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APPLICATIONS AND REQUIREMENTS OF HIGH DATA RATE INTERSATELLITE LINKS IN
FUTURE COMMUNICATION ARCHITECTURES

Abstract

Future needs for satellite communications in general include the demand for higher data rates, extended link availability and more diverse communication architectures. One element of growing importance of these architectures are intersatellite-links (ISL). Since 2004 technologies for and applications of ISL's are investigated at the Institute of Astronautics at the Technische Universität München. A focus of this research was the optimization of the data processing and communication chains for telepresence-in-space applications. For this paper the relevance and benefits of ISL's for a number of applications have been studied. The researched applications range from real-time earth observation over space tele-robotics to possible multi-nodal satellite networks. These applications generate partially diverging requirements for ISL antenna systems concerning parameters as bandwidth, pointing envelope and pointing accuracies which are identified and further investigated for technology development. A major discriminator of these requirements is the operating environment of the ISL system which is categorized in low-earth orbits (LEO), medium-earth orbits (MEO) and geo-synchronous orbits (GEO). Since a majority of the identified applications are seen in LEO the technological development was pursued for the LEO-GEO communication link. Subsequently based on these requirements an advanced, compact ISL antenna and a high accuracy antenna pointing mechanism in the Ka-Band (LISA) were developed, manufactured and tested in cooperation with German companies, research institutes and the German space organization (DLR). This paper presents results of the aforementioned analyses and their implications on further technology development efforts.