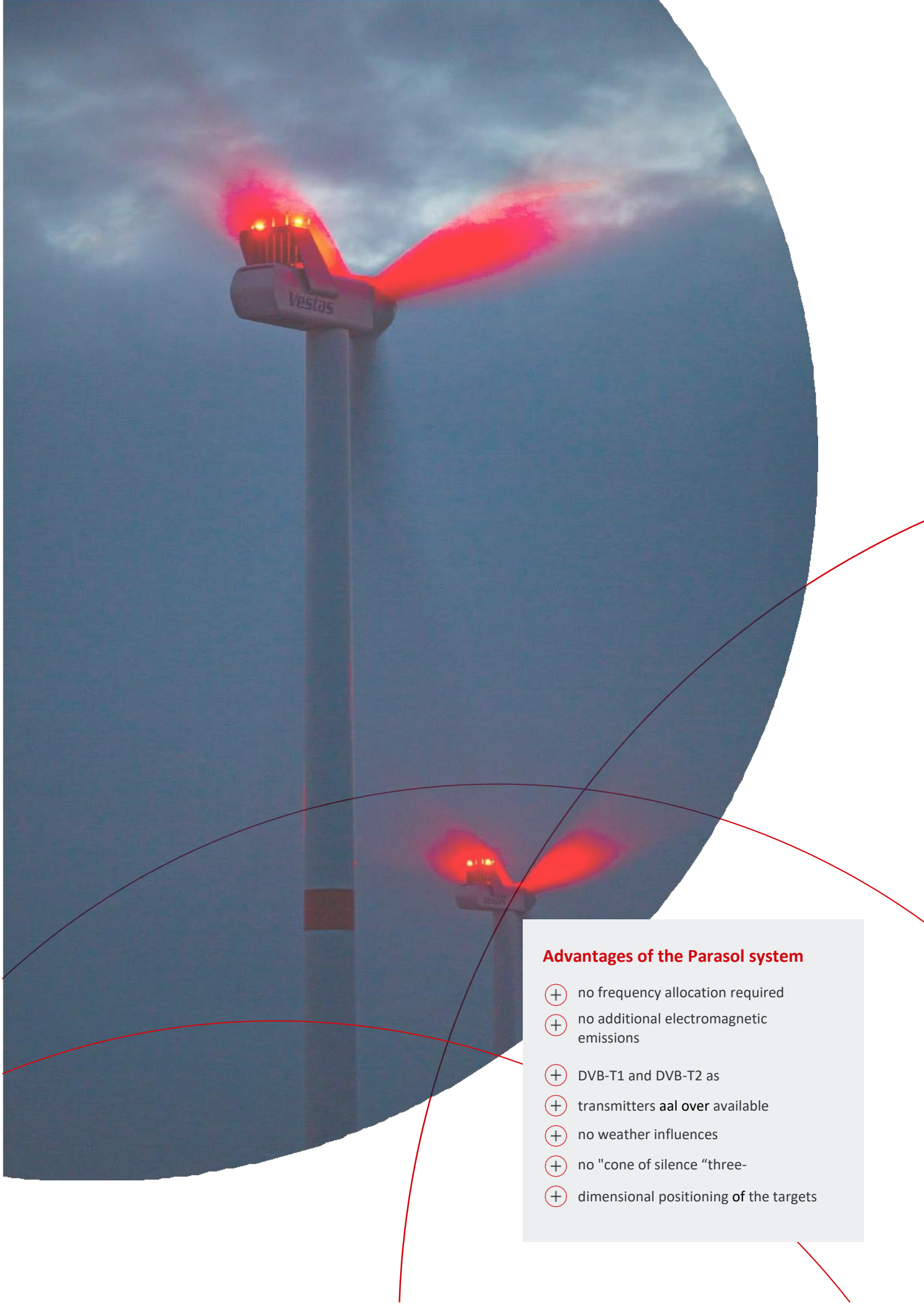
Parasol

Demand-controlled obstacle lighting - ADLS

Passive-radar-system for wind turbines



Advantages of the Parasol system

- ⊕ no frequency allocation required
- ⊕ no additional electromagnetic emissions
- ⊕ DVB-T1 and DVB-T2 as
- ⊕ transmitters aal over available
- ⊕ no weather influences
- ⊕ no "cone of silence “three-
- ⊕ dimensional positioning of the targets

Dark nights – no additional emissions

Night marking for wind turbines

If a wind turbine is over 100 meters high, it must be marked by permanent flashing lights at nighttime in Germany. These nightly flashing lights will be perceived as annoying.

