

Hardware Innovations for Radar Technologies

Automated traffic control by drone sensing

Research Project AKIRA-UTM

In the future, swarms of drones will hover over our cities and deliver parcels, goods, and even critical supplies. To turn this vision of the future into reality, solutions are needed to ensure the safe operation and automate air traffic control at lower altitudes.

The aim of the research project AKIRA-UTM is to estimate the effort required for a safe and efficient AI-based traffic management system with a monitoring and radar network not affected by interference.

Ground-based radar platform

The project partners are developing a concept for a ground-based radar platform to locate unmanned aerial vehicles reliably and permanently up to a flight altitude of 100 meters.

For the feasibility study, radar cells are being developed to form a sensor network. This network is planned as one redundant component of a larger system. It should enable significantly higher accuracy in 3D localization than current systems.

Hardware radar system objectives:

- Combining high security standards with excellent energy efficiency
- Integrating modern communication channels and architectures

Contributions from Fraunhofer IZM:

- Design of integrated radar modules of a radar system cell
- Layout and design of radar front-end modules
- Design of radar sensors in highly integrated 3D mold technology
- Calibration of the radar sensors

Target innovations:

- 3D patterning technology for 3D MIMO antennas
- Calibrating 2 to 3 radar sensors on one drone for 360° all-round visibility
- Radar MIMO architecture for radius up to 500m

Project partners

- ESG Elektroniksystem- und Logistik GmbH
- esc Aerospace GmbH
- Fraunhofer FHR

Associated partners

- InnoSenT GmbH
- GLVI Ges. f. Luftverkehrsinformatik GmbH
- KYMATI GmbH
- DLR-GfR mbH

Project volume

- € 3.5 million

Duration

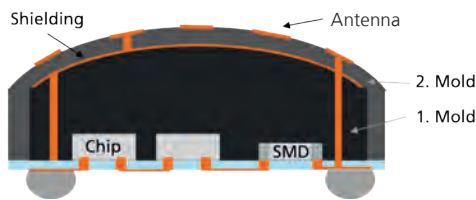
- 01/2022 - 12/2024

Funding code

- ROB-2-3410.20-04-11-02

Conventional planar antenna structures are not suitable for the purposes of the AKIRA project. Integrated 3D MIMO antennas for radar applications are being developed, using double-mold technology for the first time. These are based on 3D-structured substrates, whose geometrically precise production is being researched at IZM.

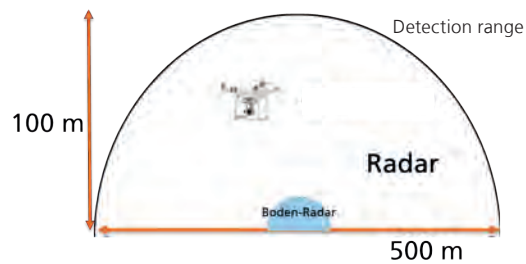
The innovative mold approach reduces costs at high productivity levels.



3D antenna with double-mold construction and integrated electronics

The 3D antennas form the core of the ground radar stations. Their detection range covers at least one hemisphere. They also enable communication between the various modules.

Connecting several cells creates a modular system for the large-scale monitoring of air-space up to an altitude of 100 m.



Single cell monitored by ground radar

Advantages of radar cells:

- Temporally and spatially exact localization of drones
- Automatic handover between radar cells

Required for autonomous mobility:

- Solutions for dynamic delivery points and active air traffic
- Redundant systems for monitoring and guiding (non-)cooperative drones

Other areas of application:

- Avionics
- Autonomous driving
- Industrial electronics



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Project Status (11/2022):

- Hardware concept development
- Construction first demonstrator

Get to know our packaging and frontend solutions for radar modules!

Contact us!

Fraunhofer IZM: Invisible - but indispensable: Nothing works anymore without highly integrated microelectronics and microsystems technology. The basis for their integration into products is the availability of reliable and cost-effective assembly and interconnection technologies.

Fraunhofer IZM, a world leader in the development and reliability assessment of electronic packaging technologies, provides its customers with customized system integration technologies at the wafer, chip, and board level. The research done at Fraunhofer IZM helps make electronics more reliable and provides customers with reliable data about the durability of electronics.

More information



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