



31122403-VD-Appendix 9-Required specification Criteria (VSE) Bird detection system

Requirement specification General MIVSP LiDAR

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Colophon

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1 Introduction

1.1 Interpretation of this document

1.1.1 General

The requirements included in this VSE are minimum requirements. From the fact that many of the requirements have a technical nature, it cannot be assumed that this VSE is entirely and in all cases correct. The Contractor must have comprehensive know-how to design, to realise and deliver a high quality installation, based on these requirements.

If Contractor feels that one or more requirements in this VSE are not realistic or violating laws and/or common standards, contractor is required to make a substantiated notification to Client without delay.

1.1.2 Reading instructions

The following reading instructions apply to this document:

- The reader is strongly advised, prior to reading this document, to take note of the definitions and abbreviations used, which can be found in the VSA;
- Referrals to the VSA will be interpreted as a referral to the VSA itself and to all underlying documents;
- Referrals to specific documents, indicated by means of the brackets-notation "[xxx]" will be interpreted as a referral to that specific document and underlying standards and other documents referred to from that document.

1.1.3 Interpretation of requirements

With regard to the requirements included in this document, the following applies:

- Requirements can be recognised by a unique identification "VSE-nn" followed by a bold header that concisely states the requirement. Below this a list can be found which is identifiable by the word "Requirement:" followed by the formal requirement text;
- Below the requirement there is room for an explanation. This explanation is not part of the requirement; however, the requirement and the explanation are interconnected. The reason for this is that the explanation provides additional information as support for the interpretation of the requirement;
- Lastly, below each requirement a verification method is mentioned. Verification methods are further explained in §1.1.4.

1.1.4 Verification method

Contractor is required to carry out all relevant tests to prove that the installation(s) delivered, complies with the requirements. The different verification methods have been specified in Table 1 below. Each of the requirements in this document includes one or more verification methods; each of those verification methods must be met.



Method	Description
Analyse	The contractor must demonstrate compliance with the requirement by means of carrying out analyses and/or benchmarks and/or simulations and/or calculations and/or by means of the analysis of test data, measuring data, performance data and/or availability data.
Certificate	A document issued by a competent authority which proves that the current material, component or process complies with the required specifications.
Documentation	Meeting the requirement must be demonstrated by Contractor by means of documentation in which the current material, component or process is described in detail.
Inspection	Meeting the requirement must be demonstrated by Contractor by means of the visual inspection of materials, components, documentation and/or equipment supplied and/or installed.
Measurement	Meeting the requirement must be demonstrated by the Contractor, by means of carrying out measurements using measuring equipment, such as field-intensity meter, Ohmmeters, network testing equipment, etc.
Test	Meeting the requirement must be demonstrated by the Contractor by means of establishing that the behaviour of the (partial) system meets the requirement. Testing must take place using predetermined procedures and under well-defined conditions, configuration and input data, possibly using specific testing tools and/or test facilities.

Table 1: Verification methods



2 Documents

2.1 Referred documents

This chapter contains a list of documents referred to from the requirements in this VSE. For the way of interpretation of referred documents and the mutual hierarchy we refer to the VSA.

[Requirements TenneT]	Employer's Requirements TenneT, Borssele Alpha and Beta Platforms, ONL-TTB-03871
[Requirements DONG]	Training and Medical Requirements, GI 08-01-10, DONG Energy Wind Power
[RWS-ELEK]	"Generic requirements electro-technical installations", 01-Jul-2010, RWS-DI
[RWS-NNV]	"Nieuwe Netwerkvoorzieningen Verkeer and Waterstaat – Aansluitvoorwaarden", Version C, 26-Aug-2009
[NPR1014]	NPR 1014 "Nederlandse Praktijkgids bliksembeveiliging" (uitgegeven door NEN als aanvulling/explanation op NEN-EN-62305), publicatiedatum 1-Nov-2009.
[NPR8110]	NPR 8110 "Nederlandse praktijkrichtlijn risicoklassenindeling overspanningsbeveiliging", publicatiedatum 01-Jan-2003.
[NEN1010]	NEN-1010:2007 + correctieblad C1:2008: "Veiligheidsbepalingen voor laagspanningsinstallaties".
[NEN-EN-IEC 61439]	Laagspanningschakel en verdeelinrichtingen
[NEN-EN-IEC 60204-1]	Elektrische installations voor machines
[NEN3140]	NEN-3140:1998 "Bedrijfsvoering van elektrische installaties – laagspanning".
[NEN-EN 50110]	NEN-EN-50110-1:2005 "Bedrijfsvoering van elektrische installaties" en NEN-EN-50110-2:2010 "Bedrijfsvoering van elektrische installaties – Deel 2: Nationale bijlagen".
[NEN-EN-IEC62305]	NEN-EN-62305 "Bliksembeveiliging" bestaande uit: • Deel 1 "Algemene principes", publicatiedatum 01-Mrt-2011; • Deel 2 "Risicomanagement", publicatiedatum 01-Dec-2006; • Deel 3 "Fysieke schade aan objecten en letsel aan mens en dier", publicatiedatum 01-Mrt-2011; Deel 4 "Elektrische en elektronische systemen in objecten", publicatiedatum 01-Mrt-2011.
[NEN-EN-IEC60529]	NEN-EN-IEC 60529 "Beschermingsgraden of omhulsels (IP-codering)", publicatiedatum 1-Mrt-2000.
DNV GL	DNV GL Rules and standards
[DNVGL-CG-0339]	• Environmental test specification for electrical, electronic and programmable equipment and systems
[DNVGL-CP0338]	DNV GL type approval scheme
[DNVGL-CP-0393]	Rotating electrical machines
[DNVGL-CP-0399]	Electric cables
[DNVGL-CP-0400]	Lightweight electric cables
[DNVGL-CP-0401]	Electric high voltage cables
[DNVGL-CP-0403]	Data communication cables – category cables



