COTS JOURNAL

9th Annual End-of-Life Directory

VPX AND VXS EYE BEACHHEAD ON VME's LEGACY

PLUS:

Simulation Makes Moves Toward Realism

TECH FOCUS: Ethernet Switch Boards

Volume 10 Number 03 March 2008 www.cotsjournalonline.com

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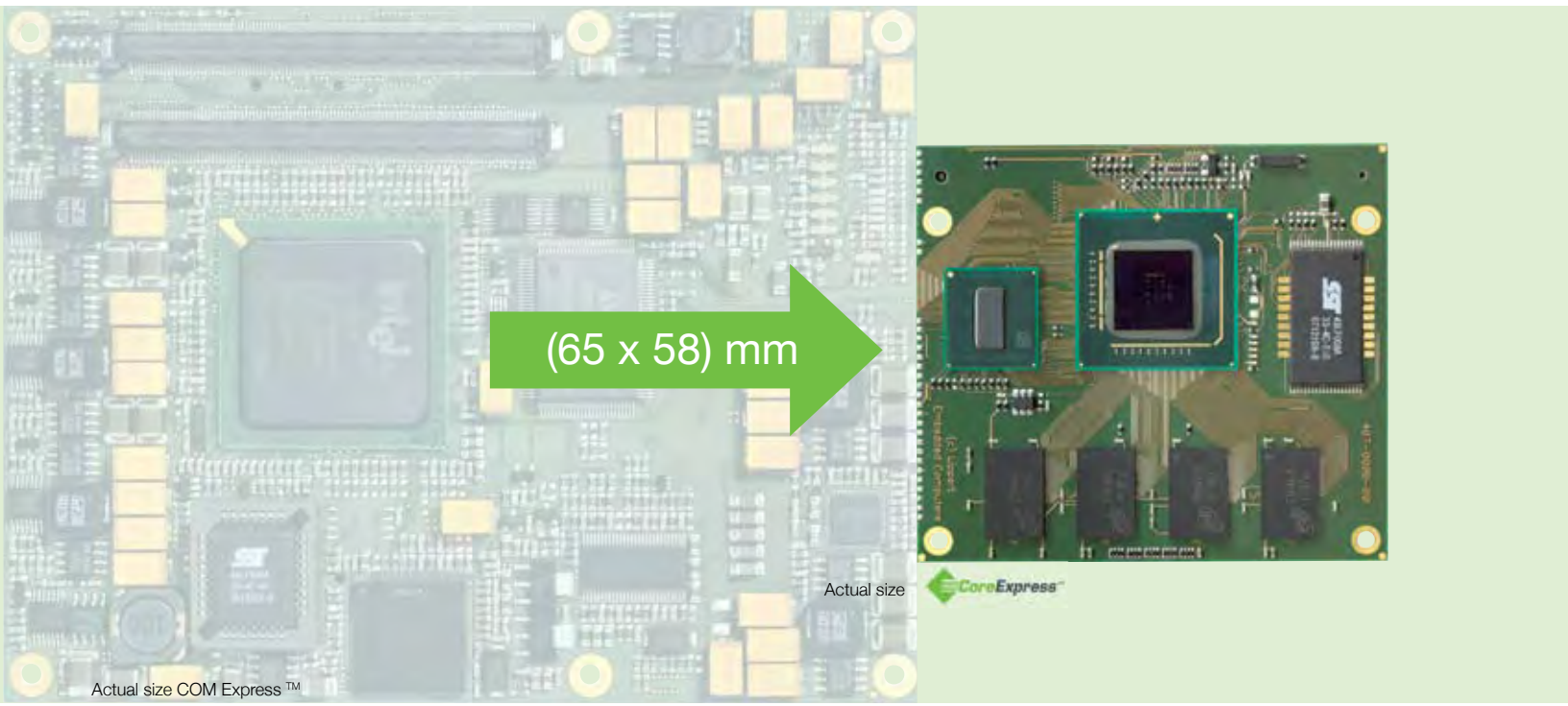

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COTS JOURNAL

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VME, VXS and VPX

Tech Recon

Advances in Simulation

System Development

EOL Directory

Technology Focus

Ethernet Switch Boards

COTS (kots), *n.* **1.** Commercial off-the-shelf. Terminology popularized in 1994 within U.S. DoD by SECDEF Wm. Perry's "Perry Memo" that changed military industry purchasing and design guidelines, making Mil-Specs acceptable only by waiver. COTS is generally defined for technology, goods and services as: a) using commercial business practices and specifications, b) not developed under government funding, c) offered for sale to the general market, d) still must meet the program ORD. **2.** Commercial business practices include the accepted practice of customer-paid minor modification to standard COTS products to meet the customer's unique requirements.

——**Ant.** When applied to the procurement of electronics for the U.S. Military, COTS is a procurement philosophy and does not imply commercial, office environment or any other durability grade. *E.g., rad-hard components designed and offered for sale to the general market are COTS if they were developed by the company and not under government funding.*

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When it comes to upgrade programs VME's legacy is a tough act to follow. The Navy's Service Life Extension Program (SLEP) for its Landing Craft, Air Cushion (LCAC), for example, involves an upgraded ruggedized VME system. The Control and Alarm Monitoring System (CAMS) on board the craft is based on a rugged enclosure with VME board set. CAMS performs information display, alarm monitoring and control functions for the LCAC's systems. Shown here, a U.S. Navy Sailor waves a LCAC ashore at Onslow Beach in North Carolina last May.

U.S. Navy photo by Mass Communication Specialist Seaman Ash Severe

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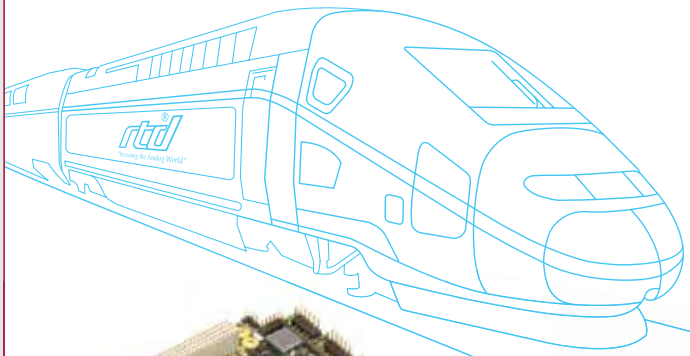
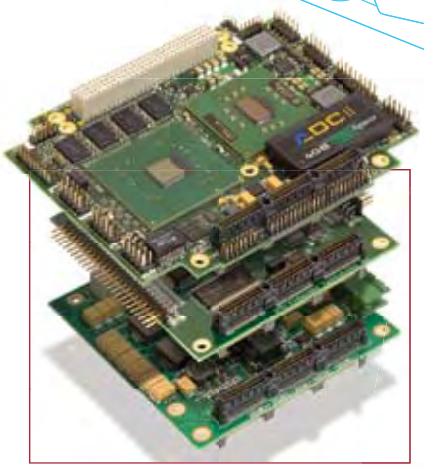
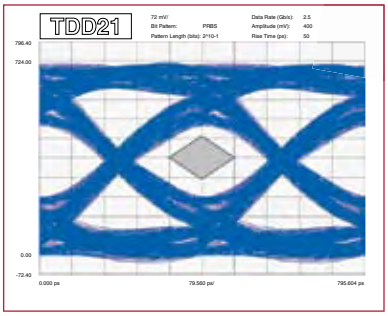


SI Test Stack



PCI/104-Express™ cpuModule, DataModule and power supply



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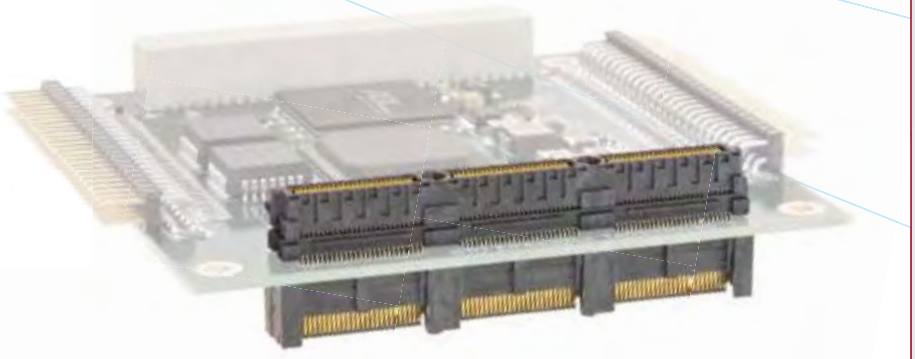

The key to the stackable PC architecture is the bus, the connector design, and the add-on card interchangeability regardless of the form factor of the CPU module. Achieving this required bringing the new desktop PC standard bus, PCI Express, to stackable PC/104 preserving its up or down stacking, ruggedness, and adaptability with advancing technology.

RTD and Samtec allocated substantial engineering and financial resources to modify the high speed, rugged Q2 connector pair to PC/104's 0.600" (15.24mm) stack height and verify that the mechanical and electrical performance was optimized. Specialized test fixtures were built and system stack heights of up to 12 test boards were assembled to detect any signal degradation while keeping Gen2 PCI Express specification in sight.

Four x1 links have the bandwidth to handle many applications. What do you do if you need more than four x1 devices? How do you meet the requirements of multiple high bandwidth PCI Express devices such as high-end graphics, powerful Virtex FPGA engines, advanced DSP architectures, and 1/10 Gigabit Ethernet to name a few? Therefore, the ability to expand through a x16 PCI Express link is an imperative for stackable PC architectures.

RTD's innovative **expressMate™** modules take advantage of the x16 link to break the current 6 board PCIe/104 and 4 board PCI-104 stack height limits. The expressMate modules use the x16 link to repopulate the x1 links and provide additional x4, x8, and x16 links, add a PCIe-to-PCI bridge, and enable PCIe peer-to-peer communication thereby assuring additional expandability and versatility for PCIe/104 and PCI/104-Express applications.

RTD Embedded Technologies, Inc.

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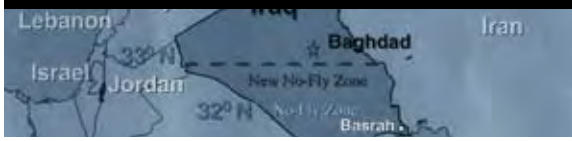
Publisher's Notebook



Niagara Falls

"Slowly I turned…step by step…inch by inch…" For buffs of comedy you'll know that this is a lead in to one of Abbott and Costello's bits; where every time Lou Costello says "Niagara Falls" this man goes crazy because it reminds him of an incident regarding his wife. He grabs Lou around the neck, starts choking him, beats on him and then comes to his senses just before killing him. Throughout the show Lou repeatedly makes the mistake of saying Niagara Falls and gets manhandled. Let me move on.

One item that is done as part of the preparation for our editorial team's trip to the AUSA Winter Symposium in Ft. Lauderdale is checking up on the major Army programs—along with changes in DoD acquisition policies. For me that means reading, not just skimming the last few issues of *Defense AT&L* (Acquisition Technology & Logistics) magazine. It's put out by the Defense Acquisition University (DAU), www.dau.mil, an arm of the DoD. The DAU is for anyone who is either a user or supplier to the military, however, it's probably more for users than suppliers. Skimming Defense AT&L gives me a quick snapshot of what acquisition subjects the DoD sees as important.

In doing this research project I also went to another publication put out by the DAU, the *Defense AR Journal*, just to make sure I was up to date. I know…why am I wasting space here in *COTS Journal*, a technology book, talking about publications that focus on acquisition? But acquisition is a key issue to inserting the right technology into a program. It was my intent to just explore recent issues when I noticed that the archives go back to 1994, the year the Big Bang happened to Mil-Spec acquisition. I couldn't resist and went through the ARJ index for that year and I came upon an article entitled: Marrying Commercial and Military Technologies: A New Strategy for Maintaining Military Supremacy, by Colonel Jeanne C. Sutton USAF, www.dau.mil/pubs/arq/94arq/sutto.pdf. This article is very long, but extremely interesting reading. The core of the points the colonel made are as valid today as they were 14 years ago, and the article should be mandatory reading for everyone that is going to either supply or implement technology in military programs.

Warren Andrews, editorial director, and I walked the aisles of AUSA Winter looking for new or interesting implementations of embedded electronics, while Jeff Child, our editor in chief, went to the sessions. Every now and then while walking the floor someone would read our media badges and blurt out, "We read *COTS Journal* all the time!" I'd politely thank them for their readership and support and occasionally we'd start talking about the industry, the market and trends. After all, that's my main reason for going to AUSA. We also had key companies that we had to visit for our military market study. Occasionally a company representative would state, "We don't do COTS, we do rugged." It's been 14 years since the DoD implemented the COTS initiative along with a definition. And I keep thinking that this has to be the year that we finally educate everyone in the industry to understand that COTS is a purchasing initiative and has nothing to do with the durability of a product. For years *COTS Journal* has published a definition of COTS right at the bottom of our Table of Contents page. It clearly states that COTS is a purchasing philosophy and not a statement on a product's durability.

So when I hear, "We don't do COTS, we do rugged"—or something similar—it's my Niagara Falls. It's like pressing a button and I have to hold back so I don't just start going into a rant. I just want to say something stupid like: "Does that mean the government funded the development of that product? Do you have to get waivers to quote the product? Does the government own the design and restrict you from offering the product? Does the government determine how much you can charge for the product? Go read Colonel Sutton's article.

The government has been a little "Loosey Goosey" with its determination of what products are COTS, and this determination is going to tighten up soon as more government contract oversight is brought into play. The relationship between prime contractors and different supplier options may soon start to look like wrestle mania as companies try to defend their infrastructure. The build versus buy pendulum has about hit its build peak and is going to start swinging back in the next year.

We ran into Doug Patterson, VP of Marketing at Aitech, at AUSA. Aitech is a supplier of COTS computing products. Doug is one of the founding fathers of the COTS/NDI (Non Developmental Item) military industry going back to 1986. He's a person who knows how to push my buttons. He spent some time torturing me about my "COTS is not a durability grade" problem. He has been getting back at me ever since I inadvertently commented and went into hysterical laughter while he was giving a presentation in the early 90s, where he inadvertently substituted the word Deliverable for Developmental when talking about NDI. I'm sure after reading this all I'll ever hear from him when we talk is…Niagara Falls. Those people with differing opinions please contact me. I'd love to debate the issue…slowly I turned…step by step…inch by inch. ▮▮

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COTS JOURNAL

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The Inside Track

Curtiss-Wright Awarded Contract for Marine Corps' G/ATOR Program

In the first publicly announced contract win involving VPX, Northrop Grumman has awarded Curtiss-Wright a contract to provide radar processing subsystems for use in the U.S. Marine Corps' Ground/Air Task Oriented Radar (G/ATOR) Program. The initial contract, valued at $4.3 million, is for development, which is expected to be completed in 2010. The production phase of the program will be executed as an option under the current contract, and is planned to start in 2010.

Curtiss-Wright will supply Northrop Grumman Electronic Systems with a rugged airflow-through radar processing subsystem. Curtiss Wright's solution uses open architecture-based standards and software to provide a high-performance, modular, scalable solution for the G/ATOR Processor. Curtiss-Wright's new

Figure 1

A humvee cruises up a dusty slope during a perimeter patrol in Iraq. Being the primary source of transportation for the Marines of the Perimeter Patrol Teams, the humvee helps them accomplish their responsibility of keeping the surrounding areas free of any threats. Photo by: Lance Cpl. James B. Hoke

VPX boards and subsystems deliver the high performance and advanced ruggedization that the G/ATOR program requires, with the additional cost and design advantages of an open architecture structure. This subsystem will be designed and manufactured at Curtiss-Wright's motion control facility in San Diego, CA, and will include the latest DSP, FPGA and single board computer products from its Leesburg, VA and Ottawa, Canada locations. The High Mobility Multipurpose Wheeled Vehicle (HMMWV)-mounted (Figure 1) Ground/Air Task Oriented Radar (G/ATOR) uses active electronically scanned array (AESA) technology to provide aircraft detection and tracking, cruise-missile detection and tracking, ground-weapon location and air-traffic control.

Curtiss-Wright Controls
Embedded Computing
Leesburg, VA.
(703) 779-7800.
[www.cwcembedded.com].

SWE-DISH to Deliver SATCOM Terminals to Navy's SPAWAR Center

SWE-DISH Satellite Systems, a DataPath company, has been awarded an indefinite-delivery/indefinite-quantity (ID/IQ) contract by the U.S. Navy's Space and Naval Warfare Systems (SPAWAR) Center to provide portable SATCOM terminals. The contract, awarded to SWE-DISH and six other companies, has a total value of up to $491 million over five years for all suppliers. The SWE-DISH portion of the award is for up to approximately $32 million in the first base year, with a potential value of up to $175 million for the base year and all option years.

SWE-DISH specializes in highly portable and mobile SATCOM terminals such as SWE-DISH Suitcase systems with CommuniCase Technology and SATCOM on-the move systems that deliver high-bandwidth capabilities beyond the edge of traditional networks. Proven in the field with the U.S. military and allied military and government organizations, SWE-DISH products are known for being innovative, very compact and easy-to-use communications systems. The contract was awarded to SWE-DISH Satellite Systems, the Sterling, VA-based business unit of SWE-DISH, which is a wholly owned subsidiary of DataPath.

SWE-DISH Satellite Systems
Sterling, VA.
(703) 476-1826.
[www.swe-dish.com].

Lockheed Martin Selects NGRAIN for JSF Aircraft Program

NGRAIN, a provider of 3D performance support solutions, announced that the Company has been selected to provide a customized version of their commercial-off-the-shelf 3D visualization and annotation software as part of Lockheed Martin's F-35 Lightning II Autonomic Logistics Information Systems ("ALIS") program. ALIS, the information infrastructure for the F-35 (Figure 2), also known as the Joint Strike Fighter, provides core functionality for maintenance, supply and training operations to aircraft technicians worldwide.

Figure 2

The F-35 Lightning II flew for the first time on December 15, 2006 from Lockheed Martin in Fort Worth, TX., carrying a wealth of advanced electronics and systems.

The JSF program is an international partnership aimed at developing an affordable, multi-role, fifth-generation fighter aircraft. It is the largest

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www.cotsjournalonline.com/getconnected

defense acquisition program to date, with a total projected value of more than $276 billion and is supported by nine participant countries. NGRAIN's software will be used by aircraft maintainers to record damage and repair details on an aircraft faster and more accurately by marking up a virtual 3D model of the aircraft. The 3D model will provide maintainers with easy access to highly accurate damage and repair status and history of the aircraft.

NGRAIN

Seattle, WA.

(866) 420-1781.

[www.ngrain.com].

Quantum3D's Systems Selected for FAA DO-178B Multi-Function Display

Gables Engineering has selected Quantum3D IGL178 and IData178 for use in a new, reconfigurable, Multi-Function Display (MFD) system targeted at air-transport, regional and business-aviation flight deck applications. IGL178 is the avionics and visual computing industry's first software-based Graphics Processing Unit (GPU) for FAA DO-178B Level-A-certifiable OpenGL Safety Critical (SC) and OpenGL Embedded Systems (ES)-based applications, and IData178 is the avionics industry's leading FAA DO-178B Level-A-certifiable model-based Human Machine Interface (HMI) and embedded visual computing application development and deployment software tool suite.

Developed by both companies in close cooperation, the Gables Reconfigurable MFD includes smart display technology that enables the system to support important flight deck functions including Attitude Direction Indicators (ADIs), Horizontal Situation Indicators (HSIs), soft controllers and other capabilities on a reconfigurable platform with significantly reduced FAA or other authority safety-critical certification expenses.

Figure 3

IGL178 is the avionics and visual computing industry's first software-based Graphics Processing Unit (GPU) for FAA DO-178B Level-A-certifiable OpenGL Safety Critical (SC) and OpenGL Embedded Systems (ES)-based applications.

The new MFD features dedicated, high-performance I/O processing that is reconfigurable for maximum flexibility and dedicated, CPU-based graphics processing that employs IGL178 to provide high-fidelity, high-performance, precision graphics. Gables' rapid-turn manufacturing capabilities offer the means to easily customize the smart MFD for multiple applications and to add any essential hard controllers, if required. The MFD includes a large LCD screen with optimized viewability and image-quality characteristics, aided by IGL178's unique image-quality enhancements including TrueStroke precision anti-aliased lines, fonts and points.

RTI to Provide Advanced Security Protection for Distributed Systems

The U.S. Air Force Research Laboratories (AFRL) has contracted Real-Time Innovations (RTI) to research and develop a Data Distribution Service (DDS) standards-based system to scan network nodes for security vulnerabilities. This Small Business Innovation Research (SBIR) effort will incorporate recent developments in active and passive network traffic sniffing, node security policy management, complex event processing (CEP), high-performance network data distribution and data persistence. A demonstration of the technologies is planned for mid-2008.

This project, entitled "Proactive Determination of Networked Node Vulnerability," addresses a pervasive need for improved tools to actively seek out weaknesses in network security before and during a security intrusion event. The objectives are to automate vulnerability scanning of network nodes, analyze the impact these vulnerabilities have on the network and communicate the resulting information to other nodes and users for appropriate responses. To address this requirement, RTI will integrate a number of innovative features that will rapidly provide a substantial capability within a very short timeframe and with reduced cost. Following a common trend in agile product development, the project will take advantage of a combination of mainstream commercial products, open-source technologies and innovative research by select security partners.

The end result of this effort, if the system is selected for follow-on development, will be a robust, broadly deployed vulnerability assessment capability well integrated with the U.S. Department of Defense (DoD) vision for its next-generation Global Information Grid (GIG) network infrastructure. This program is managed by the U.S. AFRL Information Handling branch within the Information and Intelligence Exploitation Division as part of the AFRL Computer Defense Immune System (CDIS) initiative.

Real-Time Innovations

Sunnyvale, CA.

(408) 990-7400.

[www.rti.com].

White Electronic Designs Selected for Aircraft Control Panel Project

White Electronic Designs Corporation (WEDC) was selected to design and manufacture a Night Vision Imaging System (NVIS) integrated panel for a government aircraft application. The project employs WEDC's Electromechanical Products Divisions' knowledge of military aircraft assemblies, expert design and build-to-print capabilities for the integrated NVIS control panel. One of the major requirements of the project was to ensure the cockpit illumination did not emit energy that could interfere with infrared-sensitive night vision goggles or other night vision equipment. The night vision goggles used in military aircraft are responsive to low light level intensities and employ high gain electronic image intensifiers that are sensitive to light in the near-infrared and infrared regions.

The infrared emissions from the cockpit illumination must be removed or eliminated to a degree that there is no interference with the use of the night vision equipment while providing sufficient brightness for direct viewing with the unaided adapted eye. The WEDC-designed NVIS control panel will also minimize the emissions in the infrared region without affecting the portion of the visible spectrum to which the human eye is most sensitive.

White Electronic Designs

Phoenix, AZ.

(602)437-1520

[www.whiteedc.com].

COTS Websites

www.picmg.org

PICMG Site is Ground Zero for PC- and PCI-Based Embedded Computing

With an original mission of extending the PCI standard for use in non-traditional computer markets such as industrial automation, medical, military and telecom markets, the PCI Industrial Computer Manufacturers Group (PICMG) has moved way beyond that. With the advent of fabric-based transports, PICMG specs have continued to evolve. This has resulted in a series of specifications that include CompactPCI, ATCA, AMC, CompactPCI Express, MicroTCA, COM Express and SHB Express. Now that many of those have gained some degree of acceptance in defense applications, the PICMG ranks as a key consortium for the military market to keep tabs on.

