Tech Focus: Ethernet Switch Boards

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SMALL FORM FACTOR BOARD MAKERS LAUNCH FRESH IDEAS

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11th Annual End-of-Life Directory

Volume 12 Number 3 March 2010 www.cotsjournalonline.com

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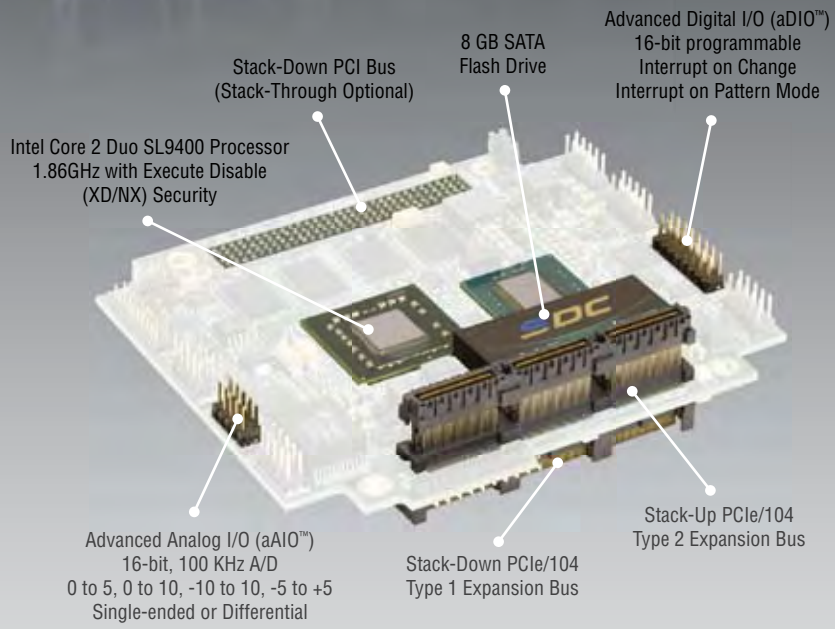
PCI/104-Express
Intel® Core™2 Duo CPU



Intel Core 2 Duo Processor	1.86 GHz – 1.20 GHz
Soldered DDR2 SDRAM	2 GB
Onboard SATA Flash Disk	8 GB†
External SATA	2
PCIe x1	8 links
PCIe x16	1 link
Gigabit Ethernet‡	2
Advanced Digital I/O	14†
Advanced Analog I/O	8†
USB 2.0 Ports‡	8
Serial Ports (RS-232/422/485)	4
Analog VGA	1
Panel	LVDS
Audio‡	1
Operating Temperature‡	-40 to 85°C

†*See figure on left for details*
‡*See web site for details on each model*

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12
Small Boards Serve Up Overlapping Innovations

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—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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On The Cover: Small form factor computer boards are essential for systems where size, power and weight constraints are high—such as the control systems inside missiles. Earlier this month the THAAD missile defense element shown here completed a successful intercept of a ballistic missile target at the Pacific Missile Range Facility off the island of Kauai in Hawaii. THAAD is a mobile system now in development designed to intercept short to medium range ballistic missiles. *Photo Courtesy of U.S. Missile Defense Agency*

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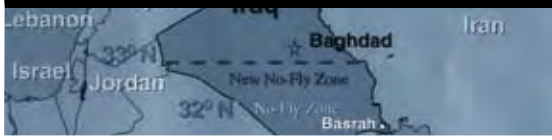

It's a Sandal That's a Boot

Late last month, Jeff Child, *COTS Journal*'s Editor-in-Chief, and I made our annual trek to AUSA Winter. Once again, the AUSA conference was very interesting and showcased that all important connection between the suppliers of electronic systems and their users. Last year we were impressed to see an increase in the number of electronic vendors from the previous year. For a stretch of almost a decade we would only find about three or four such embedded vendors at AUSA Winter. Last year we had over a dozen embedded product vendors, and this year there were more than 18. Numbers like that won't worry the organizers of the MILCOM show whose representation by embedded suppliers surpassed those levels long ago. There's no fear that embedded exhibitors will be moving away from MILCOM in favor of AUSA. It does mean that embedded suppliers are realizing that it is necessary to broaden their exposure.

Although we try to support military electronic suppliers at all the conferences, attending AUSA is really an opportunity for us to get an update on the programs that those electronics get embedded into. In previous years the AUSA floor was covered with land vehicles—not so much this year. Cancellation of the Army's Future Combat Systems program has raised uncertainty about exactly what will be the structure for the Army's next Ground Combat Vehicle (GCV). It is easy to understand that ground vehicle suppliers only brought representative products that are well established and funded for production.

Most of the other elements from the FCS program have survived in one form or another, but the Manned Ground Vehicle (MGV) is dead as a doornail. Iraq and Afghanistan are proof positive that the direction of the FCS program's ground vehicle development would not result in a system that would fit the new challenges of the Army. Last May, SECDEF Robert Gates instructed the Army that by the fall they needed to come up with a new plan for a vehicle. The plan would need to provide a vehicle or vehicles that met the need of the types of conflicts the Army would face in the future. This February the Army provided industry with its vision of what is required and a request for proposals. However, all options are on the table, so what the base GCV will end up looking like is still a mystery.

At our house we use a family phrase that has been handed down when someone expects too much out of one item: "it has to be a sandal that's a boot." That, in a nutshell, is almost what the Army is looking for. They want the GCV to have the mobility to move through urban operations like the Stryker, the ability work rough terrain like the Bradley, and the mine protection of an MRAP. Normally there would be another requirement for it to be lighter than a Jeep. But fortunately, wisdom has prevailed and there are no weight restrictions. The only mechanical restrictions are that it must be able to fly on a C-17 and be rail-transportable.

Finding an F-35-type solution for the GCV is ambitious and has a high probability the result will be something that doesn't really meet any of the requirements. There may be a greater opportunity for success by finding one or two base systems and then having the ability to add or convert components to fit the mission theater. The current milestones set delivering production GCVs by 2017. But using common sense and past experience, that means the earliest we could see any would be 2020. That time window will force the Army to make do with Strykers, Bradleys, MRAPs and Humvees for at least ten more years.

What's great for our embedded industry is also the most important element in the Army's vision: they have and will continue to develop a common electronic network for all the Army systems. Much of this effort is a continuation of what was started with FCS. And a key requirement of the proposals to be submitted for the GCV are that they must use currently available mature technology. The systems must be compatible (interchangeable) with other systems and other manufacturers, and have the ability for easy technology insertions and upgrades. I may be taking some liberties in summarizing the key requirements, but they represent what the Army really means. It's a polite way of telling primes "don't come up with designs where you try to lock yourself in as the only supplier of any of the electronic assemblies." And that's a major door opener for our industry.

GCV is only one deliverable system that will be connected to the electronic network and common systems that the Army is focusing on. With the military's explosion of unmanned systems, both air and ground, the Army has become a hot bed for COTS embedded electronics. This May we will have a special Target Report that focuses on Vehicle Modernization. The section explores the latest requirements and how these changes may be influenced by technology and the latest products available. We may not know what the GCV will look like, but there is a plan and vision for the electronics. ▮▮

Pete Yeatman, Publisher
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The Inside Track

GE Intelligent Platforms Lands Contract for AH-64D Apache Simulator

GE Intelligent Platforms has received an order for automatic video trackers valued at approximately $1.7 million from Link Simulation and Training of Arlington, Texas. The order is for a number of GE ADEPT74 real-time video tracker processing boards that will be employed as a major element of the U.S. Army's AVCATT (Aviation Combined Arms Tactical Trainer) AH-64D (Figure 1) simulation and training system upgrade program.

The GE Intelligent Platforms ADEPT74 is a full-featured automatic video tracker and image processor. It was chosen for its flexibility, powerful processing capability, and the facility to take the input of high-speed digital data directly from electro-optical sensors. A PMC site on the board allows the ADEPT74 greater flexibility for the provision of additional input video formats and image processing functionality. AVCATT is a mobile and reconfigurable virtual simulation system designed to support unit collective and combined arms training. Each AVCATT suite provides six manned modules, reconfigurable to any combination of attack, reconnaissance, lift and/or cargo helicopters. Platforms that can be simulated include AH-64A, AH-64D, OH-58D, UH-60A/L and CH-47D. AVCATT is employed to train both active and reserve component aircrews deploying in support of overseas contingency operations.

Figure 1

Platforms that can be simulated with the AVCATT include AH-64A, AH-64D (shown), OH-58D, UH-60A/L and CH-47D.

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

U.S. Air Force Command and Control Systems Use RGB Spectrum Displays

The U.S. Air Force's Advanced Displays and Intelligent Interfaces (ADII) program has developed the Interactive Datawall (IDW) to facilitate better information management and improve situational awareness in battlefield command and control environments. To achieve this capability, the ADII program's Interactive Datawall uses RGB Spectrum's SuperView multi-image display processors with three high resolution video projectors tiled onto large screens.

