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Author: Dr. Jorge Ocón
GMV Aerospace & Defence SAU, Spain, jocon@gmv.com

# THE ERGO FRAMEWORK AND ITS USE IN PLANETARY/ORBITAL SCENARIOS

**Abstract**

The European Robotic Goal-Oriented Autonomous Controller ERGO (http://www.h2020-ergo.eu/) is one of the six space robotic projects in the frame of the PERASPERA SRC. Its main objective is to provide an autonomous framework on which to integrate future space robots missions (Deep Space or Planetary Explorations) requiring a high autonomy level (e.g. Exomars or Mars2020). The concept of autonomy applies here to a whole set of operations to be performed on-board with no human supervision; for instance, a Martian rover has to avoid getting stuck in the surface, handling of communication opportunity windows, to occasionally detect serendipitous event (e.g. a rock having a specific property), etc. At the same time, orbital space missions have already successfully applied autonomy concepts on board, in particular for autonomous event detection and on-board activities planning.

ERGO provides a framework for on-board autonomy systems based on the T-REX paradigm and aimed to facilitate an easy integration and/or expansion covering future mission needs; ranging from reactive capabilities (i.e. quick response) to deliberative capabilities (that consider analysing and searching between different alternatives).

In the ERGO framework, the orchestration role is handled by a robotic main controller (Agent) implemented by GMV and based on the experience and expertise obtained from previous autonomy research programs, such as the GOAC and GOTCHA projects. The Agent implements an efficient execution environment for handling different autonomy levels (E1-E4) and capabilities, in which different control loops are coordinated during its deliberation and execution phases in runtime, guaranteeing the harmonic execution of a set of reactive and deliberative behaviours.

The ERGO Core framework is also provided with a newly developed planning system (STELLAR PDDL-based planner). All ERGO components are designed having in mind a Model-Driven-development approach (MDA) by using the TASTE technology; a middleware selected for ESROCOS, a project of the PERASPERA SRC aimed to the development of a robotic operating system able to be used in space applications. In addition to these capabilities, ERGO also uses the BIP Framework to integrate nominal and error models, and to simulate the behaviour of the system in presence of faults.

The paper will discuss the use cases that will test the capabilities of the ERGO framework; as well as its possible use in different space applications. An overview of the evolution of the design for the ERGO system will be provided; and the future extensions planned for it.