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"Whole life" COTS

JERRY GIPPER
VME life cycle model

JOE PAVLAT
Telecom and the military

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Eclipse perspective

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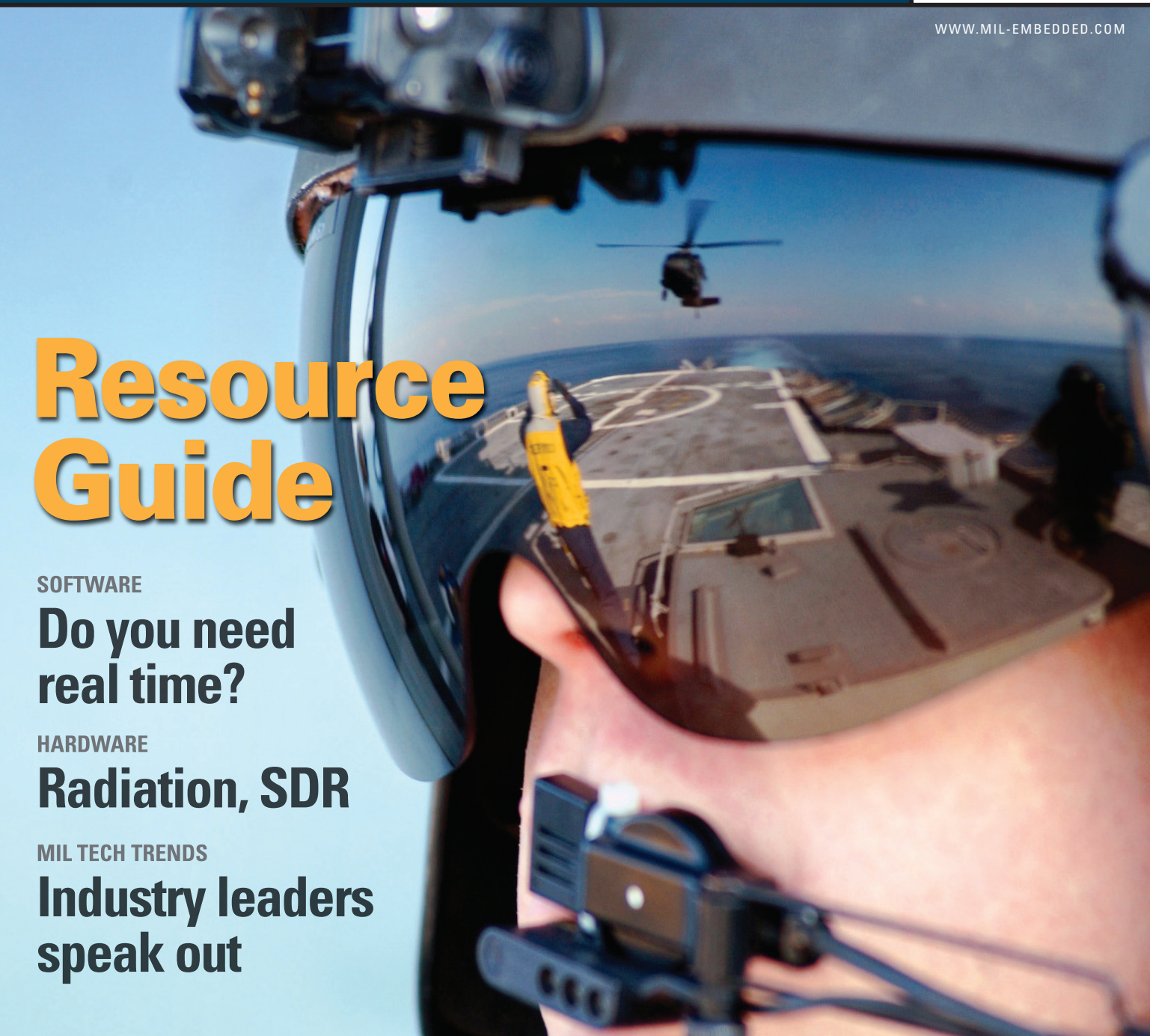

Resource Guide

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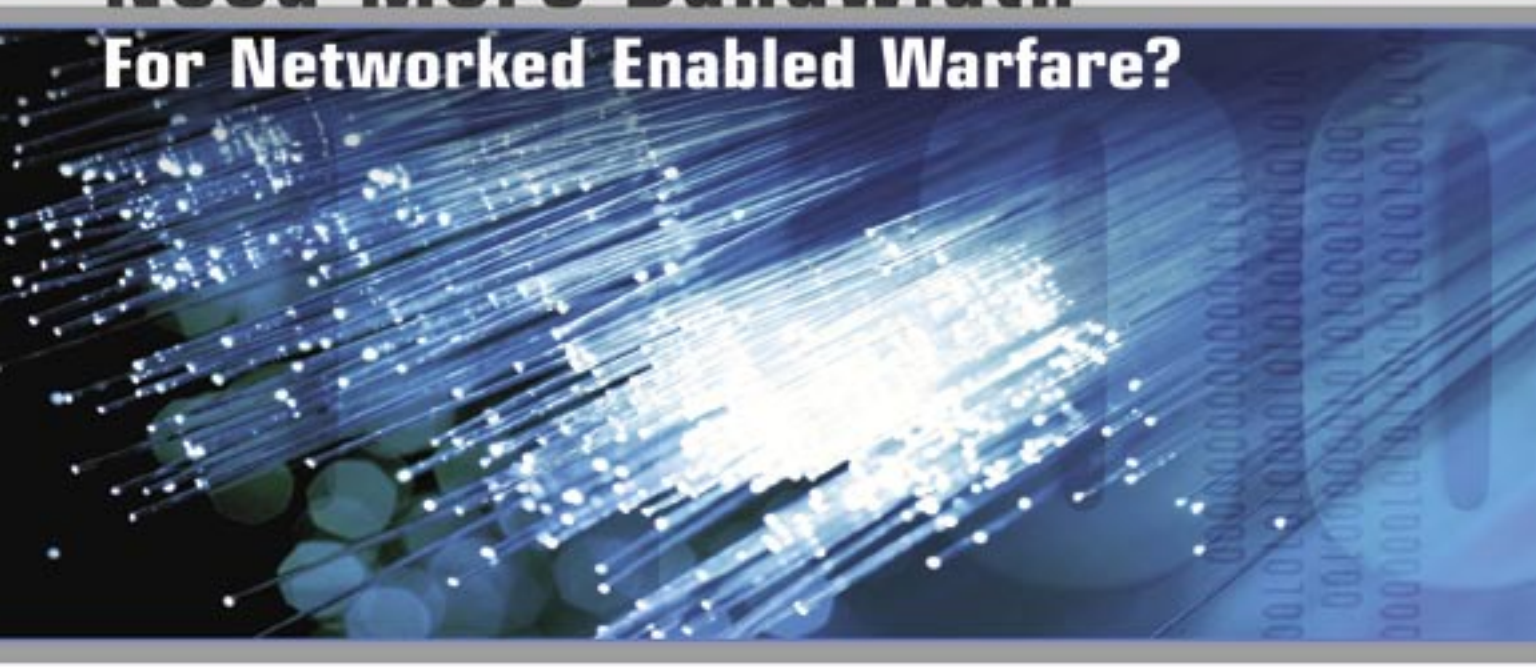

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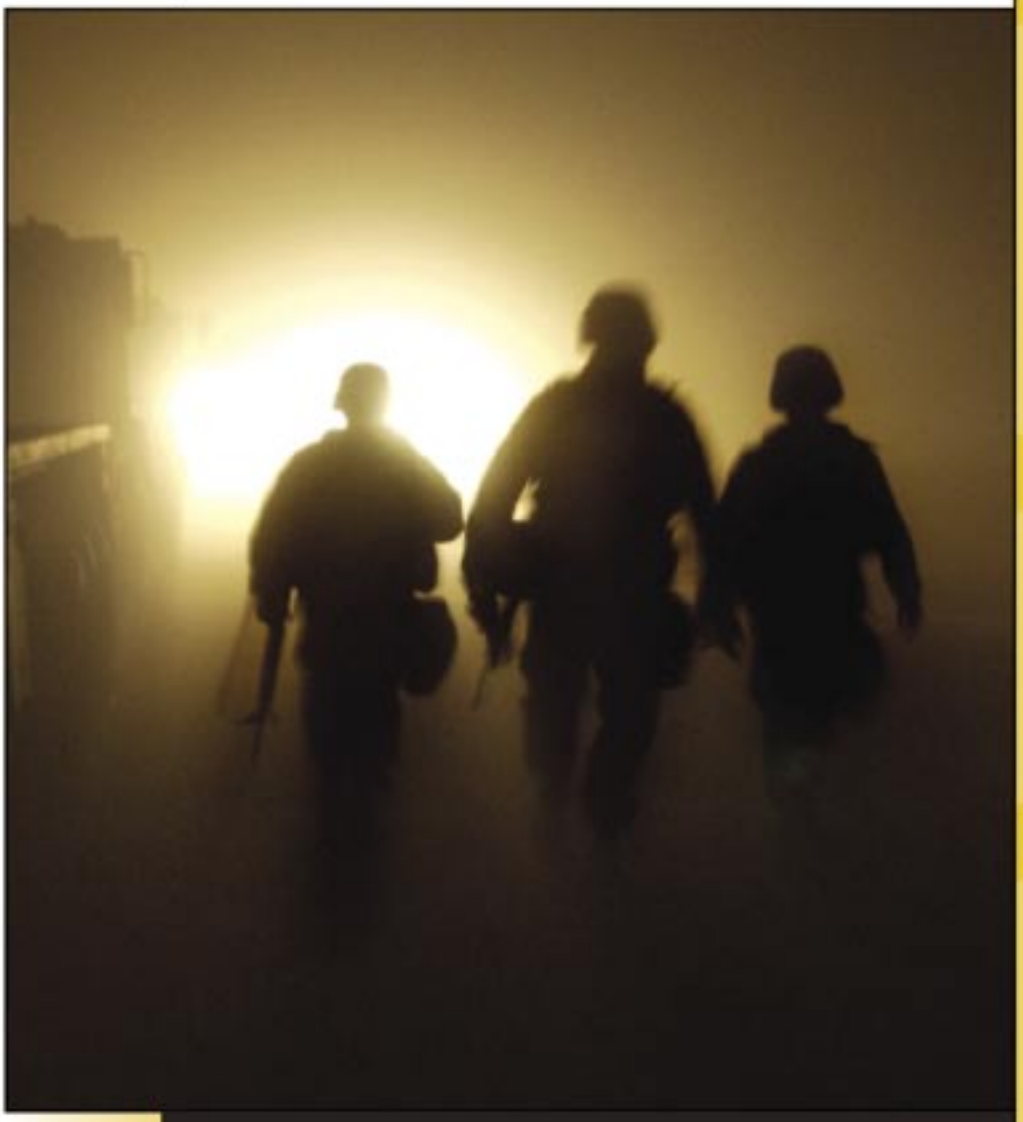

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DEPARTMENTS

8 Industry Analysis
VMEbus technology and its life cycle
By Jerry Gipper

Eclipse and the eight embedded software life cycle truths
By Don Dingee

Telecom technology and the military: Initiatives and standards
By Joe Pavlat

42 In the System
Wearable tactical computers as embedded training systems
By Joan Wood, Quantum3D

Attention to details benefits primes outsourcing military avionics systems
By Frank Willis, SBS Technologies

152 New Products
By Eli Shapiro

154 Editorial
A fresh start for ongoing programs
By Chris A. Ciufo

PRODUCT GUIDE

60 MILITARY EMBEDDED SYSTEMS Resource Guide

EVENTS

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FEATURES

SPECIAL: Hardware

20 Space-ready, radiation-tolerant processor modules: A COTS technology strategy
By Anthony Lai, Aitech Defense Systems

26 Meeting Software Defined Radio cost and power targets: Making SDR feasible
By Manuel Uhm, Xilinx and Jean Belzile, ISR Technologies

SPECIAL: Software

32 Standards and interoperability to drive RTOS industry
Q & A with John Fanelli, Wind River Systems

36 What is real time and why do I need it?
By Steve Furr, QNX

SPECIAL: Mil Tech Trends

46 FPGAs, serial fabrics and UAVs: The ones to watch
Q & A with Peter Cavill, Radstone Embedded Computing

50 Focus on systems, switched fabrics
Q & A with Tom Quinly, Curtiss-Wright Controls Embedded Computing

54 Reconfigurable systems; Disruptive technologies
Q & A with Ed Hennessy, Nallatech

E-LETTER

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Military Embedded Systems 2005 RESOURCE GUIDE PROFILES

BOARDS

Data acquisition 60
DSP 62
FPGA/Reconfigurable computing 64
Graphics 65
MIL-specific I/O 66
PCI 68
CompactPCI 70
PrPMC 75
PXI 75
PC/104 76
PMC 80
Precision instrument 85
Special purpose 85
Manufacturing services 87
Video 88
VMEbus 90
Proprietary small form factor 102
Processors 103

MASS STORAGE

Complete packaged system 107
Solid state 109
Magnetic HDD 112

MIDDLEWARE/ SOFTWARE

Development environment/Tools 114
Graphical user interface 116
Real-time operating systems 116
Linux 117
Graphics software 118
Other 113

OTHER

Miscellaneous 128

PACKAGING/ MECHANICAL CHASSIS

Electronics packaging 119
Box-level purpose built 121
ATR 122
Backplane 123
Rugged chassis 125
Connectors 127

POWER CONVERSION

DC-DC converter 129
Slot cards 131
Standalone power supply 133

RUGGED COMPUTER SYSTEMS

Mass storage 135
Other complete rugged 135
Mission computer 142

SENSORS AND RF

Wireless 147

TEST AND INSTRUMENTATION

Analyzer/Monitor 148
PXI 149
Bus analyzer 149
VXI 150

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VMEbus technology and its life cycle

By Jerry Gipper

Life cycle longevity is one of the key attributes of VMEbus that contributes to its popularity in defense programs needing high-end embedded computing solutions. Suppliers of VMEbus technology have listened well to their users. Over the years, significant improvements have been made to the performance and capabilities of this technology. The industry suppliers have developed a technology roadmap that preserves backward compatibility of today's solutions with those of the past. Utilizing a VME life cycle model is generally good life-cycle planning practice. The VME Standards Organization continues to battle the pros and cons of new technology and backwards compatibility. They have made reasonable accommodations where possible giving suppliers alternatives to move forward with leading-edge technology at a pace that suites their target markets.

The original VMEbus specification (VME32) started out as a definition for a parallel computer bus supporting 24-bit addressing and 16-bit data paths with expansion capability to 32-bit addressing and 32-bit data paths. The theoretical maximum performance of the bus was 40 MBps and it was considered exceptional if a product could hit 20 MBps. The first generations of products took several years before they started pushing the capability envelope of the original specification.

VMEbus enhancements

Enhancements were later proposed and adopted that pushed the capability to support 64-bit data paths (commonly referred to as VME64) and raised the theoretical throughput bandwidth to 80 MBps. To fully use the enhancements required that a new VME connector be implemented, this connector was cleverly designed so that VME64 products can be completely compatible with the original VME32 generations.

Recently, the VMEbus specification was enhanced once again to VME 2eSST, that extends performance by adding a two edge, source synchronizing data transfer capability that allows sustained data transfers in excess of 300 MBps. VME 2eSST is totally backwards compatible with existing connectors and backplanes. The secret sauce is in new incident wave bus transceivers that allow older backplanes to handle the high speed waveforms. The original VME32 specification had enough foresight to provide for VME 2eSST type capabilities without redefining the original bus protocols. Most importantly, this means that software does not have to be rewritten to use the new protocols.

Concepts exist that could take the parallel VMEbus to over 500 MBps while maintaining that ever important backwards compatibility. VMEbus technology has also embraced the movement to serial switch fabric solutions. These solutions are not necessarily a new concept but they are gaining new acceptance as they have become more practical and have shown tremendous ability to provide scalable high bandwidth.

Ethernet is now one of the most common fabric solutions. The VME technology family has several alternatives to choose from that use Ethernet. VITA 31, which adds Gigabit Ethernet on VME64 backplanes via a previously defined P0 connector, is the first generation of switch fabric solutions implemented in VMEbus backplanes. VITA 31 works with the existing VME32, VME64, and VME2eSST configurations.

VME Switched Serial (VXS) combines the event driven parallel VMEbus with enhancements to support switch fabrics over a new P0 connection. VXS maintains backward compatibility with existing backplanes that do not have a conflicting P0 scheme. Several fabric protocols are mapped out for VXS including 10 Gigabit Ethernet, PCI Express, Serial RapidIO, and InfiniBand. VME's parallel bus architecture provides bus control and maintenance data, handling everything from single byte transactions to 300+ MBps block data transfers. Combining this in various ways with the emerging switch fabric technologies for multi-point, high-speed data transfers creates choices for all types of embedded computing designs.

All of these enhancements to the VMEbus technology have been evolutionary in nature, carefully specified to maximize backwards compatibility, extend the technology life cycle of VMEbus, and most importantly, preserve years of investments made by users of VME technology. Additional work continues to extend the capabilities of VME technology even further.

Migration planning

But what can suppliers do to allow development programs to take advantage of the work done by the standards developers? Since most embedded computing applications have a long life, system designers and integrators need to be sure that their supplier will be capable of manufacturing computing platforms, whose form, fit, and function does not change without warning, for a period of several years.

The industry goal should be to have useful life cycles in excess of 10 years. Products should be planned to handle changes and part obsolescence to allow production to continue for a minimum of 10 years. To do this, I propose a concept of what I call a virtual product life cycle. An individual product should go through no more than three major revisions over this 10-year life span. These revisions should be timed to optimize design and manufacturing changes as well as parts obsolescence.

How would this work? Revision A is planned as the first release of the product and should be available for approximately three years (see Figure 1). At the end of year two, release the second version, revision B. There would be approximately a one year overlap of these two revisions (A and B). These versions should have consistent features and exter-

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nal envelope (the same I/O connections) to preserve compatibility and minimize migration efforts. A and B would be the same product with the changes restricted to any major engineering changes needed for cost reductions, quality and manufacturing improvements, plus any performance enhancements that do not impact the original operational model of the product.

This same process is repeated between release B and C with the exception that the release B product would have a four-year life cycle goal, again with a one year overlap with revision C. Revision C would then be the final anticipated release with a five-year life cycle goal. Allowing for a one year overlap between releases, a 10-year virtual life cycle is achieved.

The revisions to products should:

- Have consistent features and external envelope (pinout) from A to B to C to eliminate additional system changes.
- Primarily focus on changes that do not impact functionality. Users need to be aware of what could potentially change in each product revision so that effort could be made to minimize future changes, for example, dependency on processor clock speed in timing loops.
- Have a consistent programming model. Software impact must be minimal.
- Overlap time between products for qualification and regression testing.
- Be reasonably planned this way during product definition; expected changes should be thought out and communicated. Stage multiple minor changes to occur at a major revision release.
- Exceed a *virtual* life cycle of 10 years with the final product end-of-life timing based on technology and market demand.

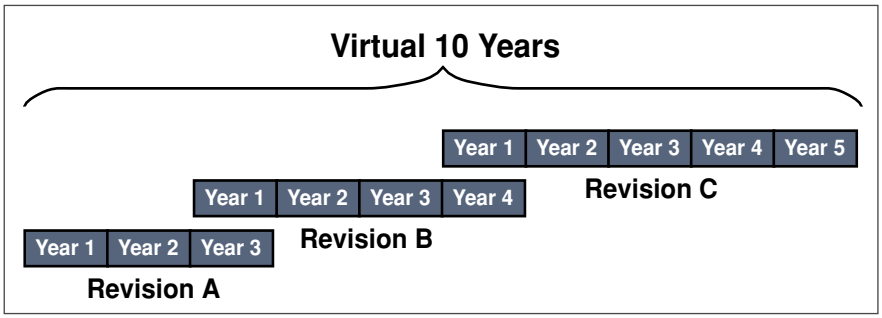

Figure 1

Major feature changes and enhancements would initiate a new product that would have its own life cycle. In turn, program managers can evaluate the options of staying on track or moving to a new product.

A traditional technology roadmap only highlights the major product. In essence, a product life cycle roadmap details the changes anticipated for a product over its life. A product life cycle roadmap following this type of mapping would allow program managers to plan technology refresh and insertion options that are compatible with their own program goals.

Jerry Gipper *is the editorial director of* Industrial Embedded Systems. *Jerry has held a variety of positions in systems engineering, sales, product marketing, business development, and strategic planning. During his career at Motorola, he had the leadership role in the worldwide rollout of more than 25 major and very successful product lines. He has written numerous articles and papers for the industry, and has spoken at various conferences. Jerry currently supports VITA with marketing services. Jerry holds a Bachelor of Science degree in Computer Engineering from Iowa State University and a Master of Science degree in Computer Engineering from San Jose State University.*

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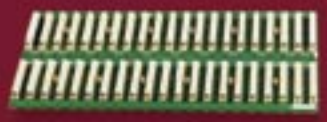

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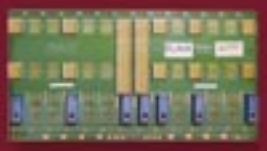

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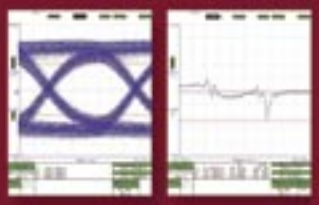

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Eclipse and the eight embedded software life cycle truths

By Don Dingee

Software development jobs in military embedded systems are filled with life cycle challenges, and they probably are not exactly what we learned in college. I'll list them as the eight embedded software life cycle truths:

1. Embedded code has to be supported forever.
2. It's more fun to develop new stuff, but most of us get paid to maintain existing stuff (at least a non-trivial part of the time).
3. To support code, it's wise to archive both the source and the tools it was built with (like some people who store a VCR with those old tapes of the family vacation).
4. Development tools haven't always played well together, sometimes new versions of toolsets from the same vendor don't get along with previous versions, and it gets more challenging with multiple vendors involved.
5. Just when the tools are working well and we're comfortable, there's newer technology we are compelled to look at.
6. To reduce risk (both technical and personal), we wait to upgrade software development tools as long as possible, preferably when starting a new project and there is a clean break.
7. The people that developed both the code and the tools around today in all likelihood aren't the people who are going to be dealing with them in 10 years.
8. "Forever" is a long time and there is not much anyone can do about it, especially if we are the ones who just took ownership of the code in year 10.

This is admittedly somewhat pessimistic, but I'll bet this pain sounds familiar. Fortunately, there is a solution emerging to help invalidate some of these truths: enter open source and the Eclipse Integrated Development Environment (IDE).

Eclipse is very similar to that toolbox most folks have in their house. The one with screwdrivers, a hammer, a socket set, Channellocks, Vise-Grips, a few Allen wrenches, and whatever other odds and ends end up in there. It started with a few indispensable tools, and new tools are added as needed, but rarely do any get tossed unless they absolutely break or something much better is found.

Eclipse development tools are built with open source on an open-standard framework. By definition, tool developers are strongly incentivized to make things play together. Here's how it should work for developers: choose an Eclipse-based environment with tools for code development, testing, debug, source control, and build control. Now select best-of-breed Eclipse plug-ins from a variety of sources to make it exactly fit the needs. New tool functionality requirements? Get new plug-ins. New microprocessor? Update the processor support files with XML. Found a better tool than the one in use? Switch to it without throwing away all the rest of the tools in the environment.

Embedded technology vendors received the message loud and clear and are getting on board with Eclipse in droves. Here is a list of some of the embedded technologies I've found searching the Internet for Eclipse IDE support.

- Operating systems: Linux in several flavors including versions from LynuxWorks, MontaVista, TimeSys, and Wind River is supported. Numerous RTOSs including LynuxWorks LynxOS, Enea OSE, Accelerated Technology Nucleus, QNX Neutrino, and Wind River VxWorks are supported.
- Processors: 1750A, ARM, Blackfin, MIPS, Pentium, PowerPC, SPARC, TI MSP430, and Xscale processors are supported.
- FPGAs and SoCs: Both Altera and Xilinx FPGA tools are Eclipse based, as are Tensilica and CoWare for SoC development.
- Languages: Java and C++ are well supported, along with HTML, Perl, PHP, Python, and XML. Aonix has support for Ada. The University of Illinois and Los Alamos National Laboratories have support for FORTRAN. I even ran across plug-ins for Pascal and COBOL, and it looks like DDC-I is pondering Jovial support.
- Structured development: SlickEdit has a new version of their editor for Eclipse, and some folks at MIT have done an Emacs plug-in. Source control tools such as Rational ClearCase and Serena PVCS are supported. Catalyst Systems' Openmake helps to automate and control the build process, and Telelogic SYNERGY automates the change management process. Cadena is a plug-in developed at Kansas State University for modeling and building CORBA components.

My apologies to the vendors I have probably left out, but my point is there is a lot of embedded Eclipse technology out there, either commercially available or posted as a contributed plug-in.

What is driving this proliferation of Eclipse tools for embedded? The answer: life cycle costs. Eclipse tools help the vendor's development teams and their customers deal with the 10-plus year life cycles familiar to most developers in military embedded systems. It's a win-win situation for the vendors doing the work because it provides value for their customers while also reducing their costs.

Defense programs are already developing in Eclipse. Accenture used tools from ILOG to build graphical elements of the US Air Force Effects-Based Operation planning tools. Boeing built parts of the Bold Stroke avionics mission-control system using Cadena. As previously mentioned, Eclipse work is being conducted at Los Alamos National Laboratories and other US government labs.

Let's look at our eight embedded software life cycle truths again. This time with the potential benefits of Eclipse in mind:

1. Supporting code forever: Eclipse won't change this, but maybe Congress will pass a statute of limitations on support for fielded military embedded systems. It could happen.
2. Supporting old stuff: If we have to, it should be in the same environment as the new stuff. Eclipse is impacting this as developers solving this exact problem create more plug-ins to deal with the old stuff in the new environment, such as the team at Los Alamos dealing with their FORTRAN.
3. Archiving tools with code: This need may be greatly reduced with Eclipse. We certainly won't have to archive the environment, but there might be some older plug-ins like compilers and processor descriptions to keep around. When we get them out and dust them off 10 years from now, they won't look totally foreign.
4. Development tools don't always play together: things seem to be playing together nicely, especially in the latest Eclipse 3.0 framework.
5. Darn, we just got the bugs out of these tools: When that new microprocessor shows up, just ask for the new Eclipse plug-ins and XML files that support it. When somebody says we have to move to object-oriented techniques, get the CORBA plug-ins. There won't be as much reason to fear sweeping progress as technology advances.
6. We fear change: The risk of a tools upgrade is greatly reduced, again due to the plug-in strategy. Developers can create two Eclipse perspectives, one with the old plug-ins and one with the new plug-ins.
7. We'll be gone in 10 years: Each of us will be so productive with Eclipse that with any luck we'll advance in our careers and won't have to work on the 10-year-old stuff.
8. "Forever" is a long time: We can do something, choose Eclipse, and the problems will be lessened 10 years from now. And, there's always a chance the person we help will be ourselves.

Eclipse is only the toolbox, solving the life cycle problem really depends on the tools we select to put in it and how skilled we are at using them. What are you seeing out there with Eclipse tools that work for you? Drop me a line.

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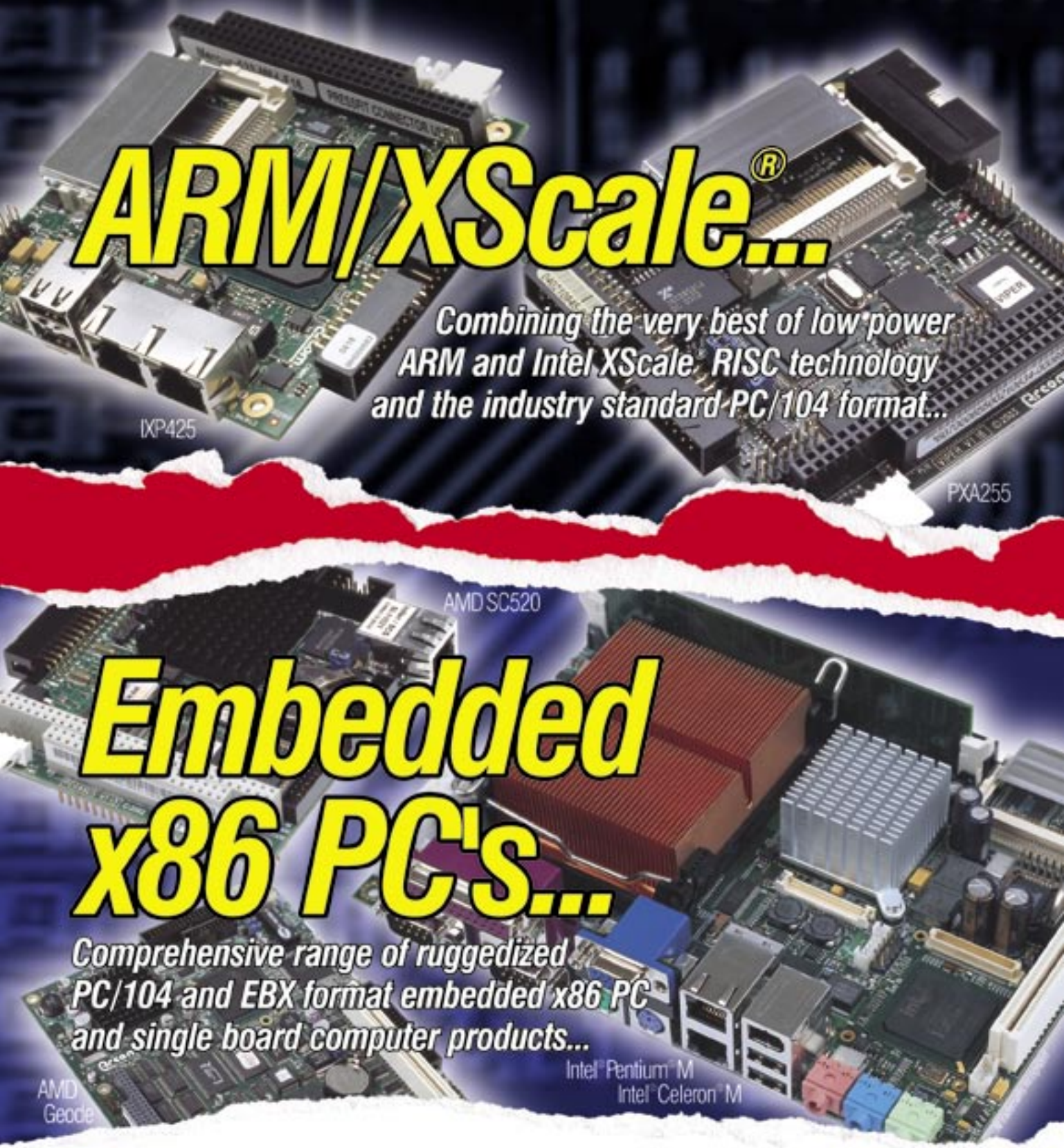

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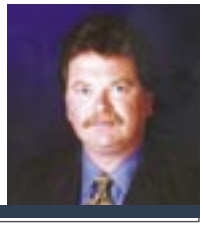
Telecom technology and the military: Initiatives and standards



By Joe Pavlat

Changes in information technology have already affected the global balance of power. The collapse of the Soviet Union was facilitated by these changes. The Soviet style of communism and centralized control of the economy led to its collapse in part because it was not compatible with the requirements of the information age. Improvements in information technologies have helped strengthen free markets and democratic forces worldwide and have also increased international trade and investment.

Some of the global consequences of the changes are reflected in the weakening of government control over society and the shifting of power away from governments to non-governmental organizations, small groups, and individuals. Knowledge gained by more and better information makes individuals and organizations more powerful and is a significant force behind democratization efforts in the Middle East and the former Soviet states.

Militarily, as both Gulf wars have demonstrated, the United States is very good at exploiting advances in information technology, in part due to the high quality of its personnel and training. The US military has an unsurpassed ability to adopt and integrate complex technical systems into preexisting forces and structures. This military technological prowess is backed by a solid civilian technical base and well-established markets for computers, software, and Internet services. With major initiatives such as Commercial-Off-the-Shelf (COTS), there is good cross pollination of civilian and military computer technology, and open standards are an important part of that. Interestingly, most other nations depend on our systems and technology for their civilian and military needs.

Recent advances in technology offer warplanners and warfighters a multitude of new opportunities. One of the major programs underway to exploit these advances is the Warfighter Information Network-Tactical (WIN-T). WIN-T is an evolving and highly integrated Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) network comprised of commercially based COTS components. It is expected that tens of billions of dollars will be spent on this program in the next decade.

Commercial telecom technology is the backbone of the WIN-T architecture, providing simultaneous voice, imagery, data, and video communications in a highly-secure network. Telecom technologies including Asynchronous Transfer Mode (ATM) data transport, wireless high-capacity networks, Voice over Internet Protocol (VoIP), and PCS cellular services are all part of WIN-T.

While people often think of ruggedized military electronics as being the most robust available, commercial telecom systems are arguably much more robust in important ways. Rather than building systems with singular resources that represent single points of failure, telecom systems are usually built using redundant components and software to manage them. Failed components are dynamically and often automatically switched out of the system and replacement resources are switched in. While it is true that military electronics generally must operate in greater extremes of temperature, shock, and vibration, the underlying architectures of telecom systems are usually more robust, fault tolerant, and scalable.

Today, the architecture of both civilian and military electronics is largely determined by the silicon and software developed for civilian commercial products. This silicon and software is undergoing an architectural sea change as technology evolution takes us from conventional parallel bused backplane architectures (including VME and PCI) to switched serial interconnects, often called switch fabrics.

The first open standard, released in 2001, for switched fabrics was PICMG 2.16. The

While people often think of ruggedized military electronics as being the most robust available, commercial telecom systems are arguably much more robust in important ways.

PICMG 2.16 architecture supplants (and often entirely replaces) the CompactPCI parallel backplane with a dual, redundant 10/100/1000 Ethernet switch fabric. This architecture has several key advantages over its predecessors.

First, PICMG 2.16 systems with no parallel data bus do not have the weakness that a single shorted data line can bring down the entire system. The links between processors are redundant serial links going through a switch. If a single board fails, it is merely switched out of operation and subsequently shut down. The switching resources themselves are dually redundant, so if a switch fails there is another one available to take over. Second, the sustained data transfer rate in a single chassis jumps from the few hundred MBps seen in VME or traditional CompactPCI to over 40 Gbps. Third, failed boards may be hot swapped out and replacements swapped in without turning off the power or otherwise disturbing a running system.

PICMG 2.16 systems are ideal for packetized data of many kinds, and are a popular choice for VoIP applications. Ruggedized and militarized conduction-cooled versions are available from many suppliers, and the popularity of PICMG 2.16 continues to grow. Figure 1 shows a ruggedized SBS Technologies CompactPCI chassis for avionics applications that equals or exceeds traditional

Figure 1

ATR-style enclosures while leveraging leading-edge telecom standards.

The VME community has adapted the move towards switched serial interconnects with the VITA 31.1 standard, which combines special VME cards with standard PICMG 2.16 switch cards. The emerging VITA 41 VXS standard creates a 2.16-like native VME architecture with a switched fabric, adding system management, an important element for managing redundant resources.

The most powerful and sophisticated open standard for switched serial interconnect platforms is AdvancedTCA, developed by PICMG, and released in late 2002. AdvancedTCA was developed for demanding telecom applications that often require that a system remain working for 30 years (>250,000 hours) without interruption. AdvancedTCA provides many features that will become highly desirable for military equipment designers as the technology broadens its application space.

AdvancedTCA systems offer fully redundant DC power feeds, hot-swap capability, a sophisticated system management architecture, and 200 W per slot thermal capability. These systems are designed to meet tough telecom NEBS environmental standards. A wide range of fabric topologies and interconnect technologies, including Ethernet, PCI Express Advanced Switching, StarFabric, and Serial Rapid I/O are supported. Heterogeneous processor types, including DSPs, network processors, and general-purpose processors can be used and intermixed. Backplane data rates can exceed 2.5 Tbps in fully loaded 16-slot AdvancedTCA systems using a full mesh fabric topology. Figure 2 depicts two- and six-slot AdvancedTCA systems from Carlo Gavazzi Computing Solutions.

Figure 2

One emerging and soon to be released standard that will be appealing to designers of deeply embedded small military computer systems is the Computer on Module (COM Express) specification. This is an entirely new PICMG specification that defines a feature rich small form factor embedded computer board. It can function alone or serve as a processor mezzanine board that plugs onto a base board containing application-specific I/O.

A wide range of peripherals, including video, USB, Serial ATA, Ethernet, PCI, and PCI Express signals are supported. COM Express boards provide a standardized interface in a small footprint of 95 mm by 125 mm. Figure 3 shows a COM Express single board computer from RadiSys Corporation.

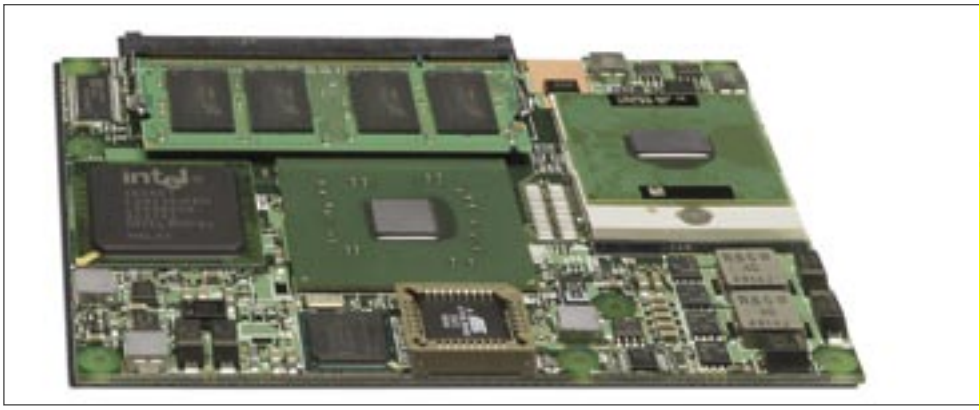


Figure 3

One important benefit of COM Express-based designs is a fair amount of protection from parts obsolescence, which plagues military electronics designers. An important use of COM Express processor boards is as a processor mezzanine board that plugs into a base board that contains application-specific electronics. COM Express processor boards that become obsolete can easily be replaced with newer or more powerful versions. Expensive and difficult software upgrades are simplified as chip specific software that used to be contained in cumbersome board support packages is now provided as a standardized (and free) Application Programming Interface (API) by the chip manufacturer.

While both commercial civilian and military systems will continue to have unique needs, there is a great deal of technology and standards development work coming out of the civilian sector. This directly benefits next generation, highly integrated and sophisticated military communications systems. As the military follows the same course as civilian information technology with its move towards packetized data, open civilian standards will play a greater part in next generation military communications systems. The ability to deliver any data anytime to any warfighter or warplanner anywhere will truly allow the American military to attain Sun Tzu's ultimate acme of skill.

Joe Pavlat *is the editorial director of* CompactPCI and AdvancedTCA Systems. *He has more than 30 years' experience in the embedded computer industry. He is currently president and chairman of the PCI Industrial Manufacturers Group (PICMG), an industry consortium that develops open computer standards for the industrial control, instrumentation, and communications markets. Joe holds a Bachelor's degree in Computer Science from the University of Wisconsin.*

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Space-ready, radiation-tolerant processor modules: A COTS technology strategy

By Anthony Lai

The processing power available from today's off-the-shelf embedded technology and boards far exceeds that available only two years ago. However, in space-based applications, technology that is five and ten years old is commonplace. The requirement to survive the rough trip into space, and the incessant radiation of in-space service has often necessitated using older and lower-performing radiation-tolerant electronics.

But that's begun to change. COTS modules loaded with leading-edge components are finding their way into orbit and deep space missions. Radiation-tolerant processors are now available, and board-level design techniques such as redundancy and voting logic can be utilized to bring desktop performance to space applications. A careful design strategy – tailored to the end application – can yield high performance in high-radiation systems.

Now that President Bush's space exploration vision is receiving initial funding, NASA is gearing up to realize the Administration's mandate to explore Mars and beyond. NASA is preparing a host of options and plans, the likes of which the space industry has not seen since the Apollo program. As before, technology will be the cornerstone and the space community is in search of a next-generation processor module that *can* meet the immediate and future demand of the country's return to space.

Furthermore, design engineers want processing power and I/O flexibility that meets or exceeds what is available on their desktop, and capabilities that are at least on par with contemporary benign environment embedded processor modules. And with the requirement for maximum technology reuse across multiple systems in satellites and space vehicles – from the avionics suite to payload packages – settling on a processor module that meets multiple system requirements simplifies the overall design task and maximizes the investment against the harsh nuclear and particle effects of space.

The good news is that unlike the Apollo program, where proprietary processors and subsystems were designed from scratch, modern Commercial Off-the-Shelf (COTS) technology can meet NASA's space demands. However, this is only true as long as appropriate design attention is paid to mitigate the space environmental effects of Total Ionizing Dose (TID), Single Event Effects (SEEs), and induced data errors.

Basic requirements

Any new processor design must target the needs of affordable, yet high-performance open-architecture avionics to field in Low-Earth Orbits (LEO), Mid-Earth Orbits (MEO), Geosynchronous Orbits (GEO), and deep space missions. An open architecture enables modularity and flexibility in a *system of systems* design. With NASA planning to launch human exploration missions to planets such as the moon and Mars, a launch vehicle developed under the Evolved Expendable Launch Vehicle (EELV) program will provide a larger payload capability to succeed in these missions.

The survival and operational environment experienced by space electronics will also become much more severe as the EELVs penetrate deeper into space and rely on nuclear power to operate electronics. Furthermore, the aerospace industry is hard-pressed to provide more onboard processing and data storage capabilities for high bandwidth real-time data from various types of advanced remote sensors. Some general space-requirements for an open-standard processor module are shown in Table 1.

Typical mission-critical space system applications that require a next-generation processing element include:

- Mission computer with redundancy
- Flight guidance and navigation computer
- Solid state recorder
- Health monitoring computer
- Robotic manipulator controller

General Requirement	Comment
Performance	Processor module needs unparalleled processing power to handle complex tasks for challenging missions.
Open architecture	Allows multiple vendors, standard interface electronics, modular I/O, longer life cycle.
Low- and Mid-Earth Orbits, Geosynchronous Orbits, deep space, and the terrestrial environment of moons and other planets	Processor module must evolve to offer various levels of radiation hardness to survive and operate missions in many space environments.
Nuclear-powered vehicles	Deep space applications and habitats in other planets may not rely on solar/battery power; instead, an onboard nuclear unit supplies power. Electronics must withstand close proximity to the nuclear unit.
Multisystem use/reuse	Processor module must be useable in multiple roles on the vehicle: from avionics to payload to general housekeeping (such as mass storage). Also, specialty applications such as a robotic arm should benefit from the same processor module.
Traveling in space requires a launch and a re-entry with possible intermediate docking in space	Processor module must be able to survive and operate through the severe launch and re-entry environments for multiple planets.

Table 1

Radiation characteristics

Regardless of the capabilities of a specific processor module, *all* onboard electronics must operate in the intended environment of space. As shown in Table 1, typical space electronics are designed for two levels of radiation hardness to accommodate specific needs of either the LEO/MEO and Mars/lunar terrestrial environment, or the GEO and deep space environment. For LEO/MEO and terrestrial missions, typical electronics should be designed to meet the following minimum requirements:

- Single Event Latchup (SEL) with LET > 37 MeV•cm^2/mg
- Single Event Upset (SEU) rate of less than 1 error every 25 years in LEO orbits

For much more severe geosynchronous applications where the effects of earth's Van Allen belts are felt, or deep space applications where the solar storm puts extreme radiation stress on integrated circuits, a processor module and associated electronics must be designed to meet the following requirements:

- Component TID > 100 krad (Si)
- SEL with LET > 37 MeV•cm^2/mg
- SEU rate of less than one error every year

Specific requirements

There are multiple techniques to make a processor module suitable for use in various types of earth orbiting and deep space missions. In order to survive and operate in these space environments with superior performance in a small and industry-standard size, the specific characteristics of a typical radiation-tolerant processor module are shown in Table 2. Note that two fundamental assumptions are made: that conduction-cooling is required in the absence of air; and an industry-standard module such as CompactPCI or VME meets the need for interoperability, upgradeability (during a long design and qualification program), and modularity.

Proposed space module

Referring back to the requirements in Table 2, the heart of a COTS radiation-tolerant processor module must be a high-performance, modular, low-power RISC microprocessor to meet the ever growing application demands of today's and tomorrow's robotic space missions. As an inherent feature of the Silicon-on-Insulator (SOI) wafer manufacturing process, this type of microprocessor is designed and tested to meet and exceed very high levels of radiation hardness. And as a side benefit, the SOI wafer manufacturing technology greatly reduces power consumption and therefore significantly increases the possible clock rates and, subsequently, achieves a processor speed with a throughput of over 1,500 Dhrystone MIPs. Other COTS microprocessors manufactured with typical CMOS-based technologies cannot even meet the lower, LEO/MEO level of radiation hardness as specified earlier.

To ensure reliability in the space radiation environment, it is necessary to use radiation-tolerant devices for the PowerPC system controller (PCI bridge and memory controllers) and other critical system functions, including user-programmable timers and counters, a safety watchdog management subsystem tied to an external radiation-hardened watchdog supervisor, reset mechanisms, CompactPCI bridge, and all the "usual" radiation mitigation schemes. PCI and CompactPCI bus interfaces are suggested to offer an industry-standard I/O expansion slot via a PMC site and to access to a modular bus system via a CompactPCI backplane.

Generally, the smaller the board's and subsequent chassis subsystem's form factor, the easier it is to fit into smaller satellites and

Functional Requirement	Comments
Microprocessor	PowerPC processor is available today with superior performance, low-power consumption and inherent radiation capabilities.
Microprocessor Caches	ECC and parity protected on-die L1 and L2 cache provides mitigation to SEE.
Volatile Memory	SDRAM arranged in a triple voting architecture (three bits per cell) ensures the processor always receives the best available data and instructions.
Non-Volatile Boot Memory	Dual-redundant boot Flash maximizes alternate paths to start a flight application in case corruption occurs in firmware and/or application images.
Non-Volatile User Memory	ECC-corrected user Flash memory provides real-time correction and detection to data corrupted by SEEs.
Legacy I/O Interface	RS-422 UART interfaces provide a console development port and legacy sensor interface.
I/O Expansion	Conduction-cooled PCI Mezzanine Card slot for flexible and modular I/O expansion.

Table 2

robotic vehicles. In this instance, 3U CompactPCI offers superior board functionality to size ratio and available user-defined backplane I/O pins in comparison to other 6U size bus technologies (such as VME). Although this ratio is seemingly relative and arbitrary, the benefits offered by worldwide industry standards, open systems computing architectures, and economies of scale far outweigh the initial and maintaining cost limitations of yesterday's purpose built and proprietary point designs.

Volatile RAM memory subsystem

Several techniques can be implemented in the volatile memory to ensure reliable mission operations with onboard flight software to enhance the radiation hardness of a space-based processor board. Several technical papers also discuss the Single Event Effects (SEE) of the processor and the side effects introduced by the instruction and data caches[1].

