

SPACE & TERRESTRIAL

Autonomous Smart (AI) Decision-Making Systems

What is *GMV Brain*?

GMV Brain is a pre-qualified high-performance software framework designed to empower autonomy of robotic systems -both space and terrestrial- through advanced autonomous decision-making capabilities. Built upon the proven heritage of the **ERGO** project (EU Horizon 2019), **GMV Brain** represents a significant evolutionary leap, consolidating GMV's state-of-the-art space robotics expertise into a robust and mature product ready for Category-B software qualification. **GMV Brain** has been engineered as a flexible, configurable and extensible solution for covering ambitious space and terrestrial missions demanding high levels of autonomy.

For further information:

If you have an application for **GMV Brain** and would like more information or to discuss your requirements, please contact the team: gmvbrain@gmv.com

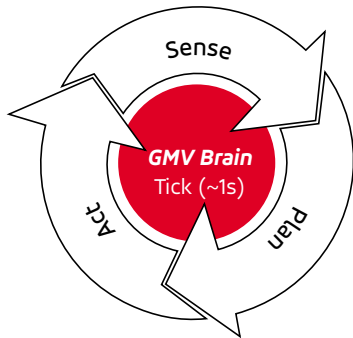


How does **GMV Brain** work?

GMV Brain autonomy framework is designed as a layered architecture (executive, deliberative and functional) which allows the framework to be easily customized to any new mission.

The outcome of this customization is a **GMV Brain** software instance or orchestrator fully aligned with mission/subsystem **CONOPS**, specifications and I/Fs, and split into two major components:

- **Agent**; an autonomous goal-oriented controller based on the well-established Sense-Plan-Act paradigm. It implements both reactive (executive) and deliberative (planning) behaviors on each (configurable) execution period (Tick).
- The Agent orchestrates the mission or subsystems by periodically implementing the following processing sequence:
 1. **Sense**: The Agent checks and processes new mission goals (from ground or other spacecraft/rovers) and periodic feedback statuses from the functional layer.



2. **Plan**: The Agent generates a plan to achieve and monitor the high-level mission goals while considering its environment. If unpredicted events are detected during the “sense”, the Agent dynamically reacts by generating a new plan (re-planning) or by executing the specific FDIR solutions.
 3. **Act**: The agent executes the nominal plan or recovery the actions by issuing low-level commands to the functional layer.
- **Functional Layer**: Responsible for the low-level interaction with all SW & HW subsystems and components (i.e. GNC, Thermal, Power, robotic arms, sensors, standard interconnects, refuelling units, etc.).

Product roadmap

GMV Brain is currently at **TRL6**, and it has been selected in 2026 by ESA (InSPoC), the European Commission (ISOS 4I), and the European Defence Fund (EDF) to provide autonomous capabilities to their new and ambitious space programs. GMV's objective is to continue increasing the system's maturity, reaching TRL8 by 2030 or sooner.

Key features of **GMV Brain**

- Designed from the ground up to enable fast and straightforward customization, tailoring and extension when required.
- Applicable to orbital, planetary and terrestrial missions.
- Goal oriented, supporting E1-E4 ECSS autonomy levels.
- On-board planning and replanning for E4 autonomy.
- Applicable to single robot/satellite and multi-robot or constellations.
- Available in different programming languages.
- Well documented and compliant with Space product quality assurance (PA) standards.
- Integrable with different ROCS, ROS and middleware.
- Compatible with a wide range of HW platforms and Operating Systems.
- Proven track record of V&V excellence across 10+ projects and counting.
- Supports OTA (Over The Air) SW updates.

Data sheet

Type	Highly customizable Autonomy Software Framework (ASF) for implementing Autonomy in space and terrestrial subsystems and applications
Autonomy Levels	Supports all ECSS autonomy levels (E1-E4), from immediate and teleoperated TCs (E1) to goal oriented TCs (E4)
Controller's reactiveness	Configurable (1Hz by default)
Deliberative planning and replanning	Two options for smart decision taking: ▪ Deterministic PDDL planner based on symbolic AI algorithms ▪ Non-deterministic optimizer based on AI constraint solver algorithms
Dynamic replanning and FDIR	Yes, dynamic replanning supported following unexpected event occurrences, newly received goals and FDIR events handling
Multi-Robot/Sat	Yes, supports collaboration and cooperation between different robots, different satellites and constellations. Applicable also to hybrid Robot-Human CONOPS.
Performance	Low CPU and memory consumption
Communication Middleware	ECSS PUS (CCSDS Space Packets), NanoSat MO Framework (CCSDS Space Packets), ESROCOS, TASTE, ROS1 and ROS2
Operating Systems	Ubuntu, PetaLinux, Xilinx, RTEMS, PikeOS and Windows (terrestrial)
HW platforms	LEON, ARM, Xilinx and PC (terrestrial)
Applications	In Space (Orbital) ▪ Mission/Payload Vehicle Manager (MVM/PVM) ▪ ISAM/IOS/OOS; inspection, rendezvous (CPO), robotic operations (capture, assembly, upgrade and/or repair, refuelling, etc.), relocation, EoL and ADR ▪ ISAM/OSAM; in-space robotics manufacturing and assembly space stations, long solar panels ▪ Earth Observation and Communications On Surface Planetary/Terrestrial exploration ▪ Surface exploration (Moon, Mars, Earth, mines, caves, nuclear and fuel plants, others) ▪ Sample return missions (e.g. MSR) ▪ Assembly and construction of future planetary ISRU and astronauts-supporting infrastructures ▪ Planetary refueling stations On Ground ▪ Digital Twins and EGSE Simulators.