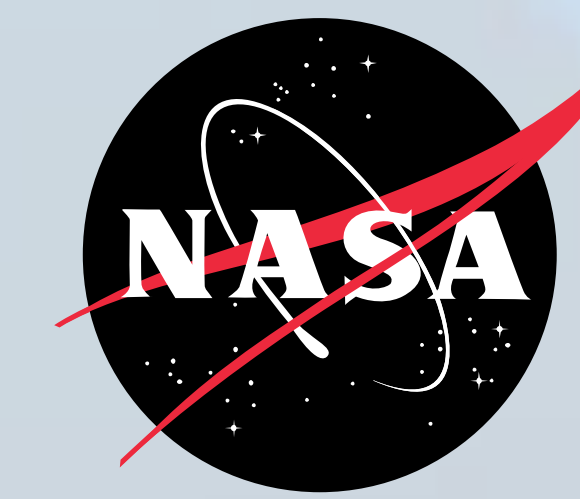




PHOTOVOLTAIC INVESTIGATION ON THE LUNAR SURFACE (PILS): DESIGN CONSIDERATIONS AND GROUND TESTING

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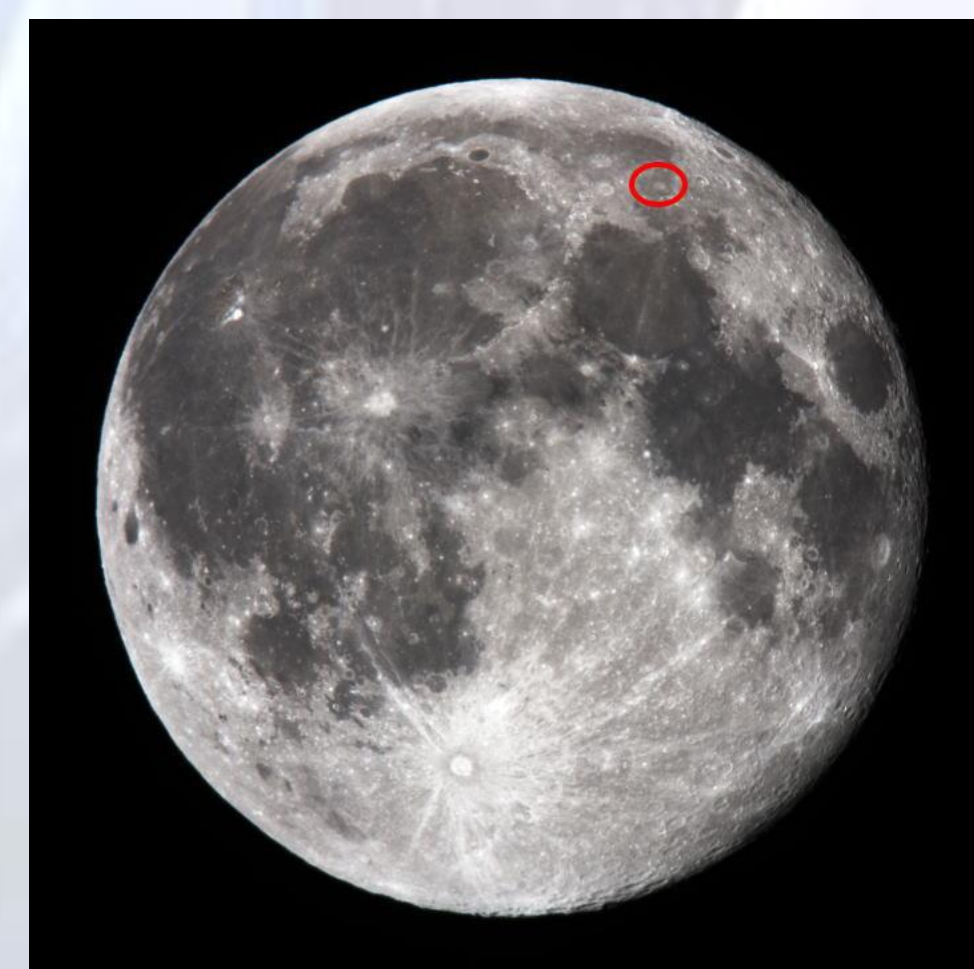
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ABSTRACT

The PILS (Photovoltaic Investigation on the Lunar Surface) platform consists of flight demonstrations of multiple solar cell technologies that could be used for future lunar missions. It also includes a solar charging experiment to shape design considerations of high voltage solar arrays on the Moon that could power in-situ resource utilization systems and other lunar surface assets. This poster and conference proceedings describe the design considerations of the PILS platform and ground testing performed prior to spacecraft integration. The platform is expected to operate on the lunar surface at Lacus Mortis in late 2022.