While radiation affects all semiconductors, memory devices are particularly sensitive to space-based effects. Random access memories such as Synchronous Dynamic Random Access Memory (SDRAM) are particularly prone to flipping bits or erasure, depending upon the space environment. Based on previous proton and heavy ion testing performed on device types, onboard volatile memory resources can be protected from radiation effects by using a number of strategies. One effective technique with SDRAM uses triple redundancy with voting mechanism logic incorporated in a radiation-tolerant Field Programmable Gate Array (FPGA).

SDRAM is used heavily in providing the actual instructions and data to the processor to execute processor instructions. In a redundant, triple-voting mechanism at the component level, three separate banks of SDRAM are implemented to maintain the data integrity. The SDRAM controller and the majority rule, triple-voting mechanism can be implemented in anti-fuse FPGAs (as opposed to Standard Random Access Memory-based FPGAs) for radiation hardness and reliability. Figure 1 shows the triple-voting mechanism of a volatile memory scheme that enables simultaneous writes to three memory banks in real time and corrects data read in triple-voting methodology.

As mentioned, selecting an embedded processor such as the PowerPC yields performance of over 1,500 Dhrystone MIPs. However, in order to maintain such processor throughput, the internal L1 and L2 cache memory must be enabled. Both L1 and L2 caches reside on the same SOI die as the processor and there-

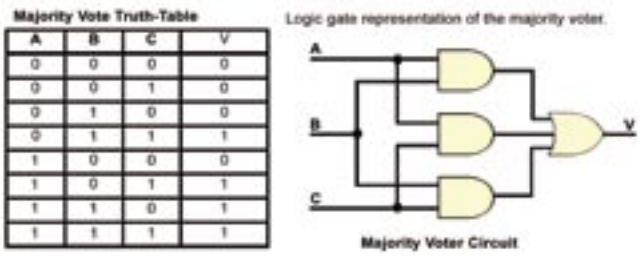

Figure 1

fore have the same inherent radiation characteristics as the processor. The internal L2 cache has a capacity of 512 KB and utilizes an eight-bit Error Correction Code (ECC) for every 64-bit word in memory. The ECC logic is used to correct a majority of single bit errors and detect multiple bit errors. The L2 tags also support parity and by-way locking. The L1 cache has a 32 KB Instruction Cache and 32 KB data cache; both types of cache are eight-way set associative and the L1 cache tags support parity, as well.

Non-volatile ROM

Similar to the protection scheme for RAM, the integrity of extensive firmware utilities stored in boot Flash can also be guaranteed by dual redundancy (two independent banks of boot Flash) in combination with a watchdog mechanism. Software-independent radiation-hardened circuitry is the key component of this watchdog mechanism and the design expects a periodic service generated by the firmware or the flight software application. The redundancy scheme maximizes an opportunity to boot successfully after an initiated or environment-induced reset (software reset, or a power cycle reset, or a SEE).

The dual-redundant scheme works as follows: upon power up, the radiation-tolerant module must successfully start the flight software, and any one defective boot Flash can be overwritten by the contents of the intact boot Flash to provide two identical copies for future start up operations. A hardware register can be added to provide a status if such overwritten operations were performed during the last reset. For further assurance against soft errors, the control logic to implement the watchdog timer and the overwritten operations are also implemented in an anti-fuse FPGA. Dual-redundant boot Flash is controlled by a radiation-hardened watchdog supervisor function (see Figure 2). The redundant Flash is used to boot up if the watchdog expires without an initial service from the boot-up firmware and subsequent service by the flight application.

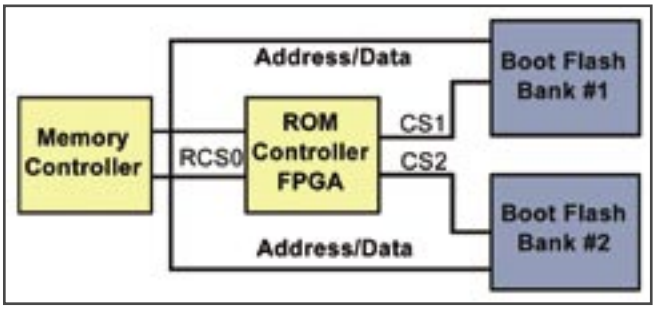

Figure 2

Besides boot Flash, additional non-volatile user memory is required to store the user's application and data such as digital filter coefficients or static data tables. The user Flash is often NOR Flash to provide best performance in random access scenarios. It is further enhanced with an ECC correction algorithm integrated with the Flash memory controller inside an anti-fuse FPGA. As shown in Figure 3, the user Flash controller calculates and writes ECC syndromes to the third Flash bank while data is written in 32-bit mode to the other two user Flash banks. The ECC mechanism corrects single-bit errors and detects multi-bit errors. When the processor initiates a read request to the user Flash, a CRC checksum is calculated and compared against the stored value. If the two checksums are different, a single-bit correction will be attempted or the flight software will be notified with a multi-bit error in the Flash. Similar to the intent of dual redundant boot Flash, the ECC-protected user Flash is also designed to mitigate SEE.

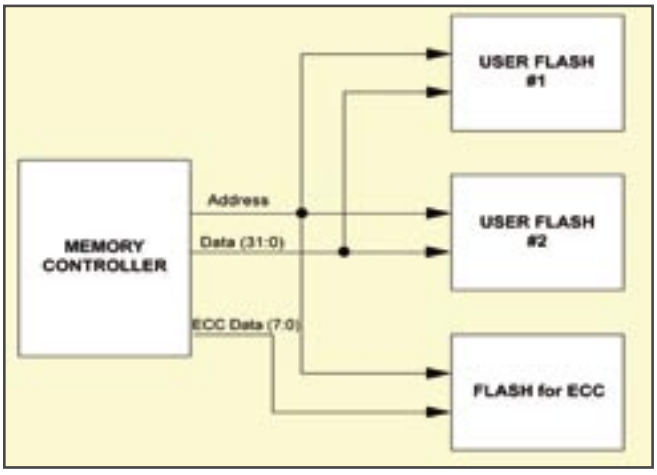

Figure 3

System-level functions

As shown in Table 2, there is more to a radiation-tolerant system processor besides the CPU and memory subsystems. A local expansion slot is an attractive feature because it enables additional mission or application specific I/O interfaces to be inserted into a single-slot solution and maintains the same system processor as a building block. This feature is particularly important when a system has a high-speed I/O interface and the high bandwidth

traffic can be localized to a dedicated bus on the processor instead of an external bus system.

For communication among other cards, a bus interface is desirable to allow expanding multiple system processors to perform redundant or different tasks. Moreover, a bus system provides access to additional I/O features that cannot fit onto a daughter card. One application example of such an I/O card is a motor controller, which typically has high current and large components that do not fit in any industry-standard I/O card form factor.

An example of such expansion and bus interfaces is the implementation of a local PCI bus for an onboard PMC site implemented in an FPGA. The same FPGA approach is used for the external CompactPCI bus. It is essential that the CompactPCI bus interface be designed to operate as either a master or slave controller to allow maximum system flexibility. In the case of a master controller, the interface should support up to eight PCI devices in a standard CompactPCI backplane (the maximum amount without additional bridging).

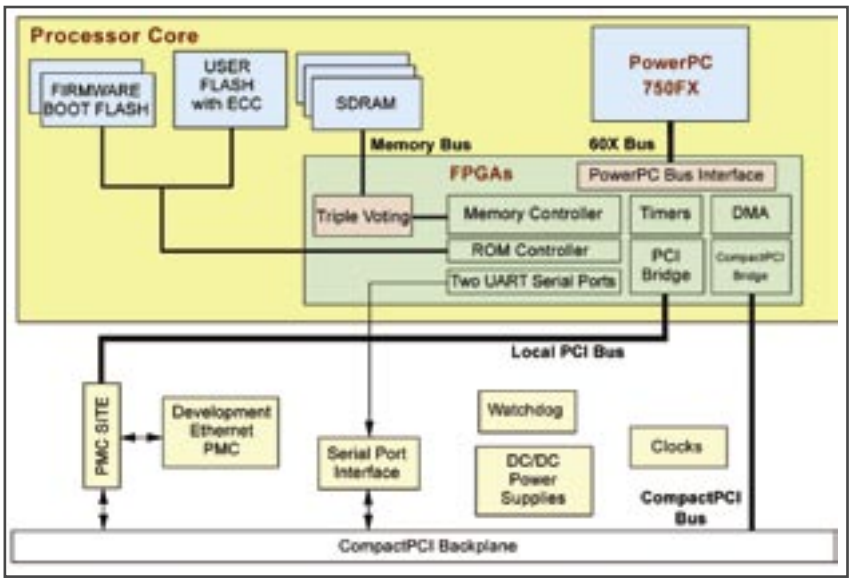

Figure 4

The UART control logic for legacy serial channels can also be implemented in an FPGA, while the serial transceivers are implemented using bipolar space-qualified devices. Timers or counters can also be implemented in an FPGA to provide auxiliary timing functions for the flight software and execution of time-based software development tools.

COTS radiation-tolerant board

We have described the ideal mitigation techniques for designing a radiation-tolerant processor card. Many of the *individual* techniques have been introduced in the past, but they are now implemented *together* to provide integrated radiation hardness enhancements at the board level in the Aitech S950 product. Figure 4 depicts the functional block diagram of the S950 and shows the flow of processing functions among the processor, memory elements, and expansion I/O or bus interfaces.

By incorporating dual footprints for various components in the design, this product comes with an engineering unit that is a form, fit, and functional equivalent to the flight unit. The engineering design units allow for rapid prototypes of space missions with software compatibility for the flight configuration. For different space environments, the processor card is offered in two flight configurations to accommodate customers' environmental and operational requirements.

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Anthony Lai *Anthony is currently space product business development manager for Aitech. He has more than 15 years of experience in space avionics design and development for radiation tolerant computer products. Prior to joining Aitech, he led several avionics payload designs at Jet Propulsion Laboratory, including the Mars 2003 Rover prototype (FIDO). Lai has an MS in Electrical Engineering from UCLA as well as a BA in Electrical and Computer Engineering with a minor in Applied Mathematics from UC Irvine.*

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Meeting Software Defined Radio cost and power targets: Making SDR feasible

By Manuel Uhm and Jean Belzile

The vision of software reconfigurable radios is finally a reality, but implementations are not as efficient as they could be. Although the radio itself can be programmed to realize multiple waveforms for joint service interoperability, current implementations require redundant hardware for multiple channels.

A better approach is to use higher performing programmable logic that can be partially reconfigured in-system. This shared resources method allows not only the radio to implement multiple waveforms, but eliminates redundant per-channel hardware. Partially reconfigurable FPGAs will save space, weight, power, and cost.

Today, Software-Defined Radios (SDRs) are becoming a reality in the military through programs such as the Joint Tactical Radio System (JTRS). However, two critical issues continue to limit the practical deployment of SDR: power and cost. Specifically, current implementations of SDRs, including JTRS Cluster 1 radios, consume more power than is desirable. This results in lower-battery life, as well as excessive thermal dissipation. Furthermore, they are still too expensive to make widespread deployment cost effective.

In order to move forward with successful deployment, these are issues that must be addressed by all SDR programs, including military and commercial. Fortunately, the technology is now available to address these issues in a significant manner by *decreasing* the number of components while still providing the necessary functionality. What is this magic technology? It is the latest generation of high-density Field Programmable Gate Arrays (FPGAs) that allow in-system partial reconfiguration. Even though the technology is applied in an unclassified SDR modem, it is worth noting that it's also applicable to other critical subsystems of an SDR, such as the RF front end, I/O, and crypto.

Dedicated resources vs. shared resources

The current model for implementing an SDR modem is known as a *dedicated resources* model. It is called dedicated resources because there is a set of processing resources that is dedicated to a radio channel where each channel typically represents one type of radio waveform, such as Single-Channel Ground and Airborne Radio System (SINCGARS). In this case, the processing resources consist of an A/D, D/A, FPGA, Digital Signal Processor (DSP), and General-Purpose Processor (GPP). In order to implement an N-channel radio, N sets of processing resources are required. This is illustrated in Figure 1 for a four-channel SDR modem supporting a Software Communications Architecture Core Framework (SCA CF), as mandated for JTRS. Current four-channel SCA-enabled SDR modem implementation requires a dedicated set of hardware for each channel (Figure 1). The more channels the SDR must support, the more hardware it contains. This adversely affects power consumption and cost.

From a functional perspective, this model of dedicated resources for each channel has been proven to work well. However, it is an inefficient usage of the processing resources, resulting in excess power consumption and cost. For example, with regard to cost in this model, the subsystem level cost of the modem scales linearly with the number of channels being supported. However, from a parts cost perspective, parts for all channels of the radio must be selected for the worst case scenario; that is, the processing resources must be able to support the largest waveform (the Wideband Networking Waveform for Cluster 1 radios), such that if only a small waveform like SINCGARS is instantiated, most of that channel's processing resources are not utilized.

This has a significant impact on driving up the cost of the modem. Obviously, the problem gets exacerbated as one scales the model further. The JTRS Cluster for Airborne, Maritime, and Fixed (JTRS AMF) installations, for example, requires some radios to support eight channels. This also has an obvious impact on power consumption. Even if all the channels are not being utilized, the processing resources are still drawing some amount of power.

A more efficient model for an SDR modem is referred to as a *shared resources* model. Unlike the dedicated resources model,

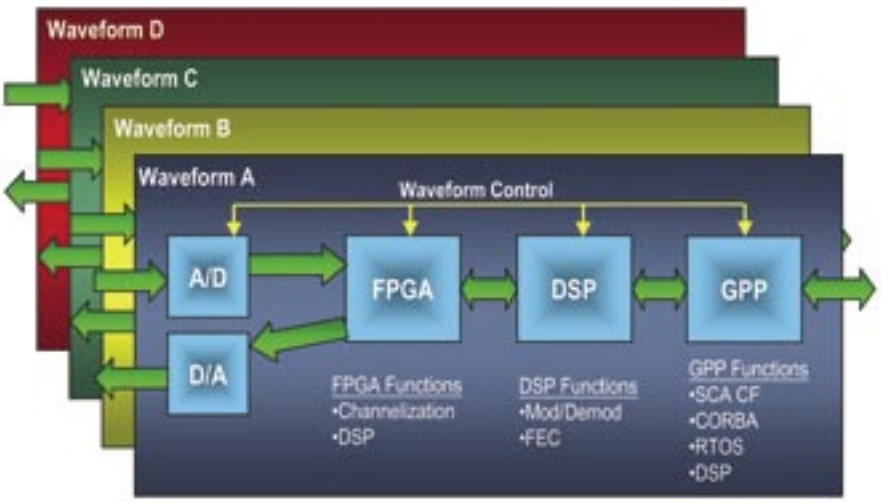

Figure 1

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this architecture offers the capability to support multiple waveforms across a single set of processing resources, allowing for much more efficient usage of the resources. The number of waveforms that can be supported is a function of the size of the waveform and the size of the available processing resources. A multi-channel SCA-enabled SDR modem using shared resources rather than dedicated resources is shown in Figure 2. In this instance, five channels supporting one wideband waveform and four narrowband waveforms have been implemented, while reducing the part count from 20 to a mere four components, (each functional block, as shown.) Implementation of this technology can result in a production cost and power consumption that is two to three times lower.

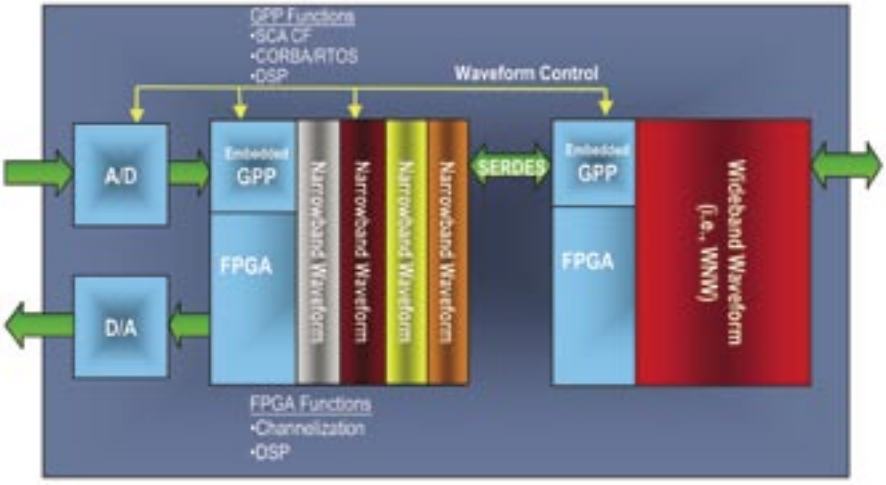

Figure 2

Also notice that in this architecture, the GPP from the dedicated resources model that manages the modem infrastructure and operating environment (which is, POSIX-compliant RTOS, CORBA ORB, SCA CF) has been integrated into the FPGA, and the FPGA is doing all the heavy digital signal processing. The embedded GPP is also a natural fit for the light signal processing, such as synchronization loop control, and the upper protocol layers such as link and network layers. Essentially, the FPGA is an SCA-enabled System-On-a-Chip (SoC). This contributes to the cost and power savings, beyond just using the shared resources model, by removing two parts per channel card: the discrete GPP and the DSP.

It is also worth noting that both models illustrated here are using 100-percent commercially available components. In the shared resources model, the SoC FPGA is a mid- to large-sized Xilinx Virtex-II PRO FPGA with an embedded IBM 405 PowerPC core, but could be a next-generation Virtex-4 FX FPGA, also with an embedded IBM 405 core.

Enabling technology

The technology that enables this shared resources model is partial reconfiguration of FPGAs. Partial reconfiguration is the ability for an application, such as a waveform, to be dynamically configured or reconfigured in a portion of the device, while other portions are either under use by other applications or unused. This allows support for multiple independent applications concurrently in a single FPGA, which is somewhat analogous to dynamic task switching or multitasking of a GPP. Without this capability, it would be necessary to reconfigure the entire FPGA to support a different application, which would result in the loss of all previous applications.

For example, if an FPGA was configured to support a SINCGARS communications link, it would have to be fully reconfigured to support an Enhanced Location Position Reporting System (EPLRS) communications link, resulting in the loss of the SINCGARS link, regardless of how much left over logic there may be in the FPGA. Clearly this is unacceptable for a radio. This is why the current Cluster 1 implementation, which does not support this capability, must use an inefficient dedicated resources model to support multiple channels.

In order to implement partial reconfiguration on an FPGA, three basic elements are required:

- An FPGA which inherently supports dynamic reconfiguration of only portions of the device while leaving the other portions unaffected, such as the Xilinx Virtex family of FPGAs. The Virtex family is column reconfigurable, meaning that individual columns of logic within the device can be dynamically reconfigured, independent of the rest of the columns.
- Partial reconfiguration software development tools which support the development of applications restricted to boundaries which comply with the hardware architecture of the FPGA. For the Virtex family, tools must be available to restrict applications to columns to match the columnar architecture.
- At least a basic controller must be available to dynamically manage the reconfiguration of the FPGA. This could be an embedded GPP, a soft core GPP (such as the Xilinx MicroBlaze core), or an external GPP connected to the FPGA. In this shared resources model, the same embedded GPP that is running the modem infrastructure and operating environment is also managing the partial reconfiguration of the FPGAs.

So why has this Commercial Off-the-Shelf (COTS) technology not been adopted for current SDR modem implementations, such as JTRS Cluster 1? The reason is simple: although COTS hardware has been available to support this technology for some time, COTS software development tools have not been available to make such application designs feasible. This is no longer the case. Standard tools from Xilinx are available by request for Virtex-II PRO today and for Virtex-4 in the fourth quarter of 2005.

Supporting shared resources in an SCA-enabled radio

A shared resources model enabled by partial reconfiguration of an FPGA to support multiple waveforms can be supported by the SCA as mandated for JTRS. In fact, partial reconfiguration can be viewed as creating two classes of firmware: static and dynamic. Static firmware is normally common to all waveforms, such as digital down converters, and/or provides infrastructure services such as accessing chips

like ADCs, DACs, and I/Os. This type of firmware is instantiated once at power up and stays valid for the duration of the uptime of the radio. Static firmware maps well to the SCA's concept of a *device*.

On the other hand, *dynamic firmware* is waveform dependent. The dynamic firmware is instantiated when the waveform needs it. Thus, it makes sense to implement waveforms as a mix of software and dynamic firmware. Because it is only present in the FPGA when it is needed, the concept of dynamic firmware is closely related to that of a dynamic linked library. Dynamic firmware maps well to the SCA's concept of a resource. Therefore, it is simple and elegant to support in today's SCA-enabled radios.

This new firmware flexibility also creates a paradigm shift. Now it allows waveforms to take advantage of the strengths of each processor type for the most efficient implementation to minimize power and size. Indeed, the firmware can handle the highly regular signal processing with great power efficiency while the processor can handle the exceptions and other data-related issues such as switching, routing, and so on. The resulting waveform is more power and size efficient than both its firmware only and software only equivalent.

Proven technology

The shared resources model using an SCA-enabled SoC has been proven to work today. Xilinx and ISR Technologies have implemented this model in a COTS Xilinx Virtex-II PRO-based SDR modem from ISR Technologies. The demonstration system uses two modems, each supporting two independent applications: a narrowband, 256 kbps waveform supporting a communications link between two Voice over Internet Protocol (VoIP) phones and a wideband, 1024 kbps waveform supporting a streaming video link between two laptop computers. Using a COTS SCA CF from the Communications Research Centre, the video link can be instantiated and torn down while maintaining the communications link and vice versa. More details on the demonstration can be found in the December 2004 *JTRS JPO Technology Awareness Bulletin* published by the JTRS Joint Program Office at http://jtrs.army.mil/sections/technicalinformation/fset_technical.html.

Figure 3 is a floor plan of a Virtex-II PRO-based SCA-enabled SDR modem SoC supporting shared resources through partial reconfiguration. Yellow areas represent static firmware and do not change from waveform to waveform. This includes the digital down and up converter, internal shared buses (the Core Connect bus for the embedded GPP) and the interfaces to external devices, such as

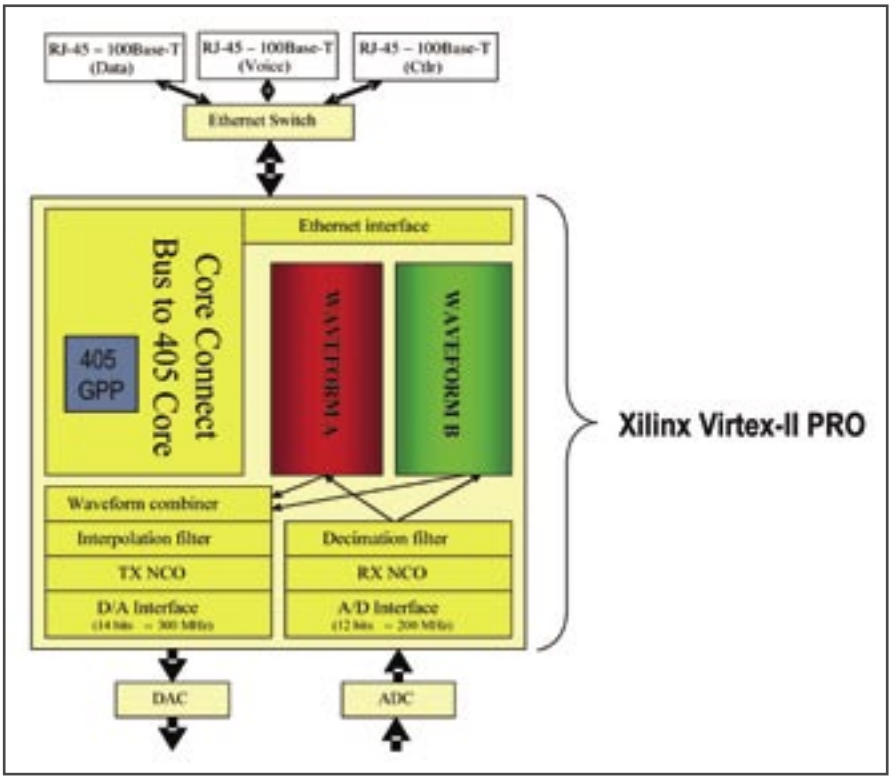

Figure 3

the A/D and D/A. The two applications (waveform A and B) run independently in the partially reconfigurable region in the right hand side of the device. If necessary, a larger waveform or smaller waveforms could run in the same space.

For the demonstration system, the engineering effort included the development of both waveforms, the development of beta software development tools to constrain the applications to partially reconfigurable regions, and integration with the SCA operating environment. This effort took approximately 10 man months in the span of two months of elapsed time.

Reconfigurability realized: SDR's real potential

Cost and power consumption are critical issues that hamper the feasibility and deployment of SDRs today. Moving from a dedicated resources model to a shared resources model can significantly drive down the cost and power consumption of the modem by factors of two and greater by reducing the number of components required to provide a given set of functionality. This model should be seriously considered for all new SDR development. Even for existing SDRs, this capability can be integrated through technology insertion to lower the production cost and increase the radio's battery life. Moreover, future waveforms can easily be instantiated using existing, already-deployed hardware.

***Manuel Uhm** is the DSP Marketing Manager for Xilinx, Inc. He is responsible for strategic marketing within the DSP Division and is one of the foremost experts in market segmentation of FPGAs in digital signal processing applications. Manuel is also currently Co-Chair of the Markets Committee of the SDR Forum. Prior to joining Xilinx, Manuel worked at Spectrum Signal Processing, Inc., a leader in Software-Defined Radio subsystems, where he was responsible for marketing.*

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U.S. Navy Photo by Aaron Peterson

Standards and interoperability to drive RTOS industry

Q & A with John Fanelli, VP of Product Planning, Wind River Systems

EDITOR'S FOREWORD

Most experts agree: the VxWorks Real-Time Operating System (RTOS) is one of the most visible in embedded military systems today. And for good reason. Wind River Systems has had a focus on military applications since the company's inception. Over the years, Wind River has continued to migrate its product line closer to defense applications, both through R&D efforts and via acquisitions such as ISI (makers of pSOS).

As Wind River continues to expand its sphere into telecom, portable appliances and enterprise infrastructure, the military's never far from view and the company continues to improve VxWorks with new ties to Linux and the Eclipse environment. **Military Embedded Systems** ***recently spent some time with John Fanelli, the man responsible for tying it all together.*** **– Ed.**

MIL EMBEDDED: ***Tell us briefly about your company's focus as applied to the military.***

FANELLI: Though Wind River's business continues to maintain a balanced portfolio among the major market segments – automotive, consumer electronics, networking, industrial, and aerospace and defense – the company has always relied upon its aerospace and defense business as one of its strongest and most consistent segments. Wind River VxWorks is the most widely deployed RTOS in the military, and is found at the heart of a vast array of military systems, including F-35 (JSF), F-22, Global Hawk Unmanned Aerial Vehicle (UAV), most US and European fighter aircraft, air, land and sea missiles, helicopters, and many miscellaneous military avionics systems, among others.

According to market analysts at Venture Development Corporation, we are the acknowledged leader in both North America and Europe for operating system technology in the military. Additionally, Wind River is focused on addressing the safety critical and security requirements of the military and is actively supporting major programs in manned and unmanned vehicles.

MIL EMBEDDED: ***We've heard from a number of hardware vendors, but what does Wind River see new in COTS (Commercial Off-the-Shelf) and/or military systems?***

FANELLI: Interoperability is the hot topic today. Most of the technologies employed by the individual US Services such as the Army, Air Force, Navy, and Marines are to a degree incompatible forcing the field soldiers to improvise solutions to overcome communication and bandwidth limitations on existing systems. Key programs include Joint Tactical Radio Systems (JTRS) and the Global Information Grid.

Standards such as Multiple Independent Levels of Security (MILS), POSIX, and SCA, among others, are the foundation of military interoperability, all the time. Of course, reusability of technology is important as well, but in order for this to become more of a reality, the Joint Services need to share development costs across programs, something that is not done today. Additionally, open source, specifically Linux, is starting to spring up more and more in military systems, which is great since we support Linux.

MIL EMBEDDED: ***What are the top three embedded technologies you're seeing in the market today?***

FANELLI: Trends include Multiple Independent Levels of Security (MILS), Integrated Modular Avionics (ARINC 653), and as highlighted before, Linux. For example, classified and unclassified information will coexist on the same hardware platform using MILS technology, replacing the "stovepipe" solutions that exist today.

MIL EMBEDDED: ***What are some of the key challenges the military faces with COTS insertion and sustainment?***

FANELLI: In order for software insertion to occur, it's important that vendors achieve conformance with standards such as POSIX; Common Criteria certification for moderate and high-assurance applications; and they must provide long-term product support and software reuse for sustainment.

Sustainment becomes equally more tractable if strict standards are applied and adhered to. As systems require replacing over the years, newer applications and systems can more easily be inserted into legacy systems if both pieces have been designed to follow strict standards.

By embracing standards such as POSIX, ARINC-653, and Eclipse, Wind River and other vendors can help guide the industry in the direction mandated by the military to ensure an interoperable future for device software systems.

MIL EMBEDDED: ***What effects will market consolidation have on the military customer?***

FANELLI: I actually see synergies, not consolidation "problems," and the military customer will benefit by some of them. Some of these synergies occur around the open-software development framework called Eclipse, where tools become extendable plug-ins within a development

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MIL EMBEDDED: ***How is the topic of "safety-critical software" affecting designers' COTS choices?***

FANELLI: Development of safety-critical software is undergoing a shift as well. Before, we had federated systems deployed on a single hardware element, using a COTS or home-grown OS. Today, we see consolidation of applications onto an ARINC- 653 platform using a COTS OS.

An example is the Boeing 787 program where multiple vendors will build applications on Wind River's ARINC-653 platform that meets DO-178B Level A certification. Now safety critical developers can also achieve the goals of portability, reusability, and modularity for their applications.

MIL EMBEDDED: ***Wind River recently endorsed the Eclipse development environment and community. What does this mean to the military user?***

FANELLI: Obviously, we believe Eclipse is strategic, otherwise we wouldn't be investing in it. Thus far, Eclipse has gained remarkable traction in the enterprise market, so now is the time to focus on repeating this success in the broader aerospace and defense industry. Wind River Workbench, with third party plug-ins, is being applied across many different programs and RTOSs (from VxWorks to Linux to third-party OSs) for both enterprise and embedded development. Primes will be able to standardize on tools/middleware and increase their efficiencies, while federated programs and software solutions will fade.

MIL EMBEDDED: ***What impact does the DOD's Global Grid and "system of systems" have upon the future and architecture of embedded systems?***

FANELLI: This initiative forces a move from conventional embedded systems design such as single board, single application, or meeting a specific project need, to what we call Device Software Optimization (DSO). DSO means that all available technology (hardware bring-up, build, configuration and verification tools, software interoperability and reusability, post deployment support) across the whole development life cycle is provided on a common, open foundation. This is the military's vision and it marries well with Wind River's vision of how the world is moving away from embedded systems design to a new frontier.

MIL EMBEDDED: ***As systems shrink to boards, and boards to chips, how can this trend continue, and how will it manifest itself in future defense systems? Secondly, what effect does this have on the systems' software?***

FANELLI: Certainly we will see more handheld devices as well as a paradigm shift in CONOPS (Concept of Operations) as processing starts occurring in real time in areas that were previously post analyzed. For example, airborne reconnaissance image exploitation will move from ground-based systems to the airborne vehicles and be processed in real time. A soldier on the ground can have a vehicle scan a road over a hill and alert them of potential improvised explosive devices that were placed there in the last few hours.

By analyzing changes in the roadside over the last few hours in real-time, the soldier can then "rewind" the information to see where the vehicle came from that placed the device. This change in processing power will bring forth a whole new wave of thinking in operations. The software will not change dramatically, but the type of application will evolve to take advantage of these new capabilities.

MIL EMBEDDED: ***How will the disconnect between commercial and military technology cycles be solved?***

FANELLI: Making COTS technology more standards based will make it interchangeable and flexible. This enables technology upgrades to be more easily accomplished and at a lower cost.

MIL EMBEDDED: ***Explain how your company addresses obsolescence mitigation.***

FANELLI: Wind River has a well-defined product life cycle strategy. For the most part, we work to provide upgrade compatibility to new technology for our customers. This allows systems to stay current and customers to plan migration (such as time and dollars) to avoid obsolescence.

Retirement is the final phase of the product life cycle and there is never a predefined time to declare that a product is retired. Instead, the choice to retire a product is driven by a number of factors, including market adoption of newer technologies, customer needs, and Wind River's overall product strategy. When a product is retired, we inform our customers well in advance and also work with them to address individual program needs. In fact, we've addressed custom support for retired products with a number of aerospace customers.

MIL EMBEDDED: ***What are the "hottest" military programs right now?***

FANELLI: The UAV programs are currently the hottest military programs. There is a lot of excitement, funding, and new ideas being fielded in the air, on the ground, and on underwater UAVs.

MIL EMBEDDED: ***What are the least likely* types *of programs and applications to use COTS software technology and civilian embedded electronics?***

FANELLI: High-assurance programs may have issues using COTS software technology as the costs of application software, OS, Board Support Package (BSP), and

"We actually think the Linux and greater Open Source community will have a large impact on military and associated programs..."

middleware certifications are still expensive and not well understood. That said, the Department of Defense is funding this technology via specific programs to help drive costs down.

MIL EMBEDDED: ***What effect will Linux have on tomorrow's military programs?***

FANELLI: We actually think the Linux and greater Open Source community will have a large impact on military and associated programs. Linux is already being leveraged in programs today and we certainly support it. While there are some security concerns with using Linux in highly-classified military programs because of code access, there are benefits such as technology innovation and low cost, to name a few.

MIL EMBEDDED: ***Xilinx FPGAs (Field Programmable Gate Arrays) will soon be reprogrammable on-the-fly. What does this mean to the RTOS?***

FANELLI: FPGAs offer flexibility and the ability to repurpose a design. While on-the-fly reprogrammability for FPGAs provides great flexibility from a hardware perspective, in an environment where the RTOS is closely connected to the hardware, changing the functionality of that hardware can significantly impact the RTOS and applications running on that RTOS.

Fortunately, we are working closely with Xilinx to address this type of issue. Xilinx currently has a BSP builder that helps developers reconfigure the BSP so the operating system can map the devices appropriately.

John Fanelli *is vice president, product planning and management, Wind River Systems. John oversees all product planning and management functions for the company's product lines. He joined Wind River from Sun Microsystems, where he spent six years in a variety of leadership roles, overseeing key software projects for networking, communications, and system services. Prior to Sun, he was a senior management consultant with Coopers and Lybrand's Integrated Strategic Services business unit, where he developed management and information technology strategies for various Fortune 500 companies. John holds a Master of Business Adminstration degree from the J.L. Kellogg Graduate School of Management at Northwestern University, a Master of Science degree in Computer Science from the Illinois Institute of Technology, and a Bachelor of Science degree in Computer Science from the University of Michigan.*

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What is real time and why do I need it?

By Steve Furr

Not all systems need an RTOS; but of those that do, does the designer know what about the system is "real time"? An RTOS can play a key role in determining how a system runs, and it's critical to choose an RTOS based upon system requirements.

Real time is a sometimes misunderstood and misapplied property of operating systems. Moreover, there is often disagreement as to when a Real-Time Operating System (RTOS) is needed. For instance, when designing an industrial control system or medical instrument, most engineers and system designers would concur that an RTOS is necessary. However, questions arise, when it comes to other applications, such as tracking systems and a variety of in-vehicle devices. Is an RTOS needed here? Or would a general-purpose OS such as Linux or Windows do the job? Often, such systems do require an RTOS, but the issue isn't recognized until later in the design phase.

Therefore, it's important to understand why the real-time capabilities provided by an RTOS are not only beneficial, but necessary for a wide variety of embedded systems. For instance, consider a system where users expect or need immediate feedback to input. With an RTOS, a developer can ensure that the system always provides feedback in a timely fashion, even when the system is handling many other compute-intensive activities. The user is never left wondering whether the system has, in fact, accepted the button push or recognized the voice command.

In a nutshell, an RTOS allows developers to control how long a system will take to perform a task or respond to critical events. Deadlines can be met within predictable, and wholly consistent, timelines, even under heavy system loads.

What, exactly, is real time?

To appreciate what real time is, what it isn't, and why it's beneficial, let us start with a basic definition of a real-time system, as defined in the Frequently Asked Questions for the comp.realtime newsgroup (news://comp.realtime or groups-beta.google.com/group/comp.realtime):

"A real-time system is one in which the correctness of the computations not only depends upon the logical correctness of the computation but also upon the time at which the result is produced. If the timing constraints of the system are not met, system failure is said to have occurred."

Real time, then, is a property of systems where time is literally *of the essence.* In a real-time system, the value of a computation depends on how timely the answer is. For example, a computation that is completed late has a diminishing value, or no value whatsoever, and a computation completed early is of no extra value. Real time is always a matter of degree, since even batch computing systems have a real time aspect to them. Nobody wants to get their payroll deposit two weeks late!

Problems arise when many activities compete for a system's resources; in fact, this is where we begin to apply the real-time property to operating systems. In implementing any real-time system, a critical step in the process will be the determination of a schedule of activities that enables all activities to be completed on time.

Any real-time system will comprise different types of activities: those that can be scheduled, those that cannot be scheduled (for example, operating system facilities and interrupt handlers), and non real-time activities. If non-schedulable activities can execute in preference to schedulable activities, they will affect the ability of the system to handle time constraints.

Hard vs. *soft* real time

Often, a distinction is made between hard and soft real time. A hard real-time constraint is one for which there is no value to a computation if it is late and where the effects of a late computation may be catastrophic. Simply put, a hard real-time system is one where all activities must be completed on time. A flight control system is a good example.

On the other hand, soft real time is a property of the timeliness of a computation where the value diminishes according to its tardiness. A soft real-time system can tolerate some late answers to soft real-time computations, as long as the value hasn't diminished to zero. Deadlines may be missed, but the number and frequency of such misses must typically comply with Quality of Service (QoS) metrics.

Frequently, soft real time is erroneously applied to OSs that cannot guarantee computations will be completed on time. Such OSs are best described as quasi real time or pseudo real time OSs in that they execute real-time activities in preference to others whenever necessary, but don't adequately account for non-schedulable activities in the system. Put simply, soft real time shouldn't be confused with non real-time.

Positive impact

Traditionally, RTOSs have been used in hard real-time environments where failure to perform activities in a timely manner can result in harm to persons or property. But an RTOS can be just as useful for applications that must meet QoS guarantees, particularly when failure to do so could result in financial penalty. This covers obvious service scenarios, such as "30 minutes or it's free," but it also includes intangible penalties, such as lost opportunities or loss of market share.

Moreover, real-time technology can be applied to conventional systems in ways that positively impact the user experience, either by improving the perceived response to certain events or by ensuring that important activities execute preferentially with respect to others in the system. For instance, consider a device that pres-

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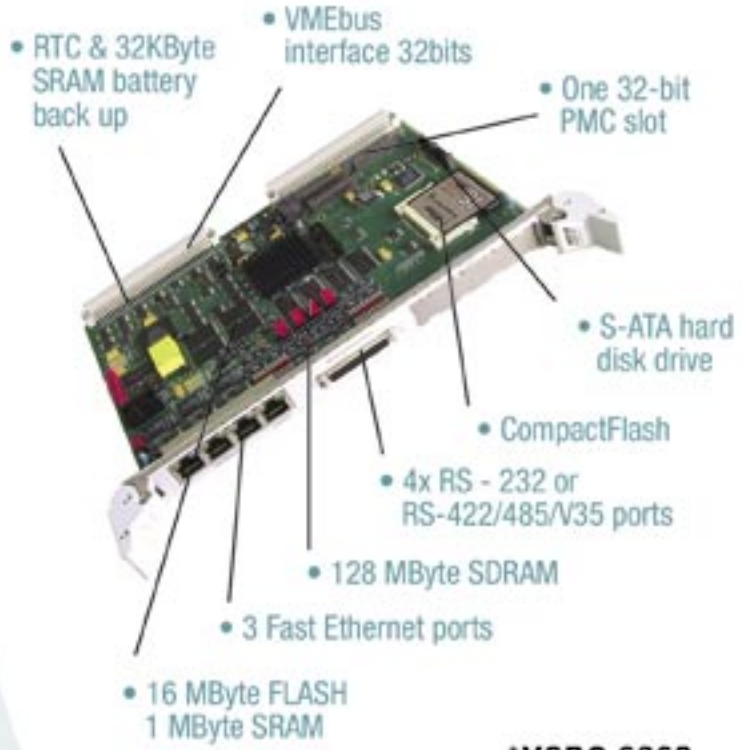

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ents live video, such as MPEG movies. If this device depends on software for any part of its content delivery, it may experience dropped frames at a rate that the user perceives as unacceptable. With an RTOS, however, the developer can precisely control the order in which software processes execute and thereby ensure that playback occurs at an appropriate and consistent media rate.

RTOS: A working definition

What, exactly, constitutes a hard real-time operating system? No universally accepted definition exists, but here is a good working definition based on real-time scheduling theory and consistent with industry practice: A hard RTOS must guarantee that a feasible schedule can be executed given sufficient computational capacity if external factors are discounted. External factors, in this case, are devices that may generate interrupts, including network interfaces that generate interrupts in response to network traffic. In other words, if a system designer controls the environment, the operating system itself will not be the cause of any tardy computations. To provide such guarantees, the OS must satisfy the following basic conditions:

1. Higher-priority tasks always execute in preference to lower-priority tasks (see Figure 1).
2. Priority inversions, which may result when a higher-priority task needs a resource allocated to a lower-priority one, are bounded.
3. Non-schedulable activities, including both non real-time activities and operating system activities, don't exceed the remaining capacity in any particular division.

In Figure 1, the RTOS scheduler determines which thread should run by looking at the priority assigned to every thread ready for execution. The thread with the highest priority is selected to run. Because of condition 3, we must discount those activities outside of the control of the operating system, yielding the external factors provision above.

From these conditions, we can derive the Operating System Requirements (OSRs) listed in Table 1.

OSR 3 and OSR 4 impose a fixed upper bound on the latency that may occur on the onset of any real-time activity. OSR 5 ensures that OS services themselves, which are internal factors, don't introduce non-schedulable activities that could violate basic requirement 3.

RTOS vs. GPOS

The key characteristic that separates an RTOS from a General-Purpose OS (GPOS) is the predictability inherent in all of the requirements specified above. A GPOS such as Linux attempts to use a "fairness" policy when scheduling threads and processes to the CPU. This gives all applications in the system a chance to make progress, but doesn't establish the supremacy of real-time threads in the system or preserve their relative priorities, as is required to guarantee that they finish on time. Likewise, all priority information is usually lost when a system service, usually performed in a kernel call, is executing on behalf of the client thread. This results in unpredictable delays and thus prevents an activity from completing on time.

By contrast, the microkernel architecture used in an OS like the QNX Neutrino RTOS is designed to deal directly with all of these requirements (Figure 2). Because of its modular design, a microkernel RTOS can employ granular synchronization mechanisms, ensuring that latencies are unaffected by system services.

The microkernel itself simply manages processes and threads within the system, and allows them to communicate with each other. Scheduling is always performed at the thread level, and threads are always scheduled according to their fixed priority – in the case of priority inversion, by the priority as adjusted by the microkernel to compensate for priority

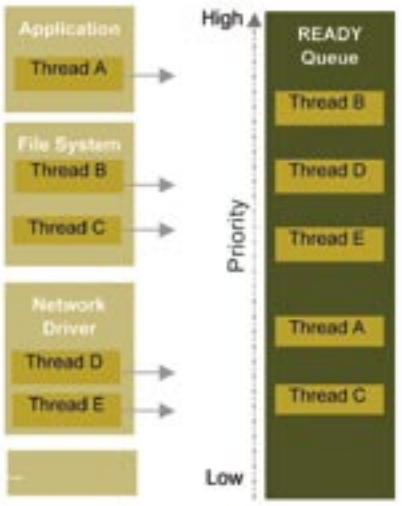

Figure 1

inversions. Consequently, a high-priority thread that becomes ready to run can preempt a lower-priority thread.

Within this framework all device drivers and operating system services apart from basic scheduling and Interprocess Communication (IPC) exist as separate processes within the system. All services are accessed through a synchronous message-passing IPC mechanism that allows the receiver to inherit the priority of the client. This priority-inheritance scheme allows OSR 5 to be met by carrying the priority of the original real-time activity into all service requests and subsequent device driver requests.

There is an attendant flexibility available as well. Since OSR 1 and OSR 5 (refer back to Table 1) stress that device-driver requests need to operate in priority order, at the priority of the client, throughput for normal operations can be substantially reduced. Using this model, an operating

Operating System Requirements for Real Time	
OSR 1	The OS must support fixed-priority preemptive scheduling for tasks. (Both threads and processes, as applicable)
OSR 2	The OS must provide priority inheritance or priority-ceiling emulation for synchronization primitives. This prevents cases of unbounded priority inversion, where a higher-priority task cannot obtain a resource from a lower-priority task.
OSR 3	The OS kernel must be preemptible.
OSR 4	Interrupts must have a fixed upper bound on latency. By extension, support for nested interrupts is required.
OSR 5	Operating system services must execute at a priority determined by the client of the service. All services on which the client depends must inherit that priority. Priority inversion avoidance must be applied to all shared resources used by the service.

Table 1

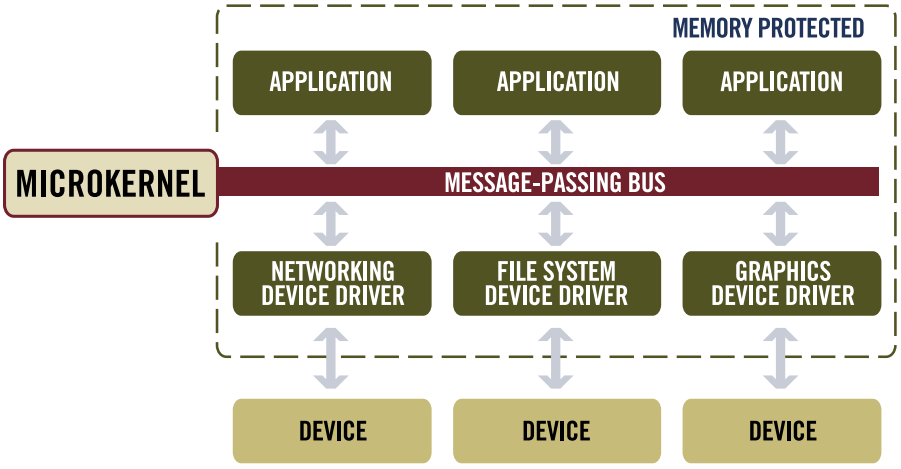

Figure 2

service or device driver can be swapped out in favor of a real-time version that satisfies these requirements.

A closer look

A closer examination of OSR 2 (the OS must provide priority inheritance or priority-ceiling emulation) showcases the value of having services execute at a priority determined by the client of the service. To begin, we must look at how task synchronization can result in blocking, and how this blocking can, in turn, cause priority inversion.

