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THE SPACE COMMUNICATION CAPABILITY UPGRADE OF THE SARDINIA DEEP SPACE ANTENNA

Abstract

This paper presents an overview of the status of the Sardinia Deep Space Antenna (SDSA) and its planned upgrade over the next few years. The SDSA shares with the Sardinia Radio Telescope (SRT) a part of the system and infrastructure, but has its own specific equipment and a dedicated control center. The Italian Space Agency is adapting this research infrastructure to provide navigation and communication services for Deep Space and Near Earth robotic and human exploration missions and to support ambitious scientific experiments. This upgrade will allow the infrastructure to be used for both space and radio astronomy research. Currently, the SDSA is equipped for operating in the X-band, specifically in the 8.4 to 8.5 GHz frequency range, which is the part of the X-band allocated by the

International Telecommunication Union (ITU) to the Space Research Service in deep space and low Earth orbit. The SDSA has already carried out several activities, including "The Cassini Grand Finale", residual doppler stability measurements by receiving the Juno spacecraft signal, and other activities related to Entry, Descent and Landing (EDL) tracking for the Insight and Martian Missions. The SDSA upgrading is funded by the Next generation Europe by the National Recovery and Resilience Plan (NRRP), as asset of EMM (Earth-Moon-Mars) project, and internal resources allocated to the development of the ground segment. EMM project aims at creating a multi-purpose laboratory on the lunar surface, to prepare the human exploration of Moon and, in perspective, of Mars. The upcoming upgrade of SDSA includes the development of two new Beam Wave Guide (BWG) optical paths, including four different cryogenic receivers, dedicated operational and scientific backends to process deep space, near Earth and lunar spacecraft signals in X-band and Ka-band and X-band and K-band respectively. The upgrade also includes antenna and ground station control software, the time and frequency reference signal generation backup and distribution, a feasibility study for a directive radiometer, and the building of new areas to host the equipment. Flight dynamics, calibration, station management and operations software will also be developed. The overall objective is to make the Sardinian antenna capable of receiving dual frequency signals from spacecraft in deep space (X-band and Ka-band), lunar missions or within 2 million kilometres (X-band and K-Band). A technical and operational commissioning with the support of the main global tracking networks follows, completing the project.