National Aeronautics and Space Administration

NASA

TECHNOLOGY SOLUTION

Optics

3D Lidar for Improved Rover Traversal and Imagery

A Space Qualified Rover Lidar (SQRLi) for navigating in poor lighting

Planetary and lunar rover exploration missions can encounter environments that do not allow for navigation by typical, stereo camera-based systems. Stereo cameras meet difficulties in areas with low ambient light (even when lit by floodlights), direct sunlight, or washed-out environments. Improved sensors are required for safe and successful rover mobility in harsh conditions.

NASA Goddard Space Flight Center has developed a Space Qualified Rover Lidar (SQRLi) system that will improve rover sensing capabilities in a small, lightweight package. The new SQRLi package is developed to survive the hazardous space environment and provide valuable image data during planetary and lunar rover exploration.

BENEFITS

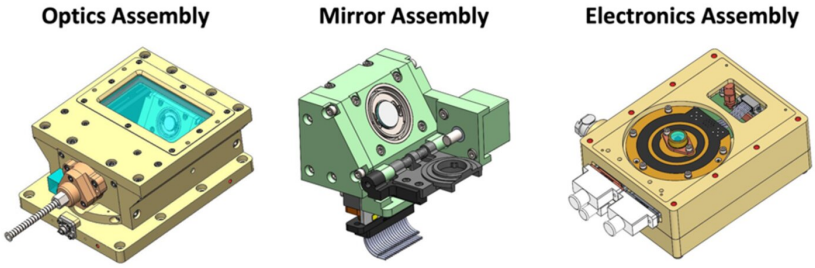
- Works in poor lighting conditions: the lidar navigation system can operate in both low ambient light and direct sunlight conditions.
- Highly robust: the SQRLi system is designed to survive harsh environments for planetary exploration.
- Lightweight with a smaller footprint: the SQRLi system is smaller and lighter than other 3D lidar systems usable for rovers.
- Wide field-of-view: the new 3D lidar meets the increased field-of-view needs of next generation rovers.
- Longer range: the SQRLi has an increased range compared to in-use rover navigation sensors.

THE TECHNOLOGY

The SQRLi system is made up of three major components including the laser assembly, the mirror assembly, and the electronics and data processing equipment (electronics assembly) as shown in the figure below. The three main systems work together to send and receive the lidar signal then translate it into a 3D image for navigation and imaging purposes.

The rover sensing instrument makes use of a unique fiber optic laser assembly with high, adjustable output that increases the dynamic range (i.e., contrast) of the lidar system. The commercially available mirror setup used in the SQRLi is small, reliable, and has a wide aperture that improves the field-of-view of the lidar while maintaining a small instrument footprint. Lastly, the data processing is done by an in-house designed processor capable of translating the light signal into a high-resolution (sub-millimeter) 3D map. These components of the SQRLi enable successful hazard detection and navigation in visibility-impaired environments.

The SQRLi is applicable to planetary and lunar exploration by unmanned or crewed vehicles and may be adapted for in-space servicing, assembly, and manufacturing purposes. Beyond NASA missions, the new 3D lidar may be used for vehicular navigation in the automotive, defense, or commercial space sectors. The SQRLi is available for patent licensing.



Design images of the major components of the Space Qualified Rover Lidar (SQRLi).

APPLICATIONS

The technology has several potential applications:

- Aerospace: enhanced navigation and imaging for planetary and lunar exploration as well as in-space servicing, assembly, and manufacturing.
- Automotive and defense: improved autonomous vehicular navigation

PUBLICATIONS

Patent Pending

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More Information

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