The Interactive DataWall fosters collaboration and participation amongst decision makers. Each IDW uses three SuperView processors to create a tiled display of screens positioned to create a single continuous image. The SuperView processor's advanced image processing performance provides high levels of detail and viewing clarity, especially useful for depicting intricate graphical maps and satellite imagery. The SuperView processor can display up to twelve real-time video and computer signals on a single high-resolution screen.

RGB Spectrum
Alameda, CA.
(510) 814 7000.
[www.rgb.com].

Curtiss-Wright Awarded Contract for Navy BAMS UAV Program

Curtiss-Wright Controls has received a contract from Northrop Grumman Corporation to provide the Advanced Mission Management System (AMMS) for the Broad Area Maritime Surveillance Unmanned Aircraft System (BAMS UAS) program in the amount of approximately $25 million. The BAMS UAS will provide the U.S. Navy with a persistent maritime intelligence, surveillance and reconnaissance system to protect the fleet and provide a capability to detect, track, classify and identify maritime and littoral targets.

Figure 2

The RQ-4N, a maritime derivative of the RQ-4 Global Hawk unmanned aerial vehicle, will be the platform for the BAMS UAS suite of maritime surveillance sensors and communications systems.

Northrop Grumman's RQ-4N (Figure 2), a maritime derivative of the RQ-4 Global Hawk unmanned aerial vehicle, will be the platform for the BAMS UAS suite of maritime surveillance sensors and communications systems. Curtiss-Wright will design, develop and manufacture BAMS UAS AMMS units at the company's Motion Control facility in Santa Clarita, CA. Hardware deliveries will start at the end of 2010 and continue through 2011.

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OceanServer Awarded Navy Autonomous Underwater Vehicle Contract

OceanServer Technology was awarded a competitive procurement to deliver two lightweight multibeam sonar equipped AUVs to the U.S. Navy. These AUVs are to be operationally tested and delivered to the Naval Special Warfare (NSW) Command at the Stennis Space Center in September of 2010. This is the fourth such award to OceanServer Technology (OTI) over the past two years and represents the most sophisticated vehicle developed by OTI to date. Fully equipped with Side Scan Sonar (SSS), Doppler Velocity Log (DVL), Acoustic Doppler Current Profiler (ADCP), Conductivity, Temperature and Depth (CTD) sensor, and Multibeam Imaging sonar, the lightweight Iver is the industry leader in man-portable AUV systems. The NSW anticipates operationally deploying the vehicles soon after delivery.

All Iver2 AUV models come standard with OceanServer's VectorMap Mission Planning and Data Presentation tool, which provides geo-registered data files that can be easily exported to other software analysis tools. This unique AUV design (Figure 3) has enabled OceanServer to

Figure 3

The Iver2 AUV is equipped with Side Scan Sonar (SSS), Doppler Velocity Log (DVL), Acoustic Doppler Current Profiler (ADCP), Conductivity, Temperature and Depth (CTD) sensor, and Multi-beam Imaging sonar.

Military Market Watch

Rapidly Expanding Global UAV Market Expected for COTS Products

Over the next ten years the market for Unmanned Aerial Vehicles will more than double, growing from $7.7 billion today to $15.7 billion by 2019. A large part of this value stems from the systems for these vehicles, which are driven by the technology and development of smaller / lighter systems, incorporating higher speed processor performance and moving toward ever increased device integration.

Despite the fact that UAVs have existed for decades, in general terms, the UAV market is still in its early stages of lifecycle. In the last five years alone, many new military and civil applications have emerged, requiring a vast array of types from large vehicles fulfilling complex integrated missions down to nano vehicles weighing less than a hundredth of a kilogram. The common thread, however, is that all these require timely, flexible and competitively priced platform and systems solutions. The use of Commercial Off-the-Shelf (COTS) components / products helps to optimize these solutions in terms of time-to-market, non-recurring cost and recurring unit price.

On average, some 30% of the airborne UAV market stems from radar, EOIR and communications systems. This excludes the significant Ground Control Station (GCS) communication market associated with these vehicles. All of these markets are highly influenced by COTS components and products, and there are strives towards common GCS and software architecture. Figure 4 shows how the market for UAVs is evolving globally. The United States continues to account for over half of the customer market, although demand from other countries is also expanding rapidly. Over the period, the United States dominates the sourcing with some 60% of the UAV market and 90% of the combined radar, EOIR and communications market being assembled in the United States. The need to design UAVs to fulfill expanding missions

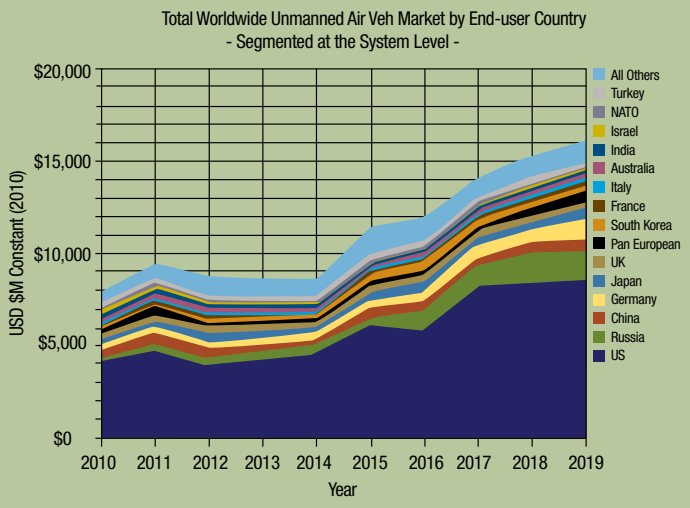

Figure 4

The U.S. is expected to dominate sourcing with some 60% of the UAV market and 90% of the combined radar, EOIR and communications market being assembled in the United States.

(in both civil and military markets) within an ever constrained budget environment will drive the application of COTS, offering up immense opportunities in the future.

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carve out a very strong position in the research space for Autonomous Underwater Vehicles, sensors and behavioral studies. The VectorMap program can input NOAA ENCs or any georeferenced charts, maps or photo images, allowing the operator to intuitively develop AUV missions using simple point-and-click navigation.

OceanServer Technology
Fall River, MA.
(508) 678-0550.
[www.ocean-server.com].

Northrop Grumman Awarded Contract for Shipboard Multi-Mission Radars

Northrop Grumman has received a full-rate production contract from the U.S. Naval Sea Systems Command for its AN/SPQ-9B shipboard radar systems, which will enhance detection and tracking of high-speed threats such as sea-skimming anti-ship missiles.

Under the fixed-price $26.2 million contract, Northrop Grumman's Naval and Marine Systems Division facility in Melville, N.Y., will supply four shipsets. The contract includes options that could bring the total value to $281.5 million. The options encompass a wide range of U.S. aircraft carriers, cruisers and amphibious assault ships, as well as the U.S. Coast Guard National Security Cutter. The AN/SPQ-9B is an upgrade to the AN/SPQ-9 radar of the MK-86 gun fire control system currently installed on CG-47 Class surface ships (Figure 5).

The high-resolution X-band AN/SPQ-9B search radar sets will greatly improve the ability to defend against small high-speed threats, such as surface-skimming anti-ship missiles, and will be integrated with the ships' fire-control systems. The multi-mission radar systems are designed to detect small fast-moving targets in the presence of clutter from ocean waves, rain and land returns, as well as chaff and jamming. The AN/SPQ-9B radars will make an important contribution to the fleet's ability to operate in littoral waters where land and sea clutter often limit the tracking and detection capabilities of search radars.

Figure 5

The AN/SPQ-9B is an upgrade to the AN/SPQ-9 radar of the MK-86 gun fire control system currently installed on CG-47 Class surface ships like the U.S.S. Ticonderoga.

Northrop Grumman
Los Angeles, CA.
(310) 553-6262.
[www.northropgrumman.com].

Special Feature

Small Form Factor Boards in Mobile Defense Apps

Small Boards Serve Up Overlapping Innovations

Driven by a desire to reduce system size, weight and power, military system developers are reaping the latest product and standards innovations from the small form factor board industry.

Jeff Child
Editor-in-Chief

Long gone are the days when small form factor boards were limited to a few types of standard form factors like PC/104. Today, while strategies vary among the various small embedded computing standards groups, there's definitely been a renaissance of new ideas and innovation in both standard and non-standard small form factor compute modules. These technologies continue to be in high demand for military applications that are extremely space- or weight-constrained or where traditionally only a fully custom solution would do the job.

Such computing technology—although always of interest to the military market—is becoming ever more critical for defense applications. These include small UAVs, robotics, mission-specific handheld systems, intelligent munitions and many others. In particular, the "Small" and "Micro" classes of UAVs face the most difficult challenge with reducing size, weight and power (SWaP), while at the same time cramming more autonomy and functions into their payload systems (Figure 1).