Let's say two jobs are running, Job 1 and Job 2, and that Job 1 has the higher priority. If Job 1 is ready to execute, but must wait for Job 2 to complete an activity, blocking is said to occur. The blocking may occur because of synchronization; for instance, Job 1 and Job 2 share a resource controlled by a lock or semaphore, and Job 1 is waiting for Job 2 to unlock the resource. Or, it may occur because Job 1 is requesting a service currently used by Job 2.

The blocking allows Job 2 to run until the condition that Job 1 is waiting for occurs (for instance, Job 2 unlocks the resource that both jobs share). At that point, Job 1 gets to execute. The total time that Job 1 must wait may vary, with a minimum, average, and maximum time. This interval is known as the blocking factor. If Job 1 is to meet any of its timeliness constraints, this factor can't vary according to any parameter, such as the number of threads or an input into the system. In other words, the blocking factor must be bounded.

Now let's introduce a third job. Job 3 that has a higher priority than Job 2 but a lower priority than Job 1 (Figure 3). If Job 3 becomes ready to run while Job 2 is executing, it will preempt Job 2, and Job 2 won't be able to run again until Job 3 blocks or completes. This will, of course, increase the blocking factor of Job 1; that is, it will further delay Job 1 from executing. The total delay introduced by the preemption is a priority inversion.

In fact, multiple jobs can preempt Job 2 in this way, resulting in an effect known as chain blocking. Under these circumstances, Job 2 might be preempted for an indefinite period of time, yielding an unbounded priority inversion and causing Job 1 to fail to meet any of its timeliness constraints.

This is where priority inheritance comes in. If we return to our scenario and make Job 2 run at the priority of Job 1 during the synchronization period, then Job 3 won't be able to preempt Job 2, and the resulting priority inversion is avoided (Figure 4).

Manipulating priorities

If you are writing an application for deployment on an RTOS, it is important to consider the effect that the RTOS's characteristics have on the execution of the application, and to understand how these can be used to your benefit.

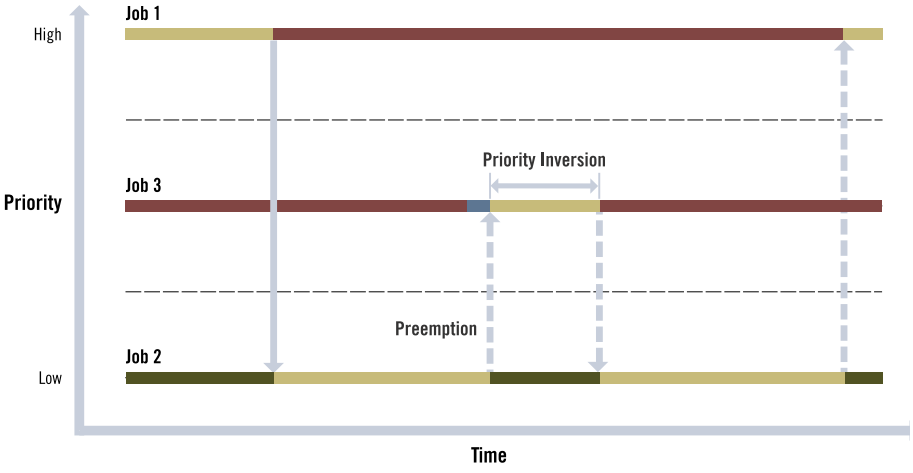

Figure 3

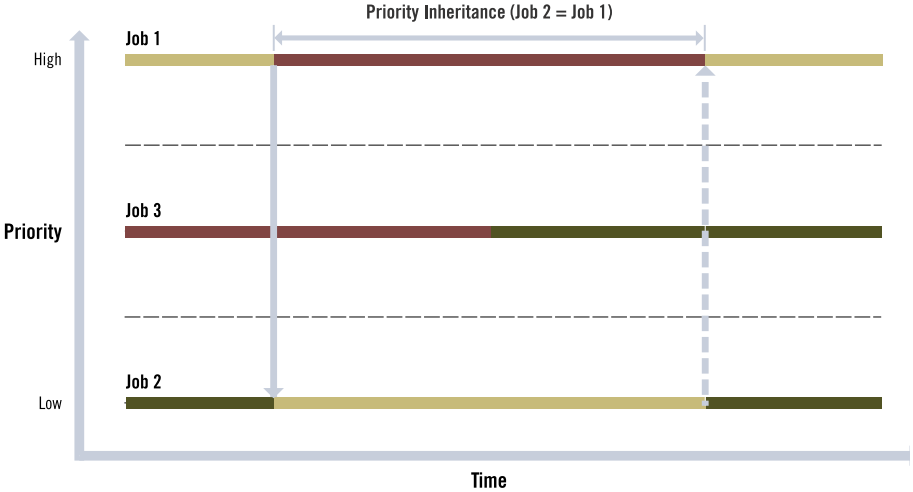

Figure 4

For instance, applications conventionally run in a round robin execution, competing with each other for a proportion of the CPU capacity. With an RTOS, however, you can manipulate the priorities of processes to have certain activities run preferentially to others in the system. Applied judiciously, this priority manipulation can dramatically improve response in areas important to the user, without potentially starving other processes in the system.

The key to ensuring that higher-priority processes and threads do not starve out other processes is to be certain of the limits imposed on their execution. By pacing the execution, or by throttling it in response to load, you can limit the proportion of CPU consumed by these activities so that user processes get their share of the CPU.

Priority manipulation can benefit a variety of applications, including, for example, media players (MP3, WAV, MPEG-2, and so on). The operation of a media player can be tied to the media rate required for proper playback (44 kHz audio, 30 fps video). So, within this constraint, a reader thread and a rendering thread can both be designed to wake up on a programmable timer, to buffer or render a single frame, and then go to sleep until the next timer trigger. This provides the pacing that allows the priority to be assigned above normal user activities, but below critical system functions.

With well-chosen priorities, playback will occur consistently at the given media rate. A well-written media player will also take into account quality of service, so that if it doesn't receive adequate CPU time, it can reduce its requirements by selectively dropping samples or follow an appropriate fallback strategy. This will then prevent it from starving other processes as well.

A strategic decision

An RTOS can help make complex applications both predictable and reliable. In fact, the precise control over timing made possible by an RTOS adds a form of reliability that cannot be achieved with a GPOS. If a system based on a GPOS doesn't behave correctly due to incorrect timing behavior, then we can justifiably say that the system is unreliable.

Still, choosing the right RTOS can itself be a complex task. The underlying architecture of an RTOS is an important criterion, but so are other factors. For instance, does the RTOS support standard APIs, such as POSIX.1? A flexible choice of scheduling algorithms? Protocol stacks such as IPv4, IPv6, and IPsec? What about support for distributed or symmetric multiprocessing? Diagnostic tools for system profiling, memory analysis, and application profiling? And what of the RTOS vendor? Do they offer a full range of engineering services and well-documented source and customization kits? How about any direct experience serving embedded developers?

On one point, there is no question: An RTOS can play a key role in determining how reliable a system will run, how well it will perform, and how easily it will support new or enhanced functionality. It's critical, therefore, to choose an RTOS and an RTOS vendor that can meet project requirements, both now and in the future.

Steve Furr *is senior OS product manager for QNX Software Systems and a coauthor of the Real-time Specification for Java (RTSJ). He currently serves as a technical member on several industry forums, including the Open Group's Real-time and Embedded Systems Forum, which is dedicated to expanding the marketplace for standardized real-time and embedded systems. In his 13 years with QNX, Steve has held various engineering positions, including software architect. He holds a Bachelor's degree in computer science.*

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Wearable tactical computers as embedded training systems

By Joan Wood

Meeting the challenge of building embedded training platforms on small, low-power man-worn operational computer systems.

When it is not practical to send troops stateside for retraining and not feasible to set up traditional training facilities in the field, it is essential to find alternate ways for soldiers to maintain readiness, develop and learn new tactics, and build team cooperation and communication through training. Recent advances in wearable tactical computers may provide the necessary platform for such dismounted infantry training activities, in addition to the C4ISR functions currently planned for these systems.

The original concept of Embedded Training (ET) as outlined in numerous papers – Navy OPNAVINST on ET (1985), Air Force Study Plan for ET (1989), Army TRADOC ET Concept (1996) – was to build capabilities into operational systems that would enable personnel to train using their own equipment while in the field. Over the past 20 years, that idea has developed into a general forward-looking directive, embodied in the Army's Future Combat Systems, that all new deployed operational systems must contain ET. We are now somewhere between building capabilities and mandatory embedded training.

Extending ET into man-worn tactical computer systems

For a vehicle-embedded system, such as an onboard tank computer, ET may mean the possibility of adding training scenarios to the tactical software package to allow the tank crew to conduct mission rehearsals or update field tactics to stay sharp during down time. Existing technology infrastructure inside the vehicle such as embedded visual displays and extended power resources help in the implementation of ET for the tank crew. However, for ET to be available and useful on a man-worn tactical computer system there are different, much greater challenges to be overcome.

The first big obstacle is accurately representing the dismounted soldier's first person view of the synthetic environment on a very small, low-power, tactical computer. The level of complexity needed to simulate a fast-moving, real-time 3D scenario is far more demanding than the limited world-view required for tank driver training. And the dismounted soldier's field of view must be properly oriented, convincingly navigated, and realistically represented in order for immersive synthetic environment training to be useful.

This requires not only that more layers of technology be appended to the operational wearable tactical computer with items such as motion trackers and head-mounted displays, but that there be powerful new 3D graphics technology incorporated into the operational unit design as well. For this to be a valid design direction, the ET elements should not result in a degradation of the operational equipment. All ET system size, weight, and power requirements must be accounted for in the design and any additional functionality needed just for training should not have a negative impact on the computer's primary operational functions. Table 1 lists some key issues to evaluate the potential for ET on a wearable system.

Functional scalability and flexible I/O: Keys to tactical and training coexistence

Imagine an advanced notebook computer, only smaller, lighter, more power efficient, and more durable, and then make it wearable. Remove the screen, keyboard, and mouse. Add some specialized I/O, rugged connectors, and long-life batteries and you have the basis for the operational version of a wearable tactical computer.

The primary functional differences between most wearable computers and one that can fully support an ET real-time 3D synthetic environment simulation are in the advanced 3D graphics capabilities, and in accompanying increased power requirements. So the challenge is to expand the 3D capabilities and performance with an advanced graphics processing unit to support immersive training, but implement it such that power requirements can be automatically scaled back as needed.

To do this requires smart power management, on-the-fly scalable graphics capa-

"A Guide for Early Embedded Training Decisions" Whitmer & Knerr U.S. Army Research Institute, July 1996
Can ET be integrated into the operational system without interfering with operational capabilities?
Do safety and training requirements suggest ET or other simulation alternatives?
Can the operational system support ET, given MPT and RAM requirements?
Will the operational systems be available for a sufficient amount of time to support ET?
Do the skills and knowledge to be taught suggest ET?
Does the ET system require visual system or motion system simulation?
Can weapon system motion and/or direct vision be simulated in a stand alone system?
Would an appended training system interfere with the operational system?
Can appended training system reliability, availability, maintainability requirements be met?

Table 1

bilities, and the right trade offs for useful I/O features and graphics optimization. The commercial migration of discrete advanced features into the mobile computing device arena has provided a wealth of opportunities to highly integrate "under the hood" elements such as the power subsystem, PCI bus, cards, drivers, and other application-specific devices. This leaves multi-use, multi-function, flexible interfaces exposed for the developer who can then focus on unique features of their application rather than how to make the system work with it.

For the system to be truly flexible it has to accommodate a wide variety of accessories and that means advanced I/O and lots of it. While certain functionality is common to almost all usage models – some type of visual monitoring, an input device, and wireless communications – some accessories are only useful for specific applications, so ancillary gear in a variety of form factors must be anticipated.

For example, a helmet Night Vision Goggle (NVG) mount can accommodate an immersive binocular Helmet Mounted Display (HMD) for field training with a synthetic environment application, or it might provide for a see-through monocular deployed tactical eyepiece for enhanced vision monitoring of an Unmanned Aerial Vehicle/Unmanned Ground Vehicle (UAV/UGV) controller. A gun-mounted thumb joystick and button array can function as the input controller for a real world moving map application, or the training weapon-mounted joystick can control a user's virtual orientation in a synthetic environment training exercise. In all cases, the I/O is unique to the application, so the ET computer must remain flexible.

Tactical visual computer: COTS components and custom know-how

An ET computer can certainly be envisioned by leveraging consumer product R & D dollars via the latest Commercial Off-the-Shelf (COTS) components, minimizing the need for government funding. In fact, embedded COTS suppliers with expertise in ergonomics, power, thermal, and systems engineering knowledge can create the ideal ET computer. Let's call it a Tactical Visual Computer (TVC). But this is only half the problem. Visual simulation optimization and real-time 3D scene management skills are also necessary when it comes to scaling 3D performance to match battery life requirements, while simultaneously harnessing video capture to enhance operational tactical applications such as forward unmanned vehicle controllers and monitoring of remote video feeds.

In short, the best-of-breed of low power, portability and processing performance plus real-time graphics engine technology is essential in dismounted soldier TVC applications. Required system features should include a powerful mobile CPU with ample system memory and aggressive power management capabilities, and a scalable performance graphics subsystem with advanced 3D features. Multiple RGB and video outputs, and support for a wide range of video input formats, along with strong video capture capabilities complete the necessary visual platform.

These advanced graphics features really set the TVC apart from previously deployed wearable PCs. Using Windows or Linux and OpenGL and Direct X APIs for ease of migration from existing desktop and CAVE training applications, including PC games, make the TVC truly PC compatible. PC compatibility has the tremendous potential of leveraging the civilian consumer games and entertainment markets for synthetic capabilities.

However, the whole system needs to be housed in a lightweight, super rugged, conduction-cooled, sealed alloy case with MIL-SPEC connector multi-function I/O ports. For extended environments, also needed are an optional solid state hard drive to replace the shock-resistant rotating media drive, and standard I/O features such as Ethernet IEEE 802.3 10/100, USB 2.0, IEEE 802.11x, and Bluetooth wireless. To cover all conceivable I/O options ranging from GPS to proprietary, requires a range of PCMCIA card options.

An integrated synthetic environment training platform

It would be rare that a TVC would need to deploy with this much I/O, but one embedded solution provider designed it anyway. Quantum3D created the THERMITE TVC system to service a wide range of needs so developers would have a fully-realized platform on which to develop and run their applications.

Originally developed by CG2 and Quantum3D for US Army Research

Figure 1

Development and Engineering Command (RDECOM) to support a Science & Technology Objective (STO) program, the Expedition (Figure 1) wearable ET ensemble utilizes THERMITE as the onboard TVC. When configured as a wearable ET system, Expedition's major components consist of an ergonomic, load-bearing vest containing the TVC and a pair of lithium ion batteries, a binocular helmet-mounted display device with stereo headset, microphone communications system, and head mounted motion tracker, fully integrated with the TVC's wireless communications system and visual and sound I/O. Rounding out the ET system is a standard training rifle with wireless input device, motion tracker, and gun mounted synthetic environment scene controller.

Over time, the market will drive evolutionary spiral development to incorporate more advanced capabilities into smaller, lighter, more power efficient packages, and the line between tactical and training will blur even further. But for embedded training in the wearable dismounted infantry arena to really take hold; these systems must become part of a soldier's daily routine; another piece of his gear; another weapon in his arsenal.

Joan Wood *is the vice president, marketing, Quantum3D. Joan Wood's background includes executive, creative, and engineering positions in the areas of advanced real time 3D computer game development, broadcast television, and publishing.*

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Attention to details benefits primes outsourcing military avionics systems

By Frank Willis

Vertically integrated government prime contractors can do it all, from boards right up to the entire airframe or vehicle. But should they?

Avionics are among the last areas of military and aerospace systems to accept and adopt COTS-based technologies. Prime contractors, previously accustomed to designing the entire system from the ground up, can benefit by outsourcing to subcontractors with expertise in subsystems, boards, and all the way down to the component level. But attention to details makes all the difference in flight success.

As Commercial Off-the-Shelf (COTS) perpetuates throughout the military, major prime contractors have turned more and more to subsystem outsourcing. And even in the most mission- and life-critical applications out there, outsourcing embedded avionics systems has clearly become a widely accepted practice among prime government contractors. The potential benefits are many – speed to market, significant savings in capital outlays, best-of-breed, and reduced costs – to name a few.

There are many reasons for this trend, not the least of which are the speed with which suppliers can respond to the needs of the prime contractor, the savings in manpower and dollars, the pure convenience of delegating the whole subsystem, and the degree of integration the suppliers are able to provide. Market pressures mandate that the large prime contractors identify and continue to invest in their core competencies, and outsource other areas not considered core to their business, such as embedded COTS subsystems. Some of the key questions primes ask themselves are:

- What value-add do we bring to designing and assembling avionics subsystems?
- Why are we investing in a subsystem manufacturing facility when there are other options?
- Since we're concerned with the overall system integrity, must we delve all the way down to the component level?

From system to subsystem

On this latter question alone, prime contractors need not delve into the details of subsystem, board- or component-level design and reliability issues. For example, an experienced subcontractor will have a deep understanding of how to manage heat flow through component mounting and placement, and component-to-case junctions. Outsource subcontractors are experts in dealing with these component-level issues using thermal vias, vacuum interfaces, heat sinks, gap pads, chassis design, and Printed Circuit Board (PCB) internal thermal layers.

Using multiple analysis tools, the subcontractor will predict factors such as thermal performance, or other environmental phenomena such as natural frequency and harmonics, or vibration and shock performance – all of which may not be part of the prime contractor's core expertise at the individual subsystem, board or component level.

During the design of rugged systems and boards, multiple factors must also be taken into consideration, such as materials, electromagnetic interference (EMI) protection, PCB construction, sealing, connectors, harnesses, human factors, fasteners, finishes and paints, manufacturability and maintainability, and many other materials and design constraints. For example, choosing antifungal, non-outgassing, and defense-acceptable materials is critical in reducing design and system qualification time.

Rattle and roll

And in avionics systems – whether fixed wing, rotary, or even projectile – the unique demands of flying through the air put incredible shock and vibration forcing functions on subsystems and components. Primes acting as systems integrators may not be as comfortable dealing with details at the component level as are subcontractor experts. For instance, the most important part of the structural analysis/design is avoiding resonant coupling between the chassis and the circuit card assemblies. Resonant coupling occurs when the natural frequencies of two objects fastened together are close enough to cause unwanted vibration.

Here again, the component level can't be ignored. In an electronic system the items usually at highest risk are solder joints between components and printed circuit cards. To avoid resonant coupling, 3D CAD models should be fixed as they will be in operation so that natural frequency analysis can be performed on chassis and circuit card assemblies. Industry experience suggests a two octave separation between the circuit card assembly and the chassis in their first mode.

Prime contractors are familiar with all of these issues, for sure, but may not wish to be bothered with them down to the board- or component-level. In theory, the underlying factors that affect component, board, and system performance are well understood. In practice, however, designing, manufacturing, and certifying a functioning rugged system becomes far less certain.

For this reason, system integrators and prime contractors seldom undertake this arduous task. Instead, they customarily turn to subcontractors like SBS Technologies and others who have remained committed to offering in-house design, manufactur-

ing and testing capabilities for rugged systems. Outsourcing the system, in fact, has become standard industry practice. As a rugged system provider, SBS Technologies has built a reputation for being able to quickly understand customer specifications and then rapidly design, test, certify, and deliver exactly the rugged system our customer needs. These are exactly the qualifications required of a subcontractor providing COTS-based avionics to prime contractors.

Frank Willis *is the Vice President, business development, SBS Technologies Government Group, headquartered in Albuquerque, NM. He has more than 20 years of experience in the embedded military and defense industry. Prior to joining SBS Technologies, he held various sales and business development positions with Dy 4 Systems, Texas Instruments, and served 22 years with the US Air Force. Frank received a Bachelor of Science degree in Mechanical Engineering Technology from California State Polytechnic University, Pomona.*

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Q & A with Peter Cavill, CEO, Radstone Embedded Computing

EDITOR'S FOREWORD

Radstone is one of the oldest companies serving the COTS market. Founded as a spin-off from Plessey Microsystems, Radstone was in the COTS (Commercial Off-the-Shelf) market back when the Primes and Subs were still debating open standards and Non-Developmental Items (NDI). An instigator of the original VME specification and the IEEE 1101.2 conduction-cooled specification, today Radstone is one of the big three vendors serving the harsh environment, deployed COTS market.

We tossed our questions up to Peter Cavill, president of Radstone Embedded Computing – a man who is so technically savvy that he previously ran the company's engineering group. **– Ed.**

MIL EMBEDDED: ***Tell us briefly about your company's focus as applied to the military.***

CAVILL: Radstone is 100 percent focused on the military – providing solutions to customers in the military marketplace is what we do. At the heart of our business is a commitment to developing long term partnerships with defense OEMs to provide them with the leading edge technology they need in either rugged or non-rugged environments. We believe we're a world leader in the field of designing and developing rugged products, with a long pedigree in bringing to market solutions that have ruggedness designed in to them from the drawing board stage.

Radstone was among the very first companies to embrace COTS as the way forward, with over 40 years of experience in designing systems specifically for military applications. We're a key long-term supplier to high-profile programs such as the M1A2 Abrams tank, MLRS, ATFLIR, Firefinder, the Eurofighter Typhoon and the Mk48, and Mk54 torpedoes.

We're also very well aware that 100 percent standard products aren't always what the customer really needs, so our business model is a highly flexible one that allows us to react to specific program requirements by developing custom versions of our products.

MIL EMBEDDED: ***What are the top three embedded technologies you're seeing in the market today?***

CAVILL: Multiprocessor systems are unquestionably one of the key embedded technologies and are enabling our customers to envisage applications that, only a short while ago, were all but unthinkable.

Another technology that's rightly capturing a good deal of attention is switched Gigabit Ethernet. There's no doubt that communications technologies are assuming much greater importance in the defense programs of today. Ethernet is a highly proven and trustworthy technology.

The third technology I'd nominate would be Software Defined Radio (SDR) and radar. We're seeing huge interest in this area and the availability of increasingly sophisticated silicon – notably Field Programmable Grid Arrays (FPGAs) – is making SDR a real growth area for our business.

MIL EMBEDDED: ***How is the increasing size, speed, and complexity of FPGAs and other programmable devices changing the nature of military systems?***

CAVILL: With the emphasis on network-centric warfare, the military is looking to acquire and process far more information, of all types, than it has ever done before. That leads to the need for incredibly powerful data acquisition capabilities and no less powerful signal processing systems. For us, that's where FPGA fits in as an enabling technology for this new generation of solutions. In data acquisition, for example, the closer you can put processing power to the capture point, at the front end of the application straight off the sensor – the antenna, for example – the more data you can capture.

Powerful FPGAs, in conjunction with powerful converters, enable you to do that and, of course, because the algorithm is executed in hardware rather than software, you can get incredible performance. Similarly at the back end of the application FPGAs can deliver enormous amounts of processing power. The SDR systems that ICS [a Radstone subsidiary] develops use FPGAs for precisely these reasons.

MIL EMBEDDED: ***There's been a great deal of industry consolidation over the past several years, both within the Primes/Subs, and within the embedded vendor base. What effects will this have on the military customer?***

CAVILL: The consolidation in the industry is a mixture of good news and bad news for military customers. The bad news is that consolidation inevitably results in a reduction in the number of potential suppliers, and thus a reduction in competition – and that can never be good for any customer looking to maximize his leverage and his spending power. On the other hand, consolidation into fewer, larger suppliers is likely to reduce volatility in the supplier base – although there may be short term pain as product lines are rationalized. Larger companies tend to be in business for longer than small ones, and that reassurance has always been valued by military customers.

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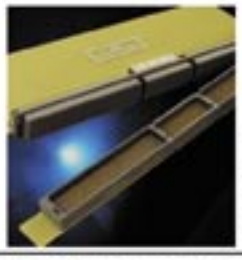

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But there is a downside to this latter point, especially if you're one of the prime contractors. If I were the CEO of one of those primes, I'd be looking at some of the recent movement in the industry and asking myself: "What's going on here?" And I might well conclude that companies that were once my suppliers are now moving up the food chain to position themselves to compete with me.

From Radstone's perspective, we're also clear on our place in the grand scheme of things: we have no ambitions to serve the military directly. You'll never hear me being reported as having said that "Our customers are our competitors."

MIL EMBEDDED: ***So are serial switched fabrics for real or just hype? Where might the military really use this technology?***

CAVILL: There's no doubt about it in our mind that switched fabrics are for real because of what they bring to the military market in terms of performance. The fact is, despite what anyone might claim, you just can't get the system throughput with today's shared bus architectures. Those will continue to have a role – VME looks destined to go on forever – but our view is that the two will coexist, with the bus providing the legacy compatibility and the switched fabric providing the raw performance.

MIL EMBEDDED: ***How does Tech Refresh, Tech Insertion, and Spiral Development really work in practice?***

CAVILL: Take the Radstone G4DSP-XE [a quad PowerPC processing card], for example: it's true to say that, in effect, that was a product at the same time as the original G4DSP was first conceived – we just announced it later, but it was *built in* to the original design, just as the G4DSP-XE's successor will have been. In designing the original board, we paid huge attention to the various silicon vendors' roadmaps to ensure that there was real longevity there. Backwards compatibility was designed in from the start – as it has to be.

What we know that you can't do is to create a new product with no thought for its future. Fundamental to any new Radstone product is the principle that it will have a roadmap that will stretch out as far into the future as possible, that takes into account both planned and unplanned component obsolescence, that it will have technology refresh opportunities and that it will provide our customers with technology insertion opportunities as and when they need them. You can't bolt those things on as an afterthought to a product that was poorly conceived in the first place.

MIL EMBEDDED: ***Explain how your company addresses obsolescence mitigation.***

CAVILL: We have our *Whole Program Life COTS* philosophy that underpinned the establishment of the Program Life Cycle Management group which exists, exclusively and entirely, to help our customers mitigate the impact of obsolescence. There is no silver bullet solution, and there never will be. However, what we can say is that we've proven time and again since Radstone first came into existence that, with the right management philosophy and the necessary expertise and experience, you can't make the problem go away but you can certainly help your customers to avoid suffering the pain.

The fact is that yes, obsolescence is a problem but how you respond to it is also a business opportunity. It's an opportunity to create better customer relationships, it's an opportunity to create differentiation, and competitive leverage and it's an opportunity to create long term revenue streams. If there's one thing that defines Radstone, it's our unique and, we'd venture to say, industry-leading approach to helping our customers deal with obsolescence.

MIL EMBEDDED: ***What are the "hottest" military programs right now?***

CAVILL: The really hot programs are the unmanned vehicle programs, especially Unmanned Aerial Vehicles (UAVs). That's where the action is – in programs like Predator and Global Hawk. Why? The military is committed to reducing the number of personnel it places in positions of danger so unmanned vehicles are an obvious response. It has to be said also that, in terms of value for money, unmanned vehicles deliver a lot of bang for the buck which makes them very attractive. From our point of view, it's something that's very exciting – not least because unmanned vehicles are huge consumers of electronics.

MIL EMBEDDED: ***We see the type and scope of embedded and COTS technologies applicable to the military as exponentially expanding. What are the challenges of insertion, interoperability, and sustainment in this rapidly expanding universe?***

CAVILL: You must start out with a stable, viable architecture that is premised upon the idea that it will form the basis of a continuing flow of leading-edge but backwards-compatible products. You define the envelope in which a series of products will operate, you define the interfaces that you'll plan to sustain over an extended period, and you design compatibility in from the very beginning. The roadmap has to be an integral part of the product concept: devising a leading-edge point solution in this market is just not going to be successful for anyone.

That said, what's key to us is finding out what the customer really wants. On occasions, we've been surprised to find that customers will happily exchange some degree of backwards compatibility if what they get back is a bigger step forward in performance. The default, though, is that what we produce today and tomorrow will provide the continuity and compatibility that characterize most military programs.

Peter Cavill *received a B.Sc. in Electrical Engineering from Loughborough University in 1968 and an M.Sc. in Microelectronics and Semiconductor Technology from Southampton University in 1970. He then worked as a design engineer at GEC Semiconductors, then at Fairchild as Manager of the European Design centre. From 1979 to 1989 Peter worked at Inmos as Director of the Microsystems Business and was responsible for the team that developed and marketed the transputer.*

In 1993, following a two year period as CEO of Anamartic Ltd., and a short period with Spider Systems he joined Radstone Technology as Director of the Industrial Products Division. Peter is currently president of Radstone's main Embedded Computing business.

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Focus on systems, switched fabrics

Q & A with Tom Quinly, President, Curtiss-Wright Controls Embedded Computing

EDITOR'S FOREWORD

Most readers will recognize the company Curtiss-Wright because of its tie-in to the famous aviators who made airline travel possible. But many may not know that Curtiss-Wright Controls Embedded Computing (CWCEC) is one of the largest suppliers of embedded products and technology to the defense and aerospace market.

Tom Quinly is president of this division of the even larger Curtiss-Wright Corporation. Tom is no stranger to Commercial Off-the-Shelf (COTS) or technology, having managed DSP and harsh-environment businesses before taking over the helm at CWCEC. Tom gave us some time out of his busy schedule to provide his view from the top. **– Ed.**

MIL EMBEDDED: ***Tell us briefly about your company's focus as applied to the military.***

QUINLY: CWCEC is the industry's most comprehensive and experienced vendor for standards-based embedded computing solutions, ranging from processing, data communication, DSP, radar, video and graphics modules, to fully-integrated subsystems where we manage the integration work beyond our customer's value-add expertise.

CWCEC and its legacy companies have delivered over 100,000 modules into the defense and aerospace market. In fact, we've delivered over 10,000 modules for the Abrams Main Battle Tank program alone. We deliver core building block solutions at the level of integration that works best for our customers.

Along with technology, we also provide our Defense and Aerospace (D&A) customers the additional services they require. Since the critical retrofit market can't always leverage COTS, CWCEC offers custom variants of our standard products. Also, our consistent product roadmaps support the spiral upgrades our customers need. Our product life cycle services guarantee supply and repair longevity after programs enter production, and our dedicated obsolescence mitigation division manages customer production programs.

MIL EMBEDDED: ***What's new in the area of COTS and/or military systems?***

QUINLY: We're at an exciting point of technology revolution. Advancements in form factors, switched fabrics, and reconfigurable computing are creating new paradigms and driving new power/weight/performance densities. These trends align precisely with demands for platforms, such as multiple Unmanned Aerial Vehicles (UAVs), Joint Strike Fighter (JSF), and Future Combat System (FCS), that we address with the technologies and expertise resident in the various CWCEC groups.

From a world perspective, conflicts such as the ongoing war in Iraq impact our D&A customers, who in turn challenge us to provide extended product support for platforms critical to our troops. Success in this area results from our commitment to our customers and our unmatched support for legacy products.

We also see increasing demand for US eyes-only program support. Our strong US design, manufacturing, and support base makes us well positioned to support this work.

Lastly, from a schedule perspective, our customers are pressed to meet tougher schedule demands. This has led us to enhance timely, on-site support for customers with demanding integration challenges.

MIL EMBEDDED: ***What are the top three embedded technologies you're seeing in the market today?***

QUINLY: While this is a dynamic time in our marketplace, today's top three answers are: First, PowerPC continues to dominate our market, it's unquestionably the default processor technology for a wide range of computing applications ranging from traditional SBCs to DSPs. We see demand for PowerPC in VME, 3U and 6U CompactPCI, Processor PMCs, in all ruggedization levels and with all leading operating systems: We don't see this trend lessening.

Second, our customers want to leverage the competitive advantage of Field Programmable Gate Array (FPGA) technology in complex systems, an area CWCEC has invested heavily in. Our goal is to provide our customers with a positive "out of box" FPGA technology experience that enables them to focus on their area of expertise rather than "bits and bytes work". We intend to be the leading vendor in delivering this capability to our marketplace. While FPGAs represent a cost and schedule programmatic risk for customers they also offer a unique size/weight/cost/power value proposition. Users of our CHAMP-FX FPGA boards tell us that we're delivering on this promise. We have powerful examples: customers have reduced a shelf of cards to a one- or two-slot solution. To mitigate risk, CWCEC provides significant support, ranging from getting customers up and running to algorithm development.

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ADVANCEDTCA CONNECTORS

This newly developed architecture and system layout allows manufacturers of telecom equipment a new standard for designing systems. ATCA stands for ***Advanced Telecommunications Computing Architecture***.

The basic structure is utilizing a modular concept. Application of this new structured approach allows various module designs that are compatible in layout and mechanical installation.

The PICMG Group created the PICMG 3.0 Standard. This Standard specifies the mechanical details with regards to input/output, voltage, current and connection parameters. Control, backplane layout and system architecture are part of the standard.

CONEC developed unique socket press fit contacts for this series of connectors. The socket contact utilizes high reliability screw machine components combined with stamped and formed press fit zone. CONEC has developed a new family of connector products that adhere to this new Standard. Products such as plugs and sockets, high power and signal contacts, have been developed.

This new connector series ia available with press fit and through hole contact types.

PRODUCT FEATURES:
- Rugged construction
- Special variations on request
- Polarizing system
- Screwdown hardware
- Premating contacts
- Press fit contacts
- Selective loading of contact positions

COMPACTPCI CONNECTORS

Compact PCI, this new bus architecture has been developed and adapted as the new standard by many computer system manufacturers. A group of companies formed the PICMG Consortium. PCI as it is known today, stands for ***Peripheral Components Interconnect***.

Telecom, datacom, computer, medical, instrumentation and industrial control manufacturers are implementing the CompactPCI Bus structure. This standardization brings many advantages to the designer of electronic systems.

CONEC is a member of the PICMG Group and has developed the 47 positions power connector types, adhering to the specifications outlined in PICMG 2.11 R1.0. Plug and socket types with various connection and contact styles have been developed. Press fit type, through hole type and high power contacts are available. Connectors can be selectively loaded to meet specific layout configurations.

PRODUCT FEATURES:
- Premating contacts in selective positions
- Polarizing, coding, system
- Mounting screws for PCB are available
- High reliability and longevity
- Selective loading, mixed layout contact configurations

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Third, we see growth in communication fabrics. Today we offer a broad range of products, from sensor interfaces such as serial Front Panel Data Port (FPDP) and Fibre Channel, to high-speed streaming I/O using StarFabric, to system-wide connectivity and Gigabit Ethernet. Netcentric computing is coming to almost every platform and a significant area of focus for CWCEC is bridging system-level I/O to the fabric paradigm.

MIL EMBEDDED: ***Conversely, what are the key technology areas that the military is demanding? Of these, are they readily available or still a "wish list?"***

QUINLY: COTS "wish-list" items often reflect a customer's success drivers. First, we address these by facilitating on-target delivery to time and cost program metrics. Second, we deliver innovative compute platforms to provide the building blocks required by their platform-specific challenges.

Since time and cost challenges are frequently driven by software requirements, code portability is one "wish-list" item we focus on. In numerous examples, our customers have migrated to next-generation products with minimal (less than one week) porting effort. CWCEC designs to open standards that don't lock our customers to proprietary solutions and retain customers through quality of products and services.

One future "wish-list" item, not yet a mature capability, is consistent and flexible programmability of systems based on different computing technologies (CPUs and FPGAs). Another is p*lug-and-play* integration when mixing software packages and I/O. Our technology breadth puts us in a unique position to achieve this level of interoperability. To focus on this goal, we recently launched the first company-wide Interoperability Lab to provide testing and development to ensure interoperability across our product line and with key third-party boards.

MIL EMBEDDED: ***Are serial switched fabrics for real or just hype?***

QUINLY: Switch fabrics aren't just where we are headed: they are here today. StarFabric was the first switched fabric adopted by our industry and CWCEC legacy companies led this movement. We have established positions on premier platforms such as JSF and FCS and we will carry this position forward to support the next generation fabrics. To CWCEC, fabrics are a fundamental architectural driver for future solutions. The question isn't will switched serial fabrics exist but rather how we provide tools and middleware to support software portability to next-generation fabrics.

MIL EMBEDDED: ***There's been a great deal of industry consolidation over the past several years. What effects will this have on the military customer?***

QUINLY: As the COTS initiative reaches a new level of maturity it drives increased investment and growth. This also results in increased journalistic coverage as evidenced by your new publication, *Military Embedded Systems*. The consolidation seen in recent years significantly lowers the risk for military customers

looking to outsource technology development and focus on their own value add: the end application domain. CWCEC, for example, offers customers one-stop-shopping, solid program management, and the confidence that their COTS vendor has financial security and will be around for a long, long time.

MIL EMBEDDED: ***Talk about applying telecom technology in military applications.***

QUINLY: While the two markets are very distinct, the COTS market definitely benefits from the telecom market's development of 10 Gigabit Ethernet and serial switched fabrics. Other areas that migrate from telecom to COTS include security, encryption, and fault tolerant architectures as well as the drive to increased reliability. Telecom is also giving us chips that work over wider temperature ranges.

MIL EMBEDDED: ***What are some of the system-level trends you are seeing?***

QUINLY: Just as board-level products went through a transition from point designs to the open architecture building blocks we have today, we are seeing a desire in the marketplace for open-architecture based subsystems that can be a building block for an integrator's own system development activities. Integrators are increasingly looking to outsource the development of these subsystems to allow them to concentrate on their core integration capability. To stay competitive and focus their efforts, many of our customers have found that it is more cost effective to team with a supplier that can provide them with a COTS-based subsystem, which can typically be supplied much more quickly than a point design box.

These subsystems can take advantage of CWCEC's large catalog of open architecture interoperable standards-based board-level products. We have the ability to put these building blocks together in a subsystem that is cost effective and developed under demanding schedules. We can also leverage our COTS building blocks to provide customization of the subsystem and to provide the level of subsystem integration that meets the needs of the customer's program.

MIL EMBEDDED: ***What are the "hottest" military programs right now?***

QUINLY: The JSF, FCS, Joint Unmanned Combat Air System (J-UCAS), Multi-mission Maritime Aircraft (MMA) are military R&D programs with promise of significant future volume deployment. There are also many interesting UAV programs. Because many new platforms are still years away, existing platforms that must be sustained and require shorter-term upgrades will result in shorter time-to-revenue for the COTS industry.

MIL EMBEDDED: ***What are the least likely* types *of programs and applications to use COTS technology and civilian embedded electronics?***

QUINLY: Space-based applications that require radiation hardening and applications that require custom form factors are typically not suitable to COTS. Surprisingly, large volume programs, such as missile programs, which aren't typically a good fit for COTS, offer a clear win/win opportunity to leverage CWCEC technology through a licensing arrangement. We can provide innovative solutions to support these programs with a business model that leverages our R&D investment.

A dedicated group within CWCEC addresses custom form factor opportunities by leveraging our core hardware and software investments to create innovative business models that bridge our customer's wide ranging programmatic needs and our R&D investment. When our customers give us a chance, we find we can find a winning solution.

Thanks, Chris for this great opportunity to communicate CWCEC's role in developing technology and solutions for the COTS market.

Tom Quinly *is president of Curtiss-Wright Controls Embedded Computing, formerly the president of Dy 4 Systems (acquired by Curtiss-Wright Controls in February, 2004). His 25-year career in high-tech industries has spanned both the defense and commercial sectors and brings a broad base of experience in operations, programs, and finance.*

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[Full disclosure: editor Chris Ciufo was formerly employed by Dy4 Systems and VISTA Controls, two companies since acquired by CWCEC.]

Reconfigurable systems; Disruptive technologies

Q & A with Ed Hennessy, VP of Business Development, North American Operations, Nallatech, Inc.

EDITOR'S FOREWORD

Nallatech is at the cutting edge of multi- and signal-processing systems, parsing complex tasks into bite-sized chunks using reconfigurable logic on modular, distributed nodes. The company uses Field Programmable Gate Arrays (FPGAs), a unique communications scheme, and a mesh-like fabric interconnect to realize ultra-high performance/size ratios. The company's products are particularly well suited to defense and aerospace applications, as Vice President of Business Development, North American Operations, Ed Hennessy clearly demonstrates.

***Ed has been in the embedded industry for a long time, managing companies through the beginning of the "COTS era" before that name was coined. We caught up with Ed in his busy role at positioning Nallatech as an even bigger player in military systems.* – Ed.**

MIL EMBEDDED: ***Tell us briefly about your company's focus as applied to the military.***

HENNESSY: Over 50 percent of Nallatech's revenue is from the defense and military market. Our primary segment is surveillance and reconnaissance, with emphasis on airborne, surface-ship, satellite communications and ground-based platforms and programs. There is also activity in the software defined radio area for signals intelligence applications. We are seeing a demand in the Unmanned Aerial Vehicles (UAV) area for increased search and target acquisition, as these platforms migrate to tactical, weapons-based systems. Although homeland security is not classified as defense and military, we are seeing a transfer of technologies to this emerging segment.

Nallatech's FPGA/reconfigurable computing technology has been regarded as "disruptive." As a by-product, this COTS-based (Commercial Off-The-Shelf) technology is in the defense and military market, primarily for tech insertions and upgrades. We continue to see defense contractors/integrators as the primary source of business. However, in the last three to five years many small to medium-sized defense system builders and integrators are "taking down" significant contracts, previously the domain of the big players.

Nallatech grew up in the defense and military market applying technology to missile simulation, with the founders of the company migrating from BAE Systems in the UK. Our people have experience and expertise in the defense and military market, not only in the application of our technology, but also with an understanding of COTS supportability, life-cycle support and program/platform knowledge.

MIL EMBEDDED: ***What's new in the area of COTS and/or military?***

HENNESSY: The industry went through a cycle, primarily due to "top line" budget/funding allocation, that caused defense contractors/integrators to have a one year perspective on certain classes of programs. This limited view severely impacted the ability to understand, plan, and provide successive refinements to the critical needs of these programs and platforms. Now, program considerations are focused on life cycle with planned improvements. Defense and military contractors and integrators are drawing in their COTS counterparts to participate in this planning process.

MIL EMBEDDED: ***So military systems are fundamentally out of sync with COTS technology cycles. Explain the impact of this on the military, and what industry and defense are doing to combat the issue.***

HENNESSY: There are two key industry challenges: 1) The imbalance of the program life cycle as viewed by the government or military customer, defense contractor/integrator, and COTS providers. The time schemes of each are out of sync. 2) The realities of obsolescence management and life-cycle support where the defense community is at the whim of the commercial market. The defense community is the party that must continue to comply and adapt.

Some military customers have adopted a view of successive refinements or Spiral Development to their program cycles and platforms. These methodologies can lessen the impact of the imbalance and minimize early obsolescence. COTS was mandated by law. However, it is through industry working groups and the collaboration of government and military, defense contractors, and COTS providers that these industry challenges will be tackled. This is now an implementation issue.

MIL EMBEDDED: ***What are the top three embedded technologies you're seeing in the market today?***

HENNESSY: The emphasis appears to be on software systems and tools (programmability), and multicomputing DSPs and FPGAs as a new entrant for the application areas that we focus on. There is also a trend emerging for server-based technologies that have

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been abundant in high-performance computing to migrate to the embedded market.

MIL EMBEDDED: ***Tell us about some of the technologies from telecom that you think will have the biggest impact on defense systems, and why.***

HENNESSY: Short-term advances include packaging solutions such as AdvancedTCA and MicroTCA. This will allow us to bring reconfigurable processing capability to more compact environments and increase functionality. Two other areas are encryption technologies and IP-enabled schemes that will be key to meeting the demands of classified applications and remote or mobile users.

MIL EMBEDDED: ***Conversely, what are the key technology areas that the military is demanding? Of these, are they readily available or still a "wish list?"***

HENNESSY: 1) Sensor-to-Shooter: this revolves around target detection/acquisition systems and weapons sequence initiation. 2) Urban Fighting Systems: concerns the experiences gained in Afghanistan and Iraq, the need to train and equip the warfighter differently and innovate new technologies with heavier emphasis on miniaturization and unmanned vehicles. Both of these are evolving, have realistic goals, and are backed by significant funding. Finally, 3) Digital Battlefield: this has made great strides; however, achieving cross-platform interoperability has been a more difficult task.

MIL EMBEDDED: ***How is the increasing size, speed, and complexity of FPGAs and other programmable devices changing the nature of military systems?***

HENNESSY: FPGAs and reconfigurable computing systems are "disruptive" in critical defense and military applications. We speak of the SWAP proposition: Size, Weight, and Performance gains achieved through the use of these technologies. SWAP is a powerful angle, allowing systems architects for the first time to develop a solution that fits the application. This is due to the "pick and choose" configurability of these technologies.

For example, in an avionics application the freedom and flexibility provided by these technologies allows the designer to look at solving the flight envelope challenge in more effective ways than utilizing conventional microprocessors. The performance gains can be astounding, sometimes accelerating an application by 50 to 100+ times at a fraction of the cost, depending on the nature of the application.

While FPGAs get rapped for complexity of programming and power consumption load, this technology is rapidly advancing with continuous introductions of compiler technology and tools. Additionally, we have done studies based on customer installations which have proven that a comparably configured subsystem based on microprocessor technology would consume as much as 100 to 200 times the power load as an FPGA-based solution.

MIL EMBEDDED: ***What are the key challenges of insertion, interoperability, and sustainment in this rapidly expanding universe?***

HENNESSY: Most COTS companies are building and supporting products. Few have put in the effort to understand the target environments, platform considerations, applications fit, and life cycle requirements that are critical to their customers' success.

While standards are aiding the cause, many COTS suppliers leverage the standards with a unique "twist" in their product interpretation that adds complexity to the systems builder. Lastly, when many COTS suppliers speak of life cycle, they are referring to their products and not the target program. Defense contractors and integrators need to work with COTS providers to minimize this gap.

MIL EMBEDDED: ***Explain how your company addresses obsolescence mitigation.***

HENNESSY: As a COTS provider, Nallatech processes and practices deal with component selection, replacement, and substitution. We also maintain an archival database to support configuration management, resulting in reproducibility and traceability. FPGA/reconfigurable computing technology is probably the closest to meeting the promise of COTS evolution, because of its range of configurability and "pick and choose" nature.

MIL EMBEDDED: ***What about all this industry consolidation?***

HENNESSY: Although there are several big players, there are no signs or indications that innovation is moving in the wrong direction or that the big players are squeezing other companies out.

MIL EMBEDDED: ***What are the key challenges faced by military systems designers?***

Probably the biggest challenges are minimizing complexity and keeping pace with customers' changing needs. The threats are changing so rapidly and dramatically that systems designers are discovering that a solution is obsolete even before it gets fully deployed. This is the beauty of reconfigurable systems such as Nallatech's.

MIL EMBEDDED: ***Talk about the top three most important issues pertaining to software in military embedded systems.***

HENNESSY: "Programmability," in terms of simplifying the task and accelerating the development cycle. Next, "standardizing" on a software platform that allows easy migration with no major rewrites or conversions, from desktop development to launching an embedded application. The third issue is "certification" as programs extend to a COTS-based solution, the awareness of requirements is surfacing. The primary challenge for the COTS suppliers is, "Will they comply and who will pay for it?"

MIL EMBEDDED: ***What are the "hottest" military programs right now?***

HENNESSY: Programs are termed "hot" because they flow from the key initiatives, are funded, and will see full deployment and production. Following is a list of unclassified programs: JTRS, JSF, FCS, DDx, LCS, ARCI-1, TUAV, AF UCAV, ACS, ATSP3,

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V161 AURORA
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SEA SPARROW (MK 57 MOD)

NSWC
V255 MUSTANG
TACTICAL TOMAHAWK WEAPONS CONTROL
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ADCAP, and RAROS. Almost more important are the areas of focus: COTS for aging aircraft, UAV suite, SDR (SIGINT), SATCOMM, and wireless base stations.

