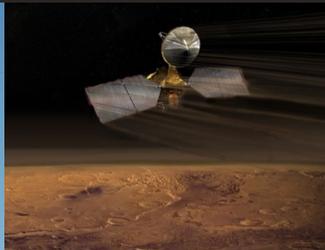**CORELIS**

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Corelis Scan Library and CodeRunner Enable Easy Development of Custom JTAG Tools

BAE SYSTEMS

The RAD750®, developed by BAE Systems, is a licensed, radiation-hardened version of the PowerPC 750®. The RAD750 design objectives were focused on cutting power consumption, weight, and cost; key attributes in designing products for space flight. Those objectives were accomplished through an architecture that increases processing speeds to an industry-leading 240 million instructions per second (MIPS) and operates at speeds of 133 MHz and greater, reducing the number of processors required. The RAD750 advanced architecture and processing throughput – ten times the performance of current space processors, according to BAE Systems – will allow a new generation of high-performance satellite payloads to solve more intensive computing problems, such as deep space navigation, precise trajectory adjustments to position spacecraft for flybys, altitude control, landing, and exploration operations.

The RAD750 is available on the three rack-unit CompactPCI Space Flight Computer (SFC), developed under contract to NASA's Jet Propulsion Laboratory (JPL). BAE Systems has sold hundreds of the SFCs to the aerospace community.

Mars Mission is a Featured Application

The RAD750 is integrated into some intense computing environments, to say the least. One of the highest profile uses is aboard the Mars Reconnaissance Orbiter (MRO). Launched August 12, 2005, the MRO is playing a key role in enabling National Aeronautics and Space Administration (NASA) to examine the surface, atmosphere, and subsurface of Mars. The main goal is to learn more about the history and distribution of water on the planet, to improve the understanding of planetary climate change and possibly answer whether Mars ever supported life. The orbiter will also evaluate potential landing sites for future missions.

Two RAD750 computers onboard the MRO are helping to navigate the satellite on its seven-month journey toward Mars. The single-board computers will control the MRO as it flies to a low orbit around the planet and also assist in the collection and transmission of information between Mars surface missions and Earth.

The reliability required of the RAD750 is underscored by the five-and-a-half year life of the mission, which won't end until December 31, 2010.

BAE Systems and Customers Seek an Easy Way to Program RAD750 EEPROM

Many customers using the RAD750 boot the computer from EEPROM and BAE Systems wanted them to have a simple way to load, reload, and debug software on the computer. JTAG was the right technology, but there was a gap in the link to the programming process.

"The JTAG connection to the Power PCI bridge chip on the product provided a path to the EEPROM, but no tools existed. We developed custom tools built on the Corelis Scan Function Library to get it done," said Craig Hatfield, Systems Engineer for BAE Systems. "We also developed additional debug utilities to provide visibility into the system without the need for any onboard software. These utilities are helpful when integrating new hardware on or attached to the computer."
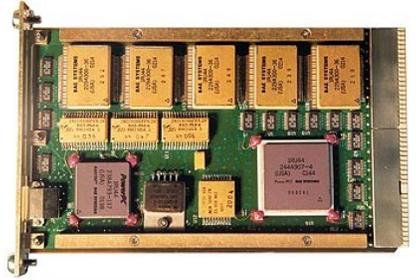
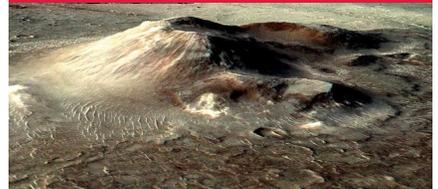*"We developed custom tools built on the Corelis Scan Function Library to get it done."*

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Hatfield had the tools ready prior to release of the RAD750 product, giving customers the required low-level interface for a complete, simplified way to program the EEPROM.

"We chose the Corelis CodeRunner JTAG emulator over other in-circuit emulators for PowerPCs because we also needed a JTAG communication path to our support chips. The emulator and Scan Function Library are able to use the same adapter and buffer, providing both interfaces in one package" said Hatfield. "That's a benefit to our customers because they can buy only one product and get a RAD750 debugger as well as visibility into our bridge devices."

Savings result from the combined emulator/debugger interface because without the shared JTAG libraries, BAE Systems, and its customers would have to purchase two JTAG systems, one for the PowerPC (RAD750) and another for the bridge chip (Power PCI). A set of JTAG tools like BAE Systems is using costs $5,000 to $10,000, and the savings are multiplied with each test station created.

The Scan Function Library (SFL) is a set of software drivers, coded in "C" and provided as a 32-bit DLL for Windows 2000/XP. The software drivers enable users to operate the JTAG port and send JTAG instructions and data to the target system. Users can incorporate the drivers in their own application software and need to code only the higher level test procedures. Sample routines in the library include flushing data out of and reading data into registers, reading the logical values of I/O pins, scanning data out of devices, and setting TCK speeds for JTAG operations.

CodeRunner

Corelis' CodeRunner debugger is a JTAG-based emulation tool. CodeRunner effectively partitions the individual processor's hardware and software resources into a multi-windowed environment that provides for ultimate clarity, increasing productivity in the areas of board bring up, driver/firmware development, and software application debugging.

The CodeRunner Debugger offers many advanced features, reaching far beyond the robust "run-start-stop" control that has made JTAG based debuggers so popular. In addition to its many breakpoint facilities, CodeRunner offers an extensive macro and scripting capability and can interpret command files written in a structured "C"-like language. CodeRunner works with all popular C/C++ cross-compilers that generate DWARF, ELF, or Stabs debug information, allowing for the greatest flexibility and cost reduction when selecting development tools. Corelis JTAG emulators are available with PCI, PCMCIA, USB 2.0, Parallel Port, and Ethernet JTAG controllers to provide flexibility when designing host and target environments.

Summary

With the simple development of its custom debugging and programming tools based on the Corelis SFL, BAE Systems is able to provide a complete hardware and software development platform for its exacting aerospace customers.

"CodeRunner is a welcome addition to the tool suite. So far, it has performed admirably," Hatfield says. "Corelis built an interface box with both Common On-Chip Processor (COP) and TAP connections, and the software was updated to add parity to the 60X bus accesses as required by the Power PCI. The Corelis people have been very helpful and responsive in providing the right tool for our job."

About BAE Systems

BAE Systems has a 20-year history of providing radiation-hardened solutions for U.S. space programs. Its RAD6000 computers were installed on each of the still-broadcasting Mars Rovers – the only control and data computers aboard the two Rovers – to execute flight, landing and exploration operations on that planet. The RAD750 represents the next-generation of space microprocessors and was vital in NASA's Deep Impact mission. NASA's program managers continue to extend the mission of the Deep Impact flyby spacecraft, which most recently encountered and captured images of the comet Hartley 2 in November 2010.

About Corelis

Corelis, Inc., a subsidiary of Electronic Warfare Associates, Inc., offers bus analysis tools, embedded test tools, and the industry's broadest line of JTAG/boundary-scan software and hardware products combining exceptional ease-of-use with advanced technical innovation and unmatched customer service. Corelis' development and test tools are used by companies such as Agilent, Dell, IBM, Intel, Microsoft, Lockheed Martin, Rockwell Collins, Hewlett-Packard, Motorola, Qualcomm, Nokia, Panasonic, TI, Ford, Broadcom, Ericsson, and many others. Corelis products are found globally in every industry developing or manufacturing electronic products.

Boundary-Scan
Without Boundaries™

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