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CONCEPTUAL DESIGN OF A PERMANENTLY CREWED LUNAR SURFACE OUTPOST RESULTS OF THE SPACE STATION DESIGN WORKSHOP 2020

Abstract

More than half a century after humankind's initial step on the lunar surface, the Moon has again become an attractive destination for new space endeavors. Targeting mainly lunar science and exploration goals, several missions are in preparation by governmental space agencies. Looking at Europe, ESA propagates a permanent human outpost on the Moon in the visionary form of a Moon Village. Not only does this settlement offer scientific and exploration possibilities, but it can also serve as a base to enable business applications on the Moon, offering chances for international cooperation. It is only consequential that this year's Space Station Design Workshop (SSDW), hosted by the Institute of Space Systems (IRS) at the University of Stuttgart investigated a similar lunar outpost. Within this week-long preliminary design study, two interdisciplinary teams composed of international students and young professionals, supported by space experts from industries and universities, tackled the challenge to conceptualize a crewed lunar surface station. Each team's outpost is not only designed to conduct scientific research e.g. radio astronomy but validates and incorporates ISRU capabilities. The stations make use of various business concepts to gradually become a financially self-sustainable platform. The results of both teams are presented and discussed in this paper covering topics such as mission analysis, subsystem design, human factors engineering, cost estimation and operation planning.