MIL EMBEDDED: ***What are the least likely types of programs and applications to use COTS technology and civilian embedded electronics?***

HENNESSY: This would include certain classes of avionics platforms that need liquid-cooled, harsh-packaged designs and MCMs that must interface with custom systems (retrofit or upgrade); certain space-based platforms that require rad-hard designs; platforms such as missiles that require special form factors and customized *fire and forget* software; and programs that require the porting and life-cycle support for non-industry standard operating systems and tools.

MIL EMBEDDED: ***Finally, are serial switched fabrics for real or just hype? Where might the military really use this technology?***

HENNESSY: Switched fabrics are real. In spite of the "fabric wars" hype, they are an integral element of the overall system. This technology can be leveraged in most network-centric applications or high-scalability applications that are typically demanding and complex. An example of a fabric-dependent application is a SATCOMM project that has in excess of 150 FPGAs, utilizing InfiniBand and Xilinx Rocket I/O channels to accommodate the high rate and volume of data being acquired by the sensor-based front end, while handling the data reduction functions.

Ed Hennessy *is vice president of business development, North American Operations, Nallatech, Inc. He has more than 25 years' experience in senior management, marketing, business development, and sales. He has contributed to the growth and success of leading companies specializing in the embedded systems market including Mercury Computer Systems, Dy 4 Systems, and Analogic/SKY Computers. His defense and military expertise spans various technologies that are applied to the avionics (surveillance/reconnaissance and tactical combat operations), navtronics (surface ship and undersea warfare), and vetronics (ground-based vehicles) market segments. Ed has developed a unique industry program for COTS supportability and life cycle considerations that has become a standard of doing business.*

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PRODUCT PROFILE INDEX

Pg/RSC#	Company/Category
11601	ACP – Graphical user interface
6601	Alphi Technology – MIL-specific I/O
10301	American Predator – Proprietary small form factor
12601	AP Labs – Rugged chassis
7701	Arcom – PC/104
10501	Arcom – Processors
11701	Ardence – Real-time operating systems
13101	Avalon Defense – DC-DC converter
6801	Avalon Defense – MIL-specific I/O
12802	Avalon Defense – Miscellaneous
12801	Avalon Defense – Miscellaneous
14001	Azonix, a Crane Co. – Other complete rugged
6301	BittWare – DSP
7601	BMC – PC/104
12301	Carlo Gavazzi – ATR
12302	Carlo Gavazzi – Backplane
6902	Carlo Gavazzi – PCI
8201	Carlo Gavazzi – PMC
12501	Carlo Gavazzi – Rugged chassis
6701	Condor Engineering – MIL-specific I/O
13001	Crane – DC-DC converter
11901	Crane – Electronics packaging
8701	Crane – Electronics packaging
13201	Crane – Slot cards
13401	Crane – Standalone power supply
9301	CES – CompactPCI
10402	Diamond Systems – Processors
10401	Diamond Systems – Processors
7801	DIGITAL-LOGIC – PC/104
9101	DNA – VMEbus
7301	DSS Networks – CompactPCI
9501	Dynatem – VMEbus
11602	EBS – Real-time operating systems
7901	Enseo – PC/104
9401	Excalibur – VMEbus
6101	Gage – Data acquisition
6102	Gage – Data acquisition
9901	General Micro Systems – VMEbus
12701	Geotest – Rugged chassis
9201	Harris Corporation, RF Communications Division – VMEbus
11302	HelloSoft – Other
11301	HelloSoft – Other
8501	Highland Technology – Precision Instrument
9001	Highland Technology – VMEbus
10101	Highland Technology, Inc. – VMEbus
12402	Hybricon – Backplane
12401	Hybricon – Backplane
12102	Hybricon – Box-level purpose built
12001	Hybricon – Electronics packaging
12002	Hybricon – Electronics packaging
12502	Hybricon – Rugged chassis
7101	Innovative Integration – CompactPCI
6002	Innovative Integration – Data acquisition
11501	Innovative Integration – Development environment/Tools
6202	Innovative Integration – DSP
12101	Innovative Integration – Electronics packaging
6901	Innovative Integration – PCI
8102	Innovative Integration – PMC
10602	Innovative Integration – Processors
7001	Inova Computers – CompactPCI
6001	ICS Ltd. – Data acquisition
6802	ICS Ltd. – PCI
8002	ICS Ltd. – PMC
8101	ICS Ltd. – PMC
14801	ITCN – Analyzer/Monitor
10601	KineticSystems – Processors
7502	KineticSystems – PXI
13701	Kontron – Other complete rugged
13601	Kontron – Other complete rugged
14101	Kontron Mobile – Other complete rugged
8502	Linktronic – Special purpose
14301	LiPPERT GmbH – Mission computer
14401	LiPPERT GmbH – Mission computer
10801	McObject LLC – Complete packaged system
13501	Medea – Mass storage
13502	Megatel – Other complete rugged
10201	MEN Micro – Proprietary small form factor
10001	North Atlantic – VMEbus
8601	Parsec – Special purpose
9601	Pentek – VMEbus
10702	Phoenix International – Complete packaged system
11202	Phoenix International – Magnetic HDD
13901	Pinnacle Data Systems – Other complete rugged
13301	Pulse Electronics – Standalone power supply
11502	Quantum3D – Development environment/Tools
14201	Quantum3D – Mission computer
12201	Radstone – ATR
7401	Radstone – CompactPCI
6501	Radstone – Graphics
13801	Rave Computer – Other complete rugged
11201	Red Rock – Magnetic HDD
11102	Red Rock – Solid state
10902	Red Rock – Solid state
10901	Red Rock – Solid state
8901	RGB Spectrum – Video
8001	Robotrol – PC/104
7201	SBS – CompactPCI
7202	SBS – CompactPCI
6402	SBS – FPGA/Reconfigurable computing
6602	SBS – MIL-specific I/O
14501	SBS – Mission computer
9802	SBS – VMEbus
9701	SBS – VMEbus
9702	SBS – VMEbus
9801	SBS – VMEbus
11801	Seaweed Systems – Graphics software
14901	Signametrics – PXI
13802	SKY Computers – Other complete rugged
15001	Spectral Dynamics ARPG – VXI
14702	SPIRIT – Wireless
14701	SPIRIT – Wireless
11401	Synplicity – Development environment/Tools
14601	Tactronics – Mission computer
11101	Targa Systems – Solid state
11001	Targa Systems – Solid state
11002	Targa Systems – Solid state
8202	Technobox – PMC
8301	Technobox – PMC
8302	Technobox – PMC
8401	Technobox – PMC
8402	Technobox – PMC
7501	Technobox – PrPMC
8801	Titan Corporation – Video
8802	Titan Corporation – Video
11702	TimeSys – Linux
12602	Tracewell – Rugged chassis
13102	Tracewell – Slot cards
12901	Tri-M Systems – DC-DC converter
12702	Tyco Electronics – Connectors
14902	VMETRO Transtech – Bus analyzer
6201	VMETRO Transtech – Data acquisition
6401	VMETRO Transtech – FPGA/ Reconfigurable computing
10302	VMETRO Transtech – Processors
7102	Voiceboard – CompactPCI
9002	Voiceboard – VMEbus

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Interactive Circuits and Systems Ltd.

ICS daqPC

ICS daqPC is a PC-based, real-time data acquisition system, which can be fully configured to offer a powerful sensor processing solution, tailored to the most demanding of user DSP requirements. Capable of accepting both ICS and third-party boards, it can be fully integrated for real-time applications that require acquisition, processing, and archiving of large volumes of analog input signal data.

The daqPC is fully interoperable with a wide range of ICS PCI products, providing a full complement of high channel count and/or high-bandwidth system solutions. In addition, the daqPC is available in a low-profile, 8.6" high enclosure, which can be expanded using a separate enclosure.

FEATURES:

- Offers high-speed record/playback capability, storing up to 1.4 TeraBytes of digital data on an array of hard drives
- Digital recording of sensor signals at more than 400 MBps sustained rate
- daqPC supports time-stamp recording, using either an on-card or off-card source
- Available in rackmount and portable versions
- Built-in 1 Gb network interface
- LabVIEW/MATLAB signal analysis options

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Boards
Data acquisition

Innovative Integration

Oruga

Oruga is an intelligent PCI data acquisition/playback card capable of capturing 64 analog input channels with 16-bit resolution at 66 kHz each, and playing four analog output channels at up to 2 MHz, with advanced triggering options offering an amazing flexibility. The C6713 DSP assures the control of all peripherals and offers ample math coprocessing bandwidth with extreme flexibility and ease of programming. With a very complete set of peripherals for a fast system integration, including digital I/O, private external data port and multi-board synchronization, Oruga is a complete solution for desktop and industrial PC applications.

FEATURES:

- 225 MHz TMS320C6713 DSP
- Advanced DMA and cache controller
- 32 MB Memory
- 32/64 input up to 66 kHz, 32:1 mux to two 16-bit A/Ds
- Four D/A 16-bit to 2 MHz each (optional)
- Complex trigger modes

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Gage Applied Technologies

New 12-bit, 400 MS/s Dual-channel PCI bus Digitizer

Gage's new CS12400 PCI bus digitizer features 12-bit vertical resolution, 400 MS/s sampling, and high 200 MHz bandwidth. The fast sampling rate enables the capture of high-speed signals with ultra-high timing precision. The high resolution allows the capture of signals with a very high dynamic range. The CS12400 is available with up to 4 GB on-board memory.

Programming-free operation is provided with GageScope® oscilloscope software. SDKs for C/C++, LabVIEW, MATLAB, and other programming environments are also available.

The CS12400 is ideal for applications such as radar, lidar, signal intelligence, imaging, spectroscopy, wireless communications, ultrasonic NDT, and manufacturing test.

FEATURES:

- High resolution AND high speed in a single digitizer: 12 bit, 400 MS/s sampling
- Available with up to 4GB of on-board acquisition memory for extremely long signal capture
- FPGA Signal Averaging option available for extracting small signals from a background of high amplitude noise
- FPGA Finite Impulse Response (FIR) Filtering option available for removing unwanted signal features, such as noise
- For programming-free operation, Gage provides GageScope, an easy-to-use windows-based oscilloscope software
- For integration into your own applications, C/C++, LabVIEW, and MATLAB Software Development Kits are also available

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Boards
Data acquisition

Gage Applied Technologies

On-board FPGA Averaging & FIR Filter for PCI digitizers

Gage's new Finite Impulse Response (FIR) Filtering and Signal Averaging FPGA technology provide a fast and efficient means for users to process data on-board Gage's digitizers and transfer only the data that is of interest to the PC for further analysis.

Signal averaging is a powerful method of improving the fidelity of noisy repetitive signals. Small signals can be extracted from a background of high amplitude noise.

FIR Filtering is a powerful method for removing unwanted signal features, such as noise, and emphasizing signal features of interest.

Applications include: ultrasonic, radar or lidar, fiber optics, stimulus-response systems, network analysis, and communications.

FEATURES:

- Signal Averaging and FIR Filtering are optional Field Programmable Gate Array (FPGA) images installed on select Gage digitizers
- Available on Gage's CS12400 (12-bit, 400 MS/s), CS14200 (14-bit, 200 MS/s), and CS14105 (14-bit, 105 MS/s) digitizers
- Waveforms can be signal-averaged at a rate of over 100,000 waveforms per second for a data processing rate of 800 MB/s
- FIR Filtering allows more complex filtering than traditional analog filters, such as Moving Average Filters & Gaussian Filters
- FIR Filtering of digitized data is performed in real-time, with no reduction of digitizer repetitive signal capture rate
- Compatible with Gage's Software Development Kits for C/C++, LabVIEW, MATLAB, and other programming environments

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Boards
Data acquisition

VMETRO Transtech

Open MDR Real-Time Data Recorder

Open MDR is a family of custom programmable modular data recorders for VME, CompactPCI, or PC systems. It is designed to enable the integration of real-time data recording into high-performance data acquisition systems such as those found in surveillance, SIGINT, telemetry, semiconductor, and medical imaging systems. Open MDR is optimized for maximum flexibility and includes onboard options for 2 Gbps Fibre Channel, Gigabit Ethernet, or RACE++ interfaces without sacrificing PMC sites. Open MDR includes VMETRO's SAN Access Software for data recording environments such as remote management, disk grouping, intelligent disk management, and real-time data recording.

FEATURES:

- 385 MBps sustained recording performance
- Real-time file system ensures deterministic operation
- Multiple input source support includes: PMC, Ethernet, Gigabit Ethernet, VME, and RACE++
- Compatible with VMETRO's SAN Access Software products

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Boards
DSP

Innovative Integration

Quadia

Quadia is a quad-DSP, dual FPGA, dual PMC site, CompactPCI board with an advanced architecture that provides the best inter-processor connectivity and access to the finest external interfaces available today. Delivering blazing performance and extreme flexibility for advanced signal capture and real-time processing applications, the board features four C6416 DSPs split into two independent clusters, each hosting a PMC site and one large FPGA for end-user code. A central FPGA routes inter-processor communication, end-user FPGA communication, external port serial I/O for PCI-Express or other private link, global memory, and PCI interface.

FEATURES:

- 720 MHz TMS320C6416 DSP (x4)
- 64 MB SDRAM per processor
- Flexible internal/external communication mesh
- 64-bit/66 MHz CompactPCI
- Two PMC sites with Jn4 to FPGA
- External data port, up to 12 Gbps

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T2 Family of Products

BittWare, Inc. is the leading supplier of TigerSHARC DSP solutions that enable OEMs to quickly and cost-effectively get their products to market.

Our DSP expertise includes all SHARCs: ADSP-TS201, TS101, 21160, 21161, 2106x, and 21020. Our solutions are available in both commercial and conduction-cooled versions, as well as standard form factors, such as VME, 6U and 3U CompactPCI, AMC, PCI, and PMC.

In 2004, BittWare opened its BittWare UK branch with its acquisition of EZ-DSP, Ltd., one of the leading software developers for Analog Devices' TigerSHARC processors, strengthening BittWare's position as a market-leading producer of COTS embedded computing solutions.

T2 Family

BittWare's newest family of products – the T2 Family – features the ADSP-TS201 TigerSHARC processor. The T2 Family includes VME, 6U CompactPCI, PCI, and PMC boards.

To take full advantage of the high-performance TigerSHARC, the T2 Family implements BittWare's ATLANTiS™ – **A**dvanced **T**ransfer **L**ink **A**rchitecture for **N**ew **Ti**ger**S**HARC® – which combines robust TigerSHARC processing with the versatile Xilinx Virtex-II Pro FPGA to offer ultra-high performance and unprecedented I/O bandwidth.

TigerSHARC COTS VME/VXS board

The newest member of the T2 Family is the T2-6U-VME (T2V6), the first-ever COTS VME/VXS board based on the ADSP-TS201, featuring eight ADSP-TS201 TigerSHARC DSPs. The board is designed for demanding multiprocessor-based operations, and is targeted towards a broad range of applications including radar, sonar, communications, and imaging. It is available in both air-cooled and conduction-cooled versions.

BittWare merges the power of the TigerSHARC with the flexibility of PMC

The T2-PMC is a multiprocessor PCI Mezzanine Card featuring four ADSP-TS201 TigerSHARCs. The T2-PMC is the third addition to BittWare's T2 family of TigerSHARC boards. In addition to the 600 MHz TigerSHARCs, the T2-PMC features a Xilinx Virtex-II Pro FPGA, 64-bit 66 MHz PCI interface, large onboard memory, and more than 4 GBps of flexible, high-throughput I/O interfaces.

FEATURES:

- Up to eight ADSP-TS201 DSPs @ 600 MHz: 3.6 GFLOPS floating-point power, 14.4 BOPS of 16-bit processing, 24 Mb of on-chip RAM
- Up to two Xilinx Virtex-II Pro FPGAs
- Up to two PMC sites with PMC+ extensions for BittWare's PMC+ I/O modules
- 64 MB to 1 GB of onboard SDRAM
- 64-bit, 66 MHz PCI interface via BittWare's SharcFIN ASIC
- 8-16 MB of Flash memory
- Two link ports per DSP dedicated for interprocessor communications
- Up to eight external link ports @ 500 MBps, each via Virtex-II Pro routing
- Up to 168 DIO via Virtex-II Pro routing
- Up to 16 channels Rocket I/O, high-speed serial transceivers via Virtex-II Pro routing
- BittWare's SW development kit for Windows® and Linux: C-callable library of control communications routines
- Analog Devices' VisualDSP; Bittwares TigerSHARC BSP for Gedae

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VMETRO Transtech

PMC-FPGA03/F Xilinx Virtex II Pro FPGA PMC

The PMC-FPGA03 is a Xilinx XC2VP20/30/50 Virtex-II Pro based FPGA PMC module, which interfaces directly to two banks of DDR SDRAM and three banks of QDR-II SRAM for high performance, low latency applications. Xilinx RocketIO channels are available at either the front panel or PMC connector as a build option. The PMC-FPGA03 communicates with a variety of Windows, VxWorks, and Linux host computers via an optimized 64-bit/66 MHz PCI bus interface. The module is available in air-cooled and conduction-cooled variants. Fiber-optic options are also available. Example VHDL code blocks are provided to show how the PMC-FPGA03 resources can be used, along with utilities for configuring Flash.

FEATURES:

- Xilinx Virtex-II Pro FPGA
- High-speed serial I/O (RocketIO)
- Parallel digital I/O
- Modular I/O system supporting standards such as LVDS and custom I/O
- 64-bit/66 MHz master/slave PCI interface
- Rugged, conduction-cooled build variants

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Boards
FPGA/Reconfigurable computing

SBS Technologies

TS-CPCI-8001 – 6U CompactPCI-based FPGA processor board

The TS-6U CPCI-8001 is an advanced, CompactPCI-based FPGA processor solution targeted at military and commercial high-performance computing applications.

The two large FPGAs and high bandwidth connection make it ideal for software defined radio, radar, sonar, image, and video processing as well as other high-performance signal processing applications.

TS-6U CPCI-8001 is available with either Altera Stratix C7 or C5 speed grade FPGAs. The board is available in commercial grade and conduction cooled versions.

SBS provides an exclusive development kit bundle with the Celoxica handel-C language tools to support faster program deployment.

FEATURES:

- High-performance, FPGA-based computing platform for demanding signal and image processing applications
- Ideal for software defined radio, sonar, and other high-performance signal processing applications
- Dual Stratix EP1S80 FPGAs onboard
- Two PMC sites with 1 GBps high-speed data paths to each FPGA
- 8 GBps connection between FPGAs for a common processor fabric
- Windows XP/2000, Linux, and Integrity software support

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Octegra3 Video & Graphics Processor

Octegra3 is the third generation in Radstone's Octegra product family. It represents a leap forward in performance, providing a technology insertion upgrade path from previous generations.

The flexible video architecture of Octegra3 enables system designers to deliver multiple sensor images to the user, bringing vital situational awareness to the point of use and enabling superior decision-making performance. Applications may select any combination of eight video inputs simultaneously for display on both outputs independently. The video input mezzanine philosophy allows a specific mix of input formats to be engineered to suit a specific application.

With dual channel output, based on state-of-the-art Visual Processing Units from 3Dlabs, Octegra3 provides significant graphics generation performance for producing overlay symbology, and the ability to drive a wide variety of video output formats.

Additionally, Octegra3 incorporates a workstation-class computing node to drive high-end applications, delivering a single-slot solution comprising video, graphics, and computing power.

Octegra3 reinforces Radstone's ongoing commitment to delivering maximum performance and functionality in a single-slot solution, and its architecture ensures that all components and interconnects are able to work at maximum efficiency. Octegra3 will benefit applications with multiple video inputs and outputs in many areas, including mission computers, radar and sonar displays, surveillance, and UAV control.

Like all other Radstone products, Octegra3 is backed up by Radstone's market-leading Whole Program Life COTS™ philosophy, which delivers an unequaled commitment to ensuring the maximum possible productive life of all the company's offerings.

FEATURES:

- State-of-the-art graphics performance
- Dual independent display capability
- Workstation-class computing performance
- Flexible video streaming architecture
- Video extensions mezzanine capability
- 6U VME form factor
- Available in five ruggedization levels, air-cooled to extended temperature conduction-cooled
- Technology insertion for Octegra and Octegra2 products

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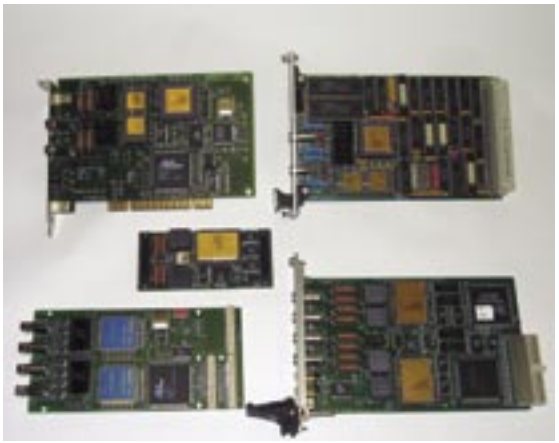
Alphi Technology

MIL-1553 for CompactPCI-PCI-PMC-Industry Pack-VME



Alphi Technology has been offering Mil-STD-1553 solutions for 15 years. We have the largest portfolio of board level solutions in the industry. Alphi supports the CompactPCI bus, PCI, PMC, Industry Pack, and VMEbus architectures. We incorporate controllers from UTMC, such as the BCRTM and the SUMMIT, as well as DDC ACE and mini ACE. All products support Bus Controller, Remote Terminal and Bus Monitor modes. All 1553 products have onboard transceivers and transformers and allow for external clocking. We support Linux, Windows, and VxWorks source packages. If you have specific design needs, contact our engineering department about our custom design and integration services.

FEATURES:

- 3U & 6U CompactPCI, one to four dual redundant channels, full BC/RT/M support, UTMC Summit, DDC ACE
- Single PMC module, one to two dual redundant channels, full BC/RT/M support, UTMC Summit, DDC ACE
- Half size and full PCI bus, one to four dual redundant channels, full BC/RT/M support, UTMC Summit, UTMC, BCRTM, DDC ACE
- Industry Pack module, one dual redundant channel, full BC/RT/M support, UTMC Summit
- 3U and 6U VMEbus, one to four dual redundant channels, full BC/RT/M support, UTMC Summit, UTMC BCRTM, DDC ACE
- Software support includes VxWorks, Linux, LabView, Windows, 'C' Libraries, and source packages

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SBS Technologies

1553-PMC3 – Conduction Cooled, 4-Channel MIL-STD-1553 PMC

1553-PMC3 is a flexible, conduction-cooled interface providing a single function, four channel, dual redundant MIL-STD-1553 interface to the PMC mezzanine.

This Advanced Single Function (ASF) architecture provides independent operation as a Bus Controller (BC), Remote Terminal (RT), or dual function Bus Monitor (BM). The ASF-PMC-4T interface equips the PMC bus system with a complete 1553 interface. This includes 1553A/1553B selections, pointer-driven transmit and receive buffers, and extensive programmable event interrupts and triggers.

Based on a high-speed FPGA, the 1553-PMC3 includes multiple DMAs per message, built-in monitoring and 48-bit, 1-µsec, resolution time stamps.

FEATURES:

- One to four dual redundant 1553 channels featuring 100 percent independent operation as BC, 31 RTs, or BM
- BC features include programmable linked lists, dual conditional branching, and full error injection/detection
- RT features include programmable response time, linked buffers, full error injection/detection
- BM features include full error detection, double buffered monitoring, 1-µsec time stamp, and multiple DMAs per message
- Complimentary drivers for most operating systems
- Integrated avionics library, including source code

SBS Technologies

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Condor Engineering

QPMC-1553 – 1, 2, or 4-Channel MIL-STD-1553 PMC Module

The QPMC-1553 provides the highest level of performance, flexibility, and interface density for MIL-STD-1553A/B on the PCI Mezzanine Card (PMC) bus. The QPMC-1553 is integrated with powerful software that reduces development time. All 1553 databus functionality is supported from our advanced Application Programming Interface (API). Standard features include IRIG/GPS synchronization capability, real-time bus playback (with ability to edit out RTs), aperiodic message insertion, error injection/detection, conditional BC branching, 45-bit time tags, and "one-shot" BC operation. The Bus Monitor mode provides 100 percent bus monitoring of a fully loaded 1553 bus.

Multifunction interfaces

The QPMC-1553 offers one, two, or four multifunction 1553 interfaces that can operate simultaneously as a BC, at up to 31 RTs, and as a BM. These can completely emulate entire dual-redundant 1553 channels internally, eliminating the need for external hardware to simulate missing nodes.

Single-function interfaces

The QPMC-1553 is available as one, two, or four single-function interfaces with all the features and functionality of the multifunction versions, but only one major operational mode is enabled at a time. These interfaces function as either a bus controller or 31 remote terminals or bus monitor.

Software

Included with the QPMC-1553 is Condor's easy-to-use, flexible, high-level API, which supports up to 16 independent MIL-STD-1553 channels. Source code and Windows XP, 2000, Me, NT, 98, 95, Red Hat Linux, and VxWorks support are provided. Support for Solaris and BusTools/1553, and Condor's GUI bus analysis and simulation solution for 1553, are optionally available. Condor's high performance and intuitive software solutions provide complete and simplified access to MIL-STD-1553 functionality for development, integration, test, embedded, and maintenance applications.

FEATURES:

- One, two, or four dual-redundant MIL-STD-1553 A/B Notice II channels
- Simultaneous bus controller, 31 remote terminals and bus monitor
- High-level API for Windows XP, 2000, Me, NT, 98, 95, Red Hat Linux, and VxWorks included
- Multifunction and single-function versions
- Front panel or rear (P14) I/O available
- Optional IRIG-B receiver/generator
- 45-bit, microsecond time-tagging
- Complete message programmability
- Flexible message status/interrupt generation
- I/O triggering and error injection/detection
- Transition cabling to 1553 cable jacks
- Optional extended temperature, variable voltage output, conductive cooling, and 66 MHz PCI bus

CONDOR ENGINEERING

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Boards

MIL-specific I/O

Avalon Defense Ltd.

MIL-STD-1553 Card for PC/104 (Single & Dual Channel)

The Avalon Defense Mil-Std-1553/PC/104 cards are available in single- and dual-channel versions. The Mil-Std-1553 cards are based on the ACE and Mini-ACE-series hybrids from ILC Data Device Corporation (DDC) and are compatible with Mil-Std-1553A, Mil-Std-1553B Notice 2, MacAir, and 1760 specifications.

The card's registers and RAM reside in the computer's I/O space. The standard, onboard 1553 hybrid(s) contain 4 K x 16 RAM for the storage of 1553 BC, RT and monitor blocks, bus controller messages, and control registers. Contact Avalon Defense Sales about versions of the card with greater memory capacity. Software drivers are supplied. Custom 1553 card designs are our specialty!

FEATURES:

- Mil-Std-1553 A/B compatible; also meets MacAir and Mil-1760 requirements
- Standard card comes with 4 K x 16 words of RAM
- BC, RT, and monitor operations – software selected
- Single- or two-channel cards available
- Commercial and extended temperature ranges
- Software drivers are supplied

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Boards

PCI

Interactive Circuits and Systems Ltd.

ICS-645C Full Length PCI Analog Input Board

A development of the innovative and market-leading ICS-645 ADC board, the ICS-645C is a differential input, high-speed, high-precision PCI bus data acquisition card designed for high-frequency sonar applications such as mine hunting; transient applications such as weapon and explosive testing; and for dynamic applications such as rocket and jet engine testing, which require a large number of high bandwidth channels.

The ICS-645C provides up to 32 channels and sample rates up to 2.5 MHz/ch. It also includes a PCI interface with DMA capability, and a 400 MBps FPDP II interface for rapid transfer of ADC data. The onboard data storage capability includes a 2 MSample "swing buffer."

FEATURES:

- A fixed frequency anti-alias filter provides cut-off at 1.25 MHz, with alternate cut-off frequencies optionally available
- Supplied with an innovative daughter card that provides analog signal conditioning
- Can be configured with up to 32 output channels at sampling frequencies of up to 2.5 MHz
- PCI 2.1 interface supports universal 3.3 V and 5 V signaling
- Differential inputs
- For FPDP II receive interfaces, the ICS-645C is capable of data transfer rates of an industry-leading 400 MBps

ICS SENSOR PROCESSING

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Innovative Integration

M6713

M6713 is a powerful and flexible DSP plus FPGA board of novel architecture for advanced data capture and real-time control in PCI systems. Designed around Texas Instruments' most powerful floating-point DSP for high-speed, high dynamic range signal processing, and Xilinx's latest FPGA for unlimited customization of the I/O peripherals as well as hardware-accelerated signal processing, the M6713 adds high-speed, low-latency I/O and deterministic control to PC systems in a COTS solution for a wide array of advanced real-time control applications.

FEATURES:

- PCI 64-bit/66 MHz
- Two Omnibus I/O module sites
- Reconfigurable FPGA option up to 1.5 million gates
- Supports multiple card I/O synchronization
- Extensive software support in source form
- Custom logic development support for FPGA

Innovative Integration
... real time solutions!

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Carlo Gavazzi Computing Solutions

Saturn 4522P/8522P PCI 2.2 Compliant Serial Controllers

The Saturn 4522P (4-port) and the 8522P (8-port) multi-port serial controllers are universal PCI cards compatible with the PCI Local Bus Specification Revision 2.2. The Saturn 4522P and 8522P cards operate in either a 5.0 V or 3.3 V signaling environment. However, these cards must be installed in PCI slots that provide 3.3 V power.

The Saturn 4522P and 8522P PCI serial communications controllers offer data transfer rates up to 256 kbps synchronous and 230.4 kbps asynchronous, full duplex. Interface options include RS-232 and RS-422/485 with DB-25 connectors via an external breakout box.

These controllers support SPARC Solaris, Rev. 7, 8, and 9; Solaris x86, Rev. 2.6, 7, and 8; and Linux.

FEATURES:

- Four and eight ports from one PCI bus slot
- PCI 2.2 compliant
- Each port is assignable for synchronous or asynchronous communications
- Supports SPARC® Solaris®, Rev. 7, 8, and 9; Solaris x86, Rev. 2.6, 7, and 8; Linux
- Compatible with Sun synchronous communications protocols
- Optional synchronous communications protocol software for Sun Solaris include X.25 and HDLC LAPB

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Inova Computers Inc

ICP-CM / ICP-PM (Celeron M/Pentium M 3 U Compact PCI CPUs)

Purposefully designed for rugged applications, the Inova Celeron M and Pentium M CPUs are free of rotating parts, wire interconnects, and cable looms that are typically responsible for failure on similar platforms.

Sitting in a class of its own, unique within the embedded computing world, is the CPU's performance scalability boasting a 533 MHz FSB and enormous 1.5 GB memory addressing potential. The latest Intel 0.09 µm (Dothan) processors can be BIOS clocked from 600 MHz to 2.0 GHz – on one single CPU platform! For true power critical or economically embedded applications, the ULV Celeron M processors, consuming just 5 W, prove their mettle by supporting either the 600 MHz or 1.0 GHz variants.

Both a single-slot, 4 HP, and an 8 HP version with integrated slim-line hard-disk interface are available as standard, with a screened version for higher operational temperatures (-40 °C to +85 °C) as an option. Thanks to SpeedStep technology, these CPUs are perfectly suited to passive cooling in embedded systems.

A bootable CompactFlash socket is integrated in the standard CPU design as are a number of PC interfaces including Gigabit and Fast Ethernet, 3x USB 2.0, ATA 133, and VGA. These interfaces are accessible either directly on the front panel or through a diverse range of rear I/O modules that enhance the I/O capability. Complementing the CPU family, Inova has developed these rear I/O modules with automatic identification for seamless CPU integration.

Built in to the SiS chipset is an analog VGA interface that is more than adequate for the majority of embedded applications. However, for graphic intensive multimedia-type projects, the integrated AGP 4x interface plays host to a variety of plug-in video accelerators with dual-head support for VGA, DVI-D, and TTL signaling for TFT flat-panel connection.

Polishing off the well thought out CPU design is an equally rounded service package for improved system integration that covers a broad spectrum from board support packages (BSPs) for VxWorks to Windows XP Embedded images.

FEATURES:

- Support from the 600 MHz ULV Celeron M to the 2.0 GHz Pentium M; processor clocking is performed in BIOS on the Pentium M CPU
- Up to 1.5 GB DDR 333 memory; Pentium M boards are shipped with 512 MB onboard; Celeron M CPUs have 256 MB DDR 266
- Integrated CompactFlash socket for the latest 4 GB MicroDrive units or industrial-grade, solid-state mass storage media
- Automatic rear I/O module recognition; all I/O signals are routed automatically to reflect the nature of the installed module
- AGP 4x socket for a range of dedicated video controller modules that enhance the built-in chipset graphics and offload the CPU
- Extended temperature option from –40 °C to +85 °C to enable operation in harsh environments
- Less than 10 W power consumption at full CPU loading on the Celeron M platform; the Pentium M CPU tops at 28 W
- Extensive OS support from Embedded Linux to Windows XP Embedded; board support packages for real-time OS are also available
- Very low emission and high immunity (essential for mobile applications), thanks to an innovative central blocking design
- Stable, vibration resistant mechanical construction that is an inherent design feature of 3 U CompactPCI
- Very high MTBF that is in excess of 200,000 hours and complements corporate-level, five-year product availability
- Successfully field tested to 55 g stressing – essential for robust and demanding military applications

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Innovative Integration

Quixote

Quixote is a 64-bit CompactPCI 6U board for advanced signal capture, generation, and coprocessing. It combines one C6416 DSP with a two- or six-million-gate Virtex-II FPGA. Utilizing the best of both worlds in signal processing technology, Quixote delivers extreme processing flexibility, efficiency, and unmatched performance. Dual 105 MHz analog I/O integrates signal capture and waveform generation right on the FPGA external interface. One PMC site facilitates integration of off-the-shelf or custom PMC mezzanine boards. A PCI-to-StarFabric bridge offers two 2.5 Gbps ports to the new PICMG 2.17 switched interconnect backplane, for up to 625 MBps board-to-board communication.

FEATURES:

- 1 GHz TMS320C6416 DSP
- 2-6 MGATE Virtex-II FPGA
- 32 MB SDRAM, 8 MB ZBT SBSRAM
- AD6645 and AD9764 converters
- 64/32-bit CompactPCI, 66 MHz, 5 V/3.3 V
- Complex trigger modes with HW event logging

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Voiceboard Corporation

BridgeWay

BridgeWay, "Radio Interoperability Simplified," 12-channel audio and radio I/F combines combines switched radio, intercom, T1/E1, VoIP, conferencing, and POTS interfaces. Operator controls include PTT or VOX keyed microphone and radio transmit controls. Each audio channel may be recorded and played back with compression and time stamping. Onboard VoIP capabilities integrate BridgeWay supported analog audio devices with packet networks via dual 100Base-T ports. Operator efficiency increases through BridgeWay's distinctive left-right channel headset audio separation, foreground/background mixing of all I/O channels, individual gain control on each channel, and simultaneous monitoring of multiple channels.

FEATURES:

- Radio interoperability seemlessly operates with radios of all types, military or commercial
- VoIP, RoIP, conferencing, intercom, PTT/VOX onboard capabilities; BridgeWay is infinitely scalable
- Optional POTS T1/E1, and H.323/SIP for broader application requirements
- Does not require chassis host CPU; host CPU can reside anywhere within the LAN/WAN network environment
- Dual redundant 100Base-T Ethernet for high reliability in military, homeland security, and emergency services applications
- A call control S/W application option eliminates months of OEM development effort getting your product to market faster

Voiceboard Corporation

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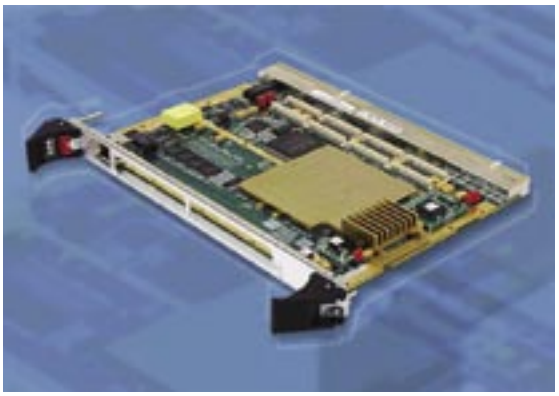
SBS Technologies

CK5 - Rugged 6U CompactPCI PPC Single Board Computer



CK5 is a rugged 6U CompactPCI single board computer with a high-performance processor, system bus, and memory bus speeds and system memory capacities.

The CK5 hosts the PPC G4 MPC7447A processor with core processor speeds up to 1 GHz and 512 KB of onboard L2 cache. The MPC7447A processor is supported with a 167 MHz MPX system bus.

The CK5 includes a high-speed DDR SDRAM controller with 167 MHz interface, multiple 10/100Base-Tx Ethernet MACs, and two 64-bit PCI bus interfaces. It also includes two MPSC ports. The CK5 offers DDR SDRAM of 256 MB, 512 MB, and 1 GB.

Each of eight programmable GPIO ports with independent interrupts can be programmed for direction, polarity, and masking.

FEATURES:

- MPC7447A G4 host processor with 512 KB on-chip L2 cache
- MV64460 PowerPC system controller (Discovery III) bridge chip
- 10/100Base-T Ethernet port to backplane (convection and conduction-cooled versions)
- The CK5 hosts two IEEE1386.1 PMC sites for expanding I/O capability with WAN or LAN I/O
- Offered as a ruggedized conduction-cooled processor card and also in a convection-cooled configuration
- Two RS-232, four RS-422, and 2 USB 2.0 ports

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Boards
CompactPCI

SBS Technologies

CR9 - High Performance 6U CompactPCI Intel® Pentium®M SBC

The CR9 is a 6U CompactPCI all-in-one CPU board with an integrated Intel® Pentium® M processor and dual Gigabit Ethernet PICMG 2.16 channels.

The CR9 is designed to meet the harsh environmental requirements of markets such as military and aerospace, heavy industry, simulation/training, and test and measurement.

The CR9 platform supports processor speeds from 600 MHz up to 1.6 GHz. It offers low power consumption and eliminates the need for onboard ventilation.

The CR9 provides a unique feature set, including up to 2 GB of DDR SDRAM (200) with ECC, three independent onboard PCI buses, support for the CompactPCI backplane, two PMC interfaces (64-bit/66 MHz and 32-bit/33 MHz).

FEATURES:

- Intel® Pentium® M processor, 600 MHz to 1.6 GHz
- Ruggedized against heat, cold, shock, and vibration for applications in harsh environments
- Hot-swap (full) PICMG 2.1 compliant, C-I-R-style
- Compliant to VITA 30.1-2002 and ANSI/VITA 20-2001
- Versions with front-panel I/O are available in various configurations with one or two PMC interfaces
- Supported operating systems are Windows® 2000, Windows® XP, QNX, VxWorks®, LynxOS®, Linux®, and others

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Metro-Switch Model 8261

DSS Networks' Metro-Switch Model 8261 is an advanced high-performance, full-featured multilayer 6U Gigabit Ethernet switch fabric board. It features 12 ports of 10/100/1000Base-T Gigabit Ethernet over copper with two 1000Base-SX/LX fiber uplinks. Model 8261 is PICMG 2.16 fabric card compliant and compatible with both standard CompactPCI and PICMG 2.16 backplanes. All 12 ports may be routed to slots on the CompactPCI backplane or externally via RTM. A system management interface is also supported via the PICMG 2.9 IPMI interface. It also supports two 1000Base-SX/LX gigabit fiber ports with 850 nm, 1310 nm, or WDM fiber connector options via front panel I/O. The Model 8261 has an onboard RISC/DSP processor for local management and can be operated as a standalone or fully managed switch. LEDS are provided for each port showing link status, transmit and receive, and link quality. All LEDS are multifunction and can be used for additional functions including cable testing and energy detection. Metro-Switch Model 8261 is also PICMG 2.1 R2.0 hot-swap compliant, providing support for the hardware connection layer.

Model 8261 uses the latest advanced high-performance, full-featured and highly integrated 12-port Broadcom BCM5690/5695 multilayer switch, with BCM5464SR quad-port transceivers, and is fully 802.3 compliant. It provides a fully non-blocking 24 Gb/32 million frames per second aggregate switching fabric. The switching function supports an extended list of features including Layer 3 switching, trunking, link aggregation, protected ports, port mirroring, advanced filtering, 802.1Q VLANs, 802.1D spanning tree, and priority-based 802.1D/802.1p CoS/traffic class expediting and dynamic multicast filtering.

The model 8261 12-port switch fabric is targeted for OEMs and systems integrators for use in telecom, military, data center server products including switches, multiplexers, edge routers, media gateways, and video broadcasting equipment.

This switch is available with an OEM developer's kit containing onboard firmware, device drivers, library functions, loopback tests, and many more features.

FEATURES:

- 12-port PIGMG 2.16/VITA 31.1 6U gigabit switch fabric card; unmanaged, lightly managed, or fully managed modes
- Onboard management firmware kernel with CLI – enables advanced multilayer switch features for specialized applications
- Switches all ports to backplane or rear I/O (available with 12-port RJ-45 RTM)
- Rugged versions available with extended temperature and conformal coating features for harsh environments
- 850 nm multimode, 1310 nm single mode, and WDM fiber connector options
- Simultaneous, fully independent operation on all ports – 32 Mpps-24 Gbps
- Fourth generation BCM5690/5695 switch fabric and BCM5464SRKB quad port transceivers from Broadcom
- High-performance wire speed on all ports – 24 Gb aggregate total; 1 MB of onboard memory for packet buffering
- Fully compliant to IEEE 802.3 specifications including auto negotiation
- Rules-based Layer 2-7 packet classification and filtering; four multi-function LEDs per port
- 802.1Q VLANs, 802.1D spanning tree, and priority-based 802.1D/802.1p CoS
- Available with OEM developer kit; VxWorks and Linux driver support

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Radstone Embedded Computing

PowerPact3 IMP2A – 3U CompactPCI Processor

Designed for demanding applications with restrictive dimensional requirements, Radstone's PowerPact3 IMP2A rugged CompactPCI single board computer packs a powerful SBC into an extremely space-efficient 3U form factor. The IMP2A offers a seamless technology insertion opportunity for existing IMP1A users and an ultra-high performance entry point for new users.

The IMP2A's processing core is based around a Freescale 7448 PowerPC processor operating at 1.4 GHz and a Marvell Discovery 3 Integrated System Controller, which combines high-bandwidth memory control and PCI bridging with an array of communication peripherals, including high-speed serial and Ethernet ports, all on a single chip.

The IMP2A features a PCI-X capable PMC site. I/O options include up to two Gigabit Ethernet channels, up to 12 bits of discrete digital I/O, and up to two serial channels capable of high-speed operation in either asynchronous or synchronous mode and are software programmable as RS-232/422 or 485.

The IMP2A is also fully supported at the chassis level by either the RDS evaluation/development chassis or the RT4 deployment chassis, Radstone's application-ready CompactPCI platform, which comprises four conduction-cooled 3U slots. The system slot is pre-loaded with a single board computer, leaving three slots for I/O and peripherals.

The IMP2A is fully supported by Radstone's Deployed Test software and a range of BSP features for standard COTS operating systems. Available in five air/conduction-cooled ruggedization levels, the IMP2A is backed up by Radstone's market-leading Whole Program Life COTS™ philosophy, delivering an unequaled commitment to ensuring the maximum possible productive life of all the company's offerings.

FEATURES:

- High-performance 3U CompactPCI processor
- CompactPCI system slot or peripheral slot
- PowerPC 7448 to 1.4 GHz
- Onboard PCI-X capable PMC site
- 1 MB on-chip L2 cache
- Up to 512 MB DDR SDRAM
- 128 MB Flash
- Two fast sync/async serial ports
- Two 10/100/1000Base-T Ethernet ports
- Up to 12 bits GPIO

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Technobox, Inc.

3923 FlexTX Processor PMC (PrPMC)

The 3923 is a FlexATX Processor PMC (PrPMC) carrier and development platform. This carrier board provides two PMC sites plus three PCI card slots (two 64-bit and one 32-bit). Using the 3923, a designer can work with a single PrPMC, dual PrPMCs, or a PrPMC and PMC for hardware and/or software development. All PCI slots are keyed for 3.3 V signaling. The PCI bus will run at 66 MHz, if all PCI cards assert 66 MHz enabled. At least one PMC site must be populated with a PrPMC running in Monarch mode. Site A's rear I/O is directed to connectors for a floppy disk and/or external IDE device. Each site has a fan to cool the mounted PrPMC or PMC.

FEATURES:

- FlexATX platform for PrPMC development and/or delivery
- Dual PMC sites enable various configurations with PrPMCs and PMCs
- Slots for three PCI cards (two 64-bit, one 32-bit), rear I/O access for external IDE or floppy drive
- Auxiliary cooling for PMC sites
- LED status for memory, configuration, I/O access, power, PCI interrupt, and bus mastering activity
- Site B rear I/O is directed to a DIN connector that emulates P2 of a VMEbus board

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KineticSystems Company, LLC

CompactPCI/PXI family of Test & Measurement modules

Known for their expertise in VXI and CAMAC data acquisition and control solutions, KineticSystems now offers a complimentary line of CompactPCI/PXI products.

KineticSystems' growing line of PXI products includes a relay multiplexer, a frequency counter, and a 14-slot PXI chassis. Additionally, KineticSystems offers CompactPCI products such as a digital I/O card, an analog output card, or high-speed digitizers.

KineticSystems' CompactPCI/PXI products are used in the aerospace, automotive, defense, and research industries worldwide for applications such as data acquisition systems, laboratory automation, jet engine/rocket testing, industrial process control, wind tunnels, and ATE systems.

FEATURES:

- P635: 3U, 8-channel, 100 kHz Frequency Counter ideal for measuring automotive and aircraft engine RPM and monitoring flow meters
- P580: 3U, 34-channel Relay Multiplexer with 4 front-panel LEMO connectors for connecting up to 4 external instruments
- C387: 6U, 256-channel Digital I/O supporting TTL, isolated input or output, relay output, AC switch output, and differential I/O
- C266: 6U, 32- or 64-channel, 16-bit D/A Converter ideal for automotive test cells, industrial control, and ATE
- 6U, High-speed Digitizers with up to 2 GS/s sampling, up to 16-bit resolution, and up to 2 GB on-board acquisition memory
- CP199: Rugged 14-slot, 3U/6U dual stack 800 Watt PXI system with high-pressure 220 CFM cooling

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BMC Communications Corp.

PC104 – UADI – 1553 – ARINC 429 – RS-232

PC104 Universal Avionics Digital Interface (UADI) is a plug-and-run device. The device uses a powerful 16-bit Flash RISC, low-power microcontroller. It supports a wide variety of communication protocols: MIL-STD-1553 dual redundant interface, ARINC 708/453, two transmit/receive ARINC channel protocols, such as 429/575/571/572/581/582/615, and more, and two transmit/receive RS-232. It includes extensive C libraries, DLLs, Windows, and Linux drivers. A variety of software programmable features include error injection-detection, sub-address selection, major/minor cycle frame, long loop test, class A/B, and so forth. The unit is available in commercial or industrial grade, MIL-STD-810E and EMI MIL-STD-416.

