

20th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE EXPLORATION AND
DEVELOPMENT (D3)

Interactive Presentations - 20th IAA SYMPOSIUM ON BUILDING BLOCKS FOR FUTURE SPACE
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PLANETARY FOUNDATION SERVICES INFRASTRUCTURE: CURRENT STATUS AND
DEVELOPMENT PATHWAYS

Abstract

Recent and upcoming interplanetary missions to both the Moon (CNSA Chang'e 3-5, ESA PROSPECT) and Mars (NASA's Perseverance) are paving the way for renewed human space exploration, a return to the lunar surface and an eventual crewed Martian mission. These future endeavours will involve extended duration stays in a planetary environment towards the establishment of a permanent human presence on the Moon and Mars.

However, in order to sustain human presence over long periods of extra-terrestrial residence, new technology and processes will be required to provide the critical life-support and other essential systems required. At present, the maturity of demonstrated planetary Foundation Services capability is low and international Agency developments are few. However, there is a strong interest from the global space sector to develop Foundation Services capability. For example, the multi-Agency ISECG ISRU gap assessment working group identified clear strategic development priorities needed to support both crewed and robotic mission activities for a sustained planetary presence.

This paper describes the development of planetary Foundation Services to meet this critical need. Foundation Services are operational activities that support exploration missions to build towards and to maintain a sustained off-earth presence. These are services for which the application demand is recurrent, continuous or enduring in nature. These services are distinct from but complementary to mission critical systems such as power, communications and life support. The scope of services is potentially large and can include monitoring and inspection, planning and logistics, civil construction, materials transport and cargo handling, remote maintenance, component manufacture and assembly.

A major opportunity exists to leverage the technology and know-how of the Australian terrestrial mining industry which has a world-class pedigree in the development of automated technologies for exploration, infrastructure development, resource extraction and processing. Key elements of this terrestrial mining value chain are transferrable to a space resources vision of sustained operations.

CSIRO, as Australia's National Science Agency, has a multi-decadal track record of success in the development of world-class integrated sensing and automation solutions for exploration and discovery that have delivered significant impact that have benefitted the resource and mining sectors globally. This paper directly explores the emerging links between the mature terrestrial mining automation technology solutions and the nascent in-situ resource utilisation (ISRU) applications in the space sector. The scope of this discussion includes remote operations, robotics, interoperability, geosensing, resource definition and material processing. Examples of this cross-domain technology transfer process are also outlined.