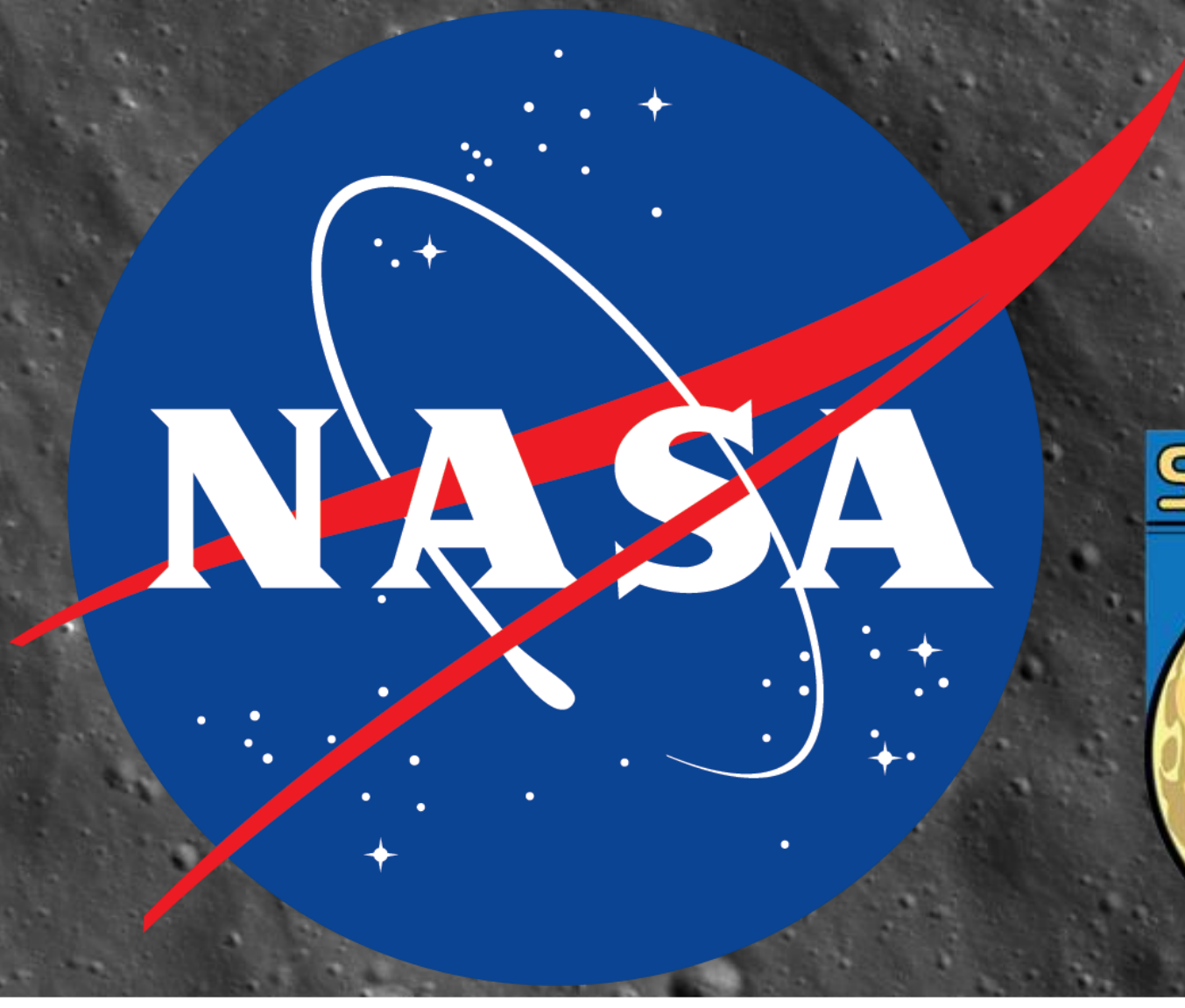




Optimization of the SCALPSS Scientific Payload to support Lunar Landing Missions, from CLPs to Artemis

