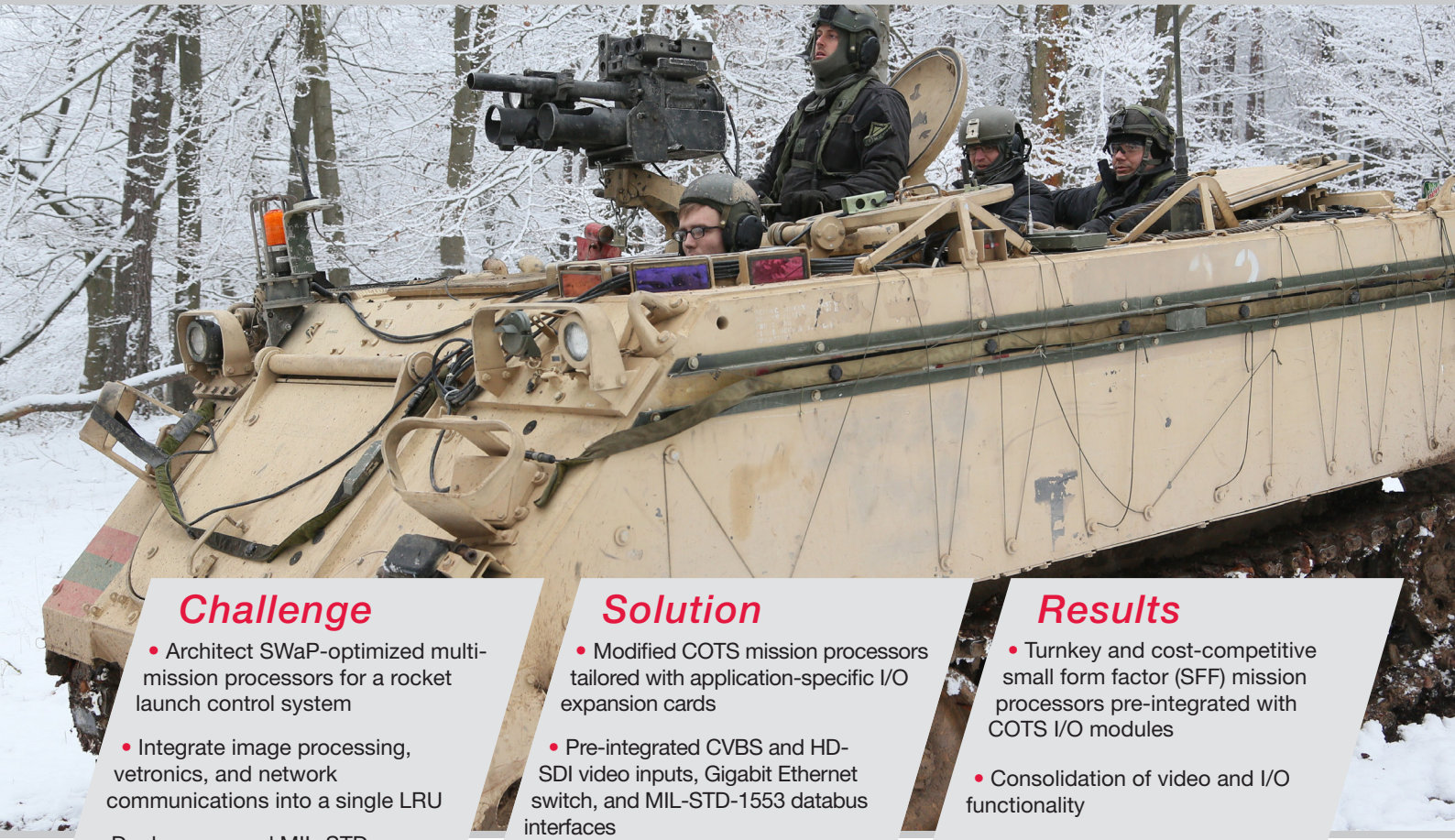
CASE STUDY

MCOTS Networked Video Processor Enables Laser-guided Rocket System

CURTISS-WRIGHT

DEFENSE SOLUTIONS



Challenge

- Architect SWaP-optimized multi-mission processors for a rocket launch control system
- Integrate image processing, vetronics, and network communications into a single LRU
- Deploy a rugged MIL-STD-compliant COTS solution with no NRE

Solution

- Modified COTS mission processors tailored with application-specific I/O expansion cards
- Pre-integrated CVBS and HD-SDI video inputs, Gigabit Ethernet switch, and MIL-STD-1553 databus interfaces
- Pre-qualification to MIL-STD-810/461

Results

- Turnkey and cost-competitive small form factor (SFF) mission processors pre-integrated with COTS I/O modules
- Consolidation of video and I/O functionality
- Rugged design to satisfy environmental test requirements

Challenge

The technology behind laser-guided "smart launchers" has advanced exponentially in the last few decades, making them increasingly accurate and cost-effective defense solutions. Nevertheless, even the most advanced systems must provide the highest levels of situational awareness to their human operators. Any disruption to the flow of information between the operator and launcher can have dire consequences.

