

IAF SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 2 (2B)

Author: Mr. Madhu Thangavelu
University of Southern California, United States, mthangav@usc.edu

USC FALL 2020 ASTE527 GRADUATE SPACE CONCEPT SYNTHESIS STUDIO - THE 2020
ARTEMIS:TWINS PROJECT**Abstract**

The last four years(2016-2020) have been exciting, both for NASA and the private space industry. Under the previous administration, assisted by the National Space Council, advisory boards and allied support entities, NASA has charted a path for the future of the US Space program that is both visionary and pragmatic. Core technologies and systems already designated and associated contracts are moving ahead under the ARTEMIS and GATEWAY banners. This 2020 USC ARTEMIS: TWINS project, following the 2018 ADAM Project and the 2019 MAXIM, continues to weave a narrative that wishes humanity to return to the Moon at the earliest, to retire the known risks, gain the vital experience needed to push on to Mars and settle other worlds. In the MAXIM Project we pushed the human emotion button for preserving the heritage of Apollo for posterity, while reminding the world what our nation accomplished on an extraterrestrial surface five decades ago, and also chose to evoke nostalgia among the heroes of the Apollo program. Leveraging what has been accomplished to date, the 2020 USC ARTEMIS:TWINS project offers concepts for both the Commercial Lunar Payload Service(CLPS) precursory missions for ARTEMIS and some alternative options for the early missions of the lunar GATEWAY project to bring back hard data that is vital for evolving safe and reliable systems for interplanetary transit crew and vehicles. The following 2020 USC ARTEMIS:TWINS project shines the light on some concept architectures we think worthy of further investigation, options to consider, as we build up the capabilities to speedily execute both ARTEMIS and GATEWAY objectives and embark on more ambitious robotic and crewed missions. Concepts proposed in the ARTEMIS precursory CLPS and robotics category include cislunar laser communications architecture, a compact and mostly autonomous 3D printer that uses regolith and concentrated sunlight to make tiles, a novel concept for robots to survive the long lunar night, and a walkerbot architecture to scale rough and rugged terrain. Concepts proposed in human space systems include an alternative architecture and orbital profile for the early Gateway elements that focuses on evolution of sturdy cislunar logistics while enabling better crew safety during the increasing solar activity of solar cycle 25 that has just commenced, enhancements to the glove of the lunar EVA suit for increased ease of dexterity, a concept that does away with EVA suit and associated cumbersome protocol, instead providing the astronaut a shirt-sleeve and cabin ambient pressure environment during EVA. Finally an architecture for exploring the interior of the skylight pit at Mare Tranquillitatis lava tube is proposed with the aim of retrieving pristine regolith samples that may potentially hold solar activity records, unperturbed over geological time. In this 2020 ARTEMIS:TWINS project we depict some precursory and early human spaceflight missions that could enrich and breathe dynamism and excitement into the narrative of both the NASA CLPS effort and the GATEWAY architecture. It seems possible to meet both the national and the international objectives with ARTEMIS and GATEWAY. Project slides may be accessed here : ASTE 527 (google.com)