ARC-LIGHT

Algorithm for Robust Characterization of Lunar surface Imaging and Ground Hazards and Trajectory

ARC-LIGHT
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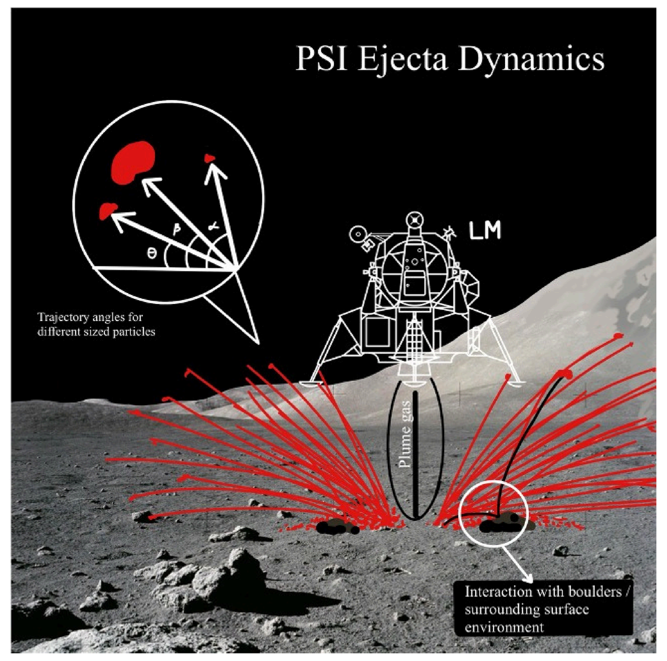
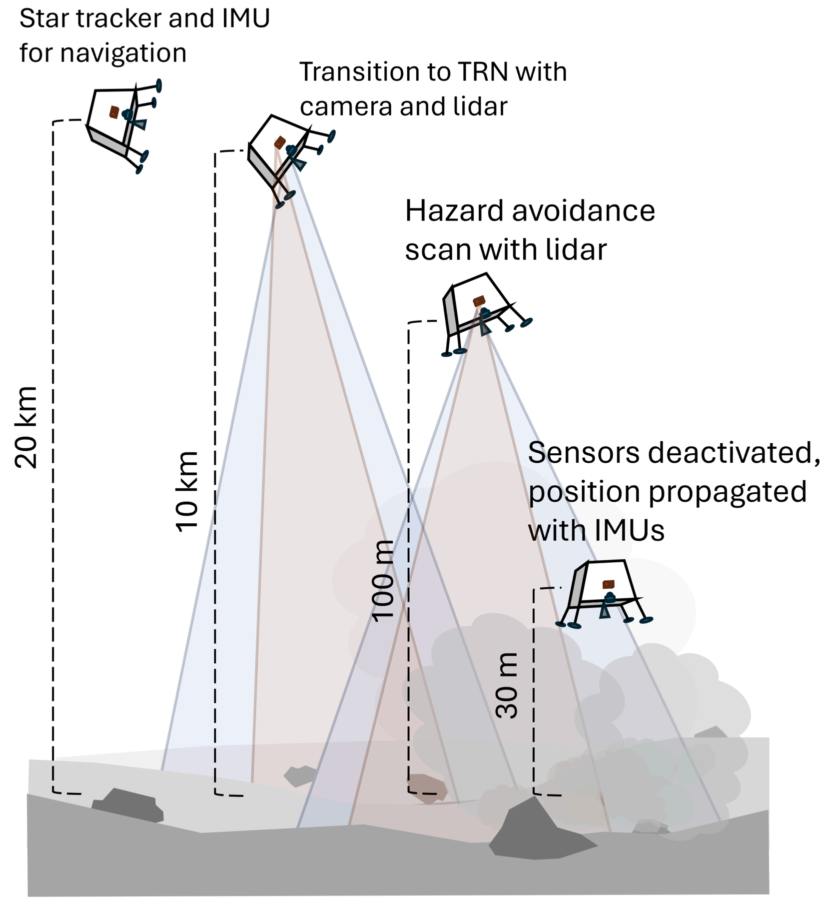
01. PSI Endangers Lunar Landings



- Plume Surface Interaction presents key hazard for lunar landings
- Lofted clouds of regolith can obstruct the view of the cameras, radars, and lidars used for navigation

