

HUMAN EXPLORATION OF THE MOON AND MARS SYMPOSIUM (A5)
Long Term Scenarios for Human Lunar Presence (2)

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ESA LUNAR IN-SITU RESOURCE UTILIZATION (ISRU) CONCEPT DESIGN AND
BREADBOARDING ACTIVITIES

Abstract

This paper addresses, starting from the background activities performed in the frame of the most relevant ESA projects in these last years on the subject, the intermediate results of the "ISRU Architecture and Technology Study"; in particular it focuses on the exploitation of ISRU for oxygen production in support of Lunar Exploration, the benefits and feasibility of which an Italian-Belgian consortium, consisted of Carlo Gavazzi Space, Politecnico di Milano (CMIC and DIA) and Space Applications Services, is performing for ESA in the frame of the AURORA Core Programme.

The paper gives an insight in the motivation, contents and main objectives of the ESA ISRU Study, and reviews the requirements and constraints of ISRU plant system and mission. Furthermore, it describes the trade-off analysis of the most promising ISRU chemical processes for the production of O₂ on the Moon and the selection of the reference one, for the following study phases; the trade-off addresses both issues strictly related to the different chemical processes and architectural issues rising from their implementation into a system.

The conceptual design of the ISRU system, according to the selected O₂ production process, is then described; this includes the definition of all subsystems and the related supporting analyses. Moreover, the ISRU chemical process and system are modelled; the model is validated using the actual test data retrieved from breadboarding activities.

At the end, the paper reports the preliminary results obtained from the breadboarding activities, which have the aim to demonstrate the feasibility of the selected ISRU process and characterize its main performance aspects.