Many Avenues to Move Forward

The small form factor area of the embedded computer market for a long while had been lacking when it came to new approaches. That's changed in recent years as groups take different—although often overlapping—views on how to move forward with standards-based small form factor technology. The PC/104 Consortium seems to favor marrying PCI Express with the tried and true PC/104 form factor. The Small Form Factor Special Interest Group (SFF-SIG) meanwhile is focused on trying a variety of different approaches to suit the miniaturization of board-level electronics. The StackableUSB camp for its part is focused on using USB (and I^2C and SPI) to replace ISA as the board-to-board interconnect in rugged stacked systems. And finally, a new group has formed around a new specification called FeaturePak, to address tiny, application-oriented personality modules—sub-credit-card size.

Meanwhile, COM Express has secured its place as the new standard for bus-less embedded computing. COM Express focuses on the compute-core and thereby safeguards development investments and lowers total cost of ownership. It enables designers to partition commodity host-processor COM Express modules from proprietary, value-added platform building blocks, including FPGAs and specialty I/Os on custom baseboards.

Formed only about three years ago, the SFF-SIG has—in keeping with its purpose—been very active in rolling out new specifications. Last fall the group released both revision 1.0 of the ISM (Industry Standard Module) and SUMIT-ISM

Specifications for small, rugged, stackable embedded systems. The SUMIT-ISM Specification documents the use of SFF-SIG's flexible SUMIT (Stackable Unified Module Interface Technology) interface on popular 90 x 96 mm stackable modules. The ISM Specification provides an explicit form-factor-only definition upon which the SUMIT-ISM Specification is built.

Because the SUMIT Specification itself defines only a board-to-board interface (connectors and pin definition), the ISM Specification was needed to define the form factor while the SUMIT-ISM Specification defines how SUMIT is implemented on ISM modules. This enabled SUMIT-ISM modules to be created with legacy support for either the PC/104 ISA bus or the PCI-104 PCI bus by allowing the module to be rotated 180 degrees as necessary to fit the legacy type required while maintaining the SUMIT interface. Legacy bus support can be supplied by the CPU and maintained up the stack, or can be provided through a bridge module in the stack itself.

The SUMIT I/O connector scheme and the COMIT Computer on Module standard rank as the two most significant fruits of the Small Form Factor-SIG. An example of a board supporting both is the EBC-Z8530-G from WinSystems (Figure 2)—an SBC powered by an Intel 1.6 GHz Atom processor measures 203 mm x 147 mm (8.5- x 5.75-inch) and supports the new Stackable Unified Modular Interconnect Technology - Industry Standard Module (SUMIT-ISM) expansion standard. The RoHS-compliant board operates over an industrial temperature range of -40° to +70°C.

The EBC-Z530-G's I/O interface features two Gbit Ethernet ports, VGA and LVDS flat panel video, a PCI Express MiniCard interface for a wireless networking module, four USB 2.0 ports, four serial COM ports, HD audio, PATA controller for both a CompactFlash and

Figure 1

An example of a Micro UAV, the RQ-11B Raven UAV is launched by hand, thrown into the air like a model airplane, and can provide day or night aerial intelligence, surveillance, target acquisition and reconnaissance.

hard disk, 48 lines of digital I/O, LPT and a PS/2 port for keyboard and mouse. Additional I/O module expansion is supported with two SUMIT and legacy PC/104 connectors. The EBC-Z530 supports COMIT and is targeted toward small form factor processor modules and baseboards leveraging the latest ultra-mobile and moderate power processor/chipset combinations. WinSystems is using a 62 mm x 75 mm card (which is roughly the size of a credit card) that includes the Atom, SCH, memory and power supplies.

SUMIT Enhances USB Capability

The revision 1.5 of the specification was released last month and added two significant improvements over previous versions. First, it describes the implementation of USB channel shifting in SUMIT-based systems. Channel shifting in stackable systems means that when an I/O card consumes a resource such as a USB channel or PCI Express lane, it shifts the remaining available resources of a like kind to the pins used by the consumed resource when they are passed to the next I/O card above it in the stack. The second improvement in the SUMIT spec describes a simple, universal resource label that conveys interoperability of a company's SUMIT-compatible product since all the interface signals supported by SUMIT may not always be supplied by an SBC or used by an I/O module.

Most recently, the SFF-SIG announced the adoption and release of the CoreExpress Specification revision 2.1. CoreExpress was originally developed as a proprietary standard by LiPPERT Embedded Computers GmbH. Under the terms of an agreement between SFF-SIG and LiPPERT, the entire embedded community will now be able to develop CoreExpress modules and applications without regard to confidentiality and without royalties of any kind. CoreExpress is a Computer on Module (COM) specification optimized for state-of-the-art, ultra-low-power processors like Intel's Atom and VIA's Nano. The form factor measures only 58 mm by 65 mm,

Figure 2

Supporting both the SUMIT I/O connector scheme and the COMIT Computer on Module standard, the EBC-Z8530-G is an SBC powered by an Intel 1.6 GHz Atom processor that measures 203 mm x 147 mm (8.5- x 5.75-inch) and supports the SUMIT-ISM expansion standard.

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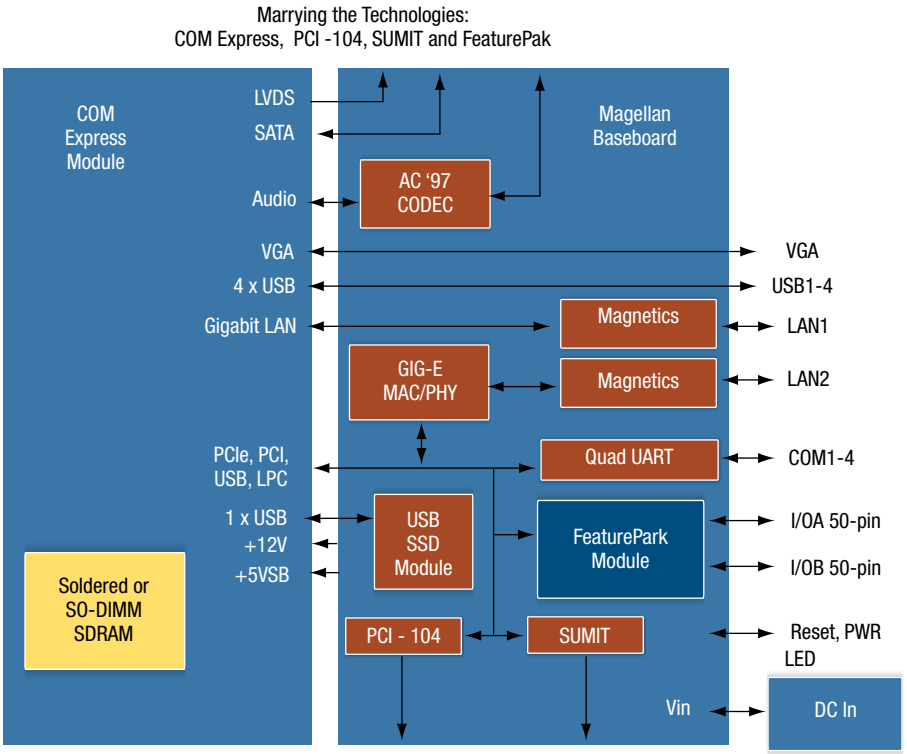

Figure 3

The Magellan board product marries several technologies including COM Express, PCI-104, SUMIT and FeaturePak I/O support.

and weighs about 28 grams. Its very low power requirements (5W) make it suitable for small, battery-powered and wearable embedded military devices.

Addressing the "Tiny" Board Requirements

Seeing a demand for a "tiny" class of embedded computing for military and other applications, a new group has formed around a new specification called FeaturePak. Exemplifying the overlap between the various industry groups and standards, FeaturePak is designed to have a level of compatibility with existing small form factor specs. Eight companies in the embedded computing market jointly unveiled FeaturePak at the Embedded World show early this month. The FeaturePak specification defines tiny, application-oriented personality modules—three-fifths the size of a credit card—that snap into low-cost, low-profile sockets on SBCs, COM baseboards and full-custom electronic circuit boards.

FeaturePak modules interface to the host system via a single low-cost, high-density 230-pin connector, which carries PCI Express, USB, I^2C and several other host-interface signals, plus up to 100 points of application I/O per module. The host interface is CPU agnostic and is compatible with both Intel and RISC architecture systems. The modules can easily be integrated into embedded designs along with Qseven, COM Express, SUMIT, PCI/104-Express, EBX and EPIC. The companies participating in FeaturePak so far include Diamond Systems, originator of the standard, plus FeaturePak Initiative Charter Members Arbor Technology, Cogent Computer Systems Inc., Congatec AG, Connect Tech, Douglas Electronics Inc., Hectronic AB and IXXAT Automation GmbH.

In a vivid example of many small form factor specs overlapping, Diamond Systems recently unveiled its Magellan product (Figure 3). This board-level subsystem marries the benefits of computer on modules (COMs) with those of stackable SBCs. Magellan's CPU core consists of a COM Express CPU module and heatspreader mounted on its bottom side, resulting in optimal thermal management and increased space for I/O functions and connectors. This design makes it possible for Magellan to integrate dual gigabit Ethernet LAN ports, a 7-30V DC/DC power supply, a full set of peripheral interface header connectors, stackable PCI-104 or SUMIT expansion, and a FeaturePak I/O module socket, in addition to a complete embedded-PC core—all within the 95 x 125 mm COM Express footprint.