[DNVGL-CP-0404]	Maritime LAN – Horizontal cabling – Copper permanent link
[DNVGL-CP-0405]	Fire protective systems for cables
[DNVGL-CP-0407]	Cable ties
[DNVGL-CP-0408]	Cable glands
[DNVGL-OS-D201]	Electrical installations
[DNVGL-ST-0076]	Design of electrical installations for wind turbines
[DNVGL-ST-0145]	Offshore substations
[DNVGL-ST-0437]	Loads and site conditions for wind turbines
[DNVGL-ST-0438]	Control and protection systems for wind turbines
[DNVGL-TAP6-800]	Electrical Equipment
[GL rules & guidelines]	Germanischer Lloyd – Rules for Classification and Construction – IV Industrial Services
[GL rules & guidelines]	Germanischer Lloyd – Rules for Classification and Construction – VI Additional Rules and Guidelines

Table 2: Referred documents



3 Object description

The object tree depicted in Figure 1 below is used to identify objects that the technical and system requirements in this **Fout! Verwijzingsbron niet gevonden.** apply to. The number between brackets is a reference to the paragraph in which the requirements belonging with the object are specified.

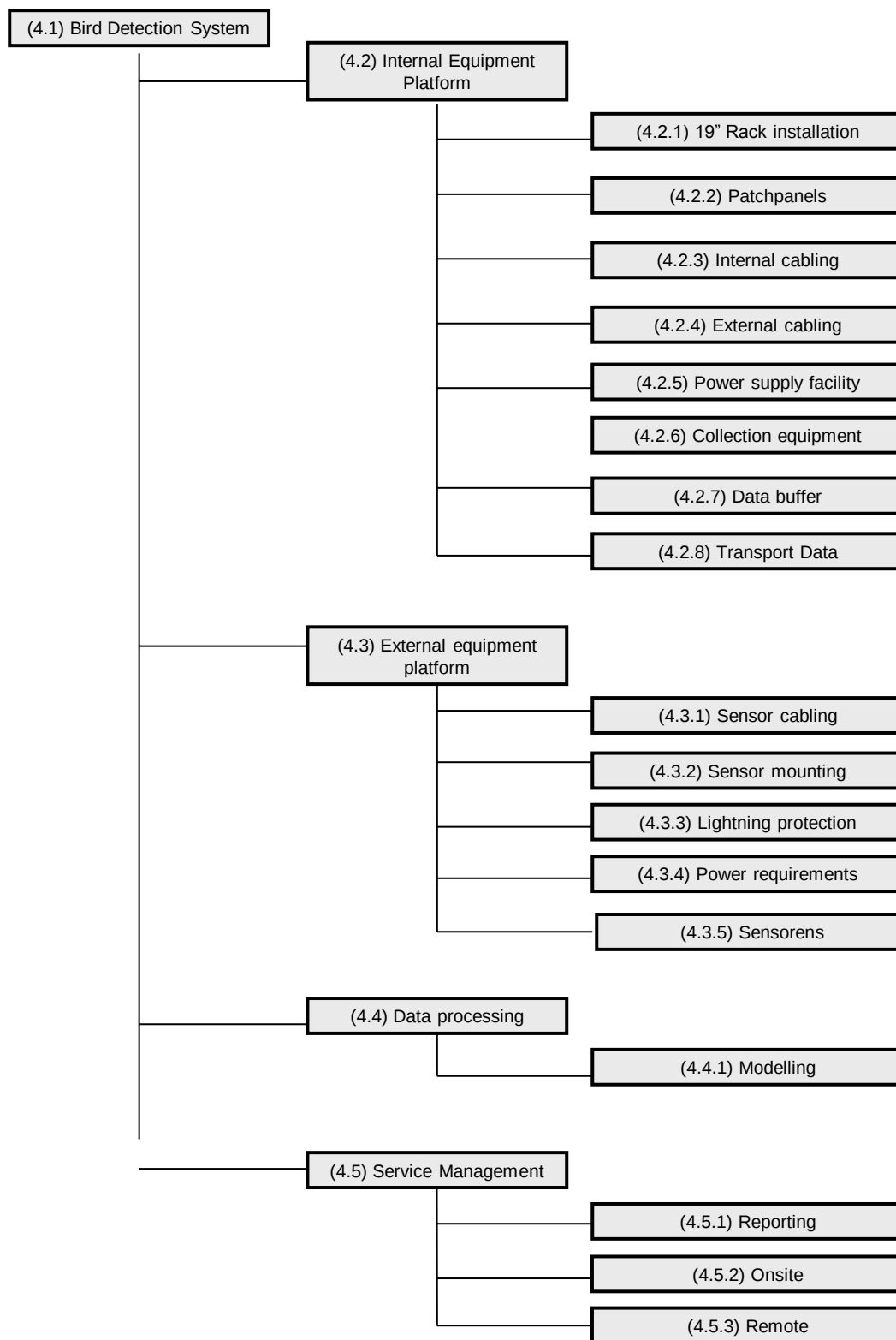


Figure 1: Object tree technical and system requirements



4 Functional, technical and system requirements

4.1 Bird detection system (BDS)

4.1.1 General

The Bird detection system must comply with at least the general requirements mentioned below

VSE-01	Bird detection in the horizontal and vertical plane
Requirement: Accept: ☐	The BDS must be able to detect birds in the horizontal and the vertical plane.
Explanation:	Each separately installed BDS must be able to detect birds at an offshore location. The system must be capable of distinguish birds from other objects at sea.
Verification:	Analysis, Documents

VSE-02	Detection of height and horizontal distribution of birds
Requirement: Accept: ☐	The BDS must be able to accurately determine and store data about height and horizontal distribution of birds, by at least establishing and recording the following: - Individual ground speed - Individual ground course - Individual flight altitude, up to a distance of at least 1000 m height - Temporary target identification based on unique sensor response - Horizontal flight path - Classification size RCS
