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Author: Mr. Mirko Viviano
MDA Space and Robotics Limited (MDSRL), United Kingdom

THE YODA DOPPLER LIDAR

Abstract

MDA UK is developing a commercial Doppler lidar system for lunar landing applications. YODA (Ytterbium laser lander Orientation and velocity from Doppler Architecture) will enable a reliable, accurate and affordable solution for moon landing capabilities. The demand for space missions that require precise landing is increasing significantly and MDA UK wants to play a key role in providing a robust system, that is particularly attractive to private stakeholders. Scanning lidars and optical cameras can be used to infer velocity information when illumination conditions and terrain feature availability permit. However, active Doppler radar and lidar are more robust solutions that are invariant to terrain features and illumination conditions. Doppler radar is a mature technology, but is large, heavy and power consuming; all of which are punitive to lunar landers, particularly to the power budget during the descent phase. Doppler lidar is a technology with mature terrestrial applications but it is new and emerging in the space domain. With more precise velocity tracking and reduced Size, Weight, and Power (SWaP) factor, Doppler lidar has considerable advantages over its radar counterpart that make it better suited toward landing applications. This was highlighted in the first half of 2024 when NASA Navigation Doppler Lidar (NDL) was included as a payload on the Intuitive Machines IM-1 Mission. European governments and industry recognise the importance of leading key technology development to maintain an independent role on future interplanetary missions. The involvement of the European Space Agency (ESA) in the project is evidence that a Doppler lidar system for precise landing is desirable in Europe; this project will pave the way for European missions to the Moon and beyond. MDA UK has extensive experience with lidar and other sensors and has already developed systems for docking, navigation, and landing, including LEIA, FLARE and SIRC. The Doppler lidar will be built on top on the knowledge and heritage of MDA UK under a contract with ESA. YODA is expected to reach TRL 6 within the current calendar year; this will be achieved by means of a Development Model demonstrating critical functions verification in relevant environment.