PC/104 Remains Strong

Not to be left out, PC/104 and all of its follow-on variants continue to hold an established position in military embedded systems. Now, as PCI Express and USB make their way into the PC/104 universe, military system developers are no longer limited to ISA-bus speed limitations. By leveraging the PC as its core foundation, PC/104—and its wider community of form factors including PC/104-Plus, PCI-104 and EPIC—has been able to leverage all facets of the PC infrastructure.

The Consortium has detailed a consolidated and consistent stackable PCI Express roadmap, starting with the adoption of the PCI/104-Express and PCIe/104 specifications. The spec brought PCI and PCI Express buses together to form PCI/104-Express. For additional room on a module, the PCIe/104 removes the PCI bus. This stackable PCI Express bus was incorporated across the Consortium's 104, EPIC and EBX form factors. A new high-speed surface mount connector was specially sponsored and designed for this application.

Maximum effort went into configuring this connector so that it was capable of handling the rugged environments of the embedded market, optimized for the 0.600-inch (15.24 mm) stack height of the PC/104 architecture, and capable of transporting the high-speed signaling of PCI Express over large stack heights while keeping PCI Express Gen 2 in sight. Maintaining the strategy of preserving ties to legacy

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PC/104, the PC/104 Embedded Consortium also added USB connections to the stackable PCI/104-Express and PCIe/104 specifications.

A recent PC/104-sized product example is VersaLogic's Wildcat (Figure 4), a high-performance SBC built around an Intel second-generation Core2 Duo processor (SP9300). The entire SBC fits on a single 4.2" x 3.8" (107 mm x 96 mm) board. Wildcat is designed for applications that require extreme CPU and video processing in a compact package. The SP9300 Core 2 Duo CPU is combined with the GS45 Graphics Memory Controller Hub and ICH9M I/O Controller Hub to form an extremely high-performance system. This SBC is suited for compute-intensive, high-end applications such as flight navigation and guidance systems. The board is qualified to MIL-STD-202G shock and vibration standards for use in harsh environments. ▮▮

Figure 4

The PC/104-sized Wildcat is built around an Intel second-generation Core2 Duo processor (SP9300). The CPU, combined with the GS45 Graphics Memory Controller Hub and ICH9M I/O Controller Hub, is suited for compute-intensive applications such as flight navigation and guidance systems.

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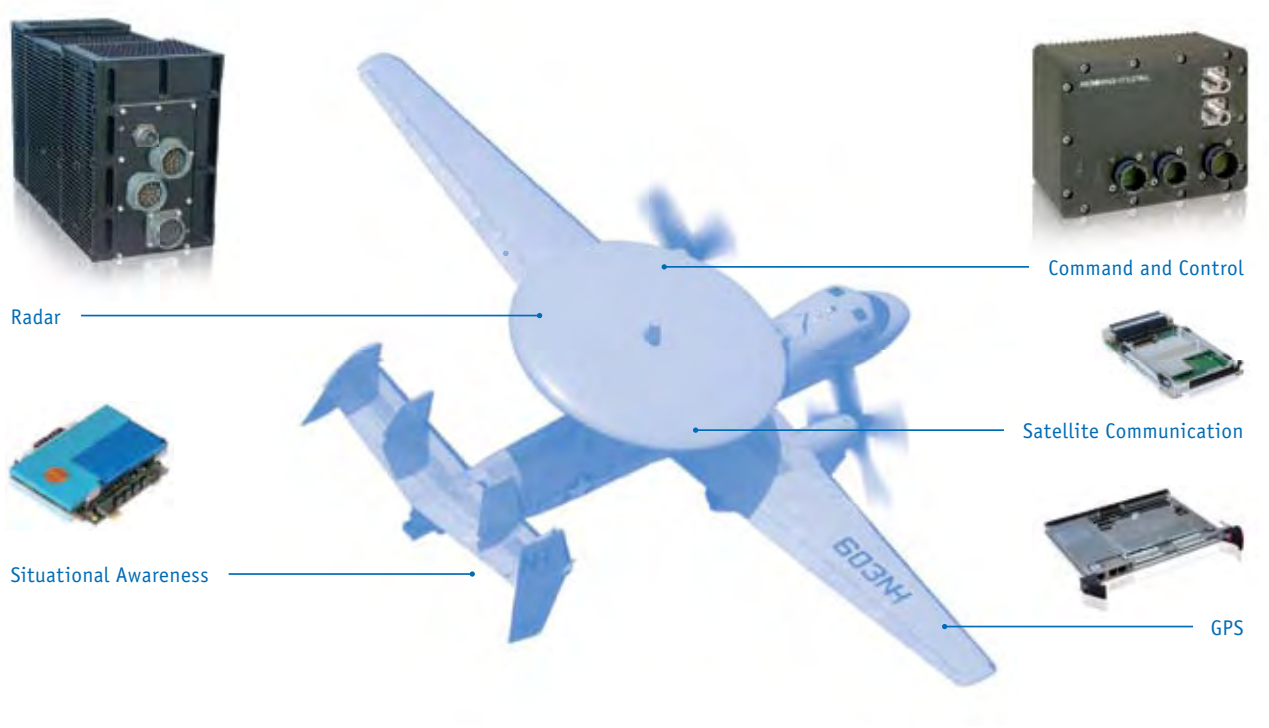

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Lorraine Orcino, Sr. Product Line Manager
RadiSys

In today's mil/aero industry, there has been a shift from customized, proprietary solutions to leveraging COTS building blocks in the deployment of mobile, mission-critical and high-performance applications. Mobile computing applications such as portable and in-vehicle computers must be rugged enough to handle the toughest environmental factors, yet efficient enough to meet application needs for power and heat dissipation.

As new processing technology hits the market, there has been an explosion of innovation in small form factor modules. These new processors enable high computing power along with low electrical power consumption; an ideal combination for mobile computing applications deployed in harsh environments. Combining a processor module with a small form factor carrier board can deliver a scalable and flexible method to create a customized system. COM Express' modular design helps designers meet the unique enclosure needs of military applications.

Figure 1

The Procelerant CEZ5XT is based on the Intel ultra-low-power Z5XX series ATOM processor on an 85 mm x 70 mm standardized Type 2 pin-out COM module. The board offers 2 Gbyte memory, a microSD socket, Gigabit Ethernet and extended voltage range.

Why COM Express?

As network-centric military systems raise the bar on compute, I/O and graphics performance, older modular form factors are unable to support the power requirements on multicore processors and limit the I/O, memory and video interfaces. The PICMG COM Express standard comprehends the latest I/O and graphics integration and supports these interfaces natively via the processor/chipset, providing customers upgrade and performance options on board rather than via add-in cards. In addition, COM Express-based solutions are highly integrated and compact, delivering high-performance processing within a small, low-power embedded form factor, making it an ideal platform for portable, battery-powered applications. Figure 1 shows an example of a COM Express board from Radisys.

Original Equipment Manufacturers (OEMs) can avoid the design churn that

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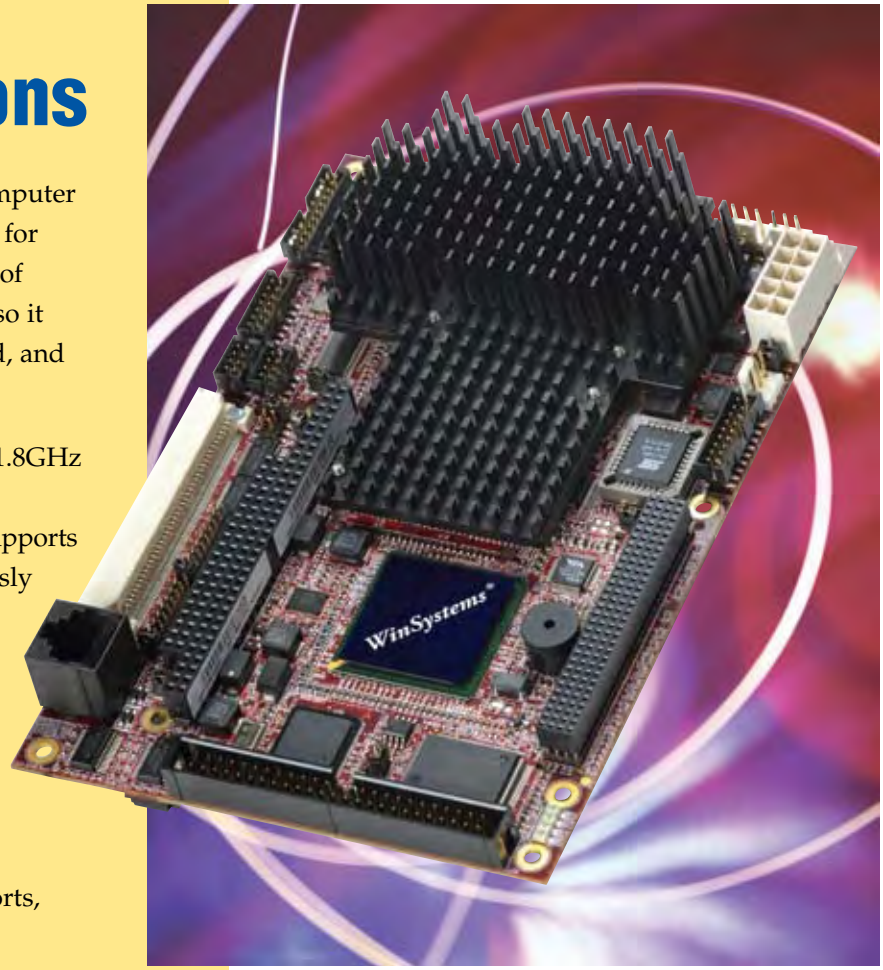

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Computer-on-Module Selection Criteria	
Small form factor	Boards are situated in space-constrained, fanless environments.
Ruggedized	Systems must survive severe shock and vibration with field-deployed use.
High performance	Applications need as much graphics and performance as the power budget will allow for.
Full featured	Platforms must be flexible enough to satisfy the requirements of multiple generations—including the integration of future I/O additions or features.