Founded in 1994, PICMG today is a consortium of over 450 companies who collaboratively develop open specifications for high-performance embedded computing applications. The members of the consortium have a long history of developing leading-edge products for these industries. Each specification has a unique PICMG identifier. And the PICMG Web site provides details on each specification, including those under development in its Specifications Directory. These specifications are represented by many leading-edge products from PICMG member companies, details of which can be found in our Product Directory. A members-only portion of the Web site provides enhanced access to information and ways to participate in the consortium's activities.

PICMG, Wakefield, MA. (781) 246-9318. [www.picmg.org].

Special Feature

VME, VXS and VPX

Network Challenges Drive Form-Factor Choice

VPX, VXS and VITA 31.1 as well as PICMG ATCA and MicroTCA architectures together form a rich set of choices for system designers. All are worth a look for meeting the net-centric needs of next-gen military systems.

Bob Sullivan, Vice President of Technology
Hybricon

Today's battlefield looks different than it did even a few short years ago, with the addition of military assets that include UAVs such as Global Hawk, Predator and Fire Scout (Figure 1). These systems bring to bear technology that helps the soldier on the field to make real-time decisions that save lives. No longer will he have to wait to see what is available to him in his arsenal. Instead, he looks at his screen—which is networked to every available option—and can deploy the force necessary to accomplish his mission.

With that in mind, future military systems will be largely network-centric. This is a relatively new paradigm that can leverage commercial technologies such as Ethernet and WiMAX, and is a natural fit for the newer "serial fabric"-based industry standards. Some of these industry standards are inherently rugged, while others are being adapted to rugged applications.

Feeding those needs, the embedded computer industry offers a broad array of form-factors and architectures that can be used to construct military systems. Many of these are truly commercial grade

Figure 1

Exemplifying the technology of today's battlefield are UAVs like the Army MQ-8B Fire Scout. Assets like these will be networked to provide soldiers every available option so they can deploy the force necessary to accomplish their mission.

All the Right Stuff for Avionics and UAV Applications:

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Designing and building board-level products and integrating sub-systems for today's advanced avionics and UAV applications is tough enough. Doing it in a true COTS environment is even tougher. But Aitech is more than equal to the challenge. Aitech delivers more than two decades of harsh environment, open systems architecture expertise and proven solutions in UAV and avionics applications such as Predator, Global Hawk, C-130, F-18, F-16, UCAV/J-UCAS, and many more...

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We've been doing it... meeting full temperature-range specifications with standard products is just part of our 20+ year heritage and commitment to COTS advancements – from the first conduction-cooled Mil-Spec VME board in 1984, to today's highest functionality MIPS/Watt boards, multi-Gigabyte, Flash-based, mass memory cards and high-speed mezzanines...for manned and unmanned applications.

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and are primarily used in benign defense applications. In contrast, ANSI/VITA standards—most notably the venerable VME bus—have traditionally been used for rugged applications.

To put the new and established system form-factors in perspective, it's helpful to review the key standards and examine their trade-offs (Table 1). Consider, for instance, the VME enhancement ANSI/VITA 31.1. ANSI/VITA 31.1 adds a 10/100/1000-baseT Ethernet fabric onto the VMEbus P0 connector, with some dedicated switch slots based on PICMG 2.16. This may fit some applications with less demanding bandwidth requirements, and it has the advantage of VMEbus compatibility.

Disadvantages are that the ecosystem for ANSI/VITA 31.1 modules is not extensive, and the 10/100/1000-baseT Ethernet bandwidth is limited. This is also only available in a 6U x 160 mm Eurocard form-factor, so it

Fabric-Based Specs for Rugged Net-Centric Apps

Standard Feature	VITA 31.1	VXS	VPX		MicroTCA	
Size	6U x 160 mm	6U x 160 mm	6U x 160 mm	3U x 160 mm	Single Width 75 mm x 180 mm	Double Width 150 mm x 180 mm
Differential High-Speed I/O pairs	none	14 pairs	192 pairs	64 pairs	18 pairs + Zone 2 & 3 to be defined in PICMG effort underway	18 pairs + Zone 2 & 3 to be defined in PICMG effort underway
Single-Ended High-Speed I/O (if all pins used)	none	31	400	120	36 + Zone 2 & 3 to be defined in PICMG effort underway	36 + Zone 2 & 3 to be defined in PICMG effort underway
Fabric Ports per Board	(2) 10/100/1000 Base-T	(2) 4x ports	(4) 4x ports	(4) 4x ports	(4) 1x ports + (2) 4x ports	(4) 1x ports + (2) 4x ports
Ethernet	ANSI/ VITA 31.1	GigE VITA 41.3	VITA 46.7	VITA 46.7	AMC.2	AMC.2
Serial RapidIO	no	VITA 41.2	VITA 46.3	VITA 46.3	AMC.4	AMC.4
PCI Express	no	VITA 41.4	VITA 46.4	VITA 46.4	AMC.1	AMC.1
VMEbus backward compatible	yes	yes except P0	Hybrid b/p only VITA 46.1	Hybrid b/p only VITA 46.1	no	no
Support 2-Level maintenance	no	no	yes. VITA 48.x REDI	yes. VITA 48.x REDI	Proposed future PICMG effort	Proposed future PICMG effort
Maximum power per board	3.3V:66W 5V:90W 12V:24W -12V:24W	3.3V:66W 5V:90W 12V:24W -12V:24W	5V:120W 12V:384W or 48V:768W	3.3V:79W 5V:120W 12V:192W	12V: 45W	12V: 80W
Forced Air cooling	yes	yes	yes. VITA 46 & 48.1	yes. VITA 46 & 48.1	yes	yes
Conduction cooling	yes	yes	yes. VITA 31.1 & 48.2	yes. VITA 31.1 & 48.2	no. PICMG effort underway	no. PICMG effort underway
Liquid flow-through module cooling	no	no	yes. VITA 48.3 & 48.4	yes. VITA 48.3 & 48.4	Possible future PICMG effort	Possible future PICMG effort
Fiber optic rear I/O	no	no	Planned VITA 46.12	planned VITA 46.12	no	no
Ruggedized modules available	yes	yes	yes	yes	no. PICMG effort underway	no. PICMG effort underway

Table 1

Detailed here are an array of form-factors and architectures available to construct military systems.

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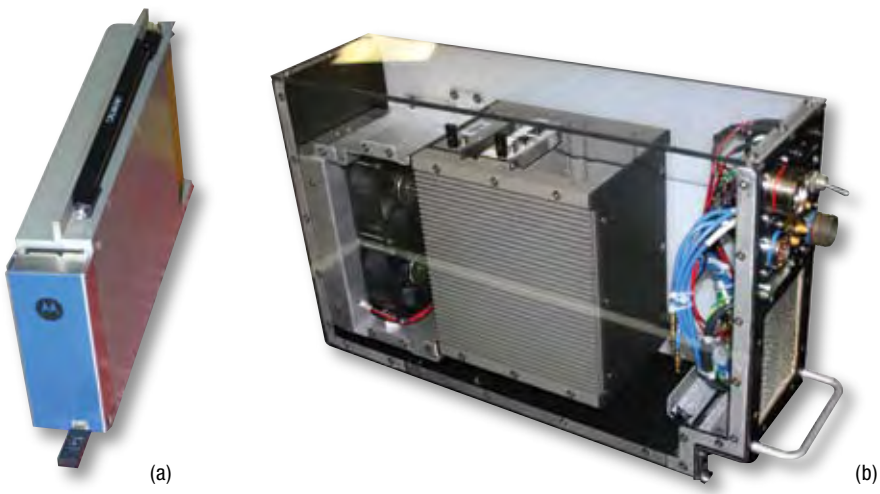

Figure 2

Shown here are a proof-of-concept conduction-cooled AMC (a) and MicroTCA chassis (b) developed by Hybricon and Motorola.

may not be suitable for space-challenged applications.

Looking over on the PICMG side, PICMG 2.16 adds a 10/100/1000-baseT Ethernet fabric onto the cPCI J3 connector, with some dedicated switch slots. This may fit some applications with less demanding bandwidth requirements, and it has the advantage of cPCI compatibility.

Disadvantages are that the ecosystem for PICMG 2.16 modules is largely non-ruggedized, and the10/100/1000-baseT Ethernet bandwidth is limited. This is also only available in a 6U x 160 mm Eurocard form-factor, so it may not be suitable for space-challenged applications.

VXS Upgrade Path

Offering an upgrade path from traditional VME, VXS uses a high-speed serial MultiGig-RT connector in place of the VME64x P0 connector, and layers a high-speed switch fabric onto the VMEbus with dedicated switch slots. This also has the advantage of VMEbus compatibility. Disadvantages are that the number of high-speed serial connections is limited, and high-speed rear I/O is limited due to limited pin count. This is also only available in a 6U x 160 mm Eurocard form-factor, so it may not be suitable for space-challenged applications.

Taking a next-generation spin on the basic VME approach, next up are the VPX and VPX REDI - ANSI/VITA 46.x and ANSI/VITA 48.x set of specifications. The VITA 46.x VPX family of standards is primarily aimed at rugged military applications, and uses high-speed MultiGig-RT connectors. The basic communication path is a high-speed serial mesh switch fabric. VPX has the advantage of having a large number of rear I/O pins, supporting either high-speed serial or parallel I/O. VPX also supports both 3U x 160 mm and 6U x 160 mm form-factors; the 3U form-factor is a big advantage for space-challenged applications. VPX also can optionally support a VMEbus (VITA 46.1), which can be useful in hybrid backplanes when mixed with VME modules.

Aimed at rugged military applications, the VITA 48.x REDI set of specifications are companion standards to the VPX family. VPX REDI builds on VPX, adding module ESD covers and additional module widths. This is important for two-level maintenance, a concept that is being promoted within several military programs. VPX REDI also supports different types of module cooling, including air-cooled, conduction-cooled and flow-through liquid-cooled, with others planned. Disadvantages are that VPX is relatively new, so the ecosystem of modules is still developing, and VPX is somewhat higher cost than VME due to the more expensive connectors.

Shifting back to the PICMG camp again, PICMG's AdvancedTCA (ATCA) is primarily aimed at telecommunications applications, and uses high-speed HM-ZD connectors. The basic communication path in ATCA is a high-speed serial mesh switch fabric. But also included are a redundant Gbit Ethernet Base Fabric as well as a robust System Management infrastructure. The System Management Infrastructure is based on redundant IPMI buses and complex System Management firmware on redundant Shelf Managers.

Advantages of ATCA include the robust System Management infrastructure (Built-In-Test), built-in redundancy, very high bandwidth fabric support and the ecosystem of communications-oriented modules. Disadvantages include the very large 8U x 280 mm module size, lack of ruggedized product and lack of conduction-cooled product.

MicroTCA Teams With AMC

Like its ATCA cousin, PICMG's MicroTCA (µTCA) is also primarily aimed at telecommunications applications and uses high-speed card edge connectors. MicroTCA started out to leverage re-use of AMC modules, which were developed as hot-swappable mezzanine cards for large ATCA cards. Also like ATCA, the basic communication path for MicroTCA is a high-speed serial mesh switch fabric, but µTCA also includes a redundant Gbit Ethernet Base Fabric. Also included is a robust System Management infrastructure based on redundant IPMI buses. Rounding out its features is complex System Management firmware on redundant MicroTCA Carrier Hubs (MCH). Redundant IPMI based Power Modules (PM) and Advanced Mezzanine Card (AMC)

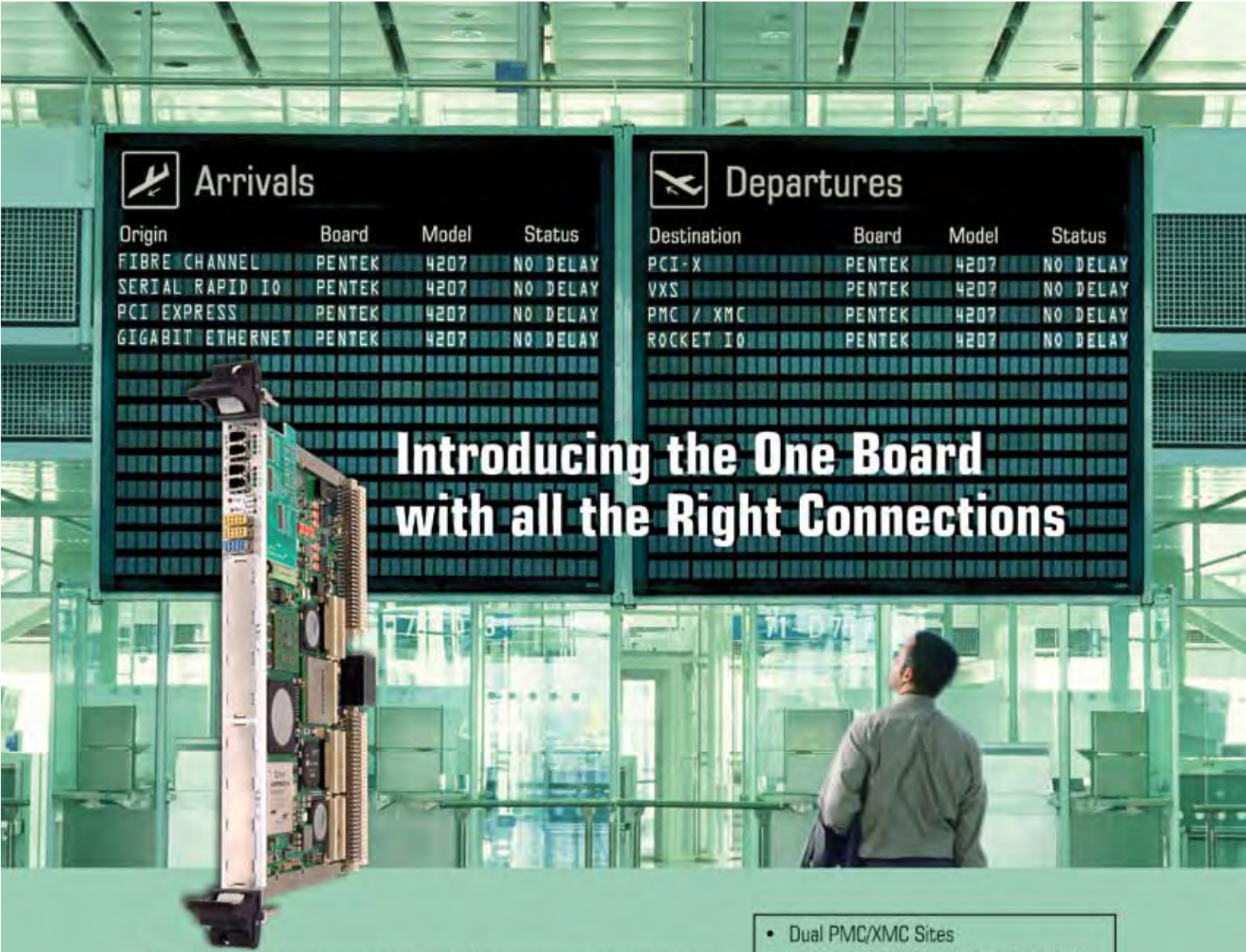

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Figure 3

Hybricon introduced the first rugged MicroTCA ATR chassis 18 months ago. The company has also demonstrated both air-cooled and conduction-cooled versions of an MicroTCA ATR chassis.

plug in modules are provided along with redundant IPMI based fan trays.

Advantages include the robust System Management infrastructure (Built-In-Test), built-in redundancy and hot-swap support, high-bandwidth fabric support, very small size (single-width modules are even smaller than 3U x 160 mm VPX modules) and the ecosystem of low-cost communications-oriented AMC modules. Disadvantages include lack of ruggedized product, lack of conduction-cooled product and limited rear I/O. These disadvantages are being addressed in the PICMG Rugged MicroTCA subcommittee effort, which is underway. Figure 2 shows a proof-of-concept conduction-cooled MicroTCA chassis and AMC developed by Hybricon and Motorola.

System developers now have several choices for embedded system applications. Network-centric applications will increasingly look to fabric-based industry standards. ANSI/VITA 31.1 is a good low-cost choice for 6U applications that require an Ethernet switch fabric. It is fully backward compatible with VME. For applications that fit this profile, it is worth a look.

VXS provides significant performance advantages over ANSI/VITA 31.1, and it has become a popular choice for signal processing applications because of the well-developed board ecosystem as well as the performance level. We see continuing design wins for VXS. VPX REDI is new, but the ecosystem is developing at an explosive rate. VPX REDI has significant performance advantages over VXS based on performance, I/O capability, two-level maintenance and robust 3U form-factor support. VPX REDI has a bright future and will be widely adopted as the ecosystem develops. Several programs have already selected VPX. One thing to keep in mind with VPX is that the connectors are incompatible with VME, so backward compatibility can only be achieved with hybrid systems having a mixture of VPX slots and VME/VXS slots.

ATCA in Military Apps

Meanwhile, ATCA has found its way into some military applications, and we see this continuing in applications having benign environments, leveraging commercial telecom technology more-or-less as is, but we do not see ATCA transitioning to rugged applications.

MicroTCA is new, but since MicroTCA is based on re-use of AMC modules from ATCA, there is an extensive ecosystem of AMC modules in place. Fueled by the initial work of the MicroTCA Ruggedization SIG (co-chaired by Hybricon), and the current specification development in the PICMG Rugged MicroTCA subcommittee, we see MicroTCA gaining a foothold in rugged applications. For its part, Hybricon introduced the first rugged MicroTCA ATR chassis 18 months ago (Figure 3). The company has also demonstrated both air-cooled and conduction-cooled versions of an MicroTCA ATR chassis. ■■

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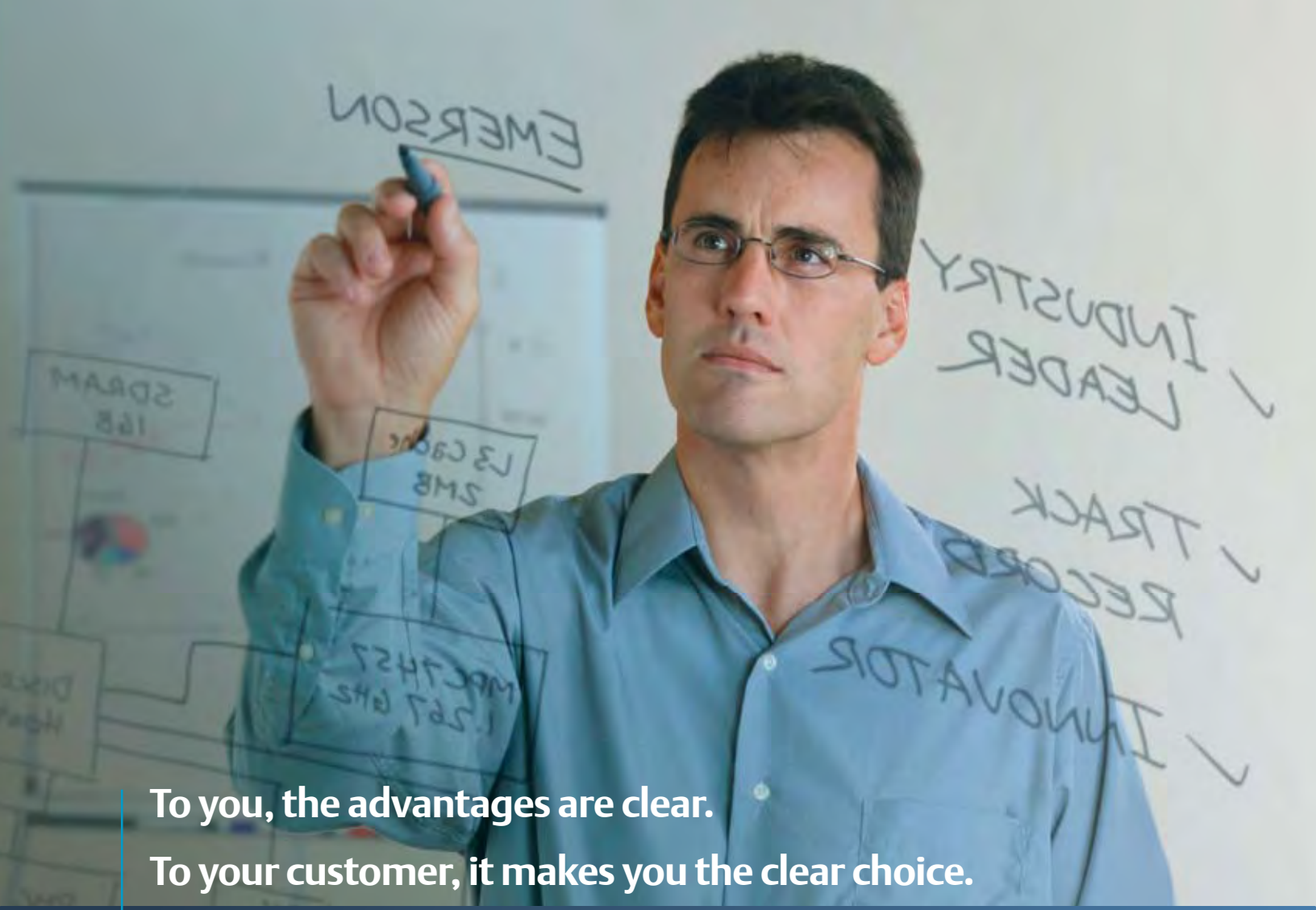

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Jing Kwok, VPX Working Group Chair
VITA

With doubts of its acceptance in full retreat, the VPX rugged board architecture is poised to provide critical embedded system integrators a more capable module spec—one that enables better exploitation of new technologies, and supports more cost-effective end-systems. The VPX boards, backplanes and chassis needed to build a new class of high-bandwidth, rugged subsystems are available now from a wide number of leading embedded computer vendors. Military system designers can now build VPX-based systems with the confidence that there is a single ANSI-ratified specification. The VITA 46.0 VPX Base Standard and VITA 46.1 VMEbus Signal Mapping on VPX were ratified in October 2007. VPX is making great strides into the market, too, with design wins in major programs. Today many programs are even mandating the use of VPX.

Work to expand on VPX continues apace. The VSO's VPX Working Group (VITA 46) continues to gain new members, including the recent addition of more first tier prime contractors as active participants. Meanwhile, significant progress is being made on existing "dot-specs," which includes the mapping of I/O signals to the VPX connector. The VSO Working Group expects to complete these dot-specs in 2008. Products based on these existing dot-specs have already emerged from active working group members.

Also underway is a set of new dot-specs aimed at providing architectural functions including support for System Management, Switch slots, Fiber Optics and RF connectors. The VSO Working Group expects to finalize the dot-specs for these next VPX milestones in 2008.

Figure 1

VPX provides the ability to handle two-level maintenance, the availability of built-in safety ground and a high-speed serial-connected non-centralized switch architecture. Shown here is a typical 6U conduction-cooled VPX board.

