



# The True ADLS Solution for Dark Nights



Automatic Detection Lighting System with  
**Passive Radar**

## Ten good Reasons for choosing Parasol

The ADLS (Automatic Detection Lighting System) from Parasol ensures dark nights along with maximum safety. Due to the long-lasting development and practical experience, the passive radar system is deployed efficiently in Germany and on the international market. Background: To minimize conflicts with planes at night, wind turbines must be equipped with an obstacle light. On the one hand a high level of safety is reached, on the other hand obstacle lights can be perceived as distracting by locals. A wind park can cause extensive light pollution at night causing a negative effect on the environment and decline in acceptance of wind turbines. For this reason, Parasol has developed a passive radar system in cooperation with the Fraunhofer Institutes for High Frequency Physics and Radar Technology (FHR). A unique solution was developed, which is specially designed for applications in wind parks since wind turbines cause extensive signal interference. Our patented passive-radar system allows the deactivation of the obstacle lights at night if no plane is detected within a defined airspace. If a plane approaches the airspace, the passive radar system detects the target and switches the obstacles

lights on. Unlike conventional radar systems, passive radar does not need a dedicated transmitter, instead already existing broadcasting stations are used. Furthermore, our solution does not rely on transponder-based methods, instead it is fully independent causing a maximum of safety. Due to these reasons a high detection accuracy is achieved, which allows darker nights and an increase in acceptance.

### Your advantages with Parasol

- ▶ No radar emissions
- ▶ Patent by Parasol
- ▶ Avoids unnecessary activation of obstacle lights
- ▶ Detection area of 450 km<sup>2</sup>
- ▶ Signals available worldwide
- ▶ Independent of the aircraft
- ▶ Low service costs
- ▶ Clear contracts
- ▶ Transparent cost overview
- ▶ Real flight tests for maximum safety

## Our Technology in Detail

A passive radar system - unlike conventional radar systems – does not emit electromagnetic waves. Instead, it uses already existing signal sources such as radio, television, or mobile broadcasting transmitters, which supply a wide coverage all over the world. This prevents unnecessary electromagnetic pollution and allows a **simple implementation** at the same time. Technically speaking every signal source can be selected, however DVB-T2 and DAB offer sufficient signal properties.

The Parasol system consists of **three sensor sites**, each consisting of a sensor unit and a reference unit. The reference unit receives the direct signal from the transmitter (e.g., TV, radio, or mobile phone). The sensor unit receives the signal reflected from the flying or ground object. The figure below shows the concept of the Parasol system. The direct signal is marked in gray, the reflected signal is illustrated in red.

As seen in the figure below, both signals do not have an equal propagation path and reach the sensor at a different time. The direct signal reaches the Parasol sensor first, followed by the reflected signal causing a time difference of arrival. Due to the fact, that electromagnetic waves travel at a constant speed, Parasol finds the position of the target. For an exact determination of the position, three sensor units are implemented forming a multistatic system. Moving objects create a Doppler effect, which allows the cal-