Table 1

Computer-on-Module selection criteria include choosing the optimal processor for the application power budget, designing for extended temperature and vibration specification requirements, and ensuring rigorous testing.

comes with implementing new processor generations by adopting COM Express, a two-board solution that is uniquely capable of delivering ruggedness and power efficiency. The platform comprises a computer-on-module (including processor, chipset and memory) and a carrier board that can be customized to specific application requirements. Manufacturers can leverage COTS computer modules and design their own carrier boards, which may include differentiating features and proprietary I/O. Table 1 lists some of the key computer-on-module selection criteria.

When designing a small form factor system with COM Express, there are several design considerations to take into account. These include selecting the optimal processor for the application power budget, designing for extended temperature and vibration specification requirements, and ensuring rigorous testing.

Selecting the Processor

Contrary to the belief that the lowest power solution dominates, mil/aero customers want the highest performing processor that they can run reliably with their application's power budget. To achieve this combination, the COM Express processor module must be thoroughly validated, tested and documented to meet the required temperature range. Boosting the performance of mainstream processing performance can be done, but is especially challenging for designers of small form factor systems who face stringent space and power constraints.

These products must be capable of operating in extended temperature ranges, from -25° to +70°C. However, the mainstream performance processors are not specified or guaranteed to meet these extended temperature ranges, and design engineers must rely on extended testing at the board or system level to ensure the processor's reliability. Some embedded computer vendors provide this critical step by analyzing and validating new

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processing technology over the extended temperature range as it hits the market, ensuring that the thermal dissipation and performance of its modules can meet the requirements of the harsh mil/aero environments.

Extended Temp and Vibration Specs

Radisys designs ruggedness into its COM Express modules by employing its proprietary Highly Accelerated Life Testing (HALT) techniques during the design phase. HALT is used in the design phase to maximize the full limits of the product design. An effective strategy for testing consists of a stepped thermal and vibration stress process during which the actual limits of the design and component performance are determined. As failure modes are discovered, they are corrected by design or component improvement until no further improvement is practical or is limited by the fundamental limit of the underlying technologies. By establishing that the design and components are capable of operating not only to the extended temperature specification, but well beyond, HALT demonstrates the true operational limits of the product.

Beyond the Limit with HASS

Once rigorous HALT design and testing have determined the product's capability for extended temperature operation, it is critical to also have a process for ongoing monitoring of that capability. RadiSys' Highly Accelerated Stress Screening (HASS) process is implemented. HASS screen limits can be set beyond the product specification to ensure that the product maintains its operating margin. In order for HASS to be truly effective, it must be performed on 100 percent of the products manufactured.

In this way, an OEM can guarantee that each product not only meets the extended temperature requirement, but that it does so with additional operating margin, ensuring long-term performance and reliability. By driving operating margin into the design, an OEM can become immune to material and process variation in manufacturing, attain high yields during all production phases, and have sustained reliability and low warranty costs, all with no surprises in the field.

Standards-based COM Express solutions are uniquely designed to deliver the right balance between being rugged enough to handle the toughest environmental factors, yet efficient enough to meet application needs for power and heat dissipation. Built with proven COTS components, COM Express modules enable reduced cycle time and quick deployment for applications with improved performance. ▮▮

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Tech Recon

OpenVPX Advantages and the VME Legacy

OpenVPX Flourishes as it Readies for Prime Time

As OpenVPX moves from completed spec to ANSI approval, its ecosystem of products continues to bloom. Legacy VME meanwhile fuels "here and now" tech refresh needs.

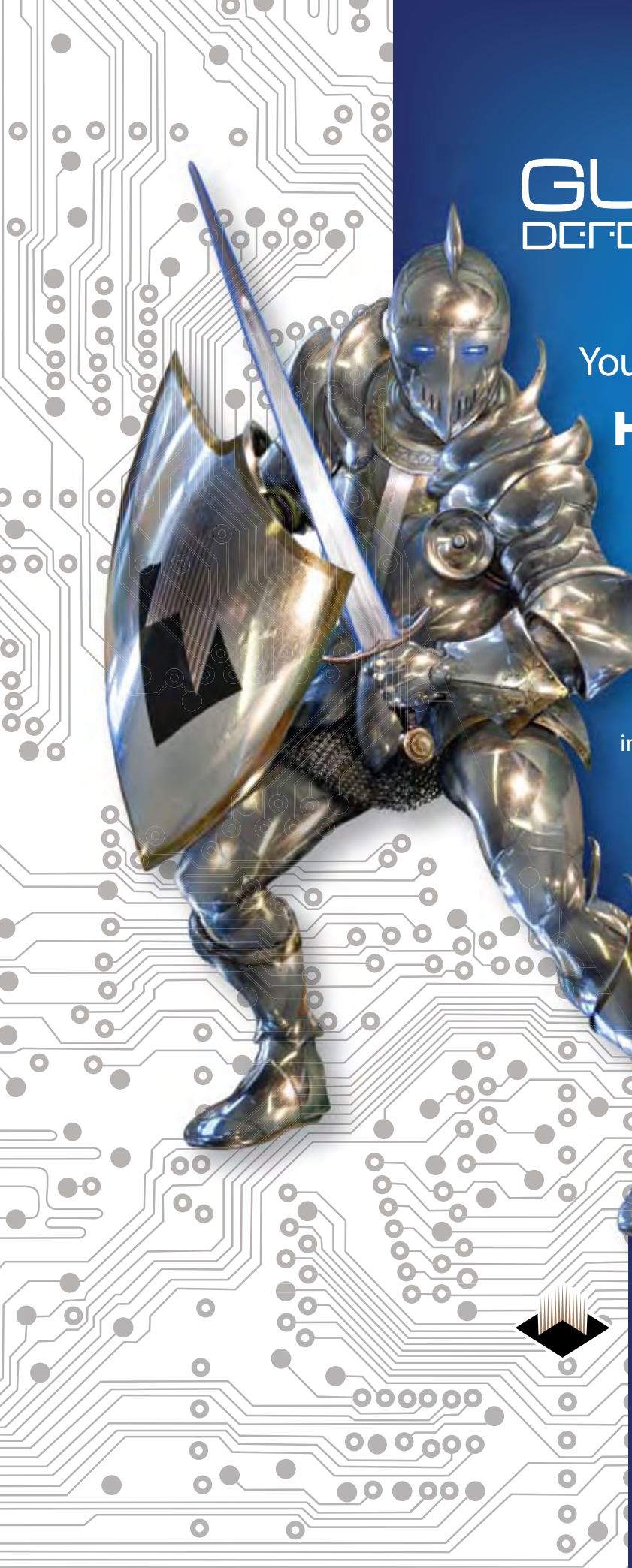
Jeff Child
Editor-in-Chief

The goal of bringing together advanced switch fabric interconnects and all the features of a modern, rugged embedded computer architecture, is finally happening in the form of OpenVPX. In the space of less than a year, a group of military embedded computer vendors and prime contractors accomplished a nearly impossible task. Under the OpenVPX Industry Working Group, these companies morphed the VPX 46 architecture into an interoperable system-level draft spec called OpenVPX. OpenVPX provides implementation details for VPX payload and switch modules, backplane topologies and chassis products.

OpenVPX solves the long-known problem that has faced VPX from its inception: With its large number of open pins and the variety of fabric options available to it, it's difficult to ensure any compatibility between VPX products of different vendors. The spec provides defense primes and suppliers clear direction

Figure 1

Ian Dunn (Mercury Computer Systems), chair of the OpenVPX Industry Working Group, officially turns the OpenVPX specification over to Mark Littlefield, chair of the VITA 65 Working Group at a press event in October.