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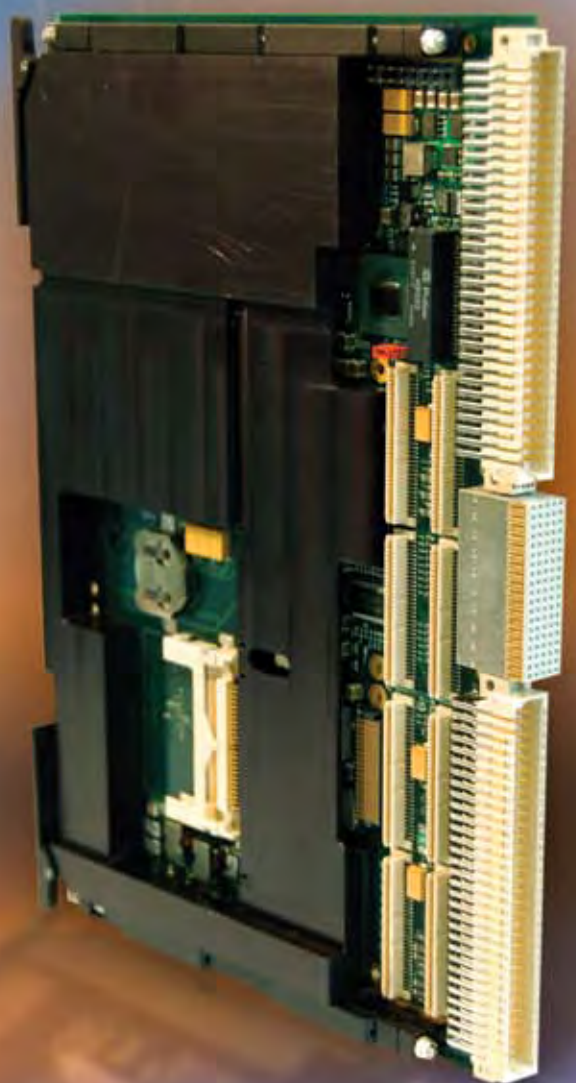

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And products based on these new dot-specs from members will emerge in 2009. Figure 1 shows a typical 6U conduction-cooled VPX board.

The factors driving VPX's rapid growth and acceptance are straightforward. First, VPX is the only open standard board architecture to directly address numerous functionality concerns facing today's aerospace and defense system designers. Among those concerns are the ability to handle two-level maintenance, the availability of built-in safety ground and a high-speed serial-connected non-centralized switch architecture. The mesh architectures enabled by the high-speed connector help reduce system slot counts and improve SWaP (Space, Weight and Power).

In a nutshell, VPX delivers near supercomputer performance in a rugged embedded package. Only VPX supports a large quantity of high-bandwidth user-defined I/O in both 6U and 3U form-factors. What's more, it's the only open standard board architecture to define signal mappings for the high-speed differential user I/O offered by the XMC (VITA 42) and PMC (IEEE 1386.1) mezzanine module standard.

Helping further the growth of VPX was the Working Group's decision to maintain the standard form-factor ecosystem attributes that helped make VME and CompactPCI successful, including the 6U and 3U height, depth, the traditional 0.8-inch pitch, front panel arrangements,

Nine Basic Features of VPX

IEEE-1101.2 **Conduction-cooled** compliant **Outline and Installation** envelope compatible with existing enclosures.
Air-cooled IEEE 1101.1/10 form-factor also supported.
Both **6U and 3U** form-factors supported.
Tyco MultiGig RT2 Connectors enable data rates of over **6.4 Gbits/s** and has been demonstrated to support 10 Gbits/s.
Three keying blocks ensure that the right card is inserted into the right slot
Alignment Block provides a robust mechanism to prevent backplane pin damage during card insertion.
Safety ground (chassis ground) protects the user from harm in a safety fault situation.
PMC sites support **standard-length PMCs** – enabling use of the existing ecosystem of PMC modules.
XMC backplane I/O support enables use of rear panel I/O.

Table 1

Listed here are the nine major features available in VPX.

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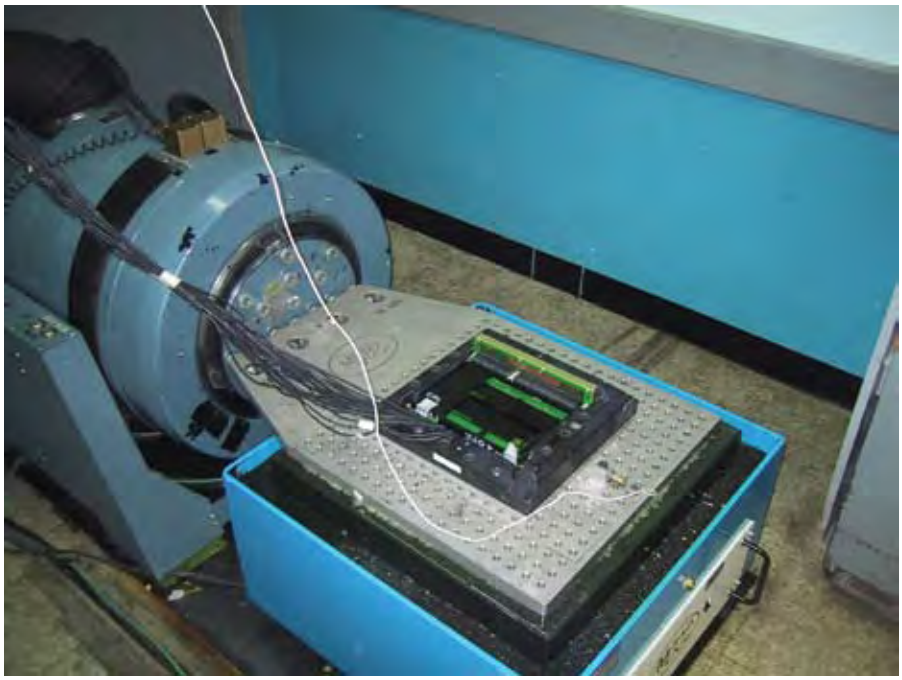

Figure 2

VPX has undergone the most rigorous testing of any open standard board architecture. Its Tyco MultiGig RT2, 7-row connector was tested on two separate 6U test boards to two separate vibration criteria. Shown here is an example of a qualification test set-up for VPX.

rear panel I/O and conduction-cooled interfaces. For legacy compatibility VPX supports the VMEbus interface. It also supports standard-length PMC and XMC modules. But it goes farther as the only standard to date to map XMC user I/O to backplane I/O.

Another way that VPX improves on the predecessor form-factors such as VME and CompactPCI is increased backplane I/O compared to both these standards. Its defined protective top and bottom metal covers (VPX-REDI) support improved logistics. This support for Line Replaceable Module (LRM) applications is enhanced by its use of an ESD-protected connector and the use of alignment and keying blocks. Even better, the alignment modules provide the board's safety ground. Table 1 lists the basic features of VPX.

Another important reason that VPX is becoming entrenched as the next-generation standard for high-performance, rugged deployed applications is the unprecedented amount of successful physical testing and verification to which it has been subjected. The VPX standard has undergone the most rigorous testing of any open standard board architecture. For example, its Tyco MultiGig RT2, 7-row connector was tested on two separate 6U test boards to two separate vibration criteria.

Two Test Approaches

One was a qualification test at typical mil/aero random vibration test levels (0.1 g^2/Hz) for 50% longer than typical mil/aero durations (1.5 hours/axis vs. 1 hour/axis). The RT2 passed all performance verification tests after this vibration exposure, including optical inspection that showed no gold wear-through or fretting corrosion. The second test was a HALT (Highly Accelerated Life Test) vibration test that stepped up the levels from 0.125 to 0.2 g^2/Hz for a total of 1.5 hours/axis. The purpose of the HALT test was achieved by finding a vibration limit of 0.2 g^2/Hz. These results, and those from several other environmental tests, are available from VITA. Figure 2 shows an example of a qualification test setup for VPX.

Perhaps the best validation of VPX's worth is that it's already being selected for exactly the types of programs for which it was designed. These include signal processing applications with high-bandwidth data requirements on the backplane, or applications that need lots of backplane I/O at high bandwidths such as the plethora of serial I/O standards in use today. Easing the way is the growing variety of VPX board types now available from major embedded board vendors, including single board computers, DSP and FPGA engines, and Gigabit Ethernet Switches. Many of these board types are available in both maximum performance/functionality 6U versions and small form-factor 3U versions for SwaP-intensive environments. Supporting that, a wide number of VPX backplanes and chassis are also available from leading enclosure vendors, enabling and easing both lab development and field deployment of VPX subsystems. ▮▮

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Converting the analog world to digital has been a driving force behind signal-intensive computing for decades. The real world is analog while computing, for the most part, is digital. Military applications, like radar or video imaging, are attempting to create a very precise digital picture of real-world data in greater detail using higher resolution sensors and cameras that can produce orders of magnitude more data than previous-generation acquisition devices. Application requirements have driven and continue to drive the need for more processing and communication bandwidth.

For instance, military surveillance applications such as Electronic Intelligence (ELINT) have had to continually evolve and improve over the years to keep up with advancements in other military technologies such as stealth, jamming and countermeasures. An example system along those lines is the Boeing RC-135, a United States Air Force reconnaissance aircraft. The RC-135V/W Rivet Joint version (Figure 1) has a sensor suite that enables the crew to detect, identify and geolocate signals throughout the electromagnetic spectrum and forward the information via Rivet Joint's extensive communications suite.

Figure 1

Applications such as ELINT have had to continually evolve and improve. An example ELINT is the Boeing RC-135, a United States Air Force reconnaissance aircraft. The RC-135V/W Rivet Joint version (shown) has a sensor suite that enables the crew to detect, identify and geolocate signals throughout the electromagnetic spectrum.

For high-performance applications such as embedded ELINT systems, it is important for processing and communication bandwidth to be balanced. It does no good to increase the processing performance without also increasing communication bandwidth, otherwise processors will be "starved" for data due to insufficient communication bandwidth. Processing power has increased tremen-

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dously over the years as CPU vendors have reduced chip geometries, increased processor clock speeds and throughput, and more recently developed multicore CPUs.

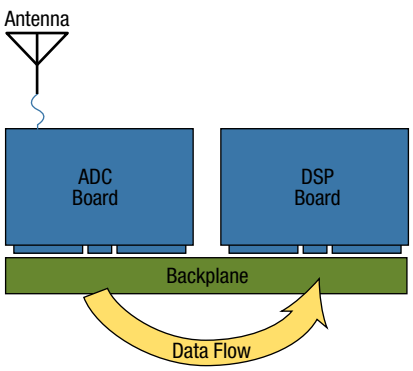

Figure 2

Depicted here is an application using a single analog-to-digital converter board outputting data to a single digital signal processing board.

In 1992, a 40 MHz TI TMS320C40 DSP was state of the art, while today, AltiVec-enabled dual-core Freescale PowerPC 8641D processors running at 1.25 GHz are commonplace in many embedded signal-intensive applications. What has been done to make sure the communication bandwidth has kept up?

In the early 1990s, embedded military systems, including ELINT systems, started utilizing VMEbus technology. But designers were continually looking to exploit the newer technologies to increase performance. As the need for performance increased, could the VMEbus be counted on to provide the communication bandwidth to support the increased application demands, or would designers have to move to a new technology? This question will be answered by focusing on a single technology used in ELINT systems—analog to digital converters (ADCs). By focusing on the ADC technology used in ELINT applications, a direct correlation to the communication bandwidth requirement in ELINT systems can be shown.

As ADC technology has advanced over the years, increasing amounts of data needed to be communicated and processed in ELINT systems. To show this progression, several representative state-of-the-art A/D technologies of their day will be highlighted in an example application (Figure 2) along with the corresponding inflection points in the VME technology to provide the necessary communication bandwidth. In this example VME technology application there is a single-channel A/D board and a single processor board. The single channel of analog data is digitized, without any processing or reduction of the data being done by the A/D board, and sent to the processor board where the digital signal processing can be performed.

In the early 1990s, a VME-based surveillance system might have utilized an A/D board with a 12-bit 1.25 Msample/s ADC, which would output

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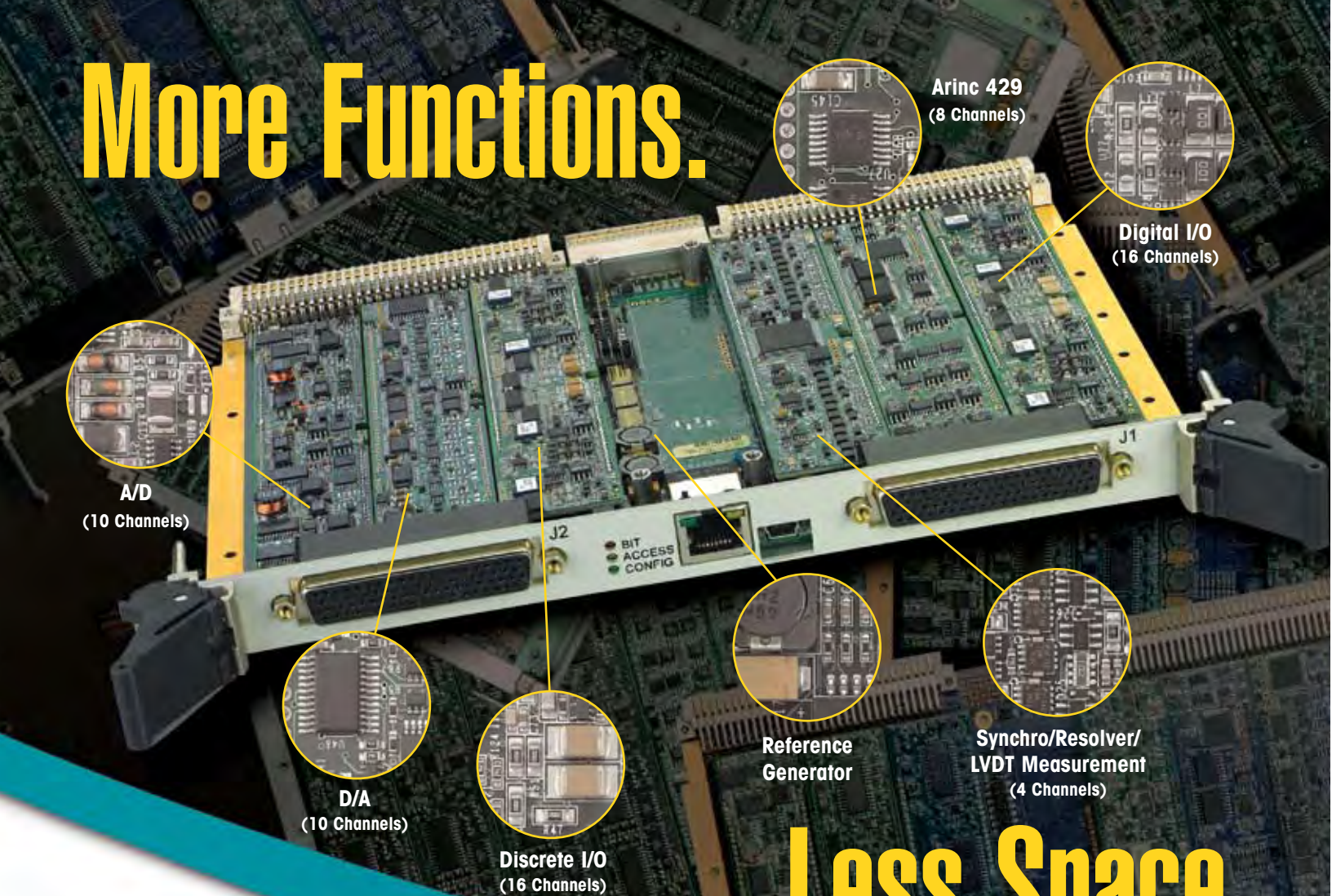

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Figure 3

VMETRO's AD3000 Single-Channel 3 Gsample/s Analog to Digital Converter XMC/PMC module sports a user-programmable Virtex-5 SX95T/LX110T FPGA.

1.875 Mbytes/s of data to the processor board. The VMEbus (VME32), with a practical bandwidth of approximately 20 Mbytes/s, had enough bandwidth to support this application.

By the mid 1990s, surveillance systems were utilizing much faster ADC technology such as a 12-bit 41 Msample/s ADC. This device could produce 61.5 Mbytes/s of data that would need to be sent from the A/D board to the processor board. Even VME64, with a practical bandwidth of approximately 40 Mbytes/s, would not have enough bandwidth to support this application.

In order to handle the resultant increased data rates, vendors started utilizing a variety of proprietary, quasi-standard and standard interconnects to increase the communication bandwidth in VME architecture. Some of the more widely used and accepted technologies included RACEway interlink and later Race++, SKYchannel packet bus and Myrinet packet network. All of these alternatives were designed to be add-on options to an existing VMEbus backplane with crossbar circuits added via a secondary backplane that fit over the backside of a VMEbus backplane. These solutions, while functional, required secondary backplanes, were limited in the number of supported slots, restricted P2 I/O access, and would not always fit in the available space in the chassis. But, they provided an effective means of increasing the communication bandwidth, some offering bandwidths upwards of 200 Mbytes/s, and thereby enabling support of the higher-speed A/D chips, such as the 12-bit 41 Msample/s ADC.

By the late 1990s, higher-performance ADCs, such as 8-bit 200 Msample/s ADCs, were becoming available. An 8-bit 200 Msample/s ADC could generate 200 Mbytes/s of digitized data, which was moving beyond the limits of the add-on VME interconnect technologies that were developed in the late 1990s.

Beginning in 2000, serial switch fabric technology was significantly improving in performance and was gaining momentum in the market. High-speed

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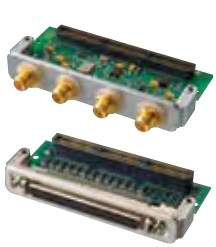

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point-to-point serial switch fabric architectures have many advantages over a parallel bus structure. They are more scalable and lend themselves well to future performance increases without major redesigns of the system.

Efforts to formally expand the capability of VMEbus to incorporate high-speed serial interconnects began in 2001 with early discussions about adding Ethernet IP capability to the backplane. This discussion quickly turned to formation of the VITA 41 working group that developed what became known as VME Switched Serial, or VXS, adding high-speed point-to-point serial lanes to the VXS P0 connector supporting protocols including Ethernet, PCI Express, Serial RapidIO, Aurora, Serial FPDP and InfiniBand.

VXS became a good choice for upgrading existing VME systems with dedicated high-speed data channels via the addition of the VXS P0 connector. VME P1 could continue to be used for system control and low-speed I/O, while P2 could be dedicated to application-specific I/O. Meanwhile, P0 could be exploited to scale additional processing nodes without impacting bandwidth over P1 or P2.

By the early 2000s, many embedded surveillance systems were utilizing 8-bit 500 Msample/s ADCs, which generate 500 Mbytes/s of data. A single x4 VXS link can provide up to 1.25 Gbytes/s of communication bandwidth with each lane running at 3.125 Gbits/s and accounting for 8b/10b encoding. This was more than enough communication bandwidth to support an 8-bit 500 Msample/s ADC.

ADCs Evolve to Keep Pace

To keep up with application requirements, ADCs continued to evolve to provide faster sampling rates and higher resolutions, which required ever increasing amounts of communication bandwidth. Over the last several years a number of high-speed ADCs have become available, such as 16-bit 500 Msample/s ADCs, 8-bit 1 Gsample/s ADCs and even 8-bit 3 Gsample/s ADCs (Figure 3). Without any data reduction, an 8-bit 3 Gsample/s ADC will generate 3 Gbytes/s of data, which is beyond the capabilities of VXS interconnects. The AD3000 offers market-leading performance and processing density in a single XMC/PMC card. This is achieved by combining a 3 Gsamples/s analog input front end and a powerful Xilinx Virtex-5 FPGA with large banks of memory, allowing both processing and acquisition in a single mezzanine card. The AD3000 is intended as a user-programmable FPGA card with an analog input port. The AD3000 is ideal for DSP applications including: Electronic Counter Measures (ECM), Spectral Analysis and Radar.

A VITA Standards Organization (VSO) working group was put together in 2004 to start a clean slate design that leveraged the capabilities of serial switch fab-

ric technologies including Ethernet, PCI Express, Serial RapidIO, InfiniBand and others. This effort by the VITA 46 working group within the VSO became VPX. VPX gives the system designer the chance to significantly increase the bandwidth using the latest in switch fabric protocols in a variety of ways from a simple point-to-point topology to a full multi-slot mesh.

The capabilities of VPX solve many of the most pressing needs of a critical embedded system with high bandwidth requirements. It provides multiple gigabytes of bandwidth on the backplane connectors, both 6U and 3U form-factors are supported, and VPX supports a large number of high-speed I/O pins to support rear I/O for conduction-cooled applications. As processor density increases, the need for adequate cooling becomes a real factor. With the addition of VITA 48, or REDI (Ruggedized Enhanced Design Implementation), there is support for convection, conduction and liquid cooling at the board level as well as two-level maintenance.

Sixteen Speedy Serial Links

The VPX standard defines sixteen high-speed serial links—often grouped as four x4 links—for board-to-board interconnects with additional available user-defined high-speed serial interconnects. Using VPX technology, today's state-of-the-art 8-bit 3 Gsample/s A/D board is able to move its data across ten high-speed serial links running at 3.125 Gbits/s to a processing board. It is clear that VPX has the communication bandwidth to support today's and tomorrow's faster and higher resolution ADCs.

Fifty years ago, the first commercially available state-of-the-art A/D converter was a 50 Ksample/s ADC made from vacuum tubes. Today's devices have sampling rates in excess of 3 Gsamples/s. As illustrated, changes in ADC technology enabled the introduction and evolution of ELINT systems. As CPU performance and analog-to-digital technology have improved, pushing the envelope for more communication bandwidth, VME technology has kept pace.

VME technology has evolved for more than 25 years to support the ever increasing performance requirements of ELINT and other sophisticated applications. The advancements in VME technology going from VME32 to VME64, to the support of add-on interconnect technologies, to the introduction of VXS and now VPX, have allowed VME technology to keep pace with the advancements in data acquisition and digital signal processing technology. VME technology is well positioned to continue to support military applications, such as ELINT, into the foreseeable future. ▮▮

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VME's legacy remains strong. However, demanding military platforms like advanced radar processing have shined a light toward VXS and VPX.

David Compston, Director, Military Product Marketing
GE Fanuc Intelligent Platforms

At more than 25 years old and still going strong, VME is the solid bedrock of military electronic systems engineering. Military system designers find it dependable, but it is starting to show some "cracks" as competing technologies create hairline fissures and are causing tremors that, if not exactly on the Richter scale, are said to threaten to destabilize the towering mountain that is VME.

What's driving this so-called seismic shift in the embedded space and why is it attracting so much interest from military engineers, especially in the areas of signal and radar processing? The answer is two new VITA specifications—VXS and VPX—which are changing the way system designers think about building multiprocessing systems. Both architectures share one thing in common: they replace some or all of the existing VME connectors with a high-speed connector designed for high-speed serial switched fabrics such

Figure 1

Shown here a Proteus aircraft flies over Southern California carrying the Global Hawk variant of the Multi-Platform Radar Technology Insertion Program radar. The Proteus is a high-altitude aircraft similar in size to Global Hawk.

