Paper ID: 80408
oral
student

30th IAA SYMPOSIUM ON SMALL SATELLITE MISSIONS (B4)
Constellations and Distributed Systems (7)

Author: Mr. Denis Acker
University of Stuttgart, Germany, diana-spacestation@outlook.com

Mr. Olaf Drozdowski
Gdansk University of Technology, Poland, olaf.drozdowski@gmail.com
Ms. Elizabeth Gutierrez
University of Stuttgart, Germany, e.gutierrezr@pucp.pe
Mr. Javier Palacios Calatayud
Spain, javier.palacioscalatayud@gmail.com

SUMMARY OF A PHASE 0/A STUDY REPORT FOR A COMMUNICATION SATELLITE CONSTELLATION FOR DIANA LUNAR INFRASTRUCTURE

Abstract

Over the past decades, many space agencies and companies have looked into the possibilities to establish a colony on the moon. An idea that began to become a reality with the Artemis missions. An important part of maintaining a developing colony is constant communication within the lunar base infrastructure and between the lunar base and Earth.

The communication within the lunar infrastructure is relevant for the early detection of failures of the robotic systems which are relevant for the construction of the infrastructure. Furthermore, a stable communication network is also necessary for scientific exploration missions by robotic systems controlled from the base or astronauts. The communication to the ground station on Earth shall allow it to send status updates from the lunar base as well as scientific data. Moreover, receiving commands from Earth should also be considered. In addition, the system shall be designed to allow video calls from base to Earth and vice versa. In case of failure, the gateway, which is currently under development, will be considered as a redundant relay station in order to be able to react quickly in case of an emergency. One viable solution for the communication architecture is to establish a satellite constellation in lunar orbit. In the context of this paper, a Phase 0/A study was conducted which included the development of a modular and scalable satellite concept designed to operate in lunar orbit. The modular design should offer the possibility of an increased transfer potential in order to be able to use the systems also for other applications in the future. The study aimed to evaluate the feasibility and potential benefits of a constellation of communication satellites orbiting the moon to provide continuous, high-speed data transfer and communication services for lunar infrastructure. The report details the technical specifications of the proposed satellite constellation, including the number of satellites and their orbits. Furthermore, a development timeline was created, which should show the potential for manufacturing the satellite systems with lunar resources in the future to create more sustainable solutions for long term operations.

Overall, the Phase 0/A study report suggests that a communication satellite constellation for lunar infrastructure is feasible and could provide significant benefits for future lunar exploration and development.