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As with any open standards VPX and, OpenVPX still aren't a slam dunk. However, all the signs are there that its chances are very good, and the industry is being very proactive in elevating awareness of OpenVPX. VME and CompactPCI are two examples of open standard architectures that didn't enjoy overnight success with the military, but rather achieved acceptance in the defense market after considerable product development and marketing efforts gained them the mindshare needed for the military to embrace them.

Spec Turned Over to VITA 65

At a press event at MILCOM Boston last fall, the OpenVPX Industry Working Group announced the completion of the OpenVPX specification and its release to the VITA 65 working group for quick ratification. The OpenVPX working group was formed in January 2009 to develop a system-level specification that addresses interoperability improvements for the VITA 46 specification. The milestone stayed true to the group's goal of completing the spec by October 2009.

The specification is designed to improve interoperability of COTS 3U and 6U VPX boards achieved by implementation of predefined system topologies. This was needed, according to members, in order to lower the risk of adoption, expand the addressable market for VPX solutions, increase the market opportunities, and accelerate the deployment of VPX solutions into defense-related applications. The specification was turned over to the VITA 65 working group, with the objective of the VITA Standards Organization's (VSO) ratification. At that event and since then several OpenVPX member companies announced OpenVPX products compatible with the new spec—and today there are

VITA Standards Organization: A Summary of Ratified Standards

Over the past year, a total of eight specifications completed the process and reached full American National Standards Institute (ANSI) recognition under the guidance of the VITA Standards Organization (VSO).

ANSI/VITA 41.6

VXS: 1x Gigabit Ethernet Control Channel Layer

ANSI/VITA 41.6 is a dot-specification to the VXS (VME Switched Serial) family that describes a method for implementing the 1x Gigabit Ethernet protocol as a control channel within the VXS architecture.

ANSI/VITA 42.0

XMC: Switched Mezzanine Card Base Specification

XMC is a new specification that defines an open standard for supporting high-speed, switched interconnect protocols on the PMC (PCI Mezzanine Card), an existing, widely deployed mezzanine form factor. ANSI/VITA 42.0 is the base specification for the XMC family of specifications.

ANSI/VITA 42.6

XMC: 10 GbE Ethernet 4-Lane Protocol Layer Standard

ANSI/VITA 42.6 is a dot-specification to the base XMC specification that defines an open standard for supporting high-speed, switched interconnect protocols with 10Gbit Ethernet.

ANSI/VITA 46.10

VPX: Rear Transition Module

ANSI/VITA 46.10, is a dot-specification within the VPX family that defines a Rear Transition Module (RTM) format for VPX boards. This specification defines 6U and 3U Eurocard format rear transition modules suitable for air-cooled, ruggedized use. Also defined is a suitable high-speed connector family for use in these plug-in modules and provisions for power and I/O connections for the rear transition module.

ANSI/VITA 49.0

VITA Radio Transport (VRT)

The VITA Radio Transport (VRT) standard defines a transport-layer protocol designed to promote interoperability between RF (radio frequency) receivers and signal processing equipment in a wide range of applications. These include spectral monitoring, communications, radar and others. In support of this variety of applications, the VRT protocol provides a variety of formatting options that allow the transport layer to be optimized for each application. VRT also enables high-precision timestamping to provide time synchronization between multiple receiver channels.

ANSI/VITA 49.1

VITA Radio Link Layer (VRL)

The VITA Radio Link Layer (VRL) standard specifies an optional encapsulation protocol for ANSI/VITA-49.0 (VRT) packets.

ANSI/VITA 51.3

Qualification and Environmental Stress Screening in Support of Reliability Predictions

This specification reflects the "best practices" within the industry for performing cost-effective qualification and environmental stress screening (ESS) to support valid reliability predictions and enhance electronics reliability. It is intended for use by plug-in unit suppliers and integrators. It defines uniform practices for conducting Qualification Durability Environment Verifications and ESS.

ANSI/VITA 58.0

Line Replaceable Integrated Electronics Chassis

This standard provides the common requirements for a family of line replaceable integrated electronic assemblies designed to accommodate industry standard plug-in module formats including VPX and others.

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Figure 2

An upgrade to the AN/TPQ-36's radar processor consists of a 3-Card Slot VME Implementation with two PowerPC-based boards, two PMC slots and VME clock interface card.

more than 78 unique OpenVPX products. Last month the VITA 65 OpenVPX System Specification was ratified by its working group. The spec now meets the final criteria enabling balloting to proceed for ANSI ratification.

Clear Implementation Language

At nearly 400 pages long, the OpenVPX System Specification spells out the technical implementation details for 3U and 6U VPX payload and switch modules, backplane topologies and chassis products, which provides clear guidance to the Defense primes and suppliers on how to build interoperable computing and communication platforms. The VPX standard was developed to define a new generation of computing systems that employ high-performance switch fabrics over a new high-speed connector, as well as operate in harsh environments.

Member companies who were part of the OpenVPX Industry Working Group and signed the OpenVPX operational MOU agreement include: Aitech, Agilent, BittWare, Boeing, Concurrent Technologies, CSPI, Curtiss-Wright, Diversified Technology, DRS Signal Solutions, Elma Electronic, Extreme Engineering, Foxconn Electronics, GE Fanuc, General Dynamics AIS, General Dynamics, Hybricon, Kontron, Lockheed Martin, Mercury Computer Systems, Molex, Northrop Grumman, Pentair/Schroff, Pentek, Pigeon Point Systems, SIE Computing Solutions, TEK Microsystems, Tracewell Systems and Tyco Electronics. In December VITA announced the formation of the VPX Marketing Alliance with the goal of continuing the marketing efforts accomplished by the OpenVPX Marketing Working Group. The list of alliance members can be found at www.vita.com/vpx.html.

VME for Tech Upgrades

While OpenVPX's future looks bright, it's older VME product like VME64 that are shipping into deployed systems today. Among the reasons for VME's soaring success in military systems is its unique ability to remain

backward compatible and facilitate technology refresh in military programs. A new board with the latest and greatest processor, memory and I/O can easily be dropped into a slot that could be decades old. That kind of easy upgrade becomes trickier as new fabric-based VITA-standard boards enter the mix. The VSO (VITA Standards Organization) currently has 24 active working groups developing specifications for the next generation of specifications. The sidebar "VITA Standards Organization: A Summary of Ratified Standards" details those that have been ratified.

The days are now gone when VME was the only option for new military system designs. That said, its ability to accommodate new technologies opens the door for a healthy stream of technology refresh business. A host of deployed programs and long design cycle programs continue to demand VME SBC upgrades that drop into an existing slot with the latest and greatest processing technology.

These sort of tech refresh/tech upgrade programs form the heart of much of the embedded-computer business. Among the highest profile of these include the F-18 Advanced Multi-Purpose Display program; Bradley Vehicle Electronics Upgrade; B-52 mission computer upgrade; Aegis Guided Missile Destroyer Sonar Upgrade; B-2 Bomber Radar Upgrade; Boeing B-1B Bomber Avionics Upgrade; Abrams Tank Systems Enhancement Package (SEP) upgrade and the C-130 cockpit upgrade. Another example is Thales-Raytheon Systems' upgrade of their Firefinder Weapons Locating Radars, which includes the AN/TPQ-36 Weapon Locating Radar (Figure 2) and the AN/TPQ-37 Artillery Locating Radar. Most all of these upgrade programs involve standards-based embedded-computer solutions such as VME. ▮▮

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Tech Recon

OpenVPX Advantages and the VME Legacy

VPX and VXS: System-Level Switched Fabric Strategies

VME has shown great success in rolling with the punches of technology evolution. Case in point is VME's evolution to VXS and VPX.

Rodger Hosking, Vice President
Pentek

Through evolutionary enhancements and technology developments, VME still serves as a dominant bus structure for high-performance, real-time embedded systems. When VME was first introduced, its shared bus backplane interboard transfer rates of 30 or 40 Mbytes/s were more than adequate for most applications. As requirements grew, VME acquired new interfaces such as VSB, RACEway, RACE++, VME64, VME320 and 2eSST, thereby ensuring a healthy community of suppliers and a new stream of products. Well into its third decade of widespread deployment, VME adopted the new VXS gigabit serial interface, clearly representing the most significant leap in backplane data transfer rates throughout its entire history.

Because VXS delivered such a dramatic improvement in embedded system performance, the use of gigabit serial technology was extended to create VPX. The OpenVPX initiative followed shortly thereafter as risk-averse government agencies, with concerns about the longevity and maintainability of new technology and architecture, mandated the need for industry-wide standards. The hallmark of any successful standard is that it continues to evolve with technology, and none offers a better example than VME's evolution to VXS and VPX.

