Parasol –
Passiv Radar basierte Schaltung der Objektkennzeichnung für die Luftfahrt
The Passive-Radar-System for Wind Turbines
Mode of Operation

PASSIVE-RADAR-SYSTEM
Time shift of direct signal to echo

- Directly received signal
- Reflected signal ("echo")

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Passive-Radar-System

Advantages
• no need of frequency assignment
• no emission of additional electromagnetic radiation
• (good at price – no radar transmitter needed)
• DVB-T1 and DVB-T2 as transmitters extensively available
• not subject to weather conditions
• no cone of silence

Challenges
• Object classification (swarms of birds / small A/C / vehicles)
• Object altimetry
• Sensor dislocation
History of development

PARASOL
Parasol – History of development

July 2012 the institut FHR contacts Dirkshof in search of an industrial partner (Dirkshof is not only project developer and operator of wind farms but offers also the know-how and ressources of the aviation industry as aircraft manufacturer at „Breezer Aircraft“)

Sept. 2013 Together with the FHR, Dirkshof installs the first Passive-Radar-System at a wind farm in Reußenköge for a test operation period of one year
Parasol – History of development

April 2014 competence and project promotion is taken over by the Bundesministerium für Wirtschaft und Energie (BMWi)

Sept 2014 successful completion of the test period

Sept 2014 Parasol GmbH & Co. KG is founded

Nov. 2014 beginning of the fist prototype production

April 2015 application of the system at the Deutsche Flugsicherung GmbH (DFS)
Parasol – History of development

July 2015  passing of the AVV (german administration regulation) identification of wind turbines

Aug.2015  general approval of the Parasol-System through DFS = approval step I

Mar.2016  implementation of the infrastructure for the Parasol-System at the wind farm Reußenköge

June 2016 completion of the control center for the surveillance of the system
Parasol – History of development

July 2016  location-based evaluation through DFS GmbH for final approval

Nov. 2016  Installation of new computer units as well as improvement in performance of the sensor network

Jan. 2017  long-term tests of each sensor cluster as well as test flights to improvement of false target discrimination

Dec. 2017  preparation for change to DVB-T2

Optimisation of the dislocation, installation of reference antennas
Parasol – History of development

Feb.2018  test flights at 300m and 600m
Mar.2018  practical acceptance test on site (FHR, DFS)
Mai 2018  final approval of the system through DFS
06.2018  optimisation of the total system for serial production
from
July 2018  dislocation of wind farms of individual clients
on
Parasol - System

The Parasol-System consists of the following components:

- 3 sensor units incl. tower fastening
- 3 analysing units incl. uninterrupted power supply (USV)
- 3 cable sets
Parasol – sensor unit

By installation of 2 antennas which are offset in their heights, an additional height measurement by interferometry takes place. Thus, a reliable difference between ground vehicles and aircrafts (even in low heights) can be made.

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Parasol – Analysing unit

- 2 receiver modules 470-870 MHz
- 3 signal generators
  (1. local oscillator, 2. local oscillator, clock generator)
- 2 analog to digital converter, 16 bit
- 1 FPGA for pre-processing
- 1 computer unit for pre-processing and control
- data memory
Infrastructure plan for existing warning lights
Infrastructure plan for Parasol warning lights

Parasol-system

Parasol warning light

FCC network with RJ45 connections (min. 1Gbit) provided by customer
The reference project – Wind farm Reußenköge

PASSIVE-RADAR-SYSTEM
Parasol - the supervised area

Wind farm with 21 turbines (Vestas V 112)

Sensors installed on:
2x Vestas V80
1x Vestas V112 = South System

2x Enercon E-82
1x Senvion 3.4M-114 = Dörpum System

applied transmitter: Flensburg (474 MHz)
Kiel
Parasol - the supervised area

Result:

Because of the elongate extend of the farm over 12 km, 2-3 systems are required to cover the whole farm.

At smaller farms up to 15 turbines, one system will normally be sufficient.

This example shows a great potential for synergy effects with further farms.
Thanks for your attention.