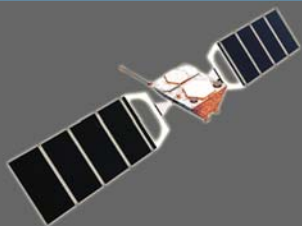
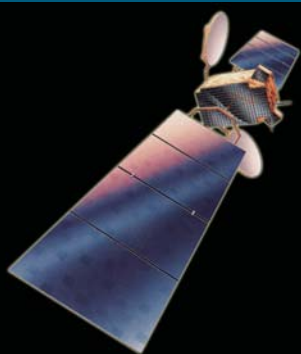


RAD6000™ Space Computers



BAE SYSTEMS

RAD6000 space computers

RAD6000 single-board computers combine commercial standards with unique radiation-hardened technology and packaging to meet the specific requirements of space applications. The RAD6000 computers include support functions to control local memory and provide standard and custom I/O interfaces. Support functions are implemented in both FPGAs and ASICs. The FPGA versions are based on the popular VME standard interface. The ASIC version supports multiple I/O devices and protocols and uses PCI as the common, on-card bus interface. This feature ensures a seamless software transition to the higher-performance RAD750™ computer, also based on PCI.

BAE Systems has consolidated its space programs into the Space Systems and Electronics (SS&E) organization. Performing organizations are located in Nashua and Merrimack, New Hampshire; Manassas, Virginia; and Colorado Springs, Colorado.

Today, BAE Systems develops and produces a wide array of space mission solutions from single-board radiation-hardened computers to complete space payloads. SS&E in Manassas, Virginia continues to specialize in radiation-hardened electronics and space applications including ASICs, memories, and single-board computers. Today, SS&E has more than 400 computers in space, including the RAD750, the RAD6000 (32-bit), and the GVSC 1750 (16-bit). The first RAD750s, the next-generation space computer, were launched in 2005.

RAD6000 microprocessor

The RAD6000 is a low-cost, high-performance 32-bit Reduced Instruction Set Computer (RISC). The RAD6000 combines the popular and proven Power Architecture™ of the IBM RISC System/6000® workstation with BAE Systems' QML qualified, radiation-hardened CMOS process to provide powerful and flexible solutions for space applications. SEU hardening has been applied to all storage elements in the RAD6000 including latches, registers, and RAMs.

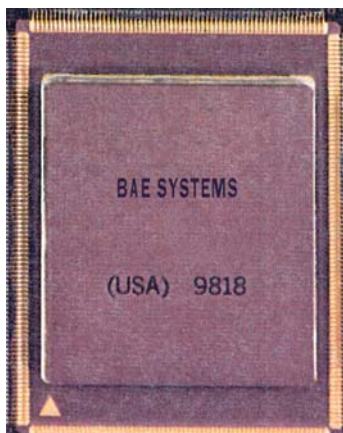
RAD6000 key features

- Up to 35 Dhrystone 2.1 MIPS at 33 MHz
- Radiation-hardened 32-bit RISC super scalar single chip CPU
- 8 KByte internal cache
- Low-power 3.3 volt operation
- 72-bit (64 data, 8 ECC) memory bus
- Variable power/performance
- Independent fixed and floating point units with concurrent operation
- Temperature range -25°C to +105°C

Radiation-hardness levels

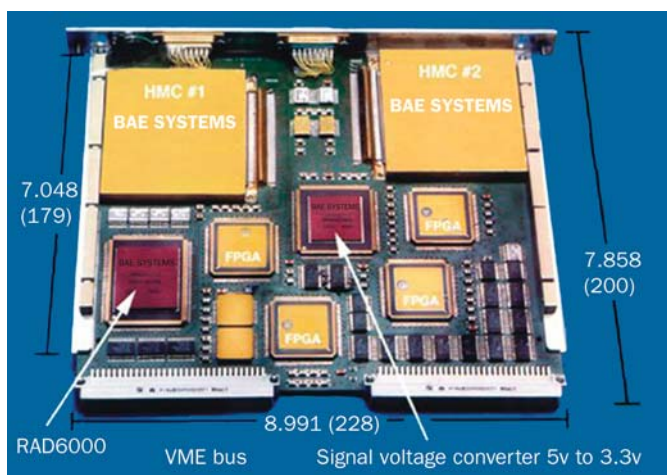
- Total dose: > 1 Mrad (Si)
- Latchup: Immune
- SEU: $7.4E-10$ errors/bit-day (90% W.C. GEO)