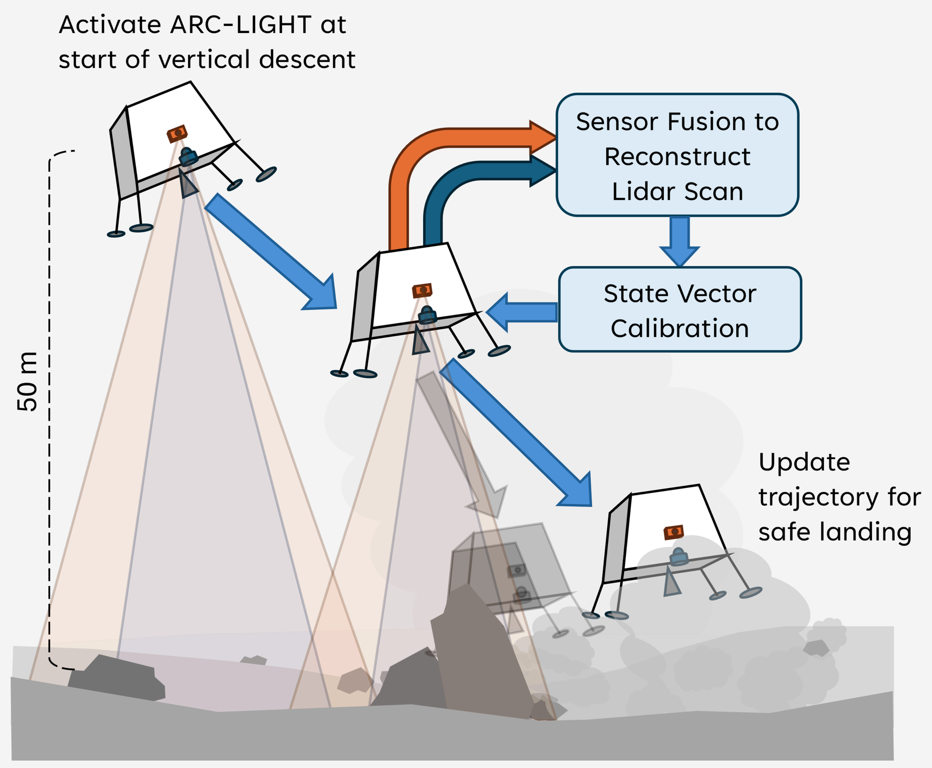
02. Landers Deactive Sensors

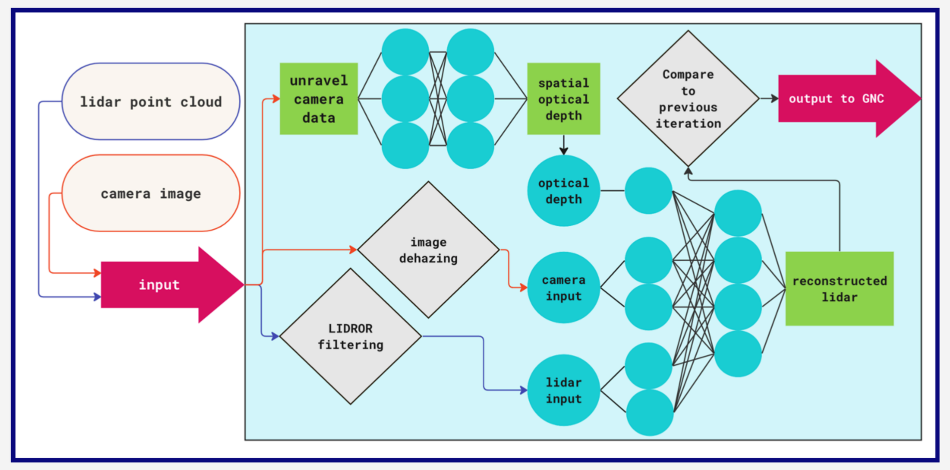
- Current landers stop using cameras and lidars during the final stages due to PSI
- Landers rely solely on Inertial Measurement Units (IMUs) to finish the descent, increasing risk



03. ARC-LIGHT Enables Lidar and Camera Use Throughout Final Landing Stage

- ARC-LIGHT is a machine learning-based sensor fusion system.
- Re-enables the use of sensors typically disabled due to PSI
- Removes erroneous signals caused by PSI allowing lidar to effectively "see-through" particle obstruction.
- Improves landing by recovering a useful detection of the surface for use by the spacecraft to adjust its descent profile or avoid hazards.
- Provides a layer of redundancy for other sensors, like IMUs.





