

Constellation On Board Computer

The Constellation On Board Computer (cOBC) is a complete subsystem entirely based on commercial components to enable high performance and short lead times at an affordable price, still delivering the high reliability Beyond Gravity is well known for. The cOBC provides a host of functions including on-board processing, GNSS receiver, ground communication and both platform and payload interfaces. The computer is fully redundant and offers flight proven fault detection, isolation, and recovery (FDIR) as well as radiation mitigation to provide a highly reliable solution.

Key features

- Fully cross-strapped **dual redundant architecture** with hot-redundant reconfiguration functions allowing fully user defined reconfiguration sequences
- **Highly performant** processor and extensive I/O support that can be tailored according to customer needs
- Manufacturing highly automated and optimized for **large quantities**
- Optional integrated GNSS receiver, **NavRIX Integral**, with support for GPS and Galileo. Accuracy of down to 1m 3D RMS
- **Full TM/TC chain** compliant to CCSDS format including optional AES256 encryption/decryption and authentication

Processing function

- Power Architecture ©
 - 2x e500Core @ 800 MHz
 - 3600 DMIPS
 - 1600 MFLOPS
 - 32 KB L1 instruction cache with parity
 - 32 KB L1 data cache with parity
- 512 KB L2 cache with ECC
- 1 GiB DDR3 processing memory with ECC
- 4 GB non-volatile storage with ECC

Supported I/O options

- Standard Power and Drive (PDIO) boards *
 - Analogue Acquisition
 - Digital and Relay Status
 - Temperature Acquisition
 - Secondary Voltages
 - Stepper Motors
 - Magnetorquers
 - Magnetometers
 - Sun Sensors
 - Pulse Commands
- Standard Chemical Propulsion (PROPE) boards *
 - Heater Control
 - Temperature Acquisition
 - Pressure Transducer
 - Latch Valves
 - Flow Control Valves
- Custom I/O boards

* See dedicated Fact Sheets for PDIO and PROPE board capabilities

Core Interfaces

- 2 x 2 TM Encoder RS422
- 2 x 2 TC Decoder RS422
- 2 x 1 Ethernet interfaces
- 2 x 6 SpaceWire links (2x1 hot powered)
- 2 x 3 CAN buses
- 2 x 18 RS422/RS485 UART interfaces
- 2 x 16 GPIO
- 2 x 4 Sync Pulse output
- 2 x 1 Separation strap inputs
- 2 x 2 External alarm inputs
- 2 x 1 M1553 BC / RT (option)
- 2 x 1 External Encryption Unit (option)

Flexibility: SpaceWire interfaces can be traded with RS422/RS485 interfaces depending on mission needs.

Core functions

- Full Telecommand/Telemetry stack (CCSDS)
- Allows user defined FPGA IP integration
- Automatic and programmable reconfiguration function in hardware
- Safe-guard Memory
- On-board time keeping in synch with GNSS
- Internal AES256 encryption, decryption and authentication function (option)

NavRIX Integral (option)

- Tracks GPS L1 C/A and Galileo E1 B/C signals and provides position, velocity and time
- Accuracy down to 1m 3D RMS with use of dynamic filtering
- Pulse Per Second (PPS) time error < 100ns RMS
- Operation without need of external LNA

Above performances guaranteed in LEO orbit

*) See dedicated Fact Sheet for NavRIX Integral capabilities

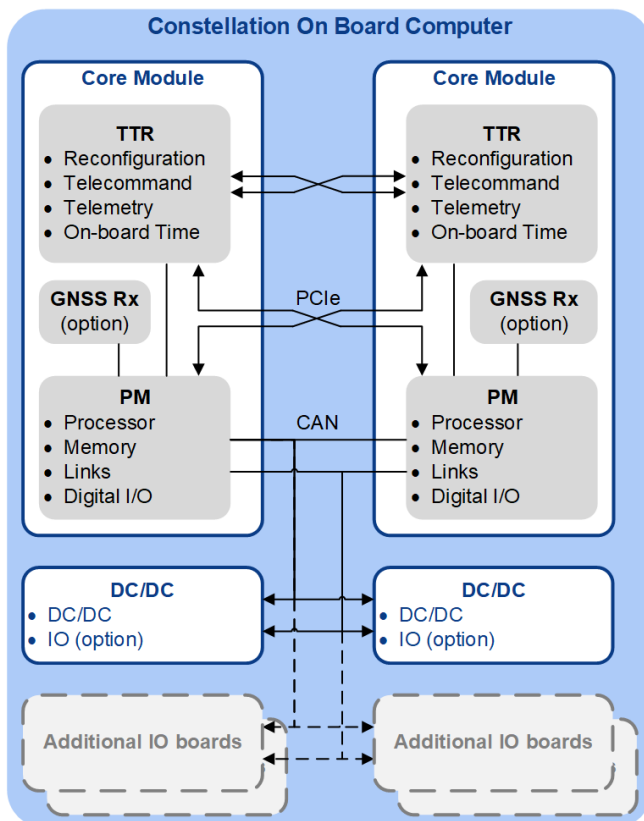
SW development environment

- Integrated software development environment
- Advanced software debug tool chain
- Fast Ethernet debug link
- Operating system independent boot and driver software
- Cross compiler suite
- Board support package for operating systems and hypervisors

Reliability

- Reliability: 99% (10 years, 30°C base plate)
- No single-point failures
- Fully dual-redundant architecture

Architecture



Radiation tolerance

- Latch-up free (tested to 53 MeVcm²/mg)
- Component Total Ionising Dose > 30 kRad
- All memories with ECC
- 3 way voting (TMR) within FPGAs
- LEO, MEO, GEO and HEO orbits suitable
 - 10+ years in LEO without additional shielding
 - Additional shielding for long mission times in challenging orbits

Environment

- Temperature -20 to +60°C
- Random vibration 15g RMS
- Shock 2000g @ 2000Hz

OS

- VxWorks
- PikeOS
- Planned: RTEMS and Linux

SWaP

- Volume 300 x 119 x 239 mm³ (excluding feet)
- Power consumption ~26W (nominal)
- Mass 5,4 Kg

Beyond Gravity computer heritage

- > 3500 failure free equipment years in orbit
- > 300 Launcher On-Board Computers
- > 120 Satellite Data Handling Systems
- Latest OBCs in orbit: Hispasat 36W-1, Göktürk 1A, ExoMars Trace Gas Orbiter, Galileo FOC 9-14, Sentinel 2A & 2B