KNE | Kompetenzzentrum
Naturschutz und Energiewende

Webinaire „Eolien terrestre et SDA“ (OFB)

Validation of ACS in Germany

Dr. Elke Bruns | Berlin | 10.09.2026

The Competence Centre for Nature Conservation and Energy Transition

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We support

- the nature-compatible expansion of renewable energies,
- **bringing objectivity to debates on the nature compatibility of the energy transition**,
- the avoidance of conflicts with nature, species, and landscape conservation.



We work

- **independently and in partnership with all stakeholders of the energy transition,**
- focusing on issues related to the expansion of wind energy and ground-mounted photovoltaics.



We offer

- **Knowledge transfer,**
- Advice,
- Exchange and dialogue,
- Facilitation through moderation/mediation.



We are funded

- by the **Federal Ministry for the Environment, Climate Protection, Nature Conservation and Nuclear Safety (BMUKN).**
- and operate as a non-profit limited liability company (gGmbH) under the auspices of the Michael Otto Foundation for Environmental Protection.

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Agenda

1

ACS in legal framework

- ACS as pprotective measure
- Economic conditions

2

Filling the legal frame

- ACS Testing Framework
- Key performance indicators
- Procedure of recognition

3

How is KNE supporting

- Overview on assessment reports
- Key information on fulfilling the requirements

4

Interim conclusion

- Status and perspectives

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ACS in German Federal Nature Protection Law



Protective measures (Annex 1, Part 2 to § 45b BNatSchG)

Basic measures

- Micro-Siting
- Reducing the attractiveness of habitat around the turbine base

Species specific measures

- **Anti-Collision Systems (ACS)**
- **Curtailment during agricultural land-management events**
- **Provision of attractive alternative foraging habitats**
- **Phenology-based curtailment** (fall back option)

Reasonableness of Protective Measures

- „Reasonable measures“
- Losses max. 6 resp. 8 % of yearly energy yield.
- Scope of curtailment is capped.
  - Not covering the whole duration of stay
- Exceeding the cap is possible
- ACS specific challenge
  - ACS are assigned 3 % loss of energy yield
  - Losses and system costs must be reasonable
    → pressure on system prices.



ACS: requirement regarding effeciency (Annex 1, Part 2 to § 45b BNatSchG

- … the system „must be ***demonstrably*** capable of ***signalling a reduction in rotor rotational speed down to ‚idling mode'*** in good time (…)".
- State in 2022: one demonstrably effective system (validated after KNE 2019/2021) available. Extension to other species possible.

→General recognition needed for additional systems and additional species.

→Requirements and procedure for validation not defined on federal level → void to be filled.