A major weapons manufacturer located in Western Asia required Intel®-based mission computers and network switches to form the backbone of a new firing control console for a laser-guided rocket system. Designed for deployment on a variety of attack helicopters and ground vehicles in support of its foreign military sales (FMS) customers, the manufacturer positioned the rocket system as delivering "low-cost precision strike" capabilities. To meet this goal, the system integrator's design team sought affordable solutions that fit within the required size, weight, power and cost (SWaP-C) constraints.

While the embedded market offered numerous mission computers and switches to choose from, the design team was concerned that deploying multiple bulky LRUs would be required to support all of the fire control console's I/O and network requirements. Their ideal solution would comprise two small form factor LRUs. One LRU to seamlessly communicate with multiple sensors and cameras, the Human Machine Interfaces (HMI), and the rocket system itself via traditional PC I/O interfaces, including Ethernet, serial, USB, and multiple high-definition (HD) display outputs. The second LRU would similarly support a MIL-STD-1553 databus, multiple CVBS and HD-SDI video capture inputs, and optically isolated RS-422 channels, but also include a managed Gigabit Ethernet (GbE) network switch. Faced with SWaP-C constraints and unique system requirements, the design team's desire for a two-LRU solution seemed unachievable. Their best path forward appeared to be a modular multiple LRU solution with scalable functionality that could grow over time to support their specific design.

MCOTS DuraCOR 8042 Mission Computer

Because the customer's rocket system was designed for integration into very demanding ground and airborne vehicles, its control solution would also have to be extremely rugged and reliable. To lower program risk, the design team sought a solution that had been previously tested and qualified to the extreme demands of the MIL-STD-810G, MIL-STD-461F, MIL-STD-1275D, MIL-STD-704F and RTCA/DO-160G standards for environmental, power, and EMI compliance. This testing would also need to address the wide range of conditions applicable to helicopter and wheeled/tracked vehicles.

Solution

Curtiss-Wright showed the design team that their desired two-LRU solution could be successfully achieved using pre-validated low-risk Parvus® DuraCOR® 8042 mission computers. The rugged, compact and modular mission computer made it the ideal solution for the firing control processors, providing the platform with the necessary processor performance and the system I/O support needed by the laser-guided rocket system. The unit's 5th gen Intel Core™ i7 ("Broadwell") quad-core processor delivered the compute power that the customer sought, and the DuraCOR's open architecture modularity allowed the required add-on I/O, video, databus, and networking modules to be pre-integrated at the factory as a turnkey solution.

Both of the 8042-based LRUs were developed leveraging Curtiss-Wright's cost effective quick-turn application engineering MCOTS services. These variants successfully and affordably integrated rugged off-the-shelf mini-PCIe and PCIe104 modules to deliver program-specific functionality without NRE. Add-on modules were integrated into bolt-on expansion I/O segments pre-fitted with MIL-DTL-38999 connectors. Both units received a 2-channel MIL-STD-1553 databus interface module, an RS170 framer grabber Mini-PCIe module supporting two Composite Video (CVBS) frame grabber inputs, an 8-port RS-422 optically isolated serial module, and two separate PC104 HD-SDI frame grabber cards, each providing an HD-SDI video input. One of the variants also included a 20-port Parvus DuraNET 20-10 fully managed GbE switch to fulfill the rocket system's network backbone requirements.

The comprehensive set of functionality packed into these mission computers enables the rocket system to receive data feeds from multiple sensors and deliver them live directly to the operators on the system's triple display outputs. Packaged in dust-proof, watertight (IP67-rated) and fanless aluminum chassis, the reliably designed units also featured an advanced power supply compliant with both ground vehicle (MIL-STD-1275) and aircraft (MIL-STD-704F, DO-160G) deployment requirements. Each MCOTS box leveraged the DuraCOR 8042 qualification testing already performed to a comprehensive set of MIL-STD-810G and MIL-STD-461F environmental and EMI tests conditions (including -40 to +71°C operating temperature and tracked vehicle-grade vibration and shock).

Results

The selection of highly reliable, rugged MCOTS DuraCOR mission computers, including a variant integrated with a DuraNET Ethernet switch, enabled the rocket manufacturer to successfully implement a highly flexible, robust solution for their laser-guided rocket system's fire control console.

These MCOTS solutions provided the rocket system with the CPU performance needed for general-purpose processing, along with the high-speed, high-resolution networked video and specialized I/O interfaces needed to integrate with a variety of platform sensors.

These robust mission processor LRUs elegantly incorporated multiple video frame grabbers, expanded serial port functionality, deterministic 1553 I/O, and a GbE network switch into a small form factor chassis. The result was a SWaP-C optimized solution ideal for deployment on both helicopter and ground vehicle platforms. Complying with the requisite ruggedness and environmental qualifications, Curtiss-Wright's Parvus DuraCOR 8042 mission computer is able to operate in almost any environment, enabling the rocket launch system's current use in multiple customer programs and the readiness to support future needs.

Learn more about the MCOTS DuraCOR 8042 Mission Computer.

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