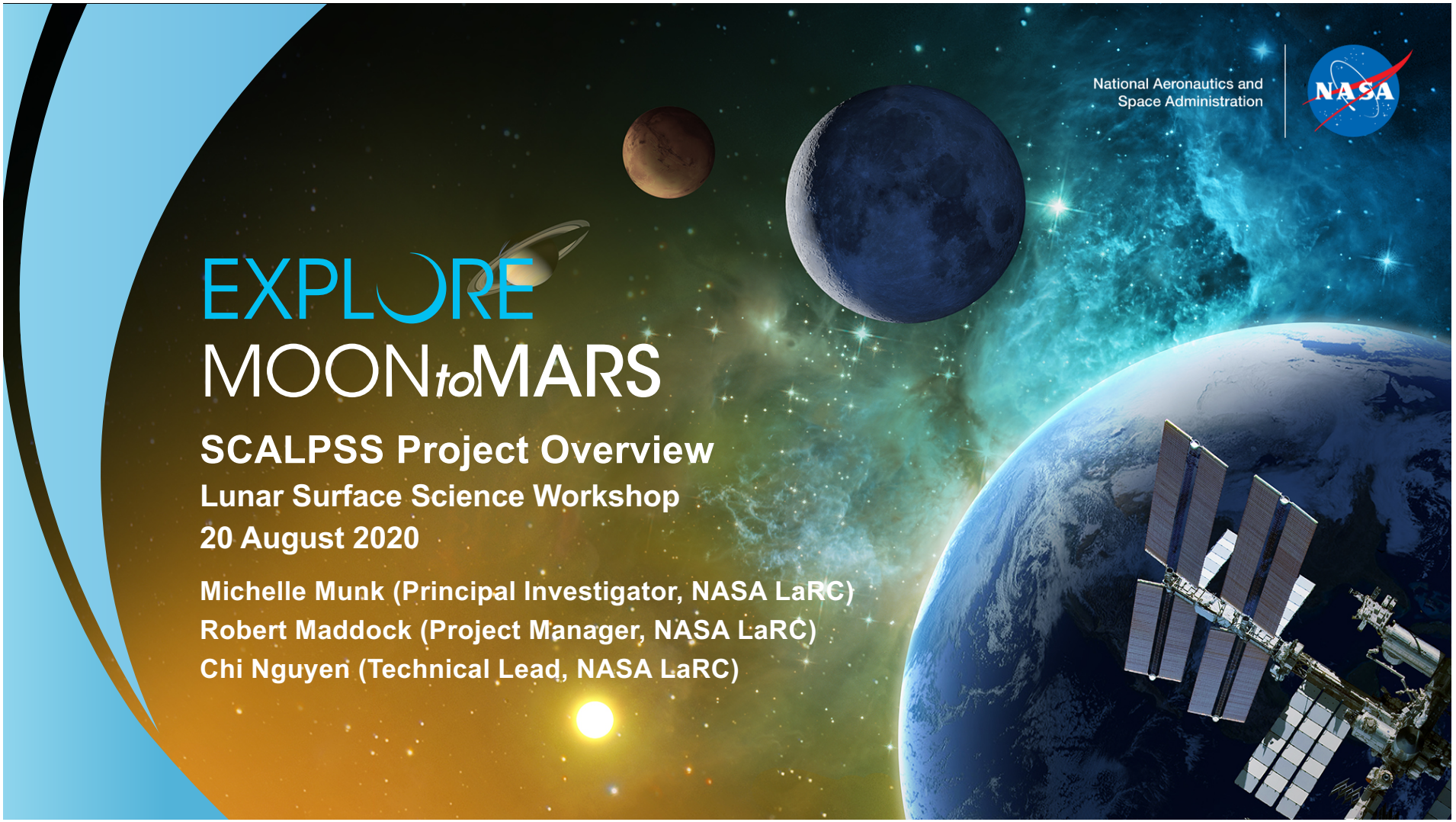
National Aeronautics and
Space Administration
NASA
EXPLORE
MOONtoMARS
SCALPSS Project Overview
Lunar Surface Science Workshop
20 August 2020
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Motivation and Project Overview