FEATURES:

- 1553 modes: BC, RT, BM, BC-RT, RT-BM, and BC-BM
- 1553 multiple store buffers with 32-bit time-tag
- Two independent ARINC receive transmit channels
- Two independent RS-232 receive and transmit channels
- ARINC RS-232, baud rate 100 Hz to 1 MHz
- Eight I/O and analog inputs with 12-bit resolution

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VIPER – PC/104 PXA255 XScale Single Board Computer

The VIPER is an ultra low power, PC/104 compatible, single board computer based on the Intel® 400MHz PXA255 XScale® RISC processor. The PXA255 is an implementation of the ARM-compliant, Intel XScale microarchitecture combined with a comprehensive set of integrated peripherals, including a flat-panel graphics controller, DMA controller, interrupt controller, real-time clock, and multiple serial ports.

The VIPER board offers a long list of features making it ideal for power sensitive embedded communications and multimedia applications. The board has been designed to take advantage of the power saving modes of the PXA255 processor and other onboard peripherals to achieve an incredible 1.9 W typical power consumption. The VIPER also supports a very low power standby mode.

The VIPER board includes a TFT/STN flat-panel graphics controller, onboard soldered SDRAM and resident Flash, 10/100Base-Tx Ethernet, five serial ports, dual USB host controller, USB client, AC97 audio/codec, CompactFlash interface (CF+), and a standard PC104 bus expansion connector. The PC/104 format is an industrial form factor measuring 3.8" x 3.6" (96 mm x 91 mm).

The VIPER is supported with development kits for the leading embedded operating systems including Windows CE .NET, embedded Linux (and RT-Linux Pro from FSM Labs), and VxWorks 5.5. Arcom also provides support for RedBoot™, a utility based on the eCos RTOS, which serves as a simple boot manager and download tool for embedded Linux applications.

To speed up the process of system integration, you can purchase the VIPER ICE industrial compact enclosure (fitted with a 320 x 240 wide temperature TFT/touchscreen display) or the rugged CYCLOPS display terminal (fitted with a high brightness 640 x 480 TFT/touchscreen display).

FEATURES:

- 400 MHz Intel PXA255 XScale processor
- 64 MB DRAM
- 32 MB Intel StrataFlash
- 256 KB battery backed SRAM
- Direct TFT/STN display support with onboard bias supply
- 10/100Base-Tx Ethernet controller
- Five high-speed serial ports (4x) RS-232, (1x) RS-232/422/485
- Dual USB v1.1 host controller and/or USB device
- Industry standard PC/104 form factor
- Very low power operation – typically 1.9 W with sleep modes down to 200 mW
- Hot-swap CompactFlash (CF+) expansion port
- Support for Trusted Computing with ATMEL TPM module

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Think Embedded. Think Arcom.
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DIGITAL-LOGIC AG

PC/104 Board with Serial ATA, MSM915

With the PC/104-*Plus* board MICROSPACE® MSM915, DIGITAL-LOGIC offers the new MSM915 PC module with increased CPU speed and more graphic performance. It was enhanced with serial ATA so two S-ATA150 drives and one P-ATA drive can be connected. Equipped with the scalable smartModule915 with a i915GM chipset, the customer can determine the performance and choose Intel® processors – from Celeron® M 600 MHz up to 2.2 GHz Pentium® M765 with 2048 K L2 Cache and equivalent Pentium® 4 performance from 600 MHz up to 4.4 GHz. The new PC/104-*Plus* computer provides all standard PC interfaces such as VGA, LCD, COM1/2, LPT1, FDD, IrDA, and PS/2 ports for mouse and keyboard. Up to 1024 MB of DDR RAM are available on the module. CPU and RAM are mechanically protected against vibrations and shocks. The MSM915 module only consumes between 10 W and 30 W.

Integrated in the Intel® 915GM, the powerful graphic "card" has up to 224 MB of video memory and is DirectX 9 compatible. It achieves resolutions up to 2048 x 1536 pixels with up to 256-bit color. The standard version further includes a TV output for HDTV, NTS, and PAL signals, six USB-V2.0 ports, an AC97/HDA compatible sound interface, a watchdog, an RTC battery, EEPROM support, and an optional CompactFlash card. The PC/104-*Plus* board is equipped with 10/100Base-T Ethernet. Booting from LAN is carried out via the Intel® boot agent. For multimedia applications, the PC/104-*Plus* board provides a 7.1 DTS sound system. The board may be expanded by the PC/104 ISA, PC/104-*Plus*.

The MSM915 is supplied by 5 V and runs under Windows® XP, Linux, and more. The module operates at a standard temperature range of 0 °C to +50 °C. On request, an extended temperature range of –40 °C to +50 °C is available. Designed for low power consumption, the MSM915 module is ideal for embedded solutions. The PC module is tested for shock and vibration and is perfectly suited for applications in the areas of navigation, telecommunications, computer peripherals, medical, measurement technologies, the aerospace industry, automotive electronics, and in Internet terminals.

FEATURES:

- Intel® Processor Celeron® M 600 MHz up to Pentium® M with 2.2 GHz
- Intel® 915 GM with 533 MHz front-side bus, ICH4, 512-1024 MB DDR-RAM SODIMM
- Extreme graphics, 224 MB (UMA), DirectX 9 compatible, 1 x VGA-CRT, 1 x DVI-D/LVDS or video-out (S-Video)
- MS/KB, FD, 1 x P-ATA, 2 x S-ATA, LPT1, 6 x USB V2.0, LAN, AC97-HDA, 7.1 DTS sound stereo with six-channel out, two-channel in
- SM855/915 Bus including PCI and LPC
- Onboard CompactFlash (option)
- PC/104-*Plus* expansion (option)
- MSM855-DVICON as adapter, offers the MSM915 to be linked to a DVI or LVDS display
- RTC-battery up to 10 years lifetime, Core BIOS Flash, EEPROM setup support, watchdog
- Optimized heat spreader and cooling feature for operating temperature of –20 °C to +60 °C (optional –40 °C to +70 °C)

DIGITAL-LOGIC
smart embedded computers

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PC/104-*Plus* Motherboard I/O Module and MPEG Decoder Set

Enseo specializes in the design of high-performance industrial servers as well as multichannel MPEG decoder products. Proprietary audio and video technology combined with high-speed CPUs, a Gigabit Ethernet interface, as well as highly defined media I/O such as IEEE 1394B, RS-232, and IEEE 802.11G, can be rapidly adapted to create high-performance, efficient, rugged, and low-maintenance solutions that fit unique customer specifications and provide a powerful competitive advantage for our clients.

This flexible platform offers an incredible variety of I/O through the various add-in slots with an ETX slot for CPU module, CompactPCI for wireless or other device, USB 2.0, PCI, and two separate PC/104-*Plus* stacks for various industrial add-in modules, including the Alchemy PC/104+ MPEG decoder.

Alchemy PC/104+ is a two-channel MPEG decoder, capable of MPEG 1, 2, and 4 decode, and a 256-color on-screen display. Alchemy PC104+ is also available with PA override to feed, bypass, or integrate with an existing PA system on any airplane or shipboard system.

This motherboard, CPU, and decoder can be purchased individually or as a board set.

This is a perfect platform for a military kiosk, video server, or general-purpose, high-quality PC subsystem.

A video server product has optional application software in Linux or Windows platforms.

The PCI slot in this platform also supports Enseo's Alchemy products with Genlock, analog pass-through, video in a window, and 32-bit graphics overlay products as well as a full line of high-definition MPEG decoders.

Customizations are available.

Enseo is a certified woman-minority-owned business.

FEATURES:

- Motherboard with ETX slot for CPU
- Two separate PC/104-*Plus* slots for MPEG decoder or other PC/104 or PC/104-*Plus* peripheral
- One Mini PCI slot, 32-bit/33 MHz (perfect for 802.11g wireless solutions)
- Two Ultra DMA IDE disk interfaces for up to four devices, inluding: CD Rom drive, DVD drive, and hard drive(s)
- ATX standard power supply connector
- One parallel port, two Serial RS-232 ports, and one IR port
- Network includes 10/100/1000Base-T Gigabit Ethernet port
- Alchemy decoder cards support up to 10 Mbps SD decode of system, program, or transport streams; synchronized play, video wall
- Alchemy outputs include differential video (S-video, composite, RGB, or YUV) and differential stereo or digital audio
- Linux, Windows 2000, 2003, or XP operating sytems support
- Non-operating temperature -45 °C to +85 °C ambient; operating temperature 0 °C to +50 °C ambient; optional chassis available
- Fanless design as a four-channel video server using the Alchemy PC/104+ MPEG decoder boards

Enseo

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Boards

PC/104

Robotrol Corporation

RPC628 Analog I/O

Analog inputs: Inputs have 12-bit resolution and can operate as 16 single-ended or 8 differential inputs, each protected to ±32 V. Full-scale voltages from 25 mV to 10 V can be used. 4-20 mA current loops are an option.

Analog outputs: Eight outputs with 12-bit resolution can be set to one of seven ranges. 4-20 mA current loops are an option.

Digital I/O: 16 I/O can be individually programmed as inputs or outputs.

Programmable features: Data transfer width, interrupt enable, auto increment enable, continuous conversion, max channel, conversion interval, two's comp or binary data, and software reset.

Other products: Other PC/104, STD32, and ISA products are available with 32 analog inputs and 16 analog outputs.

FEATURES:

- 16 SE or 8 DI inputs (Ranges: 25 mV to 10 V (unipolar or bipolar), 250 kHz throughput, inputs protected to ±32 V
- Eight analog outputs (Ranges: 2.5 V, 5 V, 10 V, ±5 V, ±10 V, -5 V to 0 V, -10 V to 0 V)
- 16 digital I/O, bit-by-bit programmable as inputs or outputs
- Options: 4 mA to 20 mA current loops for both inputs and outputs, auto scan mode (scan all inputs with one command)
- Auto increment and continuous conversion modes, programmable conversion intervals from 4 µs to 64 ms
- Programmable features: Data transfer width, interrupt, auto increment, continuous conversion, conversion interval, software reset

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Boards

PMC

Interactive Circuits and Systems Ltd.

ICS-572

Providing both receive and transmit capability for demanding radar and communications applications, the ICS-572 PMC module combines industry-leading ADC and DAC technologies with a high-density, high-speed FPGA to offer an efficient combination of cost, size, and performance in a single PMC site.

The ICS-572 PMC includes two 14-bit, 105 MHz ADCs, two 14-bit, 200 MHz DACs, a 4, 6, or 8 million gate Xilinx FPGA, 64 MB SDRAM, 8 MB QDR-II SRAM, 64 user programmable I/O via Pn4, and a 64-bit, 66 MHz PCI DMA interface.

ICS-572 is ideally suited for multi-mission applications that include radar, communications, EW, test and measurement, public safety, and so forth.

FEATURES:

- Receive and transmit functions in one single width PMC module
- Ideally suited in high-bandwidth communications applications that require both receive and transmit functions
- Two 14-bit, 105 MHz ADCs, and two 14-bit, 200 MHz DACs
- The board includes a 4, 6, or 8 million gate Xilinx Virtex II user programmable FPGA for baseband processing
- Onboard data storage with 64 MB of SDRAM and 16 MB of QDR-II SRAM, and a fast PCI 2.2 64-bit, 66 MHz DMA interface
- Comprehensive software device drivers support the ICS-572 board for the Windows, Linux, and VxWorks operating systems

ICS SENSOR PROCESSING

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Interactive Circuits and Systems Ltd.

PMC571

The PMC571 is the world's first rugged PMC to offer wide bandwidth analog-to-digital and digital-to-analog conversion capabilities at software radio frequencies. Combining it with Radstone's market-leading PowerPC and DSP capabilities will enable customers to create multi-function blade products offering analog-to-digital and digital-to-analog conversion, FPGA, DSP, and processing in a single-slot configuration.

A powerful 4 million gate FPGA provides the platform for application-specific software development within a Xilinx Virtex II environment. The 64-bit, 66 MHz PCI interface ensures compatibility with the latest generation Radstone Quad PowerPC, VMEbus, and CompactPCI boards.

FEATURES:

- Rugged software defined radio transceiver module
- 4 million gate FPGA, providing the platform for application-specific software development within a Xilinx Virtex II environment
- Sample rates up to 80 MHz and processing bandwidth of 40 MHz
- Full 64-bit, 66 MHz PCI interface and a 64-bit general-purpose I/O with 14-bit data conversion on ADC and DAC functions
- Air- and conduction-cooled ruggedization levels and extensive application and technical support data available
- Full source-code device drivers available for VxWorks and Linux real-time operating systems

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Innovative Integration

VelociaPMC

The VelociaPMC family integrates ultra-fast signal capture, generation, and coprocessing on an advanced PMC architecture. Each card combines new generation analog devices with a large user-reconfigurable Virtex-II Pro FPGA, ample DDR memory, and low jitter clocks/triggers on a 64/66 PCI with a private JN4 64-bit user I/O port and an XMC four-lane Rocket I/O (per VITA 42) that connects straight to the FPGA of our Velocia CompactPCI boards or other carriers.

This ultimate connectivity allows for rapid deployment of the most advanced systems in Software Defined Radio (SDR), signal intelligence, radar, and radio test equipment.

FEATURES:

- High-end A/D and D/A
- 4 M or 5 M GATE Virtex-II Pro
- 64-bit Jn4 to host, 64-pin, 800 MBps
- XMC serial, 10 Gbps, J5 connector
- Optional C6416 DSP
- Large DDR RAM

Innovative Integration
... real time solutions!

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Carlo Gavazzi Computing Solutions

PMC-SB StarFabric PCI Mezzanine Card

The PMC-SB is PICMG 2.17 compliant and mounts on a CompactPCI or VME64 carrier to provide a StarFabric interface. The PMC-SB converts a conventional parallel 32- or 64-bit PCI bus operating at up to 66 MHz to dual high-speed serial links compliant with the StarFabric protocol. The two links may be used separately for redundant fabric applications or may be aggregated for higher speed operation.

The PMC-SB offers a flexible SwitchFabric interface to real-time networks that scales from a few to hundreds of nodes. The flexibility and scalability of the PMC-SB are ideal for many signal-processing applications that require multiple processors to achieve real-time response and throughput.

FEATURES:

- 32-bit/33 MHz, 64-bit/66 MHz PCI interface
- Dual StarFabric links
- External RJ-45 connections (shielded CAT5 cabling for up to 10 meters) or PICMG 2.17-compatible Pn4 interconnect
- 400 MBps sustained throughput
- Transparent protocol allows PCI-based OS and application software to run without modification
- Linux, Microsoft Windows, Solaris (SPARC and x86), and VxWorks operating system support

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Technobox, Inc.

4044

The 4044 passive adapter permits standard 32- or 64-bit PCI-X card operation in a PMC-X slot. One PCI-X edge finger connector supports keying for 32-bit, 5 V signaling PCI cards. A second supports 32-bit or 64-bit, 3.3 V signaling PCI-X cards. A universal PCI-X card can be used in either position. Six 20-pin connectors (HP 01650-63203 termination) provide an interface for a logic analyzer. Onboard logic decodes PCI-X bus cycles, with associated LEDs indicating status. Additional LEDs monitor power supplies and key signals. Test points enable supply voltage measuring. Pulse stretchers enable visible detection of short-lived events. An optional PLL clock buffer is available.

FEATURES:

- Adapts 32- or 64-bit PCI cards to a PMC site
- Supports 33/66 PCI-X clock frequencies
- Logic analyzer headers (compatible with HP 1650-63203 termination adapters)
- LEDs convey PCI bus operation (PCI bus command code decoded for individual LEDs)
- Supports bandwidth measurement; LEDs display power, bus signals, and bus cycles

Technobox, inc.

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4170

This PMC board, which is built around the Silicon Image 680, is designed to accept 2.5" ATA/IDE mass storage media, as either a rotating hard disk drive or a solid state Flash disk, using industry standard mounting. Media is normally installed by the end user.

FEATURES:

- Silicon image 680 controller
- Accepts 2.5" ATA/IDE HD or solid-state disk
- Standard mounting
- Link activity LED
- Media optional

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Technobox, Inc.
Boards
PMC

4289

The enhanced 32-channel, reconfigurable RS-422/485 digital I/O PMC provides a vehicle for implementing complex digital designs requiring a differential interface. A second-generation, FPGA-based design, the 4289 includes 64-bit/66 MHz PCI bus support, up to 66 MHz local bus clock, 256 K x 32 b SRAM, and up to 20 K logic elements. Standard configuration is 12 K LEs. Other sizes are build options. All 32 general-purpose RS-422/485 digital I/Os are wired to both front panel and rear connectors. FPGA configuration cells are automatically loaded from a serial EPROM during power up. Dynamic reprogramming of the FPGA can be performed by the host or by in-circuit burning of the Flash device.

FEATURES:

- Provides 32 channels of general-purpose RS-232/422 digital I/O
- 12 K LEs (standard configuration)
- Reprogrammable by host or onboard Flash (EP1CS4)
- Variable SRAM architectures allowed
- Headers for JTAG connection and Flash programming
- Sample FPGA implementation and host "C" code

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Technobox, Inc.

4320

The 4320 is a Common Mezzanine Card (CMC) extender that provides a means to extend mezzanine boards for signal accessibility, including PrPMC (VITA 32), PMC (IEEE 1386.1), PMC-X (VITA 39), and any other CMC-derived board. The extender supports 3.3 V and 5 V PCI-bus signaling, 33 MHz and 66 MHz clock speeds, and either 32-bit or 64-bit bus widths. A 10-layer design assures optimum performance and signal quality. Four headers on the extender provide access to bus and rear I/O signals. A row of turret test points is also provided.

FEATURES:

- Extends PMC, PrPMC, or PMC-X board for test access
- Direct access to bus and rear I/O signals
- Headers and test points for logic analyzer
- Supports 33/66-MHz, 32/64-bit modes
- 3.3 V and 5 V bus signaling

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Boards
PMC

Technobox, Inc.

4352

The 4352 is an active adapter that enables delivery of a PMC-derived application in a standard PCI or PCI-X environment. Built around an Intel 31154 PCI-X-to-PCI-X bridge, it supports both PMC and PMC-X boards of any signaling level, clock frequency, and bus width. The bridge assures signal integrity even with multiple adapters plugged into a single PCI bus segment. Both the primary and secondary PCI buses support PCI and PCI-X rates, as well as 32-bit and 64-bit transactions. LEDs indicate status of power and key PCI bus signals. A four-pin power connector permits application of external power (+5 V and +12 V). An optional fan assembly (P/N 3675) is available.

FEATURES:

- Adapts PMC or PMC-X modules to PCI or PCI-X
- Intel 31154 bridge
- Supports PCI (33/66 MHz) and PCI-X (66/100/133 MHz)
- Rear I/O support
- LEDs for key PCI bus signals and power
- Accommodates external power

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Highland Technology

Model T560-1 Embedded Delay Generator

The T560 builds on Highland Technology's family of small digital delay generators, intended for use in embedded OEM applications. The T560-1 is the standard, packaged version, usable in many OEM applications and as the evaluation unit for custom versions. It uses the technology developed for the Highland models V851 VME module, V951 VXI module, and P400 (bench-top) digital delay generators, with basic TTL/CMOS input and output levels and simplified logic.

The T560 accepts an internal or external trigger and generates four precise output pulses, each user programmable in time delay and width. It is ideal for laser sequencing, radar/lidar simulation, or sequential event triggering.

FEATURES:

- Four TTL-level delay outputs, individually programmable for delay and pulse width
- 10 ps delay resolution, 10-second range, 20 ns insertion delay, 20 MHz maximum trigger rate
- Low jitter, highly accurate DSP phaselock system has crystal-clock delay accuracy w/zero indeterminancy from external trigger
- Internal TCXO time base with external lock capability; DDS synthesizer for internal trigger rates
- COMM: RS-232 serial interface standard, Ethernet optional; PWR: External universal power supply or 12 VDC power
- Easily mounted enclosure allows short cable runs and reliable unattended operation; custom OEM package or board-only also available

HIGHLAND TECHNOLOGY

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Linktronic

Radar Upgrades/Radar Scan Conversion

Linktronic is an expert in upgrading naval, army, coastal surveillance, and air traffic control radar systems with COTS. We have 15 years experience in radar design, special systems integration, link construction, conversion, and re-engineering of the world's top 10 radar systems.

Our focus is defense air-search radars, real-time control border monitoring, air traffic control, vessel traffic management, and remote vessel monitoring stations.

We are skilled in radar upgrading within limited budgets. We have installed full air traffic control systems, both naval and military, as well as naval aircraft houses.

Expertise includes instructional use/training and hand-over of radar systems.

FEATURES:

- Radar scan converters and recording – using the latest COTS technologies
- ASR-1000 radar ATC for aerial monitoring, band S, TMA, rank 60/80 mn, dual-channel AMTD, solid-state modules
- AS-100X – tactical mobile radar – completely SELF-CONTAINED in a 20-foot unit
- RCB-16 – small area tactical mobile radar – 1000 meter range w/remote alarms
- Sensors of radio frequency – for technical audit to TV cable networks – to determine the illegal connections to the TV network
- Our special skill is upgrading radar within limited budgets

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Parsec (Pty) Ltd

COTS Radar Signal Processor Platform

Radar Signal Processors (RSPs) continuously challenge leading-edge technology for high-performance processing, high data bandwidth, programmability, and testability. These demands must be met despite the contradicting requirements of reduced development time and low production cost.

Parsec's range of Commercial-Off-The-Shelf (COTS) CompactPCI and PMC products uniquely combines analog, FPGA, and StarFabric technology to provide an open standard, highly scalable, programmable platform that satisfies the stringent demands of Radar Signal Processor development.

The PM410 PICMG 2.17 StarFabric CompactPCI PMC carrier board provides full-duplex, high-bandwidth (2.5/5.0 Gbps) point-to-point links between PMC processing nodes. It also allows cascading of multiple PM410 carriers in a scalable fashion, resulting in a fully pipelined flow-through architecture.

The PM480 14-bit 105 MSps ADC PMC and PM488 14-bit 150 MSps DAC PMC modules seamlessly interface with RF peripherals at IF frequencies. Front-panel SMB connectors provide clock and trigger inputs and analog interfaces.

The PM431 and PM430 are single and dual PMC FPGA modules with respectively one and two processing FPGAs. These modules innovatively apply ALTERA® STRATIX FPGA technology to yield very high-performance processing nodes. An FPGA-based DMA engine provides sustained PCI transfer rates of 430 MBps. Each processing FPGA connects to five independent ZBT memories, delivering 2.66 GBps of memory bandwidth per processing FPGA.

These modules integrate into a CompactPCI rack to realize a programmable, high-performance Radar Signal Processor that effectively implements radar functions like pulse generation, IF sampling, timing generation, pulse compression, doppler filtering, CFAR, etc.

This COTS-based system facilitates a short, low-risk development cycle resulting in a high-performance Radar Signal Processor solution with low production cost.

FEATURES:

- Programmable RSP platform
- High processing bandwidth
- High data bandwidth
- Built-in upgrade and test features
- Short, low-risk RSP development cycle
- Low production cost
- COTS CompactPCI and PMC modules
- PICMG 2.17 StarFabric CompactPCI carrier with high bandwidth (2.5/5.0 Gbps) point-to-point links
- High-performance 14-bit 105 MSps ADC and 14-bit 150 MSps DAC PMC modules
- ALTERA® STRATIX-based single and dual PMC FPGA processing modules
- Hardware, firmware, and software development and integration services available

parsec
excellence in technology

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Crane Aerospace & Electronics

Electronic Manufacturing Solutions (EMS)

From prototype to production, Crane Aerospace & Electronics has the experience and expertise to fill your electronic manufacturing outsourcing requirements. We partner with our customers as their choice for leading-edge design and manufacturing of unique electronic packaging solutions. We provide high-quality, quick response electronic assembly services. We are established as a turnkey MIL-SPEC and commercial assembly facility conforming to all relevant standards. We offer full Surface Mount Technology (SMT) capability in addition to providing our customers with virtually all types of printed wiring board assembly technologies.

Our quality program includes compliance with government standards and statistical process control applications. We have been surveyed and approved by more than twenty prime contractors for compliance with the requirements of MIL-Q-9858 or MIL-I-45208 and various MIL-STDs. We are ISO 9002 and AS9100 qualified and a preferred supplier to several major aerospace firms.

We provide technical support throughout the planning, design, assembly, testing, and operational phases. We perform manufacturability reviews and make procurement, manufacturing, and integration recommendations.

Download our brochure at www.craneae.com/133.

Crane Aerospace & Electronics is a segment of Crane Co. that includes ELDEC, General Technology, Hydro-Aire, Interpoint, Keltec, Lear Romec, P.L. Porter, Resistoflex, and Signal Technology, all major suppliers of critical aircraft and electronic systems and components. For more information on Crane Aerospace & Electronics, visit www.craneae.com and for Crane Co., visit www.craneco.com. Crane Co. is a diversified manufacturer of engineered industrial products.

FEATURES:

- Conceptual planning
- Full turnkey component sourcing and procurement
- PWB layout
- Surface mount technology
- Through-hole assembly
- Cable and harness assembly
- Technical support
- IPC certified operators
- Test: Automated, In-Circuit Test (ICT), Environmental Stress Screening (ESS)
- Obsolescence management

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The Titan Corporation
Advanced Products & Design Division

Vigra – Video, Imaging, Graphics

We're different than traditional video and graphic board suppliers. From frame grabbers with graphics and dual monitor support to real-time video/image processing, to MPEG compression and decompression, our Vigra family of customizable, off-the-shelf board platforms can be tailored to meet the highest degree of functionality, performance, and reliability possible. Our Vigra products are based on programmable, scalable FPGAs, creating a flexible COTS technology to support video capture and display, as well as complex real-time image processing and high resolution graphics. Vigra's architecture allows you to upgrade application-specific functions, without changing the hardware.

FEATURES:

- Compression/Decompression
- Real-time digital and analog video
- Onboard, real-time image processing
- VxWorks, Solaris, Windows
- Programmable FPGA-based platform
- PCI and PMC form factors

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Boards
Video

The Titan Corporation
Advanced Products & Design Division

VigraWATCH

VigraWATCH is a multifunction, single-board COTS product to acquire, process, and simultaneously compress and decompress video and audio in real time. VigraWATCH supports two separate graphics displays, each with an independent video window in the display to simultaneously display real-time video with nondestructive graphics overlay to a window, or drive an SVGA monitor directly. VigraWATCH provides a range of programmable-bit and frame-rate compression and decompression options to meet specific bandwidth requirements.

VigraWATCH utilizes a dense FPGA and a PowerPC to perform onboard, real-time image processing and supports Titan off-the-shelf and custom algorithms as well.

FEATURES:

- MPEG-2 compression and decompression
- Real-time digital and analog video and audio
- Two real-time graphics displays with independent video windows and TV-out
- FPGA-based
- PMC and PCI form factors
- Ethernet

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RGB/View 8000/8001 Multi-input Display Processors

The RGB/View® 8000 and 8001 controllers display up to eleven real-time video windows on a high resolution monitor. Each window can be independently positioned, scaled to any size, overlaid with computer graphics, or overlapped with other windows. In addition, the user can pan and zoom within each image.

The system was developed for applications requiring the simultaneous real-time display of high quality video and computer-generated images.The RGB/View 8000 offers up to four video and two high resolution RGB inputs on a single VME board. The RGB/View 8001 supports up to eight video and three RGB inputs in two VME slots.

The RGB/View processor guarantees real-time video performance under all conditions. Its architecture has a unique advantage: the multi-image display imposes no burden on the host CPU, frame buffer, or bus.

Features include frame grabbing of individual inputs or the combined screen image over the VMEbus or Ethernet port, a fully digital signal path available with DVI input and output, and a chroma key for overlays.

Excellent video quality, real-time performance, a unique set of features, and compatibility with virtually all VME CPU and graphics boards, make the RGB/View 8000 and 8001 the finest video windowing systems available.

FEATURES:

- Displays up to eleven real-time inputs
- Compatible with inputs up to 1920X1200 Pixels
- RGB, DVI, FLIR, radar, sonar, NTSC/PAL, and S-video inputs
- Windows independently positioned and scaled
- Zooming within Windows
- Chroma key overlays
- Software independent
- 30-bit color processing
- Control over VMEbus, RS-232 port, and Ethernet
- Frame grabbing over VMEbus and Ethernet

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Highland Technology

V360 VME Eight-Channel Frequency Measurement Module

The V360 complements Highland's Arbs in acquiring low frequency inputs from industrial speed sensors. The module can measure frequency and period over a wide dynamic range, and is specifically designed to ensure reliable measurement in high-noise environments.

Differential signal inputs are conditioned, filtered, and presented to the FPGA, which manages period and frequency measurement. A microprocessor periodically reads the timer chip, checks and scales data, and loads measured values into a dual-port memory interfaced to the VME bus.

The inputs can connect directly to common transducers including variable reluctance or hall-effect magnetic speed, optical, and other pickups.

FEATURES:

- Intelligent, eight-channel, period/frequency/RPM measurement module for signal conditioning magnetic speed pickups, flowmeters, and encoders
- Also for use with AC line voltage or alternator windings, optical pickups, fuel flowmeters, contact closures, or other special levels
- High noise immunity ensures accurate measurement in industrial and aerospace environments
- Register-based, VXI compliant, 16-bit VME module with clean, simple architecture that simplifies programming
- Range: 32 bits with 20 ns LSB resolution, approximately 85 s maximum period. Transparent interlock logic allows skew-free reading of 32-bit period data
- DB37 female connector for signal inputs and current-limited +12 V excitation outputs; DB9 female connector for RS-232 serial

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Voiceboard Corporation

VS34 VoIP SuperSpan

Not just a board...a complete COTS customizable embedded solution, the VS34 VoIP T1/E1 VME single blade with a high-density DSP PMC41 mezzanine supports 60 or 120 ports. VS34 provides the necessary platform for advanced VoIP voice capabilities of today's joint services requirements for networked, mobile tactical communications equipment. The versatile VS34 offers optional downloadable firmware libraries for high-density IP conferencing, telephony, G3 fax, or V.90 modem, as well as redundant, dual 100Base-T Ethernet connections. Select primary rate ISDN, QSIG, or SS7 signaling. VoIP includes G.711, G.723, G.726, G.729, G.168, DTMF, call progress, AGC, comfort noise generation, and jitter buffering plus more.

FEATURES:

- Channelized DSO, fractional and unchannelized DS1 multiple software-selectable T1/E1 interfaces
- Single blade supports 120 VoIP ports for network interfacing and DSP processing capabilities
- Dual redundant 100Base-T Ethernet for high reliability, and support for remote server configurations
- Does not require chassis host CPU; the host CPU can reside anywhere within the LAN/WAN network environment
- Access to raw signaling data provides customers greater flexibility in customizing systems for maximum advantages
- Optional PMC750 for specific customer applications, resulting in a complete VoIP system on a blade

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DNA Computing Solutions, Inc.

NEXUS Dual/Quad Multiprocessor Board

The NEXUS™ Multiprocessor family from DNA Computing Solutions is one of the first VME processor solutions incorporating the new VME320 (2eSST™) interface for deterministic, high-speed, inter-board communications while maintaining compatibility with existing VME products. This advanced distributed processing solution enables scaling of multiple processing nodes for the most demanding signal and image processing applications.

NEXUS processing nodes use the latest 7447/A or 7448 Motorola PowerPC™ processors running at up to a 1.5 GHz clock rate. Communication between onboard processing nodes is facilitated through the two PCI-X buses providing a bisection bandwidth of up to 2 GBps.

Users are provided an onboard selection of standard I/O solutions including Gigabit Ethernet, PCI-X, and serial ports. Also, two standard (IEEE P1386) 64-bit/133 MHz PCI-X PMC sites are available for additional system interfaces and expanded functionality, including FPGAs and switched fabric interconnects. GPIO flexibility is provided on the NEXUS using the I2C bus and a user-defined transition module. Various types of GPIO are available, including LVTTL, open drain, and others, as system requirements dictate.

Board Support Packages (BSPs)

VxWorks™/Tornado™ and Yellow Dog™ Linux™ operating systems give your application a proven baseline of operating system functions and utilities including Built-In-Test (BIT), Power-On-Self-Test (POST), and Board User Configurations.

Signal processing tools

Development of advanced signal processing applications is greatly simplified using the tools available under WingSpan™. Application performance is enhanced through over 2700 Altivec™ optimized signal processing library functions with both VSIPL and "C" APIs included in WingSpan.

The NEXUS is available in an extended temperature version with rugged and quad processor versions on the way.

FEATURES:

- PPC 7447/A or 7448 CPU
- VME320 support with the Tundra 2eSST™ PCI-X to VME320 bridge
- Two independent local PCI-X buses, 64 bit/133 MHz, and two industry-standard PMC sites (IEEE P1386 compliant)
- PCI-X bridges isolate PMCs to maintain PCI-X speeds between onboard nodes and devices when slow-speed PMCs are installed
- Up to 512 DDR SDRAM with ECC and 32 MB combined user and boot Flash (per CPU/node)
- Two onboard Gigabit Ethernet ports (10/100/1000Base-T) (one per CPU/node) and serial ports with front (2) and rear (2) access
- DNA WingSpan™ Software Development Suite support with VxWorks and Linux BSPs and VSIPL (core) and vector (2200+) libraries
- Yellow Dog Linux support for NFS boot with three pre-configured kernels supplied (minimal, RL3, and RL5)
- Standard BIT capabilities include POST, user configurable boot, and application background BIT functions
- Extensive validated PMC support includes StarFabric, FPDP, 1553B, Flash card carriers, digital receivers, and PMC disk drives
- WingSpan™ support provides NEXUS and all DNA computing platforms high performance signal processing functions, utilities, and libraries
- Access to DNA Computing Solutions' outstanding customer service and technical support to ensure your project success

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Harris Corporation, RF Communications Division

SIERRA™ II Programmable Cryptographic Module

Sierra II consists of a miniaturized printed wiring assembly, custom Application Specific Integrated Circuit (ASIC), and supporting software that is embedded in radios and other voice and data communications equipment to encrypt classified information prior to transmission and storage. Sierra II is the second product in the Sierra family supporting all of the features of Sierra I, which was certified by the NSA in June 2002.

Sierra II encompasses a much broader range of functionality and offers data rates greater than 300 Mbps, low power consumption suitable for battery-powered applications, legacy and future algorithm support, and advanced programmability. Sierra II was developed by Harris to address all of the requirements of the Joint Tactical Radio System (JTRS) and NSA's Crypto Modernization Program, including the requirement for programmability.

Sierra's software programmability provides a low-cost migration path for future upgrades to embedded communications equipment without the logistics and cost burden normally associated with upgrading hardware. Sierra's small size, low power, and high data rates make it an ideal choice for battery-powered applications. It is ideally suited for JTRS applications, military radios, wireless LANs, remote sensors, guided munitions, UAVs, and other equipment requiring a low-power programmable solution.

FEATURES:

- Data rates up to 300 Mbps (dependent on mode)
- Available as ASIC and/or module
- Programmable cryptographic ASIC available in two packages for various embedded applications
- Operating temperature: –40 °C to +85 °C
- Supply voltage: 1.8 V (ASIC) or 3.3 V (module)
- Low power for battery-powered applications
- Field software reprogrammable
- Cryptographic bypass
- Type 1, 3, and 4 – cryptographic algorithms
- Key management: SARK/PARK (KY-57, KYV-5, and KG-84A/C OTAR)
  – DS-101 and DS-102 key fill
  – SINCGARS mode 2/3 fill
- Non-CCI prior to Type 1 programming
- Designed to protect voice/data traffic up to TS/SCI

HARRIS®

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Conduction Cooled RIOC 4070

Applications

The RIOC 4070 is the first conduction-cooled version of the RIOC 4068. Compared with its ruggedized companion, it complies with extreme operating conditions (such as -40 °C to +85 °C, shocks and vibrations) and offers additional real-time reconfiguration capabilities often required in UAVs and aircraft for real-time acquisition and processing.

Hardware specifications

Like most standard CompactPCI SBCs, the RIOC 4070 offers Ethernet, RS-232, JTAG, and the usual glue logic around a PowerPC core.

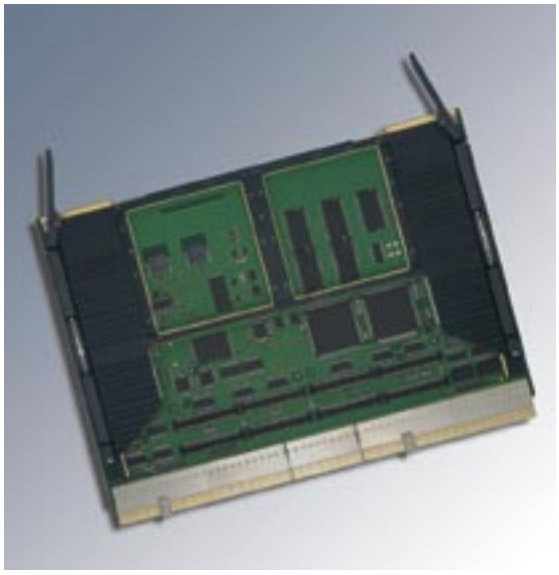
Where it differs, is the extensive use of specific FPGAs to maximize the acquisition speed on the CompactPCI and PCI buses, and the seamless data transfer to the main memory through a multi-port interface. The RIOC 4070 also offers real-time status monitoring sensors that relay information to the user software to take a variety of actions such as speed, control, partial disconnection of a faulty element, program reload, and so forth.

Both PCI and CompactPCI interfaces are equipped with a set of hardware and firmware building blocks to attach additional processors exchanging data at ultra-high speed (CES BP-Net logic).

Software specifications

CES, as a system company, designs in-house, both hardware and software elements (BSPs) and offers the package as a bundle, providing software support for all of the available hardware functions.

The RIOC 4070 is available with the general-purpose Linux® tool kit, as well as CES extended BSPs for VxWorks® and Integrity®. CES AE 653 BSPs are also available.



FEATURES:

- PowerPC 750Gx at maximum frequency
- 512 MB global memory SDRAM at 800 MBps peak
- CES-enhanced PowerPC-to-CompactPCI bridge
- 16 independent linked list DMA channel engine
- Two onboard PMC slots
- Power-on/power-off control logic per PMC slot
- High throughput DMA engine
- 32 MB NOR with compressor
- 256 MB NAND with high-speed file system
- Multiple thermal sensors
- Transparent multiprocessor extension with up to six MFCC 8446 companion modules
- Extended BSPs for VxWorks® 6.x and Integrity® 5.x

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Excalibur Systems

EXC-4000VME

EXC-4000 series avionics communications testers are multi-protocol test and simulation boards for PCI, CompactPCI, PC/104-*Plus*, VME, and VXI mainframes. The VME/VXI boards support up to eight modules with the remaining form factors supporting four modules each. Each module represents an independent test and simulation device. Most modules are based on existing Excalibur products such as the 1553Px family, the 1553 MCH family, the ARINC-429, and the H009. Additional modules, such as the RS-485/422/232 module, the 20-channel Discrete module, the CAN bus module, and the ARINC-708 module, represent new designs made especially for the 4000 series.

EXC-4000 represents a breakthrough in flexibility for avionics test equipment enabling the simulation of an entire test suite from a small number of boards. It is, for example, possible to control 20 ARINC-429 channels, 5 1553 channels, 15 input discretes, and 5 output discretes from a single VME board.

EXC-4000 is supplied with C drivers for all modules and Windows software for 1553, 429, and Discrete modules.

FEATURES:

- VME B-size and VXI C-size available
- VME/VXI support up to eight modules
- Multiple board support for all platforms
- Protocols supported: ARINC-429, MIL-STD-1553, Avionics Discrete I/O, RS-232/422/485, ARINC-708, H009, CAN bus, and Mini Munitions Stores Interface
- Operating environment: 0 °C to 70 °C standard temperature, optional –40 °C to +85 °C extended temperature
- Host interface: VME compliance – Slave A16, A24/A32, and D8/D16
- Memory space occupied: 1024 KB (128 K per module)
- Software support: C drivers with source code for all modules
- VME/VXI boards come with drivers for VISA or VxWorks
- Merlin+ Windows software for Px modules, and Merlin/MCH Windows for MCH modules
- Mystic Windows support for ARINC-429
- Exalt support available for 1553 Px, ARINC-429, ARINC-708, and Discrete modules under Windows

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VMEbus Pentium M Single Board Computer

DPM

The DPM is a VMEbus (and VME64) compatible platform based on the Intel® low-power Pentium® M (Dothan) processor. The DPM takes advantage of the Pentium M's low power consumption as a rugged Single Board Computer (SBC), and it is optionally available as an IEEE 1101.2-compliant, conduction-cooled VMEbus module with wedge locks and a full-board heat sink for high shock/vibration environments and temperature extremes.

The 855GME Graphics Memory Controller Hub (GMCH) and 6300ESB I/O Controller Hub (ICH) chipset supports PCI-X expansion, integrated VGA/DVO interface, USB 2.0, ATA/100, and Serial ATA (SATA). A DVI-I connector, two USB 2.0 ports, a 10/100Base-Tx interface, and a COM port are all accessible from the front panel. Onboard CompactFlash permits single-slot booting. Two VITA 31.1-compliant, 10/100/1000Base-Tx ports are routed to the backplane. Conventional PC I/O is accessible with industry-standard connectors on optional rear I/O modules, as well as SATA, VGA/DVO video, Gb Ethernet, and two more USB 2.0 ports. One PMC-X site is provided for additional I/O expansion.

FEATURES:

- Intel® Pentium® M Processor
- 2 MB of L2 Advanced Transfer Cache
- Available in either the ultra-low voltage 1.0 GHz @ 5 W version or the low voltage at 1.4 GHz @ 10 W
- Single-slot: VMEbus operation with an onboard CompactFlash disk for bootable mass storage
- 855GME and 6300ESB Chipset 400 MT/sec system bus
- Ultra ATA 100/66/33 IDE protocol
- PCI-X expansion offers 64 bits @ 66 MHz data transfer capability
- Integrated graphics
- DDR-266 support with a memory bandwidth of 2.1 GBps
- Tundra Universe IID PCI-VMEbus interface provides 64- bit VMEbus transfer rates over 30 MBps
- One PMC-X site with 64 bit @ 66 MHz bandwidth is available onboard

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Pentek, Inc.

High-Speed Development Platform Streamlines Your Application

The Model RTS 2503 Development Platform with the Model 4990 SystemFlow API and Development Libraries afford developers a simple way to address high-speed, real-time data acquisition processing and recording applications. The platform implements a multichannel wide-band data recording system. With a 1 GHz G4 PowerPC processor, two Virtex-II and two Virtex-II Pro FPGAs delivering 18 million gates of programmable logic, and onboard 215 MHz 12-bit A/D converters, the system provides designers with the latest technology for signal capture and processing.

The system is scalable from one or two channels in two VMEbus slots in a portable cage to 20 channels that fit in a single rack-mount chassis. Various high-speed interfaces may be used for real-time data streaming including Fibre Channel, Gigabit Ethernet, RACE++, FPDP, and the new VXS serial fabric. The onboard Fibre Channel interface may be used to store data to Redundant Array of Inexpensive Disks (RAID) or Just a Bunch of Disks (JBOD) storage systems.

SystemFlow has a modular design that includes API and libraries for the target board and the host PC. Windows Dynamic Link Library (DLL) calls are written in Visual C++. A Graphical User Interface (GUI) is provided as a front end to the host PC. The PC host front end communicates over Ethernet with the royalty-free eCos real-time operating system running on the G4 PowerPC target board, which executes real-time application code.

Development libraries for both host and target include full source code that allows developers to modify the host front end and the target code to meet their needs. The software package includes a data viewer that displays plots of collected data in either time or frequency domain. The viewer can be used to preview data before storage or to review stored data.

The Pentek GateFlow FPGA Resources support the onboard FPGAs of the RTS 2503 System. These tools include the FPGA design kit, the IP core libaries, and factory-installed cores

For more information, visit: www.pentek.com/go/mem2503

FEATURES:

- Optimized for high-speed data acquisition, processing, and recording applications
- Provides out-of-the box functionality
- A/D sampling rates to 215 MHz
- Onboard 1 GHz PowerPC processor with the royalty-free eCos real-time operating system
- Onboard Xilinx FPGAs supported with Pentek GateFlow© FPGA resources: FPGA design kit, IP cores, installed cores
- Scalable from 1-20 channels
- Includes Pentek SystemFlow™ API and development libraries
- Includes source code to simplify applications development and customization
- Includes Pentek ReadyFlow© board support libraries for quick startup and operation
- Graphical user interface
- Ideal for radar, wireless, SIGINT, telecom, and satcom applications

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SBS Technologies

VR9 – Conduction-Cooled Intel® Pentium® M-Based SBC

The VR9 is a 6U VMEbus, all-in-one CPU board with an integrated, power-efficient gigahertz processor and dual Gigabit Ethernet channels.

The VR9 is designed to meet the needs of embedded application developers addressing markets like military and aerospace, imaging, industrial automation, and communications.

Based on the Intel® Pentium® M processor, the VR9 platform is designed to support processor speeds from 600 MHz up to 1.6 GHz. It offers low power consumption, generating minimal heat and eliminating the need for onboard ventilation.

Versions of the VR9 with front-panel I/O are available in various configurations, with and without PMC support.

FEATURES:

- Intel® Pentium® M processor, 600 MHz to 1.6 GHz
- Two Gigabit Ethernet ports, 10/100/1000Base-T front or rear optional
- Two PMC extension slots, one 64-bit/66 MHz and one 32-bit/33 MHz
- Conduction cooling, conformal coating, and extended temperature range options
- High shock and vibration immunity with stiffener bars and wedge locks
- Extensive software support

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Boards
VMEbus

SBS Technologies

VXS1 – PowerPC with an InfiniBand HCA & Gigabit Ethernet

The VXS1 Rugged 6U VME PowerPC Single Board Computer works with other SBS products to bring 10 GBps InfiniBand switched fabric technology to VME systems.

The VXS1 hosts the G4 PowerPC processor with core processor speeds from 500 MHz to 1 GHz and a 167 MHz system bus. It includes two independent InfiniBand 4x links through VME_P0 and provides InfiniBand and system control traffic termination.

The VXS1 also provides two Gigabit Ethernet ports to the backplane, one 64-bit 66 MHz PCI bus interface, and one 64-bit 66/133 MHz PCI-X interface, as well as two MPSC ports that provide RS-232 (COM1) and RS-422 (COM2) rear I/O ports.

The VXS1 is compatible with VITA1.7 systems.

FEATURES:

- MPC7447A G4 host PowerPC 1 GHz processor with 512 KB on-chip L2 cache
- MV64460 PowerPC System Controller (Discovery III) bridge chip
- MT23108 InfiniBand Host Channel Adapter with 128 MB of control memory
- 2eSST VMEbus: Tsi148 VMEbus bridge
- Two Ethernet 10/100/1000Base-Tx ports at rear I/O (third port to front-panel RJ-45 connector on convection-cooled version)
- Conduction or convection cooled with extended temperature range (-40 °C to 85 °C)

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SBS Technologies

IB4X-V41 – 24-port VITA 41 InfiniBand Switch

IB4X-V41 is a high-performance, 24-port 4x InfiniBand switch in a VITA 41 form factor. This switch overlays high-speed switched serial interconnects on the standard VME backplane.