In cooperation with the Fraunhofer Institute for High Frequency Physics and Radar Technology (FHR), the Dirkshof in North Frisia has developed a passive radar system that suspends the night marking of wind turbines if it is guaranteed that there is no flying object in the operating space. The Parasol passive system does not require its own frequency allocation by the Federal Network Agency and is characterized by its enormous environmental friendliness.

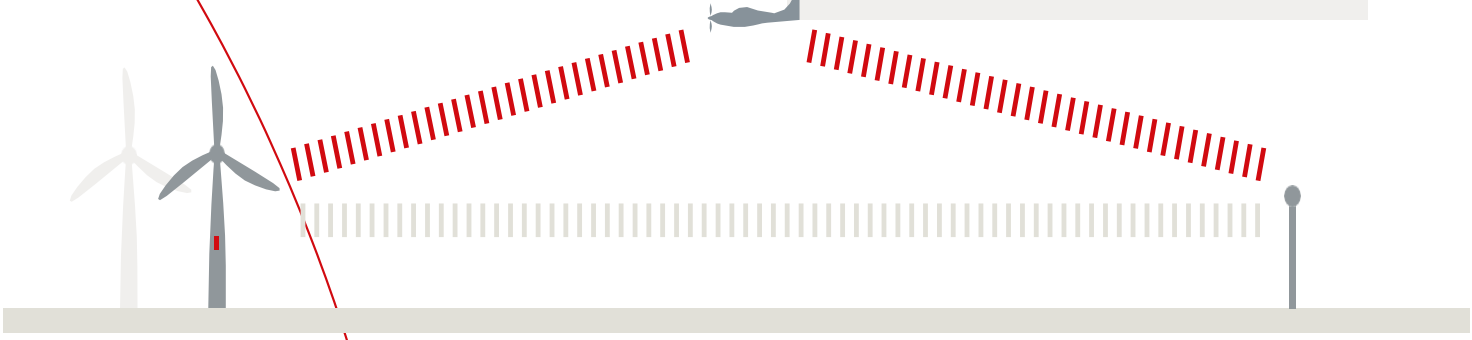
How works the Passive Radar System

The Parasol System sends – differently than traditional Radar systems – no own electromagnetic Radiation and uses the existing signals of radio, television, and mobile stations, which are already exist all over the world.

A sensor consists of two sensor units. A sensor is used to receive the direct signal emitted by the radio or television station. The other antenna receives the signals, which is reflected by the flying object. Figure 1 shows the relationship schematically. The direct signal is shown in grey and the signal path via the reflection on the aircraft in red.

As can be seen in the figure, both signals cover a different distance and do not reach the sensorics at the same time. Since electromagnetic waves propagate constantly at the speed of light, a transit time difference can be determined. Based on this time shift, the exact position of the flying object between transmitter and antenna can be calculated. Furthermore, the movement of the flying object creates a Doppler effect, which enables the calculation of a velocity vector (speed and direction of the flying object). Also, the system can decide what kind of flying object was in the area. With this technology the Parasol can differentiate between birds, cars, helicopters and some more, to shut on the lights if needed.

Illustration 1: The Respective Pathwaysbetween Transmitter Airplane and Sensor.



The detection areas

The Obstacle lighting of wind turbines must timely be activated before the overflight of an aircraft. For this purpose, the so-called detection space is used. IN Germany the General Administrative Regulation to the identification Notification of aviation obstacles (AVV from 5/2020) defines this as follows: "The detection space is the airspace that surrounds every wind turbine in a Radius from 4.000 Meter an in the Height from the ground up to 600 Meter."

Ellipsoidal interfaces

However, a distance alone is not sufficient to determine the exact position of the aircraft in the effective space.

To ensure this, two further sensors are required. Each sensor calculates an individual ellipsoid, creating a cluster of three different ellipsoids. The exact position of the aircraft is then determined from the intersection of the three ellipsoids.

The Fraunhofer Institute continues to stand by our side as a reliable cooperation partner to continuously optimize this demanding technology in the future.