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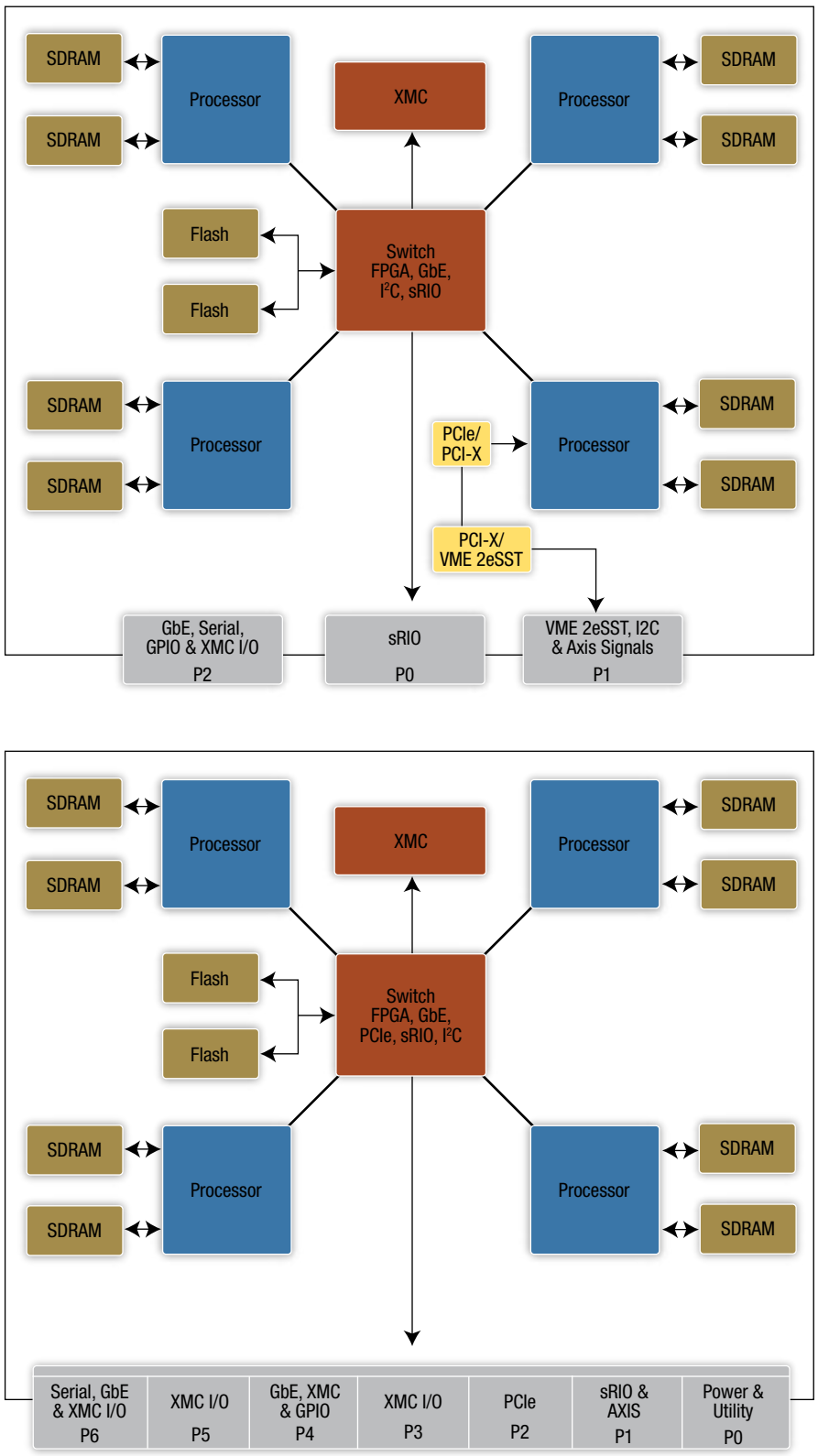

Figure 2

From an architecture point of view, this (VXS) DSP220 (top) is virtually identical to the (VPX) DSP230 (bottom).

as PCI Express and Serial RapidIO. An example application that is pushing the envelope of upgradeable radar processing is the Multi-Platform Radar Technology Insertion Program. Figure 1 shows a Proteus aircraft carrying the Global Hawk variant of that radar system. The Proteus is a high-altitude aircraft similar in size to Global Hawk.

Serial switched fabrics promise massively higher data rates than those of which VME is capable—a growing requirement in today's demanding military embedded computing environments—with a four lane (x4) PCI Express port rated at up to 8 Gbits/s in each direction, while a similarly configured Serial RapidIO port attains up to 10 Gbits/s. Both VXS and VPX offer full support for serial switched fabrics. The question for military computing developers is: how do you distinguish between these two apparently competing solutions?

Fortunately there are some clear differences between the technologies that help us here.

Compatible With Legacy VME

VXS is designed to be fully compatible with legacy VME boards, and hence only the optional P0 connector is replaced by a high-speed fabric connector. VPX takes a different approach, replacing legacy connectors with fabric connectors and yet still offering backward compatibility, this time through a "hybrid" backplane arrangement with a flexible combination of VPX and VME bus slots. The art is to determine which is better for a particular application.

One key difference may be in the arrangement of the fabrics. VXS uses a single 15-wafer 7-row Multigig RT2 P0 connector, providing a maximum of two x4 fabric ports per payload slot. A typical VXS system will accommodate up to eighteen payloads and one or two switches. This arrangement works well for larger systems but represents a significant overhead in smaller systems, perhaps employing five or fewer boards.

Centralized switch slots—as found in VXS—really come into their own with larger systems. For critical, high-availability applications, it is possible to accommodate more than one switch, typically configured in a dual star layout to

allow for failover. The real benefit, however, comes in the sophistication of the interconnection architectures that dedicated switching slots permit.

Take, for example, the GE Fanuc Intelligent Platforms CRX800, which is a VXS (VITA 41.2)-compliant 22-port Serial RapidIO switch card. This VXS switch offers eighteen x4 Serial RapidIO (sRIO) payload ports, four x4 sRIO inter-switch ports and a PowerPC MPC8548 management processor. This 22-port VXS switch employs no fewer than ten Tundra TSI578 Serial RapidIO switch devices, configured for maximum throughput and minimum latency between ports. This interconnect model is often preferred by software architects who appreciate the greater freedom this permits them in assigning processing tasks to individual processing nodes.

By contrast, VPX replaces all legacy connectors with six 16-wafer RT-2 connectors plus a smaller P0 utility connector. This enables VPX boards to support a minimum of four x4 fabric ports per slot and potentially more if other requirements allow. For example, GE Fanuc Intelligent Platforms' DSP230 quad PowerPC multiprocessing blade can support up to eight x4 fabric ports with a combined total bandwidth of 220 Gbits/second. The other key benefit conferred by deploying new connectors throughout is the ability to support multi-gigabit I/O technologies such as digital video, 10G Ethernet, FPGA Aurora links and so on.

Distributed Switching Scheme

With higher connectivity per slot, VPX lends itself to a distributed switching architecture, typically configured as a mesh. With each VPX board offering four x4 ports, a five-way mesh can be easily abstracted, and larger systems are equally possible. This kind of architecture also has the benefit of being almost infinitely scalable, as additional switching capability is added with every processing node.

Both VXS and VPX offer similar choices in terms of actual switch fabric, and this is always uppermost in a system designers mind. Market acceptance would suggest that PCI Express is a leading candidate; however, the type of application under consideration—demanding radar processing, for example—is typically a highly scalable application, with some customers either running or planning to run up to 80 nodes per enclosure. PCI Express, for all its virtues, does not scale as easily.

With the limitations of PCI Express in mind, Serial RapidIO stands out as the best alternative. It has gained traction in the military market and it is high performance—higher performance than either PCI Express or Gigabit Ethernet. It has the intelligence and determinism necessary to ensure correct routing but without, for example, the overhead of Ethernet, and it is inherently scalable. Even better, Serial RapidIO is a natural partner for the PowerPC architecture, given the 8641's support for an on-chip end point.

So how does all this technology translate in practice? In fact, VXS and VPX boards are not actually that much different under the skin. Take, for ex-

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Expansion Bus	PC/104 ISA Bus	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PCI-104 PCI Bus	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
	PCI Bus Masters	4	4	4	4	4	4	4	4	4	4	4		4
	APIC (add'l PCI interrupts)	9	9	9	9	9	9	9	9	9	9	9		
CPU and BIOS	CPU Max Clock Rate (MHz)	1400	1400	1400	1400	1400	400	650	400	650	400	650	500	500
	L2 Cache (KB)	2048	2048	2048	2048	2048	256	256	256	256	256	256	16	16
	Intel SpeedStep Technology	✓	✓	✓	✓	✓								
	ACPI Power Mgmt	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	1.0	1.0		
	Max Onboard DRAM (MB)	512	1024	1024	1024	1024	512	512	512	512	512	512	512	512
	RTD Enhanced Flash BIOS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Nonvolatile Configuration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	RTD Quick Boot	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	USB Boot	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Peripherals	Watchdog Timer & RTC	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	ATA/IDE Disk Chip (MB)	4096	4096	4096	4096	4096	4096	4096	4096	4096	4096	4096	4096	4096
	Audio		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
	Analog Video	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA
	Digital Video	LVDS	LVDS	LVDS	LVDS	LVDS			TTL	TTL	LVDS	LVDS	LVDS	
	AT Keyboard/Utility Port	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	PS/2 Mouse	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	USB Mouse/Keyboard	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
I/O	**RS-232/422/485 Ports**	4	4	2	4	2	2	2	2	2	2	2	2	2
	USB Ports	4	2	4	2	4	2	2	2	2	2	2	2	2
	10/100Base-T Ethernet	1	1	1	1	1	1	1	1	1	1	1	2	1
	ECP Parallel Port		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	aDIO (Advanced Digital I/O)	14	18	18	36	36	18	18	18	18	18	18	18	18
	multiPort (aDIO, ECP, FDC)		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SW	ROM-DOS Installed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DOS, Windows, Linux	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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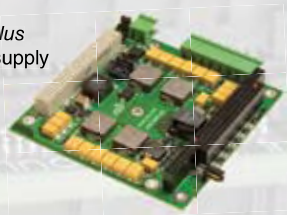

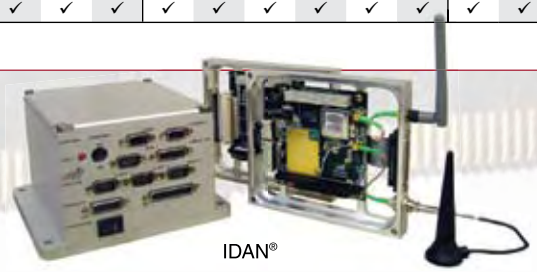

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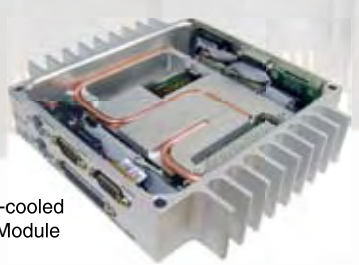

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Bus	Active Bus	PCI	PCI	ISA	ISA	PCI	PCI	PCI	ISA	ISA	ISA	PCI	PCI	PCI
	Passthrough Bus	ISA				ISA	ISA					ISA		ISA
	DMA or PCI Bus Master	✓	✓	✓	✓	✓	✓	✓				✓	✓	✓
	McBSP Serial Ports	✓	✓			✓	✓	✓						
Analog Input	Single-Ended Inputs	16	16	16	16	16	16	16						
	Differential Inputs	8	8	8	8	8	8	8						
	Max Throughput (kHz)	1250	1250	500	100	1250	500	500						
	Max Resolution (bits)	12	12	12	16	12	16	16						
	Input Ranges/Gains	3/7	3/7	3/4	1/4	3/6	3/3	3/3						
	Autonomous Calibration	✓	✓											
	Data Marker Inputs	3	3	3		3								
Conversions	Channel-Gain Table	1K	1K	1K	1K	1K	1K	1K						
	Scan/Burst/Multi-Burst	✓	✓	✓	✓	✓	✓	✓						
	A/D FIFO Buffer	8K	8K	8K	8K	8K	8K	8K						
	Sample Counter	✓	✓	✓	✓	✓	✓	✓						
	SyncBus	✓	✓			✓	✓	✓						
Digital I/O	Total Digital I/O	16	16	16	16	16	16	16	48	18/9	64	48	48	48
	Bit Programmable I/O	8	8	8	8	8	8	8	24	6/0		48	48	✓‡
	Advanced Interrupts	2	2	2	2	2	2	2	2			2	2	✓‡
	Input FIFO Buffer	8K	8K	8K	8K	8K	8K	8K						
	Versatile Memory Buffer											4M	4M	8MB
	Opto-Isolated Inputs										48			
	Opto-Isolated Outputs										16			
	User Timer/Counters	3	3	2	2	3	3	3	3	3		10	10	6
	External Trigger	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓‡
	Incr. Encoders/PWMs									3/9		4/8	4/8	✓‡
Analog Out	Analog Outputs	2	2	2	2	2	2	2						
	Max Throughput (KHz)	200	200	200	100	200	100	100						
	Resolution (bits)	12	12	12	16	12	16	16						
	Output Ranges	4	4	3	1	4	5	5						
	D/A FIFO Buffer	8K	8K			8K	8K	8K						

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ample, two quad multiprocessing blades (Figure 1) from GE Fanuc Intelligent Platforms. The DSP230 VPX blade features four Freescale MPC8641D processors with eight banks of DDR2 SDRAM together with Serial RapidIO and PCI Express fabrics to all nodes. In addition, an onboard Gigabit Ethernet switch provides 1000BASE-T connections to each node.

The DSP230 has a fabric architecture optimized to provide high bandwidth for both multiprocessing and I/O connections, since signal processing applications often have to deal with significant amounts of each. Almost all modern I/O devices have adopted PCI Express as their "bus" and so DSP230 can be configured to support either a one x8 PCIe port or two x4 ports through the VPX backplane. This is important as it allows direct connection to the latest FPGA technology such as Xilinx Virtex5 parts, which are now available with hard PCI Express cores. In addition, one x8 PCI Express port connects to an onboard XMC mezzanine site for maximum flexibility.

Four Freescale 8641D processors are linked together by a Tundra TSI578 Serial RapidIO switch with one x4 port to each processor, plus four x4 ports to the VPX P1 connector. System densities of 4 to 144 processor cores per enclosure are possible with high-speed fabric interconnect to all nodes over serial RapidIO.

The real benefit of the DSP230 lies in its dual fabric architecture—four x4 serial RapidIO ports can link up to five boards in a mesh arrangement whereby each node is immediately connected to every other node, while at the same time PCI Express supports high-bandwidth I/O streaming directly into the processing mesh.

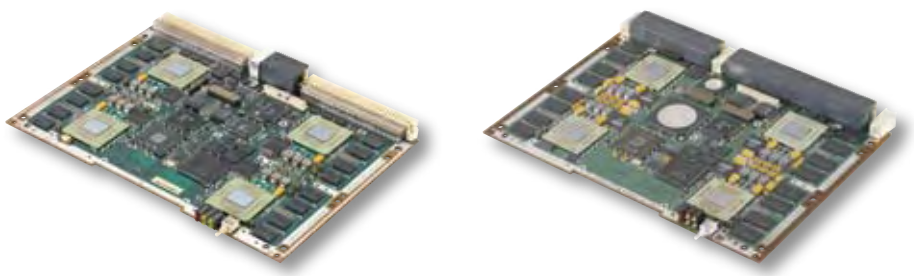

Figure 3

Almost the only visual difference between the DSP220 (VXS) (left) and the DSP230 (VPX) (right) is the connectors.

Shared Board Architecture

The DSP220 is effectively the VXS version of the DSP230. It shares much of the same internal architecture, with four 8641D processors, serial RapidIO and PCI Express fabrics and an XMC mezzanine site. The major difference is that the VXS backplane only supports two x4 serial RapidIO ports to the P0 connector. This means there is no ability to bring PCI Express out to the backplane. It also means that a dedicated serial RapidIO switch card will probably be needed somewhere in the system; with just two ports, the options for forming a mesh are limited.

The big gain with VXS is that existing VME boards can easily be accommodated in the same backplane, at least as long as those boards do not already use a P0 connector. The use of dedicated switch slots also means that there is greater scope for a "standard" VXS backplane—although military systems often employ dedicated backplanes in any event—to accommodate I/O wiring into the backplane (Figure 2).

Of course, it's not just about the technology. It's also about, for example, the compromise that developers are prepared to make in balancing performance against

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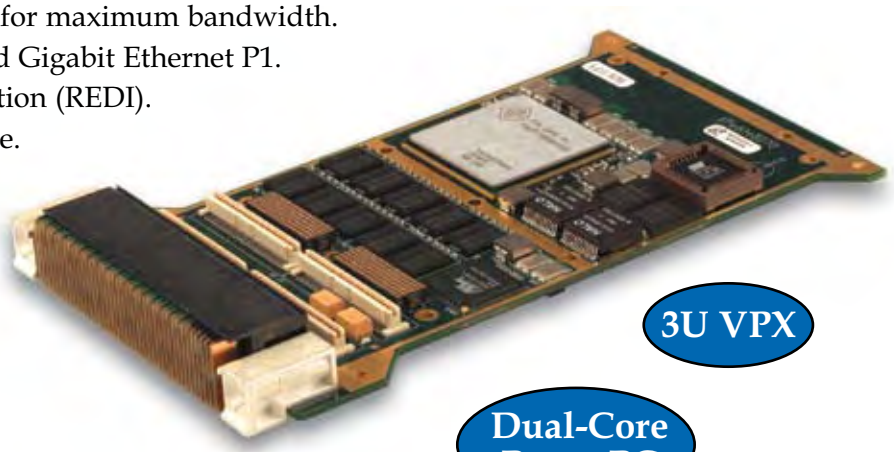

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risk—with each program typically having its own, unique requirements. VPX, for example, promises the most gain in terms of future scalability—but some have expressed concern that it may not yet be ready for "prime time." Some of those misgivings have been addressed, especially since VITA 46.0 (the base standard) and VITA 46.1 (VMEbus signal mapping) achieved ANSI ratification in October 2007. Others rightly point out that further VPX standards have yet to be agreed upon, and there is still discussion about the performance of the Multigig RT-2 connector in the most severe environments, although qualification testing has repeatedly shown it to be at least as good as the existing VME connectors in that regard. VXS, on the other hand, represents a probable lesser performance gain—but at lower perceived risk.

Both VXS and VPX are already finding distinct niches in demanding signal and radar processing applications. Lockheed Martin, for example, recently selected VXS for the MEADS (Medium Extended Air Defense System) program, an international program that sees the United States working with Germany and Italy to provide next-generation point defense capabilities. The MEADS radar system utilizes the full capabilities of the CRX800 22 port sRIO switch and the DSP220 VXS multiprocessing board.

Similarly, VPX is being mandated for an increasing number of ground and airborne applications, including some high-profile military programs. Its VPX-REDI (VITA 48) format is attracting significant interest, primarily in two-level maintenance (2LM) scenarios, where the advantage of an ESD-protected connector combined with screened top and bottom covers provides a unique COTS solution.

Finally, what of the old warhorse, VMEbus—the architecture that is, in theory at least, under threat from VXS and VPX? The fact is that it shows no sign of weakening, with recent technology refreshes such as 2eSST boosting bandwidth to 320 Mbytes/s. VME single board computers are also leveraging the latest processor technologies such as the Intel Core 2 Duo and Freescale 8641 PowerPC processors—and already incorporate PCI Express and high-speed XMC mezzanines. For many classes of application, both now and the foreseeable future, this will be more than sufficient.

If anything, VXS and VPX should be taken as indications, not of any emerging weakness in VME, but rather of its inherent strength. Both VXS and VPX are clearly developments of an underlying architecture that continues to provide a firm foundation on which the challenging military embedded computing applications of tomorrow can be built. VME has traditionally been characterized by—and become popular because of—the flexibility it offers: VXS and VPX are two highly complementary further manifestations of that flexibility. ■■

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Advances in Simulation

Military Simulations Get Real

Using Digital Molecular Matter (DMM) simulation, wood breaks like wood, metal bends and tears like metal, and glass shatters like glass. The result is more realistic military simulation and training programs.

Vik Sohal, Chief Operations Officer
Pixelux Entertainment,
a division of Objective Interface Systems

Military simulations today rely heavily on art-swaps or real-time substitutions of art assets. When you shoot a window, a script is run to display an animation showing the window breaking. In some cases these art swaps are combined with rigid body physics systems in an attempt to provide emergent behavior.

The problem with both of these approaches is that they are severely limited in terms of providing what simulation users expect—realism. The number of options to show how an object will behave is severely limited. There is no provision to take into account the stresses encountered by the assets as they are subjected to simulated forces, nor is there any means of determining how to set the behavioral response of the assets (establishing whether something is wood, glass or metal for example).

Now there's a completely new approach toward managing damage within simulations using a technology called Digital Molecular Matter (DMM). Military simulation based on DMM, a product called "DMMfx," was introduced at the 2007 I/ITSEC and represents a way to provide realistic deformation and fracture in real-time within military simulations. Wood breaks like wood, metal bends and tears like metal, and glass shatters like glass. DMM achieves this capability by modeling the stress within a scene through finite element representations of the art assets in simulation. Greatly desired damage features such as buckling,

Figure 1

With Digital Molecular Matter (DMM) simulation, wood breaks like wood, metal bends and tears like metal, and glass shatters like glass. DMM achieves this capability by modeling the stress within a scene through finite element representations of the art assets in simulation. Shown here is a tank breaking through some wooden fences in a simulation using DMM.

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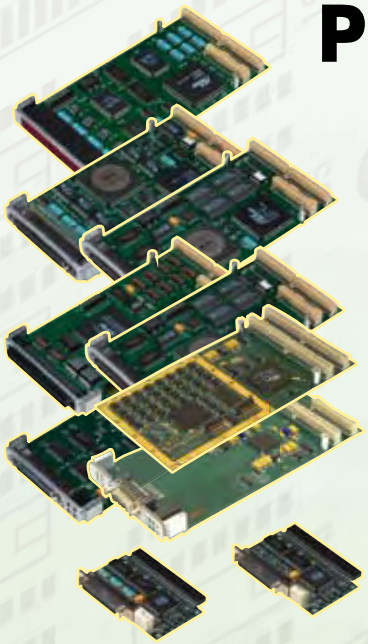

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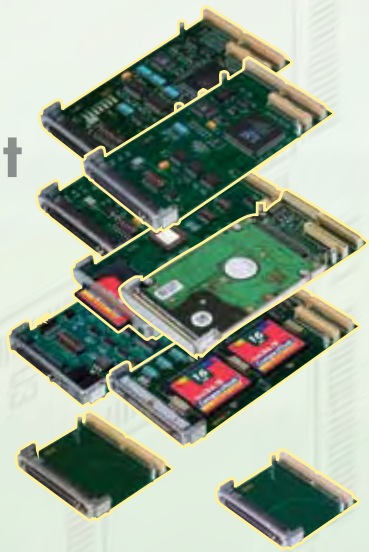

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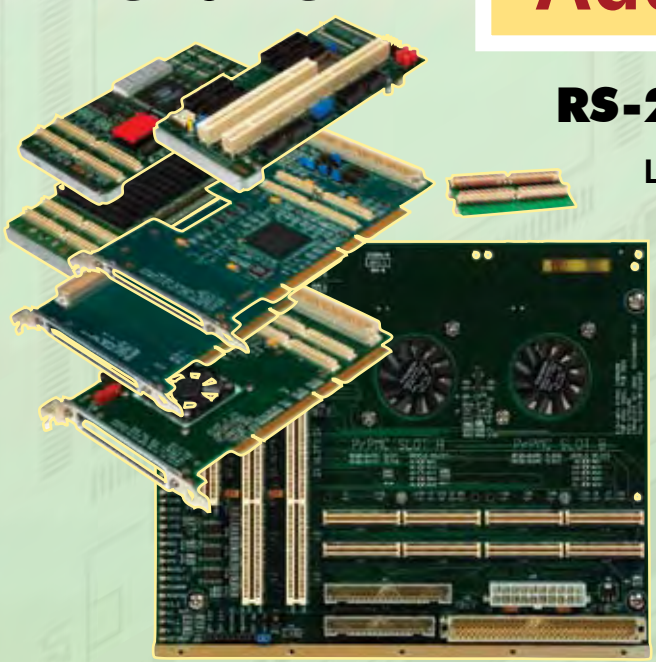

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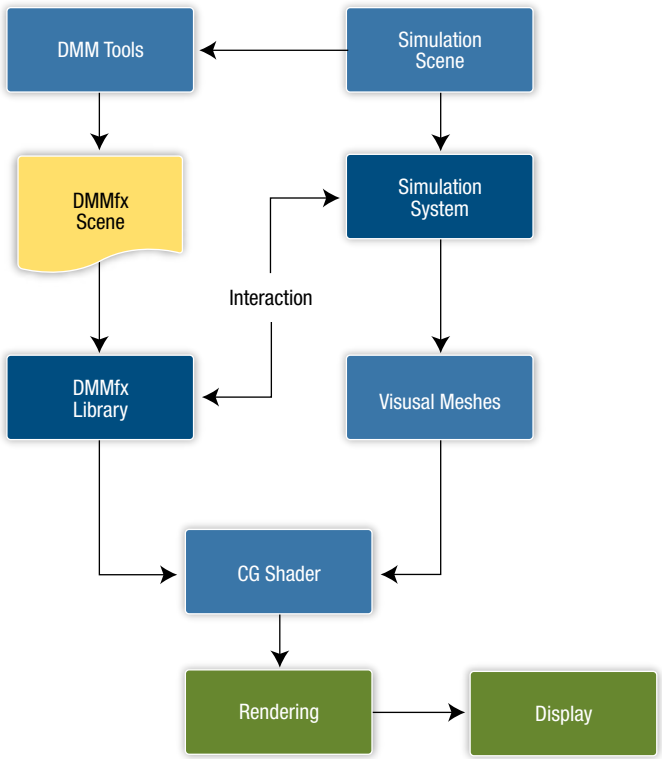

Figure 2

In DMMfx, the DMM toolchain is used to convert the simulation scene into a DMM scene, which is then given to the DMMfx Library for simulation. The DMMfx scene consists of a set of volumetric, tetrahedral meshes with a series of attributes for indicating a diverse set of parameters ranging from plasticity to toughness.

