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BUSINESS MODEL FOR A LONG DURATION MANNED LUNAR MISSION: REFUELING,
RESOURCE COMMERCIALIZATION AND REVENUE STREAMS

Abstract

The establishment of permanent human activities on the Moon is envisaged as a stepping stone for future space exploration and for the expansion of mankind in the Solar System. Lunar In Situ Resource Utilisation (ISRU) will not only play a crucial role in extending human presence in space, but also has the potential to strongly benefit life on Earth and to boost new interplanetary economy. As a recent study on Lunar In Situ Resource Utilisation (ISRU) and commercialization, the LUnar Propellant Outpost (LUPO) envisioned a program devoted to Liquid Oxygen (LOX) production and selling, aiming at generating profits mainly refuelling space missions, along with other minor revenue streams. The present paper deepens the analysis of LUPO's business plan starting from the programme's findings for Fiscal Year 2018. Evidences estimating the water mass fraction inside Shackleton Crater as high as 25% are taken as new reference in updating cost and selling prices of LOX both on Moon surface and in orbit, with respect to last projections based on a 5% fraction. All the costs related to ISRU and LOX production implementation, which are heavily affected by technological solutions, have also been revised. Competitors analysis and breakdown is refreshed on the basis of the latest advancements in launch-related costs and refuelling alternative concepts. The importance of secondary revenue streams is assessed in higher detail, particularly regarding liquid hydrogen production, gaseous oxygen and hydrogen production, water production and infrastructure utilisation by third parties. Finally, a tradeoff of new income sources is carried. Selling dehydrated regolith from ISRU processes as a building material is considered. The production of multimedia and digital products based on life and activities on the Moon, such as documentaries, live-streams, and a virtual reality program based on the images sent back to Earth, is considered for outreach and profit generation perspectives. Astronaut training for future Mars missions could also be performed on the Moon, generating an additional revenue stream. This study is carried out within the framework of the 11th edition of the international Specializing Master programme in SpacE Exploration and Development Systems (SEEDS) of 2018/19 at Politecnico di Torino (Italy), in cooperation with students from ISAE-Supaero (France), and University of Leicester (UK). The project is supported by Thales Alenia Space Italy, the European Space Agency, and the Italian Space Agency.