SpaceWire for Operationally Responsive Space as part of TacSat-4

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Short Paper

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ABSTRACT

The rapid integration, launch, and deployment of satellites in response to emerging needs has been a focus of various organizations. This concept has been termed "Operationally Responsive Space" (ORS) by the United States Department of Defense(USDOD). One vision of ORS calls for the positioning in a depot of interchangeable satellite payloads and spacecraft buses with a common interface. Upon direction to deploy a particular mission, the appropriate payload would be selected and integrated with a bus, and the space vehicle would be launched. To support such a system, standardized hardware and software interfaces are needed between the payload and bus. For the development of ORS Bus Standards, the SpaceWire standard (ECSS-E-50-12A) has been specified as part of such a payload-bus interface for high rate data. Data interfaces can be modelled in a number of ways, such as with the OSI layer model. SpaceWire offers the appeal of standardization of physical, data, and network layers. The TacSat-4 satellite, part of the USDOD TacSat experiment series, is intended as a combination of a prototype Standardized Bus for small satellite national security missions and an example payload. This implementation includes an instance of the SpaceWire interface called out in the ORS Payload Developer's Guide. For the bus and payload SpaceWire interfaces, existing SpaceWire logic designs were used, notably the gate array core developed by NASA GSFC. This was intended as a demonstration for ORS that use of existing and freely available intellectual property can streamline design, enhance reliability, and empower instrument and payload vendors.