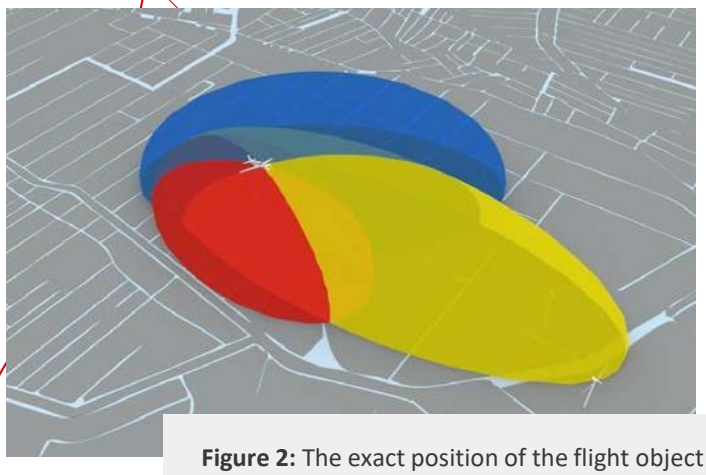


Figure 2: The exact position of the flight object was on the cutline of the three ellipsoids.

Forward-looking Technology

- complete remote controllable Components
- self-diagnostic for MaximumSafety
- permanent Recording of the Operating states
- Complete 360° detection
- no Frequency allocation through the Federal Network Agency required

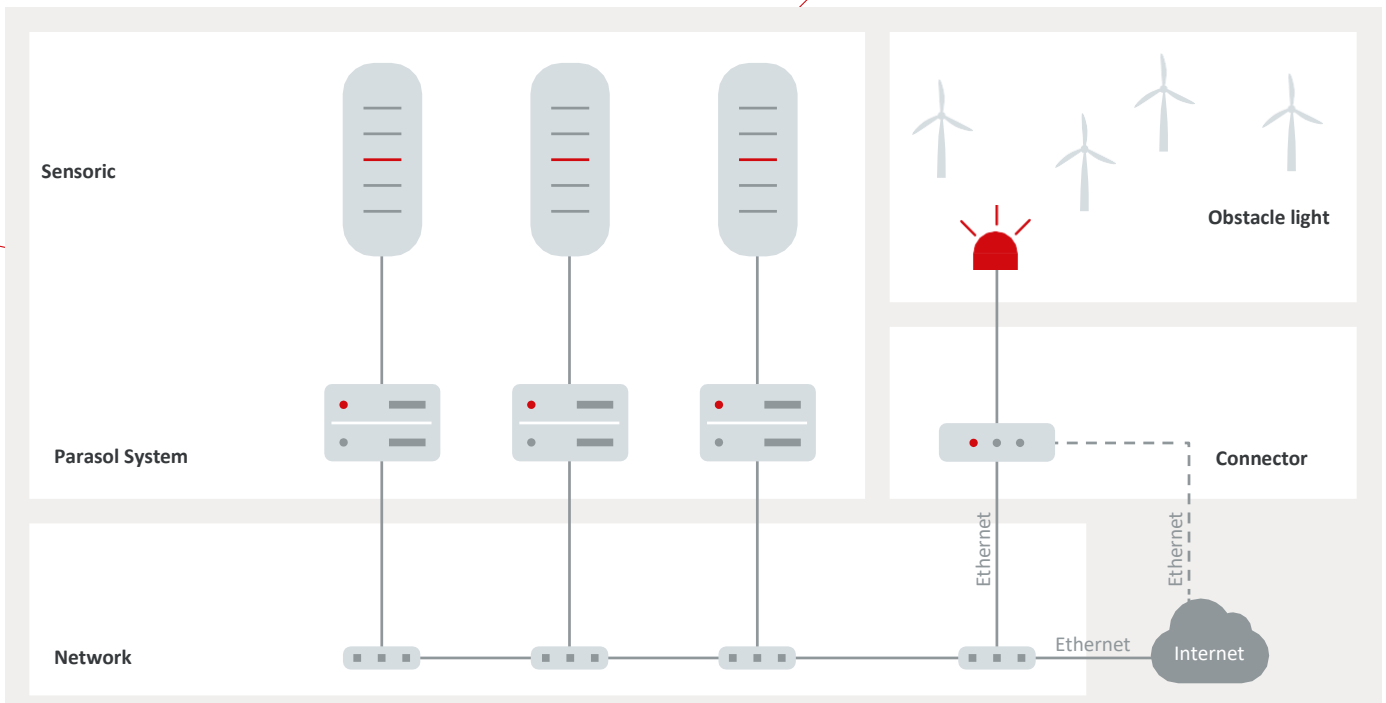


Figure 3: Infrastructure plan

Installation of the system

From acceptance up to commissioning

Recognition under aviation law

Whether passive or transponder based: Each ADLS system must be accepted individually. The respective recognition applies exclusively the corresponding detection area – for each new project was a separate recognition be obtained. On the one hand, documentation is required for this. In the most German ADLS projects, the wind farm must be flown to show the real function of the ADLS.