Left Image: Digital rendering of the Astrobotic Peregrine Lander. PILS is mounted on the right side of the spacecraft. Image Credit: Astrobotic, image used with permission.



Right Image: Red circle shows approximate location of Lacus Mortis at 45° N

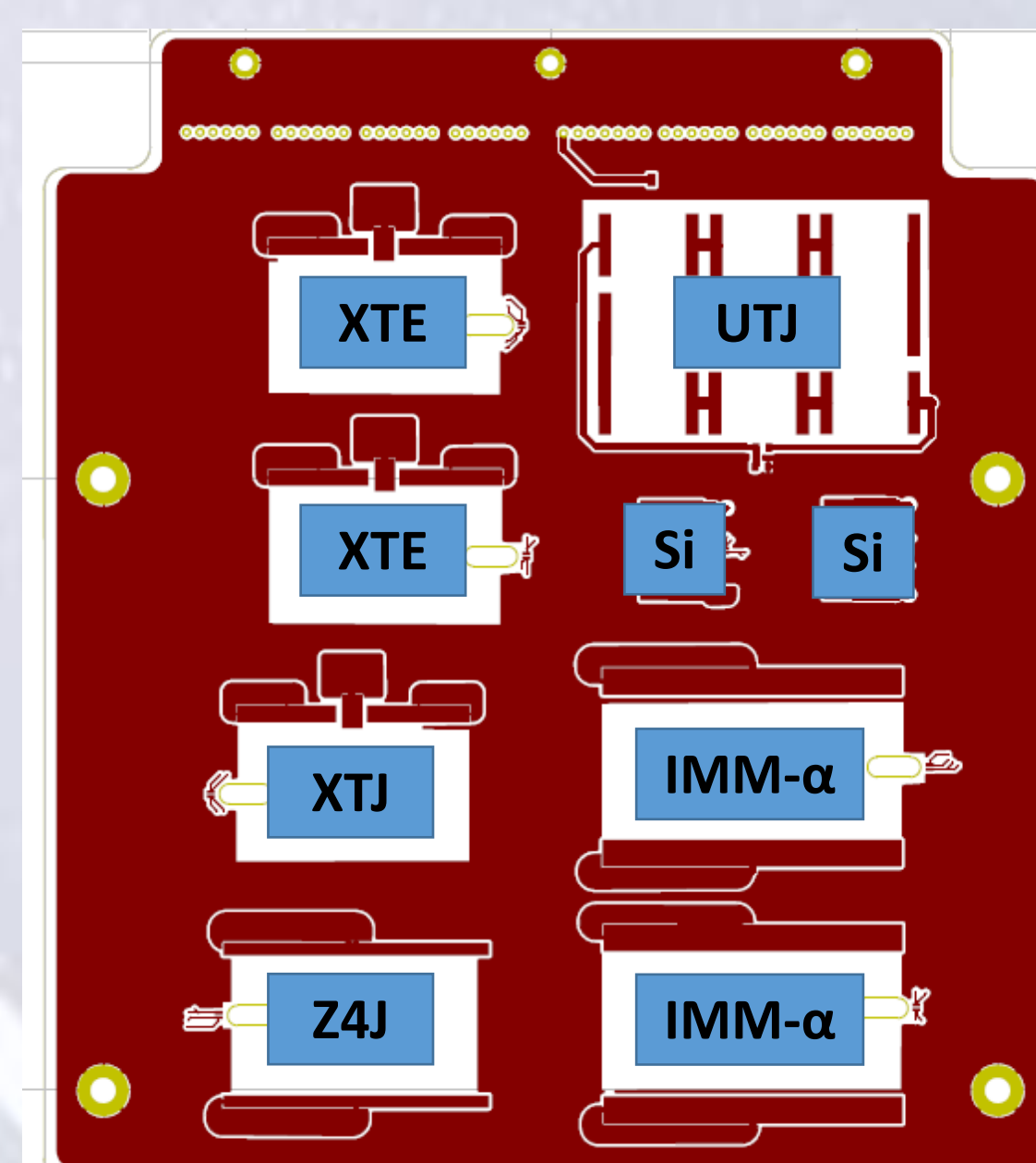
REQUIREMENTS

Overall requirements: 1.) the payload do no harm to the Lander 2.) is delivered on time for integration and flight 3.) provide good science data to be disseminated to the technical community.