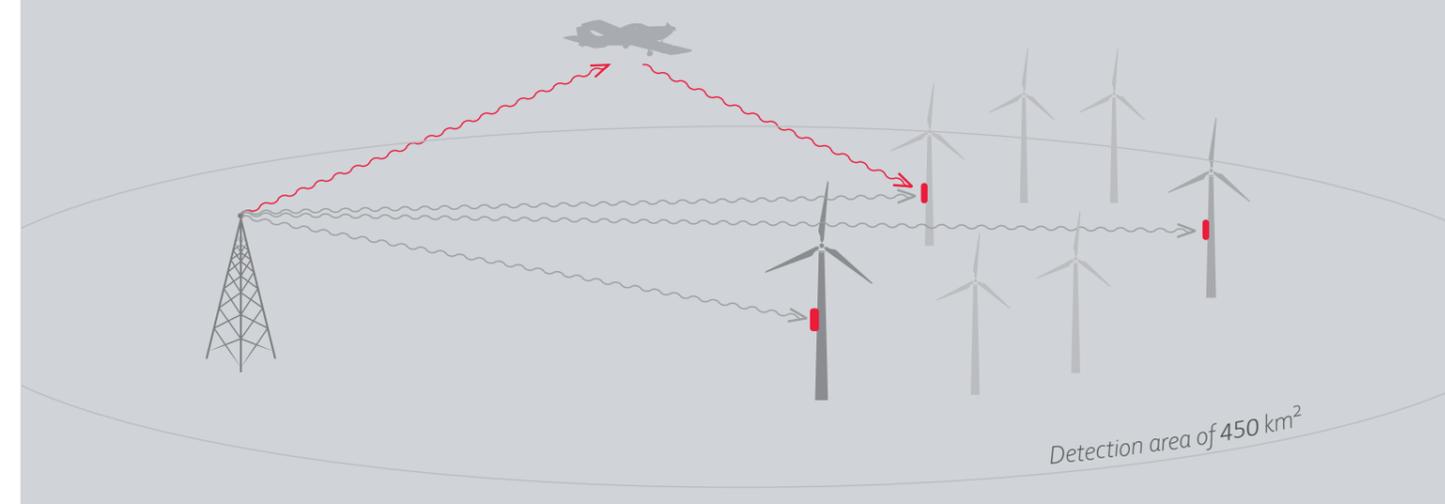
culaton of the target's speed and direction. The received signals are transformed to the range-Doppler domain in order to enhance the effectiveness and precision. Thanks to the data fusion of all sensor sites, a high accuracy and reliability is achieved.

A detection area of more than 450 km<sup>2</sup> is made possible. The area extends from ground level up to 4.000 m and can be adopted to country-specific regulations or future changes in requirements anytime. All wind turbines in the detection area benefit from this advantage. Parasol has developed a specially designed filter to suppress the clutter produced by wind turbines. Passive radar technology is completely independent from transponder technology since it relies on the reflection of electromagnetic waves. This creates a **high level of safety** for aviation and **avoids an unwanted activation of obstacle lights at night**. The ISO9001 certified passive radar system can be adapted to different specifications and is available worldwide. In addition, the system is modular based making it easy to extend in case of an expansion of the wind park.

### We support Wind Turbine Retrofit

In case of lacking compatibility or missing options to control obstacle lights, Parasol supplies support to ensure the retrofit of wind turbines. As an expert in this field, Parasol consults and contacts partners to supply technical support.

Three Parasol sensors receive the signal from an existing radio or TV transmitter as well as the reflection from a plane within the detection area.



# Large Coverage – Low Costs

Obstruction lights equipped at wind turbines must be switched on in time if a plane crosses a specific air space. The delay between the detection and activation of the lights is limited commonly to less than a second. By using modern infrastructure Parasol fulfills this requirement. To separate a relevant plane from non-relevant, a so-called detection area is defined. The detection area covers the wind park; therefore, the name Parasol is chosen which can be translated as sunshade. The detection area covers a size of 450 km<sup>2</sup> per Parasol unit and can be increased by the use of additional units. Planes within the detection area are classified as targets, which activate the obstacle lights. Thus, any number of wind turbines can be combined to a single detection area. This leads to an immense reduction of costs and complexity. Next to the installation of the ADLS (Automatic Detection Lighting System) Parasol also offers technical support in the field of obstruction lights. For a fully functional ADLS it is necessary to connect the output of the passive radar system to the control unit of the obstacle lights. Due to our long-time experience, we offer the knowledge to connect any kind of obstacle lights to our passive radar system. Our specially designed contract supplies an all-round carefree package. If this package is selected, Parasol takes over the complete installation and functions as the permanent operating company of the ADLS. The contract includes any service and maintenance for guaranteeing a safe operation.

A clear and predictable overview of all arising expenses is achieved. For each system, a one-time set-up fee and an annual provision fee are charged. If a wind turbine is dismantled, the right to end a contract under specific conditions applies. This uncomplicated financing model avoids hidden costs and allows a precise prediction of costs. The process of an installation is shown in the table below.

