CASE STUDY

Flexible I/O System Design Reduced Cost, SWaP, and Time

CURTISS-WRIGHT

DEFENSE SOLUTIONS

Challenge

- Prime integrator had just six months to develop new ISR system
- COTS system required mix of standard and non-standard I/O
- Needed L200 ruggedization, low-SWaP, and flight ready

Solution

- 3U VPX board with standard I/O and on-board FPGA
- Buffers and I/O circuitry on front panel PCB board
- Commercial software and lab system with I/O board functionality

Results

- Met demanding schedule and budget constraints
- COTS solution with SWaP advantages of a custom design
- Created new approach for supporting fast turnaround low-volume programs or demos

Challenge

A leading prime contractor of airborne imaging systems came to Curtiss-Wright with a 3U OpenVPX™ system architecture design problem they were doubtful could be solved, given the project's constraints. What they sought was a small volume, fully rugged, flight-worthy processor system configured to support a mix of standard and custom I/O protocols. Size, weight, and power (SWaP) constraints eliminated the option of using multiple individual I/O boards to meet their interface requirements. On the other hand, a custom I/O board design would have incurred unacceptably high NRE costs, along with unacceptable risk and schedule impacts. Ultimately, the customer needed a custom system design, while their budget would only support an off-the-shelf solution – and they needed delivery in six months, an unusually short turnaround schedule for a new system design. To put it mildly, the customer was skeptical that their challenge could be met using COTS hardware. Another option might have been to contract a development house to provide a modified COTS (MCOTS) solution, but typically, these suppliers are set up to address high volume projects, making engineering resources especially precious.

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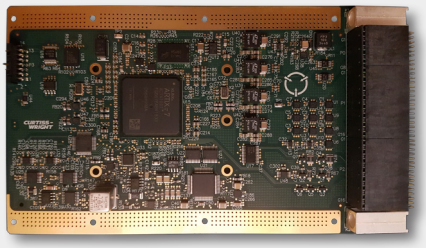

Simple and fast modifications to the 3U OpenVPX I/O board (also available as XMC module) eliminated costly custom solution and reduced system slot count.

Solution

Curtiss-Wright's System Integration team came up with an innovative solution to meet this customer's tight budget and schedule. By performing some quick I/O customization on an existing 3U OpenVPX I/O module and placing the required custom buffers and I/O chips on the system chassis's front-panel PCB, we were able to sufficiently lower NRE and avoid the unacceptable cost and SWaP burden of using multiple custom boards. Fortunately, the 3U OpenVPX module was already configured with the majority of the standard I/O types needed for the program. Curtiss-Wright only needed to program the FPGA already resident on the board in order to support the non-standard I/O and protocols. To accelerate FPGA development, the customer provided their requirements and Curtiss-Wright performed the needed FPGA customization, delivering a fully turnkey custom FPGA with full source code. Later, if required, the customer could make any additional changes to the FPGA as desired.

Customization, or major overhaul, of the I/O board was avoided by performing any needed signal conversions at the front-panel connector PCB. The only software task involved simple modifications to the Linux driver to support the new functionality. Because much of the system's functionality depended on the I/O module, Curtiss-Wright was able to speed the customer's application development by rapidly configuring and delivering commercial development systems. This was realized by combining the appropriate development boards from the FPGA supplier with commercial PC desktops based on the same processor chipset as the Curtiss-Wright I/O board. The FPGAs were pre-programmed with the required non-standard I/O using the same FPGA functionality and API as the rugged OpenVPX module. Delivered to the customer just weeks after the program began, the development system enabled the customer to begin their software integration work immediately, using the actual I/O board drivers and the actual FPGA functionality, all re-targeted to a different physical form factor using commercial equipment.

Results

Curtiss-Wright delivered a COTS-based Level 200 system that meets all the requirements for deployment in an airframe. The application tailoring approach taken for this project, to their surprise and satisfaction, successfully met the customer's strict requirements for both schedule and budget. The result was a solution that delivered all the advantages of a custom solution with the schedule and near-cost of a COTS system.

This success story also established an innovative design strategy ideal for addressing low volume and tight schedule programs or demonstration systems. By making easy, quick, and low-cost modifications to the I/O board, now realized in both 3U OpenVPX and XMC mezzanine module form factors, customers can avoid having to choose between expensive custom solutions or increased slot counts. Modifications to the I/O board can be done quickly, often resulting in hardware being ready to order in only a couple of weeks. For FPGA development, Curtiss-Wright offers a spectrum of options – from having the customer program the system, to having Curtiss-Wright provide initial customization followed by the customer adding their unique functionality after, to even full turnkey FPGA development for a custom application. To further aid the customer's application development, the I/O board FPGA and drivers are all delivered with complete source code.