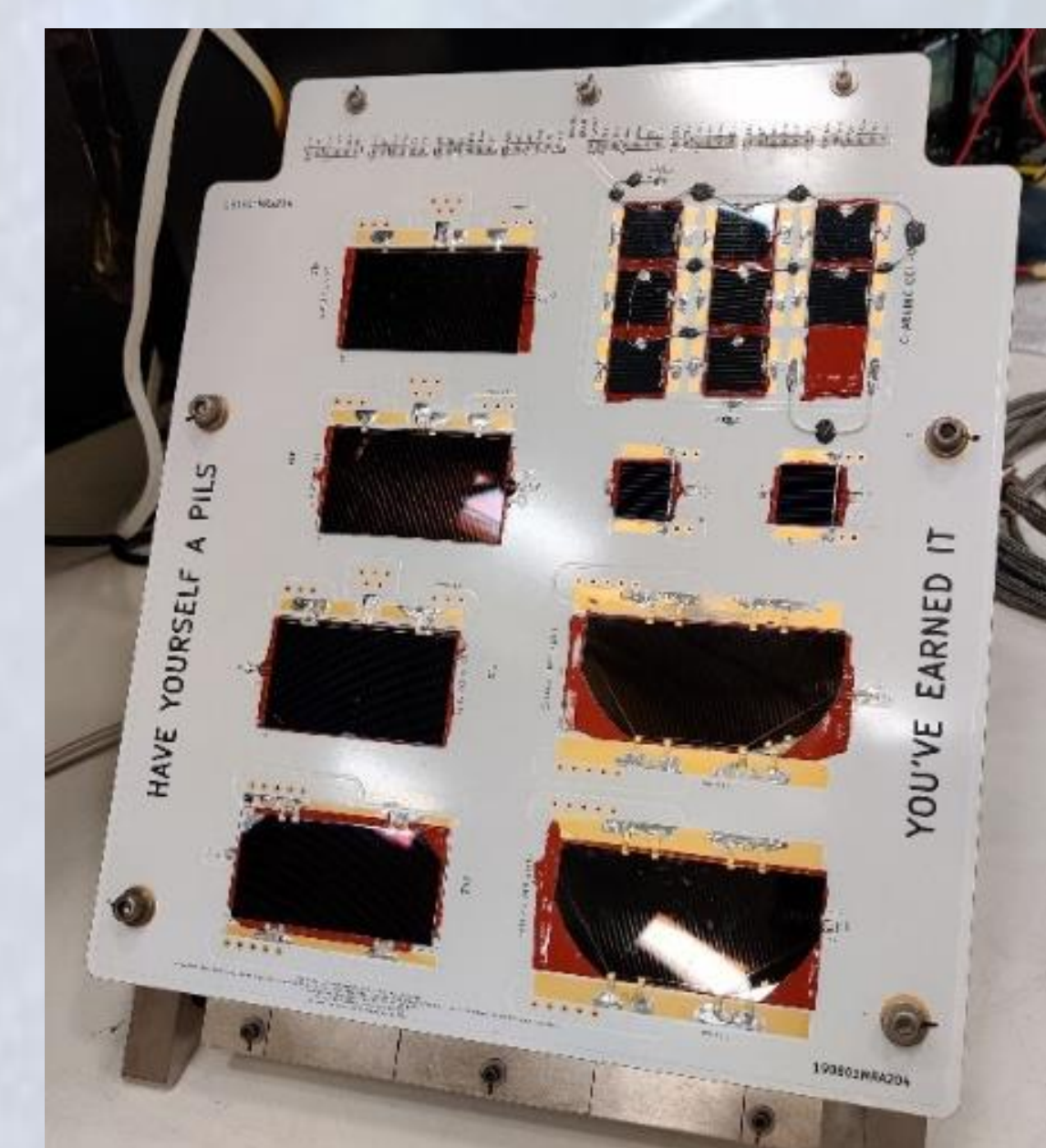
Additionally, any payload needed to be less than 15 kg in mass, not require more than 8 W continuous power, and operate at a 28 V DC bus.