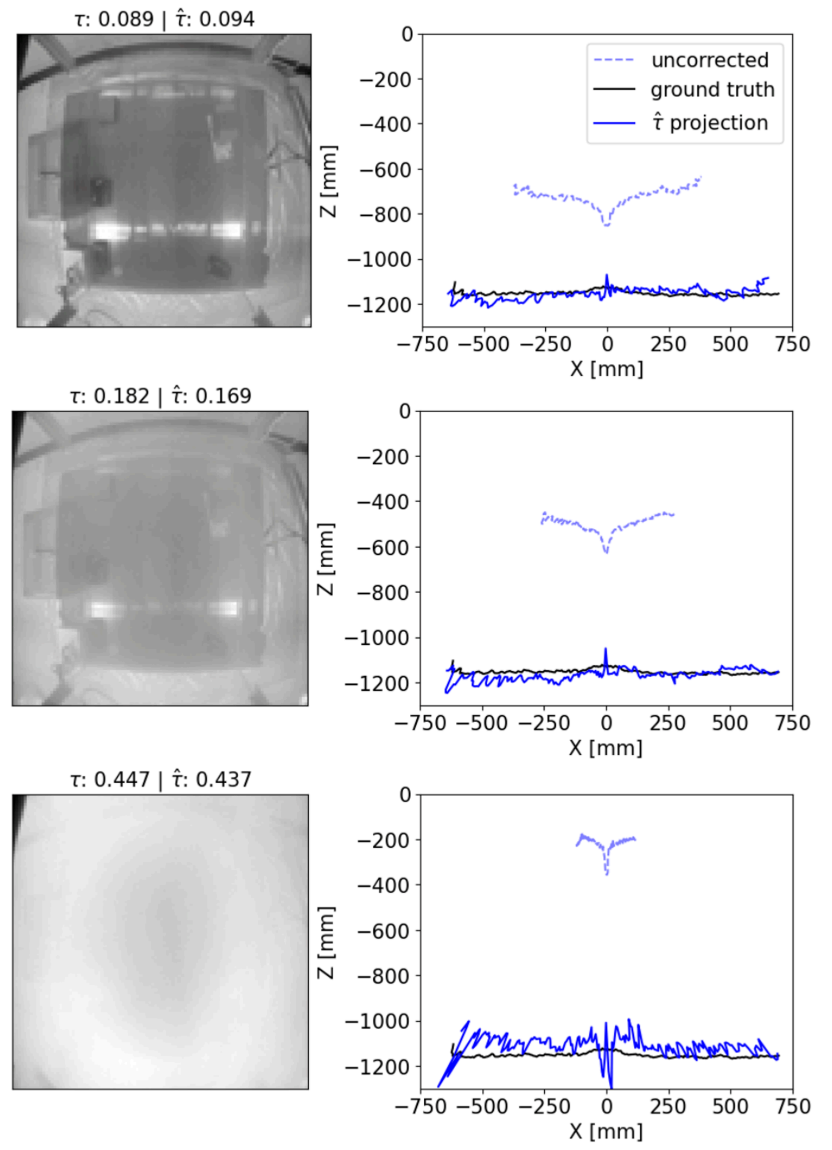
04. Concept Validation Using Lunar Testbed

- Set-up consists of:
  - Enclosed test bed that can be filled with atomized particles (Di-Ethyl-Hexyl-Sebacat).
  - Sensors to measure current optical depth, camera, and lidar.
  - Target to track how well the reconstructed scan can detect obstacles in the testbed.
- Used to support the development of a prototype algorithm.

SELENE (Sensor Efficacy in the Lunar Environment Experiment)

05. Prototype Results

- Prototype algorithm uses a Convolutional Neural Network to determine DEHS optical depth τ
- Optical depth information is used to project lidar scan, reconstructing the ground truth scan



06. Implementation Plan

- Initial experiments reveal the prototype algorithm's ability to "see-through" optical obstruction.
- 3 1/4 yr timeline includes:
  - Synthetic data generation
  - Software development
  - Integration and validation
- Budget:
  - Employee salaries: 1,548 FTE
  - Hardware and software costs: $275,150

Consequences

Likelihood	Minor	Significant	Major	Severe
Almost Certain				
Likely	Issues with hardware & software integration		Lack of training data	
Moderate				
Unlikely	Lack of personnel expertise	Signal processing computation cost & Reliability		Error during training