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ICARUS – Tracking System

Description:

ICARUS uses CDMA communication technology (Code Division Multiple Access) to transmit small amounts of data from the ground to a decoding computer unit in low earth orbit (400-800 km orbit altitude) with low energy consumption. ICARUS thus realizes IoT (Internet of Things) communication via satellite. ICARUS consists of a remote sensing platform on the ISS, the receiver-transmitter unit located on the animal and the computer centre. The receiver-transmitter units are attached to animals selected by the researchers. These animals are equipped with GPS receivers to determine the position of the animal. The data can then be retrieved from the remote sensing platform on the ISS using a narrow-band data signal on the frequency 468.1 MHz. After they have been transmitted on the frequency 402.25 MHz with a bandwidth of approx. 1.5 MHz for reception on the ISS, they are forwarded to the Mission Control Center and from there to the data center. The data can be retrieved by the researchers from the Movebank (a database for animal movements), among others. In addition, the researchers can also retrieve the data from the animals (receiver-transmitter unit) on site using a mobile device. One of the challenges was to minimize the volume of data to be sent to the ISS.



Innovative Aspects:

Billions of animals move across continents and borders. It is therefore hardly possible for researchers to observe individual small animals continuously and over a long period of time as they migrate. ICARUS is intended to remedy this situation. By analysing the local and global spread and migration paths, further information is to be gained about the spread of infectious diseases by animals (songbirds, bats, insects), the probability of the presence of a bird population in a certain area, movement patterns during migration, impairment of the bird population by environmental influences and much more. The Icarus transmitters, which also have a GPS function, weigh a mere five grams each and are barely bigger than a euro cent coin. The smallest transmitters available prior to Icarus weighed between 15 and 20 grams.

Application Areas:

Research into animal lifestyles-

- Conservation of animal diversity-
- Evaluation of the impact of climate change-
- Better understanding of the spread of epidemics (for example, bird flu)- Securing basic food resources
- Tracking of almost anything

Space Heritage:

ICARUS is based on a cooperation between the DLR Space Administration and the Russian space agency Roscosmos. Using funds from the Federal Ministry for Economic Affairs and Energy (BMWi), the Max Planck Institute for Ornithology (MPIO) in Radolfzell develops a new system for the global tracking of animal migrations. The ICARUS system consists of two main components – small animal transmitters (tags) and the space hardware (antennas and on-board computer)