CASE STUDY

Successful Integration of a Launcher Video Telemetry System Using COTS Equipment

CURTISS-WRIGHT

DEFENSE SOLUTIONS

Challenge

- Difficult environmental conditions with a reliable solution required
- Commercial application demanding high performance at a low cost
- Flexible system needed to meet future applications with different mission profiles

Solution

- Systems proven in harsh environments
- Commercial off-the-shelf (COTS) equipment approach with some adaptation (Space COTS)
- Modular hardware approach

Results

- System successfully passed qualification testing
- Technical requirements, schedule, and budget restrictions achieved
- Adaptable system that accommodates functional changes or additions

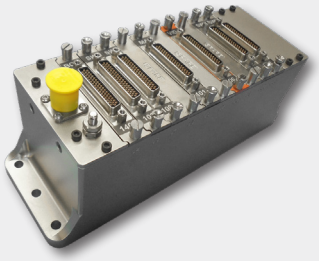
Challenge

Réaltra Space Systems Engineering is an Irish company dedicated to the design, development, and manufacturing of cost-effective space electronic systems using cutting-edge technologies. Réaltra was awarded a contract to develop a launcher video telemetry system (LVTS) that will provide the on-board live video telemetry for a launcher that is anticipated to fly in 2021. Réaltra's team of space industry experts needed a solution that could meet a number of difficult challenges, including a harsh environment, a tight budget, short schedule, and the need for system flexibility.

The LVTS needed to deliver HD video during all phases of the launcher's mission, from leaving the ground to inserting the payload into orbit. The end customer wanted a system capable of both recording the video and broadcasting live during all phases. While live streaming will not always be required, the first launch would be broadcast live, so reliability under harsh conditions was extremely important. The successful transmission of such high bandwidth data is particularly difficult given the vehicle quickly accelerates to multiple times the speed of sound (eventually to some 19,000 mph / 30,000 kph) and reaches a destination thousands of kilometers from the launch site.

To achieve this feat, the equipment needs to be both reliable and high performance. The harsh environmental factors include mechanical (vibration and shock), thermal (rapid temperature changes and heat dissipation difficulties in a vacuum), and radiation. While the mission profile means equipment will only be exposed to a high-radiation

HDC-430-1 Airborne High Definition IP Ethernet Camera



KAM-500 Data Acquisition Unit - 9 slots

environment for hours (as opposed to days or weeks for missions to the international Space Station (ISS) for example), it is still an issue that needs to be mitigated against. These conditions are particularly challenging, as the system needs not just to survive, but to operate reliably during the whole mission.

Another factor which must be considered for all space equipment is the size, mass, and power limitations. Equipment needs to be as small and light as possible, while utilizing as little power as needed to meet the performance requirements. The final limiting factor was cost. The vehicle manufacturer needed to operate within the scope of very limited budgets that are now commonplace with the commercialization of the sector, and this means suppliers must be highly cost effective.

Solution

Given the reliability requirements, Réaltra selected Curtiss-Wright to provide the main components of the LVTS thanks to their proven heritage in providing systems for space applications. The system they chose consisted of a HD Ethernet (IP) video camera (HDC-430), a modular data acquisition system (DAS) (Acra KAM-500), and an RF transmitter (TTS-5549-1) that have been integrated with a Réaltra developed intelligent power distribution unit and battery power source.

The HDC-430 is a rugged camera designed for use in applications that require either H.264 or H.265 compression. It can connect directly to any Ethernet switch and can be configured for single or multiple video output streams (e.g., to send a high-bandwidth stream to a recorder and a lower one to a transmitter). The KAM-500 system included a switch module that connected to the camera, a processor module (MAT/101) that hosted custom software used to manage operational aspects of video (e.g., timing and modes of video system), and a CCSDS encoder module (ENC/112) used to format the data for the transmitter.

All of the components were available as COTS products, which helped keep costs down since no specific new technical developments were needed to meet the end-user requirements apart from some additional ruggedization where required. This also meant a very fast delivery time so the components could be integrated into the LVTS for qualification testing.

Results

The system components from Curtiss-Wright were delivered on time to Réaltra and the LVTS successfully passed environmental tests. The LVTS is being delivered by Réaltra to the end customer for flight opportunities in 2021. The past heritage of such systems and Réaltra's proven track record in combining COTS and traditional approaches for the development of highly reliable solutions provide confidence that the LVTS system will perform reliably in future space missions.

The modularity of the solution means there is a core system that can be modified relatively quickly and easily. This provides the desired flexibility to meet the needs of other platforms by modifying an already proven system rather than building a new one from the ground up. For example, more cameras could be added by simply connecting them to the switch module, additional data could be telemetered through intelligent management of available bandwidth, and, using the appropriate data acquisition modules and alternative transmitter/antenna combinations, different power or transmission requirements could be met.

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