**TESTING ROVER COOPERATION CONCEPTS IN MOON ANALOG SITE**

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**Introduction:** Interplanetary exploration will consist of human machine collaboration. First, most exploration is done without humans, e.g. with rovers. These rovers can perform exploratory tasks themselves or perform preparational tasks for human arrival or settlement to support human exploration. Earlier research into rovers in moon/Mars analog environments has been performed different times, even investigating human-rover collaboration. Rover-rover collaboration in moon or Mars analog environment however, is a new ground for research. In this research, yet to be performed at the HI-SEAS (Hawai‘i Space Exploration Analog and Simulation) analog habitat, as part of the EMMIHS-III (EuroMoonMars-International Moonbase Alliance- HISEAS) mission from January 18th to the 1st of February 2020, collaboration between different rover concepts will be investigated.

![Figure 1 Helalanie rover performing leveling task](image1.png)

**Apparatus:** Three rovers are used for this research. The first is PISCES’ (Pacific International Space Center for Exploration Systems) rover called Helalanie [1]. She has previously been used for preparing and compacting the ground for a Vertical Take-off and Landing pad. Helalanie is the biggest rover of the three and weights over 700lbs. It is able to carry 240lbs of payload and is driven by four 24inch wheels. When equipped with a levelling blade or a compacting roller it is capable of preparing the ground for constructions or pathways.

The second rover is the Lunar Zebro [2]. It is originally designed as swarm robot, able to accomplish complex tasks autonomously in collaboration with other rovers. The zebro features a rugged drive train, a camera and can carry small payloads.

The third rover is a toy robot equipped with a remote controlled arm and camera

![Figure 2 Lunar Zebro](image2.png)

Focus of the research is on robot-robot cooperation scenarios:
- Video support: One robot filming the other
- Rover rescue: One robot helping the other through rough terrain, or big robot retrieving a smaller robot
- Communications relay: One robot providing a communication relay to ther robots
- Rover transportation: One robot providing logistic support to another robot
- Collaboration between task specific rovers: One robot paving the way for a less mobile robot

**Research results:**

Will focus on the effectiveness of the various cooperation scenarios
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References: