# Methodology and Assessment for the Applicability of ARINC-664 (AFDX) in Satellite/Spacecraft On-Board Communication Networks

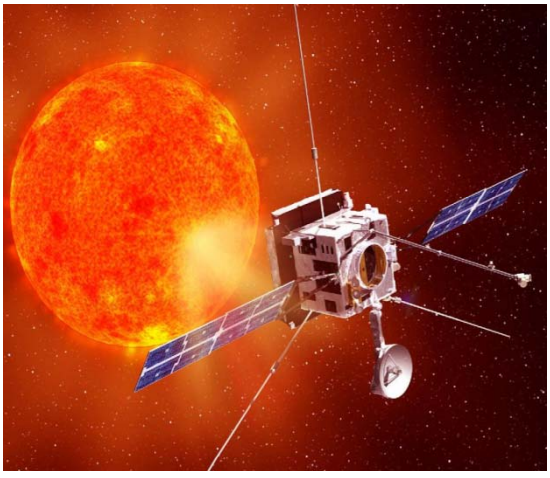
## *Key Innovation*

ARINC-664 Part 7 specification (AFDX) provides the enabling technology for network I/O in Integrated Modular Avionics (IMA) architectures, since it is designed based on the IMA concepts and requirements (ARINC 653 specification), which is already an ESA roadmap (i.e. IMA4Space project).

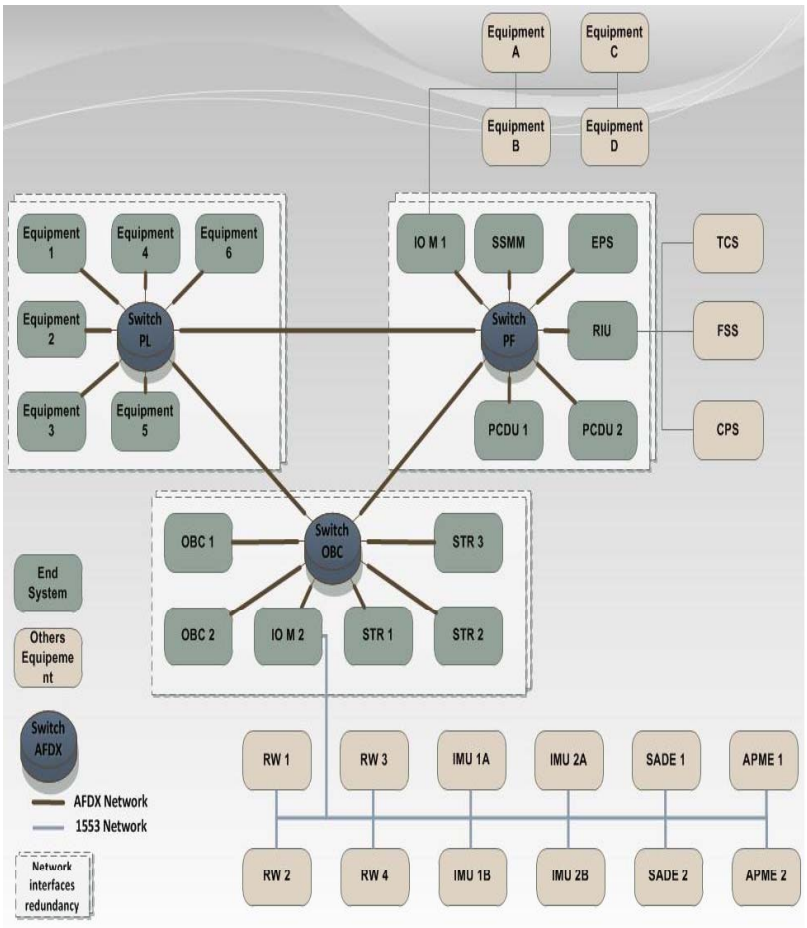
In order to avoid the lack of flexibility, scalability, reliability and to improve security and qualification process in **spacecraft on-board data networks**, ARINC-664 (AFDX) could be the solution by offering hardware assisted service, determinism and standardisation as a minimum. Additionally AFDX has been validated and is in use today in the European avionics industry, which has in some areas quite similar requirements with the space domain, in which could be more easily adopted (over SpaceWire, or directly Ethernet for space).

