

G-THEIA1+ on-board smart camera

G-Theia1+ is GMV's embedded space camera including computer-vision accelerated processing unit on-board.

High-performance on-board, rad-hard solution, constrained volume, mass, and power. Cost-affordable camera solution which offers in-flight reconfiguration of programmable HW to use the camera in combination with different vision-based applications.

It is being validated for space-based surveillance system in the active-debris removal domain, as a stand-alone solution including sensing part, avoiding mechanical operation (minimizing in fact any operation), and including on-board processing with the purpose of fast-response identification and reduction of downlink data.

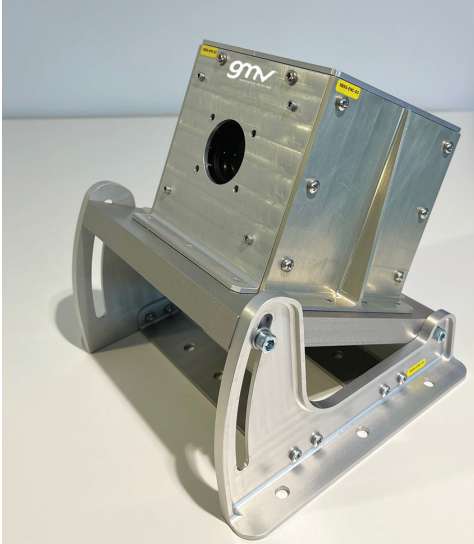
All the computationally intensive functions are programmed or dynamically reconfigured to include the necessary VHDL accelerators in large space-qualified FPGA.

It includes a second camera input to create a double optics camera, for instance combining a NAC and WAC re-using processing.



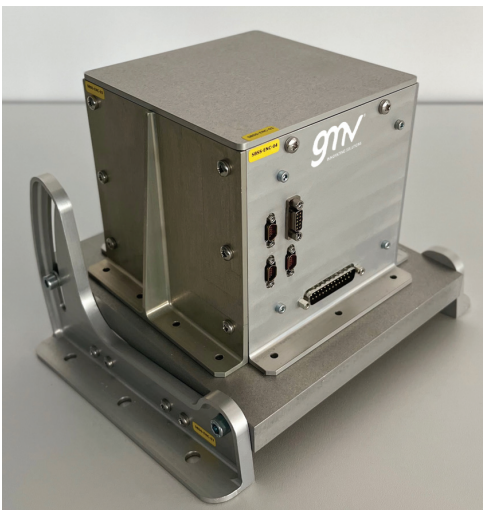
How does **G-THEIA1+** work?

G-THEIA1+ is GMV's embedded space camera including computer-vision accelerated processing unit on-board. It is a smart sensor conceived as a modular design composed of four boards: sensor board, camera & interfaces controller, computer-vision accelerator co-processor and power distribution board. It includes camera enclosure, thermal dissipation, baffle and baseplate mounting for different tilting configurations.



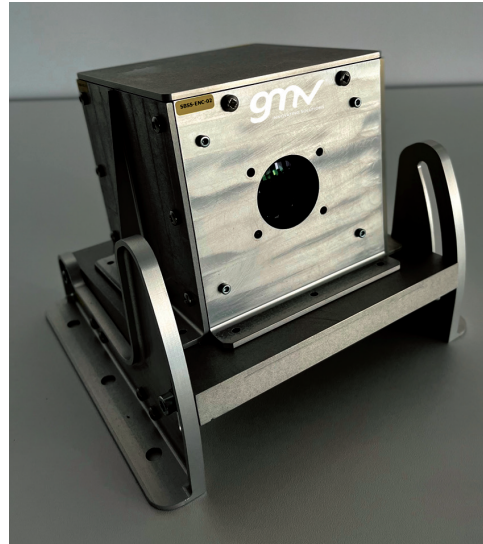
Characteristics:

- 12-bit monochrome CMOS 1024x1024/2048x2048 images
- Data I/F: SpaceWire 90-100 Mbit/s (CCSDS/PUS TMTC)
- Application memory and programming non-volatile
- Computer-Vision IPs on FPGA-based co-processor
- Radiation-hardened components
- Operational Temperature: -30°C to +80°C
- Operational Power Consumption:
 - Camera only <4W
 - Camera + Co-processor <14W
- Power I/F: 28V +6V/ -8V unregulated bus
- Mass budget: 1200 g including enclosure and electronics
- Volume budget: 150mm x 140mm x 150mm



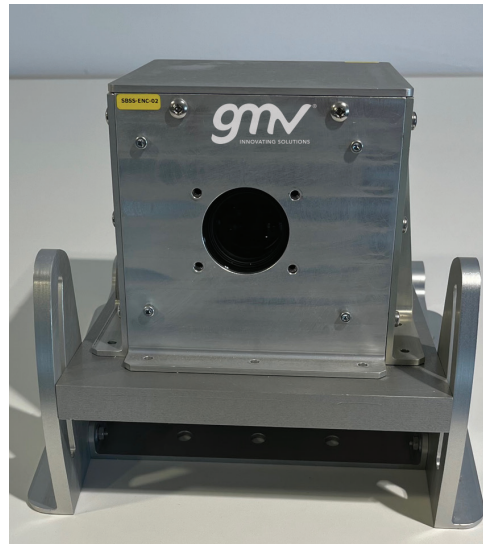
Key Features

- Real-time imaging solution for space
- Data processor and camera embedded solution in one
- Prototype for Space-Based Surveillance System also used for vision-based navigation
- Includes possibility for a secondary camera, allows missions requiring different distance detection of targets (different FOVs)
- Each optic allows 2 FOVs applying cropping and/or binning techniques
- TRL6



General Considerations

The readout image acquisition, image corrections and camera interfaces are implemented in a dedicated FPGA.



The utilization of two FPGA within **G-Theia1+** (one for sensor control plus interfacing and other for executing image processing algorithms) allows to dedicate second FPGA to computer vision tasks necessary for accelerated functions, operating in parallel to the first FPGA.