Mars Exploration (3)
Mars Exploration (2) (2)

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AUTONOMOUS DECISION MAKING (ADE) IN VERY LONG TRAVERSES ON MARS

Abstract

The ADE on ground demonstration represents a breakthrough with respect the way a robotic machine could explore an unknown and potentially hostile environment, both in space and/or on Earth. This paper will present the high level objectives and the ambitions of ADE Autonomous Decision Making (ADE), which are multiples when analysed over time. In the short/mid-term needs ADE is advancing in designing, developing and testing key technologies suitable to better explore (increase of scientific and overall data collection) autonomously planetary surfaces exploration (in long traverse) while guaranteeing fast reaction (on board deliberative capabilities), mission reliability and safety, and optimal exploitation of robotic means resources within reasonable costs. When translating those objective to the long term ADE will contribute in extending human access to space while making a step ahead towards the preparation of those technologies required for the future exploration, onsite resource exploitation of planetary surfaces and effectively support manned space mission. The challenge of ADE is to validate, in a MSR SFR like scenario, the capabilities to demonstrate the functionalities of a planetary rover system with very-long traverse capabilities (kilometres per sol) by autonomously taking the decisions required to progress, reduce risks and seize opportunities of data collection. During the planned Mars analogue campaign, the rover will travel independently (goal oriented autonomy) from a starting point (e.g. a lander) towards and end point (say a cache of sample), perform fully autonomous opportunistic science, being this the capability of detecting potentially interesting and unknown/unplanned environmental features within collected images and successive analysis of the same to maximize the collection of planetary data, on the way and return to the lander with the acquired soil sample. This is achieved thanks to the ADE capability to autonomously and safely modify the nominal plan (re-planning mission objectives) along the long traverse path in case of identification of a scientifically interesting feature/s or environmental hazards (slopes, craters) in compliance with system level constraints (power availability /generation and storage), on-board resources (mass memory, uplink budget) and temporal restrictions (sol duration, rover lifetime).