Explanation:	A BDS is required to gather at least the data mentioned above and buffer it. More specifically in the height of the rotor swept area (RSA) of the turbine blades between 25-300 m height. If more information is available, it is preferred that also this information is supplied.
Verification:	Analysis, Documents, Inspection

VSE-03	Maximum diameter sensor in the horizontal plane
Requirement: Accept: ☐	The sensor for the BDS may have a maximum diameter of 400 cm in the horizontal plane.
Explanation:	The sensor for the gathering of horizontal information may not have a diameter exceeding 400 cm. Preferably an as small as possible sensor.
Verification:	Certificate, Documents

VSE-04	Maximum diameter sensor in the vertical plane
Requirement: Accept: ☐	The sensor for the BDS is allowed to have a diameter of up to 400 cm in the vertical plane.
Explanation:	The sensor for gathering the vertical information may not have a diameter exceeding 400 cm. Preferably an as small as possible sensor.
Verification:	Certificate, Documents



VSE-05	Maximum weight sensor for the horizontal and vertical plane
Requirement: <i>Accept:</i> ☐	The sensor for the BDS for the horizontal plane and vertical plane weight is allowed to a maximum weight of 400 kg.
Explanation:	The weight of the sensor for gathering the horizontal and vertical should not exceed 400 kg. Preferably an as light as possible sensor.
Verification:	Certificate, Documents

VSE-06	Suitable for offshore placement
Requirement: <i>Accept:</i> ☐	All externally positioned components of the BDS must be demonstrably suitable for placement at sea with an expected operational lifespan of 10 years.
Explanation:	All parts and materials used, placed outside the ICT rooms must be resistant to conditions as they occur on a platform or wind turbine at sea, depending on the eventual placement and during a period of minimally 10 years without loss of function.
Verification:	Certificate, Documents