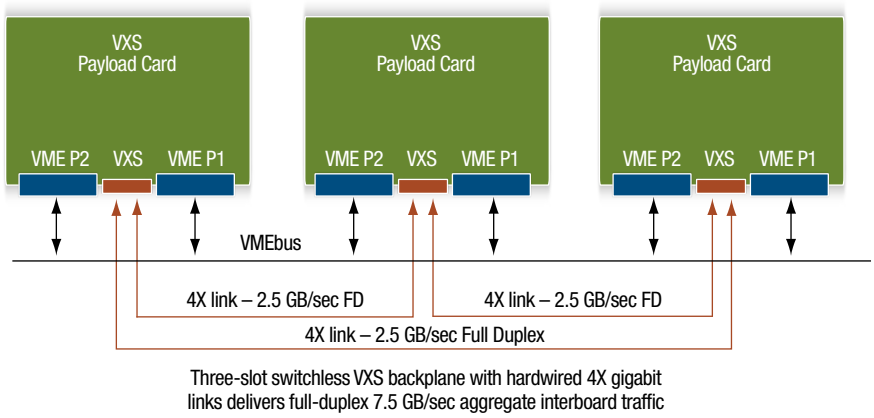

Figure 1

In this simple configuration of a VXS switchless mesh backplane, three VXS cards are joined in a ring configuration, with each card connected to the other two through two 4X links hard-wired in copper as part of the backplane.

VXS: High-Bandwidth Connectivity

Motorola's VME Renaissance announcement in 2003 unveiled the new VXS initiative, officially designated VITA 41 by the VITA Standards Organization (VSO). It defines the implementation of gigabit serial technology for VME in a logically layered specification, while carefully preserving the legacy VME form factors and bus operations. At the top layer, VITA 41 defines the connectors, pin designations, dimensions and mechanical structures for cards and backplanes—completely free of any mandates for specific slot interconnection strategies, protocols or fabrics.

VXS defines two types of cards: the payload card and the switch card. Both utilize the same mechanical outline as a standard 6U VME card. The payload card fits a new gigabit serial connector

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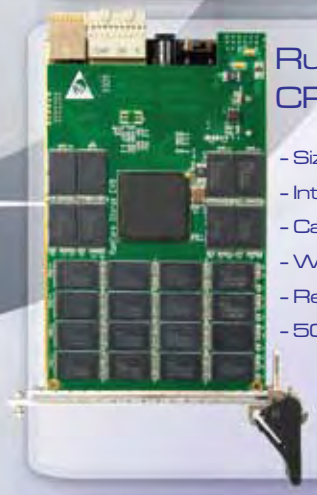

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Expansion Bus	PC/104 ISA Bus			✓						✓	✓	✓	✓	✓	✓
	PCI-104 PCI Bus	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓
	PCIe/104 Express Bus	✓	✓												
CPU and BIOS	CPU Max Clock Rate (MHz)	1860	1200	1400	1400	1400	1400	1400	1400	650	650	650	650	500	500
	Intel SpeedStep Technology	✓	✓	✓	✓	✓	✓	✓	✓						
	ACPI Power Management	3.0	3.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	1.0	2.0	2.0
	Max Onboard DRAM (MB)	2GB	2GB	512	1GB	512	1GB	1GB	1GB	256	256	256	256	256	256
	RTD Enhanced Flash BIOS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Nonvolatile Configuration	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	RTD Quick Boot	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	USB Legacy (Keyboard & Boot)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Peripherals	Watchdog Timer	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Solid State Hard Drive Disk Chip	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB	8GB
	Audio	✓	✓		✓	✓	✓	✓	✓		✓	✓	✓		
	Analog Video	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA	SVGA
	Digital Video	LVDS	LVDS	LVDS	LVDS	LVDS	LVDS	LVDS	LVDS			TTL	LVDS	LVDS	
	PS2 Mouse/Keyboard/Utility Port	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	USB Mouse/Keyboard	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
I/O	RS-232/422/485 Ports	4	4	4	4	4	2	4	2	2	2	2	2	2	2
	SATA	2	2												
	USB 2.0	6	6	4	2	2	4	2	4	2	2	2	2	2	2
	Gigabit Ethernet	1	1												
	10/100Base-T Ethernet			1	1	1	1	1	1	1	1	1	1	2	1
	Parallel Port				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	aDIO (Advanced Digital I/O)	14	14	14	18	18	18	36	36	18	18	18	18	18	18
	aAI (12-bit Advanced Analog Input)	8	8												
	multiPort (aDIO, ECP, FDC)				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
SW	ROM-DOS Installed	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	DOS, Windows, Linux	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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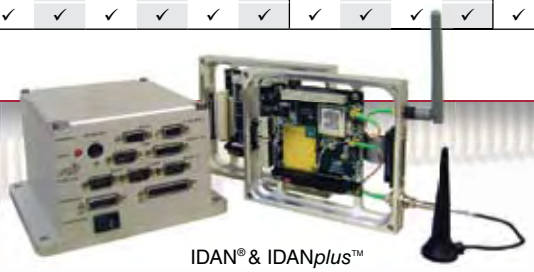

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Bus		Active Bus	PCI	PCI	ISA	ISA	ISA	PCI	ISA	ISA	ISA	PCI	PCI	PCIe	PCI
		Passthrough Bus	ISA					ISA				ISA		PCI	ISA†
		DMA or PCI Bus Master	✓	✓	✓	✓	✓	✓				✓	✓	✓	✓
		McBSP Serial Ports	✓	✓				✓							
ANALOG	Analog Input	Single-Ended Inputs	16	16	16	32	16	16							
		Differential Inputs	8	8	8	16	8	8							
		Max Throughput (KHz)	1250	1250	500		100	1250							
		Resolution (bits)	12	12	12	12	16	12							
		Input Ranges/Gains	3/7	3/7	3/4	3/4	1/4	3/6							
		Autonomous Calibration	✓	✓											
		Data Marker Inputs	3	3	3			3							
	Analog Out	Analog Outputs	2	2	2	4	2	2							
		Max Throughput (KHz)	200	200	200	200	100	200							
		Resolution (bits)	12	12	12	12	16	12							
		Output Ranges	4	4	3	3	1	4							
		D/A FIFO Buffer	8K	8K				8K							
	Advanced Features	Channel-Gain Table	1K	1K	1K	1K	1K	1K							
		Scan/Burst/Multi-Burst	✓	✓	✓	✓	✓	✓							
		A/D FIFO Buffer	8K	8K	8K	8K	8K	8K							
		Sample Counter	✓	✓	✓	✓	✓	✓							
		SyncBus	✓	✓				✓							
DIGITAL	Digital I/O	Total Digital I/O	16	16	16	16	16	16	48	18/9	64	48	48	48	48
		Bit Programmable I/O	8	8	8	8	8	8	24	6/0		48	48	48	✓†
		Input FIFO Buffer	8K	8K	8K	8K	8K	8K							
		Opto-Isolated Inputs									48				
		Opto-Isolated Outputs									16				
		User Timer/Counters	3	3	2	2	2	3	3	3		10	10	10	6
	Advanced Features	Advanced Interrupts	2	2	2	2	2	2	2			2	2	2	✓†
		Versatile Memory Buffer										4M	4M	4M	8MB
		External Trigger	✓	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓†
		Incr. Encoders/PWMs								3/9		4/8	4/8	4/8	✓†

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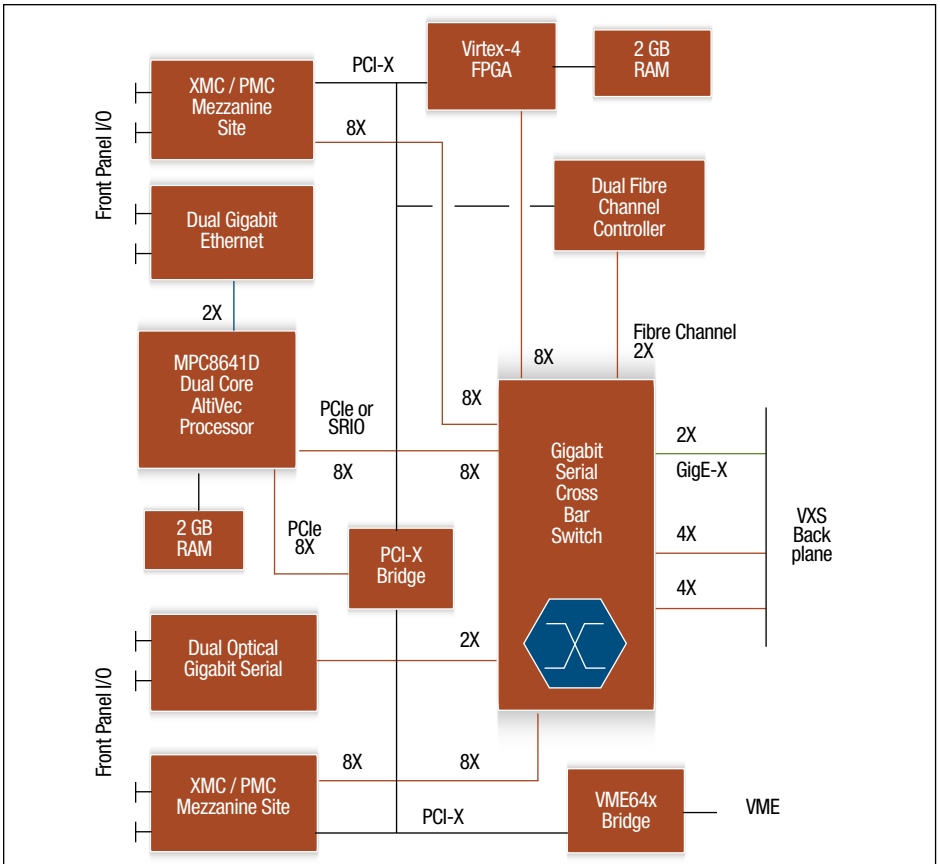

Figure 2

The Model 4207 VXS PowerPC I/O processor offers dual XMC sites and an onboard fabric-transparent gigabit serial crossbar switch.