Installation of an ADLS
Determination of the detection area and preliminary dislocation
Complete dislocation by mobile antennas and test flights
Installation of the Parasol system
Authorization of the system by the national authority
Revision of the admission
Automatic Detection Lighting System in service

# Parasol in Practice

Passive radar is an ideal solution for your wind park. No frequency allocation is needed which allows a fast implementation. Our system uses already existing broadcasting station as transmitters, which reduces the cost immensely. Passive radar does not use complex transmitter technology since the system only receives signals like commercial radio receivers. Unlike transponder-based ADLS solutions, passive radar is completely independent of the avionic making it especially safe and exact. If the transponder is deactivated for any reason, transponder-based ADLS are unable to perform a detection. The Parasol sensor units are installed on a 9-meter-high mast, which is erected close to a wind turbine. If necessary, the sensor units can be attached to the mast of the wind turbine by a magnet. Thus, our solution is simple to install and offers good accessibility for service and maintenance. In addition, the system can be checked remotely, which simplifies the administration. During the installation, no wind turbines are interrupted or shut down, therefore no loss of income is caused. Parasol supplies the ability to expand the passive radar system as needed, if nearby or repowered wind turbines are implemented to the ADLS.

To give you an example: The benefits of choosing Parasol can be shown by a project in northern Germany near Oldenburg. Many plant operators decided to set up a corporate solution to realize the implementation of an ADLS. Parasol was commissioned to realize this ADLS project. Until now in total six ADLS have been installed by Parasol, which create a unique detection area of more than 2.600 km<sup>2</sup>. All wind turbines are located within the detection area and deactivate their obstacle lights if no plane is detected at night. To ensure a long and independent availability, the sensor units are placed on a 9-meter-high mast. This allows wind turbines to be serviced or dismantled without any restrictions for the ADLS. The infrastructure of Parasol connects the passive radar system to the control unit of the obstacle lights in real time. Consequently, obstacle lights are switched on only as needed at night. Parasol has long lasting knowledge in terms of ADLS and technical management of wind parks. We use straightforward solutions, to guarantee quick, uncomplex and affordable realizations.



A technician servicing the antennas of a Parasol unit near Oldenburg. Annually all antennas and cables are checked and readjusted if necessary. Parasol checks the sensor units remotely which allows a fast error cause analysis.



The entire ADLS can be erected without the use of the wind turbine's infrastructure. In this way the service and maintenance are completely independent of the wind turbine. At the same time, the infrastructure of the ADLS is fully autonomous of the wind turbine's lifetime. Therefore, a single ADLS can last for several generations of wind turbines.



# Parasol meets National and International Guidelines

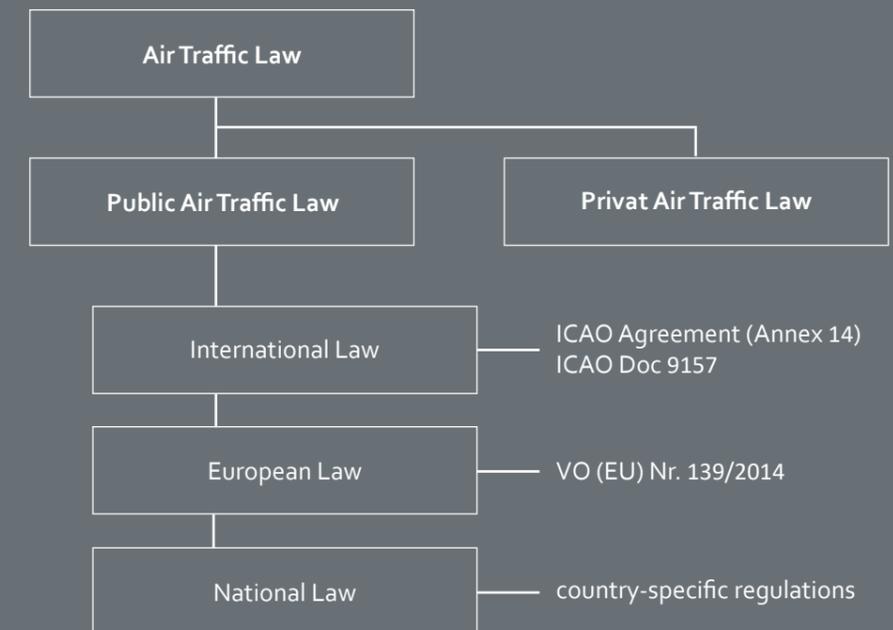
Parasol's ADLS meets tomorrow's **national and international requirements** by now. Next to German law the passive radar system fulfills all international **guidelines of EASA and ICAO**. Since our ADLS solution conforms to maximum safety requirements, you receive an ultramodern technology to perform effective airspace surveillance. Due to the modular design, the system can be expanded to any number of wind turbines. The combination of several sensor units has already been deployed successfully in the past and lead to a significant reduction of costs. The ADLS is completely independent of the wind turbine's infrastructure which