VSE-07	Low maintenance interval
Requirement: <i>Accept:</i> ☐	All components of the BDS must have a minimal lifespan of five years with a minimum maintenance interval of nine months.
Explanation:	The components are placed on an offshore platform or wind turbine that it visited maximally twice per year for standard maintenance. System components requiring minimal maintenance are preferred.
Verification:	Certificate, Documents

VSE-08	High availability
Requirement: <i>Accept:</i> ☐	The BDS must supply and buffer data locally for at least 98% per month.
Explanation:	The BDS must gather qualitatively sufficient data during at least 98% of the time and process it locally and store it in the data buffer. This implies that the entire system must be operational to gather qualitatively sufficient data.
Verification:	Analysis, Documentation

VSE-09	Minimum number of components
Requirement: <i>Accept:</i> ☐	The BDS must consist of as few components as possible to be able to supply qualitatively sufficient data.
Explanation:	Since there is little space available for the installation, the supplier must provide the best possible design. As a consequence it is also expected that the maintenance will be easier.
Verification:	Documentation



VSE-10	Plannable maintenance by third parties
Requirement: <i>Accept:</i> ☐	In terms of plannable maintenance, third parties should be able to perform maintenance on the BDS, following the instruction of the supplier.
Explanation:	The plannable maintenance is possibly carried out by third parties, which implies that third party personnel with a common technical training, should be able to carry out the maintenance, based on a one-time short instruction by the contractor.
Verification:	Documentation

VSE-11	Installation by third parties
Requirement: <i>Accept:</i> ☐	It should be possible for the BDS to be installed by third parties.
Explanation:	The BDS is installed on the platform by the Site Integrator and, if necessary, on the wind turbine. This Site Integrator has personnel, trained by the contractor, who may carry out the installation and connection of the system components. This might take place with the assistance of the supplier, if necessary/desired.
Verification:	Analysis, Documentation

VSE-12	Remote system management
Requirement: <i>Accept:</i> ☐	The BDS must be accessible for remote maintenance, for system management and adjustment of the settings.
Explanation:	The supplier is required to supply a system that is accessible for the most common remote maintenance/management tasks. The system must be accessible via an IP network and preferably via a web browser.
Verification:	Documentation

VSE-13	Remote monitoring
Requirement: <i>Accept:</i> ☐	The BDS must be suitable for remote monitoring via the IP network and also for automatic notification of disruptions.
Explanation:	The supplier is required to deliver a system that can be monitored via an IP network and gives a, preferably SNMP V2, notification in case of any pre-defined disruptions.
Verification:	Documentation, Inspection

VSE-14	Transport hardware
Requirement: <i>Accept:</i> ☐	The hardware must be delivered free of charge and damage-free, at a location in The Netherlands, pre-determined by the site integrator.
Explanation:	The supplier must package the materials to achieve damage-free delivery throughout The Netherlands after transport.
Verification:	Inspection



4.2 Internal Equipment Platform

Included in the Work is the delivery of cabling and a processing/actuation unit. The installation is carried out under supervision of, or via the Site Integrator.

4.2.1 19-inch rack installation

VSE-15	19-inch dimensioning equipment BDS
Requirement: <i>Accept:</i> ☐	The BDS is delivered with equipment for the internal placement, suitable for easy installation in a standard 19-inch cabinet.
Explanation:	The internal equipment that is to be placed internally, is dimensioned in such a way that it can easily be placed into a 19-inch rack, for instance by mounting with the use of cage nuts. Separate equipment must be supplied being fixed, on a 19-inch plateau.
Verification:	Documentation, Inspection

VSE-16	Option for supply offshore resistant 19-inch rack
Requirement: <i>Accept:</i> ☐	The contractor must be able to supply a 19-inch rack resistant to offshore conditions for the installation of the internal equipment in case no indoor space is available and the placement is carried out on a wind turbine or platform.
Explanation:	If no indoor space is made available by the object owner of the wind turbines, the internal equipment must be mounted in its own weather resistant cabinet, outside on the platform. The contractor is required to show an example of a similarly carried out installation.
Verification:	Analysis, Inspection, Documentation

VSE-17	Available space 19-inch rack vertical
Requirement: <i>Accept:</i> ☐	The BDS may, with regard to the internal equipment, not take up any more room than one 19-inch rack or 42 height units.
Explanation:	The central equipment that is to be placed internally, is dimensioned in such a way that it occupies no more than one 19-inch patch cabinet. This space figures 42 HE.
Verification:	Documentation