RAD6000
Microprocessor



RAD6000 radiation-hardened processor product family

The versatility of the RAD6000 is demonstrated in the variety of past and current application configurations available, including packaging options, architecture variations, memory configurations, and I/O selections. Being gate-for-gate identical with its commercial counterpart, the RAD6000 uses many commercial software products without modification, including the industry-leading Vx-Works™ operating system, significantly reducing application software development costs and risk.



Mars Rover RAD6000 flight computer, FPGA-based

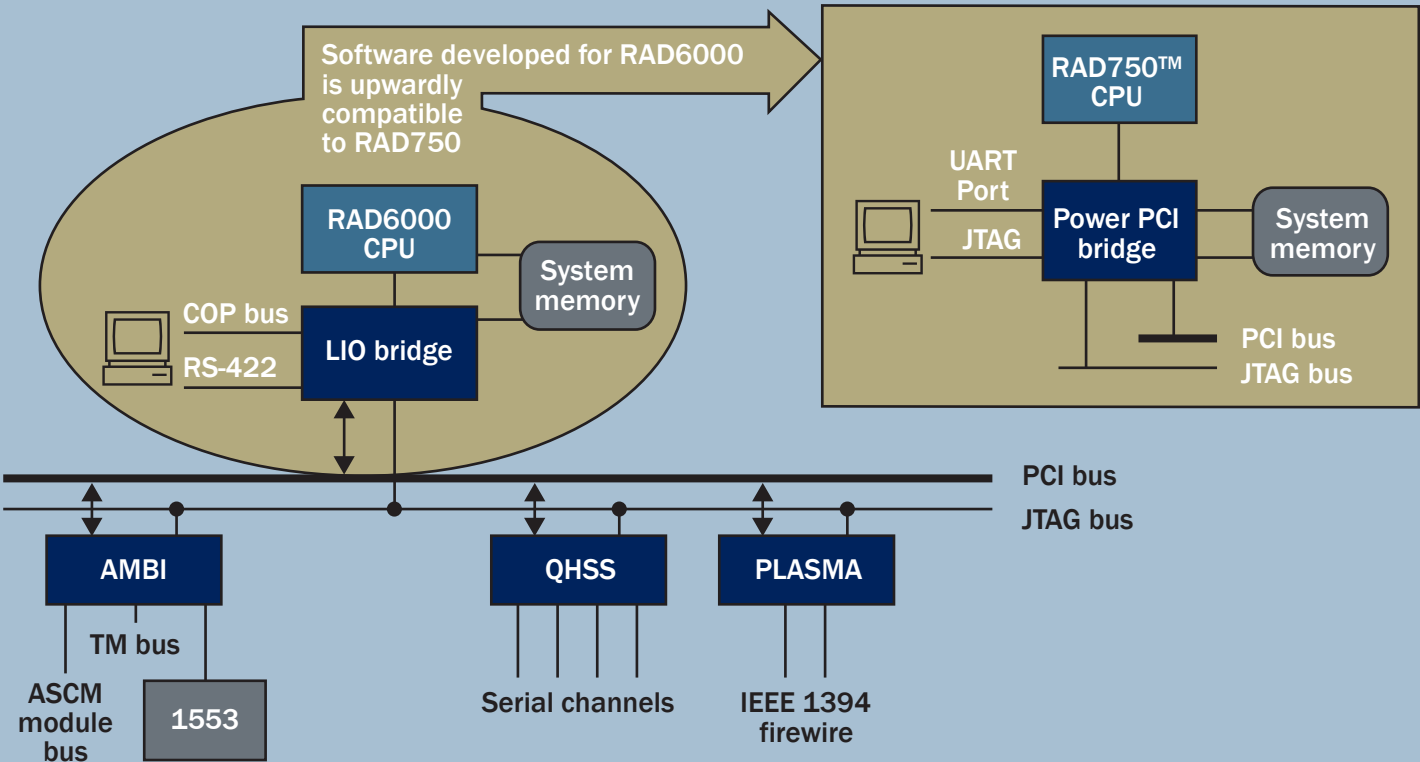


“Of course there is intelligent life on Mars . . .
we helped put it there!”

Processor board configuration information (other configurations available)

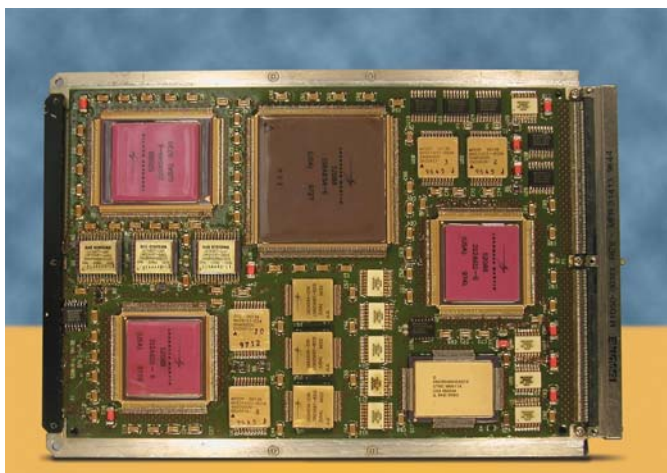
	Single Board Computers			Dual/Triple Redundant Computer Subsystem
	ASIC-Based	CompactPCI	FPGA-Based	
Performance	Variable to 35 MIPS	Variable to 26 MIPS	Variable to 22 MIPS	Variable to 21 MIPS per processor
Frequency	Variable to 33 MHz	Variable to 25 MHz	Variable to 20 MHz	Variable to 20 MHz
