

SPACE COMMUNICATIONS AND NAVIGATION SYMPOSIUM (B2)  
Mobile Satellite Communications and Navigation Technology (4)

Author: Mr. Daniel Bindel  
OHB System AG-Bremen, Germany, daniel.bindel@ohb-system.de

Mr. Markus Stefer  
University of Bremen, Germany, markus.stefer@hf.uni-bremen.de  
Mr. Davide Padeletti  
ZARM University of Bremen, Germany, davide@zarm.uni-bremen.de  
Mr. Gilberto Arantes Jr  
ZARM University of Bremen, Germany, gilberto.arantes@hotmail.com

## RELATIVE NAVIGATION WITH HIGH-FREQUENCY RADIO WAVES

**Abstract**

For the support of exploration missions to the surface of other celestial bodies (Moon, Mars), a relative navigation system was designed by the University of Bremen. Within the scope of the german RIMRES project (Reconfigurable Integrated Multi-Robot Exploration System), several institutes develop technology for future robotic missions. While the rover chassis, mechanics and control is designed by the DFKI (German Research Center for Artificial Intelligence) in Bremen, several navigation topics are handled by the ZARM (Center of Applied Space Technology and Microgravity) of the University of Bremen.

The presented REIPOS (Relative Interferometric Position Sensor) technology is able to provide relative direction and distance measurements between electronic sensors. Moreover, it will be able to exchange data between the sensors. As the RIMRES project is a technology development and demonstration approach, no space qualification is intended in the current stage of the systems.

The application of the REIPOS sensors shall be a multi-robot surface exploration mission, where satellite navigation services are not or only rarely available and limited in its accuracy. As every mobile and stationary element of the mission is equipped with such an electronic sensor, a network of many units can be established. Although only relative navigation is possible with the REIPOS technology, the mobile units (rovers) will be able to find and track every other unit in the network, as the direction/heading can be measured.

Due to the communication link capability it shall also be able to set up a system of radio beacons for a package oriented data transfer throughout the network.

The first high frequency radio components have been developed and are currently under test. After the proof of concept for the measurement principle, the paper will give an overview over the first test results and the performance specifications of the system. The subjects of investigation are the direction and distance accuracy, as well as the data rate and coverage relation.