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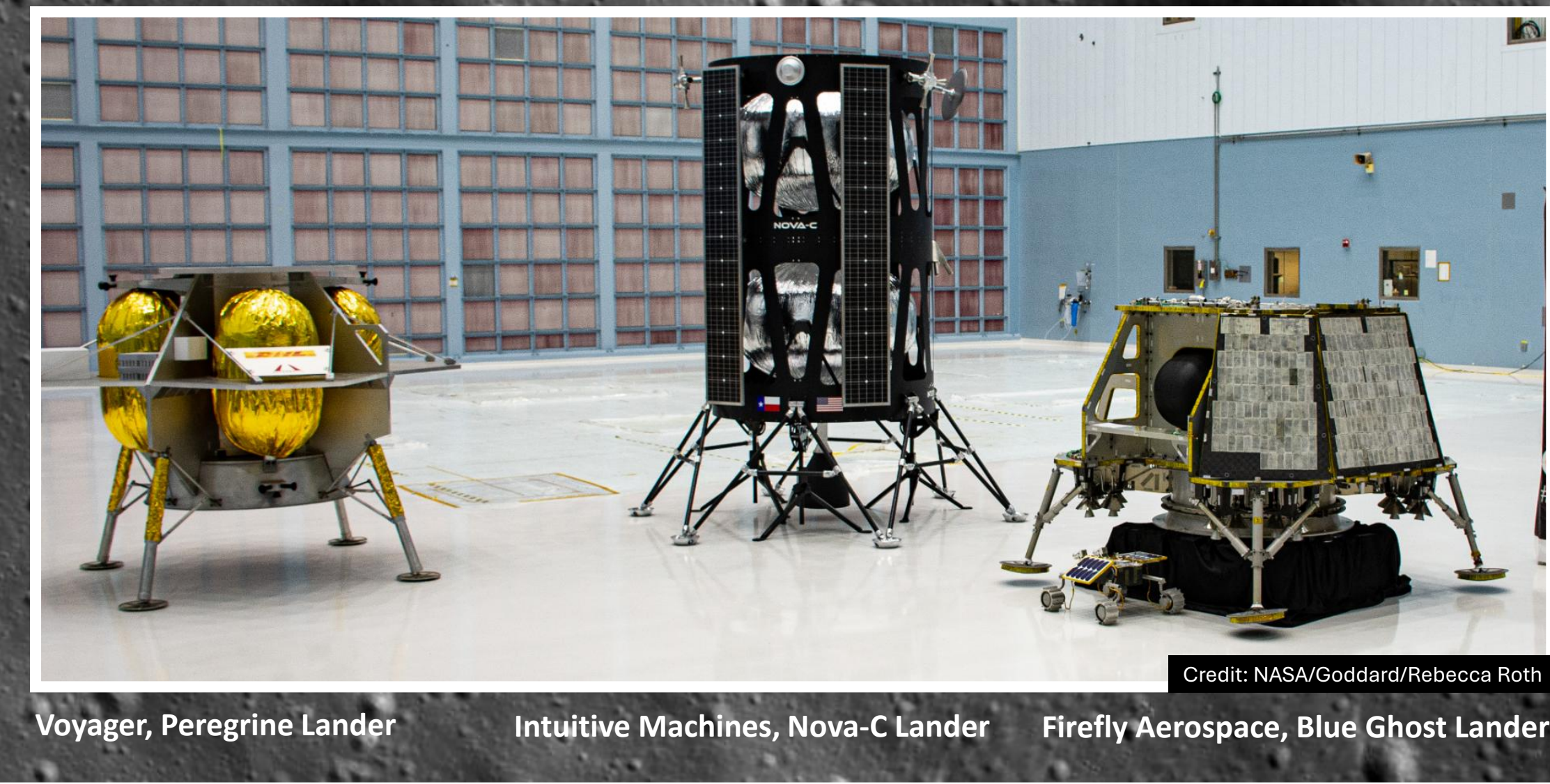
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Abstract

Lunar landing data is limited, expensive to obtain, and essential for the progression of the Human Landing System class landers and Artemis flights. The effect of the Plume Surface Interactions (PSI) of a lander's jet plume onto lunar regolith is a costly problem to simulate and impossible to truly reproduce in a ground test. The mission of SCALPSS is to study how lander jet plumes interact with the lunar regolith surface. This poster details the process of designing and optimizing the scientific package of SCALPSS for the landers of the Commercial Lunar Payloads (CLPs) missions.

