PLANNING AND INTEGRATION OF INSTRUMENTS TO SUPPORT IVA/EVA ACTIVITIES FOR ExoSpaceHab

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Introduction: Every day we are closer to returning to the Moon and as the date approaches, the work and preparation for the return to be possible is constant and is increasing. The Apollo missions left a footprint that is difficult to erase and as humanity progresses, it seeks to meet again with that place. Thanks to Lunar exploration we have had a better knowledge of our satellite and it has allowed us to continue studying the future possibilities that its surface can offer; water in the form of ice in its polar caps, an abundant source of Helium-3, the possibility of using regolith as a material to build radiation protection with 3D printers, among others [1].

But is the Moon the limit of a possible settlement? Will we manage to leave a human footprint on Mars? Will we be able to go further? There may be questions that still do not have an answer, but if something is clear it is that each day, we are closer to achieving it.

This research enters the field of analog missions, which are simulations in places on Earth whose geographical or meteorological characteristics are close to the extreme environments of the Moon or Mars. These simulations are taking place in modules in which internal and external activities can be carried out. The experiments that can be made are very extensive and depend on the objectives of the missions. Generally, the crew is multidisciplinary to simulate the future teams of surface missions to cover a greater field of experience to solve any problem and carry out a wide range of experiments in different areas of knowledge, just like the ISS crews [2].

During the missions the crew is isolated for a period of time inside the module, the connection they have with the outside is only with the Ground Segment device, the retransmission delay is simulated in the same way as if it were a real mission, with a difference of just seconds when it is a Lunar analog mission and with a 20 minute delay if it is a mission focused on Mars. The rhythm of life within the habitat is scheduled and organized and each analog astronaut is trained to carry out the mission. The duration of the mission depends on its requirements, there are analog missions of short duration and analog missions that are longer in time, to simulate, for example, a future trip to Mars [3].

Throughout this research work, it is intended to study which are the necessary instruments that must be located in the modules of the analog missions, in order to be able to develop the specific scientific experiments foreseen for each mission, both those that concern intravehicular activities (IVA) and extravehicular activities (EVA) with the spacesuit.

A comprehensive study is going to be carried out to identify which equipment is common to the majority of the missions and which equipment is specific and to what type of scientific research activity it is associated, in such a way that knowing the requirements of the mission we can know what type of instrumentation we need to complement the basic equipment of the module. The habitable module in which this research is working for is ExoSpaceHab, it is being created by Lunex, EuroMoonMars and ExoSpaceHub, it is a module in process of construction and development that intends to carry out analogs and outreach missions.

Methodology: The project will be carried out through a collection of existing data, not only through published papers and literature, but also by making the established professional visits to EAC/DLR (Germany), Astroland (Spain) and having the opportunity to participate in an analog mission the EMMPOL 14 at the AATC (Poland) as analog astronaut / researcher, some other analog habitat like Hi-Seas (Hawaii) is contemplate as part of the research. If some conceptual explanations are needed, they could be made by diagrams and drawings with digital graphic tools.

Conclusions: The analog missions are a key activity to prepare the future missions to the surface of other celestial bodies, these activities require a specific equipment to achieve the research goals, and for that need to be good selected.

The final research that is going to be done through the development of this project to achieve the final goal, *define and allocate the basic and specific instruments required to do IVA/EVA activities in the ExoSpaceHab module*, is going to be a good summary of different analogs missions with organized information, creating a value document to check in a quick view interesting data to understand the growing and relevance of this field.

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References:

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