Key Facts GESTRA EUSST/Network

- Project duration: Beginning of 2021 to end of 2023
- Build-Up of an additional receive unit including the necessary networking technology
- Performance gain
  - by more receive channels
  - by exploiting bistatic angles
- Extension of orbit heights from 100 to 3,000 km
- Fully digital beamforming on GPUs
- Semi-portable, bistatic setup

Key Facts GESTRA TX2

- Planned project duration: End of 2021 to end of 2027
- Development and Construction of an additional transmit unit including the necessary networking technology
- Performance increase
  - by additional transmit power
  - by use of GaN technology
- Orbital altitudes: 100 to 3,000 km
- Fully digital beamforming through signal generation in each individual channel
- Semi-portable, multistatic setup

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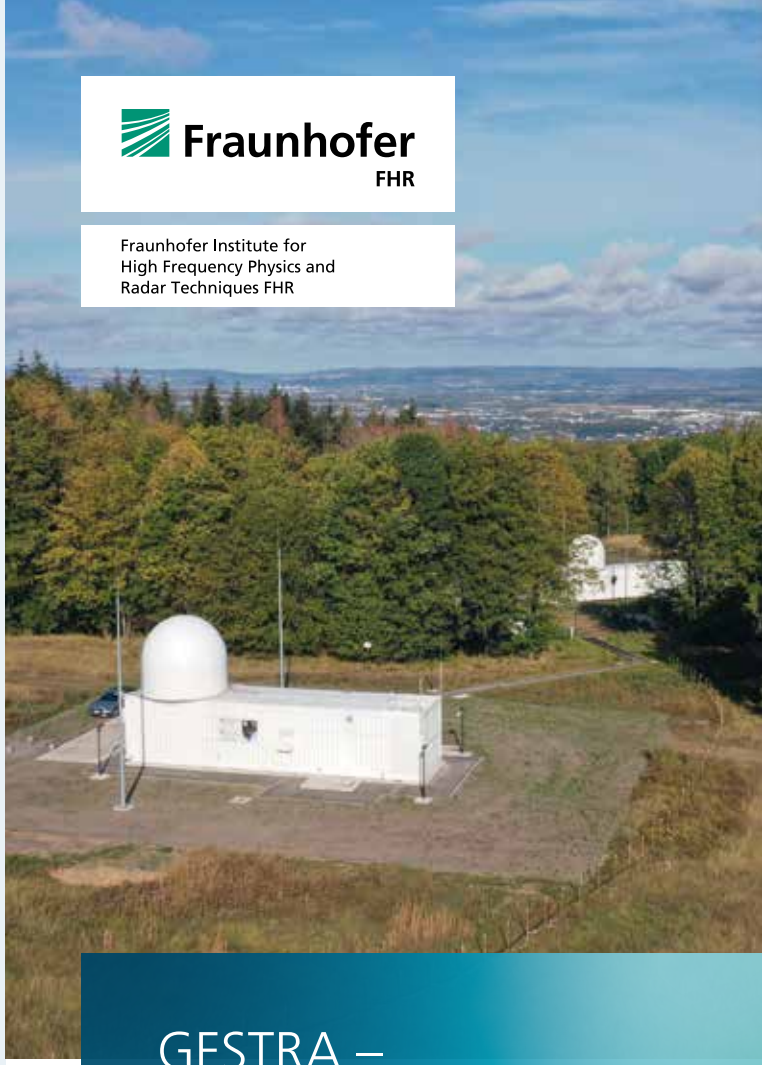
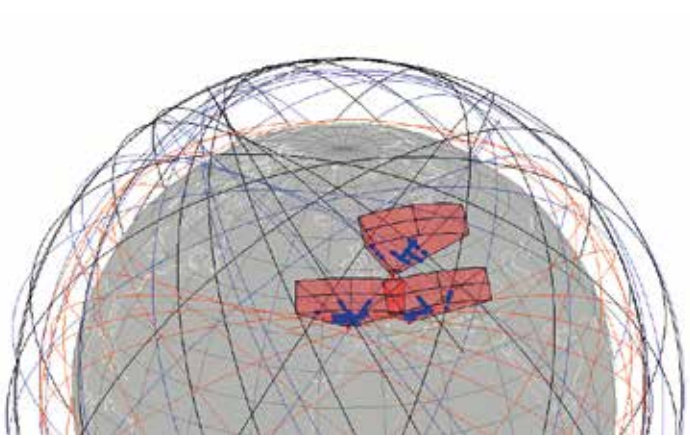
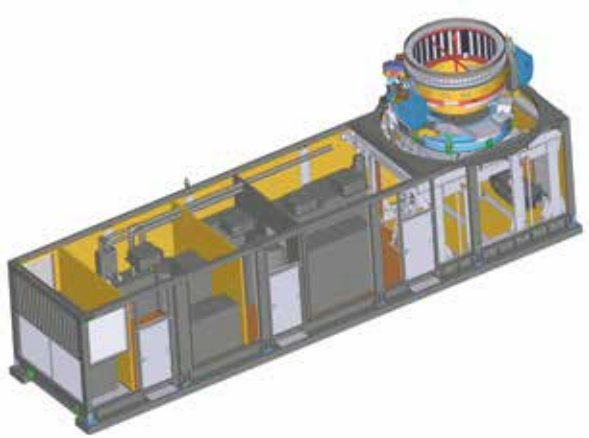