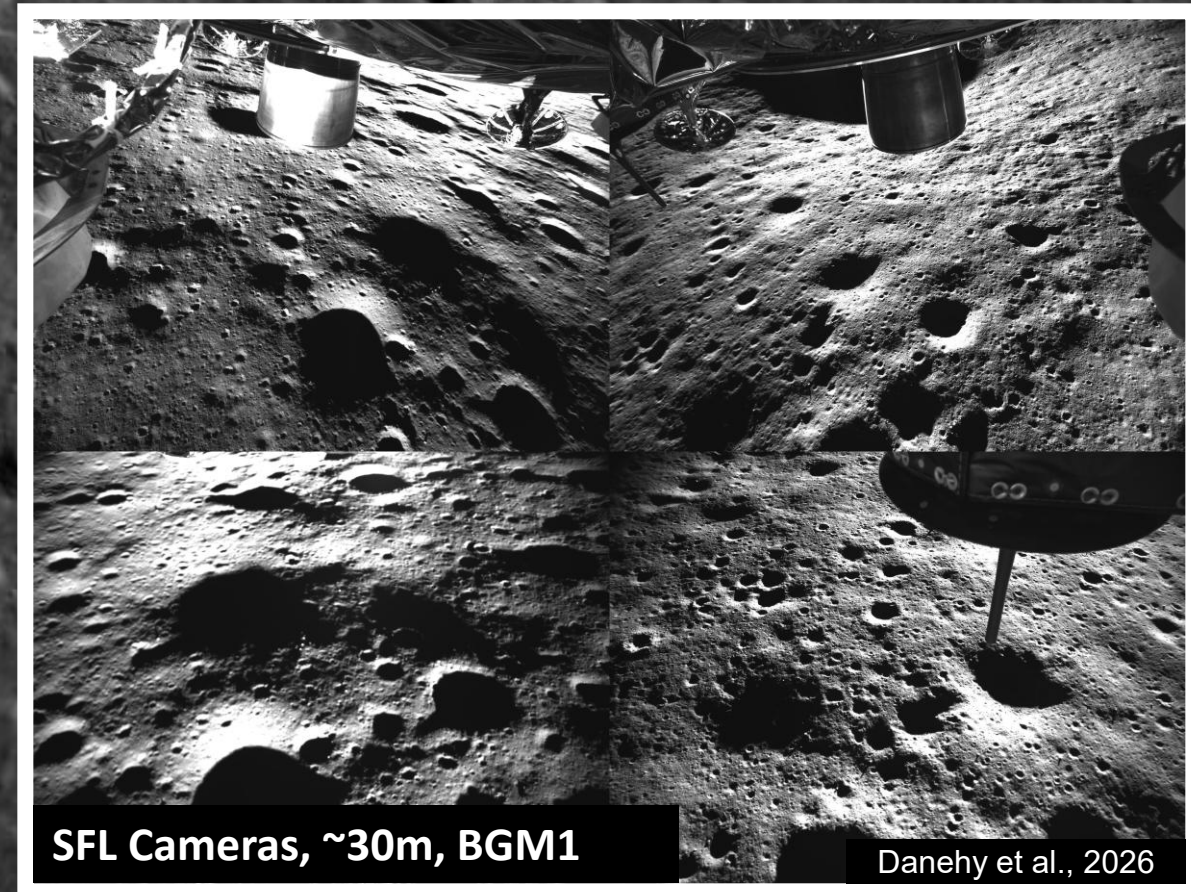


SCALPSS Background

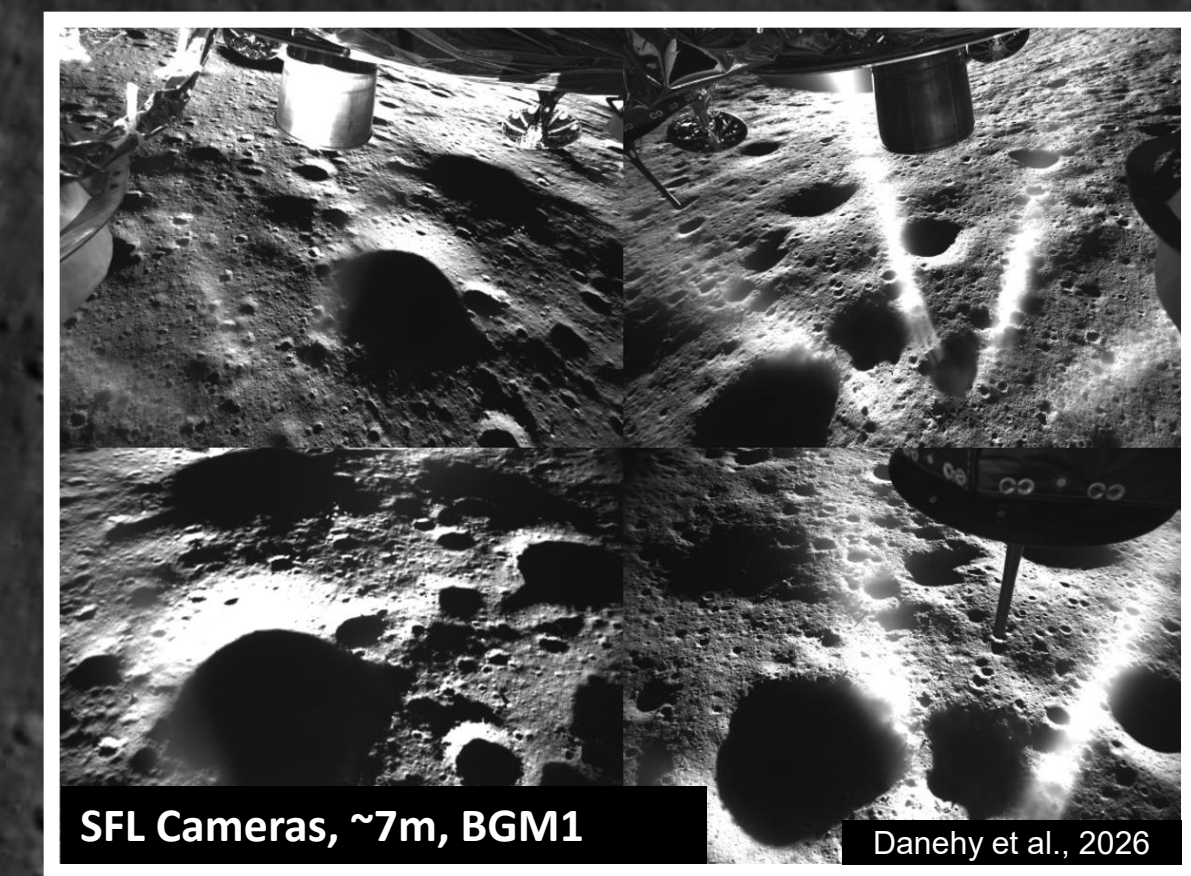
Stereo Cameras for Lunar Plume Surface Studies

The primary scientific goals of SCALPSS are to:

- 1) Determine the pre-PSI digital elevation map (DEM) of the landing zone during the descent stage of the lander,

