



Modular Architecture for Robust Computing

Within the European Space Agency's Module Architecture for Robust Computing (MARC) project, SEA is responsible for the complete hardware architectural design and development

The primary goal of the MARC project is to raise the Technology Readiness Level of the concepts and architectures for multi-processor fault-tolerant on-board processing systems. The manufactured hardware is required to demonstrate the essential features of a fault tolerant, high availability distributed avionics system for Spacecraft based on a SpaceWire network, to a point where it is considered to be a product that is "one-step-from-flight".

The main applications foreseen for this architecture include missions requiring extensive distributed fault-tolerant on-board processing capabilities, such as advanced payload data processing systems and highly autonomous space exploration systems.

The existing MARC hardware design provides a scalable solution that can meet the demanding needs of future missions. For example, the SpaceWire network architecture is scalable to include new functions and to provide duplicate paths to achieve the level of redundancy needed for each specific mission.

An important aspect of the demonstrator hardware is that it permits the design to be upgraded to a fully space qualified system without any architectural changes. The hardware design is compatible with space qualified software standards (ECSS-E-40) and the Spacecraft Onboard Interface Services (SOIS) communication standards as mapped onto SpaceWire.

The FDIR handling features and associated test and validation activities are focused on the robustness of the SpaceWire network and its ability to reliably provide a medium for distributing both data and commands. The integrity of the commanding infrastructure will be assessed in terms of guaranteed delivery and response while still complying with the stringent requirements imposed on command delivery, detection and execution latency by time critical embedded systems used for space applications.

It is anticipated that the outcome of the MARC FDIR and system performance testing will show that the SpaceWire bus can be adopted as an effective replacement for the MIL-STD-1553B bus to communicate both high criticality commands and data in a Spacecraft environment.