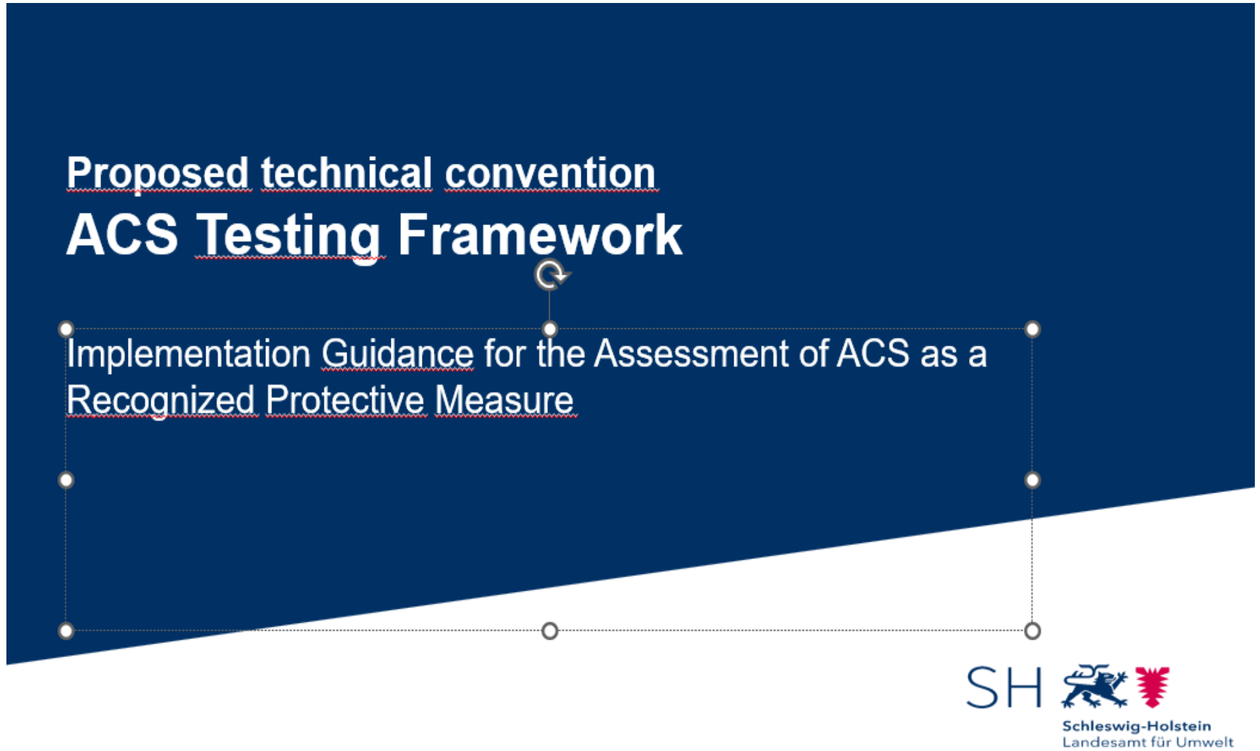
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Filling the legal frame



ACS Testing Framework

- Prüfrahmen AKS Schleswig-Holstein (MEKUN & LfU Schleswig-Holstein 2024)
- Research project; interdisciplinary working group under the leadership of the State Agency for the Environment (LfU)
- Introduced in SH by decree of August 8th 2024
- To be applied fom 1.1.2025 on.
- Transitional rule for ongoing trials
- Mandatory after 31.12.2025



Standards for fundamental effectiveness

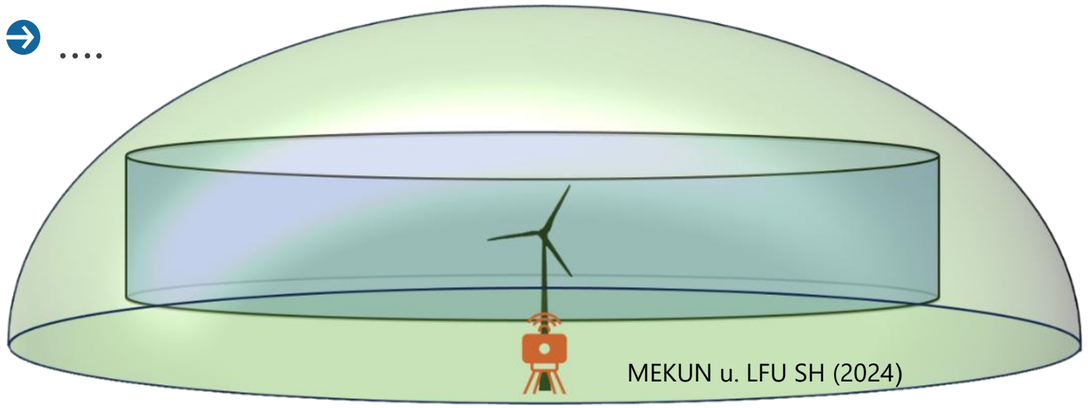
Standards with regard to main sections

- Testing
  - Setup, two sites (differing influence factors)
  - LRF data collection,
  - documentation
- Validation
  - Data selection, statistical data analysis
  - Impact analysis and transferability
- System development and operation
  - Quality management,
  - Installation, operation (documentation)

Standardization field test /data collection

Definitions (see Glossary)

- E.g. detection range, reaction range
- ....