VSE-18	Available space 19-inch rack depth
Requirement: <i>Accept:</i> ☐	The BDS equipment should take no more cabinet depth than 100 cm.
Explanation:	The central equipment that is to be placed internally, is dimensioned in such a way that it can be placed in an 80 cm wide x 100 cm deep 19-inch rack.
Verification:	Documentation



4.2.2 Patch panels

VSE-19	Supply of patch panels
Requirement: Accept: ☐	The contractor is required to deliver 19-inch cabled patch panels for the connection cabling to the central equipment. These patch panels must be at least Cat 5E certified and fitted with an RJ-45 interface.
Explanation:	If the contractor wishes to use patch panels, these must be delivered fully cabled in a 19-inch dimensioning. These patch panels should be easy to install in a 19-inch data rack by use of cage nuts.
Verification:	Documentation

4.2.3 Cabling

VSE-20	Standardised inter-connection cabling
Requirement: Accept: ☐	The contractor must fit all internal cabling before delivery. This cabling must be standardised and patch cables must be standard cables with a suitable length and at least Cat 5E certified, fitted with an RJ-45 interface. In case of any deviation, this should be specified.
Explanation:	If contractor wishes to use inter-connection cabling, this must be fitted and specifically documented before delivery. Any deviation from the standard Cat 5E cabling with an RJ-45 interface must be additionally specified.
Verification:	Certificate, Documentation

4.2.4 Cabling Extern

VSE-21	Cabling Sensors
Requirement: Accept: ☐	The contractor must deliver all cabling necessary for connection of the sensors, fitted and to length. This cabling must be delivered being specified as well as documented.
Explanation:	The contractor must deliver power supply cabling and other sensor cabling, dimensioned and fitted, for the benefit of easy installation by the Site Integrator. If cabling is required to be fitted on site, this must be delivered being specified and documented.
Verification:	Certificate, Documentation, Inspection, test, measurements

4.2.5 Power supply

VSE-22	Power supply specification BDS voltage
Requirement: Accept: ☐	For the internal equipment, the BDS requires a power supply based on 220-240 volt.
Explanation:	The voltage delivered for the components of the BDS must function at 220-240 volt.
Verification:	Inspection, test, measurements



VSE-23	Power supply specification BDS power
Requirement: Accept: ☐	The BDS should consume no more energy than 3.5 kWh
Explanation:	The maximum peak capacity, necessary for all components of the BDS should be no more than 3,500 Watts per hour.
Verification:	Certification, Documentation, Inspection, test, measurements

VSE-24	Power supply specification BDS connection
Requirement: Accept: ☐	The BDS requires a power supply based on 220-240 volt, Schuko grounded plugs.
Explanation:	The supply voltage delivered for the components of the BDS should exclusively function, standard 220-240 volt, by use of grounded Schuko plugs.
Verification:	Inspection, test, measurements

VSE-25	Power supply specification BDS grounding
Requirement: Accept: ☐	The BDS must be grounded for all components
Explanation:	All components of the BDS must be facilitated for ground connection
Verification:	Documentation, Inspection, test, measurements

4.2.6 **Collection equipment**

VSE-26	Processing speed of bird data
Requirement: Accept: ☐	The BDS must be able to process sensor information into data within one minute to suitable data for bird information.
Explanation:	The BDS must, demonstrably, be able to supply useable bird information to the end user, with a maximum delay of one minute.
Verification:	Analysis, Documentation, Inspection, test, measurements

VSE-27	Analysis Software
Requirement: Accept: ☐	The BDS should contain software applications, able to analyse spatial and temporal patterns.
Explanation:	The analysed data should provide insight in the current bird migration and flight movements on and around the location of the sensor. This data will be used for the implementation of the mitigation measure, as well as for validation of bird observations in the field.
Verification:	Documentation, Test



VSE-28	Validation of detection
Requirement: <i>Accept:</i> ☐	The contractor must show, by means of measuring results included documents, that the system is validated for so-called "known targets".
Explanation:	The contractor must be able to prove that the supplied system can identify birds. This must be demonstrated by means of a comparable system and related test and measuring results.
Verification:	Analysis, Documentation, Inspection, test, measurements

VSE-29	Link with SCADA
Requirement: <i>Accept:</i> ☐	The BDS must be suitable for linking to a SCADA system
Explanation:	The contractor must confirm that the BDS is capable to send a signalling to adjust the rotation speed of wind turbines via a SCADA system, for instance in case of excess of a pre-set number of birds per time unit per square kilometre in the vertical plane.
Verification:	Analysis, Documentation, Test