In the event of changes, such as the addition or repowering of wind turbines, only this change must be re-acknowledged.

Federal Immission Control Act

Thus, the first step is a comprehensive documentation of the Parasol system and the turbines that specify the operating space. This includes, for example, the location coordinates, the total height, the firing as well as any adjustments to the lighting and the network structure.

After the documentation has been accepted by the Airspace authority, a practical test is carried out in which a defined pattern is flown at different heights.

Everything from a single source

The documentation and flight test are carried out by Parasol. The only task of wind power operators is to provide the necessary information. With this Parasol organize a complete ADLS project.

With the help of our mobile measuring unit, a first preliminary determination of the active space and the required sensors is carried out.

Technical requirements

The installation of the Parasol system can be carried out during ongoing operation, which means that there is no loss of yield.

Depending on the location, the sensors are attached to the tower magnetically or with a separate mast (9 meters high) on the crane field. For the cable feed into the tower, a ventilation opening can be used, or a 10 mm small hole can be drilled into the tower. The corresponding approvals of the manufacturers for the boreholes are available to us for many tower types.

For communication between the Parasol system and the obstacle lighting must be known, which type, and manufacturer is used. Parasol can offer its own obstacle lighting but normally uses the existing lighting unit and this is what we are ensing about. For control it, we are using the Parasol-Connector. He gets from the sensors the ADLS-Signal that there is no aircraft in the working space, and that the lighting can be switched off. This process achieved via a conventional internet connection with low bandwidth. The Connector Communicates following with the already built-in lighting and is completely independent of the Type of wind turbine and whose Software.

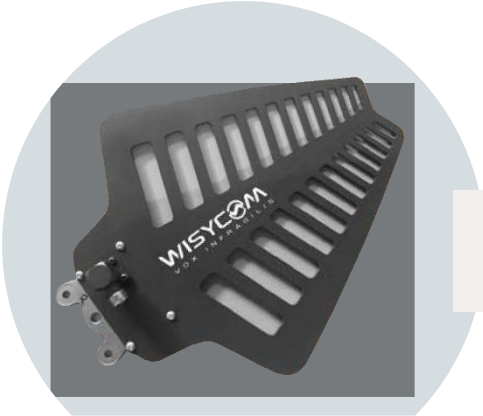
Signal provision contract possible

The deployment contract ace **at all-round carefree** package: In the provision **Contract** Parasol represents the installer and operator of the system. Thus, all expenses and responsibilities are clearly bundled at Parasol.

A one-time installation fee and an annual provision fee are charged per wind turbine. This time Creates a Convenient solution with clearly defined financial outlay. Thanks to our database, we are also able to link you to neighbouring wind farms in compliance with the data protection guidelines.

Support in plant upgrades

If the compatibility of the existing fire of the wind turbine needs an update or if there is no option to control the fire. Parasol can support the upgrading of it with an on Serviceteam and strong cooperation partners in this area. The goal is to upgrade the fire in OEM quality and for a low pricing.



The new, industrialized antenna generation is significantly smaller: This not only minimizes the effort – it also makes assembly easier.

Project planning phase

First, the coordinates of the wind turbines, the special features of the park and the communication plan of the turbines to be equipped must be available. An initial deployment using special software provides information about the positioning and number of antenna units required. This is followed by the placing of the for the ADLS System.

Summary

Parasol is the first choice when it comes to increasing the acceptance of wind turbines in the population. The system is completely emission-free and thus supports the sustainability and health concept that is being promoted by renewable energies. The effective space design also allows several neighbouring wind farms to be merged, which can achieve a significant synergy effect both technically and in terms of price. In conjunction with the manufacturer-independent integration of aviation, this creates long-term investment security.

The way to demand-controlled Obstacle Lighting with Parasol

Provision of the coordinates of the wind turbines

Determination of the potential space and Deployment

Placing of order

Installation of the Parasol system

Complete deployment by means of a mobile measuring unit and by Flying on site

Acceptance and recognition of the system by the Air Traffic Control

Modification of the Building Permit for wind turbines

Demand-driven night marking

Parasol

So that the night stays dark.

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