- Mean flight velocity ($v_{species}$) for „the“ 15 species
- Laser Rangefinder reference detection method

Minimum detction distance (MEKUN u. LFU SH 2024)

$$r_{Reaction\ range}\ [m] = v_{species}\ [m/s] \times t_{Ttime\ to\ idle}\ [s] + r_{blade\ length}\ [m] + f_{measurement\ error}\ [m]$$

Key performance indicators

Mean Overall Rate

- is the mean empirically determined rate at which the anti-collision system (ACS) detects the target bird species within the detection range.

MEKUN & LfU Schleswig-Holstein 2024

Mean Protection Rate

- is the mean empirically determined rate which describes the proportion of **collision-vulnerable flights** that are successfully protected from collision by the ACS.
- must always be interpreted together with the **false-positive rate**, since the two figures can be correlated.

False-positive rate:

- is defined as the rate at which the ACS incorrectly identifies a non-target species as a target species and therefore issues a **curtailment signal**.

Key performance indicators

Mean Overall Rate[1]
(lower bound of the confidence interval stands at 70%)

or

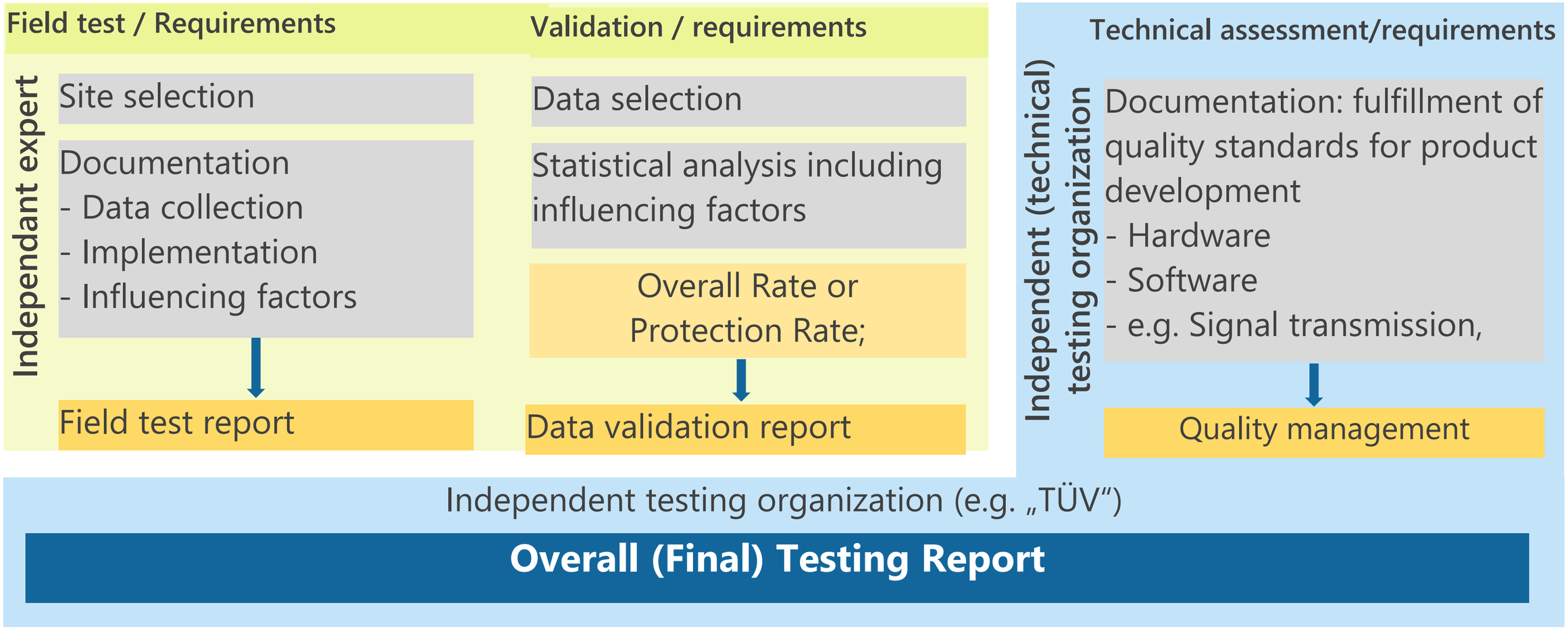
Mean Protection Rate[2]
(lower bound of the confidence interval stands at 75%)