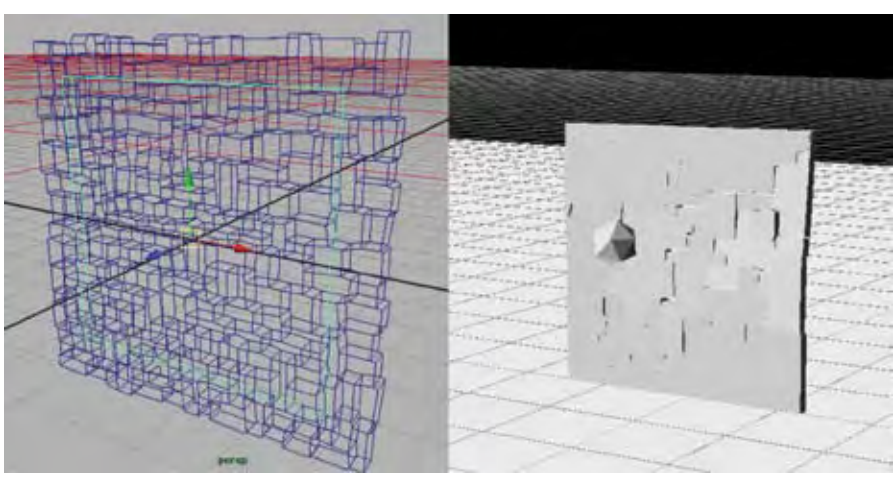

Figure 3

The DMMfx pipeline supports the concept of "splinterization." Splinter geometry can provide a very high degree of realism by giving the appearance that fracture is occurring in a more complex way than it actually is without the increased overhead of denser tet meshes. Shown here is a stone wall with splinters.

collateral effects, tearing and fracture can now occur in completely expected ways, providing simulations with the unpredictability and realism necessary to ensure their effectiveness. Figure 1 shows a tank breaking through some wooden fences in a simulation using DMM.

Video games are driving the technology that we are finding in military simulations. The video game field has problems that are strikingly similar to the military simulation arena. Specifically, the problem of art assets generation has become a very real detriment to getting games out on time and within budget. With the recent upgrade in console systems (PS3, Xbox360), gamers are expecting a corresponding upgrade in the quality of their entertainment. Unfortunately, there is a very big problem in this area: While visually the new systems can render scenes that look very real, they lack the kinetic realism that must match or exceed the visual realism. Or to put it another way, "things don't move as good as they look."

Anticipating this growing problem in gaming, Pixelux Entertainment set out in 2004 to create an entirely new kind of physics system. The roots of this system lay in the well-established world of finite element analysis (FEA). Up to that point, FEA systems had largely been used to run simulations in an off-line mode. Given the complexity of these simulations, nobody expected that it was possible to run them in real time. Another problem was that while FEA systems simulated the stresses within objects very well, they did not really do anything about fracture. Dr. James O'Brien's seminal work on animating fracture had set the ball rolling in terms of establishing a direction for breaking things.

With all the elements in place, Pixelux began working on a real-time implementation of a finite element physics system that applied the fracture and deformation principals outlined by Dr. James O'Brien. In parallel, a tools' development effort was also begun to create the toolchain that would allow ordinary meshes created by artists to be turned into finite element volumetric meshes.

The result of all this work—Digital Molecular Matter (DMM)—attracted the attention of LucasArts, which at the time was beginning an effort into simulation-based gameplay. LucasArts wanted to use simulation-based technologies like DMM to augment gameplay while simultaneously reducing production costs in their new Star Wars and Indiana Jones games. After an initial demonstration in late 2005, Pixelux began working in a partnership with LucasArts to develop and refine DMM technology so that it was an artist-friendly, high-performance technology that could work within the constrained environment of a video game console.

When considering the problems inherent in today's simulation systems, one has to consider two major components—visual fidelity and kinetic fidelity. For a simulation to be convincing, kinetic fidelity always has to exceed visual fidelity.

Let's define these terms further. Visual fidelity can be considered to be the degree of visual realism inherent in a scene. Things like how good the shadows look, or how smoothly the shading is done over a surface, are all attributes of visual fidelity. Kinetic fidelity defines how well things in a simulation move. An example of kinetic fidelity is how something reacts when hit by something else, or how closely to reality a wooden table reacts to a heavy object placed on it.

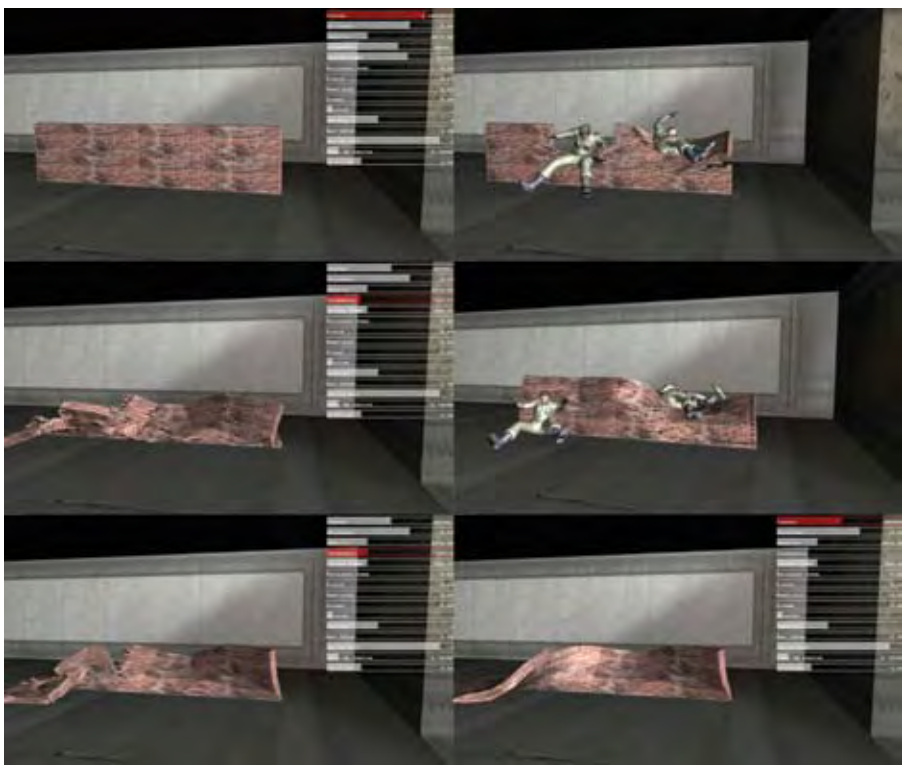

Figure 4

Material adjustment is the tweaking of the physical properties of a DMMfx object. DMMfx material adjustment is something that is done in a real-time setting, ideally inside the simulation environment itself. Shown here is a brick wall having its material properties adjusted.

Rigid Body Dynamics

When considering the kinetic fidelity of modern simulations, the term "rigid body dynamics" or RBD system is commonly used. An RBD is a very abridged way of representing the physical quantities of simulation objects. The coefficient of restitution (bounciness), mass, inertia, dampening, translation and rotation are generally the only physical parameters that can be changed in a RBD. Because objects in the real world have many more degrees of freedom than just the 10 that RBDs use, simulations done with them can look like everything is made of giant Styrofoam blocks that never bend or break.

A person's perception is tuned very highly to movement, and so kinetic fidelity is a major visual cue in providing immersive simulations. Because visual fidelity has seen so much advancement over the past 10 years, it has served to exasperate the problem of a lack of kinetic fidelity. In the field of animation, it is well understood how important it is for the visual fidelity to be less convincing than the kinetic fidelity in order to provide a convincing element of animation. Pixar has kept their cartoonish style chiefly because their lighting models are so good that bumping the visual fidelity up to its true potential would cause them a problem of having to increase the kinetic fidelity of their animations up to a level not possible with manual animation.

A potential solution to this problem is to use finite element analysis in real time. Because finite element analysis is based on the representation of a mechanical continuum within an object, it is ideally suited for providing a massive increase in kinetic fidelity. Where a RBD system may have only 10 degrees of freedom (coefficient of restitution, 3 translations and 3 rotations, inertia, mass and dampening), a finite element system can have thousands, each corresponding to the ways in which each element can move. What's more, the properties of these elements can be set in many different ways, allowing objects to be created that mimic their real-life counterparts with amazing accuracy—wood that breaks like real wood, metal that bends and deforms and even tears, and concrete that crumbles. The result is a degree of kinetic fidelity that has never before been seen in real-time visual simulation. Being able to do finite element simulation in real time is an entirely new concept and has led to the coining of the term "material physics system."

Working with Objective Interface Systems (OIS), engineers at Pixelux adapted Digital Molecular Matter (DMM) for the simulation market. Introduced to the simulation market as DMMfx, this solution provides both real-time middleware and a set of tools to create DMM objects. The interaction of these parts is shown in a typical visual simulation environment in Figure 2.

A middleware layer is a subsystem that adds functionality in a modular fashion. The DMMfx middleware does this by running independently of the primary simulation system. The information exchanged between the primary simulation system and DMMfx consists of things like forces being applied to specific parts of the scene, whether objects are being kinematically "driven" (moved outside of simulation) or other physically based interactions. Since the entire DMMfx scene is based on physical properties, force feedback is a natural result and can be used for all sorts of interesting visual possibilities as well as generating highly realistic sound from collision, stress and fracture.

The result of these interactions is a finite element mesh, which can be broken or deformed. To aid in rendering the resultant interactions, DMMfx provides a shader program that maps the visual deformations resulting from the tetrahedral mesh to the visual mesh being rendered.

In addition to all this, the DMMfx middleware also provides support for a visual embellishment called a "splinter geometry." This is geometry that is related to the physical material being simulated. For example, you might use wood splinters for wooden objects and you might use brick-and-mortar splinters for brick walls. Many other splinter possibilities are possible; all are dependent on the effect desired.

Compressing and Freezing

DMMfx also has the ability to compress objects within a scene so they do not consume space. This can be used for level-of-detail if needed. Freezing is also a major capability that allows very large scenes to be constructed without having to simulate all elements. Tetrahedral meshes that are not live are "frozen," which means they are put into a dormant state that can be quickly changed if needed.

The DMM toolchain provides simulation artists with the ability to turn their visual creations into physical ones. A key part of doing this is that artists generally work with surface meshes that are basically shells with the appearance of volume. In order to make these visual objects into physical ones, we must make them solid with volumetric properties. The toolchain encompasses the process of doing that by automatically constructing a physical representation based on a visual one.

Creating a DMM object starts with an artist-created surface mesh. This mesh is then used as the basis for a "tet cage," or a shell of points around the surface mesh. The tet cage is in turn used to create a "tet

mesh"—a tetrahedral tessellation of the volume bounded by the tet cage. Finally, if the object is breakable, the tet mesh has to be clipped against the surface mesh and have internal faces added to tetrahedral boundaries, which will be visible when the object breaks. DMMfx objects can break only along tet boundaries.

The DMMfx pipeline also supports the concept of "splinterization." This involves the association of material-specific geometry with the tetrahedral mesh. The toolchain includes facilities to create splinters (Figure 3) through 3D extrusions of 2D bitmaps. This allows the rapid construction of things like bricks, tree splinters and rocks from 2D illustrations. Splinter geometry can provide a very high degree of realism by giving the appearance that fracture is occurring in a more complex way than it actually is without the increased overhead of denser tet meshes.

All the tools within the DMMfx toolchain are also available in the form of a Maya plugin. Within the plugin, one can directly convert visual meshes into DMMfx FEA meshes as well as use simulation to create "canned" animations too complex to simulate in real time.

Material Adjustment

Material adjustment is an additional step, but is a very important step in correctly applying DMMfx to a simulation. To describe the process simply, it is the tweaking of the physical properties of a DMMfx object. You might want to make a brick wall that is slightly elastic to achieve a certain effect. Or you might want to make a glass window out of safety glass instead of plate glass (one breaks differently than the other since it is pre-stressed). DMMfx material adjustment is something that is done in a real-time setting, ideally inside the simulation environment itself. There are, however, real-time viewer applications that one can use to adjust it off-line. Figure 4 shows a brick wall having its material properties adjusted.

The resulting simulations of DMMfx are fairly impressive. Deformation and fracture add an incredible amount of kinetic fidelity to a scene to which our visual cortex is very sensitive. Watching a wall slightly bend before it breaks is a great visual cue, as is the sound a wooden door makes before it cracks.

Modern processors are now fast enough to run finite element analysis-based simulation in real time. By utilizing a physics system based on FEA, simulation designers will be able to reduce their asset creation cost while increasing both their visual and kinetic fidelity, making the simulations more convincing and immersive. Simulations are no longer scripted scenarios, and time-to-deployment is exponentially faster. A simulation that once took months to create now takes only days or weeks. ■■

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DoD Groups and Specialist Firms Team to Tackle EOL Issues

Component obsolescence continues to plague the military market. An infrastructure of government groups and specialty commercial firms are helping ease those challenges.

Jeff Child,
Editor-in-Chief

The broad scope of obsolescence—referred to as Diminishing Manufacturing Sources and Material Shortages (DMSMS) in military circles—shows no sign of going away any time soon. In fact, as commercial and consumer system lifecycles shrink, the components used in those board markets are facing ever shorter life spans. Fortunately there's a growing infrastructure of companies and organizations armed to battle this problem. *COTS Journal*'s Ninth Annual End-of-Life Supplier Directory, displayed on the following three pages, lists those players and what they do.

There are a number of ways to deal with the problem of a chip that has gone end-of-life. There are numerous after-market chip suppliers who stock inventories of obsoleted devices. Among them is a mix of small firms specializing in after-market business, and large distributors who include after-market products in their portfolio. There are also packaging firms who do custom assembly of obsolete integrated circuits using existing wafer and die.

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The directory lists the key DoD initiated organizations whose responsibilities include component obsolescence management and support. Among these, the Defense Microelectronics Activity (DMEA) plays a key role by developing and coordinating solutions to DoD obsolescence problems. The group has specific responsibility for issues relating to semiconductors.

Setting Up DMS Teams

When any large military program gets underway, a Diminishing Manufacturing Sources (DMS) team is set up. That team comprises members from the program office itself as well as from the various depots, acquisition logistic centers (ALCs) and OEMS involved. The DMEA then acts as a resource to the team by offering technical advice.

The solution to any obsolescence program takes either one of two paths. First is a logistics solution—finding the appropriate components through DSCC or other sources. The other is an engineering solution—redesigning the system in order to negate the need for the obsolete parts. If the DMS team can't find a part, the DMEA can sometimes help find the part through its contacts. Their main focus however is to help evaluate whether a logistics solution is best or whether it's perhaps more cost-effective to either reverse engineer the ICs involved and move to an ASIC, or compress several functions into a single ASIC. As ASIC mask costs rise, increasingly FPGAs are being used instead of ASICs.

Sometimes it still makes sense to go with a logistics solution. That's particularly true when a component could help several different programs. The role of the Defense Supply Center, Columbus (DSCC) Sourcing and Qualifications Unit is to establish and maintain a known-good supplier base. Such suppliers must successfully demonstrate that their products meet the specified performance, quality and reliability levels via the DoD product Qualification program. In essence, the DSCC's role is an item manager for piece-parts, working with the inventory control points of the various branches of the military.

Rounding out the team of organizations serving a DMS role is the Government-Industry Data Exchange Program (GIDEP). GIDEP acts as a centralized database for various kinds of information, including DMS issues. Its broader role is as a center for sharing technical information essential during research, design, development, production and operational phases of the lifecycle of systems. They keep track of DMS notices when parts become obsolete and solutions for those notices. GIDEP also has the responsibility of hosting the DoD DMS Teaming Sub-Group on their databases. ▮▮

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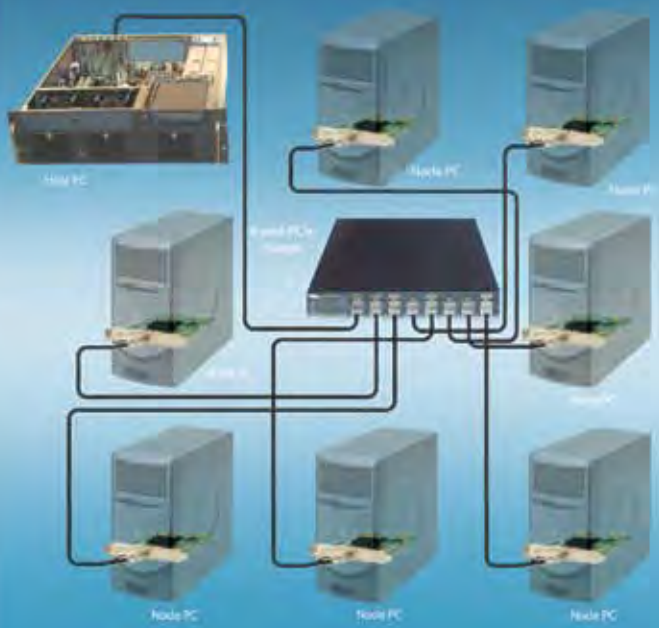

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Chip Supply	Orlando, FL. (407) 298-7100. [www.chipsupply.com].	D, P	Offers semiconductor die and packaging solutions. Capabilities include post wafer fab processing, including dicing, inspection, engineering and test services; obsolescence management/life cycle planning; and specialized packaging solutions, including ceramic, CSP, TAB and QML.
CPU Technology	Pleasanton, CA. (925) 224-9920. [www.cputech.com].	B, E	Uses advanced design tools in developing system-on-a-chip-based technology to produce modernized, backward-compatible embedded computing solutions and high-performance, general-purpose multicore processors for use in military and commercial environments.
DMEA	McClellan Park, CA. (916) 231-1506. [www.dmea.osd.mil].	B, E, F, G, P	DMEA provides long-term, strategic support for the entire range of DoD systems that utilize microelectronics. DMEA uses a unique, innovative methodology to reverse-engineer microelectronic devices to determine their function and a specification; analyze possible solutions; and design, build, and test the best solution. An on-site reconfigurable foundry produces die in several critical process technologies.
DPA Components International	Simi Valley, CA. (805) 581-9200. [www.dpaci.com]. [www.dpems.com].	D, P, S	Specialty recovery process to remove and reuse die from OEM plastic or ceramic packaged parts, repackaging, upscreening and testing. Comes close to DMEA definition of "reclamation," but at a die level.
DSCC-VQ	Columbus, OH. (614) 692-0662. [www.dscc.dla.mil/offices/sourcing_and_qualification/].	DB, G, R	QML/QPL product for OEM procurement and logistics support to military services. Provides oversight of electronic component manufacturers for the military services.
Electronic Material Industries	Toluca Lake, CA. (818) 763-9584. [www.militarycomponents.com].	O	Buys, sells and stocks military and commercial electronic components.
Falcon Electronics	Commack, NY. (631) 351-8515. [www.falconelec.com].	L, O, S	Distributor to the avionics, military and space industry. Segregated product handling per JEDEC and MIL-STD. Offers DMS support services such as Global Semi Search and access to an extensive obsolete inventory. Also offers upscreening.

