To a dusty Moon: Rashid's mission to observe lunar surface processes close-up. S. Almaeeni[1], S.G. Els[2,] H. Almarzooqi[3], on behalf of the ELM development and science team, [1]Mohammed Bin Rashid Space Centre (PO Box 211833, Dubai, UAE, sara.almaeeni@mbrsc.ae), [2]Mohammed Bin Rashid Space Centre (PO Box 211833, Dubai, UAE, sebastian.els@mbrsc.ae), [3]Mohammed Bin Rashid Space Centre (PO Box 211833, Dubai, UAE, hamad.almarzooqi@mbrsc.ae).

Introduction: The Emirates Lunar Mission (ELM) is an initiative taken by Mohammed Bin Rashid Space Centre (MBRSC) to design and develop the UAE's first robotic mission to another celestial body. The *Rashid* rover is the core of the ELM, and with its mass of only 10 kg, it falls into the category of micro-rovers. The rover's main mission will last for one lunar day, which is the equivalent of approximately 14.5 Earth days. It is designed to traverse a distance of several hundred meters giving this rover the ability to approach objects of interest. To investigate such objects, Rashid is equipped with a suite of scientific instruments and experiments, designed to investigate the processes which alter the lunar surface, and which also impact future surface missions (manned and unmanned) to airless bodies within the solar system. This paper describes the ELM mission and the rover subsystems of the rover.

The ELM mission: The ELM consists of the Rashid rover and its ground segment. Both of these mission segments are being developed by and at MBRSC. The mission operations will be conducted at MBRSC in Dubai. However, the delivery of the rover to the lunar surface will be performed by a partner which is currently being selected. After surface deployment, the rover will operate for the remainder of the lunar day and eventually also during parts of the subsequent day.

Rover System: The *Rashid* rover is designed to be tele operated on the lunar surface. Based on the main objective of the mission, the rover shall be able to traverse the landing site and obtain high resolution images of the lunar surface. As a secondary objective, four science instruments will be used to observe in-situ the lunar soil and its interaction with the cosmic environment.

Rover mobility and navigation: The rover is designed to climb slopes of 20 degrees and overcome obstacles, like rocks, of a maximum height of 10cm. It employs a skid-steering locomotion mechanism to perform steering maneuvers by simply applying different speeds in forward and backward on each side. As shown in Figure 1, the rover is accompanied with 2 wide field cameras. For navigation purposes, a camera is mounted on a mast which provides 360degree visibility around the rover due to the field of view of the camera and mast's gimbals module. The second navigation camera is a rear mounted camera which provides a closer look of the rover's tracks. These cameras will also be used to capture images of the lunar surface and to assist in identifying scientifically interesting objects. They also play an important role on helping the operators to drive the rover remotely.

Power system: From power subsystem point of view, the rover has solar panels on both sides mounted at 80 degrees to collect solar energy during surface operations.

Communication: The *Rashid* rover has two communication subsystems; primary and secondary. The primary communication subsystem is exchanging the data with the ground station through the lander's communication system. On the other hand, the secondary subsystem is a direct communication between rover and Earth.

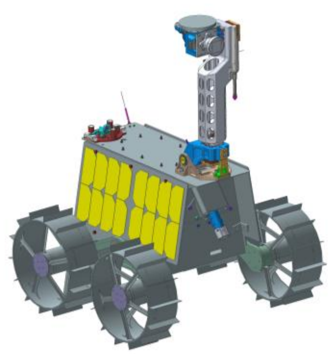

Figure 1: The *Rashid* rover

Science objectives: The mission also includes science investigations. The investigations chosen for the mission are based on open issues in lunar research, as identified by the Lunar Exploration Roadmap 2016a and the Strategic Knowledge Gaps 2016b [1].

The mission investigates the following properties about the Moon:

1. Dust and regolith properties, including particle size distribution, morphology, and petrography
2. Thermal surface properties at the small scale
3. The electron sheath and photo-electron density above the surface

4. Adhesion of dust to different materials

More details on the instrumentation which will address these topics, are given in [2].

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References:

[1] https://www.nasa.gov/exploration/library/skg.html
[2] Els S., et al., LSPC 52, 2021 (this conference)