VSE-30	Validation in the field
Requirement: <i>Accept:</i> ☐	The BDS must be locally equipped with the possibility to read the currently gathered data, for validation purposes, in a spatial image on a screen of at least 15-inch and 19-inch at most.
Explanation:	For the purpose of on-site system validation, an opportunity should be created at the ultimate installation location, to view the gathered data in a spatial image. Therefore data processing and presentation must take place almost simultaneously, allowing for observations and results to be compared at the same time.
Verification:	Documentation, Test

VSE-31	Remote analysis
Requirement: <i>Accept:</i> ☐	The contractor must provide a system enabling the end user to view the gathered data from any location desired, when using personal authentication via an internet portal.
Explanation:	The end user, connected to the internet, should be able to view and present the gathered data from any location. Access preferably via an internet browser.
Verification:	Documentation, Test

4.2.7 Data buffer

VSE-32	Buffering of gathered data
Requirement: <i>Accept:</i> ☐	The BDS must be able to buffer the processed data for at least three weeks.
Explanation:	The BDS must provide enough data storage space to store at least three weeks of processed data, to bridge network interruptions. After repair of the network this



	buffer should be transferred to the mainland.
Verification:	Analysis, Documentation

4.2.8 **Transport of Data**

VSE-33	Transportation of data via IP-network
Requirement: Accept: ☐	Based on an IP-network connection, LAN/WAN, the BDS must be able to transfer the data gathered to the end user, with an assurance that all gathered data was delivered to the mainland by means of a so-called "incremental database".
Explanation:	For the transfer of gathered data, the BDS must be made accessible via a standard ethernet LAN/WAN, at an as high as possible speed, to be determined in consultation with the network supplier. In case the data connection fails temporarily, the gathered data should be automatically synchronised and actualised.
Verification:	Documentation, Inspection, test, measurements

VSE-34	Manual transport of data
Requirement: Accept: ☐	The BDS should provide the opportunity, by means of a simple action, taking no longer than 4 hours, to bring gathered data which is a maximum of 3 weeks old, when visiting the location.
Explanation:	In case of a lasting disruption concerning the submitting of data to the mainland via the IP network, the data should be available locally.
Verification:	Documentation, Test

VSE-35	Speed of data via internal IP-network
Requirement: Accept: ☐	The BDS must be internally connected, based on an IP-network with at least one gigabytes speed per second.
Explanation:	Network components in the internal network of the BDS should use an as high as possible data speed. In case of deviation, this should be specified.
Verification:	Documentation, Inspection, test, measurements

4.3 External Equipment Platform

4.3.1 **Sensor Cabling**

VSE-36	Standard inter-connection cabling
Requirement: Accept: ☐	Where possible, the BDS should as much as possible make use of standard cabling and connectors.
Explanation:	The BDS is required to use standard cabling and connectors to facilitate easy installation of the sensor by the Site Integrator. The type of connection must be delivered specified and documented.
Verification:	Documentation, Inspection, test, measurements



VSE-37	Cable connectors
Requirement: Accept: ☐	The contractor is required to use cable connectors, fitted in accordance with the cable specifications. Connectors exposed to outside air must be protected against weather effects.
Explanation:	The contractor must ensure that supplied cables and connectors are suitable for offshore conditions.
Verification:	Documentation

VSE-38	Mounting specifications for sensor antenna cables
Requirement: Accept: ☐	The contractor provides the specifications and the documentation necessary for the installation of the sensor cabling.
Explanation:	The sensor cabling is subsequently installed conforming to the instructions of the contractor, so that it remains compliant with the imposed specifications.
Verification:	Inspection, measurements

VSE-39	Network cables – copper based
Requirement: Accept: ☐	Applicable to all copper based network cables: 1. All network cables applied in cable ducts or on cable trunking must be CAT6 of higher certified; 2. Patch cables must at least meet the CAT5E specification.
Explanation:	Copper based network cabling must be of the highest possible quality and also future-proof as much as possible, in accordance with a currently established certification.
Verification:	Inspection, documentation, certificate of certificates

VSE-40	Network cables – glass fibre based
Requirement: Accept: ☐	Applicable to all glass fibre based network cables: 1. The glass fibres must be suitable for the intended application; 2. It concerns a metal-free, moisture-resistant, terminated glass fibre cable meant for both indoor and outdoor use.
Explanation:	Glass fibre cabling must be non-conductive and of the highest possible quality for use at sea. It is preferred that these cables do not need replacement during the intended lifespan of the BDS.
Verification:	Inspection, documentation, certificate of certificates

4.3.2 Sensor Mounting

VSE-41	Transport sensors preparation HAT
Requirement: Accept: ☐	The contractor must transport sensors, including mounting materials, to the installation location determined by the Site Integrator.
Explanation:	The Site Integrator ensures the installation on location. The contractor is required to



	ensure that the necessary materials arrive at the location undamaged.
Verification:	Inspection

