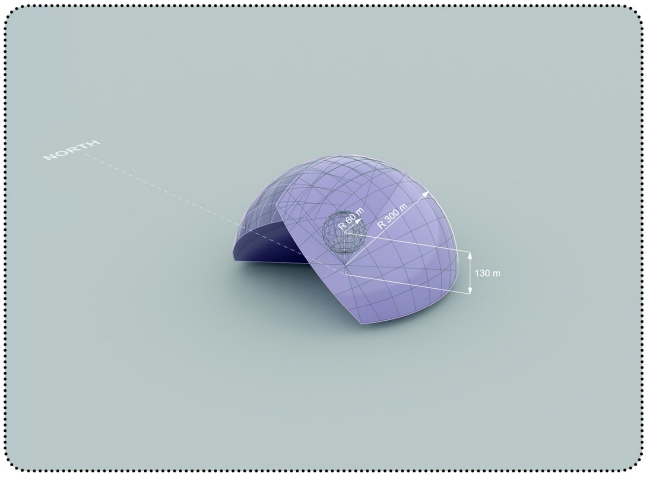
3D Projection
Long Distance Cameras 1-2-3-4-5 & 6



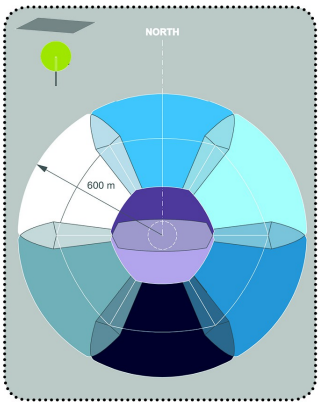
2D Sections
At ½ of the Rotor Swept Area height (RSA)



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)