Statistically determined Performance Rates

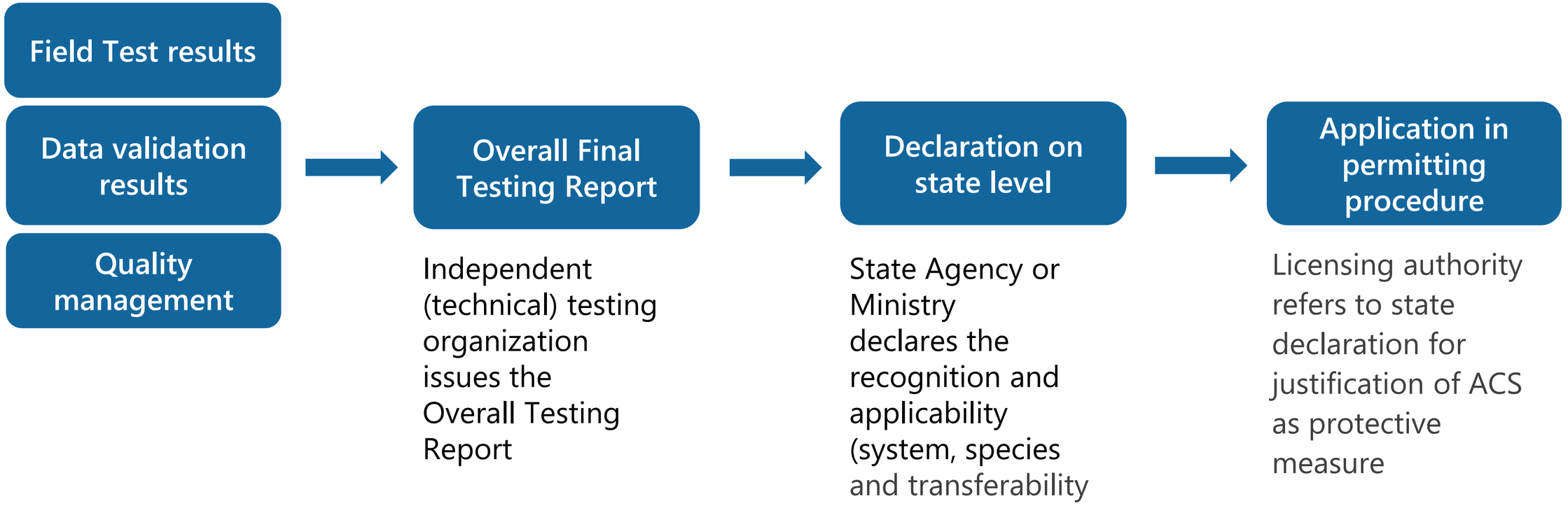
- using statistical models (GLMMs, GAMMs).
- Integrates detection range, detection rate, classification rate, coverage of detection range and influencing factors
- More demanding method; less transparent, but higher explanatory power

[1] The overall rate (empirical mean) reflects the detection rate, the classification rate, and the coverage within the (species-specific) detection range
[2] The protection rate (empirical mean) reflects the proportion of target bird species within the detection range that are theoretically protected from a collision.

