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ROVING WITH THE BUZZARDS: A TRL5 AUTONOMY MARATHON

Abstract

The Mars Sample Return (MSR) campaign constitutes a complex, long-term operation aiming at returning samples from the surface of the red planet to Earth. As part of this campaign, the Sample Fetch Rover (SFR) was conceived as a European contingency to NASA's Perseverance rover to fetch and deliver these samples to the return vehicle. Although this concept was dropped, it served to develop

and validate autonomous traverse strategies that are useful for future planetary and lunar exploration missions. This is the context and motivation behind the shakedown of the Field Test Rover System (FTRS) during the Integrated BreadBoard 2 (IBB2) project.

This paper presents an overview of the first real-world demonstration of such a robotic system. The IBB2 shakedown took place in September 2022 at a silica sand quarry, which offered both unfeathered, flat terrain and irregular, rocky terrain to cover a breadth of test scenarios. The locomotion subsystem was representative of the SFR design comprising two differential rocker bogies, 8 independent actuators, and NASA wheels featuring shape memory alloy tyres. The test campaign demonstrated the GNC technologies critical to the mission on real hardware very early in the development, providing significant confidence in the design. In particular, this campaign encompassed a series of GNC use cases with increasing levels of autonomy, including a fully autonomous 300m traverse showcasing the novel Absolute Global Localisation (AGL) algorithm. At the end of this paper we include some discussion about the results obtained and conclusions reached that may prove useful for the conceptualisation and design of GNC strategies for future robotic exploration missions.

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