T0121-S Flyover Mapping and Modeling

Problem Statement

- Planetary pits could be modeled during lander flyover in descent. This program innovates and develops technology for flyover mapping and modeling.

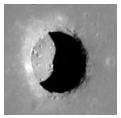

Photo: Lunar Skylight

- Relevant technology roadmap needs include 3-D perception, destination terrain imaging, mapping and characterization, and GN&C sensors.
- Potential users include robotic precursor missions to the Moon and Mars.

Technology Development Team

- PI: Dr. William “Red” Whittaker
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- Carnegie Mellon University
- Student Team Lead / POC: Neal Bhasin (neal@cmu.edu)
- Sponsor: KVH Inc.
- Funded by: NASA USIP

Flight Experiment

Experiment Readiness:

- Propulsive flight test: Mar 2015

Test Vehicles:

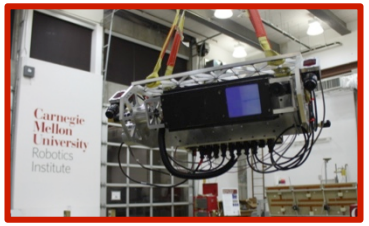
- sRLV - Masten Xombie

Test Environment:

- Previously tested on helicopter Dec. 2014
- Requested flight demonstrated flyover modeling on space-relevant vehicle and trajectory over planetary skylight analog structure

Test Apparatus Description:

- Pose estimation with stereo cameras, IMU
- Modeling with gimbaled high-resolution color camera and scanning LIDAR
- Photos: Vehicle-payload integrated system in flight test (left), indoor instrument calibration (right)



Technology Maturation

- TRL 5: Modeling system demonstrated in relevant environment on helicopter for altitude range and vibration.
- TRL 5: Modeling software performance verified in visual simulation.
- TRL 6: End-to-end terrestrial test of modeling system in relevant landing trajectory, with flight over planetary skylight analog.

Objective of Experiment

- CMU's Pit Modeling Instrument modeled the shape and appearance of a ring of cargo containers using imagery and data acquired during flyover test.

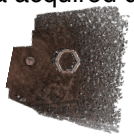


Photo: Generated Flyover Model

- Demonstrated reliable, accurate, dense 3D modeling of planetary surface features.
- Data from the requested flight verifies hardware reliability, pose estimation accuracy, and modeling accuracy and density.

4.1.1 3-D Perception ; 4.1.3 Terrain Mapping, Classification, and Characterization
7.1.1.1 Destination Imaging & Characterization ; 9.4.7 GN&C Sensors and Systems

1/2015