Fundamental recognition of ACS



Procedure of fundamental recognition of ACS



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How KNE is supporting the recognition



Overview on assessments and reports

- KNE collects information on assessments and reports
- Providing transparency and traceability

Example

System		
Grundsätzliche Anerkennung		
Prüf- bzw. Validierungs-bericht(e)	**TÜV Nord (2026): Abschließender Prüfbericht zur Validierung des AVES-AKS gemäß Prüfrahmen für Antikollisions-systeme (Schleswig-Holstein). 28.05.2026. Hauschild, J. (Bearb.). 34 S. Im Auftrag der ProTecBird GmbH.** Link zum Dokument	**Rotmilan**
Feldtest/Erprobungs-bericht(e)	Bioplan (2026): AVES-Wind Onshore Antikollisionssystem zum Schutz des Rotmilans (*Milvus milvus*) - Nachweis der Wirksamkeit und Beschreibung der Datenerhebung. Im Auftrag der ProTecBird GmbH. 36 S. Link zum Dokument	
Datenauswertung/ Statistische Validierung	Mercker (2025): Statistische Begutachtung des Antikollisionssystems „AVES-Wind Onshore" für den Seeadler vor dem Hintergrund des LfU-AKS Prüfrahmens und der „KNE-Checkliste". Ergänzungsprüfung Seeadler AVES-Wind Onshore. Ergänzungsprüfung Seeadler AVES-Wind Onshore - 2025. Bionum GmbH – Büro für Biostatistik. Im Auftrag der ProTecBird GmbH. 19 S. Unveröffentlicht.	
Ergänzungsprüfungen		
	TÜV Nord (2026): Abschließender Prüfbericht zur digitalen Validierung des AVES-AKS für die Vogelart **Rohrweihe** gemäß Prüfrahmen für Antikollisionssysteme (Schleswig-Holstein) 10.06.2026. Hauschild, J. (Bearb.). 20 S. Im Auftrag der ProTecBird GmbH. Link zum Dokument TÜV Nord (2026): Abschließender Prüfbericht zur digitalen Validierung des AVES-AKS für die Vogelart **Weißstorch** gemäß Prüfrahmen für Antikollisionssysteme (Schleswig-Holstein) 09.06.2026. Hauschild, J. (Bearb.). 23 S. Im Auftrag der ProTecBird GmbH. Link zum Dokument	

Status of fundamental assessment and recognition

- KNE has no „formal“ role in the recognition process
- KNE informs about the status of reports and recognition of ACS (neutral view)
- Support system developers to show progress and status
- Suppport authorities in federal states to decide on declaration
- Supporting permitting authorities.

System	Fundamental recognition		
	Species	Status (→ Link to reports)	Recognition
Brand, version	Red Kite	Overall test report/proof	☒ Yes
		Report(s) → Link - [e.g. Field test, data analysis]	☒ Yes
Brand, version	Red and Black Kite	Overall test report/proof	☒ Pending
		Report(s) → Link - [e.g. Field test data analysis]	☐ Yes
Brand, version	Red Kite	Overall test report/proof	☒ No
		Report(s) → Link - [e.g. Field test data analysis]	☒ No

Example

State of supplementary assessment and recognition for additional species

- A supplementary assessment and recognition has to be carried out
  - for additional species (see table)
  - in case of system alterations
  - in case of limited transferability due to differing site conditions.

System	Supplementary recognition		
	Species	Status (→ Link to reports)	Recognition
Brand, version	White Stork	Test report/proof	☒ Yes
		- Report [e.g. data analysis]	☒ Yes
	Montegu's Harrier	Test report/proof	☒ Yes
		- Report [e.g. data analysis]	☒ Yes
Brand, version	White-tailed Eagle	Test report/proof	☒ Pending
		- Report [e.g. data analysis]	☒ Yes
Brand version	Honey Buzzard	Test report/proof	☒ No
		- Report [e.g. data analysis]	☒ Yes

Example

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Interim Conclusion

4

Status and perspectives

- Two ACS are recognized, one is pending, one is about to commission the overall testing report
- Applicable on target species Red and Black Kite, White tailed Eagle, Harrier, White Stork. More species to come
- Economic constraints and „reasonableness of yield losses“ limit the application.
- Negative effects (wear and tear) have to be adressed (less /less straining stops)
- >100 ACS licensed or planned in licensing procedures. Most applications in North Germany.



Quellen

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Thank you for your attention!

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