VSE-42	Antenna plan
Requirement: Accept: ☐	The contractor must provide support to the Site Integrator with respect to a correct performance of the BDS system in the antenna plan
Explanation:	Together with the Site Integrator, the contractor must establish whether the antenna plan meets the expectations, if any adjustments are required, the contractor should provide information.
Verification:	Inspection, documentation, measurements, test

VSE-43	Instruction for placing sensor and cabling
Requirement: Accept: ☐	All placed materials and possible equipment, including antenna-setup point and cable loop, must be installed in such a way that water accumulation is prevented.
Explanation:	The purpose being the prevention of corrosion and pollution.
Verification:	Documentation

VSE-44	Maximum wind force
Requirement: Accept: ☐	The antenna installation must be designed and placed such that it can withstand wind force twelve Bft, including associated gusts, without getting damaged.
Explanation:	The contractor must provide specifications to prove that the sensors to be placed meet abovementioned requirement.
Verification:	Analysis, Documentation, Certificate

VSE-45	Wind force while in operation
Requirement: Accept: ☐	The antenna installation must be designed to be able to provide the necessary bird detection data up to wind force eight Bft.
Explanation:	The contractor must issue specifications that the sensors to be placed meet abovementioned requirement.
Verification:	Analysis, Documentation, Certificate



4.3.3 **Lightning protection**

VSE-46	Lightning protection
Requirement: <i>Accept:</i> ☐	All metal components of the antenna installation must, unless they are part of the lightning protection, be properly grounded.
Explanation:	The contractor must demonstrate that the external equipment can easily and properly be grounded.
Verification:	Documentation

VSE-47	Installation of lightning protection
Requirement: <i>Accept:</i> ☐	The placement of sensors should not lead to an increased risk of local lightning strike. If the installation of a sensor does so, the Contractor, together with the Site Integrator, should take appropriate measures resulting in an equal or lower risk.
Explanation:	Measures that are to take place in consultation with RWS could consist of adjustment and/or expansion of an existing lightning protection installation, by realising an entirely new lightning protection installation. The prevailing standards, including [IEC62305], [NEN50164] and [NPR1014] are applicable here.
Verification:	Inspection, test, measurements

VSE-48	Protecting equipment against lightning strike
Requirement: <i>Accept:</i> ☐	The contractor must prove that the equipment can be properly protected against the consequences of a direct lightning strike in the sensor installation and against induction voltage as a result of lightning strike in the vicinity of the location.
Explanation:	The location of the equipment to be installed may suffer from lightning strikes. The contractor is required to provide documentation, reducing the risk of damage to a minimum
Verification:	Documentation

4.3.4 **Power supply**

VSE-49	Power supply specification sensor voltage
Requirement: <i>Accept:</i> ☐	The sensor must be powered from the central area
Explanation:	The sensors of the BDS must be powered from the area where the central equipment is placed. Should this turn out to be impossible, this must be specified. Preferably served by a 3-phase 400 volt.
Verification:	Inspection, test, measurements



4.3.5 Sensors

VSE-50	Documentation specifications for placement of sensors
Requirement: Accept: ☐	The contractor provides the training-, specification- and other documentation necessary for the placement of the sensors by third parties.
Explanation:	The installation of the sensors is carried out by the Site Integrator, who will need sensor-specific specifications and documentation for correct placement. These will be drawn up and supplied by the contractor.
Verification:	Documentation

VSE-51	Training for support workers
Requirement: Accept: ☐	The contractor provides the training of personnel of the Site Integrator, necessary for the placement of the sensors.
Explanation:	The installation of the sensors will be carried out by the Site Integrator, who will need sensor specific training for the correct placement, which will be drawn up and provided by the contractor.
Verification:	Documentation

VSE-52	Target detection
Requirement: Accept: ☐	The contractor must demonstrate, by use of documents, that a so-called "Standard Aviation Target" target or SAT, described in FAA's Advisory Circular 150_5220_25 (RCS 250 cm ² , mass 500 grams) is detected at the following distances: Range: 0.6 to 2.0 Km. Target 1 SAT at a height of 300 metres Range: 0.6 to 6.0 Km. Range 2 SAT up to a height of 900 metres
Explanation:	The contractor must provide proved and documented evidence that the abovementioned targets are detected by use of the supplied system.
Verification:	Documentation, Test