GESTRA – Radar Networks for Space Surveillance and Tracking





Starting Position

Modern society relies to a growing extent on the utilization of near-Earth space, with the result that this area now accommodates a large number of satellites. The ongoing expansion of this infrastructure has, however, also led to a dramatic increase in the number of non-functional objects, such as decommissioned satellites, burnt out rocket stages, and debris particles. The likelihood of active systems being destroyed as a result of collisions with space debris is now very acute.

It is estimated that there are currently around 36,500 objects with a minimum diameter of ten centimeters and over 1,000,000 objects with a minimum diameter of onecentimeter. Due to the high orbital speeds of up to 25,000 kilometers per hour, these are extremely dangerous projectiles that are capable of seriously damaging or even completely destroying any active satellite they encounter. A catalog with high-precision orbital data for all critical objects, which would allow satellite operators to plan evasive maneuvers to protect their infrastructure, is necessary.

Space Surveillance with GESTRA Networks

Realization at Fraunhofer FHR

Radar-based space surveillance is a topic of high topicality and importance due to the steadily increasing use of nearr Earth space. The German Space Agency of the German Aerospace Center (DLR) has commissioned Fraunhofer FHR to establish a network of powerful sensors: The GESTRA (German Experimental Space Surveillance and Tracking Radar) system in conjunction with the additional compatible sensors GESTRA EUSST and TX2.

Once completed, the sensor network will be operated from the German Space Situational Awareness Center (GSSAC) via remote control. A number of flexible and innovative surveillance and orbit tracking modes are available. These modes operate via electronic beam steering using phased array antennas. As a result the freely configurable monitoring of large surveillance volumes as well as long tracking sequences to generate highly accurate orbit information can be achieved.

Outlook

Following the implementation of the Commissioning Results Review (CRR) of GESTRA in 2021, the system will be handed over to the German Space Situational Awareness Center. In terms of its surveillance capabilities, the GESTRA concept is inherently scalable. As a result, it is well suited for being integrated into further expansion stages of radar sensor networks.

For this reason, DLR Space Agency commissioned FHR with the construction of a further receive unit called GESTRA EUSST and is planning to commission an additional transmit unit called GESTRA TX2 by the end of 2021.

Both systems will generate technological added value by using innovative networking technology. Further benefit will be achieved by upgrading the array with fully digital beamforming capabilities.