allows a long use time. Our solution is **not reliant on the lifetime of wind turbines**, therefore various generations are supported by a single system. Passive radar does not base on the aircraft's equipment like transponder-based systems, instead it receives the reflections of electromagnetic waves autonomously. To supply user-friendly monitoring, the system offers remote control and a self-diagnostic function. Aircraft movements are recorded permanently and display by a digital map allowing a live tracking of all detected targets. Additionally, the map illustrates the location of the wind turbines and the position of the implemented sensor sites including the size of the detection area. Due to the large detection area, **costs and efforts are reduced** while maximum safety is guaranteed.

Parasol has multiple sales partners in Europe to provide you a local contact person for your project as fast as possible. Our contact recommends you in all matters and takes care of the project management, operation, service, and maintenance. This ensures a correct installation and faultless operation of our patented passive radar system. At the same time, you receive help and an uncomplicated and fast realization of the project.

# Act independently of Others

The International Civil Aviation Organization (ICAO) is an agency of the United Nations (UN) and has over 190 member countries. It creates standards and recommendations to ensure an elevated level of safety in aviation. Furthermore, the organization has published guidelines for the implementation of an ADLS (Automatic Detection Lighting System). According to **ICAO requirements**, an ADLS is needed „to activate the obstacle lights only if an approaching aircraft is detected in order to reduce light emission of wind turbines.“ Several solutions have been presented in the past; however, Parasol supplies the most independent ADLS on the market. Our passive radar system does not rely on the equipment of the approaching plane and is fully independent of the wind turbine's infrastructure. Due to the capacity overload of transponder signals caused by the rapidly increasing air movements, transponder-based systems cannot perform an unambiguous detection. A separation between relevant and non-relevant target is not possible which can lead to unnecessary light emission. In worst case an inoperable transponder can cause a total system failure of a transponder-based ADLS. Primary radar has similar independence compared to passive radar; however, a loss of the transmitter leads to a fatal collapse of the system. Our passive radar system uses multiple transmitter due to the availability of civil broadcasting stations. Parasol offers an independent solution, thus false detections and light emission are reduced to a minimum. The international law recommends the skill to detect planes **regardless of the aircraft's equipment**. Transponder-based solutions do not fulfill this advice, active radar systems may fulfill this task, however these need a dedicated transmitter, which increases the costs and complexity immensely. A passive radar system meets all requirements and recommendations and is completely independent at the same time. It cannot be ruled out that regulations may be tightened in the future. Parasol offers you an ideal choice and supplies a fully recognized and sustainable product, which meets future requirements today.



*The Parasol system is technically capable of monitoring the entire lower airspace G (Golf). It is qualified to be installed close to wind turbines, which are constructed around visual flight rules (VFR) routes.*



# Parasol combines Safety and Dark Nights

Parasol is your first choice to increase the acceptance of wind turbines among the public. Since the system produces no electromagnetic emissions, it is environmentally sustainable and forward-looking. Passive radar does not rely on the aircraft's equipment, because no transponders are necessary to detect planes. Furthermore, no complex transmitters are implemented, which increases the reliability and ease of maintenance of the system. We use already existing broadcasting stations, which are available worldwide. This guarantees a high level of safety at low operating costs. Nearby wind turbines or wind parks can be

combined to a single detection area, which allows an enormous technical and financial benefit. Our system can be checked remotely resulting in a user-friendly accessibility. Parasol offers a clear overview of all costs and an all-round carefree package to ensure maximum financial safety.

You are not from the wind power sector but looking for a customized solution for airspace or airport surveillance? No problem! Parasol is constantly working on innovative solutions to make our world safer. Feel free to contact us or visit our website!

## Imprint

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