Company/Organization	Contact	Category	Comment
GD California	Livermore, CA. (925) 456-9900. [www.gdca.com].	B, E, O	Manufacturer specializing exclusively in legacy boards, system-level products and obsolescence management. Over 3,000 products include VME, CompactPCI, STD/STD32 and Multibus systems. Custom and off-the-shelf products are manufactured for industries including military, semiconductor, medical, telecom and industrial.
GIDEP	Corona, CA. (951) 898-3213. [www.gidep.org].	DB, G, R	The DoD's centralized database for DMSMS issues; hotlinks to numerous industry references on DMSMS. Host for the DoD DMSMS Knowledge Sharing Portal (DKSP).
IEC/IECQ	Geneva, Switzerland. +41 22 919 02 11. [www.iecq.org].	R	IEC generates international standards for the practice of uprating components and using them in systems. IECQ conducts the IEC's certification program for electronic components, processes and related materials, including aerospace.
IHS	Englewood, CO. (303) 397-2896. [www.IHS.com].	DB, L	4DOnline Parts Universe catalogs more than 14 million electronic parts from over 500 manufacturers in 350+ categories. HAYSTACK contains over 100 million parts in Federal Supply Catalog and over 40 U.S. Army, Navy, Air Force and related databases. Fasteners eCatalog enables identification, specification and sourcing of aerospace and defense standard fasteners/hardware.
Innovasic Semiconductor	Albuquerque, NM. (505) 883-5263. [www.innovasic.com].	E	A fabless semiconductor company that provides embedded solutions and replacement IC services for the long life-cycle market.
Inventory Locator Service (ILS)	Memphis, TN. (901) 794-5000. [www.ilsmart.com].	DB, L	Focuses primarily at the subsystem level.
L-3 Communications, Advanced Products & Design	San Diego, CA. (858) 597-9166. [www.L-3Com.com/apd].	B, E, P	Rapid Retargeting engineering services developer/provider for board-level electronic components and subsystems. Approach relies on reconfiguring hardware and software to be form, fit and functional replacements.
Lansdale Semiconductor	Tempe, AZ. (602) 438-0123. [www.lansdale.com].	D, E, O, P	Aftermarket support of over 3,000 obsolete ICs from Motorola, Philips, Intel, National, AMD and others. Manufactures products using the original tooling to ensure same performance and quality. QML certified to MIL-PRF-38535.
Maxwell Technologies	San Diego, CA. (858) 503-3300. [www.maxwell.com].	E, P	Uses MCM package as form, fit and functional replacement. Company's Rad-Pak technology enables commercial devices to meet space requirements. Fabless, QML-certified, with radiation testing and laboratory analysis capabilities
Minco Technology Labs	Austin, TX. (512) 834-2022. [www.mincotech.com].	D, O, P	Semiconductor, processor and tester serving military, space and commercial industries.
MTI	Fort Walton Beach, FL. (850) 664-6070. [www.mtifwb.com].	B, DB, E, L, R	Obsolescence management software, engineering services, design, redesign and manufacturing.
NAPCO International	Hopkins, MN. (952) 931-2400. [www.napcointl.com]	B, DB, D, O, P, S	A global engineering, materials management, procurement, packaging, containerization and light manufacturing company specializing in the support of military tracked and wheeled equipment.
Now Electronics, N2O Semi Division	Huntington, NY. (800) 669-3532. [www.n2osemi.com].	L, O, P	Distributor specializing in all types of obsolete memory and specialty semiconductors. Provides support for legacy products from Dens-Pak, as well as support for DMS for White/EDI, IDT, Cypress, MOSAIC, APTA/HMP and Austin. Mil-Spec and other advanced packing and testing services available.
Pikes Peak Test Labs	Colorado Springs, CO. (719) 596-0802. [www.pptli.com].	B, D, E, L, O, P, S	Lab experienced in electronic component testing and evaluation, including environmental testing, destructive physical analysis, failure analysis. Also offers calibration services. Does high- and low-temperature testing and upgrade screening for commercial, industrial and military part

Company/Organization	Contact	Category	Comment
Precience	Silver Spring, MD. (301) 421-9054 [www.precience.com].	DB	Assists in up-front component selection, lifecycle prediction algorithm and EOL notification. Delivers environmental compliance management, component obsolescence and lifecycle management, content management and design chain management solutions. Provides data cleansing, as well as a RoHS data aggregation tool to speed compliance with product lifecycle management environmental health and safety implementations.
QP Semiconductor	Santa Clara, CA. (408) 737-0992. [www.qpsemi.com].	DB, D, E, F, R	QML manufacturer and supplier of high-reliability hermetic ICs for military, aerospace and industrial applications; solutions for DMSMS and EOL problems.
Richardson Electronics	LaFox, IL. (630) 208-3637. [www.rell.com].	DB, O, P	Distributor serving RF and wireless communications, industrial power conversion and medical imaging markets. Engineering services are available to aid product manufacturing, systems integration, prototype design and parts logistics from design-in through after-market stages.
Rochester Electronics	Newburyport, MA. (978) 462-9332. [www.rocelec.com].	D, F, O, P, R	Authorized/franchised supplier of aftermarket parts for over 40 semiconductor suppliers with over 500 million finished parts and 3 billion die. Manufactures over 15,000 aftermarket devices, from commercial to fully certified military. Offers packaging and testing to extend product life even further.
Sarnoff	Princeton, NJ. (609) 734-2168. [www.gemes.com].	B, E, F, R, P	Government-authorized contractor for Generalized Emulation of Microcircuits (GEM) program.
Sensitron Semiconductor	Deer Park, NY. (631) 586-7600. [www.sensitron.com].	B, D, E, F, P, R, S	Full-service provider including R&D, design, wafer fabrication, packaging, screening, testing and engineering. Maintains a wafer fabrication clean room and a microelectronics manufacturing clean room
Sypris Test and Measurement	Orlando FL. (800) 839-4959. [www.wetest.com].	S	Offers test and calibration services to space and defense prime contractors, government agencies and commercial manufacturers, including automotive, avionics, telecom and medical. Services include semiconductor and passive component test, wafer probe, product test and evaluation, and repair and calibration of general electrical and mechanical test equipment. Fixed locations, on-site locations and mobile calibration facilities nationwide. ISO-9001:2000 registered, DSCC-approved, A2LA (ISO/IEC-17025) accredited and ISTA-certified.
T.S.I. Microelectronics	Danvers, MA. (978) 774-8722. [www.tsimicro.com].	D, E, O, P	Manufactures custom thick and thin film hybrids to SCDs for DSCC and military OEMs. Offers custom IC packaging into hermetic packages. Design and reverse engineering; second source to various obsolete hybrid circuits and discrete semiconductors.
Total Parts Plus	Fort Walton Beach, FL. (850) 244-7293. [www.totalpartsplus.com].	DB	Internet obsolescence and material content databases for all grades of semiconductors as well as database enhancement services

Abbreviation	Categories	Explanation
B	Board level	Solves board-level DMS problems (as opposed to component-level problems).
DB	Database	Provides a database covering topics such as alternate sources, devices that are obsolete, cross-references or uprating results.
D	Die processor	Refers to processing OEM die, not an emulated solution.
E	Emulation/reverse engineering	Vendor may emulate a DMS device in a gate array or full-custom device, or provide a pseudo-form, fit and functional equivalent.
F	Foundry	Has foundry capability to fabricate wafers
G	Government agency	-—
L	Locator	The vendor provides a service to locate DMS components and boards/systems.
O	Obsolete inventory	Maintains OEM inventory in die or packaged form.
P	Specialty packaging	Packages components as monolithic or multi-chip modules.
R	Industry reference	Denotes an organization or company with widely recognized knowledge or information concerning the DMS industry.
S	Uprating/upscreening	Performs uprating or upscreening.

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Technology Focus

Ethernet Switch Boards

Ethernet Switch Boards
Enter the 10 Gbit Era

The crop of rugged Ethernet adaptor and switch cards continues to expand. Now 10 Gbit products are also joining the mix.

Jeff Child,
Editor-in-Chief

Ethernet has become entrenched as a critical building block for a variety of military programs. Ethernet is being deployed in multilayer switches with dual IPv4 and IPv6 forwarding to support the DoD's sweeping plans to leverage the benefits of IPv6 (Internet Protocol version 6). Meanwhile, Ethernet is being used as an interconnect fabric in compute-intensive applications like sonar, radar, or any application that networks sensor arrays together.

Offering higher and higher levels of performance and capability than the other military I/O technologies, Ethernet is now taking on much more data-intensive and time-critical applications. Both 1 Gbit and 10 Gbit Ethernet can now—when properly implemented with offload technology—provide a highly deterministic, high-performance fabric suitable for the most demanding real-time applications.

In the past, Ethernet's main role was as a control plane solution. Now, thanks in part to the emergence of rugged 10 Gbit Ethernet products, Ethernet is now finally fast enough for data-plane use. Military system designers are now talking about or using 10 Gbit Ethernet as a "fat pipe" to move data between subsystems. Systems that need to pump data into a server farm, for example, for further processing and analysis are looking to 10 Gbit Ethernet as the interconnect linked directly into the server network. This often means bridging to other protocols in electronic warfare (EW) or combat systems to move data from subsystem to subsystem or from box to box. Ethernet is being used to bring sensor data into other systems—as an alternative to other less common protocols like FPDP, Fibre Channel, or proprietary schemes.

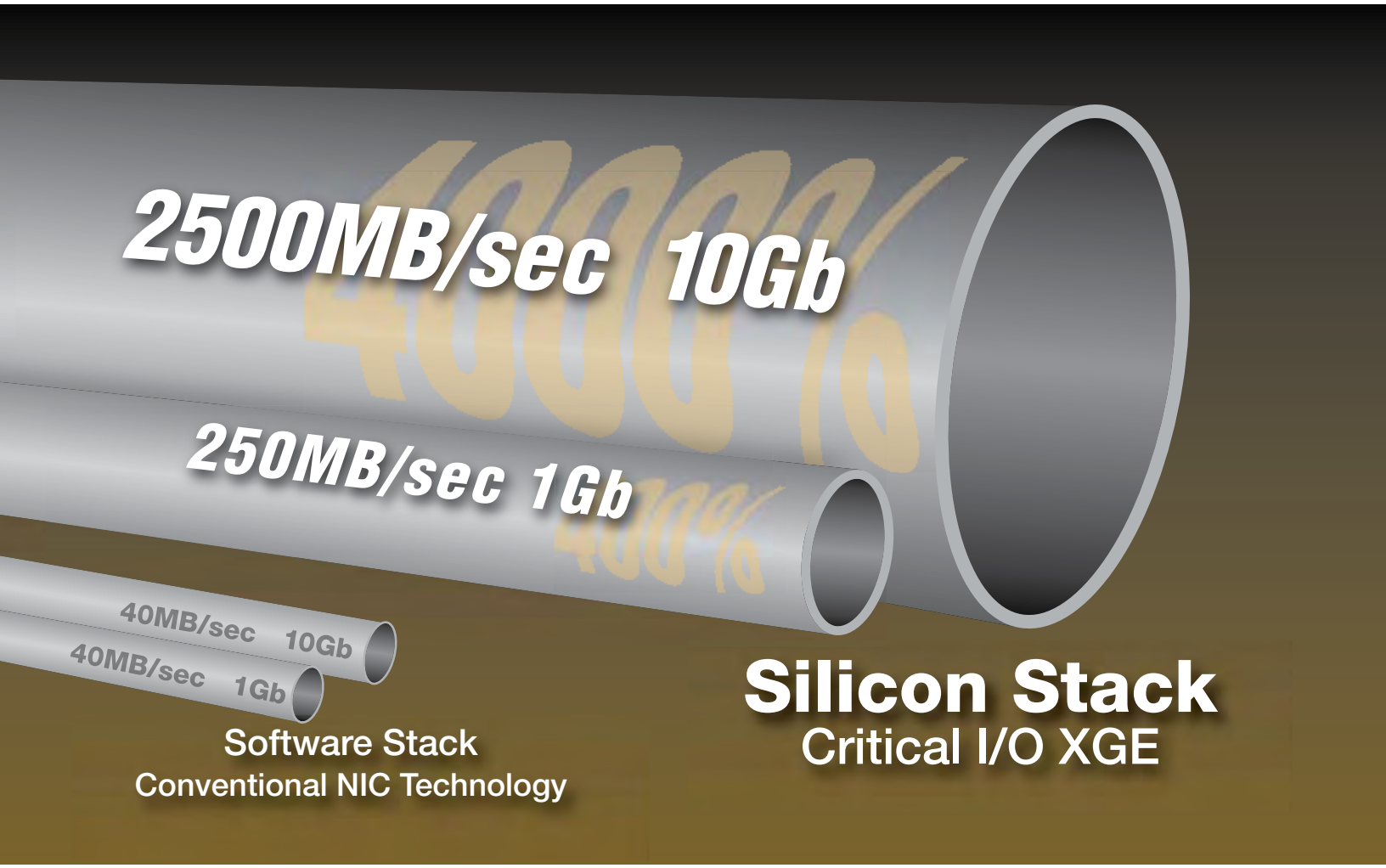
Ethernet-based IP technology is being employed in Raytheon's SSDS Mk 2 (Ship Self-Defense System) program. The SSDS MK 2 Modification 1 is used on aircraft carrier USS Ronald Reagan. (Figure 1). Raytheon uses Performance Technologies' Advanced Managed Platform IP-comms platform to provide sophisticated remote monitoring capabilities, and an IP-based networking platform for the SSDS system. The Performance Technologies IP-based platform solution features an Intelligent Shelf Manager (a self-contained computer) that provides sophisticated remote monitoring capabilities, and an IP-based networking platform for the SSDS system.

Figure 1

Ethernet-based IP technology is being employed in Raytheon's SSDS Mk 2 (Ship Self-Defense System) program. The SSDS MK 2 Modification 1 is targeted for use on aircraft carriers like the USS Ronald Reagan.

The SSDS MK2 system relies on distributed off-the-shelf embedded computers that provide automated detection through engagement capability, coordination and control of weapons and situational awareness command and control at the battle group level. Follow-on development will include enhanced air and surface capabilities for slow moving targets as well as organic training capability. ▮▮

Which Way do You Want Your 10Gb Ethernet?



Silicon Stack Technology from Critical I/O. 10Gb Ethernet at Wire Speed.

[**Problem**] You're expecting 10Gb Ethernet to deliver a whole lot more performance to your embedded system. But what if you invest in it and get no gain at all? The performance of nearly all existing 1Gb applications are limited by the software overhead associated with the TCP/IP protocol stack. This bottleneck is in the software stack, not the network hardware. So, simply upgrading to 10Gb pipes will not improve your system's performance.

[**Solution**] Unlike conventional Ethernet interfaces or processor-based "offload" products, Critical I/O's Silicon Stack technology eliminates this inherent bottleneck by offloading protocol processing to silicon; thereby achieving sustained line-rate performance, microsecond latency, and rock-solid deterministic behavior. And, Silicon Stack is 100% compliant with Ethernet standards, allowing you to leverage existing applications and hardware.

XGE Silicon Stack Ethernet
vs. Software-based Stack

	Software Stack		Silicon Stack	
	1Gb	10Gb	1Gb	10Gb
Throughput max sustained rate in MBytes/sec	40 varies with protocol		250	2500
Host Overhead	Very High		Very Low	
Latency	125 µsec		12 µsec	5 µsec
Determinism typical variation	Horrible ± 200 µsec		Rock Solid ± 1 µsec	
Reliability	Poor when under heavy load		Excellent under all load conditions, no dropped data	

CRITICAL IO

www.criticalio.com

Technology Focus:

Ethernet Switch Boards

Layer 3 Gbit Ethernet Switch Rides 6U VME

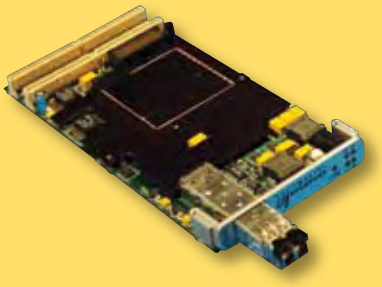
Applications including ground mobile, shipboard, airborne and homeland security all demand the right mix of networking functionality and physical ruggedness. The ComEth4070a family is a complete line of 6U VME L3 fully managed Gbit Ethernet switches for embedded applications. The ComEth4070a series uses the latest-generation Gbit switch engine and PHY transceiver. It combines a layer 2+ switch and a full layer 3 router in a single board with optimized power consumption. The ComEth4070a supports full-wire speed L2 bridging and IP routing with L2-L4 Access List for classification, filtering and prioritization.

The ComEth4070a provides 24 Gbit Ethernet ports with a full-wire speed switching capacity of 37 Mpps. ComEth4070a switches are fully managed and can easily be monitored from a browser, a remote application, a CLI or SNMP. The Switchware software provides Layer 3 functions, allowing static and dynamic protocols (RIP, OSPF), IP routing, proxy-ARP and DHCP-relay. The IP protocols are carried out by the processor and the forwarding is carried out by a full-wire speed L3 engine router. These switches can be used in all types of environments with operating ranges from standard, extended, rugged and conduction-cooled grades. Prices start at $5,200 in low quantities.

ACT/Technico
Ivyland, PA.
(215) 956-1200.
[www.acttechnico.com].

10 Gbit Ethernet XMC/PMC Boasts Optical Transceiver

As 10 Gbit Ethernet becomes mature and entrenched in the networking world, the military is turning its eyes toward it. There to satisfy such needs, AdvancedIO Systems has released its V1021, a configurable 10GbE connectivity and packet processing XMC/PMC module. Thanks to the integration of SFP+, the latest 10 Gbit optical transceiver technology, the V1021 provides high bandwidth data-pipe performance with flexible processing functionality in a single chassis slot. This optimization enables system developers in resource-demanding real-time applications such as radar, signals intelligence and sensor processing to pack more functionality into a system while reducing its size and cost.



AdvancedIO's V1021 is an open-standard form-factor module that solves the problem of connecting real-time embedded systems to extreme high-speed Ethernet networks, a problem many liken to drinking from a fire hose. Like AdvancedIO's deployed V1020 product, the V1021 can also be used as a high-speed pipe to directly interconnect embedded processing systems. Because of its compatibility with AdvancedIO's V1020 software and functionality, existing V1020 customers who require higher-density systems can deploy the V1021 in its place without making any application source code changes. As well, both modules use the same fiber optic LC connectors.

AdvancedIO Systems
Vancouver, British Columbia
Canada.
(604) 331-1600.
[www.advancedio.com].

XMC Adaptor Supports Four 10/100/1000 Ethernet Ports

The industry is rapidly fleshing out its selection of XMC products, and Ethernet adaptor functionality ranks as one of those. Concurrent Technologies has released one of the first of a series of XMC mezzanine cards—the XM 510/x24—a quad port gigabit Ethernet adaptor, supporting 1000Base-T, 100Base-Tx and 10Base-T. Where performance, functionality and space are key elements, the XM 510/x24 can be installed on a suitable host board, such as CompactPCI, VXS, VPX or VME to provide four network ports within a single-width XMC site. Commercial and extended temperature versions are available, and ruggedized, conduction-cooled or air-cooled versions will be available shortly. The board is suitable for applications requiring high-speed data throughput and lower-latency communications; target embedded markets include industrial control, telecommunications and defense.

The XM 510/x24 contains two Intel 82575EB Ethernet controllers. Each controller implements two Ethernet ports and integrates (into a single device) the functionality of two Ethernet Media Access Controllers (MAC), two 10/100/1000 Mbits/s PHY transceivers and a x4 PCI Express interface. The XMC host board's connection to the XM 510/x24's two Ethernet controllers is via a x4 PCI Express switch. The four Ethernet ports can either connect to the front or to the rear panel. The XM 510/x24 is a single-size card and is compliant with the XMC (Switched Mezzanine Card) specification. Each Ethernet Controller connects to its own 128 Kbyte in-circuit programmable flash EPROM that includes PXE firmware.

Concurrent Technologies
Woburn, MA.
(781) 933-5900.
[www.gocct.com].

ATCA System Manages Packet Traffic and Security

The AdvancedTCA architecture is slowly starting to gain some traction in defense applications, particularly those focused on hefty communications challenges. Continuous Computing offers a new ATCA system capable of supporting deep packet inspection at 10 Gbit/s line rates to deliver application-aware traffic management and aggregation. The bladed solution provides enhanced security capabilities to detect and prevent unauthorized access, protect against denial of service attacks and facilitate virus scanning.

This ATCA traffic management and security system provides system developers a platform that enables them to expedite the rollout of new "content-aware" network elements considered essential to deliver high quality and secure IP networks. Continuous Computing's new traffic management and security platform provides a carrier-grade solution for deep packet inspection in edge and core network equipment. The system includes up to 10 advanced deep packet inspection blades as well as two redundant 10 Gbit Ethernet switches, all housed in a robust carrier-grade ATCA chassis. Each packet processing blade, known as FlexPacket ATCA-PP50, incorporates two XLR732 multicore MIPS devices from Raza Microelectronics that deliver packet processing and security at line rates up to 20 Gbits/s.

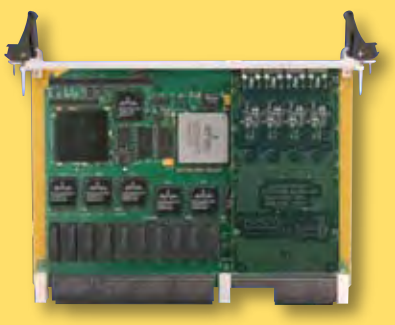
FlexPacket supports a dual redundant 10GbE backplane fabric with a range of 10 Gbit Ethernet and 1 Gbit Ethernet ports to the front and rear depending on a customer's specific cabling requirements. Each XLR732 multicore MIPS64 processor supports up to 8 Gybtes of memory (16 Gbytes per blade) and can connect to mezzanine sites for supporting TCAM and dedicated content processors via the on-chip hyper-transport interface.

Continuous Computing
San Diego, CA.
(858) 882-8800.
[www.ccpu.com].

VPX Card Serves Up Multilayer Gbit Ethernet Switching

VPX, the fabric-based next-gen VME form-factor, is gaining more and more momentum every month. A variety of SBC products have emerged, and now special function boards like Ethernet switch boards are adding to the VPX ecosystem. For its part, Curtiss-Wright Controls Embedded Computing has announced the first high-density 6U VPX Gbit Ethernet multilayer switch/router board designed for rugged embedded aerospace and defense applications.

The new VPX6-684 FireBlade II, available with 12, 20 or 24 Gbit Ethernet ports and up to 4x10 Gbit Ethernet ports, is ideal for system integrators architecting secure high-performance IPv4/v6 Intra-Platform Networks (IPNs). The board, which operates as either a fully managed or an unmanaged switch/router, provides significant performance and configuration advantages to developers building Layer 2 or Layer 2/3+ networks. Additional feature enhancements include support for routing up to 4x10 Gbit Ethernet to the FireBlade's P1 connector, and support for copper interfaces to the backplane for all of the board's 12, 20 or 24 Gbit Ethernet ports.



The VPX6-684 FireBlade II is ideal for use in applications that require high levels of security. When used as a Unified Threat Management (UTM) router, the VPX6-684 FireBlade II provides strong perimeter defense via an ICSA certified firewall. Additional security features supported by the board include Access Control List (ACL) filtering, Network Address Translation (NAT), Virtual Private Network (VPN) with tunneling support (IPSec/L2TP), IPv6 ESP/AH payloads and Encryption/Decryption/Authentication support.

Curtiss-Wright Controls
Embedded Computing.
Leesburg, VA.
(703) 779-7800.
[www.cwcembedded.com].

Managed 16-port Gbit Switch Rides 3U VPX

Support of IPv6 is a core requirement for network-centric warfare. Feeding that need, GE Fanuc's NETernity GBX410 is a fully managed (Layer 2/3) Gigabit Ethernet switch designed to meet the most demanding requirements for network switching in tactical applications. This Gigabit switch is available in both air- and conduction-cooled formats and features a non-blocking shared memory architecture. This provides 72 Gbit/s core offering full wire speed performance with minimal latency on all ports simultaneously.

The GBX410 has comprehensive management capabilities that include VLANs, Link Aggregation, Spanning Tree, IPv4, IPv6, Traffic Policing, Quality of Service (QoS), Guaranteed Bandwidth and SNMP. The GBX410 can be expanded to a 32-port non-blocking solution by connecting two GBX410s together via the integral 10 Gigabit uplink ports.

The GBX410 provides optional optical expansion through a separate Optical Expansion Board. All twelve rear ports can be converted to optical outputs to give sixteen ports of Gigabit, either 1000 Base-SX or 1000 Base-LX, and two port of 10 Gigabit, either 10G Base-SR or 10G Base-LR. Onboard built-in test (BIT) ensures the GBX410 can be easily linked with other boards to provide integrated system-level health monitoring and diagnostics.

GE Fanuc Intelligent Platforms
Charlottesville, VA.
(800) 368-2738.
[www.gefanucembedded.com].

VME Card Is Full L3 Gbit Ethernet Switch

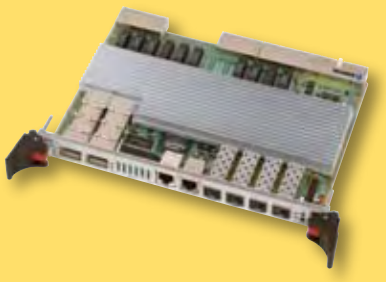
Perhaps the most attractive aspect of VME is its ability to marry today's technology with legacy platforms. Exemplifying that concept, Interface Concept has announced the ComEth4070a family, a complete line of 6U VME L3 fully managed Gbit Ethernet switches for embedded applications. The ComEth4070a series uses the latest-generation Gbit switch engine and PHY transceiver. It combines a layer 2+ switch and a full layer 3 router in a single board with optimized power consumption. The ComEth4070a supports full-wire speed L2 bridging and IP routing with L2-L4 Access List for classification, filtering and prioritization.

The ComEth4070a provides 24 Gbit Ethernet ports with a full-wire speed switching capacity of 37 Mpps. ComEth4070a switches are fully managed and can easily be monitored from a browser, a remote application, a CLI or SNMP. The Switchware software provides Layer 3 functions, allowing static and dynamic protocols (RIP, OSPF), IP routing, proxy-ARP and DHCP-relay. The IP protocols are carried out by the processor and the forwarding is carried out by a full-wire speed L3 engine router. These switches can be used in all types of environments with operating ranges from standard, extended, rugged and conduction-cooled grades. Prices start at $5,200 in low quantities.

