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Scout Rover Applications for Forward Acquisition of Soil and Terrain Data

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Extended Abstract

As opposed to the present mars exploration missions future mission concepts ask for a fast and safe traverse through vast and varied expanses of terrain. As seen during the Mars Exploration Rover (MER) mission the rovers suffered a lack of detailed soil and terrain information which caused Spirit to get permanently stuck in soft soil.

The goal of the FASTER[1] EU–FP7 project is to improve the mission safety and the effective traverse speed for planetary rover exploration by determining the traversability of the terrain and lowering the risk to enter hazardous areas. To achieve these goals, a scout rover will be used for soil and terrain sensing ahead of the main rover.

This paper describes a highly mobile, and versatile micro scout rover that is used for soil and terrain sensing and is able to co-operate with a primary rover as part of the FASTER approach. The general reference mission idea and concept is addressed within this paper along with top-level requirements derived from the proposed ESA/NASA Mars Sample Return mission (MSR) [4]. Following the mission concept and requirements [3], a concept study for scout rover design and operations has been performed [5]. Based on this study the baseline for the Coyote II rover was designed and built as shown in Figure 1. Coyote II is equipped with a novel locomotion concept, providing high all terrain mobility and allowing to perform side-to-side steering maneuvers which reduce the soil disturbance as compared to common skid steering [6]. The rover serves as test platform for various scout rover application tests ranging from locomotion testing to dual rover operations.

From the lessons learned from Coyote II and for an enhanced design, a second generation rover (namely

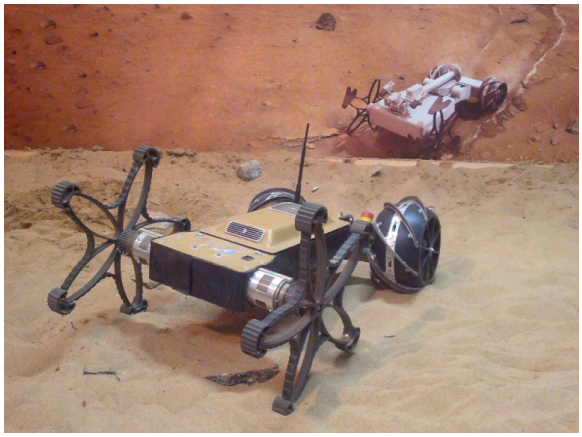

Figure 1: Coyote II: Test platform for scout rover applications

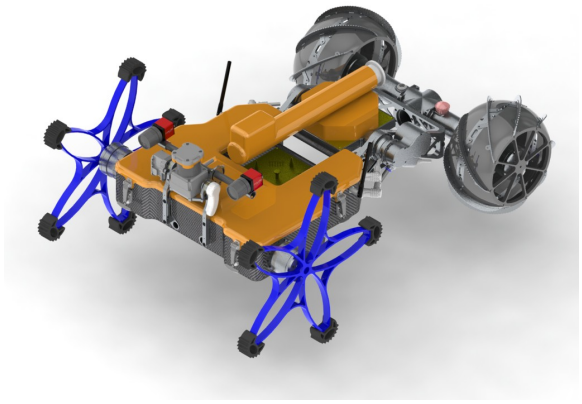

Figure 2: CAD rendering of the full assembled Coyote III scout rover carrying its soil sensor payload

[1]Forward Aquisition of Soil and Terrain Data for Exploration Rover

Coyote III) as shown in Figure 2 is being built. This rover serves as scout rover platform for the envisaged FASTER proof of concept field trials. The rover design is based on the test results gained by the Coyote II trials. Coyote III is equipped with two soil sensors, (1) the Wheel Leg Soil Interaction Observation (WLSIO) system, and (2) a Dynamic Plate (DP). These two soil sensors are designed by [2] and proposed to evaluate the trafficability of terrain in front of the primary rover. While the main body houses the WLSIO system, the DP sensor is mounted to the rover via an electro-mechanical interface (EMI) [7], providing a modular payload bay.

Within the FASTER approach the scout rover will travel ahead of a primary exploration rover acting as 'remote' sensor platform. This requires a specialized software setup for the scout rover, allowing to safely follow a predefined path while conducting soil measurements. The general operational concept of the scout rover acting in a dual rover team is addressed while focusing on the scout rover software implementation to allow autonomous traversal.

A set of integration tests for dual rover operations is planned using the Coyote II and/or Coyote III platforms. Furthermore, it is intended to perform proof of concept field trials with Coyote III as scout rover and the ExoMars breadboard BRIDGET [1] as primary rover. Along with the test results from interface integration testing, the first test results of dual rover field operation may be presented.

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