

SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)  
Mobile Satellite Communications and Navigation Technology (1)

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## ICARUS – A NEW GLOBAL OBSERVATION SYSTEM FOR SMALL OBJECTS (ANIMALS)

**Abstract**

Sharing planet Earth as a common habitat, the well-being of humans is directly connected to the existence of animals, be it as a source of food, the origin and carrier of diseases, or as an early warning system for human impacts on nature. Around the globe, billions of animals are roaming wildly all the time. They connect the most remote places on Earth and in the oceans, and could be our sensors, our eyes, ears and noses for the health of our planet. However, we poorly understand the biology of most wild animals, especially small ones, because we cannot track their locations, their behavior, and the reasons for their death. We need to know where, why and when animals are migrating and where they face problems to preserve essential ecosystem services and to safeguard our own human livelihoods. ICARUS (International Cooperation for Animal Research Using Space), a research endeavor that transcends disciplines and continents, will close this knowledge gap by monitoring the local, regional and global movement patterns of tagged animals. The German Space Administration DLR and the Russian space agency Roscosmos signed a cooperation agreement to demonstrate the capabilities of an ICARUS Earth-Space communication system in a joint mission on-board the ISS. The main challenge of ICARUS is the implementation of an operating two-way communication link via RF between tags attached to the animal and the payload at the ISS. A miniaturized tag is under development that provides in addition to the communication with the payload in space the capability to measure its absolute GPS position in regular intervals, thus tracking the animal with high accuracy, and to acquire local temperatures and acceleration values that give indications of the behavior of the animal – all with a mass of the tag less than 5 gram. During contact with the ISS the tag transmits the recorded data and receives reconfiguration commands using the ICARUS payload and the Russian space and ground infrastructure as relay station to the ICARUS operations center and the scientific Movebank database. The manufacturing of the ICARUS payload qualification models is already initiated; the flight hardware will be installed at the Russian Segment of the ISS in 2016. An overview of the ICARUS system, the communication and operation concept, the status of the technical development and the implementation at the Russian segment of the ISS will be presented.