Interactive Presentations (IP)
Topic 2 - Interactive Presentations (2)

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LASER TECHNOLOGIES FOR INFORMATION AND NAVIGATION SUPPORT (INS) OF LUNAR MISSIONS, AS WELL AS FOR RESEARCH OF THE EARTH – MOON DOUBLE PLANET SYSTEM TO THE BENEFIT OF FUNDAMENTAL COORDINATE SUPPORT (FCS) OF SPACE NAVIGATION, GEODESY AND SELE

Abstract

1 Upon development of GLONASS, there have been and are being engineered the laser aids which can serve as prototypes of the INS and FCS technical solutions for all the three stages of the Moon exploration suggested by the RAS and Roscosmos. These prototypes (research and technological groundworks) are as follows: - ground-based quantum-optical and radio-laser stations (QOS and RLS) operating within the national and international geodetic laser ranging networks; - ground-based lunar ranger (LR) being constructed within the scope of the RD project Ephemerides at the Titov Altai optical laser center (AOLC); - one-way quantum-optical system (OQOS) consisting of the onboard segment including the photodetecting equipment (O2QOS) and the optical retroreflector system (ORS), and the ground-based system (QOS – GOQOS); - intersatellite laser navigation and communication system (ILNCS) and its ground-based terminal – laser ground-based measurement and communication site (LGMCS - Sazhen-L); - passive laser geodetic satellites (PGS); - laser ranger (altimeter) for LEO surveying satellites. 2 At the initial stage of the Moon exploration prior to the establishment of the lunar-based selenodetic network implementing a selenocentric reference frame, the navigation and time support for transfer and near-lunar orbits, as well as for the Moon's surface, can be implemented within the PZ-90.11 reference frame based on the laser pseudorange determination by four or more GLONASS satellites. In this case, the measuring tools are a laser transmitting system (LTS) on the object to be determined and a photodetecting system (a single-channel O2QOS with SW-based pointing at the Moon) on the Glonass-K satellites of the MEO and HEO segments. If implemented using the available hardware components, the following system characteristics can be provided: - positioning error: R = (20 50) cm; inf R 10 cm; 2 5 - time scale (TS) collation error: t 3 ns; inf t 0.1 ns; - coverage: R 400,000 km; - pseudoranging error: 1 cm; - LTS mass – about 7 kg; - transmission unit power consumption: (200 – 250) W. - PDS mass on the Glonass-K NSC – about 2 kg; - PDS power consumption: (25 – 30) W. 3 Prior to deployment of passive and active selenodetic and the Moon's navigation artificial satellites (MAS) in near-lunar orbits, a detailed research of the Earth-Moon planet system to the benefit of fundamental coordinate support is only possible on the basis of ranging from the AOLC lunar ranger to the lunar-based retroreflectors with a sub-centimeter accuracy.