Delivering greater than a magnitude of bandwidth increase to the VME backplane, this switch is ideal for embedded systems in military, COTS, medical imaging, and telecommunications markets.

The IB4X-V41 has 18 payload connections, four inter-switch connections, and two front-panel copper connectors that can be converted to fiber through use of an SBS IB4X-OMC media converter.

Designed to withstand temperatures from -40 °C to +85 °C, the IB4X is available with conduction cooling or air cooling.

FEATURES:

- Complete, 24 port, 4x InfiniBand switch in a VITA 41 form factor for use in VME systems
- Massive increase in aggregate switch bandwidth on VME – 480 Gbps
- Fully non-blocking internal switch architecture and support for cut-through and store and forward algorithms
- 18 payload ports and four interswitch links
- InfiniBand v1.1 and VITA 41, 41.1, and 41.10 compliant
- Conduction-cooled and air-cooled versions available

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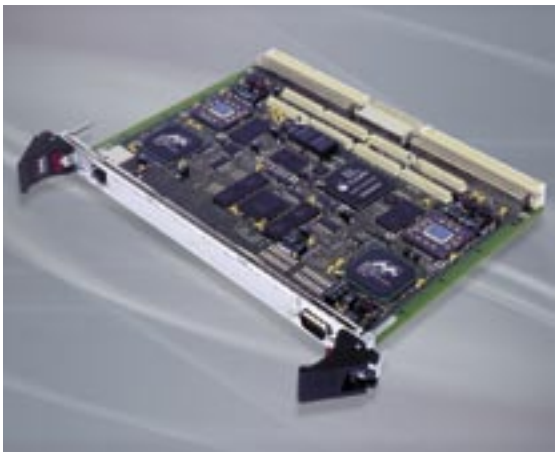
Boards
VMEbus

SBS Technologies

VG5 – VME6U Dual PowerPC Single Slot CPU board



VG5 is a dual- or single-processor VMEbus computer board designed to meet the needs of high-performance embedded applications. It addresses markets such as aerospace, industrial automation, and any markets where real-time and/or signal processing is needed.

Operating system support includes VxWorks, Linux, and LynxOS.

The ultra-compact 6U single slot, all-in-one design includes flexible memory and Flash configurations. Onboard peripherals include up to two Gigabit (VITA 31.1-compliant) ports, two 10/100Base-T Ethernet ports, up to four high-speed, multi-protocol serial controllers (HDLC, BiSync), one serial-ATA compatible port, two PMC extension slots, and general-purpose I/Os.

FEATURES:

- Dual processor and chipset design for independent processor nodes
- Ruggedized versions with high immunity to shock and vibration, conduction cooling, conformal coating, and a -40 °C to +85 °C temperature range
- A user-programmable FPGA for controlling peripheral functions or additional I/Os; support by available development kit
- Dual PMC sites support flexible mezzanine cards, enabling additional I/O, processing, or other functions
- Custom assembly for specific applications supports optimum price/performance for each application
- Single processor versions available

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V269-FPIO 3Row Dual Xeon-LP SBC "Equinox"

The V269-3R FPIO (Front-Panel I/O) "Equinox" solution from General Micro Systems (GMS) is the first dual Xeon-LP, high-performance server built for Legacy 3 Row systems that need all the I/O out of the front. This product allows applications to perform "technology refresh" for existing systems, fully utilize the features of the Xeon-LP processor, which provides the performance of a desktop Pentium IV processor at half the power consumption, and support a long life cycle (minimum of five years).

In addition, the Xeon-LP supports multiprocessing and is socketable. The V269-3R FPIO Equinox can function as a high-performance server and is ideal for applications requiring processor horsepower, exceptional bus speed, and configurability. The GMS V269-3R provides systems designers an excellent solution when they require dual processors, dual gigabit mass storage capability, and disk-less operation. These advantages make the V269-3R Equinox an ideal choice, especially for military/aerospace command and control systems for shipboard or air- or land-based environments.

The VME interface for the V269 is provided via the Tundra Universe-II® device. This device supports all VME-D64 master and slave modes of operations as well as the system controller functions. GMS has full software support for this device under VxWorks®, Solaris®x86, Linux®, and QNX®, as well as the highest performing driver for Windows®NT/2000/XP in the industry. GMS "VMExpress" is the industry benchmark for VME performance and functionality. Additionally, with the addition of VME/IP, the VMEbus can be transformed into a virtual network, and thus eliminate the big endian/little endian issues. GMS VMExpress is also supported under Venturcom Real Time Extension® (RTX).

FEATURES:

- Dual, low-voltage 2.4 GHz Intel Xeon® Pentium® IV processors
- 533 MHz Front Side Bus (FSB)
- 512 KB of on-die L2 cache for each processor
- Up to 8 GB of low-cost DDR DIMM SDRAM memory
- Dual Gigabit Ethernet ports
- Ultra-wide SCSI 160/320
- Dual video graphic engines: analog and digital
- RGB with sync-on-green and DVI for each port
- Support for three additional PMC sites via a triple PMC expansion module
- 4 MB BIOS Flash with power-on, self-test functions
- V269: Available in two-slot, three-slot, and four-slot solutions
- Supports Windows®2000/XP, VxWorks®, Solaris®x86, QNX®, and Linux®

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North Atlantic Industries, Inc.

64C1

North Atlantic Industries' multifunction VME card (64C1) provides high performance and high functional density along with enhanced diagnostics to support embedded and test and measurement applications. What sets this card apart from the competition is its ability to mix and match a wide range of functions and provide extensive diagnostics, which includes background built-in-test, to ensure that the cards are functioning properly. This DSP-based design contains six slots for various functions and an additional slot for an AC reference oscillator. If a fault should occur, the card generates an interrupt to indicate which channel is malfunctioning. This universal card eliminates the need for specialized, single function cards by providing an assortment of functions on one single card.

The "motherboard" contains six independent module slots, each of which can be populated with a function specific module. Other features include self-calibration, low power, and user-programmable parameters. Functions per slot include A/D (10 channels), D/A (10 channels), RTD (6 channels), discrete and digital I/O (16 channels), synchro/resolver (4 channels), LVDT/RVDT (4 channels), and an AC oscillator. Each test and measurement and embedded application typically requires a different combination of analog and digital I/O. North Atlantic Industries' 64C1 series is a solution that reduces the overall number of cards required for system integration, reduces the total power required by the cards, and thereby reduces the total heat generated by the system. The 64C1 is currently in production and is available in two temperature ranges (0 °C to 70 °C) or (-40 °C to +85 °C) in both air-cooled and conduction-cooled, wedge lock versions. It can also be used in both commercial and military applications.

FEATURES:

- Multiple functions on a single-slot VME card
- Background self test, transparent to user operation
- Available in CompactPCI format and PCI format (coming soon)
- Geographical addressing (field selectable)
- Connections via front panel, P2/P0 or both
- Conduction-cooled, wedge lock versions available
- Independent A/Ds (not muxed) running at 50 kHz and higher
- Discrete I/O: each channel programmable as input or output
- D/As capable of delivering 20 ma
- Alternate version (64D1) available for increased density
- 64D1: Communication capability – RS-232/422/485, MIL-STD-1553, Profibus and ARINC 429
- 64D1: I/O capability – High Density, Discrete (0 V to 50 V) I/O and TTL I/O

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Highland Technology, Inc.

V375 VME Four-Channel Arbitrary Waveform Generator

Model V375, one of Highland's family of arbs, has an extended output bandwidth and adds four inputs for user waveforms to sum into the four channel outputs. A burst mode allows software or external input to trigger generation of one or more waveform cycles.

The V375's design features make it ideal for simulating sensor signals from complex rotating machines. Onboard microprocessor-executed macro commands simplify generation of pure and distorted poly-phase AC waveforms with amplitude, frequency, phase, and distortion components smoothly variable in real time. Other macros create complex pulse trains with real-time control of pulse positions, amplitudes, and missing pulses.

FEATURES:

- Four independent DDS frequency sources allow smooth variation of waveform scan rates without requiring table reloads
- Four memory-table-driven waveform generators scan up to 65,536 discrete points per waveform at up to 15 MHz point step rate
- 16-bit amplitude resolution; 32-bit frequency resolution
- Per-channel divisors allow simulation of fractional "gear-ratio" waveshapes
- Output frequency, amplitude, phase, and DC offset are smoothly variable; multiple waveforms can be loaded and selected in real time
- Programmable waveform jump and triggered burst; channels may be synchronized within a module or across multiple modules

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ADVERTISER INFORMATION

Page/RSC#	Advertiser/Product description
14	ACT/Technico - VITA 31.1 Systems
35	AIM - Avionics Integration Modules
5	Aitech - COTS Products and Capabilities
37	Alphi - PowerQUICC II SBC
59	Ampro - ETX-800
14202	AP LABS - Rugged Enclosures
15	Arcom - XScale and Embedded PC Technology
52	Astec Power - Power Solutions
11	Bustronic - Backplanes
41	Condor Engineering - Interface Solutions
51	Conec - AdvancedTCA Connectors
7602	Connect Tech - Serial Communications
27	Crane - Military/Defense Products and Services
156	Curtiss Wright - Design and Build Productrs
2	Data Device - COTS Solutions
17	Diversified Technology - Embedded Computer Module Solutions
9	Elma - 12R2 Rugged Enclosure
30	Embedded Planet - PowerPC Computing Engine
19	Excalibur - Rugged Systems
7	GE Fanuc - Defense Solutions
57	General Micro Systems - GMS Computing Engines
151	Geotest - Obsolescence Replacement Solutions
48	Hypertronics - Ruggedized VME64x Connectors
22	Kontron - Rugged Computing
47	Kontron - Embedded Computer Module
2301	Megatel - PCpi
4502	MPL - Rugged Embedded Computers
33	Pentek - Software Radio System
4501	Phoenix - Data Storage Modules
29	Premier Magnetics - Data Bus Interface Transformers
153	Radstone - G4DSP-XE
31	Rave Computer - AMD Opteron Processor-based server
18	Real-Time Innovations - NDDS Middleware
10	Red Rock - Mass Storage Modules
155	SBS - AVC CPCI 3000
24	SDR Forum - Software Defined Radio Technical Conference
13	Seaweed Systems - COTS Graphics Solutions
21	Technobox - Adapters and Tools for PMCs
25	Technobox - PMCs and PIMs
2302	Technobox - PMCs
3	Themis - Mission-Critical Computers
55	Vector - Series 790 Ruggedized Chassis

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MEN Micro, Inc.

EM03 Embedded System Module

The EM03 Embedded System Module (ESM) puts a new PowerPC core, the 833 MHz PowerQUICC III MPC8560 from Freescale Semiconductor, in an extended temperature platform suitable for embedded communications applications, such as routers, switches, hubs, gateways, multi-service access platforms, or embedded Linux servers, that must operate in rugged military environmental conditions.

The EM03 can be plugged into many types of standard or application-specific carrier cards, including 6U carriers for CompactPCI or VMEbus systems. In a 6U CompactPCI system, for example, the EM03 might be combined with two PMC modules on the same 6U carrier. Or, in a PCI-104 based system, PCI-104 I/O modules might be stacked onto the EM03 for additional functionality.

At 7.4 W the PowerQUICC III processor on the EM03A is relatively low power. It can operate over an extended temperature range of -40 °C to +85 °C. The EM03 can interface to a 32-bit/33 MHz PCI bus or to a 64-bit/66 MHz PCI bus. Integrated on the PowerQUICC III are two Gigabit Ethernet ports, one Fast Ethernet port and two serial communication ports. On the EM03, this I/O is led to RJ-45 front-panel connectors. On another version of the module, the EM03A, this I/O is not led to front-panel connectors, but is available on the board itself via a J3 ESM connector. An onboard SO-DIMM slot enables the EM03 to be configured with up to two gigabytes of 133 MHz double data rate (DDR) RAM main memory. As much as 1 GB of NAND Flash is also available for program memory.

An FPGA on the EM03 can be configured with additional functionality, such as interfaces for ATM, E3/T3, or HDLC. Other typical interfaces like CAN bus, USB, IDE, or graphics could also be loaded into the FPGA.

MEN Micro is quoting 10-year availability of the EM03.

MEN's ESMs are complete computer systems on a mezzanine card. An ESM consists of a CPU chipset, main memory, mass storage connection, essential I/O, and an onboard BIOS or monitor firmware. MEN also supports several operating systems including Windows, Linux, and a variety of real-time OSs.

FEATURES:

- Computer system on a mezzanine card (processor, chipset, memory, I/O); interfaces to 32-bit/33 MHz or 64-bit/66 MHz PCIbus
- PowerPC processor (833 MHz PowerQUICC III MPC8560) is well suited for rugged military communications and control systems
- Extended temperature operating range of -40 °C to +85 °C
- Memory: SODIMM slot for up to 2 GB of DDR RAM with ECC, 1 GB of NAND Flash, 8 MB Flash, 32 MB SDRAM connected to FPGA
- I/O interfaces: 2 Gb Ethernet, 1 Fast Ethernet, and two serial ports, and IDE port; real-time clock, power supervision, and watchdog
- FPGA onboard for additional functionality such as interfaces for ATM, E3/T3, HDLC, CAN bus, USB, IDE, graphics, and others
- All of MEN Micro's ESMs feature a small footprint compatible with 6U carrier cards and additional mezzanine cards
- Other PCI-104-compliant Embedded System Modules (ESMs) from MEN include:
  - ESM based on both Intel Pentium and Freescale PowerPC with support for Windows, Linux, and real-time OSs
  - ESM starter kit and ready-to-configure functionality for FPGA accelerated development
  - ESMs with a wide variety of standard I/O options with (and without) onboard FPGAs
- PCI-104 modules can be stacked onto an ESM for added functionality or I/O

men micro, inc.

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American Predator Corporation

Gator Mini-ITX Industrial Controller

The Gator Mini-ITX is a low-power industrial controller for embedded applications. This compact (6.7" x 6.7") controller is powered by the Intel® Pentium® M/Celeron® M processor and the 855GME chipset.

The Gator Mini-ITX features a 400 MHz front-side bus and supports up to 2 GB of DDR 333/266 SDRAM.

Bus expansion is handled by one (1) 32-bit PCI slot and one (1) Mini-PCI slot.

The Gator Mini-ITX also features integrated Intel® Extreme Graphics 2, an optional dual-channel LVDS controller, built-in sound, Gigabit Ethernet, two (2) serial ATA connectors, USB 2.0, and six (6) RS-232 ports.

The Gator Mini-ITX carries a five- to eight-year production life-cycle guarantee.

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Morgan Hill, CA 95037
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www.americanpredator.com
For more info contact: info@americanpredator.com

FEATURES:

- Powered by the Intel® Pentium® M/ Celeron® M processor and Intel® 855GME chipset (400 MHz front-side bus)
- Two (2) DIMM sockets support up to 2 GB of DDR 333/266 SDRAM (supports both ECC and non-ECC memory modules)
- One (1) 32-bit PCI slot and one (1) Mini-PCI (PCI 2.2 33/32 MHz connector Type III)
- Integrated Intel® Extreme Graphics 2, AC'97 sound and Gigabit Ethernet
- Two (2) serial ATA connectors (150 MBps)
- Five- to eight-year production life-cycle guarantee

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VMETRO Transtech

VPF1 Dual PowerPC, Dual Virtex-II Pro FPGA VME Card

The VPF1 is a 6U VME64x card that supports VITA41 backplane switch fabric communications via VXS over P0. The VPF1 comprises four processor nodes: two 1 GHz PowerPC 7447A CPUs, and two Xilinx XC2VP70 Virtex-II Pros. Each processor has fully distributed memory, and each FPGA supports multiple inter-node communication channels. These channels bind together local processors and those on separate boards for seamless and scalable processing. A PMC site, GigE, and P2 resources enable IO. VPF1 cards are available in air-cooled or conduction-cooled builds, enabling easy migration from development to production. A comprehensive suite of PowerPC and FPGA tools facilitate rapid development and deployment.

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vmetro.com
For more info contact: info@vmetro.com

FEATURES:

- 2x PowerPC 7447 CPU nodes and 2x Xilinx Virtex-II Pro FPGA nodes
- VXS compatible
- 8x 2.0-3.125 Gbps off-board serial communications channels
- Ethernet, RS-232, RS-422
- 64-bit, 66 MHz PMC site for local I/O
- Air-cooled and rugged, conduction-cooled build variants

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Diamond Systems Corporation

Athena

The new Athena CPU from Diamond Systems combines the low-power VIA Eden processor (400-660 MHz) with onboard memory and data acquisition into a new compact form factor measuring only 4.2" x 4.5". The result is a small, low-heat dissipation, and extremely rugged embedded CPU that fits in tight spaces. Onboard 128 MB RAM, LCD + CRT video, AC97 audio, four USB ports, four serial ports, a 16-bit low-noise data acquisition circuit, and extended temperature operation make Athena an all-in-one, complete embedded solution for demanding applications. Athena is customizable for harsh environment applications with features like latching connectors, hardwired configuration, and conformal coating.

FEATURES:

- Single-board solution: Integrated CPU + data acquisition provides smaller size and increased reliability
- Low-power VIA Eden processor for high performance with reduced power: 400 MHz/10 W/fanless, 660 MHz/12 W/fan
- Integrated LVDS LCD, CRT, Ethernet, four RS-232, four USB 1.1, PS/2 keyboard/mouse
- Data acquisition features include 16 16-bit A/D, four 12-bit D/A, 24 digital I/O, two counter/timers
- Rugged design: -40 °C to +85 °C operation, memory soldered on board; proven use in military and aerospace applications
- Operating system compatibility: Linux, QNX, VxWorks, Windows 2000/XP/XPe/CE .NET, DOS

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Boards
Processors

Diamond Systems Corporation

Hercules-EBX

Hercules introduces a new level of integration in EBX format CPUs. Combining processor, data acquisition, and power supply onto one board results in a thinner, more rugged, and easier-to-assemble embedded system. This 3-in-1 design addresses the needs of mobile and vehicle applications by offering reduced size, weight, cost, and power consumption. Hercules integrates a Pentium-III class processor, professional-quality analog I/O circuit with autocalibration, and wide-input DC/DC power supply onto a single EBX format board measuring 5.75" x 8.00". Hercules is customizable for harsh environments with features such as latching connectors, hardwired configuration, and conformal coating.

FEATURES:

- Single-board solution: Integrated CPU + data acquisition + power supply provides smaller size and increased reliability
- Low-power VIA Eden processor for high performance with reduced power: 550 MHz/10 W/fan-less, 750 MHz/13 W/fan
- Integrated S3 Savage 4 video, LVDS LCD, CRT, AC97 audio, four RS-232/485, four USB 1.1, PS/2 keyboard/mouse
- Data acquisition: 32 16-bit A/D, 4 12-bit D/A, 40 digital I/O; Power supply: 5-28 VDC input, 40 W output power
- Rugged design: -40 °C to 85 °C operation, memory soldered on board; proven use in military and aerospace applications
- Operating system compatibility: Linux, QNX, VxWorks, Windows 2000/XP/XPe/CE .NET, DOS

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APOLLO – EBX Intel Pentium M/Celeron M SBC

The APOLLO uses the Intel® Pentium® M processor to offer the best combination of high-performance computing features with the lowest power dissipation. This single board computer can be fitted with the Intel® Pentium® M or Intel® Celeron M processors with speed options from 600 MHz to 2.1 GHz. The combination of Enhanced Intel SpeedStep® Technology and the Intel 855GME/ICH4 chipset ensures that the board is ideal for compact systems with restricted ventilation and can be used to create extremely high-performance, fan-less systems. All these features are incorporated onto an industry standard EBX board with standard connectors for many of the I/O connections.

The APOLLO includes a hot-swap CompactFlash (CF+) socket for use with memory and I/O cards (Wi-Fi, Bluetooth, modem, and memory cards). The single, PCI 2.2-compliant slot can be used to drive a three-slot PCI riser card for compact system integration.

The APOLLO is fitted with an ATMEL Trusted Platform Module (TPM) device for use in applications that require a high level of software security and tight control of application code execution.

The board also includes a tamper detect input, which operates with or without main power applied, and a simple LCD character display interface for systems without a traditional VGA display.

The APOLLO is ideally suited for low-power, high-density server racks, 1U and 2U systems with fan-less passive cooling, and rugged, secure computing installations.

FEATURES:

- Intel Pentium M/Celeron M processor options from 600 MHz to 2.13 GHz
- Industry standard EBX format
- Up to 1 GB DDR DRAM
- Dual 10/100Base-Tx Ethernet ports or 10/100Base-Tx plus a 1000Base-T Gigabit Ethernet port
- IEEE-1394 FireWire port for high-performance video applications
- Four serial ports – (2x) RS-232, (1x) RS-232/IrDA, (1x) RS-232/422/485
- Six USB 2.0 ports
- Fan-less operation – up to +65 °C
- Enhanced security features including tamper detect and support for trusted computing via a TPM device
- PCI and hot-swap CompactFlash (CF+) port expansion
- Display output for analog CRT and/or LVDS, supporting dual independent displays; also, expansion for DVI or secondary CRT
- Audio CODEC with six-channel surround sound support

Arcom
Think Embedded. Think Arcom.
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KineticSystems Company, LLC

Powerful, Feature-Rich Interfaces & VXI Controllers

KineticSystems provides computer interfaces and VXI controllers for high-performance data acquisition, control, and ATE systems.

Choose from one of KineticSystems' PowerPC-based VXI slot-0 controllers, or the new V153 VXI slot-0 controller featuring a high performance Pentium® 4 embedded processor.

Complete Fiber-optic Interface Systems (FOXI™) are available to support distances between nodes up to 2 km (6560 ft.) with an I/O throughput up to 10 MB/s. The FOXI system includes a V122 FOXI PCI Host Adapter that is capable of linking up to 126 V120 VXI Slot-0 controllers via a fiber-optic highway.

Also available is the V15x VME to VXI carrier/adapter card.

FEATURES:

- V151, V152, V154: Single-width, C-size, slot-0 controllers with embedded PowerPC processors
- V153: New high-performance Pentium 4-based slot-0 controller with 1.7 GHz and 2.2 GHz clock options
- Includes Ethernet, RS-232 serial port, real-time clock, timers, and counters
- Two PMC card options for fast/wide SCSI, IEEE 488, fast Ethernet, USB, etc.
- V15x: C-size carrier used to convert VME controllers into slot-0 VXI controllers; also compatible with other VME modules
- FOXI: PCI host interface and one or more high-performance controllers connected via a 10 MB/s fiber-optic highway

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Innovative Integration

SBC6713e

SBC6713e is a high-performance, flexible, standalone DSP board with Ethernet connectivity, loaded with I/O peripherals. Built around the powerful, C-friendly, 300 MHz floating point C6713 DSP, it is a fully open platform with 15+ OMNIBUS off-the-shelf daughtercards available that provide a wide choice of A/D and D/A and also support simple EMIF bus interfacing to custom I/O daughtercards. TCP/IP is running on a dedicated DM642 coprocessor to preserve the C6713 for user code and other peripheral controls. System-level integration is facilitated with onboard digital I/O, DDS time base, external clock input, multi-card sync, FPDP port data links, 2 MB Flash ROM, and watchdog.

FEATURES:

- 300 MHz TMS320C6713DSP (Floating Point)
- Two OMNIBUS I/O expansion sites
- 10/100Base-T Ethernet, RS-232 port
- FPDP data port to 200 MBps
- Capable of 100 percent standalone operation
- 600 K gate Spartan-IIE for user code (optional)

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Phoenix International

Phalanx SAN – Fibre Channel Storage Area Network

Phoenix's Fibre Channel SAN System delivers the advantages of a Storage Area Network – increased data accessibility, performance, speed, ease of data management, and scalability to meet increasing data storage needs – with a high-performance, fault-tolerant system of redundant components and subsystems for total system reliability. The basic Phalanx Fibre Channel SAN Storage System features a 2 Gb Fibre Channel fabric switch, with an eight-port (expandable to 64 ports) configuration and 1 TB of RAID data storage (expandable to 60+ TB). In addition, the system supports multiple operating systems and seamless backup capabilities to multiple archival devices.

PHOENIX INTERNATIONAL

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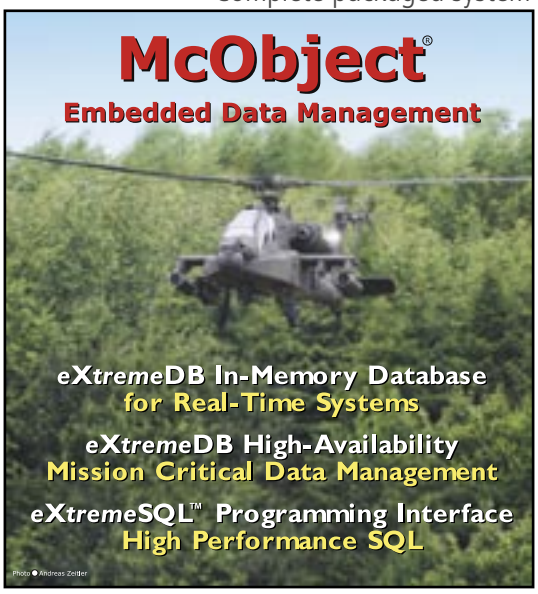
FEATURES:

- 4U ruggedized 200 MBps dual port RAID system
- Stackable Fibre Channel switch; eight 2 Gb Fibre Channel ports scalable in four-port increments to 64 ports
- 1 TB storage capacity expandable to 60+TB
- Redundant, hot-swap power supplies and cooling fans
- Management GUI and failover software
- Optional transit/op case

Complete packaged system



FEATURES:

- In-memory; no file system required
- Embedded (not a client/server architecture)
- Blazingly fast – the in-memory embedded architecture yields micro-second transactions, even on modest hardware
- High availability, implemented via a time-cognizant two-phase commit protocol
- Optional transaction logging module for persistent data
- Optional SQL interface
- Tiny code size, starting from just 50 KB
- Very efficient storage manager – typical overhead is just 15-40 percent (meaning 1 MB of data needs just 1.15-1.4 MB of memory)
- No dynamic memory allocation; suitable for the most stringent safety requirements
- Highly portable; written in ANSI C, with no dependence on the C runtime library; eXtremeDB can even run without an RTOS!
- XML interface to simplify data exchange with other XML-enabled systems
- Developer friendly – creates a type-safe, intuitive programming interface with extensive error checking to speed development

McObject LLC

eXtremeDB In-Memory Embedded Database

To support modern warfighting, Military-Aerospace (MilAero) systems must manage tremendous volumes of data, including tactical information, navigation data, system status, and more. Consequently, MilAero systems have evolved into substantial computing platforms that are tightly integrated and continuously share information, both internally and with other systems. This presents multifaceted data management requirements, including high performance, concurrent access, high availability, complex searching, and reliability.

eXtremeDB, a Commercial Off-the-Shelf (COTS) database, is playing a growing role in helping MilAero developers meet the need for a real-time, in-memory database with high availability capability. Many firms, including Boeing, EADS, and SAIC, have found that the performance, reliability, and time-to-market benefits of a proven database justifies the cost.

Technological advances have made the use of "real" databases an option in embedded MilAero systems. An in-memory embedded database operates near the speed of RAM access and eliminates the unpredictable latency accompanying file I/O and inter-process communication. In addition, with "eager, 2-safe" replication implemented via a time-cognizant protocol, in-memory data management offers the unsurpassed reliability of a high availability system with redundancy and failover capability, which can be further enhanced by the use of nonvolatile RAM (NVRAM).

When considering data management for MilAero equipment, developers and engineering managers must inspect potential solutions at multiple levels. Database architecture must be streamlined and provide the performance needed for real-time systems. Maintaining data availability in the face of hardware or software failure must be addressed, usually with a redundant solution. Finally, developers must understand their database at the programmatic level, making source code availability a prerequisite.

To learn more about eXtremeDB or to obtain an evaluation copy, contact a McObject representative today.

mcobject
precision | data management

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Red Rock Technologies, Inc.

RRT-1DVW-LW

SCSI DVD-RW drive

This module provides a transparent interface from the ultra-wide SCSI LVD bus to the low-profile DVD-RW ATAPI interface drive. Modes of operation include DVD-RW, DVD-ROM, CD-RW, CD-R, and CDROM.

The DVD-RW drive may be accessed as a standard SCSI device. SCSI bus signals are available at P2 and front panel connectors. Only power is taken from the VMEbus.

These modules provide a high-capacity field replaceable unit for removable DVD-RW, DVD, CD-RW, and CDROM media.

SCSI termination is provided within the unit. The SCSI interface is fully configurable for 8-bit, single-ended and SCSI-2 compatibility.

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www.RedRockTech.com
For more info contact: info@redrocktech.com

RSC #10901 @ www.mil-embedded.com/catalogrsc

FEATURES:

- Enables usage of removable, re-writable, durable DVD-RW and CD-RW media in the field
- VMEbus form factor occupies one 6U slot; CompactPCI version available
- Ultra-wide SCSI LVD interface available at front panel and P2 connectors
- Can be configured for 8-bit, single-ended and/or SCSI-2 operation, thus supporting legacy systems
- Front panel status and activity LEDs
- P2 cable adapter panel available

Mass storage
Solid state

Red Rock Technologies, Inc.

RRT-1SP-LW

SCSI to PCMCIA adapter

This adapter provides a transparent interface from the ultra-wide SCSI LVD bus to removable PCMCIA storage devices, and optionally to a fixed 2.5" ATA Flash or hard drive.

PCMCIA devices and optional 2.5" drive may be accessed as separate SCSI logical units. SCSI bus signals are available at P2 and front panel connectors. Only power is taken from the VMEbus.

These modules provide a high-capacity field replaceable unit capable of withstanding higher shock and vibration environments.

SCSI termination is provided within the unit. The SCSI interface is fully configurable for 8-bit, single-ended and SCSI-2 compatibility.

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RSC #10902 @ www.mil-embedded.com/catalogrsc

FEATURES:

- Two hot swappable PCMCIA card slots plus an optional fixed ATA hard drive or Flash drive
- VMEbus form factor occupying one 6U slot; CompactPCI version available
- Ultra-wide SCSI LVD interface available at front panel and P2 connectors
- Can be configured for 8-bit, single-ended and/or SCSI-2 operation, thus supporting legacy systems
- Front panel status and activity LEDs
- P2 cable adapter panel available

Mass storage

Solid state

Targa Systems

Series 4 Removable Flash Disk DTU

Targa Series 4 DTU (Data Transfer Unit) is the perfect Network Attached Storage (NAS) device for your military and aerospace systems, replacing server attached storage in most airborne platform application systems. These systems include flight management, cockpit instrument display, terrain awareness, and warning, map systems, radar systems, cockpit/ground communications, navigation positioning, and satellite communications. The removable disk feature of the Series 4 product line enables easy updating of files.

The Series 4 is the ideal removable storage solution when your requirements include high-capacity storage and fast data transfer speeds.

FEATURES:

- Small, lightweight, rugged construction providing reliable data storage
- Locking access door with door open detect and shutdown
- Capacities up to 36 GB in a compact, removable, rugged 2.5" Flash disk
- Interfaces: SCSI-2; SCSI-3, USB, ATA, MIL-STD-1553, and Ethernet
- Data transfer rates: > 18 MBps
- Input power: +28 VDC or +5 VDC

L3 communications
Targa Systems Division
2081 Merivale Road, Suite 200
Ottawa, ON K2G 1G9
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www.targasystems.com
For more info contact: sales@targasystems.com

RSC #11001 @ www.mil-embedded.com/catalogrsc

Mass storage

Solid state

Targa Systems

Targa Series 3 PC Card DTU

Targa Series 3 PC Card Data Transfer System is the perfect Network Attached Storage (NAS) device for your military and aerospace systems, replacing server attached storage in most airborne platform application systems.

These systems include flight management, cockpit instrument display, terrain awareness and warning, map systems, radar systems, cockpit/ground communications, navigation positioning, and satellite communications.

With PC card capacities now at 8 GB, the removable PC card feature of the Series 3 product line enables easy updating of files.

FEATURES:

- Small, lightweight, and rugged construction provides reliable data storage
- PC cards (ATA) capacities: up to 8 GB
- Interfaces: SCSI-2; 8-bit, single-ended Serial RS-422/485 and RS-232, MIL-STD-1553, USB, and 10/100Base-T Ethernet
- Locking access door with door open detect and PC card shutdown
- Input power: +28 VDC with 20 ms holdup, or +5 VDC
- Mounting:
  - – Panel mount – (DZUS) per MS25212C at K=4
  - – Internal mount – 3.5"-disk form factor; hard mount with robust door

L3 communications
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2081 Merivale Road, Suite 200
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Tel: 704-708-4720 • Fax: 704-708-4722
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For more info contact: sales@targasystems.com

RSC #11002 @ www.mil-embedded.com/catalogrsc

Targa Systems

VME25 & CPCI25 Conduction-Cooled Flash Disks

Targa's solid-state Flash disk module has been specifically designed to replace hard disk drives in rugged and environmentally demanding applications. The single-slot board, incorporating the same Flash disk technology as Targa's solid state 2.5" disk products, is currently available in the VME and CompactPCI form factors, in both convection-cooled and conduction-cooled versions.

The boards are a ruggedized, high-reliability, solid-state design with no moving parts. Flash memory with capacities up to 30 GB are available in this single-slot form factor.

L3 communications
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www.targasystems.com
For more info contact: sales@targasystems.com

RSC #11101 @ www.mil-embedded.com/catalogrsc

FEATURES:

- Ruggedized, high-reliability, solid-state design, no moving parts
- Up to 30 GB of Flash memory in a single-slot form factor
- Interfaces – USB, SCSI-1, SCSI-2 & SCSI-3 (ultra) compatible, 8-bit (SCSI narrow), ATA, memory map I/O
- Single slot – 6U VME, 6U CompactPCI, 3U CompactPCI
- Write protect and high-speed erase features
- MTBF: 500,000 hrs (MIL-STD-217, GB)

Red Rock Technologies, Inc.

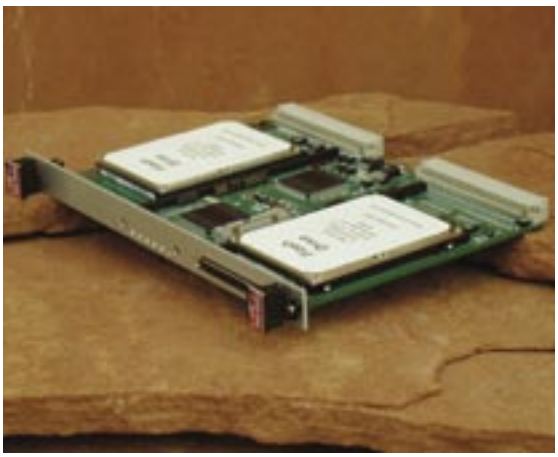
RRT-1SFA-LW

SCSI Flash drive
Red Rock Technologies' RRT-1SFA-LW provides a transparent interface from the ultra-wide SCSI LVD bus to 2.5" ATA Flash drives.

Capacities up to 64 GB are available in a single 6U VMEbus slot. Drives are addressable as one large disk or may be accessed as separate SCSI logical units. SCSI bus signals are available at P2 and front panel connectors. Only power is taken from the VMEbus.

These modules provide a high-capacity field replaceable unit capable of withstanding higher shock and vibration environments.

SCSI termination is provided with the unit. The SCSI interface is fully configurable for 8-bit, single-ended and SCSI-2 compatibility.



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RSC #11102 @ www.mil-embedded.com/catalogrsc

FEATURES:

- Capacity up to 64 GB; no additional software is required for operation as a SCSI bootable drive
- VMEbus form factor occupies one 6U slot; CompactPCI version available
- Ultra-wide SCSI LVD interface available at front panel and P2 connectors
- Can be configured for 8-bit, single-ended and/or SCSI-2 operation, thus supporting legacy systems
- Front panel status and activity LEDs
- P2 cable adapter panel available

Mass storage

Magnetic HDD

Red Rock Technologies, Inc.

RRT-1SHA-LW

SCSI hard drive

Model RRT-1SHA-LW provides a transparent interface from the ultra-wide SCSI LVD bus to 2.5" ATA hard drives.

Capacities up to 240 GB are available in a single 6U VMEbus slot. Drives are addressable as one large disk or may be accessed as separate SCSI logical units. SCSI bus signals are available at P2 and front panel connectors. Only power is taken from the VMEbus.

These modules provide a high-capacity field replaceable unit capable of withstanding higher shock and vibration environments.

SCSI termination is provided with the unit. The SCSI interface is fully configurable for eight-bit, single-ended and SCSI-2 compatibility.

FEATURES:

- Capacity up to 240 GB
- VMEbus form factor occupies one 6U slot; CompactPCI version available
- Ultra-wide SCSI LVD interface available at front panel and P2 connectors
- Can be configured for 8-bit, single-ended and/or SCSI-2 operation, thus supporting legacy systems
- Front panel status and activity LEDs
- P2 cable adapter panel available

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Mass storage

Magnetic HDD

Phoenix International

VF2-350-SCW-RHD Removable Hard Drive

The new VF2-350-SCW-RHD is a high-capacity/high-performance product specially designed to provide portability and security in transporting large amounts of data from capacity-hungry applications including mission planning, data acquisition, image processing, raw data analysis, and software development. It incorporates up to a 300 GB, 10 K RPM, hot-swap, wide ultra-SCSI hard disk drive mounted in a standard VME two-slot, 6U plug-in module. Phoenix International, an SDVOSB, is the only manufacturer of VME data storage products that is ISO 9001:2000 certified. The company has a 10-year industry reputation for consistent delivery of rugged COTS VME data storage solutions.

FEATURES:

- Hot swap 10 K RPM hard disk drive with capacities from 36 GB to 300 GB
- Transparent to any operating system
- SCSI connect via front-panel and/or backplane P2 connector
- Sensiterm: automatic internal bus termination
- Rugged steel construction
- 1,400,000 hour MTBF

812 W. Southern Avenue
Orange, CA 92865
Tel: 800-203-4800 • Fax: 714-283-1169
www.phenxint.com
For more info contact: amos3@phenxint.com

RSC #11202 @ www.mil-embedded.com/catalogrsc

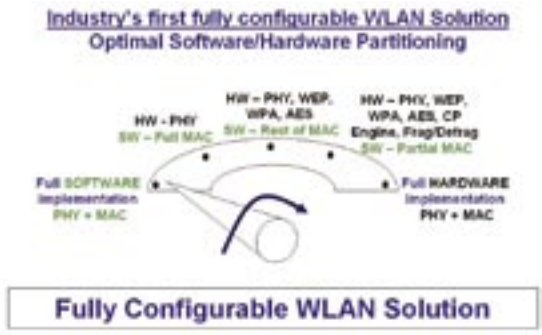
HelloSoft Inc.

HelloSoft Configurable and Mobile Wi-Fi Solutions

HelloSoft's Configurable Wi-Fi Solutions for IEEE standards include 802.11a, b, g, e, and i. These solutions are completely hardware/software partitionable and configurable to adapt to customer architectures. HelloSoft's Wi-Fi solutions are available in five potential combinations:

- PHY and MAC in software
- PHY in RTL and MAC in software
- PHY and security algorithms in RTL; rest of MAC in software
- PHY, security algorithms, CP engine, and frag/defrag in RTL; partial MAC in software
- PHY and MAC in RTL

HelloSoft's Mobile WLAN solution is a unique ultra-low-power 802.11 implementation for mobile devices. It is ideal for devices that require power-efficient Wi-Fi implementations.



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www.hellosoft.com
For more info contact: info@hellosoft.com

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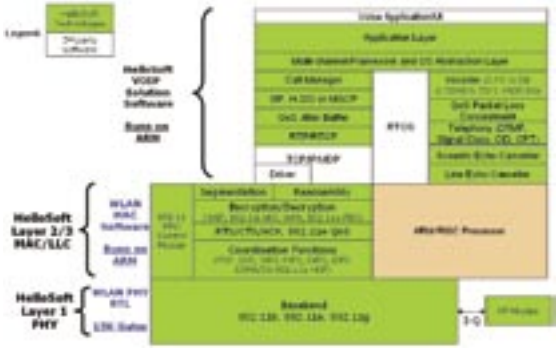
FEATURES:

- Completely configurable hardware or software WLAN solution; customizable implementation to adapt to customer architectures
- Ideal for proprietary high-security-enabled Wi-Fi implementations; portable to any CPU or DSP architecture
- Increased range and improved bit-error performance
- Highly optimized hardware with low gate counts; ideal for applying WLAN to cameras, imaging devices, handsets, and mobile devices
- Interoperability tested; passes MAC/LLC conformance tests; exceeds IEEE channel model performance metrics
- Ultra-low-power and ultra-low-cost Wi-Fi implementations

HelloSoft Inc.

HelloSoft RISC-Only VoIP and VoWLAN Software Solutions

HelloVoice™ is a highly optimized RISC-only VoIP software solution designed specifically for IP handsets, ATAs, mobile phones, carrier edge equipment, and other VoIP clients. It incorporates a comprehensive VoIP software stack with all necessary media processing, signaling, SIP, echo cancellation, jitter buffer, and framework elements as an integrated solution. HelloVoice™ is designed using a modular and separable system architecture that enables portability to different OS/RTOS and processor architectures. HelloSoft VoWLAN is an optimized extention of HelloVoice™ for ultra-low-power chordless IP handsets and consumer devices. HelloVoice™ is a solution-of-choice by major OEMs/ODMs.



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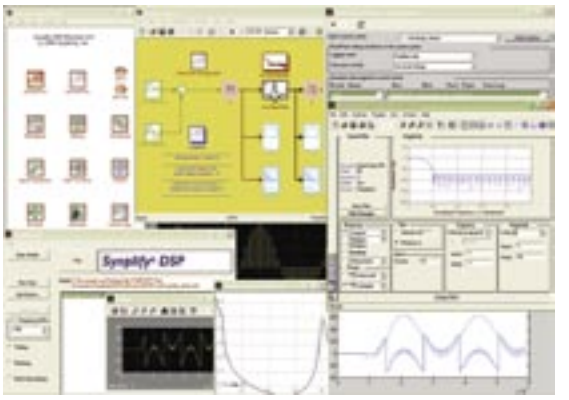
RSC #11302 @ www.mil-embedded.com/catalogrsc

FEATURES:

- Single RISC-only Implementation; all networking, control, and "DSP" components run on a single ARM processor
- Field deployed and proven for handsets, ATAs, carrier edge equipment, and other VoIP clients
- Industry-best performance for media processing algorithms on RISC processors
- VoIP solution-of-choice by major OEMs/ODMs and semiconductor manufacturers
- Ultra-low-power and ultra-low-cost Voice-over-WLAN architecture
- Designed for portability to different OS/RTOS and processor architectures; modular and separable system architecture

Synplicity, Inc.

Technology-Independent DSP Synthesis from Simulink® to FPGA



DSP designers are increasingly targeting FPGAs for implementation of their high-performance DSP designs. FPGAs can achieve an order of magnitude performance boost over standard DSP chips through efficient and parallel implementation of DSP functions. Until now there has been no good way to get a design specified at the algorithm level from tools such as Simulink® by The MathWorks, into high-quality RTL code.

Synplify® DSP software is a true DSP synthesis solution and the only one that performs high-level DSP optimizations from a Simulink specification. These special DSP optimizations allow designers to capture the behavior needed for their DSP algorithm without worrying about the specific implementation in hardware. The Synplify DSP solution automatically produces a highly optimized, technology-independent implementation of the design ready for RTL synthesis into your choice of FPGA device.

For more information about Synplicity's Synplify DSP solution, visit our website at http://www.synplicity.com/products/synplifydsp/index.html or e-mail info@synplicity.com.

FEATURES:

- Fully integrated fixed-point blockset of common DSP functions useful for many DSP applications, such as Software Defined Radio
- User-extensible DSP IP library for custom functions
- DSP synthesis toolbox for optimizing both performance and area (cost) using unique system-level retiming and folding technology
- Access to the full range of algorithm development and analysis tools within Simulink
- Waveform portability for quickly targeting your choice of FPGA hardware from a single Simulink design
- Floating-point to fixed-point conversion and analysis
- Synthesizable RTL code and test-bench is automatically created from a Simulink specification

Synplicity
Simply Better Results

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www.synplicity.com

For more info contact: info@synplicity.com

RSC #11401 @ www.mil-embedded.com/catalogrsc

Innovative Integration

Middleware/Software
Development environment/Tools

Pismo Toolset

The Pismo Toolset is a comprehensive, state-of-the-art collection of software tools and libraries used in the development of applications for Innovative Integrations's Matador and Velocia Series of DSP boards. Pismo covers all the aspects of a new DSP project.

Pismo is used in conjunction with Code Composer Studio, Texas Instruments' integrated development environment, for code editing, compiling/linking, downloading, and hardware-assisted debugging via JTAG. Downloading is also possible over the PCI bus (without JTAG) simply by running our download utility.

FEATURES:

- Target DSP example programs in source form with project files for Code Composer Studio
- Sample applications showing host PC as well as target DSP coding techniques
- 300+ function DSP and peripheral control library with full source code
- Online Windows help file with hypertext cross references
- One full year of hot-line technical support

Innovative Integration
... real time solutions!

2655 Park Center Drive
Simi Valley, CA 93065
Tel: 805-520-3300 • Fax: 805-579-1730
www.innovative-dsp.com
For more info contact: sales@innovative-dsp.com

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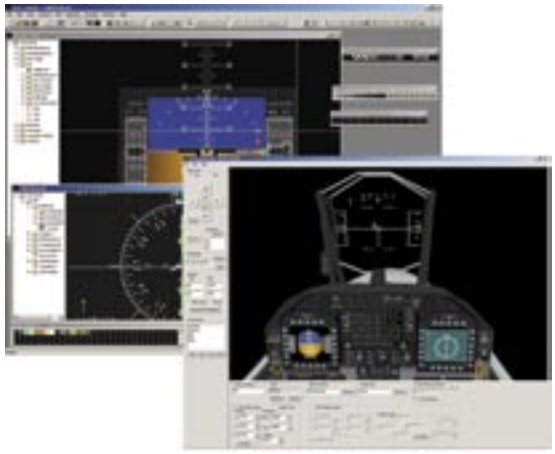
Quantum3D, Inc.

Middleware/Software
Development environment/Tools

IData™ Advanced Human Machine Interface Tool Suite

The IData suite of powerful, cost effective, PC-based Human Machine Interface (HMI) tools enables rapid prototyping, development, and deployment of dynamic, interactive, cross-platform 2D and 3D OpenGL-based HMIs for embedded systems, data display, and simulation applications. IData dramatically reduces development time and integration efforts enabling developers to move seamlessly between prototype/simulation environments and deployed systems under desktop and embedded operating systems. The optional IData3D module integrates powerful 3D visualization capabilities, resulting in a powerful toolset for the creation of innovative 2D/3D applications with unprecedented portability.



