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MONITORING AND RESEARCH OF ANIMAL MOVEMENTS ON EARTH BY MEANS OF THE  
SCIENTIFIC HARDWARE INSTALLED ON THE ISS RS

**Abstract**

The most important task of astronautics is monitoring and studying our planet. In addition to remote sensing data, important information about our planet can be obtained from animal migration data. To validate the tracking technology of animals and birds' movements, the joint German-Russian ICARUS project was set up on the International Space Station (ISS). The ISS is the perfect laboratory for on-orbit testing of equipment and various space technologies.

In 2018 ICARUS hardware, that receives information from tiny transmitting/receiving sensors attached to tracked animals and performs its primary processing, was installed on the ISS RS.

The onboard equipment of the project was created under the Cooperation Agreement between the German Aerospace Center DLR and the State Corporation ROSCOSMOS. Under this Agreement the Russian Uragan space experiment is combined with the ICARUS project (International Cooperation for Animal Research Using Space).

Several large scientific projects are carried out in the process of experiments with ICARUS hardware.

Conducted tests and obtained results of animal and bird migration research with the help of ICARUS system proved the efficiency of the system created on board the ISS RS. The ISS RS capabilities as the orbital scientific laboratory for the testing of new systems and technologies were demonstrated in the process of establishing and operating the system, and that was one of the objectives of the Uragan experiment. The global monitoring system of objects movement makes it possible to address important scientific and application tasks. If utilized simultaneously, the complete Uragan scientific equipment complex (Photospectral system hardware, Videospectral system hardware, the hyperspectrometer, High-resolution infrared radiometer hardware, etc.) aboard the ISS RS provides great opportunities in animal and bird migration research. Earth observation with the help of Uragan equipment will enable monitoring of the moving objects of interest as well as help to find out the reasons for their migration change.

This technology can also be used to predict dangerous and catastrophic events, such as earthquakes, spread of various diseases, etc. It can also be useful for monitoring dangerous glacial floods, landslides, etc.

The paper analyzes the experience of animal migration monitoring system validation on board the ISS RS, which incorporates the achievements of modern astronautics, satellite navigation, control and

microelectronics technologies, and the paper also outlines scientific findings obtained in framework of Russian research program of Uragan space experiment.