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THE EXOMARS ROVER MISSION MANAGEMENT SOFTWARE FOR OPERATIONS PLANNING ON MARS

Abstract

ExoMars programme is part of cooperation between ESA and Roscosmos. It consists of two missions investigating the Martian atmosphere, surface and sub-surface searching for traces of past and present life, characterize the Mars geochemistry/water distribution and improve the knowledge of Mars environment. After landing, the ExoMars Rover egresses from the Landing Platform and starts its mission, which foresees the capability of travelling semi-autonomously across the Martian surface. Its nominal mission lasts 218 SOLs. During this period the ExoMars Rover, will complete a series of 'experiment cycles' consisting of the acquisition of terrain samples of particular scientific interest and their detailed analysis. The Exoars Rover executes its challenging mission dealing with different constraints such as limited time and bandwidth for communication to/from Ground through the TGO relay orbiter (no DTE link), unstructured and generally unknown operation environment (variable atmospheric conditions, variable thermal condition), surface hazards cannot be easily detected from the Orbiter Images.

The ExoMars Rover Mission Management Software (MMS) is a software component collecting all the functions that allow Ground Operators to organise the necessary activities to accomplish the mission objectives taking into account above mentioned constrains. The article presents a description of the ExoMars Rover MMS functionalities that are mainly related to the execution of an Activity Plan spanning up to 2 SOLs and the management of alternative Activity Plans basing on the result of predefined validation checks executed at fixed points. The capability allows to foresee a set of alternative plans to be executed by the Rover in case the main plan cannot be completed. This functionality enhances the autonomy deployed on-board to manage contingency cases during the execution of the surface operations by adding the capability to perform adaptive replan after failures or in case resources necessary to complete the nominally planned activities are found less than estimated on Ground.

The article will also describe the provided high level virtualisation of the operation to be executed by Rover and instrument into Robotic Actions/Tasks that request the execution in the right sequence and using the right parameters of all the low level commands that are necessary to execute a defined activity. It will be also provided a description of MMS Architecture with necessary interfaces to other ExoMars Rover Software components and Validation approach. This allow to highlight the possibility of integration of the same application software component in other on board software where similar capability are required.