FEATURES:

- Easy-to-use tool environment enables rapid prototyping, development, and deployment
- Support for industry-standard OpenGL and OpenGL ES for embedded systems
- Built-in user interaction capabilities enable use of sophisticated widget-based elements
- Image/3D file import/display enables use of digital photographs and industry standard imagery and 3D content creation tools
- Electronic Flight Instrument System (EFIS) symbology supports complex behaviors, map/radar image download, and live video overlay
- Supports Linux®, Microsoft® Windows, and Windows CE, Wind River vxWorks®, and other embedded RTOS environments

QUANTUM3D®

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www.quantum3d.com/products/Software/idata.html
For more info contact: salesinfo@quantum3d.com

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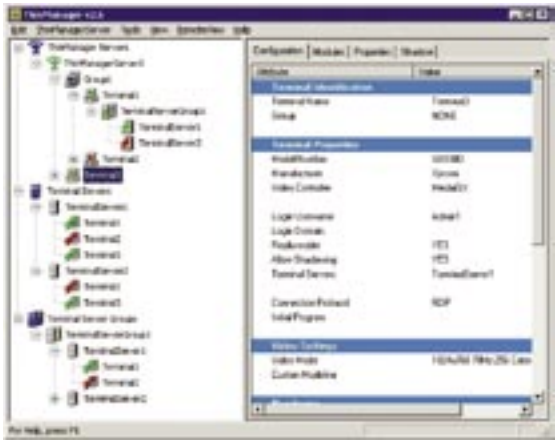
Middleware/Software

Graphical user interface

ACP

ThinManager – Thin Client Management Software



A Thin Client platform provides the most secure Windows environment available. Secure servers support hundreds of clients, each displaying only the data needed to perform a specific job. Access is only available where expressly given.

Nuclear weapons labs, chemical agent disposal facilities, and nuclear power plants all rely on ThinManager to keep them in strict compliance and running 24 hours a day. It is not possible to store data on the Thin Clients, and it is not possible to add a virus or unwanted application.

ThinManager makes the servers redundant and enables instant replacement of any failed Thin Client device with no requirement for any specific hardware vendor.

FEATURES:

- Security – Data and applications never leave the secure server, and theft of the Thin Client results in no data loss
- Reliability – By deploying fault tolerant servers, every Thin Client gets the benefits of redundancy without the expense
- Interchangeable hardware – A Rockwell Thin Client can be replaced with a Xycom without even losing the operator's screen
- Low bandwidth requirements – Only the display changes are sent to the Thin Clients so updates can occur even at 9600 baud
- Rapid deployment and software updates – Update the server, and every connected Thin Client is immediately updated
- Simplified maintenance – Servers are maintained by trained staff; Thin Clients are simply installed wherever needed

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Alpharetta, GA 30005
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www.acpthinclient.com
For more info contact: dhancock@acptc.com

Middleware/Software

Real-time operating systems

EBS, Inc.

ERTFS Pro Plus

ERTFS is the most reliable, FAT32 high-performance, embedded FAT32 file system. Deployed since 1987, it is used in hundreds of demanding military, scientific, industrial, and consumer applications.

ERTFS offers support for 64-bit files and state-of-the-art handling of streaming data and digital video.

A 64-bit file interface shatters the 4 GB barrier making it possible to create files that could be 24 TB in length. In practice, files are large enough for storing video and high-volume streaming data on today's 100+ GB disk drives. Failsafe operation eliminates volume corruption from power failures and media removals.

Looking for DO-178B partners.

FEATURES:

- Extremely low latency file seeks
- Deterministic file IO operations
- Programmer controlled pre-allocation of file extents
- Volume defragmenter subsystem provided
- High-speed data logging routines are available
- 64-bit files

39 Court Street
Groton, MA 01450
Tel: 978-842-4049
www.embeddedsoftware.com
For more info contact: sales@ebsembeddedsoftware.com

Ardence, Inc.

Middleware/Software
Real-time operating systems

RTX® – Real-time Embedded Software Solution for Windows®

RTX is a high-performance, deterministic, real-time solution for Windows that provides unprecedented control, saves developers time, reduces system costs, and gets products to market faster.

RTX enhances Windows' universally adopted look/feel with features that enable real-time determinism, better control, and unmatched dependability. By offering a compliant Win32 API set, RTX application portability is simplified between various Windows operating systems.

Get a free evaluation version of RTX at: https://eval.ardence.com/mes

Ardence is a global leader in designing and developing software solutions that enhance the control, security, dependability, and management of Windows.

FEATURES:

- Control Windows with deterministic memory management
- Reduce system costs by eliminating the need for customized or specialized platforms
- Increase performance through the smallest footprint in the market and sub-microsecond latency
- Improve reliability with support of standardized x86 HALs – HALx86 as well as PIC and APIC with ACPI
- Speed time to market through intuitive development tools that easily integrate into standard Windows IDE

266 Second Avenue
Waltham, MA 01776
Tel: 800-334-8649 • Fax: 781-647-3999
https://eval.ardence.com/mes
For more info contact: info@ardence.com

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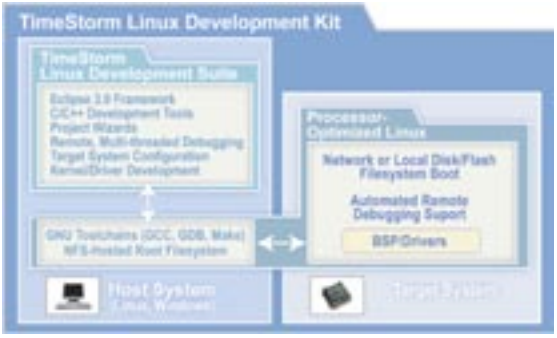
TimeSys Corporation

Middleware/Software
Linux

Processor-Optimized TimeStorm® Linux Development Kits

Processor-optimized TimeStorm Linux Development Kits (LDKs) speed and simplify development of systems based on PowerPC, MIPS, ARM, and Intel architectures. Each certified and supported TimeStorm LDK from TimeSys includes a complete processor-optimized 2.6 Linux distribution with platform-specific Linux features, ready-to-run target images (kernel and file system), and the Eclipse 3.0-based TimeStorm® Linux Development Suite (LDS) cross-development environment to facilitate application development and platform customization on Windows or Linux hosts.



FEATURES:

- Certified and supported processor-optimized 2.6 Linux distributions for PowerPC, MIPS, ARM, and Intel architectures
- Platform-specific Linux features
- Rich set of device drivers, network protocol stacks, and user-space applications
- Pre-built, ready-to-run target kernel and root filesystem images
- GNU toolchains to facilitate development and debugging of custom applications
- Eclipse 3.0-based TimeStorm Linux Development Suite (LDS) cross-development environment

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www.timesys.com
For more info contact: info@timesys.com

RSC #11702 @ www.mil-embedded.com/catalogrsc

Seaweed Systems, Inc.

SeaWind/178

Seaweed's Seawind/178B product family comprises three scalable product and service offerings for customers implementing 2D and 3D OpenGL graphics in DO-178B certifiable embedded systems for a wide variety of operating sytems.

1. **CertCode –** is the software-only product providing the application developer a scalable subset of the OpenGL API. It has been developed from scratch by Seaweed to meet the standards of DO-178B level A and offers an implementation ideally suited to critical applications.

2. **CertKit –** includes CertCode and additionally provides a kit of all of the data and documentation required for the application developer to generate the certification submission, including test procedures and a full test harness. All data and documentation has been collected during Seaweed's product development, and not reverse-engineered.

3. **CertAssist –** includes CertKit and offers a turnkey solution to certification. Seaweed Systems carries out the verification program on representative target hardware and completes all the documentation necessary to support customer application certification.

The COTS approach taken by Seaweed provides several benefits to its customers. Seaweed's products provide:

- Full life-cycle support and continued bug reporting (including safety assessment reports for each bug) and bug fixes
- Distribution to multiple customers so each acquires the leverage inherent in other customers' use
- Support for multiple SBC/graphics-architectures/RTOS/API-subsets
- Rapid availability, which has already been shipped on several programs
- Fixed cost

SeaWind/178 is compact (small footprint) and comprises low-complexity linear code, making it more efficient than typical OpenGL implementations.

FEATURES:

- Developed from scratch and certifiable under DO-178B to Level A, so all artifacts are generated during the actual development
- Available already on a wide variety of target platforms
- Low-risk, fixed-cost approach to DO-178B graphics certification
- Extremely small footprint OpenGL subset implementation
- Low-complexity, linear code offers superlative performance
- Supports 2D and 3D applications
- Integrates with leading RTOS tool chains, including: VxWorks, VxWorks AE653, INTEGRITY, INTEGRITY-178, and LynxOS-178
- OpenGL ES safety-critical compatible

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Woodinville, WA 98077
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www.seaweed.com

For more info contact: info@seaweed.com

Crane Aerospace & Electronics

Custom Microelectronics

From design to build-to-print, Crane Aerospace & Electronics has the experience and expertise to fill your microelectronic out-sourcing requirements. We provide prototype to production services with mixed volume and blended technologies to fulfill our customer's requirements. Our expertise in miniaturizing electronics results in increased reliability, reduced costs, lower weight, and increased board density. We manufacture high-density, high-reliability microelectronic products for the space, aerospace, military, medical, industrial, and commercial markets. We also provide microelectronics as standalone components, on boards, and in boxes as part of our EMS custom offerings.

Our facilities are certified to quality standards ISO9001 and AS9100-B. High-quality products are ensured by our established and qualified processes and our trained, experienced, and certified operators.

Crane Aerospace & Electronics works with the customer to determine the package, quality, test, and project plan. Verification that the product meets specification, transfer to new product manufacturing, qualification, and final customer approval occur before the product is released to full production.

Download our brochure at www.craneae.com/134.

Crane Aerospace & Electronics is a segment of Crane Co. that includes ELDEC, General Technology, Hydro-Aire, Interpoint, Keltec, Lear Romec, P.L. Porter, Resistoflex, and Signal Technology, all major suppliers of critical aircraft and electronic systems and components. For more information on Crane Aerospace & Electronics, visit www.craneae.com and for Crane Co., visit www.craneco.com. Crane Co. is a diversified manufacturer of engineered industrial products.

FEATURES:

- Chip and wire with bare die assembly
- Ball Grid Array (BGA) and µBGA
- Flip chip
- Chip on flex
- Chip on board
- Hermetically sealed metal packaging
- Optoelectronic packaging
- 3D packaging
- Obsolescence management

CRANE
AEROSPACE & ELECTRONICS

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RSC #11901 @ www.mil-embedded.com/catalogrsc

Packaging/Mechanical chassis

Electronics packaging

Hybricon Corporation

Electronic Cabinet System Solution

Three VME enclosures are installed in Hybricon Corporation's electronic cabinet system solution, which was designed using extensive thermal analysis to ensure robust cooling. Custom air plenums above each VME enclosure prevent preheated air from flowing from lower to upper enclosures. Each plenum has a system alarm board and temperature sensor mounted in the outlet side. Patented CoolSlot®, air-deflecting card guides and nine 48 VDC fans in each enclosure provide cooling for 240 W per slot.

The cabinet is constructed with an open base panel, solid top panel, and lift-off side panels with a fully vented front door and top vented rear door. Mounting rails are standard "U-shape."

FEATURES:

- Houses three VME enclosures
- Extensive thermal analysis
- Custom air plenums prevent rise of preheated air
- Each enclosure fitted with smoke detector and temperature sensors

Hybricon®
Innovation • Quality • Service

12 Willow Road
Ayer, MA 01432
Tel: 1-877-HYBRICON • Fax: 978-772-2963
www.hybricon.com
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RSC #12001 @ www.mil-embedded.com/catalogrsc

Packaging/Mechanical chassis

Electronics packaging

Hybricon Corporation

Military COTS Liquid-Cooled Enclosure Solution

Hybricon Corporation's military COTS liquid-cooled enclosure solution was designed for optimum cooling through the use of an air-to-water heat exchanger. Three AC fans in a series mounted above the card cage and a single heat exchanger fan provide a simulated average airflow of 225 LFM per slot. The airflow path is arranged in a closed loop through an air-to-water heat exchanger, which uses a 50/50 ethylene glycol water mixture delivered at 3 GPM and 10 PSI. The enclosures are configured with a 21-slot VME64x backplane mounted on slides for easy access. Low acoustic and structureborne noise levels are achieved using fans set in series and shock and vibration isolators.

FEATURES:

- Air-to-water heat exchange
- Shock isolated system
- Munson Road tested
- Low acoustic noise
- 750 W embedded power supply
- Patented CoolSlot®, air-deflecting card guides eliminate hot spots and improve board cooling by as much as 50 percent

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Innovative Integration

TOPO-6713

Packaged instruments built around the SBC6713e
This fully contained SBC6713e-based instrument core allows developers to rapidly deliver application specific instruments for a wide range of signal capture, generation, and coprocessing applications.

Developers can now immediately focus on DSP software development to customize the TOPO-6713e into a unique and flexible piece of instrumentation. It is equipped with two AD16 cards and provides 32 simultaneous 200 kHz A/D channels at 16-bit resolution. Data is digitized in close proximity to the sensor array, can optionally be pre-processed on the DSP, and flow continuously to a PC over Ethernet cable for viewing, analysis, and logging.

FEATURES:

- Instrument quality housing
- Full autonomous operation
- Instrument functions programmable with DSP
- User-interface display and navigation key
- Front-panel I/O connections
- Rear panel Ethernet, DIO, and other ports

Innovative Integration
... real time solutions!
2655 Park Center Drive
Simi Valley, CA 93065
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RSC #12101 @ www.mil-embedded.com/catalogrsc

Hybricon Corporation

Airborne Video Processor System

This system designed by Hybricon Corporation enables the use of multiple video processing cards in a high-altitude airborne environment. An intelligent temperature control system maintains internal temperatures above 0 °C with minimal impact on the power budget. The system was designed with both LED monitoring and optional remote monitoring. EMI/RFI (MIL-STD-461-D) control is provided by honeycomb filtering on all inlets and outlets and proper design of gasketing at all metal seams. Front to rear, side cable passages, a recessed card cage, and removable front cover provide complete cable management with tight EMI/RFI containment.

FEATURES:

- FAA certified to airborne shock, vibration, and environmental requirements
- Redundant power supplies increase system reliability
- Integration of CPU/Carrier cards with multiple video and fiber-optic PMC and IP modules
- Complete cabling of copper and fiber interfacing
- Internal heater and control system allows operation of integrated COTS content below rated minimum operating temperatures
- Intelligent temperature control and fan speed control with remote monitoring options

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RSC #12102 @ www.mil-embedded.com/catalogrsc

Radstone Embedded Computing

Liquid-cooled ATR Solutions

Radstone ATR solutions have long been the benchmark by which others are judged, mechanically without parallel, featuring engineered-in quality and flexible enough to enable cost-effective adaptation to program requirements. Now, with liquid cooling, Radstone can decouple ATR cooling from the limitations of the chassis' immediate environment and push power dissipation levels up to 1 kW. This represents a step increase in capability without the need to sacrifice existing board level mechanics or maintenance procedures, and enables legacy boards to coexist with newer, high-power processor, DSP, or graphics designs.

For applications where a liquid-cooling infrastructure already exists, Radstone offers a set of COTS ATR chassis based on either VME or CompactPCI backplane architectures. Lightweight and cost-effective, these chassis connect to the platform's coolant supply by means of quick-release valves. A wide range of liquids is supported including polyalphaolefin (PAO) and ethylene glycol/water. Internally, each chassis has a modular power supply that can be specified to work from either a +28 VDC source, 270 VDC or 115 Vac. PSU outputs can be adjusted to match requirements.

For self-contained upgrades and original installations, the standard COTS liquid-cooled ATR can be linked to a separate heat rejection unit – the HRU-1000R. This heat rejection unit combines the necessary liquid storage, pump, fans, heat exchanger, and control electronics in a small, flight-worthy, one-half ATR short package.

Radstone liquid-cooled ATR solutions are backed up by a full systems integration service and, as a program evolves, by class-leading obsolescence management and long-term support services.

FEATURES:

- Full COTS product set
- Up to 1 kW dissipation
- Accepts legacy and future conduction-cooled boards compliant with IEEE 1101.2, ANSI/VITA 30.1
- VMEbus and CompactPCI
- Two architectural options:
  - Plumbed into existing liquid-cooled infrastructure
  - Standalone with HRU-1000R heat rejection unit
- Suitable for use on any airborne, ground, or naval platform

RADSTONE
EMBEDDED COMPUTING

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RSC #12201 @ www.mil-embedded.com/catalogrsc

Carlo Gavazzi Computing Solutions

714 Series ATR Chassis

The 714 Series is an aluminum chassis that utilizes the dip brazing fabrication process, which seals the enclosure and aids in its natural convection to conduct heat away from the boards and power supply. Wedge lock guides secure the boards into the rack and provide a thermally conductive path for removing heat. Up to 135 W can be expected from the power supply while the chassis is in a 50 °C ambient environment. The power supply plugs directly into the backplane to eliminate the need for power cabling to the backplane. The internal rack infrastructure supports the DIN mechanical specification, which enables the chassis to be fitted with VME64, VME64X, and CompactPCI backplanes.

FEATURES:

- 3/4, 1, 1 Long, and 1-1/2 size conduction cooled, Air Transport Rack (ATR) chassis
- Meets ARINC 404A/MIL-STD-91403
- Accommodates VME64, VME64X, and CompactPCI backplanes; custom backplane configurations are also available
- Backplane I/O breakout area and direct plug-in power supply provides a more rugged design by reducing the number of cables
- Highest wattage available
- Thermal simulation model available

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COMPUTING SOLUTIONS

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Carlo Gavazzi Computing Solutions

VXS Switch Fabric Backplanes

The VITA 41.x VXS backplane is designed for high-speed switch fabrics while maintaining J1 and J2 connections to support legacy VME64x cards. This VXS backplane replaces the 95-pin J0 connector of the VME64x with a MultiGig RT-2 high frequency connector for serial data traffic. This 12-slot VXS backplane is set up in a dual star configuration with two fabric switch slots and 10 VME64x payload slots. Each payload slot supports two 4x serial links. One serial link is wired to the first switch slot while the other is wired to the second switch slot. The two switch slots are designed with Inter-Switch links.

FEATURES:

- 12-slot VITA 41.0 VXS backplane
- 10 VME64x payload slots
- Two fabric switch slots
- Dual star configuration
- Inter-Switch links
- SMT passive termination

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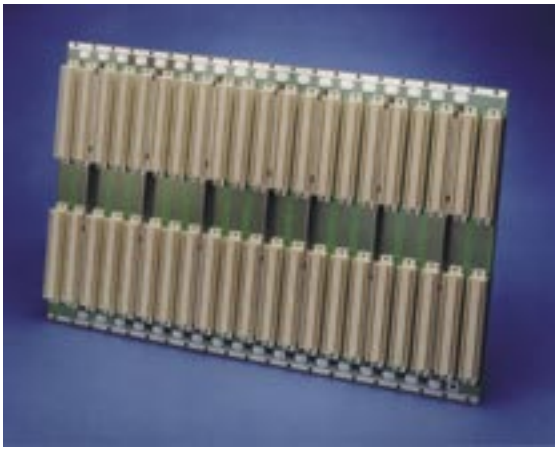
Packaging/Mechanical chassis

Backplane

Hybricon Corporation

VME64 Extension High Current VITA 1.7 Backplanes



Hybricon Corporation's high-power VME64x backplanes comply with the VITA 1.7 high current standard for VME64x. Able to handle more than 150 W per slot, VITA 1.7 provides a standardized way to implement high-power VME64x systems. These significantly increased current levels require upgraded backplane designs to support the higher current power connections.

The high-performance, low-noise VITA 1.7 backplanes are constructed in a 12-layer stripline design for optimal signal integrity, with the outside layers incorporating a chassis ground EMI shield. The backplanes have been tested to meet the signal integrity requirement of 320 MBps data transfer per ANSI/VITA 1.5 2eSST.

FEATURES:

- Complies with the ANSI/VITA 1.7 high current standard for VME64x
- ANSI/VITA 5.1 Raceway compatibility guaranteed
- 12-layer construction ensures optimum signal performance
- Patented stiffeners placed every three slots ensure board rigidity
- High current internal ground planes
- Easy-to-wire, 8-32 thread high current power studs

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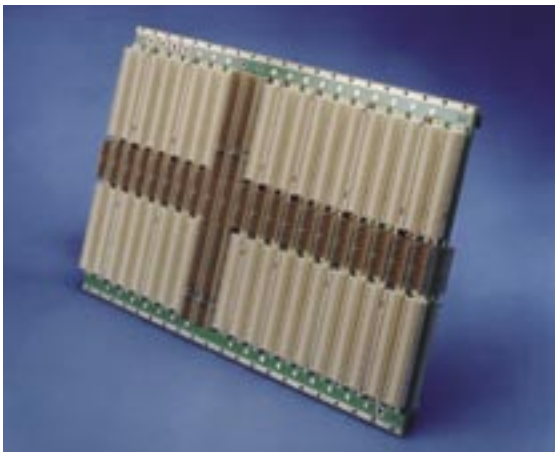
Packaging/Mechanical chassis

Backplane

Hybricon Corporation

VXS Backplanes



Hybricon Corporation's VXS switch fabric backplanes are designed to meet the latest VITA standards, including VITA 41.1 InfiniBand™, VITA 41.2 Serial RapidIO™, VITA 41.3 Gigabit Ethernet, and VITA 41.4 PCI Express. These backplanes leverage Hybricon's signal integrity analysis and implementation experience to achieve the highest performance with the VMEbus tested to 320 Mbps per VITA 1.5 2eSST.

The boards are constructed in a 20-layer, low-noise stripline design with the outside layers incorporating a chassis ground EMI shield. The 21-slot VXS backplanes provide two VITA 41.x fabric slots and up to 18 VITA 41.x payload slots with 4x links to two switch slots.

FEATURES:

- Compliant to the latest VXS switch fabric VITA standards
- High performance, low noise
- 20-layer construction ensures optimum signal performance
- InfiniBand™, Serial RapidIO™, Gigabit Ethernet, and PCI Express versions available
- Stiffeners placed every two slots ensure board rigidity
- Custom configurations available

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Carlo Gavazzi Computing Solutions

794 Series 2U Rugged Platforms

Carlo Gavazzi's 794 Series Rugged Militarized/Industrial Platform provides the user with fault-tolerant features in a 2U package for military applications.

Made of pre-plated steel, the 794 Series platform is rack-mountable, consisting of a shock and vibration isolated sub-chassis to meet the requirements of RTCA/DO 160D, MIL-STD-901D, and MIL-STD-167. It is also fully shielded to meet the requirements of MIL-STD-461E. The 794 Series platform utilizes an electronics heater control system, which heats the chassis to a safe operating temperature even in environments as low as -40 °C, while also cooling in warmer environments via dual 44 CFM 12 VDC fans that pressurize from front to rear.

FEATURES:

- Designed to meet MIL-STD-901D, MIL-STD-810E, and others
- Can be configured with any full- or half-size ATX motherboard and operating system upon request
- 3.5"/2U (H) x 19" (W) x 20" (D)
- Lockable EMI tight cover
- Dual redundant hot swap, 350 W power supply
- Includes custom I/O rear panels, a front circuit breaker, an AC indicator, a time meter, and a power supply fuse

CARLO GAVAZZI COMPUTING SOLUTIONS

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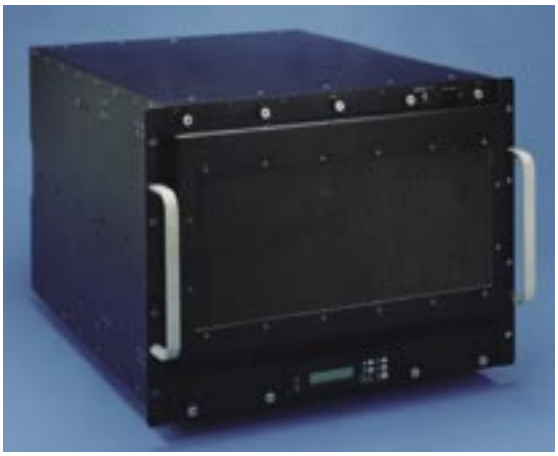
Hybricon Corporation

Military Ruggedized COTS Chassis

Hybricon Corporation's ruggedized 8U rackmount enclosures provide robust cooling in a compact stackable design. High-performance cooling supports demanding high-power applications, delivering 310 LFM per slot, sufficient cooling for 60 W per slot. Custom versions are available with cooling up to 100 W per slot.

The RME821M enclosures are designed to meet MIL-STD-461 EMI radiated and conducted emissions and susceptibility standards by using gasketing at all seams, and 1"-thick honeycomb panels at both air intake and exhaust openings. The enclosures are available with 21-slot CompactPCI®, VME64x, VME, or VXS backplanes and up to 2100 W of embedded power.



FEATURES:

- High-quality ruggedized construction
- Designed to meet military shock, vibration, and EMI standards
- Cooling up to 100 W per slot
- Compact 8U size
- Designed to cool extremely dense CPU and DSP boards
- Extensive chassis monitoring with external Ethernet and RS-232 interfaces

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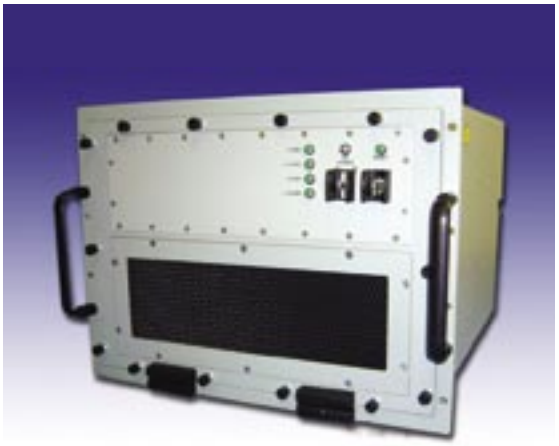
Packaging/Mechanical chassis

Rugged chassis

AP Labs

FS-1270 Rugged Rackmount Enclosure



The AP Labs FS-1270 is an 8U-tall, ruggedized VME enclosure designed for 6U VME boards with an optional peripheral carrier available in 10- and 12-slot versions. The enclosure is provided with easy front loading access. The peripheral carrier is removable and mounts in the VME cardcage. It can accommodate up to four 5.75" removable drive carriers. An 800 W power supply LRU is included with the chassis.

AP Labs designed the FS-1270 to meet MIL-S-901D in an isolated rack, MIL-STD-810E, and MIL-STD-167-1 shock and vibration specifications for severe environments. The FS-1270 meets typical MIL-STD-461 EMI requirements. Optionally, the FS-1270 can be upgraded to meet MIL-STD-108E for drip-proof requirements.

FEATURES:

- Front-load, rugged, hard-mount chassis (10, 12, or 18 slots) – 19" (W) x 14" (H) x 22.1" (with fan = 24.1") (D); weight 85 lbs.
- Available with VME64X, VME64X with J0, VME64 backplanes
- Shock: MIL-STD-810, MIL-S-901D, Vibration: MIL-STD-167, EMI/RFI: MIL-STD-461
- Hinged front door for easy card access; removable peripheral carrier in 10- and 12-slot versions
- Power supply LRU(s) with blind mating connector; (dual redundant power supplies available)
- Front-to-rear airflow; side-to-rear cooling is an available option

AP Labs

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Packaging/Mechanical chassis

Rugged chassis

Tracewell Systems Inc.

Tracewell S36 Rugged System Platform

Tracewell Systems, a leader in advanced rugged mobile systems, offers the highly adaptable S36 for air, sea, and ground-based applications. The MIL-STD-461 design uses a unique shielding method to support up to 21, 6U boards. Power options include DC or AC input with added capability for MIL-STD-704 compliance. Cooling for up to 100 W/slot makes S36 ideal for next-generation processors. To meet low-weight rugged requirements, optional advanced welded laminate construction provides a very light, highly rigid platform. Remote system monitoring is available, including standalone web-based control. The S36 also supports several standard backplane architectures or, if needed, full custom architectures.

FEATURES:

- Output power ranging from 400-2000 W, wide range AC (47-440 Hz) or 28/48/300 VDC input
- High-capacity, forced air cooling for up to 100 W/slot; optional conduction or fluid cooled designs available
- Up to 21 slots, 3U or 6U, in VME64x, VXS, CompactPCI, full custom, or mixed architecture
- Remote monitoring, VFD/LCD display options, and control interfaces for RS-232/485, Ethernet, or IPMI
- MIL-STD 461, 704, 810, and 901 environments
- Available thermal, EMC, and HALT/HASS qualification testing in-house

Tracewell Systems

567 Enterprise Drive
Westerville, OH 43081
Tel: 800-848-4525 • Fax: 614-846-4450
tracewellsystems.com/products/tracewellS36vme64x.htm
For more info contact: sales@tracewell.com

RSC #12602 @ www.mil-embedded.com/catalogrsc

Geotest-Marvin Test Systems, Inc.

MTS 207 Rugged Field Test Set

The MTS-207 is a state-of-the-art portable PXI platform for field testing and data acquisition applications. Its architecture is based on the MTS-206 Maverick Field Test Set – the first PXI-based system to be qualified and certified by the United States Air Force for munitions testing. It combines the test capabilities of an I-Level test set in a compact, rugged, flight-line qualified enclosure.

The MTS-207 is ideal for use in harsh environmental conditions. Its modular 14-slot PXI chassis is secured via five shock absorbers to meet stringent shock and vibration requirements per MIL-STD-810. The MTS-206 can be controlled by an optional integrated LCD display and touch screen.

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FEATURES:

- Ultra-rugged and portable PXI platform for field and flight-line applications
- Meets MIL-STD-810E requirements for harsh environmental conditions
- Built-in, shock-mounted, 14-slot PXI chassis (seven 3U and seven 6U slots)
- A wide range of PXI modules available to tackle any test or data acquisition application
- Optional touch-screen display; remote control and display unit (RCDU)
- Optional heaters for extreme low-temperature operation and MIL-STD-461 compliance (EMI)

Tyco Electronics

Tyco Connectors Support VITA 46

Tyco Electronics MULTIGIG RT-2, seven-row connector supports VITA 46 cards in both 3U and 6U format. It is a high-speed, "pinless" backplane connector system. VITA 46 cards are PICMG 2.0 Rev. 3 air-cooled-compliant, O & I envelope, and are compatible with existing enclosures. They are also compliant with the VITA 30.1 conduction-cooled form factor and the new VITA 48 form factor. Vita 46 cards support PMC sites, XMC backplane I/O, and contain an alignment and key block with a robust mechanism to avoid pin stubbing. Each wafer within the connector system contains a built-in "ESD" protection point, planned to support Level 2 maintenance. Contact John at: jtlarkin@tycoelectronics.com or call 717-592-2074.

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For more info contact: jtlarkin@tycoelectronics.com

RSC #12702 @ www.mil-embedded.com/catalogrsc

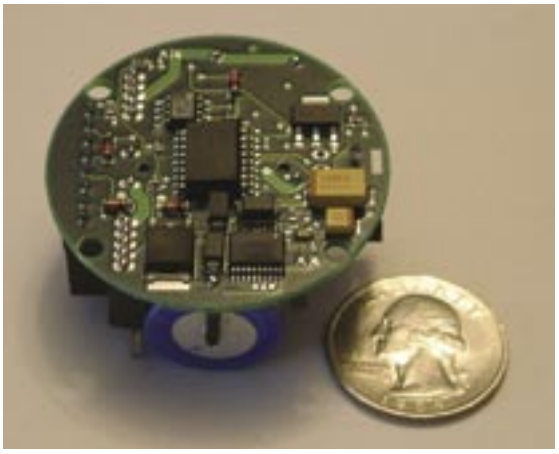
FEATURES:

- Based on Tyco Electronics MULTIGIG RT-2, seven-row connector system
- Depth fits enable typical stiffening bar and PMC
- 7-row, 16-wafer and 8-wafer construction
- Power, differential, and single-ended wafers utilized to match system requirements
- Built-in ESD grounding protection
- Robust alignment and keying system

Other
Miscellaneous

Avalon Defense Ltd.

Electronic Initiator ADF-EI-xxx Series



Avalon Defense Ltd. has created a safe and reliable electronic ignition device for the missile and rocket industry. This device can replace older mechanical and electro-mechanical devices in many applications. Onboard safety features include acceleration and output protection circuitry. Charge and Fire times can be programmed along with Fire Delay from (umbilical) separation. Other conditions can be defined (contact us for details).

The device can be customized for your system and dimension requirements. An onboard microprocessor and serial port allow for simple updates and changes. Charge and Fire voltages can be modified per your specifications. The standard device is for initiating 1 Ω/1 A loads.

FEATURES:

- Onboard processor for control and conditional sequencing
- Small size
- Customization of dimensions available
- Customization of charge and fire voltages available
- Serial port for remote configuration and updates
- Onboard power and charge indicators

AVALON DEFENSE LTD.

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Other
Miscellaneous

Avalon Defense Ltd.

DigiSquib™ Digital Squib ADF-DSxx Series

The Avalon Defense DigiSquib™ offers a new concept in safe and reliable switching of power to electronic systems. The DigiSquib™ replaces pyrotechnic switches in many applications and is reuseable. The DigiSquib™ is initiated by supplying an external voltage for a minimum time period. The DigiSquib™ has two control inputs, the activation voltage and the protect override. The activation voltage initiates the DigiSquib™ operation, while the protect pin operates as a safety/enable input. The protect input is only polled by the device for a preprogrammed time period, after which the signal is ignored by the device. The patented design includes redundant circuitry for added safety.

FEATURES:

- Rugged, safe, and reliable switch replaces pyrotechnic devices in most applications
- Reuseable; can be returned to non-active state; allows for safe “abort” sequence
- Different devices for different power requirements
- Successfully flight tested
- Optional accelerometer for additional (conditional) safety and can be controlled via serial port
- Available in SMT or through-hole packages

AVALON DEFENSE LTD.

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RSC #12802 @ www.mil-embedded.com/catalogrsc

HESC104 – 60 W Power Supply with Smart Battery Charging

The HESC104 provides 60 W total output power in a PC/104 form factor DC/DC power supply. All four common voltages (+5 V, +12 V, -5 V, -12 V) are included for maximum versatility. The HESC104 is specifically designed for vehicular or other mobile applications and has heavy-duty transient suppressors (5000 W) that clamp the input voltage to safe levels, while maintaining normal power supply operation.

The HESC104 is perfect for low-noise embedded computer systems and has a wide input range of 6 to 40 VDC that is ideal for battery or unregulated input applications. Organic semiconductor capacitors provide filtering that reduces ripple noises below 20 mV. This low-noise design makes the HESC104 ideal for use aboard aircraft or military applications or wherever EMI or RFI must be minimized. Control of the HESC104 can be through the PC/104 header or the optional serial port enabling full control for almost any configuration.

The HESC104 has a built-in smart charging circuit capable of charging batteries supplied by Tri-M or any other source. It provides up to four stages of battery charging and can charge Lead-Acid, NiCd, or NiMH batteries and is also SMBus Level 3 compatible. Charge currents are up to 4 A, and battery charging voltages range from 9.5-19.5 VDC. The HESC104 can be programmed to shut down based on a user-defined set of conditions. Configuration software is provided to define battery charging curves as well as control shut down operation. Configuration settings are stored in an onboard EEPROM.

FEATURES:

- 60 W output
- Quad output voltage standard (+5V, +12V, -5V, -12V)
- 6-40 VDC input range
- Reverse polarity input protection
- High power, with smart charging and UPS functionality
- 9.5-19.5 VDC charging voltage
- Multi-stage charging for SLA, NiCd, and NiMH battery modules
- Advanced power management functions
- Extended temperature operation (-40 °C to +85 °C)
- PC/104 form factor (3.55" x 3.75")
- Also available in a serial control format (HESC-SER)

TRI-M SYSTEMS - ENGINEERING

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www.tri-m.com

For more info contact: info@tri-m.com

RSC #12901 @ www.mil-embedded.com/catalogrsc

Crane Aerospace & Electronics

Standard or Custom DC/DC Converters

FEATURES:

- Mil/Aero DC-DC converters 1-300 W
- Space DC-DC converters 5-120 W
- -55 °C to +125 °C operating temperature range for most products
- Available qualified to Class H or Class K of MIL-PRF-38534
- Associated converter products include EMI filters and hold-up modules
- 3.3-35 VDC outputs
- 5-270 VDC inputs

Crane Aerospace & Electronics manufactures high-density, high-reliability, microelectronics and power conversion products for the aerospace, space, military, medical, industrial, and commercial markets. We offer more than 1,200 off-the-shelf power conversion products in addition to custom manufacturing of microelectronics backed by more than 35 years of experience.

Our standard, off-the-shelf products feature DC/DC switching converters and EMI filters. These converters and filters are ideal for distributed power systems and point-of-use applications where light weight, small size, and high reliability are critical for program success. Inputs range from 5-270 VDC with power levels from 1.5-260 W.

Many of our DC/DC converters offer an on/off (inhibit) function to disable internal switching and a synchronization function to time the switching cycles to an external voltage.

Options for our standard products include flanged or unflanged packages, different lead configurations, and different screening levels. Most products operate over the full military temperature range of -55 °C to +125 °C. Screening levels can be as minimal as standard screening or as high-end as Class K (of MIL-PRF-38534) with a radiation hardness of R (will survive up to 100 k Rads).

For more information and to download our datasheets, visit www.craneae.com/135.

Crane Aerospace & Electronics is a segment of Crane Co. that includes ELDEC, General Technology, Hydro-Aire, Interpoint, Keltec, Lear Romec, P.L. Porter, Resistoflex, and Signal Technology, all major suppliers of critical aircraft and electronic systems and components. For more information on Crane Aerospace & Electronics, visit www.craneae.com and for Crane Co., visit www.craneco.com. Crane Co. is a diversified manufacturer of engineered industrial products.

CRANE
AEROSPACE & ELECTRONICS

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RSC #13001 @ www.mil-embedded.com/catalogrsc

Avalon Defense Ltd.

Power conversion
DC-DC converter

High Efficiency, Multiple Output, DC/DC Power Supplies

Avalon Defense builds DC/DC power supply modules for the military and industrial markets. All supplies operate with a nominal 28 VDC input (most operate with a 40 VDC maximum input). Avalon Defense offers single- and multiple-output DC/DC power supplies for embedded use. Power supply modules are available in SMT or through-hole packages. Temperature range is between -40 °C to +85 °C. These modules are constructed to survive abuse. Our power supply modules have been used in rocket programs and survived ground impact.

Our standard modules have the following voltages: 15, 12, 5, 3.3, 2.5, and 1.8 V. Current ratings for these supplies are up to 4 A per output. Custom outputs are also available.

FEATURES:

- Rugged construction; small footprint
- High-power/high-efficiency design
- Four output voltage modules available
- Up to 40 VDC input range
- Operation between -40 °C to +85 °C
- Input transient power protection and ESD protection (2 kV)

AVALON DEFENSE LTD.

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Tracewell Systems Inc.

Power conversion
Slot cards

Tracewell TTX400 24 VDC Input Power Supply

Tracewell's TTX power supplies are ideal for applications requiring dependable performance under harsh conditions. The TTX provides high-density (400 W in just 3U), high-efficiency, reliability, and control, all within one slot. The planar magnetic design is software controlled, enabling >80 percent efficiency and full power operation up to 60 °C. MOSFETs replace O-Ring diodes to reduce heat dissipation. Magnetics and MOSFETs have direct thermal contact with side-mounted heat sink for exceptional heat transfer and low airflow restriction, further improving reliability in harsh conditions. TTX can also be adapted for odd form factor or non-air-cooled applications including conduction or fluid.

FEATURES:

- Wide input range from 18-36 VDC for 24/28 VDC applications
- High current DC outputs include 5 V/30 A, 3.3 V/45 A, +12 V/5 A, and -12 V/1 A custom output options available
- Available in 3U up to 350 W and 6U at up to 700 W; optional two-slot design for low airflow applications
- Active monitoring for voltage, temperature, and output current with optional I2C control per IPMI v1.5
- Hot-swap compliant, single-wire active current share for up to eight supplies
- Conformal coat (optional)

Tracewell Systems

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tracewellsystems.com/products/PDF/TTX4003U1S24S.pdf
For more info contact: sales@tracewell.com

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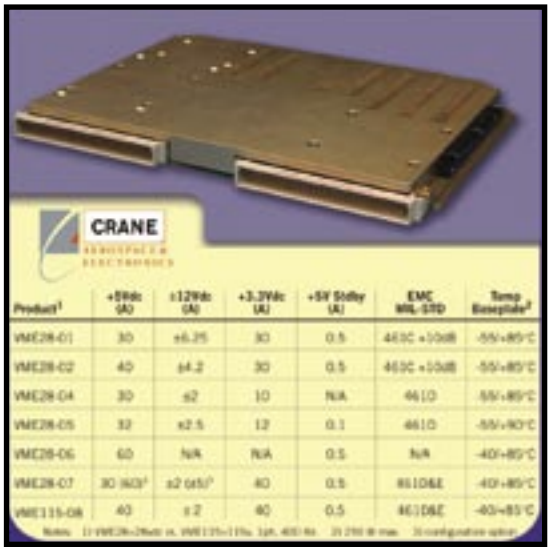
Crane Aerospace & Electronics

VME Power Solutions



Crane Aerospace & Electronics rugged, VME 6U-format, power cards offer the ultimate in power conversion dependability for your military, avionic, vetronic, and other high-reliability system needs. Extensive reliability growth testing is performed to assure the integrity of the design and manufacturing process. We use modular building blocks to offer you custom configurations with the maximum degree of flexibility.

Designed for military and aerospace applications, our power supplies operate using standard 28 VDC or 115 V, one-phase, 400 Hz input power and provide multiple output voltages.

Crane Aerospace & Electronics has a staff of highly skilled application engineers who will work with you in the event that additional modifications are needed to assure that your power system requirements are met.

Visit us at www.craneae.com/136.

Crane Aerospace & Electronics is a segment of Crane Co. that includes ELDEC, General Technology, Hydro-Aire, Interpoint, Keltec, Lear Romec, P.L. Porter, Resistoflex, and Signal Technology, all major suppliers of critical aircraft and electronic systems and components. For more information on Crane Aerospace & Electronics, visit www.craneae.com and for Crane Co., visit www.craneco.com. Crane Co. is a diversified manufacturer of engineered industrial products.

FEATURES:

- Standard VME (Eurocard) form factor
- 28 VDC input
- Multiple outputs
- Overcurrent/overvoltage protection
- Short-circuit protection for all outputs
- Operating temperature up to 85 °C without performance derating
- Conduction- or air-cooled
- Designed for military/defense and aerospace applications
- Custom configurations to your specifications
- Obsolescence management

CRANE
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RSC #13201 @ www.mil-embedded.com/catalogrsc

Military Grade VME Format Power Supplies

Pulse Electronics has been established for more than 25 years as innovators in the design, development, and manufacture of military-grade, high-efficiency, and robust power supply and power management systems utilized in the most discerning of applications within the aerospace, defense, and communication industries.

Most recent developments include the introduction of a range of rugged VME format power supplies engineered to meet the most demanding military and aerospace environments.

Housed in a single-slot, plug-in 6U package, the advanced design utilizes the benefits of leading-edge planar magnetics technology for optimum reliability consistent with a lightweight and low-profile outline.

The modular topology approach ensures optimum application flexibility by being factory configurable to offer optional AC/DC input and combinations of multiple power output configurations (5 V, ±12 V, 3.3 V, 5 V standby) to 500 W.

The high-efficiency concept utilizes conduction cooling with optional wedge-lock clamping, and all models carry full EMC qualification and environmental compliance to applicable Mil-Spec requirements.

Standard features include independently regulated and isolated outputs with enable and system reset functions. Protection features include overvoltage, overcurrent, overtemperature, undervoltage lockout, input failure, power transient, and reverse polarity.

Multiple system operation incorporates load sharing and dual redundancy integration.

Full data and specifications are available upon request from Pulse Electronics. The company is available to work with customers to ensure specific application, integration, and budget requirements are met.

FEATURES:

- Single-slot, 6U-standard VME outline
- Factory configurable for optimum application flexibility
- Conduction cooled with power output options to 500 W
- Optional wedge-lock clamping
- Leading-edge planar magnetics technology for optimum reliability
- Lightweight and low-profile outline
- 115/235 Vac single phase and 28 VDC input options
- Configurable multiple output options (5 V, ±12 V, 3.3 V, and more)
- -40 °C to +85 °C operating temperature range
- Integral extended "hold-up" capability
- EMC and environmental Mil-Spec compliance
- Complete system integration support

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For more info contact: davidblofield@pulse-electronics.co.uk

RSC #13301 @ www.mil-embedded.com/catalogrsc

Crane Aerospace & Electronics

Standalone Power Solutions

FEATURES:

- AC/DC converters
- Low-voltage power supplies
- High-voltage power supplies
- Avionics power subsystems
- TWT amplifiers
- Transmitters
- Obsolescence management

Crane Aerospace & Electronics meets the evolving needs of military aircraft avionics and electrical system manufacturers with rugged power solutions that hit the mark for lower costs, lighter weight, and higher reliability. From standard power supplies to custom designed power management and distribution systems, Crane Aerospace & Electronics has the proven military expertise to deliver what you need. Our products are used in electronic warfare, communications, missiles, smart munitions, radar, and ISR.

Crane Aerospace & Electronics companies are known for their technical strength, proven product reliability, innovative solutions, and overall value. Each company is ISO9001 and/or AS9100 certified. We are committed to operational excellence and world-class processes. From application engineering, through design and manufacturing, Crane Aerospace & Electronics offers a comprehensive approach to product specification, design certification, and service. New electronic manufacturing capabilities enable us to offer build-to-print solutions for microelectronics, cards, subsystems, and systems. So, whether you're looking for a standard or custom-designed military power solution, Crane Aerospace & Electronics has the proven experience to deliver what you need.

For more information, visit www.craneae.com/137.

Crane Aerospace & Electronics is a segment of Crane Co. that includes ELDEC, General Technology, Hydro-Aire, Interpoint, Keltec, Lear Romec, P.L. Porter, Resistoflex, and Signal Technology, all major suppliers of critical electronic systems and components. For more information on Crane Aerospace & Electronics, visit www.craneae.com and for Crane Co., visit www.craneco.com. Crane Co. is a diversified manufacturer of engineered industrial products.

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Medea Corporation

Medea's Ruggedized COTS RAID Shuttle Storage Solution

Medea's RAID Shuttle is the industry's smallest, ultra-high performance, ruggedized disk storage array. It offers 1.6 TB of formatted storage on removable ATA disk drives contained in a compact, shock and vibration protected enclosure that protects data integrity and capture rate capability in harsh environments such as mobile land, and airborne and high altitude settings up to 40,000 feet. It has been certified for airborne, shipboard, and off-road vehicle use. An optional hermetically sealed version is available for use in high-altitude unpressurized aircraft.

The Fibre Channel interface provides data transfer rates up to 200 MBps and sustained transfer rates of 180 MBps.

