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UTILISING AUSTRALIAN INFRASTRUCTURE TO FACILITATE PERSISTENT DEEP SPACE OPTICAL COMMUNICATIONS.

Abstract

Optical communications allows significant data rate improvements over Radio Frequency technology while also reducing resource consumption on the spacecraft. The NASA Deep Space Optical communications (DSOC) mission aboard the Psyche spacecraft continues to set new distance records for optical communications in the solar system. The NASA ground station for DSOC is the 5 m Hale telescope at the Palomar observatory in California. The geographical separation of Australia would provide a significant increase in downlink time, link availability, and data throughput for future deep space optical communication missions.

We study the potential utilisation of existing Australian assets to provide a Southern Hemisphere receive station for a deep space communications demonstration, using the current DSOC mission as a case study. We evaluate the performance of telescope facilities at the Siding Spring Observatory and receiver instrument hardware currently under development at the Australian National University for lunar optical communications. The largest optical telescope in Australia, the 3.9m Anglo Australian Telescope (AAT), and the ANU 2.3m Telescope are both considered as viable candidates to achieve the required link budget. The larger aperture telescope allows for higher data rates but comes with more complicated operations and instrument integration.

We study the link budgets and potential data rates for both telescopes at distances up to 2.7 Astronomical Units (AU), and combine this with practical implementation complexity for both telescopes. This distance is representative of DSOC's maximum operational distance from Earth and covers the range of distances to Mars over its multi-year cycle. The increases in link availability and capacity when networking the proposed Australian site with the two current deep space compatible stations will also be shown.