Major Program Success at **Raytheon T.I.** Made Possible with Xilinx Hi-Rel FPGAs

Designers of defense systems have long recognized the benefits of using FPGAs for their system designs. The flexibility, reconfigurability, and easy access to devices used for prototyping are but a few of the compelling reasons why FPGAs are rapidly becoming the technology of choice for defense industry designers. This has been dramatically demonstrated with the recent design successes of a team of engineers at Raytheon T.I. Systems in McKinney, Texas, where they have successfully designed Xilinx FPGAs into their Horizontal Technology Integration (HTI) system.

The HTI system, being developed by Raytheon T.I. and Hughes, is a second generation FLIR (forward looking infrared) system that can be used in many different land-based fighting vehicles, as well as attack aircraft. First generation FLIR fire control systems were used successfully in Operation Desert Storm. However, the development of FLIRs with higher resolution and a longer identification range is critical to extending the advantage of the U.S. and its allies over future adversaries.

The design team at Raytheon T.I. was faced with some formidable challenges — notably, cost and development time. Xilinx high-reliability (Hi-Rel) FPGAs are the heart of the HTI system. However, before this decision could be reached, a careful trade study of Hi-Rel FPGAs versus Hi-Rel ASICs was performed. Careful consideration of Hi-Rel ASIC NRE costs, development time, required design reviews, prototype delivery schedules, and the inherent risks associated with doing an ASIC led to the conclusion that FPGA technology should be preferred.

Mr. Cal Tenhet, Electrical Design Engineer at Raytheon T.I. said, "Because ASIC suppliers are no longer supporting the Hi-Rel market, the rapidly changing technology evolution for ASICs is forcing designers to continually re-design to make timing specifications fit smaller process parameters. While FPGAs are going through a similar evolution, the continued support of Xilinx to the Hi-Rel market enables us to proceed without these continuous re-designs. Additionally, by using Xilinx FPGAs, we did not need to use valuable time and engineering resources generating test vectors."

Multiple Xilinx FPGAs are used in the HTI system to perform numerous control functions. On the scan control CCA (circuit card assembly), an FPGA serves as a microprocessor interface to all A/D-D/A converters. It's also the serial interface to the digitizer CCA, transferring data and signal controls. The FPGA emulates a UART RS232 interface between the video converter and scan control CCAs, generates video timing gates, and provides optical position sensor counters.

Tenhet and the design team at Raytheon T.I. also had to deal with a highly accelerated development schedule for the HTI program. The flexibility of Xilinx FPGAs enabled them to meet a very aggressive schedule, on time.

"We were able to go to layout and pick pin configuration prior to the completion of the design," Tenhet said. "With Xilinx FPGAs, we could make any necessary design changes right up to production. In fact, due to the flexibility of the FPGAs, we were able to do our design sequentially and incrementally —
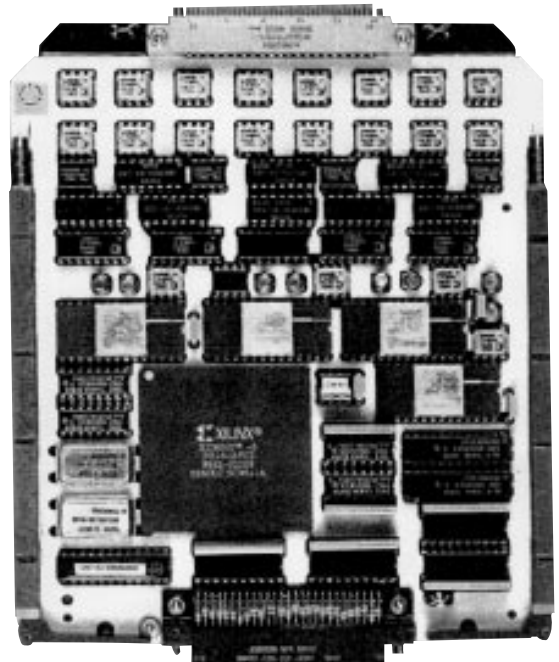
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a real plus given the tight schedule we were working under."

The ability to make system upgrades in the field proved important to the HTI program. "If we need to make upgrades to the system in the field, we can do so by reconfiguring the serial PROMs' firmware, which is very cost-effective," Tenhet said. "We couldn't do this with ASICs."

System designers continue to face the dilemma of finding suppliers committed to the Hi-Rel market. With so many others choosing to exit this market, it has become more difficult for defense industry designers to find reliable long-term sources of supply. Xilinx, a QML supplier to MIL-PRF-38535, and its active SMD program are making this search easier.

"The commitment of Xilinx to the Hi-Rel/Military market also played a very big part in our decision to use their FPGAs for HTI," Tenhet said. "Because of this level of commitment, Xilinx provided high levels of support during the design cycle, and helped resolve problems quickly to keep us on schedule. In fact, because Xilinx acted as part of the design team, our schedule never slipped. The HTI program could not have succeeded without Xilinx Hi-Rel FPGAs, and a lot of the successes enjoyed by our engineering team on this program can be directly attributable to Xilinx." ◆