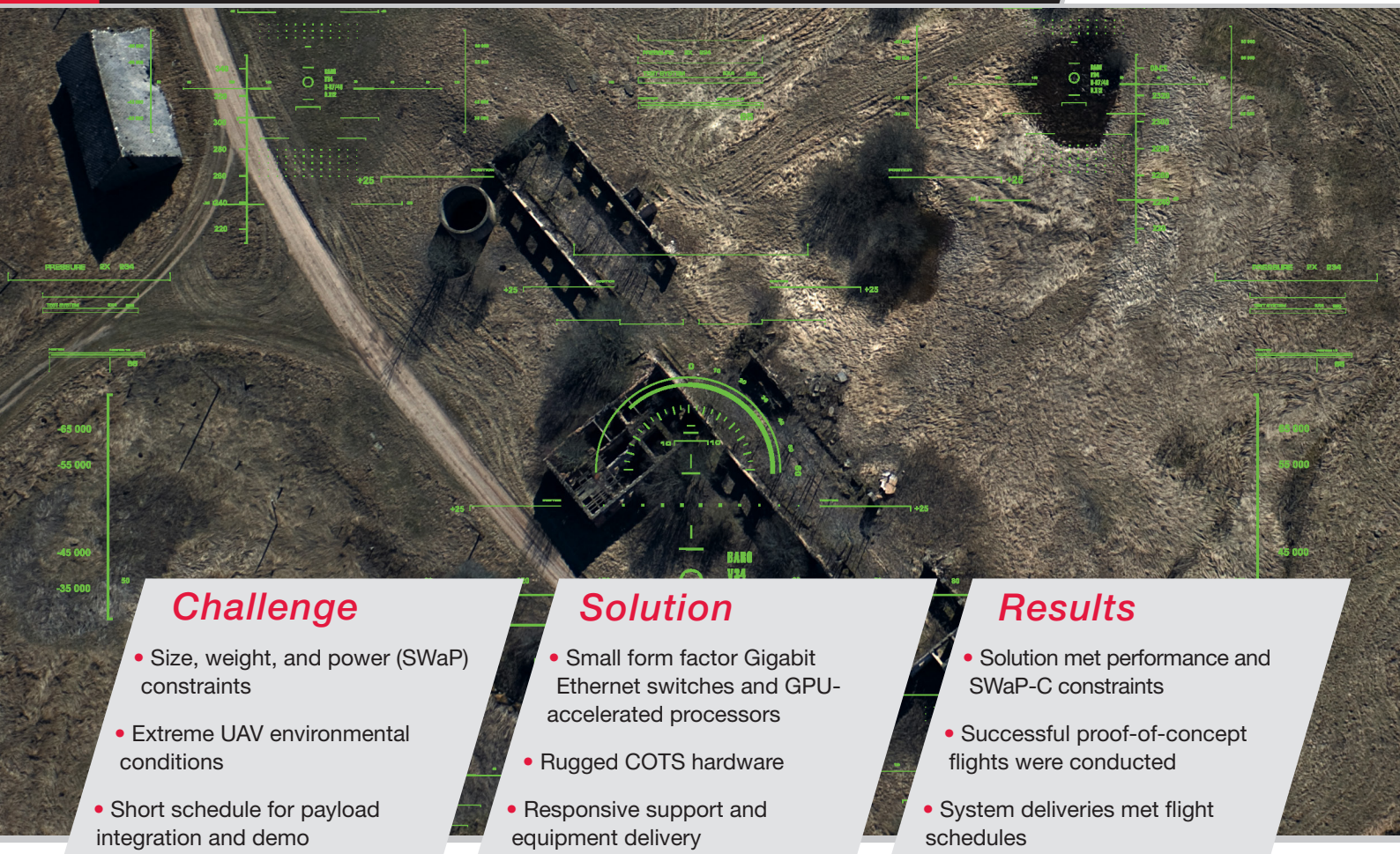
CASE STUDY

USFF Mission Processors and Network Switches for ISR UAV Targeting System

CURTISS-WRIGHT

DEFENSE SOLUTIONS



Challenge

- Size, weight, and power (SWaP) constraints
- Extreme UAV environmental conditions
- Short schedule for payload integration and demo

Solution

- Small form factor Gigabit Ethernet switches and GPU-accelerated processors
- Rugged COTS hardware
- Responsive support and equipment delivery

Results

- Solution met performance and SWaP-C constraints
- Successful proof-of-concept flights were conducted
- System deliveries met flight schedules

Challenge

As unmanned vehicles become more powerful and complex, their electronics payloads must adapt to match new mission objectives. This often forces aerospace and defense system integrators to push for reductions in size, weight, power, and cost (SWaP-C) of on-board line replaceable units (LRU). Such was the case for a new variant of unmanned aerial vehicle (UAV) in development for the United States government for intelligence, surveillance, and reconnaissance (ISR) missions.

The UAV prime contractor began developing an airborne targeting system, which incorporated a large number of sensors and required 10 ultra-small form factor (USFF) mission computers per ship set for image processing. The computers required multiple Gigabit Ethernet (GbE) ports and RS-422 serial interfaces, as well as GPU-cores compatible with NVIDIA's CUDA® parallel processing environment. The UAV also required two rugged Ethernet switches to connect these computers together on a local area network to share collected data.

Because the UAV would be flown in harsh conditions, these miniature computers and switches needed to operate under extended temperatures, high altitude, shock, and vibration common to airborne platforms. The delivery schedule was also critical as the integrator had a tight deadline for a proof-of-concept flight demonstration.

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Solution

In order to meet environmental challenges and program objectives, the system integrator turned to a proven rugged commercial off-the-shelf (COTS) mission system partner. They chose Curtiss-Wright who provided Parvus® DucaCOR® 312 mission computers for image processing and Parvus DuraNET® 20-11 Ethernet switches for the network backbone. These systems were selected because of their small size, rugged environmental and EMI qualification testing, and modularity to adapt to different payload interfaces.

The DuraCOR 312 is an USFF mission computer built around the NVIDIA® Jetson™ TX2i "supercomputer-on-a-module" integrated in a miniature rugged chassis. It was the only solution with the reliability, performance and CUDA GPGPU compatibility the customer required. The unit combines powerful NVIDIA Pascal™ GPU signal processing with a multi-core 64-bit ARMv8 CPU. It also supports integration of add-on mini-PCIe I/O cards, M.2 SSD and removable 2.5" SSDs.

The Parvus DuraNET 20-11 is a rugged 8-port Gigabit Ethernet (GbE) layer-2 switch optimized for extremely demanding SWaP-constrained vehicle and aircraft platforms. The unit boasts an ultra-miniature design with a physical size of roughly 10 in^3 (164 cm^3) in volume, 0.50 lb (0.23 Kg) in weight, and 5W typical power consumption. Two DuraNET 20-11 network switches support sharing ISR data processed by the DuraCOR computers from on-board sensors.

Results

By choosing rugged COTS subsystems, the customer was able to reduce risk, while saving time and money. Because the prime contractor received the units from a single supplier, the prime contractor could also depend on Curtiss-Wright's systems interoperability and single point of contact for customer support.

The prime contractor was under pressure to deliver a solution in time for a scheduled platform demonstration. Curtiss-Wright delivered units and provided support to help them configure the device and optimize the hardware's performance in preparation for their demo. The initial demonstration was successful and follow-on flights are scheduled to test additional electronics payloads. The customer appreciated Curtiss-Wright's support and the reliability of the products they integrated.

Figure 1: Parvus DuraCOR 312

Figure 2: Parvus DuraNET 20-11