Power (maximum)	< 10 Watts at 33 MHz	< 7.5 Watts at 25 MHz	20 Watts at 20 MHz	11.9 Watts (EOL) at 20 MHz per processor
Power (low)	2.5 Watts at 4.1 MHz	< 3.1 Watts at 5 MHz	5 Watts at 2.5 MHz	8 Watts (EOL) at 2.5 MHz per processor
Memory	8 MByte SRAM	8 or 16 MByte SRAM	128 MByte DRAM	4 MByte SRAM
EEPROM/PROM	Up to 128 Kbyte PROM	4 MByte EEPROM	3 MByte EEPROM	EEPROM configurable 1, 2, 3, 4 MByte 128 Kbyte PROM
Mass (board)	< 1.0 Kg	< 0.9 Kg	< 1.2 Kg	< 4.8 Kg (2 processors and power supplies in box)
Size	IEEE 1101.7 (6" × 9")	6U Compact PCI	6U VME	10.3" × 2.9" × 8" excluding mounting feet
Interfaces	ASCM module bus, RS422	1553, UART, PCI, discretes, interrupts	RS232	1553, serial UART, discretes in & out, interrupts
Support functions	ASIC	ASIC	FPGA	ASIC & FPGA

RAD6000 architecture



Variety of standard interfaces supported

- ASCM module bus
- MIL-STD 1553
- High-Speed Serial (HSS)
- IEEE 1394 backpanel I/F
- PCI (via LIO chip)
- RS-422 or RS-232 UART



RAD6000 ASIC-based single board computer



Dual/triple redundant computer subsystem with power supply

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Cleared for Open Publication by DoD 07/06

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