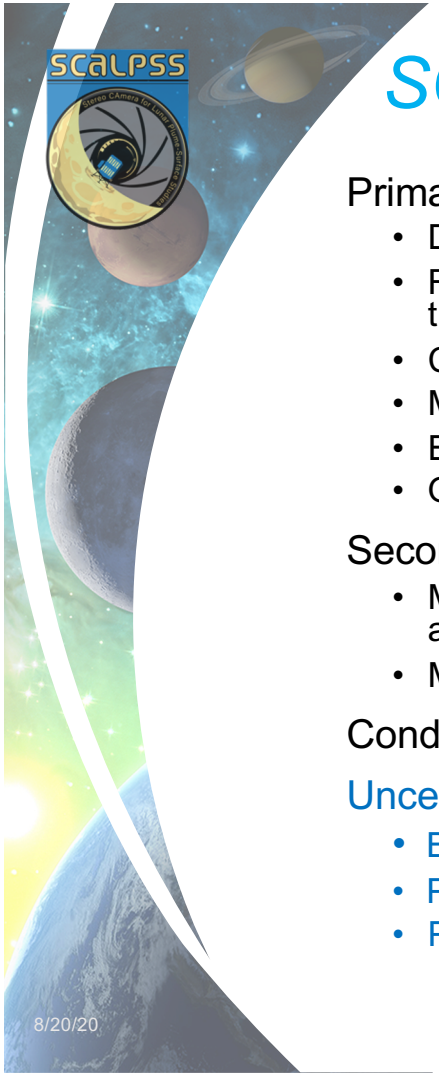
- As landers grow to human scale, understanding how these landers interact with the environment (including other landed assets), particularly during the landing event, becomes increasingly critical.
- SCALPSS is the first payload specifically designed to collect Plume Surface Interaction (PSI) flight data for verification of computational models. Complements NASA modeling/ground testing project.
- Stereo CAmera for Lunar Plume-Surface Studies (SCALPSS) was selected in February 2019 by the Science Mission Directorate (SMD) NASA Provided Lunar Payload (NPLP) Development Program
- SCALPSS is scheduled to fly on the Intuitive Machines NOVA-C lander to Vallis Schröteri in October 2021, as part of the initial Commercial Lunar Payload Services (CLPS) mission selections
- The SCALPSS payload is currently undergoing environmental testing in support of a payload delivery in October 2020
- SCALPSS 1.1, planned for CLPS flight 19D to Mare Crisium in early 2023, will be a “re-fly” of SCALPSS incorporating lessons learned/minor design changes to reduce risk and enhance science

Project partners include:

NASA Langley Research Center (Lead)

NASA Marshall Space Flight Center

Jet Propulsion Laboratory / California Institute of Technology



SCALPSS Science Objectives

Primary Science Objectives

- Detect onset altitude of ejecta and erosion effects *(turn on @ 30 m altitude)*
- Record transient 3D crater morphology as the vehicle is descending to estimate transient crater formation volume rates *(15 fps through landing)*
- Capture post-landing 3D site-alteration morphology
- Measure crater depth, diameter and eroded volumes
- Estimate erosion rates
- Quantify uncertainty in photogrammetry measurements *(post-landing images)*

Secondary Science Objectives

- Measure ejecta structure during onset and descent (may be able distinguish ejection angles, ejecta sheath morphology, etc.)
- Measure dust settling density as a function of time *(10 s post-landing @ 15 fps)*

Conduct comparisons between predictions and flight reconstructed data

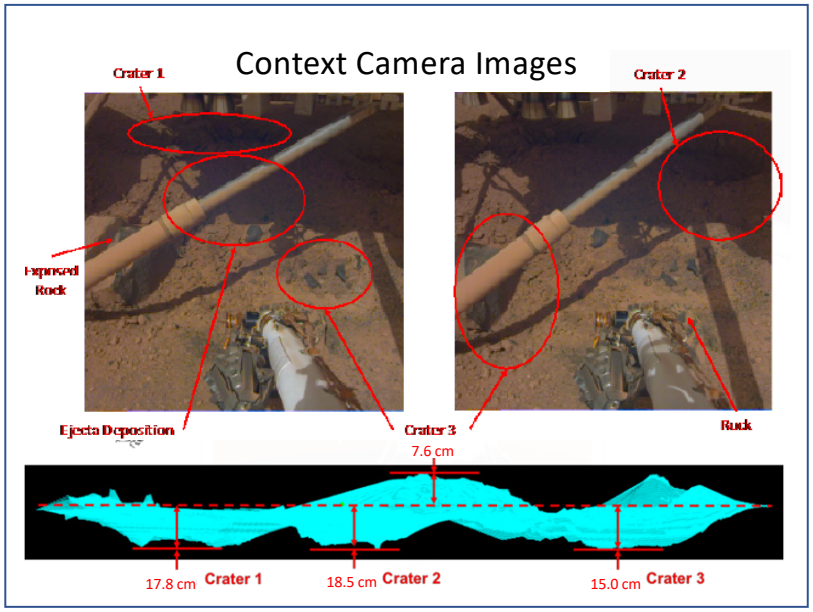
Uncertainties will remain, due to regolith unknowns:

- Bulk density (compaction, porosity)
- Particle size distribution
- Particle shape and cohesion

} At depth, down to [20 cm] (?)

