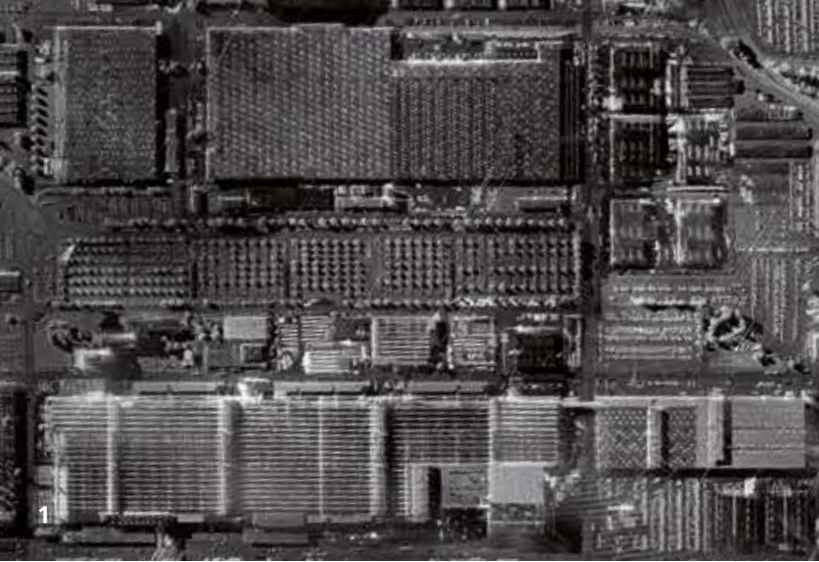


KEY TECHNOLOGY RADAR





ABOUT FRAUNHOFER FHR

Fraunhofer FHR is one of Europe's largest research institutes for high frequency and radar technology. It develops customized sensor concepts, techniques, and systems for the defense, space, traffic, and production sectors as well as for man and environment.

From reconnaissance, surveillance, and protection systems to real-time capable sensors for traffic and navigation all the way to quality assurance and non-destructive testing in production: The Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR develops customized electromagnetic sensor concepts, techniques, and systems for its partners, from the microwave range through to the lower terahertz range. These are used for high-precision distance or position determination as well as imaging with a resolution of up to 3.75 mm, ensuring robust and reliable operation even in rough environmental conditions with high temperatures, vibrations, or zero visibility because of smoke, vapors, or fog.

Fraunhofer FHR conducts research on new radar and high frequency techniques and systems. The institute employs its know-how to support companies, authorities, and other public bodies with technology consulting services and studies as well as prototyping for its partners and together with its partners to overcome unsolved challenges. From the conceptualization, design and simulation to construction, testing, and the production of pilot series, the special focus is on the maturity of the systems and their suitability for serial production to ensure a quick transformation into a finished product in cooperation with a partner.

With multiple anechoic measuring chambers, technology centers for analog and digital PCB manufacturing as well as comprehensive high frequency technology, the institute is superbly equipped for the development of modern sensor systems. With a budget of approx. 34.6 million euros and a

staff of about 340, Fraunhofer FHR is one of the largest radar research institutes in Europe. Through the institute's own research groups at universities and the numerous lecturing and teaching activities of its staff members, new insights from basic research are continuously being incorporated into the institute's work. In addition, thanks to its excellent network within and outside of the Fraunhofer Society, for instance as members of Research Fab Microelectronics Germany, the institute has access to broad, interdisciplinary knowledge and is always able to find the ideal consortium, even for large-scale projects.

The ability to carry out non-contact measurements and the penetration of materials using high frequency and radar technology open up a range of possibilities for the localization of objects and people. That is why the high frequency sensors of Fraunhofer FHR – from traditional waveguide technology to highly integrated silicon-germanium chips, and thanks to the advances in miniaturization, digitalization, and systems that self-adapt to each situation – are an affordable and attractive option for an increasing number of application areas, some of them highly sophisticated.



BUSINESS UNITS

Fraunhofer FHR supports its customers and partners with technology consulting, design, construction, prototyping, and testing services for the development of new radar applications.

Defense

Fraunhofer FHR develops new technology and new concepts for surveillance and reconnaissance as well as for the camouflaging of internal radar systems and the deceiving and jamming of enemy systems to ensure effective protection of land, water, and air. This technology and the concepts are adapted to the individual tasks and platforms to create smart, modular, multi-module, and compact radar systems for defense.