Together with an intrinsic improvement of systems performance, product assurance and reliability, applying the concept of AFDX into spacecraft on-board system is expected to provide multiple benefits at all industrial level such as standardized and configurable systems, products and technology elements, easier and faster integration of complex systems, larger procurement basis, and easier sub-contracting scheme.

**The MISSION project aims to apply the IMA avionics concept on spacecraft, together with highly deterministic interconnected on-board network (ARINC-664, AFDX). It will constitute an enabling technology harmonization and standardization action.**



©ESA—Artist view of Solar Orbiter




AFDX Use Case Network Topology

## *MISSION Approaches*

- **Define** the methodology for applying ARINC-664 (AFDX) in on-board spacecraft/satellite communication networks

- **Define** the interfaces/modifications to existing on-board I/O subsystems

- **Implement** and **validate** an experimental prototype ARINC-664 (AFDX) network for spacecraft on-board communications

## *MISSION Objectives*

❑To perform a state-of-the-art (SOTA) analysis for on-board data networks architectures, concepts and requirements in the space sector.

❑To analyse the requirements for introducing ARINC-664 (AFDX) in satellite/spacecraft on-board data networks.

❑To perform simulations for the applicability of ARINC-664 (AFDX) for space data networks.

❑To design and develop ARINC-664 (AFDX) configuration and traffic profiles for space.

❑To develop and validate a representative ARINC-664 (AFDX) over Ethernet ground demonstrator of the on-board architecture.

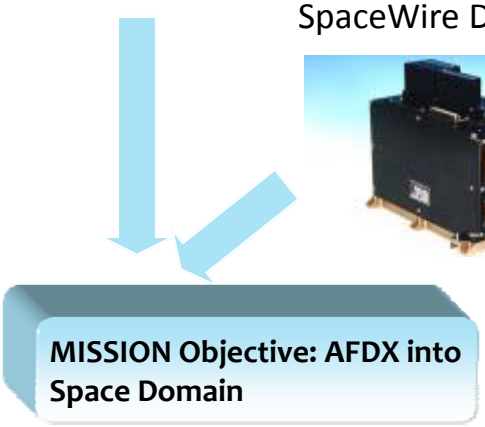
❑To develop and validate a representative ARINC-664 (AFDX) over SpaceWire ground demonstrator of the on-board architecture.

❑To widely disseminate the knowledge to be generated by the project and promote the adoption of the MIISSION approach in the space sector.

❑To exploit the MISSION results for the benefit of the participating SMEs.

AFDX in Service

SpaceWire Device ©ESA




## *MISSION Benefits*

To date, there are many European SMEs developing products and solutions around the ARINC-664 (AFDX) and IMA technology in the avionics domain. The benefits MISSION aims to offer:

**B1**: Perform a feasibility study and validation (through simulations and demonstrators) towards the migration of the AFDX technology from the avionics domain to the space domain.

**B2**: Pave the way for the entire European AFDX community to exploit this know-how in the space market, thus providing them with significant competitive advantages and offering new business opportunities in the space sector.

**B3**: Allow the development of new Software, Hardware subsystems, solutions and products to be developed for the space market, thus its impact to the European Hi-Tech industry is expected to be high.

## *MISSION Expected Results*

**R1** : The representative ARINC-664 (AFDX) over Ethernet ground demonstrator of the on-board architecture and the associated validation results.

**R2** : The representative ARINC-664 (AFDX) over SpaceWire ground demonstrator of the on-board architecture and the associated validation results.

**R3** : Simulation results providing recommendations for the applicability of AFDX in spacecraft/satellite on-board data networks.

**R4** : The consolidated evaluation results and roadmap for the deployment of ARINC-664 (AFDX) in the space sector.

**R5** : A methodology for applying ARINC-664 (AFDX) in spacecraft/satellite on-board data networks.

**R6** : The ARINC-664 (AFDX) configuration and traffic profiles for the representative on-board architecture.

## CONTACT

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