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www.medea.com
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FEATURES:

- The RAID Shuttle uses a rugged 3/4 ATR enclosure and is very compact at 7.62" (H) x 7.5" (W) x 12.52" (D)
- The Fibre Channel interface provides data transfer rates up to 200 MBps, and sustained transfer rates of 180 MBps
- The RAID Shuttle offers a rugged enclosure for about the same price as a commercial FC/SCSI array
- A real-time RAID algorithm for guaranteed bandwidth, even with component and drive failures
- A built-in, four-port, self-healing hub for multi-host connections
- Mil-Std AC or DC power supply

Megatel Computer Corporation

PCpi

The PCPi board is a rugged, full-featured Pentium class SBC. This board supports low-power Socket 7 processors and utilizes an ALI chipset, which provides both PCI and ISA buses. It is PC/104 compliant and 104Family I/O compliant. This board is available with a broad range of options that can be mixed in any combination to maximize performance and minimize price. Many options and base features are packed into this tiny board, all of which are combined into a small rugged package that is powered from either dual (3.3 V and 5 V) supplies to minimize onboard power dissipation, or from a 5 V option. The PCPi is designed for high-reliability applications with an operating temperature of -55 °C to +115 °C.

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FEATURES:

- Low-power Socket 7 processor up to 266 MHz; 32-256 MB SDRAM (soldered); Asiliant CRT and flat-panel PCI display controller
- Onboard watchdog and power monitors; onboard thermal monitoring gracefully throttles performance under high temperature conditions
- Error checking and correcting (ECC) memory option; flexible FSB speed (factory tailored to OEM application requirements)
- ATA/IDE UDMA 66 hard drive interface; CompactFlash storage compatible socket
- Frame-grabber with up to four channels of analog video input; touchscreen and Controller Area Network (CAN) controller
- 10/100Base-T or 10/100/1000Base-T (Gigabit) Ethernet; three USB, three Serial, one LPT, floppy, RTC, and all basic AT peripherals

Kontron

MilPAC

MilPAC is a fully sealed, high-performance portable computer designed for use in extremely harsh environments. Built to survive both military and industrial "lethal zones" – applications for which conventional rugged portables can't survive – this ultra-tough portable was developed to take the everyday punishment rugged portable computers are subjected to, in stride. The MilPAC is engineered to survive situations in remote field service, on-site maintenance, flightline systems analysis geophysical exploration, shipboard exposure, factory floor environments, and military deployments. Now part of Kontron Mobile Computing Division, Dolch Computer Systems joins one of the largest and leading embedded computer technology companies worldwide. Having access to the best rugged engineering groups in the world and more than 1800 employees worldwide, we can continue to provide our customers with ultra-tough and lightweight industrial computers, expanded support services, and high-performance portables.

FEATURES:

- Rugged construction
- Fully sealed case dust, drip and rain proof
- Three PCI open expansion slots
- 14.1" XGA TFT screen

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NotePAC

NotePAC is completely sealed from intrusion by water, salt-laden air, and blowing dust and dirt. It combines a high-strength cast-magnesium case and shock mounted components to form a portable platform that can withstand a shock load as might be experienced during rough transportation. The NotePAC has been thoroughly tested to MIL-STD 810F and IEC 529 to prove conformance to all design goals for shock and vibration loading. To ensure that the system meets all moisture and dirt intrusion requirements, it is certified to the stringent criteria of IP 54 set by the National Electrical Manufacturer's Association (NEMA) and the International Electrontechnical Commission (IEC). The fully rugged NotePAC is the world's most versatile and expandable notebook, offering the widest range of I/O ports and accessory upgrade ports in the industry. The NotePAC expansion module is the only fully rugged notebook to accommodate either two three-quarter-size PCI cards or two three-quarter-size ISA cards. Cutting edge engineering, ultra-rugged, all metal NotePAC can survive extreme environmental conditions. Now part of Kontron Mobile Computing Division, Dolch Computer Systems joins one of the largest and leading embedded computer technology companies worldwide. Having access to the best rugged engineering groups in the world and more than 1800 employees worldwide, we can continue to provide our customers with ultra-tough and lightweight industrial computers, expanded support services, and high-performance portables.

FEATURES:

- Sealed – NEMA 12 and IP 54 rated
- Rugged magnesium alloy casing
- Drop proof – 36" free drop to concrete
- Shock mounted components

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Rave Computer Association

SX2500 Aluminum Short Depth Rackmount Computer

Available early July 2005
The custom Rave System 1U Aluminum Short Depth (ASD) contains a Sun Microsystems® SPARC SX2500 motherboard, which features the latest UltraSPARC® IIIi dual processors that operate on Solaris 8 5/03 or later OS.

This low-profile system contains two 3.5" removable drive bays, slim line 5.25" DVD-ROM, and a 400 W power supply. The lightweight Rave System 1U ASD unit has the dimensions of 16.93" (W) x 1.70" (H) x 22.0" (D), with a projected weight of 25 lbs, which makes it easy to install into several military environments, including EMI cabinets on the Maritime Mine Countermeasure (MCM) and Coastal Minehunter (MHC) ships.

FEATURES:

- Motherboard: Sun® SX2500; Processor/Cache: 1.28 GHz UltraSPARC™ IIIi with 1 MB L2 external cache, and one or two CPU modules
- System memory: registered DDR PC2100 (ECC); Maximum: 16 GB, using eight 2048 MD DIMMS
- Expansion slots: one 64/32-bit PCI slot (allows full length cards)
- Standard interfaces: one 10/100/1000Base-T Ethernet port with rear panel RJ-45 connector
- SCSI: two dual channel ultra 160/320 SCSI ports; IDE: two ATA/100 IDE ports Serial: one serial port with DB9M connector
- USB: four USB 1.1 ports with ext. USB connectors, and three USB 2.0 ports (via opt. PCI card); Parallel: one port with ext. connector

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For more info contact: military@rave.com

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SKY Computers, Inc.

SMART Systems Family

The SMARTpac™ 600 and the SMARTpac 1200 are designed as complementary systems. The SMARTpac 600 is an ideal solution for processing an application's front-end data acquisition needs, while the SMARTpac 1200 provides the back-end horsepower for computationally intensive signal processing and image analysis. The 19" rack mountable SMARTpac systems utilize InfiniBand™ technology interconnect throughout the system yielding high bandwidth, low latency, and secure data communications.

FEATURES:

- Open standards-based
- Highly scalable architecture
- Linux, InfiniBand, MPI, VSIPL, and CORBA technologies
- Built-in system health monitoring and management
- Extensive software development tools
- High-speed/low-latency interconnect bandwidth

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Pinnacle Data Systems

Life-Cycle Management Solutions

Pinnacle Data Systems provides product life-cycle management services to global original equipment manufacturers. Over the past decade, Pinnacle has developed its expertise in the design, manufacture, and support of OEM computer solutions in mission critical industries. Specializing in high-density embedded computing platforms, Pinnacle has a proven track record and flexibility to provide solutions at each stage of the product's life cycle – development to deployment to End-of-Life. The goal of Pinnacle's product life-cycle solutions is to integrate the design, manufacturing, production, and support functions in a seamless process that enables our customers to bring higher quality products to market faster, as well as support and extend the life of their current product lines.

Pinnacle has been designing products to fill OEM's special needs for more than 16 years and excels at developing creative and cost-effective solutions. By utilizing a highly-educated and experienced team of design engineers to create custom products, Pinnacle's area of expertise ranges from simple accessory boards to large-scale ruggedized server systems. By combining the latest design tools and techniques with the most up-to-date technologies, Pinnacle can deliver and support custom yet cost-effective designs to its customer base.

Pinnacle also offers a variety of conformal coating services, providing environmental and mechanical protection to dramatically extend the life of mission critical systems and components. Conformal coating is useful for protecting circuitry in severe environments while maintaining a low stress environment for components and connections. Such conditions include extreme temperature and humidity changes and the demands of military and industrial applications. Pinnacle provides a thorough analysis of OEM-specific requirements and will develop a program to best meet your needs while providing coating services to military specifications. Pinnacle also has support programs that extend the warranty, service, and logistical support once the product has been coated.

FEATURES:

- Product life-cycle management services
- Custom design services
- Conformal coating services
- Regulatory certification services
- RoHS services
- Asset recovery/reverse logistics services

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For more info contact: info@pinnacle.com

Azonix, a Crane Co. Company

TC2500 Standalone Embedded Computer

FEATURES:

- Totally sealed NEMA 4 enclosure
- Transportable for mobile applications
- Extreme shock and vibration resistance
- Display is viewable in night light and bright sunlight
- Low-power design
- High level of EMI and RFI shielding
- Zone 1 HAZLOC certification, non-purged
- Embedded PC architecture
- Wireless communication capability reduces rig-up/rig-down time and cabling expense

Azonix, utilizing its core competency in certifying equipment for harsh and hazardous areas, is at the forefront of embedded PC control in extreme outdoor environments. The TC2500 benefits from more than a decade of experience in design and field use for ProPanel industrial workstations and controllers.

The TC2500 is a standalone embedded computer designed to fit remote terminal applications as a thin client or embedded controller. This hardware platform is built to survive mobile installations, where setup time is critical, and weather cannot be an obstacle. The system is light, thin, self-contained (sealed unit is self-cooling by radiant heat dispersion technology), and highly portable by hand (one-man carry with incorporated carrying handle). The TC2500 is designed to bring computer interface capabilities to locations that were previously unavailable because of installation difficulty or hazardous and harmful environments.

The TC2500 is powered by an embedded controller that can run a browser, Java applets, or other small applications over a .NET or Embedded XP operating system. It can run Ethernet or serial protocols, communicating via copper, fiber, or wireless. The unit can operate in extreme temperature and vibration conditions, and works with intrinsic safe peripherals, pointing devices, and external keyboards.

This is an Azonix designed and manufactured product. Azonix Corporation offerings include highly engineered computers and displays that are used for automation, as a user interface and command and control center at the optimum "point of attack," and COTS computers that have been rated for bridge control and other marine applications. We also offer ultra-rugged, intrinsically safe (for hazardous areas) wintel computers, displays, data acquisition and control, and communication platforms that include high-security wireless and cabled Ethernet networking technology.

For additional information, visit www.craneae.com/138, contact our Houston Business Center at 800-950-2382 (832-251-8800), or e-mail Dani Alkalay at dalkalay@azonix.com.

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Embedded Computing Module (ECM)

Kontron's ECM is a low-power, high-performance, Intel Pentium M-based Embedded Computing Module. Meeting Mil-Std 810F ratings for shock, vibration, humidity, water, and temperature, the ECM features a solid, rugged, cast magnesium alloy construction to protect internal subsystems. The ECM is designed specifically for the OEM who requires a small form factor rugged PC engine for their application-specific solution.

The ECM's small footprint makes it ideal for body-worn and in-vehicle embedded applications. The ECM was designed to allow OEMs to develop easy custom I/O that tailors the end product to the application.

You can design your own full-featured embedded PC to power your OEM systems, but it's complicated, expensive, and requires specialty engineering, testing, and packaging. The ECM lets you skip expensive and time consuming steps in the product development process allowing you to move faster to trial, marketing, and selling.

Kontron offers a full-featured development kit including an ECM and two I/O interface modules with PC-Card, serial, USB, parallel, Ethernet, FireWire ports, and others, to allow rapid system prototyping and testing.

FEATURES:

- Hardware
  - Small, lightweight, military rugged design
  - Water, shock, and vibration resistant
  - Low power, high performance
  - Removable hard drive, 802.11 b/g wireless connectivity
  - Modular I/O designs
- Applications:
  - Embedded in-vehicle communications
  - Body-worn, test measurement, maintenance, and communications
  - Surveying
  - Aviation telemetry
  - Situation awareness
  - Surveillance
- Deliverables:
  - Engineering specifications to field trial in 30-60 days
  - 50 percent reduction in development time and costs
  - Military standard rugged enclosure
  - High-performance, small form factor PC

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Quantum3D, Inc.

THERMITE™ Tactical Visual Computer

THERMITE is the first COTS, PC-compatible embedded system designed for man-wearable and vehicle-based deployed C4ISR, C2, mission planning, training, maintenance, and surveillance applications. THERMITE features a lightweight sealed alloy case, Mil-Spec connectors, advanced power management, 1 GHz mobile CPU, 512 MB memory, shock resistant or solid state hard drive, advanced 2D/3D graphics with video capture support, and comprehensive I/O including Mil-Std-1553B and IEEE 802.11. Designed for WinXP or Linux-based applications where small size, long battery life, and performance is critical, THERMITE delivers workstation graphics and video capabilities where they're needed most.

FEATURES:

- COTS, wearable Tactical Visual Computer for C4ISR, C2, mission planning, training, maintenance, and surveillance applications
- Open architecture, PC-compatible system with flexible, wireless/wired I/O options; supports Linux® and Microsoft® Windows®XP
- Lightweight, compact, sealed alloy case with Mil-Spec connectors and conduction cooling for extended environment operation
- Advanced power-saving technology with clock throttling and discrete power-down for long battery life and continuous field use
- NVIDIA® GeForceFX® Go 5200 Mobile GPU with 64 MB; supports stereo and dual VGA and NTSC, PAL, S-Video, and RS-170A outputs
- Video-capture with support for color space conversion, scaling, and overlays for NTSC, PAL, S-Video, and RS-170A formats

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RSC #14202 @ www.mil-embedded.com/rsc

Cool RoadRunner 4

The Cool RoadRunner 4 provides embedded PC applications with the computing power of the Pentium M processor. Even military applications can profit from this high-performance processor when using this PCI-104 module. The PCI-104 definition specifies a board format with a size of only 3.55" x 3.775" and uses the PCI bus for system expansion. The Cool RoadRunner 4 is a complete single board computer with all relevant peripherals built right into it, so it does not need additional boards. Especially interesting for deployment in rough environments is the fact that the 1.4 GHz version of the Cool RoadRunner 4 may be passively cooled, thus eliminating the need for mechanical moving parts. Passive cooling can be realized in two ways, either using a heatsink directly on top of the processor, or mounting a heat spreader. Given proper mechanical design, the latter enables distribution of the heat to the computer's enclosure. The module is optionally available for an extended temperature range of -40 °C to +85 °C and needs only to be passively cooled at 1.4 and 1.0 GHz.

The Cool RoadRunner 4 combines Intel's Pentium M processor with the 855GME chipset. This chipset features a fast graphics engine and provides outstanding graphics performance for embedded computer applications. Its display controller uses up to 64 MB of shared memory and handles two independent displays, which support resolutions of 2048 x 1536 pixels. In addition to ordinary SVGA-monitors, TFT flat panels can be connected using the dual channel LVDS interface.

Six USB 2.0 host ports are also integrated and allow easy addition of peripheral devices. There is a 1000Base-T Gigabit Ethernet controller integrated onboard for network connectivity. Sound I/O is realized with a standard AC-97 codec. The ATA-100 compliant EIDE interface enables connection of standard hard disks or other storage devices. The main memory can be expanded up to 1 GB using suitable DDR-333 SODIMM modules.

Troubleshooting is easy with supervision LEDs for power, watchdog, Ethernet, and life signalization on the module. The Cool RoadRunner 4 is currently available with 1.4 and 2.0 GHz processors.

FEATURES:

- Intel® Pentium® M 755/738 processor at 2.0/1.4 GHz
- Intel® Celeron® M 373 processor at 1.0 GHz
- Up to 1 GB DDR-333 SODIMM RAM for demanding memory requirements
- Intel Extreme Graphics 2 with 2D and 3D capabilities; resolution up to 2048 x 1536 pixels
- Standard VGA adapter as well as dual channel LVDS for displays
- 1000Base-T Gigabit Ethernet enables very fast data transport over the network
- 6 x USB 2.0 host ports for easy addition of peripherals
- Low power consumption: Only ~14 W when using the 1.4 GHz processor
- Passive cooling is possible, either with heatsink or heat spreader
- Extended temperature range of -40 °C to +85 °C is optionally available for the 1.4 and 1.0 GHz processor versions
- Watchdog for system supervision
- AC97 compatible sound I/O
- Supervision LED for power, watchdog, Ethernet, and life signalization

LiPPERT the embedded PC Company

Hans-Thoma-Strasse 11
Mannheim , 68163
Tel: +49-621-432140 • Fax: +49-621-4321430
www.lippert-at.com

For more info contact: info@lippert-at.com

LiPPERT GmbH

Cool FrontRunner

The Cool FrontRunner is designed as a very low power, rugged embedded PC module. It is a complete single board computer built in compliance to the PC/104-*Plus* standard. This standard defines computer boards with a size of only 3.55" x 3.775" and both bus systems, ISA and PCI, respectively. The module draws only 5 W from a single 5 V power supply, thus making extensive cooling unnecessary. Together with the soldered RAM chips and the optional extended temperature range, the Cool FrontRunner is very well suited for harsh environments, which are typical for military applications.

The Cool FrontRunner is powered by an AMD Geode GX 500 processor @1.0 W, running at 366 MHz. Teamed with the CS5535 I/O companion chip that has many standard peripherals already integrated, and a Super I/O chip, it effectively resembles a complete PC system. Either VGA monitors or digital TFT displays (18-bit parallel or 24-bit LVDS), selectable via jumper or BIOS settings, can be used.

The Cool FrontRunner features all standard peripherals: There are four USB 1.1 ports, IDE, PS/2 keyboard, PS/2 mouse, and LPT. Three serial ports are integrated onboard, two of them can be configured by software to conform to either the RS-232 or RS-485 standard, the third is RS-485 only. The built-in, real-time clock is buffered with an integrated GoldCap. There are eight freely usable GPIO pins for application defined signals available on a cable connector. A Fast Ethernet controller is provided for networking. Sound I/O is provided with an AC-97 codec. An ATA-66-compliant EIDE interface enables connection of standard hard disks, CD/DVD drives, or other devices such as CompactFlash adapters. A DIL32 DiskOnChip socket is also integrated.

The Cool FrontRunner is available with either 128 MB or 256 MB of onboard RAM. Troubleshooting is made easy with supervision LEDs for power, watchdog, Ethernet, and life signalization on the module. The PC/104 and the PC/104-*Plus* buses enable system expansion with many commercially available peripheral I/O boards.

FEATURES:

- AMD Geode™ GX 500 @ 1.0 W Pentium compatible processor, running at 366 MHz
- 128 or 256 MB RAM soldered to the board
- DiskOnChip 2000 socket
- Display adapters for VGA and TFT
- Fast Ethernet 10/100Base-T
- Four USB 1.1 host ports
- Three serial ports with RS-232/422/485 protocols
- Eight programmable general-purpose I/O
- Supervision LED for power, watchdog, Ethernet, and life signalization
- Power consumption: a mere 5 W at 5 V only
- Passive cooling – no fan required
- Extended temperature range of -40 °C to +85 °C optionally available

Hans-Thoma-Strasse 11
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Tel: +49-621-432140 • Fax: +49-621-4321430
www.lippert-at.com

For more info contact: info@lippert-at.com

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SBS Rugged Systems–Designed to Thrive in Harsh Environments

Ruggedized systems from SBS Technologies include advanced vehicle computers, rugged chassis, and rugged electronic boards and components for use in military and space systems. Our advanced computing platforms are designed to meet the challenges of extreme temperatures, shock, vibration, EMI, and G-forces.

SBS Rugged Systems provide robust, yet highly flexible COTS computing platforms suited for a wide variety of avionic, vetronic, and navtronic applications where complete reliability and immunity to extreme environmental conditions are required.

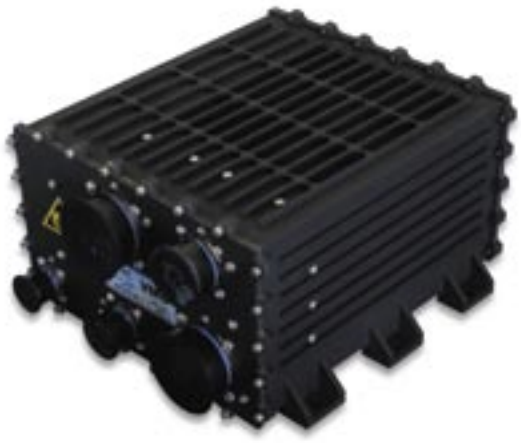
Featuring ruggedized computing platforms in VME and CompactPCI formats, SBS systems are available in dozens of standardized configurations. These systems include ruggedized chassis with integrated processor, I/O, and signal processing subsystems, as well as expansion slots and rugged power supplies.

SBS also provides custom integration to quickly create a custom design based on our extensive product portfolio. A custom design might involve minor adjustments to standard systems and boards, or it could include customized interfaces, platforms, and configurations. We also offer development support and advance prototypes.

SBS ruggedized systems are based upon VME and CompactPCI backplanes.

AVC-3000 Series
Our AVC-CPCI-3000 Series systems are based around one to three CompactPCI 3U-form-factor single board computers and I/O boards. They feature casings that are both strong and lightweight. At their core, a robust COTS power supply and ruggedized single board computer integrate with other CompactPCI modules to deliver reliable, cost-effective performance.

AVC-6000 Series
Our AVC-6000 Series systems are based upon VME and CompactPCI 6U-form-factor single board computers and I/O boards. They feature rugged casings that are both strong and lightweight and are based upon ruggedized single board computers and I/O boards.



FEATURES:

- AVC-CPCI-3000 Series Advanced Vehicle Computers are based upon CompactPCI 3U systems:
  - 3-14 CompactPCI 3U slots
  - 65-300 W rugged power supply
  - PPC or Intel-based SBC(s)
  - Flexible I/O options
- The AVC-CPCI-6001 Advanced Vehicle Computer is based upon a CompactPCI 6U system:
  - Eight CompactPCI 6U slots
  - 450 W rugged power supply
  - PowerPC-based SBC
  - Flexible I/O options
- AVC-VME-6000 Series Advanced Vehicle Computers are based upon VME 6U systems:
  - 5 VME 6U slots
  - 150 W-300 W rugged power supply
  - PPC or Intel-based SBC(s)
  - Flexible I/O options

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Albuquerque, NM 87110
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Tactronics

Generation III CROW

Information system reliability and security is a major component of success on the battlefield. This is one of the guiding principles behind Tactronics' Generation III CROW computers – ultra-rugged, man-portable computing devices that can be counted on under any circumstances.

These easily deployable computers have all the power and speed (1.6 GHz) needed to support an extensive array of connections, including 10/100Base-T Ethernet, Serial, USB, and two kinds of video (VGA and LVDS). Combine this level of connectivity and computational ability with a low power consumption (< 35 W) and a gigabyte of high-speed RAM in a lightweight shell, and the result is a personal, mobile data center able to access, process, and relay crucial information using advanced applications such as live video, image capture, and GPS.

CROW computers feature either one (1) fixed and one (1) removable high-speed, 60 GB hard disk drive (CROW 2000 model), or two (2) removable 60 GB drives (CROW 3000 model). This removable hard drive design allows the CROW units to be instantly declassified with the push of a button.

Like all Tactronics' products, the CROW units are as tough as they come. Milled from solid aluminum alloy, the CROWs are engineered to meet or exceed military standards for shock, vibration, pressure, and temperature extremes, as well as resistance to electromagnetic interference. Fully-gasketed and fitted with positive locking, weatherproof cable connectors, these devices are also impervious to rain, wind, fog, and other environmental assaults.

Tactronics' Generation III CROWs are mobile computers with the muscle to drive advanced applications and the toughness needed to give units in the field that critical strategic edge in combat zone intelligence and situational awareness.

FEATURES:

- Solid Billet 6061-T6 aluminum alloy chassis
- 1.6 GHz high-speed processor
- 1 GB high-speed RAM
- 60 GB (7200 RPM) removable hard disk drives
- Lowest power consumption in the industry (< 35 W)
- Built-in internal voltage regulation and wide input voltage range
- Transient power surge and reverse polarity protection, and EMI suppression
- MIL-SPEC D38999 Series III external cable connectors
- Submersible to 1 m for one hour
- USB, dual-speed Ethernet and serial connectivity
- VGA and LVDS video output
- Completely customizable based on user requirements

Tactronics
Failure is Not An Option™

381 Old Riverhead Road, Suite 12
Westhampton Beach, NY 11978
Tel: 631-288-0264 • Fax: 631-288-8659
www.tactronics.com

For more info contact: sales@tactronics.com

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SPIRIT Hawk-12.8K – High Speed Data Modem Solution

SPIRIT Hawk-12.8K is a complete software and hardware product implementing High Speed Data Modem Functionality (HF). It's fully compliant to MIL standards for waveforms and functionality including MIL-STD-188-110A/B (39-tone parallel waveform), STANAG 4539, and STANAG 4415.

An additional PC software package, in a combination with the modem above, provides a complete e-mail-over-HF solution. The solution utilizes the STANAG 5066 protocol stack and supports both the HMTP and CFTP style of e-mail transfer. SMTP interface is provided so that industry standard e-mail clients can be used (such as Outlook and Outlook Express). Other STANAG 5066 clients, such as HFChat and the IP Client, are also supported.

FEATURES:

- Up to 12,800 bps operation
- Single-channel, full duplex operation capable (as required by MIL-STD-188-110B paragraph 5.3.1.4.4)
- Modem remote control port to allow control of waveforms, data rates, interleavers, and other operational parameters
- Capable of independent receive and transmit data rates to handle propagation differences or available power levels between stations
- Can be used in both mobile and fixed station installations
- Provides fully automatic data rate change control (DRC) to optimize the data rate to the channel conditions

SPIRIT DSP
Embedded Voice Experience

R & D center – 27, B. Kommunisticheskaya
Moscow, 109004
Tel: 7-095-912-7024 • Fax: 7-095-912-7103
www.spiritdsp.com
For more info contact: biz@spiritdsp.com

SPIRIT
Sensors and RF
Wireless

SPIRIT Eagle-64K Modem

The modem is intended for voice/data communication over a satellite channel for mobile and airborne applications requiring high dynamic capability.

A proprietary waveform design and latest signal processing technologies provide robust communication under severe propagation conditions in the multi-ray and fast-fading environment, targeted for airborne communication and mobile vehicle installations. Multi-ray tolerance allows use of omnidirectional antennas instead of high-precision satellite tracking units.

Proprietary "instant lock" technology guarantees fast link establishment at big Doppler frequency shifts (up to 12 kHz) and provides exceptional robustness to signal losses.

FEATURES:

- Provides voice/data communication over satellite channel for mobile and airborne applications requiring high dynamic capability
- Ensures robust communication under severe propagation conditions in the multi-ray and fast-fading environment
- Multi-ray tolerance allows use of omnidirectional antennas instead of high-precision satellite tracking units
- SPIRIT "instant lock" technology enables fast link establishment at big Doppler frequency shifts and robustness to signal losses
- Proprietary waveform provides high channel selection and robustness to noise, interference, and frequency selective jams
- Can be equipped with SPIRIT proprietary vocoders (1200 to 8000 bps) for digital voice communication without external hardware

SPIRIT DSP
Embedded Voice Experience

R & D center – 27, B. Kommunisticheskaya
Moscow, 109004
Tel: 7-095-912-7024 • Fax: 7-095-912-7103
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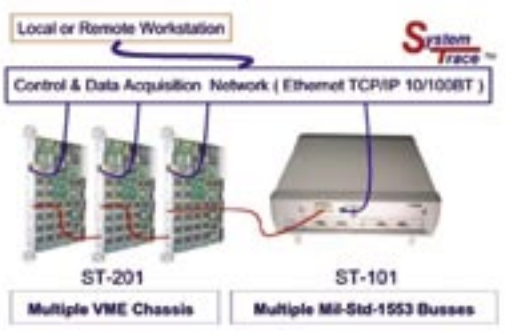
For more info contact: biz@spiritdsp.com

ITCN

ST-201 VME Backplane & ST-101 1553 Data Bus Monitor/Analyzer



SystemTrace has been designed to provide global visibility into system operation by monitoring key "data flow" in multiple, dissimilar data streams incorporated in embedded systems. This monitoring is accomplished using Real-Time Non-Intrusive (RTNI) techniques so that the act of monitoring does not affect the system operation. The data files collected "synchronously" at the key dataflow points are "time-correlated" so that dependencies on actions among system elements can be observed.

SystemTraceTM has a networked architecture that incorporates distributed monitor modules for VME backplanes, Mil-Std-1553 data busses and future additions. A feature is also included to time-correlate the software execution in the system's processing units to the data in the heterogeneous data streams.

These modules can be distributed throughout the Embedded System and over different physical locations. SystemTraceTM can take the form of laboratory instruments or on-board monitors with man-machine interfaces supporting operational functions. SystemTrace™ is:

– Scaleable
– Distributed
– Synchronized
– Adaptable to different data media
– Able to simultaneously monitor multiple dissimilar data streams in real-time
– Monitor and time-correlate software execution events with other system events monitored in separate data streams – Uses a common Graphical User Interface(GUI) for setup, run-time presentations and post-run analysis

The SystemTrace ST-201 VME Backplane Monitor/Analyzer is capable of monitoring and recording activity on all four VME backplane buses (Data Transfer Bus (DTB), Arbitration Bus, Interrupt Bus, and Utility Bus). This feature enables the analysis of data transfers between processors or any other device that participates in data transfers and VMEbus arbitration. VME protocol interactions can be analyzed by specifying operations on the Arbitration, Utility, and Interrupt Buses as "Events" for the module to monitor and record.

Any specific operation or group of operations on the bus can be recorded by setting up the module to identify them as Events and selecting the Recording Action.

FEATURES:

- Simultaneous, real-time, non-intrusive monitoring of up to 32 unique nodes (any combination of VME and/or 1553)
- Richly featured Windows GUI for setup and analysis of 32 SystemTrace modules
- Long-term data acquisition and storage via SystemTrace host module
- Time-correlated data collection
- Up to 256 unique Events collected per session
- Local or remote setup and control via 10/100Base-T TCP/IP
- Runtime data displays
- Eight cross module triggers
- Complex triggers and filters (64 Level State Machine)
- Programmable and reusable data collection scenarios
- Open data interface
- Post-run analysis software

591 Congress Park Drive
Dayton, OH 45459
Tel: 937-439-9223 • Fax: 937-439-9173
www.itcninc.com

For more info contact: sales@itcninc.com

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Signametrics Corporation

SMX2064 7-1/2 Digit Multifunction Digital Multimeter

Only Signametrics' DMMs and Instrumentation Switching Modules deliver full system accuracy. Other PXI and PCI switches degrade measurement system performance to 3-1/2 or 4-1/2 digits.

The SMX2064 Multifunction Digital Multimeter has:
- 7-1/2 digits resolution
- Very high accuracy
- High measurement speed
- Flexible triggering facility
- A wide range of measurement functionality

The SMX4032 Relay Multiplexer features:
- Very low leakage currents and capacitances
- Very low thermal voltages
- Very low noise and high bandwidth

It is virtually the only PXI multiplexer card that maintains the full accuracy of a 6-1/2 or 7-1/2 digit multimeter.

FEATURES:

- Full line of digital multimeters ranging from cost-effective 5-1/2 digits to high-performance 7-1/2 digit multifunction
- SMX2064 7-1/2 Digit Multifunction Multimeter has very high accuracy, high speed, and flexible triggering
- SMX4032 Instrumentation Relay Card routes high accuracy signals to 6-1/2 or 7-1/2 digit multimeters with full signal integrity
- Relay switch cards integrate seamlessly with digital multimeter cards
- The product line is fully supported and compatible with virtually any software running under Windows or Linux

Signametrics
6073 50th Avenue, NE
Seattle, WA 98115
Tel: 206-524-4074 • Fax: 206-525-8578
www.signametrics.com
For more info contact: sales@signametrics.com

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VMETRO Transtech

Vanguard VMEbus Analyzer, Exerciser, & Protocol Checker

Vanguard VMEbus Analyzers debug, test, and validate next-generation VME boards and systems. This analyzer captures and displays up to 2 M samples of bus activity at rates up to 133 MHz using powerful trigger and store qualifiers, and offers extensive system performance measurements. The exerciser emulates master or slave devices and offers a script engine. The protocol checker detects 60 protocol errors and operates concurrently with all other functions.

The analyzers are controlled via Ethernet or USB from a PC running Windows and VMETRO's BusView graphical user interface. The Ethernet port allows connection to Vanguard analyzers anywhere that a network connection is available.

FEATURES:

- Supports VME, VME64, 2eVME, and 2eSST
- 2 M sample trace buffer at 256 bits
- State and timing analysis
- Concurrent and independent operation of all functions
- Automatic protocol checker
- Advanced exerciser with master, slave, system controlller, and interrupt generator

VMETRO TRANSTECH
1880 Dairy Ashford, Suite 400
Houston, TX 77077
Tel: 281-584-0728 • Fax: 281-584-9034
vmetro.com
For more info contact: info@vmetro.com

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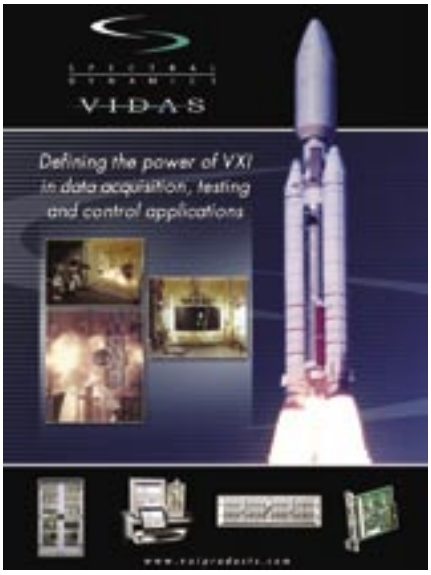
Spectral Dynamics ARPG

SD-VXI High Performance Shock/Transient Test Systems



VIDAS system solution: Spectral Dynamics, Advanced Research Products Group (ARPG™) proudly offers VIDAS™ (VXI Data Acquisition System), a high-speed, high-performance VXI hardware and software solution. VIDAS combines dynamically scalable channel count with the versatility and features you want, plus the performance you need for complex testing. Our products offer superior fidelity and excellent channel-to-channel phase match for the most accurate measurements in the industry.

System overview: Our VIDAS systems incorporate modular, VXI instrumentation and a fully integrated WinXP® native software package called IMPAX-SD™. It uses build-on-demand database technology to automatically manage and configure your testing environment for measurement, control, reporting, and correlating data timing for high-speed testing applications. IMPAX-SD ™ eliminates manual setup/calibration operations, gives lightning fast data display, and instant review to reconfigure your test on-the-fly. ARPG™ offers turnkey solutions, custom engineering, or system components for build-your-own system solutions.

Applications:

- Acoustic shock measurement
- Explosive shock studies
- Electromagnetic propulsion research
- Rocket testing
- Aircraft power system testing
- Component test stands
- Calibration labs
- Gas turbine testing

Who we are: ARPG offers more than 30 years of data acquisition experience and component level high-speed transient recording solutions. Our customers range from military, aerospace, government labs, and educational institutions to commercial industrial applications.

The buck stops here: SD-ARPG is a premier single source vendor providing consistency in concept, design, integration, and support. We are an experienced turnkey system supplier that provides application support throughout the entire process. Call us today at 510-252-0475 or visit us at www.vxiproducts.com.

FEATURES:

- Up to 1024 independent channels, modular, scalable design; 1 M differential inputs with excellent channel-to-channel phase matching
- Full bandwidth flat response: 0.1 dB DC to 1 MHz, 2.3 MHz @ 3 dB; programmable input range steps: 3 dB differential, 6 dB single-ended
- Up to 5 M samples/sec/ch sample rate, independant Sigma Delta ADC/channel; 8-channels/card; auto-tracking, anti-alias filtering
- Incremental bandwidth licensing down to 50 kSps enables future growth path plus cost savings on initial system
- Five trigger sources per card: VXI bus trigger, external, software, real-time, and data flow, includes trigger qualification
- Pre- and post-trigger recording, multi-event recording; gated mode for burst recording, dual clock rate data recording
- Parallel load snapshot data FIFO on each channel for system-level snapshot in time; deep data memory up to 128 MS/ch
- Built-in full bridge conditioning and constant voltage excitation for each channel; automated end-to-end setup/calibration
- Passive Input Panel System (PIPS) or Smart Interface Panel System (SIPS) for simplified user interface and site wiring
- PIPS/SIPS accommodate special function signal conditioning requirements: bridge completion, constant voltage/current
- Portable and 19" rack-mount, high-powered VXI instrumentation chassis and other system integration items available
- IMPAX-SD System Configuration Control Software supports remote application control with named pipes or socket server

VIDAS
Spectral Dynamics

4424 Technology Drive
Fremont, CA 94538
Tel: 510-252-0475 • Fax: 510-252-0474
www.vxiproducts.com

For more info contact: remelmanm@sd-star.com

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Make Obsolescence a thing of the past...

Geotest
Marvin Test Systems, Inc.
www.geotestinc.com

Marvin Group

...with Geotest's Obsolescence Replacement Solutions.

Geotest - Marvin Test Systems, Inc., provides cost-effective alternatives to sustaining legacy Automatic Test Equipment that is no longer supported by the manufacturer. We offer 100% Form-Fit-Function drop-in replacements for obsolete GPIB instruments manufactured by HP, Wavetek, Tektronix, and more. These new instruments have the same physical size and specifications as the original equipment, making replacement a hassle-free solution.

Geotest also offers complete system replacement solutions for Summation (Fluke) SigmaSeries test systems. The PXI-based components include direct replacements for many Summation SigmaSeries cards, which along with ATEasy Test Executive, allows existing Test Program Sets to be transitioned with minimal effort.

BENEFITS OF GEOTEST OBSOLESCENCE REPLACEMENTS:

- Reduces ongoing maintenance and repair costs while decreasing downtime
- Solves incompatibility issues as Geotest replacements respond to the original GPIB command set
- Provides long-term, reliable solutions
- Technical assistance available online or direct from our knowledgeable support team

To receive a free copy of our Obsolescence Replacement Solutions brochure, call our Customer Sales Support team at the toll free number below.

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By Eli Shapiro

CARRIER BOARD: PMC

Pentek

Website: www.pentek.com
Model: 7131-702 **RSC No:** 20561
A 16-channel multiband digital receiver with dual 14-bit, 105 MHz A/Ds • Four quad multiband digital receiver chips driven by the samples from both A/Ds • Equipped with either XC2V1000 or XC2V3000 FPGA devices from the Xilinx Virtex-II family, with logic densities of one or three million gates, respectively • Operating temperature range of –20°C to +65°C • Qualified for 20 g shock and 2 g sine vibration • Optional conformal coating extends operating range to 100 percent relative humidity and protects the board from environmental contaminants


RSC 20561

DATACOM: GENERAL

North Atlantic Industries

Website: www.naii.com
Model: 64D1 RSC No: 20608
A 3-module, single-slot, multifunction VME communications card • Includes three combinations of the following: Six channels off synchronous or asynchronous RS-232C/RS-422/RS-485, two channels of dual redundant MIL-STD-1553 BC/RT/MT, eight channels of ProfiBus

ENCLOSURE + CARD RACK

Aitech

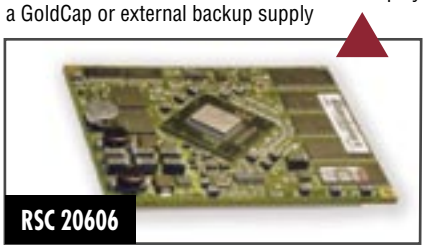
Website: www.rugged.com
Model: E118 **RSC No:** 20605
A rugged, single-slot chassis enclosure for 6U VMEbus or CompactPCI single board computers • Capable of withstanding extreme environmental conditions of altitude, temperature, humidity, shock, vibration, EMI/RFI, and chemical exposure • Machined from 6061-T6 aluminum • Available with captive fasteners, helical wire-rope-type shock and vibration isolators, and mounting brackets for hard-mounted configurations suitable for cold-plate applications • Finish treated for corrosion and fungus resistance • Fully sealed Faraday cage and complete EMI/RFI power line filtering • Built-in power supply • Operating temperature from –46°C to +71°C at 5 percent to 95 percent relative humidity with condensation • MIL-STD connectors for input power and I/O are all located on one side of the enclosure


RSC 20605

PROCESSOR: POWERQUICC

Dynatem

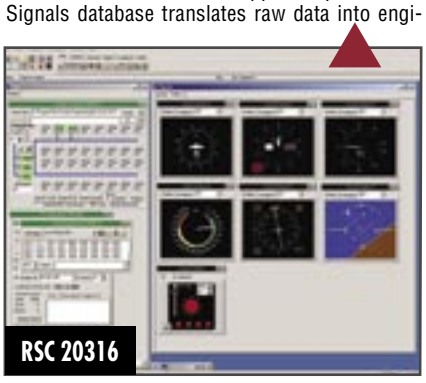
Website: www.dynatem.com
Model: PM854 **RSC No:** 20606
A small Computer-on-Module (COM) that makes all the features of the Freescale PowerQUICC MPC8540 available for custom design • Complete, autonomous industrial computer that makes all MPC8540 I/O signals available; all signals are routed to high-density connectors on the carrier board • MPC8540 with Embedded e500 Book E compatible core at up to 1 GHz • Up to 512 MB of DDR SDRAM with ECC support • 64 MB of Flash memory • Disk-On-Chip option supports up to 1 GB of ATA-Flash • Includes an RTC backed up by a GoldCap or external backup supply


RSC 20606

PROTOTYPING AND DEBUGGING: BUS ANALYZER

Condor Engineering

Website: www.condoreng.com
Model: BusTools/GSS **RSC No:** 20316
A simulation and analysis tool designed for systems integration environments and other development and test environments that require graphical representation of complex, multi-protocol bus data • Simultaneous support for MIL-STD-1553, ARINC 429, and STANAG 3910 within a single software environment • Abstracts board-level APIs to a common environment syntax • Provides a flexible project/work book/work page structure, and signal database (ICD information) import/export capability • Provides a structured generic interface for each of the supported protocols • Signals database translates raw data into engineering units, which can be based on standards or can be defined by the user • Variety of signal tools for displaying data, including gauges, stripcharts, input devices, typical aircraft instruments, and others • Provides support for VBScript


RSC 20316

TURNKEY SYSTEM

Getac

Website: www.getac.com
Model: M220 **RSC No:** 20604
A rugged notebook with a 14" screen • Meets or exceeds IP54, IEC529 and 68, as well as MIL-STD-810F and 410E • 1/4 GHz Intel Dothan LV processor (Pentium M) with Centrino Mobile Technology • Up to 2 GB of DDR SDRAM • 64 MB of shared video RAM • 400 MHz FSB • Available with 40, 60, or 80 GB quick-swap hard disk drives, and a variety of optical drives • Available with Enova X-Wall 40-bit real-time cryptographic gateways incorporated into the motherboard, ensuring that data encryption does not degrade system performance • Windows XP or Linux operating system support


RSC 20604

Kontron

Website: www.kontron.com
Model: ECM **RSC No:** 20607
A ruggedized, small-form factor PC engine for high-performance, application-specific mobile systems • Measures 6.5" (L) x 4" (W) x 1.8" (H) • Light weight and small enough for body-worn systems • Third-party, MIL-STD-810F certified packaging • 1.4 GHz Intel 738 Pentium M processors with 2 MB cache • Up to 1 GB of DDR SDRAM • Integrated Intel Pro Wireless 802.11b/g wireless networking capability • Removable 40 or 60 GB hard drive • Low EMI design • One docking connector for managing all I/O devices, including a full PCI bus


RSC 20607

For further information, enter the product's RSC# at www.mil-embedded.com/rsc

High five! The new G4DSP-XE from Radstone

Five reasons to celebrate:

Massive signal and data processing performance thanks to quad MPC 7447 compute nodes.

Huge node-to-node bandwidth thanks to the ultra-fast AccelerX loosely coupled PCI-X architecture. PMC sites are bridged from the AccelerX ring for maximum internal data speeds with no degradation.

Ultra Quick interprocessor messaging thanks to separate compute node interfaces into a central hardware message-passing accelerator.

Scalability guaranteed by two StarFabric ports at P0, plus four Gigabit Ethernet ports for additional I/O.

Superior software support including VxWorks, LynxOS, Integrity, VSIPL, Radstone Message Passing Library (RMP) and built-in-test (BIT).

The Radstone G4DSP-XE
The unbeatable choice for fast effective multi-processing.

RADSTONE
EMBEDDED COMPUTING

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A fresh start for ongoing programs

By Chris A. Ciufo

Welcome to the premiere issue of *Military Embedded Systems* magazine. You're one of the lucky 15,000 people who are receiving the industry's newest publication focused exclusively on the embedded technology used by military decision makers. Our readers are a varied bunch and range from hardware, software, and systems engineers to project and program managers. In all cases, the common denominators between you all are:

- Embedded technology
- Military programs
- Long life-cycle requirements
- A system-level view to problem-solving

Embedded technology takes on many forms, ranging from Intel's latest Pentium M 32-bit microprocessor to greater than 1 Mbps MIL-STD-1553 chipsets, to Microsoft's variant Windows.CE Portable Media Center. In par, the US military is "drafting" closely behind the leading edge products offered to consumers and businesses, such as digital cameras, home entertainment systems, enterprise software, automobile navigation devices, and more. That's because with less than 0.5 percent of the world's semiconductor consumption, the military looks predominantly to other markets to feed its need for embedded technologies. Much of the technology that appeals to the Department of Defense (DOD) is available as Commercial Off-the-Shelf (COTS) product, but some of it is purpose-built and program-specific.

Our readers look at the world from a program-specific viewpoint. Whether committed to a program or bidding on one, working in a laboratory on primary research, or awaiting funding for System Development and Demonstration (SD&D), you probably make your decisions from program to program. As editors, we understand program funding requirements, color of money issues, technology insertion, spiral development, and long life cycles. In fact, long life cycles are not just a component of technology selection in military programs, they are the *fundamental* requirement – usually more important than cost. Keeping a legacy program's hardware operational throughout a 10-year period, meeting new operational objectives without having to recertify an entire system, and dealing with the changes in technology during a long period of time are challenges each military system decision maker faces every day.

Military Embedded Systems is a technology magazine designed for system-level decision makers, focusing on the entire life cycle of a military program.

And what about systems? As the DOD's technology road map moves toward a *system of systems* approach, standalone boxes or stovepipe implementations are simply outdated. Not only are individual Line Replacement Units (LRUs) replacing entire boxes, but a platform's value-add to the war fighter increasingly relies on some other remotely located system. Military designers are literally thinking "out-of-the-box", as their systems have to rely on data and intelligence located in another system.

If you wrap all of these topics together – embedded technology, a programs focus, long life cycle requirements, and a system-level design approach – you have the mission statement for the magazine you're holding in your hands. *Military Embedded Systems* is a technology magazine designed for system-level decision makers, focusing on the entire life cycle of a military program. Whether the technology is COTS, program-specific, or straight out of DARPA, our mission is to provide you, the reader, with on-target technical material that helps you do your job.

We'll still provide in-depth insight on the latest PowerPC processor, on reconfigurable DSP systems, on methods for conducting heat from 100 W VME or CompactPCI LRUs, or on the latest secure RTOS and DO-178B trends. But we'll always focus on how these, and other, embedded technologies apply throughout the life of a military program – including the bitter end when obsolescence-induced cost avoidance numbers are necessitating a complete redesign.

This premiere issue is jammed with sections called Mil Tech Trends, In the System (highlighting box-level insight), and Industry Analysis – with technical commentary by some of the industry's best-known technical minds. So, join me as we launch *Military Embedded Systems,* and be sure to look for both print and electronic versions throughout 2005, and an increased frequency in 2006.

Your suggestions are welcome. Please drop me a line at cciufo@opensystems-publishing.com, or visit www.mil-embedded.com.

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Group Editorial Director

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