Space

Fraunhofer is a leader in space observation and reconnaissance based on radar technology: The institute develops systems and processes for the detection, tracking, imaging, and analysis of objects such as satellites or space debris in orbit and creates risk analyses. For this purpose, Fraunhofer has developed the virtually unique TIRA system and is currently developing the complementary system GESTRA for continuous surveillance in space.

Security

Fraunhofer FHR provides compact, high-performance sensor technologies to support emergency forces with detailed information – in real time, in all weather and visibility conditions, and in areas with difficult access. Its prevention and emergency response systems scan suitcases or monitor areas, for example, to detect sources of fire, unstable buildings, or unauthorized objects such as drones.

Traffic

Fraunhofer FHR uses new hardware concepts and software-controlled systems to optimize radar for increased security in the air, at sea, and on the road. From smart automotive radars that adapt themselves to each traffic situation to sea rescue systems capable of reliably detecting even very small objects at sea all the way to landing aids in helicopters.

Production

High frequency technology makes it possible to screen a large variety of materials that are not transparent in the visible range. Fraunhofer FHR's compact sensors do not use ionizing radiation and are capable of detecting even the slightest of differences in a material. The ability to precisely measure distances down into the micrometer range is key to consistent high quality in zero-defect production – in real time, in 24/7 operation, and in-line with belt speeds of up to 20 m/s.

Human and environment

Fraunhofer FHR designs robust, reliable active and passive radar systems for precise environmental monitoring, geomonitoring, precision agriculture and forestry as well as the surveillance of the surrounding areas around wind farms. The institute also studies how the non-contact penetration principle of radar can be used for medical technology and health care applications.





CORE COMPETENCIES

Thanks to its interdisciplinary research activities, Fraunhofer FHR is in a position to design, construct, test and utilize complex techniques, systems, subsystems and components. The institute covers the entire development chain for radar and high frequency systems and therefore has a unique selling position.

Electromagnetic fields

Fraunhofer FHR's competence in the numerical calculation of electromagnetic fields, which forms the basis for the characterization of scattered fields and the design of innovative antennas and antenna arrays, was developed over decades. This core competency can be applied across all business units.

High frequency systems

With its ability to build innovative and complex assemblies in the microwave and millimeter wave range, the institute can provide its partners with demonstrators and first prototypes. The spectrum includes planar circuits, waveguide components, integrated circuits, broadband technology, array-based subsystems as well as active and passive radar systems. The miniaturization of components and subsystems is an attractive sub-competency.

Signal processing and imaging

Fraunhofer FHR is globally recognized and has received several awards for its activities in the area of signal processing. The institute has comprehensive expertise in the development and successful application of highly complex mathematical operations for the processing of single and multi-channel signals. These are used for scene reconstruction in the form of position and motion parameters of detected targets or for the computation of radar images.

Cognitive radar and classification

Fraunhofer FHR has developed techniques for the non-cooperative classification of air, sea and land vehicles which are based directly on the measured radar signatures. These techniques are primarily used for military applications. An internally constructed experimental system is available for the generation of such signatures. The relevance of these processing algorithms is also increasing in the civilian sector where they are used, for example, to process sensor data in the area of autonomous driving.

Space radar

Due its work with the space observation radar TIRA and its competence in the area phased array-based space observation, Fraunhofer FHR has a unique selling position in field of radar-based space observation. The institute offers valuable assistance in issues relating to space debris, high-precision orbit detection, the detailed technical analysis of satellites as well as support in all satellite mission phases, from the launch through to re-entry.

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Prof. Dr.-Ing. Peter Knott (executive)
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TITLE *Fraunhofer FHR's radar systems are optimally adapted to their tasks: from miniaturized sensors for unmanned systems up to the institute's largest radar for high-resolution space observation.*

1 *From large heights, in poor visibility, by day or night: Radar images are indispensable for reconnaissance.*

2 *The seventh sense: Capable of capturing a large amount of environmental information, radar is a valuable sensor for autonomous systems.*

3 *Fraunhofer FHR's radar systems provide for increased safety and comfort in the air, at sea, and on the road.*

4 *Radar detects the smallest of movement without contact. Fraunhofer FHR conducts research on how this can be used in the future, for example to monitor the vital parameters of many patients.*

5 *At Fraunhofer FHR, radar systems from the size of a match box up to the volume of a van can be developed, built, and tested.*

6 *Compact, flexible, efficient – these are the essential characteristics of Fraunhofer FHR's industrial measuring technology.*

7 *The vision for a sea rescue scenario: A transponder integrated into the life jacket allows for the localization of shipwrecked persons using harmonic radar.*