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BUSINESS UNIT DEFENSE

TITLE *Precise information retrieval also in complete darkness or in foggy conditions: the systems and techniques developed by Fraunhofer FHR for surveillance and reconnaissance generate photorealistic radar images.*

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INDISPENSABLE FOR RECONNAISSANCE AND PROTECTION

In all weather conditions, radar systems deliver a multitude of information and pave the way for the reconnaissance of unknown territories – on water, on land or in the air. With its extensive know-how, Fraunhofer FHR covers the entire spectrum of high frequency and radar techniques for defense purposes.

Smart, modular, multi-modal and compact. These are the special demands placed on future radar systems, demands that have formed the focus of research at Fraunhofer FHR for many years already. The reconnaissance and surveillance techniques for close- and long-range applications are subject to ongoing development. The scientists also examine innovative concepts for camouflaging internal radar systems as well as for jamming or deceiving enemy systems. Fraunhofer FHR evaluates new camouflage materials and methods in the course of regular measurement campaigns that are carried out for partners of the institute. Here, the scientists attach great importance to ensuring that the camouflage scenarios are as realistic as possible, for optimal camouflage is always adapted in line with the geographical and climatic conditions in the operational area. In this way, the German Armed Forces and industry benefit from an objective and independent examination of their material. In addition, the institute provides assistance in the development of modern processes for the jamming and deception of external radar systems on all platforms.

In the imaging area, Fraunhofer FHR delivers internationally acclaimed results. It carries out pioneering work in the area

of Moving Target Indication (MTI) and is also an international leader in this field. The scientists focus intensively on the detection, tracking and classification of ground (GMTI), maritime (MMTI) and airborne targets. In particular, the detection of compact aircraft is a theme of growing importance. The scientists are currently investigating several approaches to close this capability gap in the fastest possible manner.

The researchers provide fast and flexible solutions with »software-defined radar«: intelligent software gives radar a greater degree of freedom and a wide spectrum of applications. The utilization of commercial, terrestrial wireless transmitters (radio, television) allows air surveillance exclusively with passive receivers. The application of machine learning techniques and other methods from the area of computer science clears the way for cognitive radar. Research activities focus on the development of a radar system which, to the greatest extent possible, automatically adapts to the specific task and the respective conditions. This reduces personnel requirements and assists operators during situation assessment.

Fraunhofer FHR combines these skills with miniaturized systems, a further research field. Thanks to the development of its own chips on a silicon-germanium (SiGe) basis, complete systems, known as radar-on-chip, can be constructed on a surface of just a few square centimeters. This miniaturization not only reduces the volumes required for assembly but also lowers the costs and power requirements of the system. In addition, these innovative systems also respond to new requirements: there is a growing demand for indoor surveillance and reconnaissance applications, particularly in urban environments. The agility and size of the carrier platform play a major role here. Thanks to SiGe systems, high-performance millimeter wave radar systems are now available for use in unmanned carrier systems, e. g. UAVs.

With its broad and in-depth experience, Fraunhofer FHR provides comprehensive counseling and judgment capabilities for its partners in the private and public sectors. Fraunhofer FHR also brings its expertise to bear in various bodies, e.g. NATO STO Task Groups and EDA CapTechs. This facilitates the creation of synergy effects that promote knowledge creation in national and international cooperations. In joint projects with industrial partners, the institute continuously integrates its research results into practical applications and products.

- 1 In addition to developing systems for reconnaissance and surveillance, Fraunhofer FHR conducts research on radar systems for military camp protection.
- 2 3D radar image of Karlsruhe's city center. Heights are color-coded.
- 3 High resolution images can be generated up to 300 GHz – also at a distance of over 100 m.
- 4 The FHR airplane Delphin is used to test techniques and systems in the course of measurement campaigns.



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