Interface Concept
Briec de l'Odet, France.
+33 (0)2 98 57 30 30.
[www.interfaceconcept.com].

cPCI Ethernet Switch Offered in Three Rugged Levels

The concept of EOIP (Everything Over IP) is catching on strong in the military. Voice-over-IP networks aboard aircraft carriers, for example, is one step in that direction. Cost is a factor in such network implementations. With that in mind, Kontron's CP6923 board provides built-in switching capabilities for cPCI installations at an unmatched price-to-performance ratio by implementing the latest technologies including the highly compact Broadcom BCM56502 Gigabit Ethernet switch chip. The Kontron CP6923 is a 6U hot-swappable cPCI switch with 24 Gbit Ethernet ports and two high-capacity uplinks (10GbE), which makes systems cascadable. It supports all relevant standards in carrier-grade L2 and L3 switching, routing, VLANs and QoS (Diffserv) developed by Kontron.



The Kontron CP6923 now comes in three rugged levels defined as R1, R2 and R3. The R2 and R3 versions are available with E2 capabilities (extended temperature range from -40° to + 85°C). The R1-version is designed for standard application requirements in air-cooled environments. The R2-version is ruggedized for higher shock and vibration environments in accordance with the EN60068-2-27/64 (similar to VITA 47's EAC6) specification. The R3-version is fully conduction-cooled and meets VITA 47's ECC4 requirements.

Kontron America
Poway, CA.
(858) 677-0877.
[www.us.kontron.com].

PICMG 2.16 Board Sports Dual 10 Gbit Ethernet Uplinks

Applications like airborne or ship borne communications systems demand a mix of high bandwidths and the resilience of high availability. Feeding such needs, Performance Technologies offers the CPC6620, an advanced PICMG 2.16 embedded Ethernet switch featuring 24 10/100/1000 Mbit switch ports, two 10 Gbit uplink ports and support for IPv6 routing. Available in ruggedized and conformal-coated versions with fiber-optic 10 Gbit uplinks, the CPC6620 can be configured to monitor network status and to continuously check its own health through real-time integrity tests. In the event of system or network failure, data can be automatically re-routed to an alternate path.

Performance Technologies' line of high-availability Advanced Managed Platforms are available in configurations including 1 Gbit or 10/100 Ethernet switches, comprehensive remote shelf management, high-performance x86 and PowerPC compute elements accommodating Linux, SolarisT or Windows operating systems, and HA middleware. Options include applications processors, a wide range of networking I/O products and communications protocols, and NexusWare, the Company's CGL 3.2-registered and POSIX-compliant Linux distribution and development environment. These configurations provide a complete, integrated base platform for system designers looking to develop a wide range of applications, and are designed to reduce integration time and lower development costs.

Performance Technologies
Rochester, NY.
(585) 256-0200.
[www.pt.com].

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Fax: +33 (0)298 573 000 **Web:** www.interfaceconcept.com

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Platform Blends cPCI PSB and Switched Ethernet

The communications and IP networking segment of military technology can draw on a rich universe of hardware developed for comms infrastructure applications. Exemplifying that trend is One Stop Systems' OSS-HW400c/2 core-processing platform. It features two PCI Telecom Mezzanine Card (PTMC) sites for CT Bus-enabled I/O interfaces that are interconnected through a high-speed Layer 2 Gigabit Ethernet switch to the dual node CompactPCI Packet Switched Backplane (cPSB). The HighWire core architecture provides a powerful computing environment for addressing a wide range of military communications applications.

For processing, the HW400c/2 boasts a Freescale 1 GHz MPC7447A PowerPC processor with Marvell MV64462 System Controller. The system offers front panel management via 10/100/1000 Ethernet and System Management per IPMI/IPMB (PICMG 2.9). The system sports front and rear I/O support, up to 1 Gbyte of DDR333 SDRAM and a 128 Mbyte flash file system. The PTMC site onboard supports 3.3V signaling and PICMG 2.3 Rear I/O mapping. The two 0/100/1000 Ethernet cPSB sites comply with PICMG 2.16 single or dual node. Two 10/100/1000 Ethernet ports are provided per PT5MC site, with an additional Front Panel RJ45 Ethernet port. The 32/64-bit, 33/66 MHz PCI 2.2 CompactPCI interface supports full and basic CompactPCI Hot Swap (PICMG 2.1) in a cPCI 6U x 4HP (single slot) form-factor. Maximum power requirements for the board are 20W at 5 VDC and 5.3W and 3.3 VDC.

One Stop Systems
Escondido, CA.
(760) 745-9883.
[www.onestopsystems.com].

Five-Port PC/104 Fast Ethernet Switch Supports Port-Based VLAN

When developing space-constrained, high-reliability aviation and military systems for net-centric operations in extreme temperature/high-shock/vibration environments, military engineers are turning to virtual LAN technology. In particular, port-based VLAN functionality support enables any combination of ports to be connected together in subnets for use in a small secure or non-secure network. To meet this need, Parvus has introduced the PRV-

1059 VLAN-enabled five-port PC/104 Ethernet switch, designed and tested to MIL-STD-810F, and featuring very low power consumption of 1.5W and highly reliable extended-temperature operation up to +85°C. Its five transceiver ports are fully IEEE 802.3 and IEEE 802.3u compliant and designed so any port can serve as an uplink.

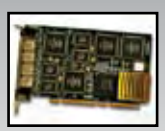
Supporting auto-MDI-MDIX network installation, the board is designed for simple plug-and-play operation, enabling up to five embedded computing devices to be networked together using 10BaseT or 100BaseTX LAN connections. It integrates fully independent media access controllers (MACs), an embedded frame buffer memory and a high-speed address look-up engine, along with support for auto-crossover, auto-polarity, auto-negotiation and bridge loop prevention. The compact, 90 x 96 mm, PRV-1059 switch is available in non-RoHS and RoHS-compliant (lead-free) versions. Pricing is $199 for base models and $249 for models with VLAN support.

Parvus
Salt Lake City, UT.
(801) 483-1533.
[www.parvus.com].

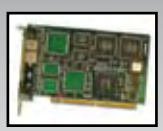
aptyc

What's in the Embedded Industry's Basement?

FEATURED PRODUCTS



Quad port Gigabit Ethernet copper PCI adapter
115 remaining
$299
Make An Offer!



Dual port Ethernet copper PCI adapter
105 remaining
$199
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Single port Gigabit Ethernet copper PCI adapter
60 remaining
$149
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Dual PCI-X SCSI Ultra-3 LVD host adapter
65 remaining
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Dual PCI SCSI Ultra-3 LVD host adapter
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NEWEST PRODUCTS

19" 8U Rackmount Monitor, aRGB, VGA, DVI-D, S-Video, CVS 1280x1024
2 remaining
$2143
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1U 1024X768 20.5" Deep 15" TFT/LCD
1 remaining
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1600X1200 8RU 20.1" Panel Mount TFT/LCD
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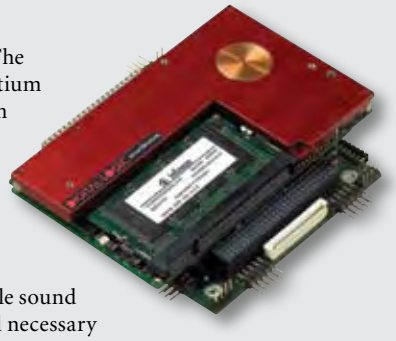
Pentium M SBC in PC/104-Plus Format

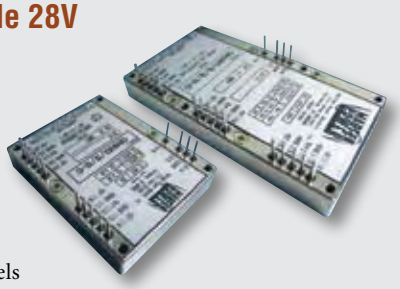


The Pentium M has been designed into arguably a wider range of form-factors than any other processor. The PC/104-Plus form-factor is one of those. With the MSM855, Swiss-based Digital-Logic offers a powerful Pentium M embedded computer board in PC/104-Plus format. Equipped with the scalable smartModule855, users can determine the performance and select among the Intel processors from Celeron M 300 up to Pentium M 755 with equivalent Pentium 4 performance from 600 MHz up to 4.0 GHz. The PC/104-Plus computer is based on the Intel 855GME chip set with 400 MHz front side bus and provides all standard PC interfaces such as COM1/2, LPT1, a floppy interface, an IrDA interface, and two PS/2 ports for mouse and keyboard. There is up to a Gbyte of DDR RAM as main memory on the module available. CPU and memory are mounted exchangeable, but mechanically protected against vibrations and shocks.

The standard version further includes five USB-V2.0 (Universal Serial Bus) ports, an AC97 V2.3 compatible sound interface, a 100/10-Base-T port and interfaces for a CompactFlash card and an IDE hard disk. In addition, all necessary power supplies and a microcontroller for advanced ACPI power management functions are integrated.

Digital-Logic, Luterbach, Switzerland. +41 (0)32/ 681 58 40. [www.digitallogic.ch].

DC/DC Modules Provide 28V Input, Up to 225W

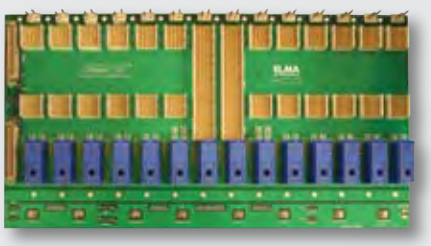


Applications in military and aerospace call for unique and highly reliable converters with multiple independent outputs. With that in mind, Martek Power Abbott has announced the addition of two high-power, multichannel models to the 28V Input DC/DC converter family. The new models, CB150D and CB225T, are available at 2 VDC, 3.3 VDC, 5 VDC, 5.2 VDC, 12 VDC, 15 VDC, 24 VDC and 28 VDC outputs, expanding the choice of output power of the CB series DC to DC power converter to a range of 5 to 225W.

Measuring 2.28 x 2.90 x .0.50 inch (57.9 x 73.7 x 12.7 mm) in size, the CB150D is a 150 W device with two independent 75W output channels. The CB225T, measuring 2.28 x 4.35 x 0.50 inch (57.9 x 110.5 x 12.7 mm) in size, is a triple output module with three independent 75W output channels. Both DC/DC converters feature a wide input range of 16 to 40 VDC and a power density of 45W/in3. These together with full specified performance over an operating temperature range of 55° to +100°C from no load to full load make the two new models unique in the mission critical market segment. Pricing of the CB150D and CB225T in the quantity of 50 to 99 are $495 and $675 respectively.

Martek Power Abbott, Torrance, CA.
(310) 202-8820. [www.martekpowerabbott.com].

AdvancedTCA Backplanes Ready for Radial IPMB

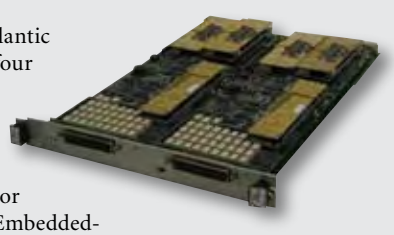


It's hard to believe time has flown by so fast, but the early players in ATCA are already offering their second-generation products. An example is Elma Bustronic, which has developed new second-generation AdvancedTCA (ATCA) backplanes. The new ATCA backplanes have routing implemented for radial Intelligent Platform Management Bus (IPMB) signals. Radial IPBM provides dual segment access to every IPM controller even when only one shelf manager is present or operational. This is an important option for ATCA systems to provide higher reliability and redundancy.

The backplanes also feature 14-slots with a Dual Star routing topology. Bustronic now uses the familiar AMC female connector, used in MicroTCA and other form-factors, as the shelf manager connectors. They were chosen because they are widely used, reliable and offer a high pin count in a small space. The connectors are dense enough to be placed next to the slots (called Slot 0) so that they can fit within a card cage for 19-inch rackmount systems. Mesh topology backplanes are also available in 2, 5 and 14-slot sizes standard. Custom versions of Bustronic's ATCA backplanes are also available. Pricing is under $2,000 depending on volume and configuration.

Elma Bustronic, Fremont, CA.
(510) 656-5829. [www.elmabustronic.com].

VXI Card Provides Up to 0.005-Degree Accuracy



VXI remains the proven choice for VME-compatible instrumentation work. Supporting that area, North Atlantic Industries (NAI) offers a high-density, DSP-based, single-slot VXI card whose modular design provides up to four synchro/resolver instrument-grade measurement channels and up to four synchro/resolver instrument-grade stimulus channels; or up to eight synchro/resolver embedded-grade stimulus channels; and up to six programmable reference supplies. All functions of the 65CS4 are independent, are user-programmable for either synchro or resolver format, and may be formatted for single-speed or multi-speed applications. The unit also incorporates an internal wrap-around self-test function that does not require external hardware or software. Synchro/resolver instrument-grade measurement and stimulus accuracy is to within 0.005 degrees. Embedded-grade stimulus accuracy is to 0.015 degrees. Instrument stimulus and reference outputs provide 2.2 VA of drive and are programmable from 47 Hz to 10,000 Hz. The 65CS4 is available with an operating temperature range of 0° to +50°C. Pricing for 100 pieces starts at $10,000 each.

North Atlantic Industries, Bohemia, NY. (631) 567-1100. [www.naii.com].

PMC Pair Target Graphics and Comms

PMC remains the most popular mezzanine module standard used in the board-level computing industry. Because of this continued popularity, Cornet Technology is offering the CPMC-722 and CPMC-DSCC, the first of the company's PMC offerings. The CPMC-722 (shown) offers a variety of graphics display options for CRTs and LCDs. The board's 8 Mbytes of internal SGRAM video memory improves the graphics controller performance by making the read/write process more efficient. It supports up to 1280 x 1024 x 24-bit color resolution, which is ideal for viewing on 19-inch monitors. For those requiring advanced graphical display applications, the CPMC-722 comes with a 128-bit 2D/3D floating-point rendering engine for enhanced precision display. The CPMC-722 is available now. Price starts at $600. An extended temperature version is also available.

The CPMC-DSCC provides up to 10 Mbits/s for synchronous and 2 Mbits/s for asynchronous communication transfers. The board supports a full range of protocols including HDLC, SDLC, LAPB, LAPD, PPP, ASYNC and BISYNC. The CPMC-DSCC is available now at a starting price of $800.

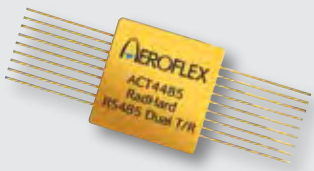
Cornet Technology, Springfield, VA. (703) 658-3400. [www.cornet.com].

1553 PC/104-Plus Card Boasts IRIG-106 Chapter 10 Support

1553 has graced just about every flavor of embedded form-factor, and PC/104 is no exception. Exemplifying that trend, Data Device Corp. (DDC) has introduced newly enhanced Software Development Kits (SDK) for MIL-STD-1553 PC/104-Plus and PCI-104 cards. The SDK allows users to develop source code to simulate, monitor, or troubleshoot 1553 data buses with support for the latest versions of operating systems including VxWorks 6, Linux 2.6 and Windows 2000/XP. This SDK allows users to quickly integrate DDC's 1553 cards into their "C" source code applications. A common SDK exists across all operating systems allowing the programmer portability across different platforms. The easy-to-use high-level functions abstract all low-level hardware accesses and memory allocation such that specific hardware knowledge is not required.

The BU-65578C PC/104-Plus card provides up to four dual redundant MIL-STD-1553 channels, five user-programmable digital discrete I/Os, selectable external or internal time-tag clock, and an IRIG-B time synchronization input. The card has an intelligent hardware offload engine that dramatically reduces PCI bus and host CPU utilization, while storing 1553 Monitor data in a convenient and portable IRIG-106 Chapter 10 file format.

Data Device Corp., Bohemia, NY. (631) 567-5600. [www.ddc-web.com].



RadHard Transceiver Supports Multipoint RS-485

Demand has been stirring for a high-reliability, radiation-hardened, general-purpose, high-speed, balanced interface for multipoint applications. Responding to such needs, Aeroflex Plainview has announced the RadHard ACT4485 monolithic dual transceiver designed for multipoint data transmission RS-485 applications. The ACT4485 meets the requirements of the TIA/EIA-485 Standard, which specifies low-voltage differential signaling drivers and receivers for data interchange across half-duplex or multipoint data bus structures.

The ACT4485 has several features that support the high-reliability application. The receiver has a fail-safe condition that guarantees a high output state when the bus is open or shorted. The driver maintains high impedance in tri-state or with power off supporting up to 32 bus transceivers connected to the bus. Manufactured in Aeroflex Plainview's Mil-PRF-38534-certified manufacturing facility, the transceiver is built with Dielectrically Isolated Bipolar technology, operates at -55° to +125°C, and is screened in accordance with MIL-PRF-38534, Class K. The ACT4485 is $599 in lots of 100. Prototypes and production units are currently available.

Aeroflex, Colorado Springs, CO. (719) 594-8035. [www.aeroflex.com].

5.7-Inch TFT Touchscreens Offer Sunlight Readability

Displays used by deployed military personnel need more than the ordinary display technology. Feeding such needs, Phoenix Display International (PDI) has introduced a new line of sunlight-readable 5.7-inch TFTs with QVGA (320 x 240) resolution. The sunlight-readable 5.7 QVTA TFT module offers improved contrast, color saturation and response time over CSTN products. PDI also offers the 5.7 QVGA as a standard transmissive module with or without a touchscreen.

PDI achieves sunlight-readable performance by manufacturing the TFT cell using high-aperture panel technology, high-transmittance color filters and a unique anti-reflective polarizer scheme. The result is a clear and extremely bright display that is ideal for high ambient light or outdoor, high-brightness applications.

PDI's sunlight-readable model of the 5.7 inch QVGA TFT (model no. PDI-T320240SR-5.7) is illuminated with high intensity white LEDs and offers brightness of 300 cd/m^2 (typical). The unit features a contrast ratio is 400:1 and a response time of 15 ms. This model also utilizes the HX8218A (Source) and HX8615A (Gate) drivers from Himax. In 1,000 quantities, Phoenix Display offers the 5.7-inch QVGA transmissive at $62.50 each, the transmissive with touch model at $71.85 each and the sunlight-readable model at $87.25 each.

Phoenix Display International, Tempe, AZ., (630) 359-5700. [www.phoenixdisplay.com].

Pentium M Rides Rugged, Fanless PC/104 Card

Space-constrained, power-constrained applications are where PC/104 shines. With that in mind, MPL has rolled out its MIP10, a fanless PC/104 solution with a standard wide temperature range from -20° to +60°C as well as in extended temperature. The solution is also available with conformal coating. The MIP10 is a complete Industrial PC on a footprint smaller than two credit cards. The design is based on the Intel Centrino Mobile Technology. The Board incorporates the low-power embedded Pentium M 1.4 GHz with 2 Mbyte L2 cache. The MIP10 comes with a full set of PC features including Gbit Ethernet.

The board provides soldered-on CPU and ECC protected SDRAM, Compact Flash slot and SATA interface. Also included are two serial ports integrated next to four USB ports. The MIP10 can be expanded for all requirements over PC/104 as well as PC/104-Plus. All interfaces are available on lockable headers to ensure a safe connection even in areas where vibrations cannot be avoided.

The MIP10 is designed from scratch to operate under extreme and normal conditions without the need of fans or without de-rating or throttling. The MIP10 is rugged enough to be used in any application.

MPL, Dättwil, Switzerland. +41 56 483 34 34. [www.mpl.ch].

Portable Interface Tool Links 1553 to USB

With over three decades under its belt, the venerable MIL-STD-1553 bus still dominates as an internationally accepted data bus standard for many military platforms. For applications where data integrity and low latency are the priorities, MIL-STD-1553 is likely to remain the military interface of choice. Meanwhile Fibre Channel, Ethernet and Extended 1553 top the list of possible upward migration paths from 1553. Although fundamentally an avionics bus, a wide variety of systems such as tanks, ships, missiles, satellites and even the International Space Station, rely on 1553.

National Hybrid Inc. (NHi), a division API Nanotronics, has developed an affordable, portable 1553 to USB interface. NHi's 1553/USB Pocket Pal is a redundant 1553 BC/MT/RT Terminal with 64K words of internal ram. It interfaces to a 2.0-compliant USB port, enabling a laptop computer to function as an autonomous 1553 Work Station. Weighing less than 7 oz., and small enough to fit within a shirt pocket, allows the user to take this 1553 USB anywhere. NHi's 1553/USB Pocket Pal features include: Hardware and Software development, Bus Exercisor, Bus Evaluation and Trouble Shooting. Bus management and bus integrity analysis are also key applications for the Pocket Pal.

API Nanotronics, Hauppauge, NY.
(631) 582-6767. [www.apinanotronics.com].

Gbit Managed Switch Delivers Redundant Ethernet

As a networking technology and as an interconnect scheme, Ethernet has won the hearts and minds of military system designers. The Industrial Automation Group of Advantech has introduced the EKI-7656C 16+2 combo port industrial managed redundant Gigabit Ethernet switch. This compact and industrially hardened switch offers advanced traffic control for optimum network performance and security, along with rapid self-healing fiber-optic ring capabilities to ensure network uptime in adverse environments.

The 18-port EKI-7656C features 16 Fast Ethernet (10/100Base-TX) and two combo gigabit (1000Base-T) ports, which support both copper (RJ-45) connections and optional industry-standard Small-Form-factor Pluggable (SFP) modules, giving users the power and flexibility to configure the switch for their unique application requirements. About the size of an "AA" battery, SFPs are available in single-mode and multi-mode fiber models, for fiber connections ranging from 500M to 110 km (1,800 feet to 68 miles). To meet the real-time fault-tolerant needs of embedded networking, Advantech developed the ultra fast X-Ring, which in the event of a fiber cable fault or similar problem, switches to the backup connection in less than 10 ms, ensuring solid and reliable network communications. Ideal for demanding environments, the EKI-7656C features industrial-grade components, is designed to withstand extreme shock and vibration, and includes redundant 12 to 48 VDC power inputs.

Advantech Corporation, eAutomation Group,
Cincinnati, OH. [www.advantech.com].

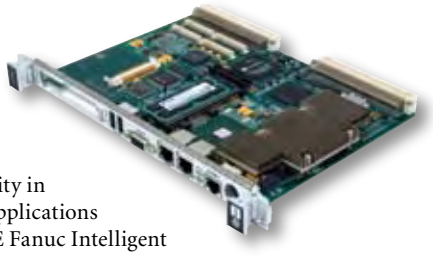
Dual-Core PrAMC Configured for ATCA and MicroTCA

ATCA and MicroTCA, slowly but surely are gaining traction in the military market. Network Power announced the PrAMC-6210, a next-generation AMC available for a volume price of under $2,000. Available in both full and mid-size versions for AdvancedTCA (ATCA), MicroTCA and proprietary architecture systems, the PrAMC-6210 is based on Freescale's MPC8641D PowerPC dual-core processor.

Developed by the Embedded Computing business of Emerson Network Power, the PrAMC-6210 is designed to provide modular, upgradeable, computing power. OEMS can use the PrAMC-6210 to boost the performance of their existing Power Architecture applications, such as protocol processing, packet processing, data management and I/O management, while lowering their total cost of ownership by consolidating hardware. To support high-speed packet data transfers on and off the card, the PrAMC-6210 features Gbit Ethernet and PCI Express interfaces to the carrier or backplane. With ever-increasing application and data transfer requirements, this combination of more traditional GbE interfaces and the emerging PCIe interface allows developers to easily migrate existing applications. Emerson expects PrAMC-6210 modules to be available in the second quarter of 2008.

Emerson Network Power, Tempe, AZ. (800) 759-1107. [www.emersonnetworkpower.com].