PILS PLATFORM DESCRIPTION

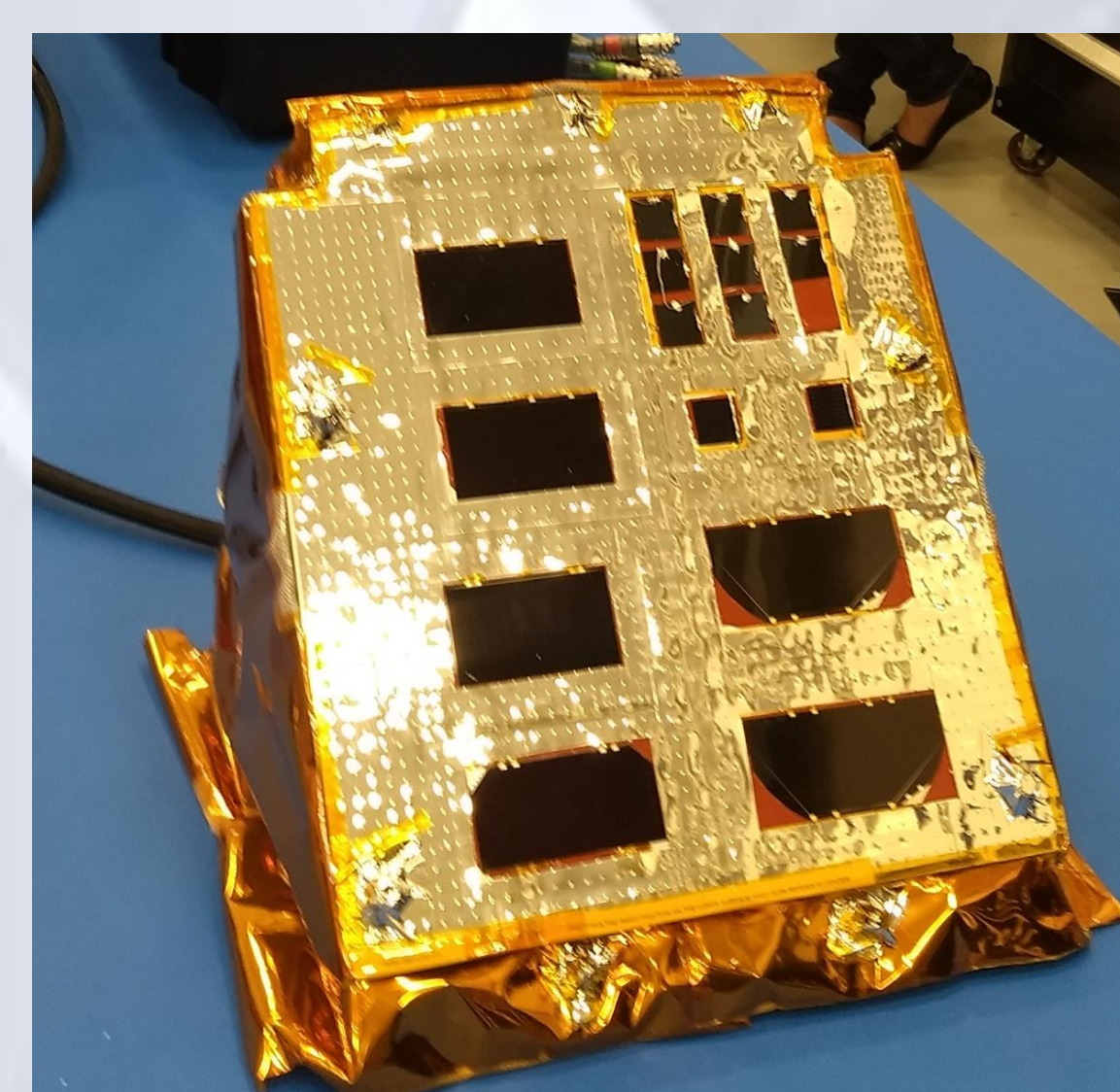
The PILS platform has been designed to allow for testing of multiple solar cells of various sizes to be exposed to the space and lunar surface environment, electrically characterized throughout the mission. A small array of cells have their coverglass connected to measure electrostatic charge accumulation.



Left Image: Schematic of the platform top sheet showing solar cell technologies used.



Right Image: Photograph of the top sheet with solar cells mounted and electrically connected.



Photograph of the final flight configuration. Reflective tape and multi-layer insulation (MLI) have been added to the platform to help with thermal control throughout the mission.

MISSION STATUS

The platform has been integrated to the Astrobotic Peregrine Lander and is expected to launch by the end of 2022. After an approximately 30 day cruise to the Moon, the lander will operate on the surface for approximately 240 hours.

TESTING

Thermal: Tested performance in a horizontal vacuum chamber outfitted with a liquid nitrogen cold wall. The platform was illuminated by a Spectrolab X25 solar simulator outside the chamber through a quartz window. Operation was verified through 4 thermal cycles with a cold start performed during the final cycle. The platform operated successfully throughout the tests.

Structural: Modal and structural analyses were performed on the platform to meet the “do no harm” requirement and to ensure that it would survive launch. The flight platform was tested in the GRC Structural Dynamics Laboratory under random vibration.

Electromagnetic Interference (EMI): Testing was required to ensure platform was not susceptible to external electromagnetic signals and that it was not emitting any signals that could interfere with the lander or other payloads. The platform was tested through MIL-STD-461G.

ACKNOWLEDGEMENTS

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