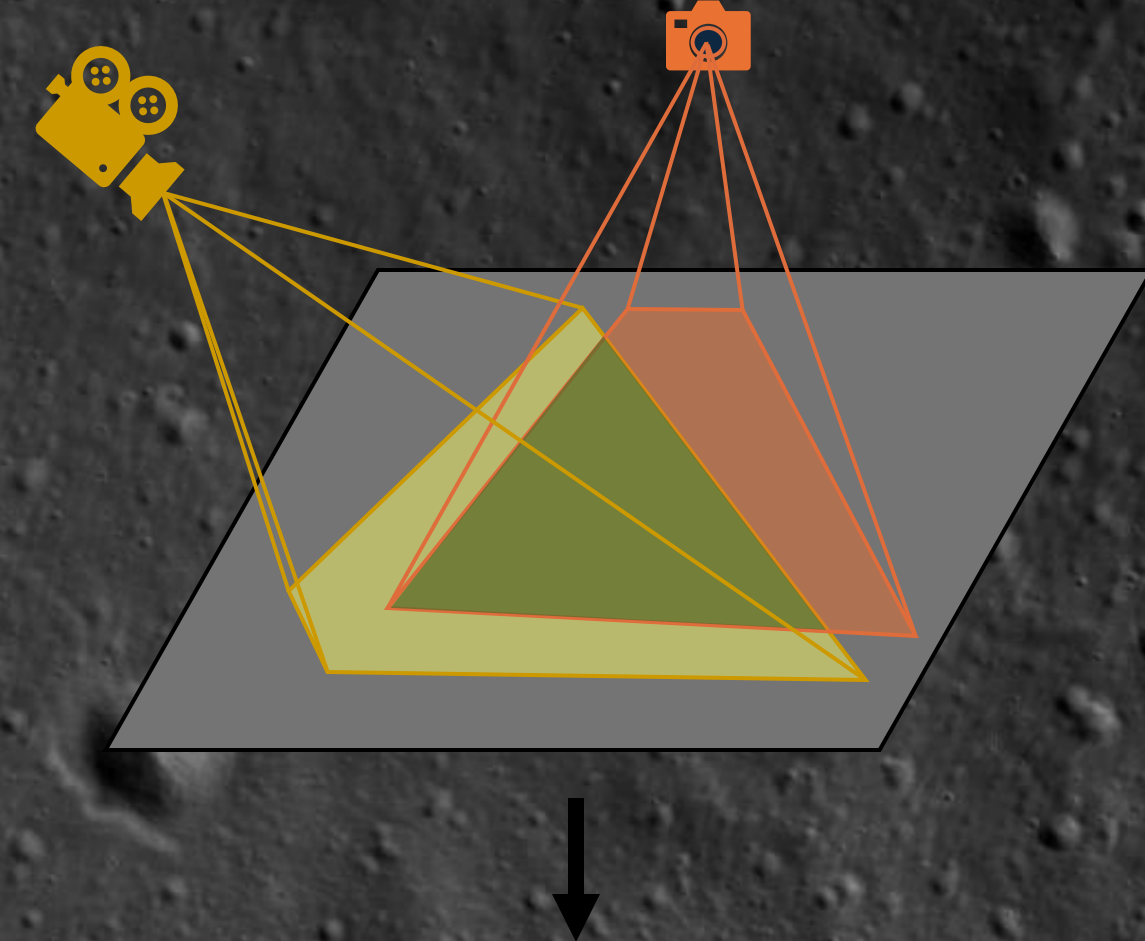


- 2) Collect descent videos, capturing the onset of PSI, and

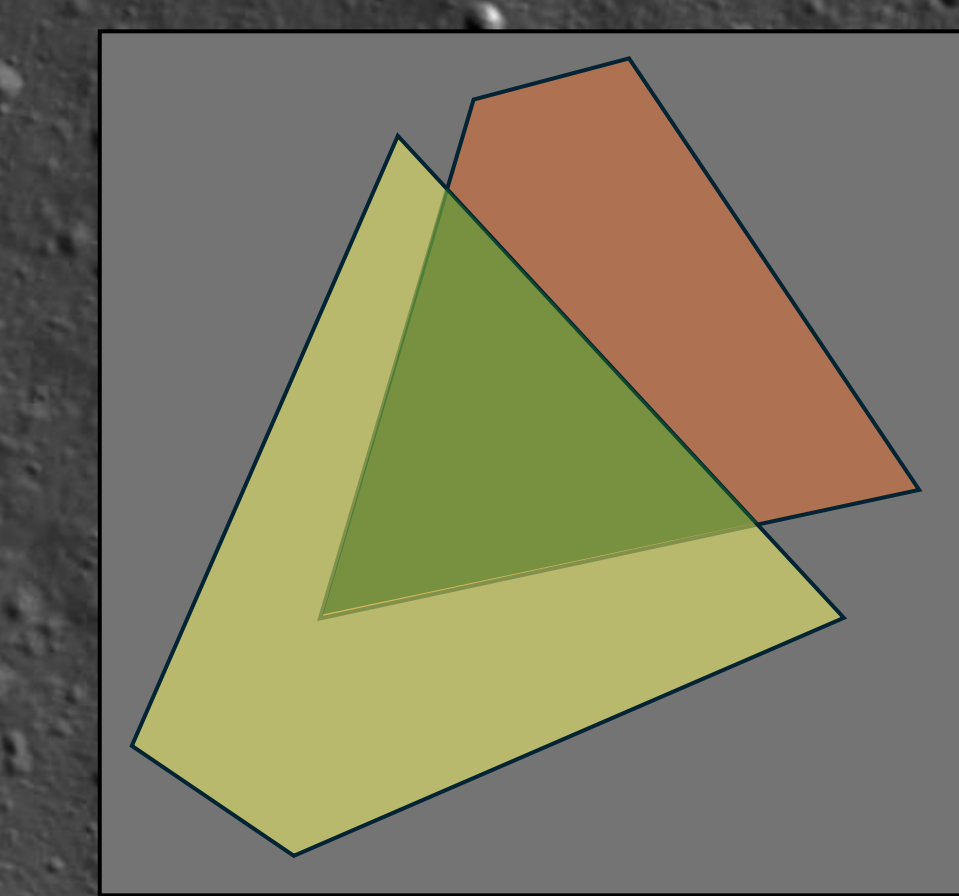


- 3) Collect a high-quality DEM post landing, to measure the total erosion of the landing PSI.

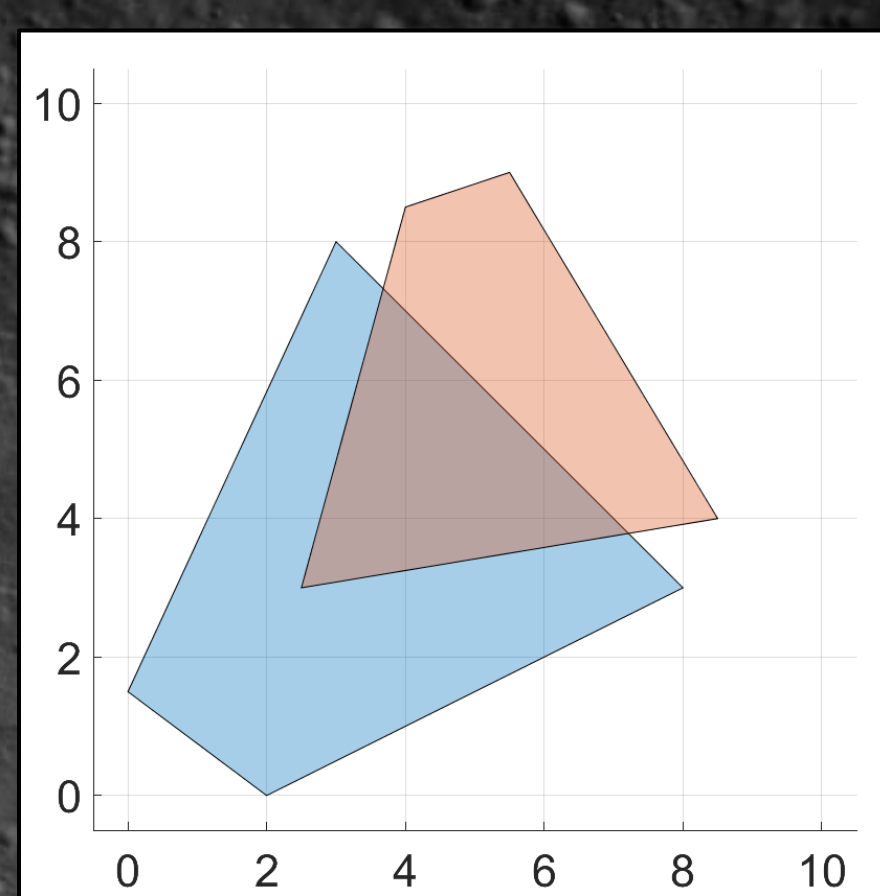
FOV Simulations



- Camera projections are simulated in 3ds Max.
- These camera projections are measured on a flat plane representing the lunar surface, capturing optical interferences of the lander.
- These camera positions are imported into MATLAB, being saved as polygons, where simple set operations can be made on the projected areas.