Stereo Photogrammetry

Mars InSight Topography Analysis

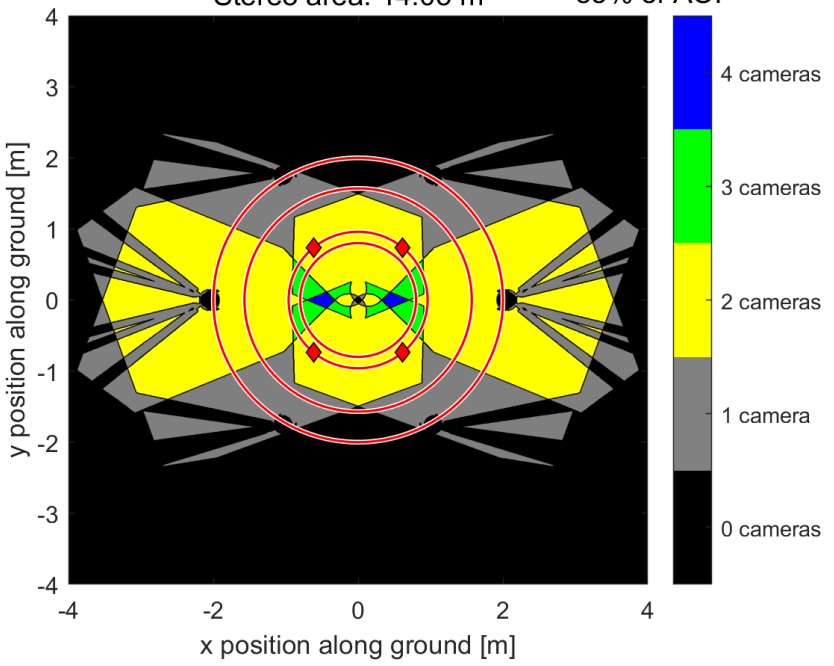


Estimated Accuracy of Pseudo-Stereo Method: +/- 0.25 cm
(Mehta & Liever, 2019)

Stereo Coverage of SCALPSS Cameras

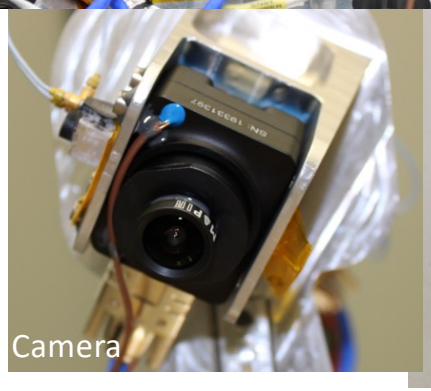
R = 0.96 m, h = 0.95 m, θ = 40°, ω = 30°, ϕ = 5°, α = 0°, β = 90°

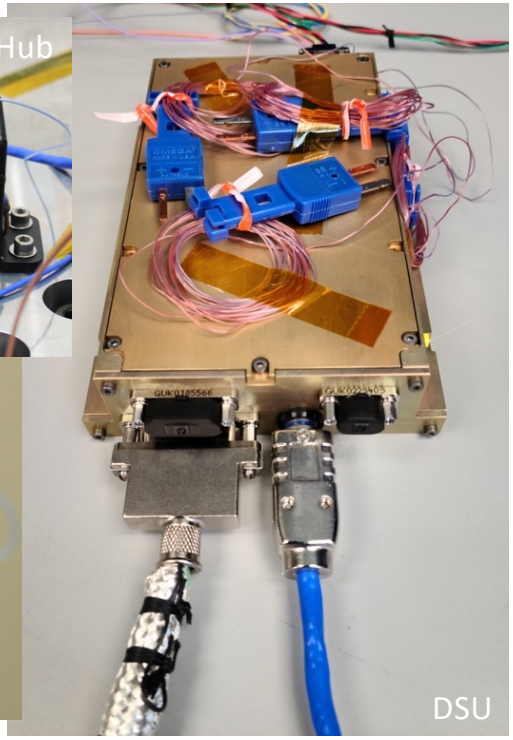
Stereo area: 14.05 m^2 85% of AOI



SCALPSS Payload Architecture

- SCALPSS is a distributed payload with 6 separate components
- Data Storage Unit (DSU)
  - build-to-print of M2020 EDLCam electronics
- USB Hub
  - hardened; same COTS part as used for M2020 EDLCam
- 2 pairs (4 ea.) short focal-length high resolution down-look cameras
  - COTS camera; same make as M2020 EDLCam cameras, but monochrome model
  - COTS lenses; short focal-length lenses used for SLS
  - optimized locations and pointing to maximize stereo coverage





Questions?