VSE-53	Minimum target size detection
Requirement: Accept: ☐	The contractor must demonstrate, by use of documents, that a bird, the size of a medium songbird, with a detectable size of RCS 10cm ² , can be detected at a distance of one kilometre.
Explanation:	The contractor must provide proved and documented evidence that the abovementioned target is detected with the supplied system.
Verification:	Documentation, Test

VSE-54	Coverage diagram
Requirement: Accept: ☐	The contractor must provide a coverage diagram for the horizontal and the vertical plane of the sensors in steps of 10%, where the detection curves are expressed as the 'detection probability', as a function of the 'target sensor cross section', flight altitude, distance and 'sea state'.
Explanation:	The detection accuracy of the sensor is shown, based on so-called 'coverage diagrams' by 10% steps. This must be provided for both the horizontal and the vertical plane, and at what distance and height range detection takes place.



Verification:	Documentation, test, measurements
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VSE-55	Disruption by turbine blades WTG
Requirement: Accept: ☐	The contractor must demonstrate that the system can handle disruption by turbine blades. Specifically how in the vertical plane it can handle disruption by turbine blades when placed on a wind turbine platform whereby bird can still be detected.
Explanation:	The contractor must demonstrate that the system can handle disruption by turbine blades, where the description shows: • How the system handles rotating turbine blades • To what extent the rotating turbine blades influence the detection, identification and tracking of birds • Practice results of the performance of the system at placement under a rotor • Practice results of detection of birds near a working turbine with rotating blades at a speed of at least 10 revolutions per minute
Verification:	Inspection, test, measurements

VSE-56	Minimal refreshing frequency of data horizontal
Requirement: Accept: ☐	The BDS provides new position information of the bird's flying path in the horizontal plane, at least every three seconds.
Explanation:	The contractor demonstrates that the system is capable of providing a new measurement every three seconds.
Verification:	Documentation, Measuring

VSE-57	Minimal refreshing frequency of data vertical
Requirement: Accept: ☐	The BDS provides new information about bird flux in the vertical plane, at least every three seconds.
Explanation:	The contractor demonstrates that the system is capable of providing a new measurement every three seconds.
Verification:	Documentation, Measuring

VSE-58	Sensing range in vertical plane
Requirement: Accept: ☐	The BDS is required to detect bird movements from sea level up to at least one kilometre altitude in the vertical plane.
Explanation:	The contractor must provide proved and documented evidence that the abovementioned target is detected using the supplied system.
Verification:	Documentation, Test



4.4 Data Processing

4.4.1 Modelling

VSE-59	Gathered data suitable for processing
Requirement: <i>Accept:</i> ☐	The BDS must supply the processed data in such a way that it is suitable for future modelling.
Explanation:	The gathered data will, at a later stage, be used for the models to be drawn up. Contractor must demonstrate by use of an example that the gathered data is suitable for this application.
Verification:	Analysis, Documentation

4.5 Management

4.5.1 Reporting

VSE-60	Factory Acceptance Test plan for functionality of sensors
Requirement: <i>Accept:</i> ☐	The contractor is required to draw up a plan for the FAT test of the functionality of sensors.
Explanation:	By means of this test plan we must be able to determine whether the sensors are functioning in correspondence with predetermined expectations. After testing, this document will be part of the completion report.
Verification:	Inspection, measurements, test

VSE-61	Insight in algorithms for model development
Requirement: <i>Accept:</i> ☐	The contractor must provide insight and assistance to scientists of the end user regarding the algorithms used to analyse the gathered data.
Explanation:	The contractor shall reveal the algorithms or openly discuss them with the team that focuses on the modelling. The description of the algorithms will have a highly technical level, making it useable and suitable for scientific research. The algorithms themselves do not have to be shared.
Verification:	Analysis, Test

4.5.2 On location

VSE-62	Management
Requirement: <i>Accept:</i> ☐	The contractor must be able to provide support on location to the Site Integrator if requested.
Explanation:	The contractor must be able provide maintenance at the location where the BDS is ultimately placed.
Verification:	Documentation



VSE-63	Ability to shut down sensors with emergency shut down button
Requirement: Accept: ☐	The contractor must equip the system with an interface to connect a mechanical emergency button to shut down the system from a safe distance.
Explanation:	The contractor must deliver an interface connection to shut down the sensors with a mechanical button (close loop contact). This for maintenance staff and in case of emergency.
Verification:	Documentation, Test

4.5.3 Remote

VSE-64	Users interface
Requirement: Accept: ☐	The contractor is required to provide a system for remote management.
Explanation:	The contractor must be able to perform remote maintenance, this system must also be available for contractor for investigation of problems.
Verification:	Documentation, Inspection