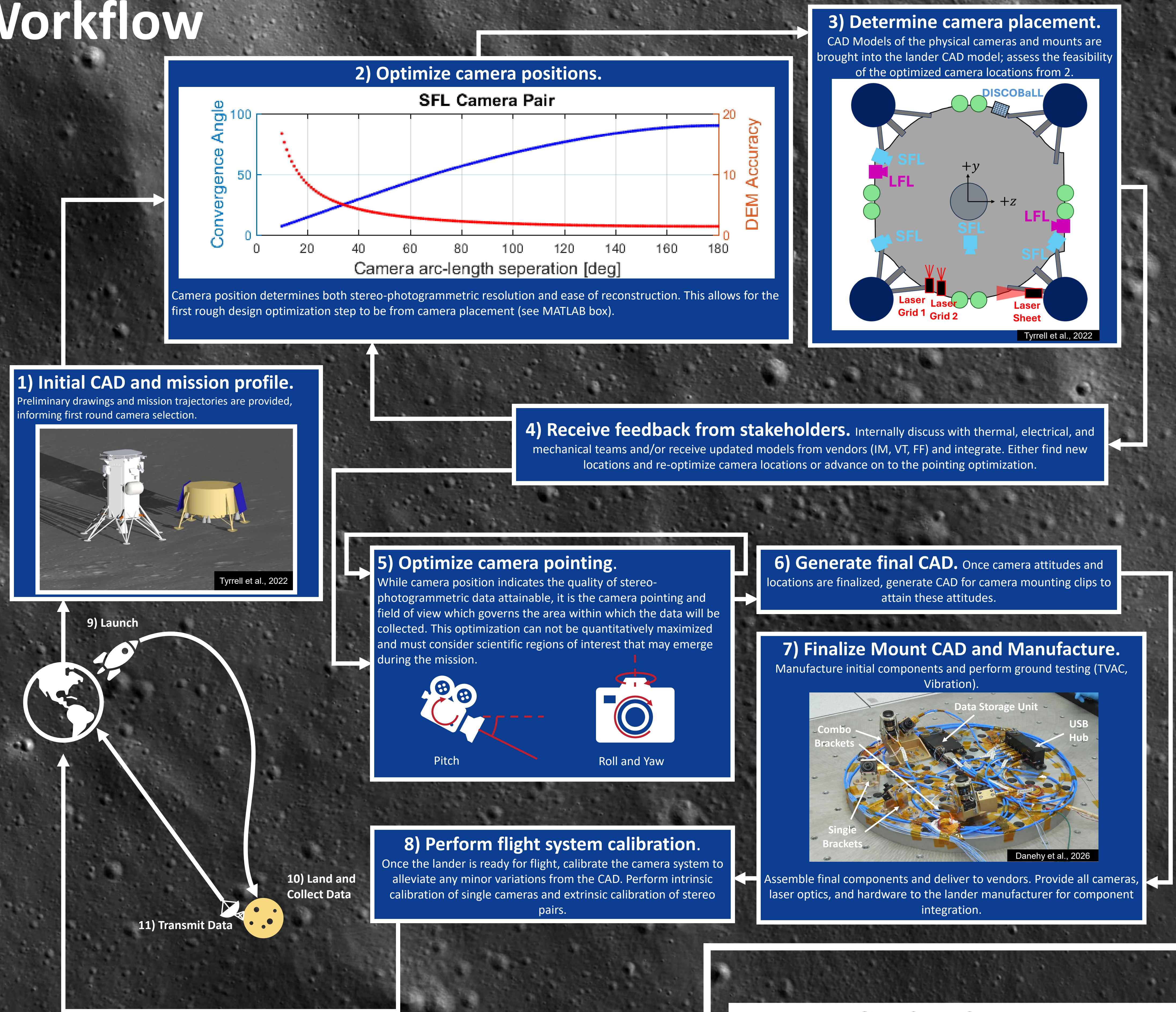


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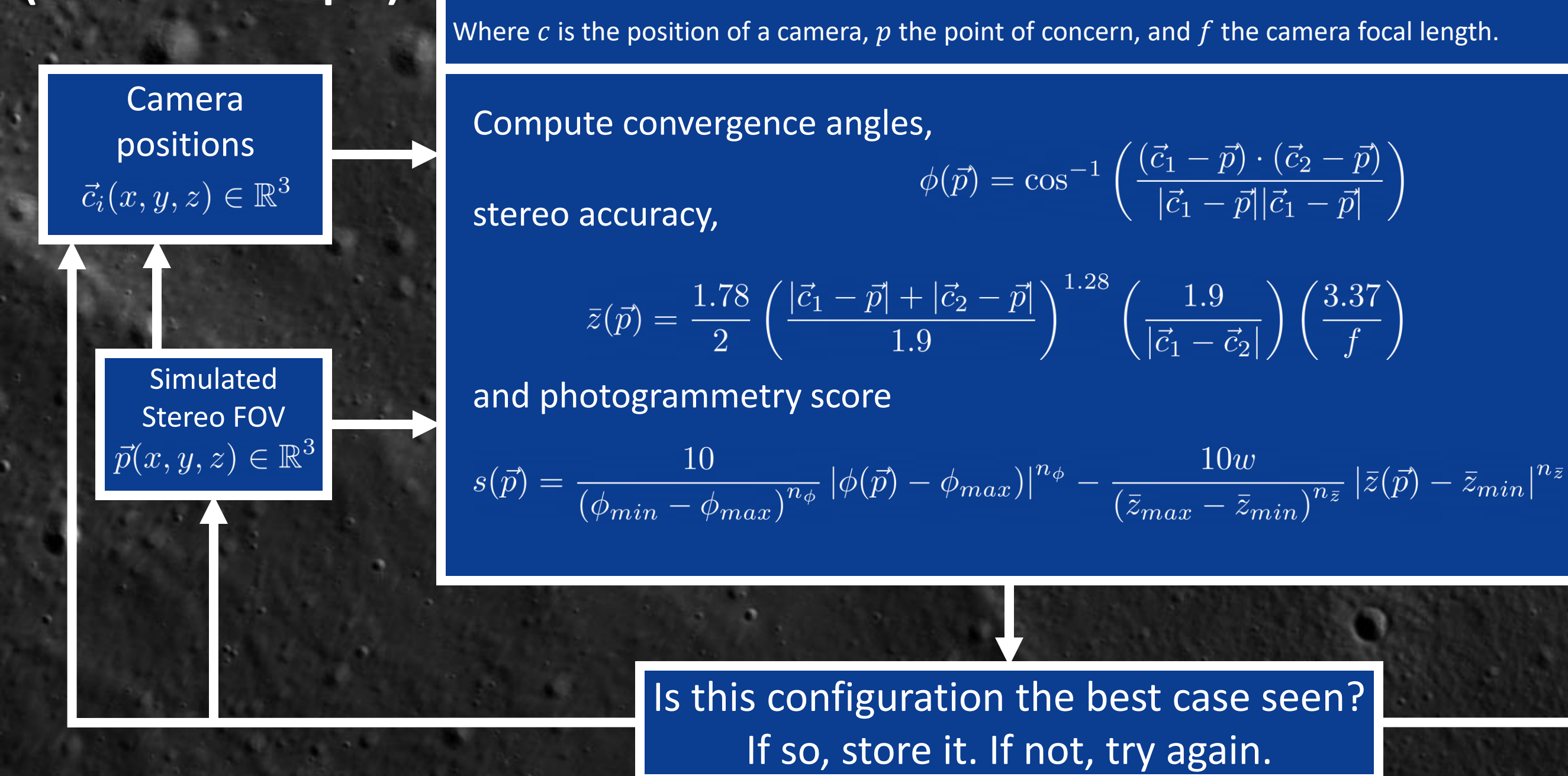
polyShapes ~8B

Workflow



MATLAB Optimization Process

(Workflow Step 2)



Conclusion and Future Work

- A doubly-recursive optimization cycle optimizes the SCALPSS scientific payload for maximum scientific data recovery, ease of collection, reconstruction, and maximum mission lifetime.
- The Firefly, Voyager, and Intuitive Machines landers will launch NET Q4-2028.
- The SCALPSS team at NASA Langley will be able to more efficiently design, manufacture, and deliver SCALPSS systems to their commercial partners with these methods.
- With the increase in frequency of lunar missions, and the advent of larger and heavier landers being sent to the moon, SCALPSS data can inform PSI-inducing vehicle designs and operational procedures.
- Additionally, SCALPSS will lay the groundwork for further exploration of the science in different rarefied PSI environments, such as Mars.

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