VME Boards Maximize I/O Functionality

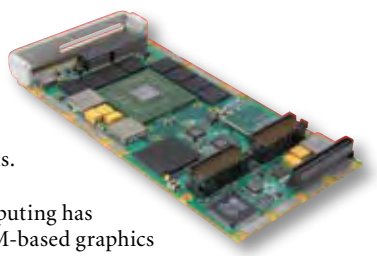


It's impossible to deny the importance of I/O connectivity in today's demanding defense applications for embedded computing. GE Fanuc Intelligent Platforms today announced their V7768 and V7769 6U VMEbus single board computers. The two new boards, which extend the company's established VME64 roadmap, also provide evidence of the company's commitment to supporting the latest Intel processors and mobile chipsets.

Both single board computers offer the Intel Core2 Duo processor operating at 2.16 GHz and the Mobile Intel 945GME Express Chipset. The dual-slot V7769, which provides dual SAS (Serial-Attached SCSI) connectors on the front panel, can optionally be configured with an onboard 2.5-inch SATA hard drive. It features three PCI-X PMC slots, allowing for maximum user-defined connectivity. The single-slot V7768 can also be expanded via the PMC237 mezzanine board to provide legacy PMC functionality. Up to 4 Mbytes of Level 2 cache and up to 2 Gbytes of DDR2 SDRAM are provided by each board, as are two Gigabit Ethernet ports via the front panel. Two SATA ports, two serial ports, four USB 2.0 ports and PS/2 mouse/keyboard ports are also standard.

GE Fanuc Intelligent Platforms, Charlottesville, VA.
(800) 368-2738. [www.gefanucembedded.com].

NVIDIA G73M Graphics Climb Aboard XMC



Graphics processing silicon developed for the gaming realm are used extensively in military graphics implementations. Exemplifying that trend, Curtiss-Wright Controls Embedded Computing has announced its first NVIDIA G73M-based graphics display control card, the XMC-710 XMC mezzanine module. This new COTS graphics card is the company's first designed to the new advanced XMC (VITA 42.3) open standard architecture, and is designed for use in VME, VPX and CompactPCI systems.

The XMC-710 graphics accelerator provides dual output and video capture capability. The card is powered by the NVIDIA G73M supported with a 128-bit local frame buffer interface with up to 512 Mbyte DDR2 frame buffer. To support customers with unique requirements, the XMC-710 was designed to adapt to and interoperate easily with different systems. An example of this built-in flexibility is the card's I/O mapping architecture, which simplifies adaptation to a specific host card's unique pinout configuration to ensure optimal I/O routing and video signal integrity. This flexibility enables system integrators to cost-effectively deploy the XMC-710 on third-party basecards. Pricing for the XMC-710 starts at $4,580. Evaluation units are available now, with production unit availability scheduled for Q2 2008. Both air-cooled and conduction-cooled versions, according to CWCEC ruggedization guidelines, are available.

Curtiss-Wright Controls Embedded Computing, Leesburg, VA.
(703) 779-7800. [www.cwcembedded.com].

Conduction-Cooled 3U cPCI Blade

Serves Up 1.5 GHz Core2 DuoA series of 3U CompactPCI blade SBCs is based on a high-performance and long-term supply processing chipset from the Intel Embedded Architecture. The ITC-320 series from Thales features three types of top performance single- and dual-core Intel processors and four types of environmental builds, including a rugged, conduction-cooled version. Equipped with the latest dual-core 1.5 GHz Intel Core2 Duo LV processor, the ITC-320 is able to meet high demand signal and data processing applications. Using the 1.2 GHz Intel Core Duo processor, the ITC-320 product is the best trade-off between computing performance and low power consumption. The ITC-320 version supports the 1.0 GHz Celeron M processor and is an excellent choice when power dissipation is a critical issue.

The ITC-320 series features all the high-performance I/Os that are available on brand new laptop PCs such as an UXGA graphics controller on PCI Express, two Gigabit Ethernet network interfaces configurable by software either on the front RJ-45 connectors, or on the rear J2 connector, quad SATA 150 ports and quad USB 2.0 ports. The ITC-320 series will be available during the first quarter of 2008 and will start at $2,600 in small volume, subject to specifications.

Thales, Edison, NJ. (732) 494-1010. [www.thalescomputers.com].

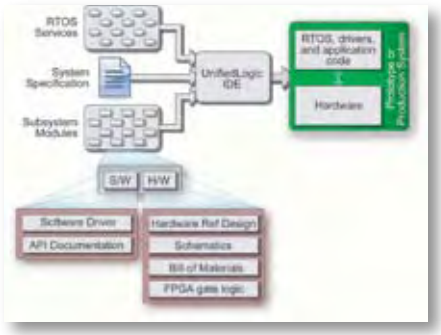
3U cPCI Blade Sports AMD Geode LX 800

3U CompactPCI has become a favorite choice for space-constrained, power-constrained designs. Specifically designed to operate at a very low power consumption of less than 10W at full loading, the new cPCI-3600 series from Adlink Technology is based on the latest AMD Geode LX 800 at 0.9W processor and AMD Geode CS5536 companion device to offer an optimal power/performance ratio for military, automation and transportation applications. With its optional soldered memory and CompactFlash slot, the cPCI-3600 series allows for integration in rugged applications where high vibration and adverse environments are common. The cPCI-3600 series also offers two 10/100 Ethernet ports and an onboard 2.5-inch hard drive for versatile automation and transportation applications that require reliable network connectivity and efficient remote management.

Designed in a dual-slot form-factor, the cPCI-3600 series offers memory configuration options of 256 Mbyte DDR 400 MHz memory (soldered) and one SODIMM socket that supports up to 1 Gbyte of RAM. The cPCI-3600 also provides two 10/100 Ethernet ports, an onboard 2.5-inch IDE HDD port, one CompactFlash socket, two USB 2.0 ports, two serial ports, one parallel port (SPP/ECP/EPP), one PS/2 keyboard/mouse interface and an AC'97 audio interface.

Adlink Technology, Irvine, CA.
(866) 423-5465. [www.adlinktech.com].

Tool Set Aids System Development on Xilinx Spartan-3 Kits



Gone are the days when developing software for an FPGA required a lot of complex engineering work. A new concept in development platforms provides the tools needed for embedded system development, including an RTOS, hardware reference designs and the tools that automatically integrate them for implementation on FPGAs. The UnifiedLogic platform from Eridon automatically customizes and configures the UnifiedLogic RTOS and integrates peripherals around an FPGA for both prototype and production hardware.

A free trial version of the UnifiedLogic Development Platform can be downloaded from Eridon's Web site and is ready-to-go for Xilinx Spartan-3 Generation Starter Kits with many examples of using their peripherals. It includes the software-centric UnifiedLogic IDE, the UnifiedLogic RTOS and extensive documentation and demonstration code for the Spartan-3 Generation Starter Kit Boards. Immediately after installing the UnifiedLogic Development Platform, an embedded software developer with no FPGA expertise can configure peripherals and begin writing code for a Spartan-3 Generation Starter Kit Board.

Eridon, Wayzata, MN. (952) 474-5110. [www.eridon.com].

Passive Tap Module Uses USB to Ease RS-232 Troubleshooting

As military systems move to higher levels of computer density, they still have to interface with a myriad of legacy serial I/O ports. A passive tap module using a USB port provides a low-cost, high-performance RS-232 data monitoring and logging solution in a convenient, lightweight package. The EZ-Tap from Stratus Engineering provides an easy-to-use inline passive RS-232 connection in a standard DB9 connector pin-out with a digital camera-style "mini-B" USB connector to allow efficient USB data extraction from an MS-Windows-based Host PC.

The EZ-View companion host software allows the user to display time-tagged RS-232 communication transactions in real time on the host PC via a scrolling window style-display. EZ-View supports various display formats as well as data save and recall for off-line analysis. Each EZ-Tap comes complete with a passive breakout adapter, 6-foot USB cable and Stratus Engineering's user-friendly EZ-View data-monitoring software. The EZ-Tap data-monitoring package supports standard and non-standard baud rates as high 250 Kbits/s. Single unit pricing is $139.95.

Stratus Engineering, San Diego, CA. (858) 663-1841. [www.stratusengineering.com].

XMC Blends Four Channels of 24-bit A/D Conversion

A mix of fast, precise analog-to-digital conversion is key in applications where vibration, acoustic and high dynamic range measurements are required. With just that in mind, an XMC I/O module from Innovative Integration features four simultaneously sampling, sigma delta A/D channels. The X3-SDF device has programmable output rates up to 24 bits at 2.5 Msamples/s and 16 bits at 20 Msamples/s using the programmable filter in the ADC. The X3-SDF module was developed in response to requests for DC-accurate measurements with very-wide dynamic range at sample rates up to 5 MHz.

A precision, low-jitter time base or external clock is used for sample rate generation. Sample rates up to 20 Msamples/s, with less than 10 kHz programmable resolution, are supported as well as external clocking. Trigger methods include counted frames, software and external triggering. Data acquisition control, signal processing, buffering and system interface functions are implemented in a Xilinx Spartan-3 1-million-gate FPGA. Two 1Mx16 memory devices are used for data buffering and FPGA computing memory. Quantity one pricing is $2,125.

Innovative Integration, Simi Valley, CA.
(805) 578-4260. [www.innovative-dsp.com].

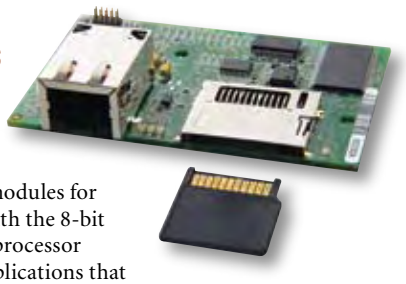
Rugged Raid Array Has Four 4 Gbit Fibre Channel Ports

A rugged, high-performance 4 Gbit Fibre Channel RAID array features a 12 hard disk drive array housed in a rugged 3U panel height enclosure providing 4 Gbit/s FC host interfaces to high-performance SAS and/or high-capacity SATA II HDDs. The RPC12 from Phoenix International is compliant with military and industrial specifications such as MIL-STD-901D, MIL-STD-810F and NEBS level 3. The design of the RPC12's rugged, cableless, passive midplane-based, high-density 3U chassis provides an increased environmental operational envelope (-20° to +60°C, 45,000 ft altitude with sealed HDDs), redundant, hot-swap components and massive storage capacity, while assuring the highest level of data availability.

The major components and features of the Phoenix RPC12 Fibre Channel RAID Storage System include the 3U Ruggedized Dual Port Fibre Channel RAID System with single active (dual active, failover/failback option) controller. There are two 4 Gbit/s Fibre Channel ports and battery free cache backup. The unit features enclosed and electrically isolated hot-swap drive canisters with an operational altitude to 45,000 ft and an operational temperature range of 20° to +60°C. Cool operation involves a maximum 10°F temperature rise. The RPC12 supports Windows, Linux and Unix (Cluster Certified) as well as including management GUI and failover software.

Phoenix International, Orange, CA.
(800) 203-4800. [www.phenixint.com].

Module Targets Large Memory 8-bit Designs



Low-power, high-functionality systems rank as one of the more dynamic areas of military system development. A new series of modules for development of applications with the 8-bit 58.98 MHz Rabbit 4000 microprocessor enables a new generation of applications that use more memory for data and code. The RCM4300 series from Rabbit provides the onboard mass storage and even more performance and easier design than any other alternative in its price range. Software design is supported by a new release of Rabbit's Dynamic C tools.

Dynamic C version 10.21 includes the new Megabyte Code Support (MCS), enabling designers to use over 1 Mbyte of SRAM for shared code and data. Pin-compatible with the complete family of Rabbit 4000-based core modules, the RCM4300 supports twice as much code space compared to any other Rabbit core module, enabling complex embedded applications such as data encryption and security-enabled Web servers. The RCM4300 series also provides the capability to implement up to 1 Gbyte of storage using an industry-standard miniSD memory card. The price for the RCM4300 is $80 (1,000s) and the RCM4310 is $69 (1,000s). The RCM4300 development kit, which comes complete with all the hardware and software tools, is priced competitively at $299.

Rabbit, Davis, CA. (530) 757-8400. [www.rabbit.com].

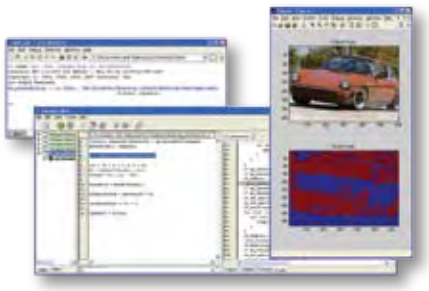
Modular Mini-ITX Open Frame Panel Computer

Stand-alone "bus-less" computer platforms are finding a key niche in embedded military designs. With that in mind, the FPM610 series from Advansus, is an Open Frame Panel Computer with a 15-inch color TFT display that accommodates a variety of Mini-ITX system options, ranging from the Intel Core2 Duo to the Celeron M 600 MHz processor. The FPM610 unit makes it easier and faster to do custom system development with flexible Mini-ITX board choices, multiple displays and audio streams, powered COM ports and one built-in power supply.

Advansus currently offers four versions of the FPM610 Open Frame Panel Computer that incorporate an Intel 945GME, 915GME, 910GMLE or 852GM mini-ITX motherboard. All versions of the FPM610 support both LVDS and DVI dual-view displays, 5.1-CH audio with an additional 5W audio amplifier, and one fast Gigabit Ethernet controller with an RJ-45 LAN port. Based on modular design, the FPM610 series accepts most Mini-ITX motherboards with custom I/O shielding available upon request. The system has a robust stainless housing for use in harsh environments, one internal hard drive bay for 2.5-inch IDE HDD storage, and one built-in 200W power supply, which reduces complex wiring.

Advansus, Taipei, Taiwan.
+886-2-8177-7089. [www.advansus.com.tw].

Library Facilitates Matlab-to-C Synthesis



Military systems are relying on ever more complex sets of software. A third-party function library enables Matlab developers to generate functionally equivalent, redistributable C code for more than 300 Matlab equivalent functions with redistributable source, including a wide variety of toolbox functions. The library, developed by Catalytic, now lets algorithm developers generate equivalent C models from Matlab code that take advantage of higher-level Matlab functions, a formerly manual effort.

Using Matlab functions offers algorithm developers significant productivity improvement, but when it comes to handing off the algorithm for incorporation in products or prototypes, they are faced with a hurdle. Since Matlab functions are delivered in M code or compiled form, a manual translation step is required to replicate the equivalent functionality in C code. Depending on the complexity of the function used, the translation could add anywhere from one to six staff weeks of effort per function. With both automatic and user-directed function substitution, Catalytic MCS enables easy use of Catalytic functions without source code modifications. With the Catalytic Function Library, developers now have a low-risk path from Matlab functions to functionally equivalent, redistributable C code. Pricing for the library is subscription-based from $5,000 per year including quarterly updates.

Catalytic, Palo Alto, CA. (650) 846-2555. [www.catalytic.com].

FPGA Card Enables Flexible I/O

A low-cost, general-purpose programmable I/O card connects to the host computer via USB or PC parallel port. The 7I43 from Mesa Electronics uses a 200K or 400K gate Xilinx Spartan-3 FPGA for all logic, so it can credibly be called an "anything" I/O card. The FPGA can be configured by downloading from the USB or Parallel port bus side, and also has local configuration storage available with an on-card EEPROM. Efficient switching regulators are used for FPGA core and 3.3V power, allowing the 7I43 to be USB bus powered. The 7I43 can also be powered by an external 5V source.

The 7I43 has 48 I/O bits available on two 50-pin connectors. Both connectors use I/O module rack-compatible pinouts. All I/O bits are 5V tolerant. The I/O connectors are compatible with our 7 series daughter cards for isolated I/O, motion control, RS-422 interface and other applications. Configurations are provided for simple GPIO, Smart Motion control (SoftDMC), host-based motion control (HostMot2), buffered step & direction generation and a waveform generator. Quantity 100 price of the 7I43 is $59 (200K version) or $67 (400K version).

Mesa Electronics, Richmond, CA.
(510) 223-9272. [www.mesanet.com].

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Coming Next Month

- *Tackling Large UAV Payload Challenges.* Large UAVs like the Global Hawk, Predator, Hummingbird and others are packing in an unprecedented amount of processing and communications payloads. This section examines the technology trends key to this area, and describes what's unique about some of the newest system revisions.
- *ATCA-Based Military Systems.* Although designed originally for the telecommunications market, ATCA has slowly and quietly gained numerous project wins in a variety of comms-oriented military systems. This section explores the latest ATCA system solutions available and what in particular about them is attractive to military system developers.
- *GPP, DSP, FPGA Trade-offs.* The question of whether a general-purpose processor (GPP), a digital signal processor (DSP) or an FPGA is the most efficient signal processing strategy is a constant moving target. But as FPGAs get more powerful with more and more embedded computing muscle, they are starting to edge out the other alternatives. This section looks at how these trade-offs are critical in signal processing applications such as military radar, sonar and SIGINT.
- *1553 Boards.* With over three decades under its belt, 1553 remains a popular interconnect for low latency avionics needs. But other alternatives like Fibre Channel and Ethernet are usurping not all, but some of 1553's traditional territory. This section updates readers on the product and technology trends driving board-level 1553 products, and will include a product album of representative 1553 switch board products in form-factors such as VME, cPCI, PMC and PC/104.


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Editorial

Jeff Child, Editor-in-Chief

AUSA: Five-Year Looking Glass

Being in the business of covering electronics and embedded computing technology, I find it helpful to think in terms of comparing "macro" trends on a year to year basis. And examining such technology as applied to the military market requires an extra level of caution. That's because nothing without some solid "staying power" ever gains a foothold in the defense world. For example, when I starting hearing a lot of hype about multicore processors a couple of years ago, I was interested but not convinced on how solid they were. But now I've seen a real shift to where the Intel Core-Duo ranks as the most dominant CPU designed into new embedded computer products—replacing the Pentium M, which previous held that distinction.

While computing technology goes through fairly vivid changes year to year, not so with military programs. For most all the major military programs, whose development cycles stretch over several years, progress tends to move slow—even when they're on schedule. For me, that's one reason I find going to the Association of the U.S. Army (AUSA) Winter Symposium particularly valuable. I've been going to AUSA long enough now that I've started to see a real sense of the Army's progress toward transformation and modernization. In 2003, for example, any stuff displayed at AUSA on the Joint Tactical Radio System (JTRS) program and Future Combat Systems (FCS) was still pretty much "concept" mock-ups. Even non-JTRS software radios where still in an early phase back then.

Fast forward to AUSA Winter 2008 late last month. A number of exhibitors had JTRS radios that you could touch and feel. The FCS team members had a variety of systems and components one could touch and see like the FCS Unattended Ground Sensors, the Integrated Computer developed for the FCS vehicles and the NLOS-LS (Non-Line of Sight - Launch System). In contrast to 2003, there were also a lot of examples at AUSA of technologies on display aimed specifically at aiding the warfighter in this new era of asymmetric warfare where locating, defeating and defending against IEDs are top priority.

As an added bonus this year at AUSA, I got to attend a Media Briefing on the FCS Program presented by Major General Charles Cartwright, FCS program manager.

At present, the Army is working through the detailed requirements changes that emerged last year. These requirements changes are the result of the adjustments announced early last year with the restructure of FCS from 18 to 14 systems. Some of the impact of that restructuring is already apparent. For example, a requirement for the deferred Class II unmanned aerial vehicle to carry a laser designator is to be assigned to the Class I aerial vehicle. Reportedly, that means the Class I aerial vehicle therefore needs a more powerful engine. Meanwhile, the deferral of the Class III aerial vehicle means that its mine detection mission requirement will need to be assigned to other platforms.

All the individual FCS systems are being designed to meet the system-level requirements and restrictive space, weight and power (SWAP) constraints. Still underway is the process of making trade-offs between requirements and design, and they have not yet finalized decisions about how to implement requirements within several areas of concern, including weight, power, space, reliability and unit costs. For example, most of the manned ground vehicles are at risk of not meeting their weight, maintainability and other requirements. With that in mind, the program is still working on designing a hull for manned ground vehicles that not only meets weight constraints but also requirements for protecting vehicle crews against mine blasts. Along similar lines, the program is trying to confirm a design that will balance competing requirements for the Class I unmanned aerial vehicle to perform as needed, yet be small and light enough to be carried in a soldier's backpack.

An ongoing challenge facing FCS is its dependence on other comms-related programs. The FCS program's network and software development are of a magnitude, size and complexity unprecedented in DoD history. The Army and the FCS Lead System Integrator team (Boeing and SAIC) are facing numerous areas of high risk such as enterprise network performance and scalability, immature network architecture, quality of service on a mobile ad-hoc network, end-to-end interoperability with strategic networks of the global information grid, and synchronization of FCS with the Warfighter Information Network-Tactical (WIN-T) and JTRS programs. For their part, WIN-T and JTRS do not have mature technologies and are at risk of having delayed or incomplete delivery of capabilities to FCS.

That said, a key milestone for WIN-T was hit in late January, with General Dynamics C4 Systems and teammate Lockheed Martin successfully finishing the engineering field test and preliminary design review for Increment Two of the WIN-T. According to General Dynamics, that puts WIN-T on schedule to conduct limited user tests in 2008 and deploy new technology to soldiers in 2009. WIN-T Increment Two provides a mobile broadband network that will enable commanders and command posts to carry out battle plans and to collaborate while on-the-move.

From my perspective at least—although these advanced programs seem to move slow to the naked eye—my annual visit to AUSA last month left me with the impression that the past five years have been pretty dramatic in terms of technology advancement for the Army. ▮▮

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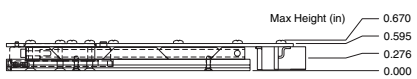

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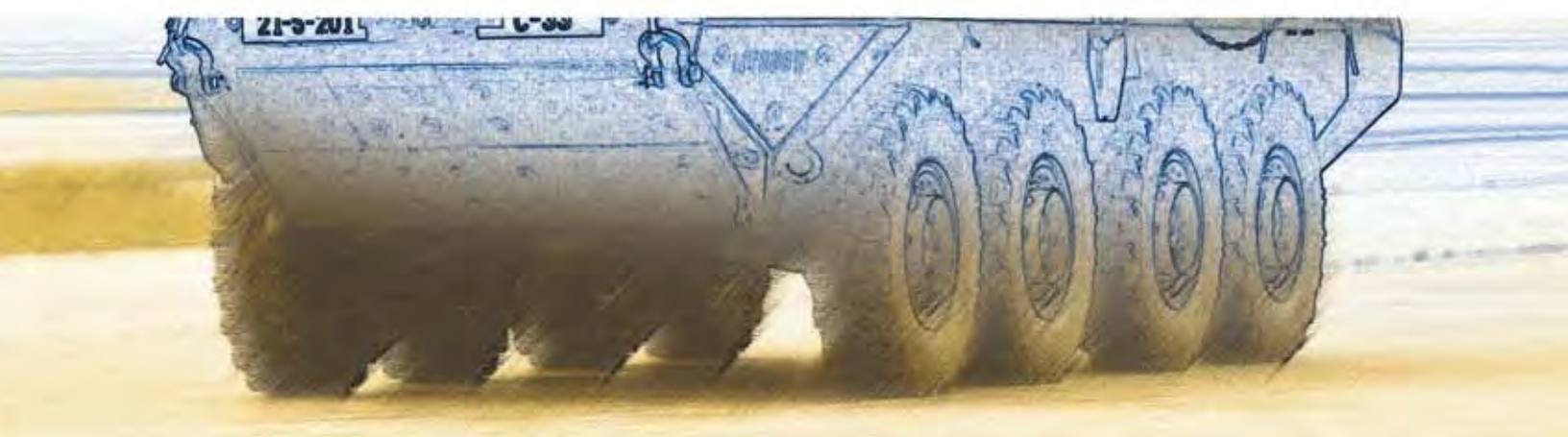

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