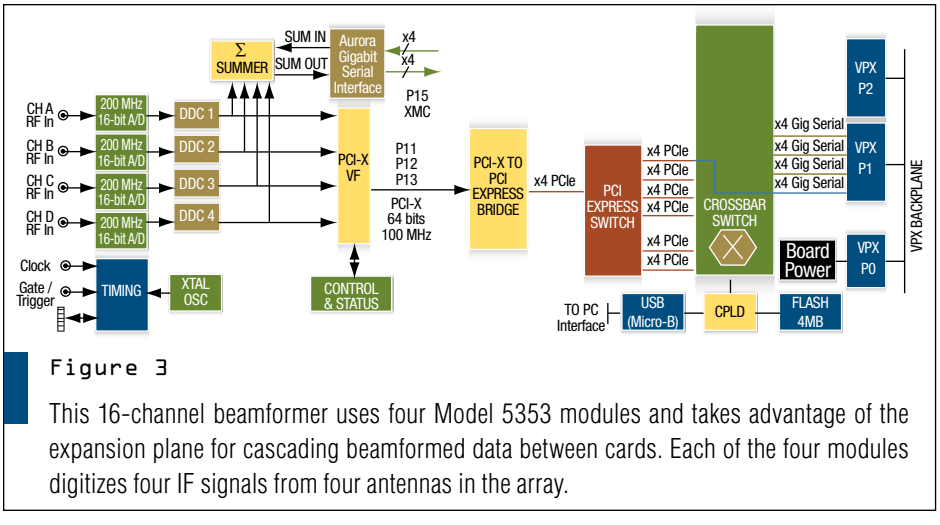

Figure 3

This 16-channel beamformer uses four Model 5353 modules and takes advantage of the expansion plane for cascading beamformed data between cards. Each of the four modules digitizes four IF signals from four antennas in the array.

(MultiGig RT2) between the existing P1 and P2 connectors, designated as P0. Most legacy VME backplanes provide clearance for the new P0 connector, thus allowing insertion of VXS cards for backward compatibility even though the VXS interface is not engaged.

VXS backplanes have one mating MultiGig RT2 connector for each payload card slot. VITA 41 does not dictate any specific backplane topology and leaves plenty of flexibility for various architectures. The simplest configuration is the VXS switchless mesh backplane shown in Figure 1. Here, three VXS cards are joined in a ring configuration, with each card connected to the other two through two 4X links hardwired in copper as part of the backplane design. At a serial bit rate of 3.125 GHz, this system supports simultaneous data transfers between the cards in both directions at an aggregate rate of 7.5 Gbytes/s.

VPX: Tremendous Fabric I/O Capacity

With each new generation of powerful, high-performance embedded solutions—including processors with higher clock rates and wider buses, data converter products with higher sampling rates, and FPGAs, RISCs and DSPs offering incredible computational rates—an equally capable backplane solution was needed to eliminate system bottlenecks by keeping pace with the data transfer rates. By extending the use of gigabit serial links already proven under VXS, the embedded community created the VPX initiative, which was formally defined under VITA 46. As a migration from the earlier VME and VXS standards, VPX shares the same outline as 3U and 6U cards and supports XMC mezzanine modules defined under the VITA 42 standard.

While VXS only allows one MultiGig RTS connector on a 6U card, VPX extends that number to three for a 3U card and to seven for a 6U card. As a result, VPX payload cards support a much higher traffic bandwidth than VXS, with 8 to 24 gigabit serial 4X ports compared to only two with VXS. Like the VXS specification, the VITA 46.0 VPX base specification does not define backplane topologies or specific gigabit serial fabrics or protocols. As with VXS, implementations of each fabric protocol are defined as sub-specifications, or "dot specs."

As industry started using VPX, a new extension emerged to deal with severe environmental requirements. The VITA 48 REDI - Ruggedized Enhanced Design Implementation defines specific mechanical designs for enhanced thermal management using forced air, conduction cooling and liquid cooling methods. It also defines protective metal covers for the cards to satisfy new requirements for simplified field servicing in deployed military applications.

OpenVPX Sorts it All Out

The OpenVPX organization was formed in January 2009 to promote industry-wide standards and long-term availability of VPX technology across the industry. The original VPX specification was being used, but because it permitted such a wide range of architectures, VPX systems tended to be unique, vendor-specific implementations.

The mission of OpenVPX was to enhance the original VPX standard by adding a set of well-defined system architectures, nomenclature and conventions to enable interoperability among vendors. Consisting of key vendors in the embedded system community, all eager to convince government and military customers that VPX was suitable for current and future systems, the group made fast progress and turned over the completed specification to the VSO in October 2009 for standardization under VITA 65. In February 2010, the specification was ratified by VSO, and ANSI approval is expected sometime later in 2010.

Language for Standardization

OpenVPX defined new nomenclature systems to describe the gigabit serial links in terms of the number of lanes and their function. The term "pipe" is used to define the number of bi-directional differential serial pairs grouped together to form a logical data channel. Pipe sizes range from one lane (1X) called an "ultra-thin pipe" or UTP, up to 32 lanes (32X) called an "octal fat pipe" or OFP. The popular 4X link is called a "fat pipe" or FP. OpenVPX also categorized the different kinds of traffic carried through the pipes as "planes." The five planes defined are the utility, management, control, data and expansion planes.

In order to define architectural characteristics of systems, several "profiles" were defined. A slot profile specifies the pipes and planes found on the backplane connectors of each slot. The module profile specifies the pipes, planes, fabrics and protocols implemented on each card. The backplane profile defines how the slots are connected to each other by pipes. And finally, the development chassis profile includes the backplane profile and defines the dimensions, power supply and cooling method.

VPX and VXS Products

Dozens of embedded computer hardware vendors have developed numerous VXS and VPX products. They include backplanes, complete card cages and chassis, A/D and D/A converters, software radio cards, XMC carriers, single board computers, DSP and RISC array processors, FPGA cards and memory cards.

VXS fully supports PMC mezzanine modules and the gigabit serial extension for PMC modules known as XMC. Both 3U and 6U VPX modules are also compatible with the gigabit XMC interface. The enormous base of existing PMC and XMC I/O modules offers integrators many choices for their VXS and VPX application solutions. Integrators can immediately take advantage of a rich variety of offerings in the market.

As an example, Figure 2 shows the Pentek Model 4207 VXS PowerPC I/O processor with dual XMC sites and a

wealth of critical interfaces for high-performance embedded systems. At its heart is an onboard fabric-transparent gigabit serial crossbar switch, highlighting the vital role of serial technology for interconnecting resources within the board and to other boards across the backplane.

VPX Applications

The latest embedded system designs show a definite shift toward serial fabric-based system architectures using both PCIe and SRIO, primarily to improve board-to-board data transfer rates to handle higher signal bandwidths, more powerful FPGAs and processors, and faster peripherals.

VPX cards in 3U and 6U sizes can support one or two XMC modules, respectively. Native PCIe and SRIO gigabit serial interfaces on these XMCs are often directly compatible with processors, other devices on the carrier board, and also with VPX backplane control and data planes. Other XMC protocols like Xilinx Aurora are ideal for raw high-speed data links, often directly connectable to VPX data and expansion planes.

Because they deliver substantial performance benefits, the latest FPGAs and gigabit serial fabrics increasingly dominate embedded system designs. Although these technologies are prevalent in both VXS and VPX platforms, VPX offers a clear advantage, not only because it offers many more links, but also because it simultaneously accommodates multiple protocols. For example, GigE can handle system management, while PCIe can be used for command and control, Serial RapidIO can support high-speed data transfer between processors, and Aurora can enable FPGAs to communicate raw data across the expansion plane.

Beamforming Systems Improve

Beamforming applications use an array of antennas to improve directionality of reception and improve signal quality. The signal arrival delay at each antenna is based on the path distance from the source. The beamforming process adjusts the gain and phase of each antenna signal to cancel the delay path differences for signals arriving from a particular direction. Aligned signals are summed together to produce high signal to noise reception in the chosen direction. By adjusting gain and phase in each path, the antenna is electronically "steered" without the need for moving mechanical structures.

Examples of applications that use beamforming include direction finding, where a beamformed antenna can be steered to locate the arrival angle of a signal source. Two or more arrays can be used to triangulate the exact location of the source, which is extremely important for signal intelligence and counter terrorism efforts. Radar Receiver applications use both linear- and two-dimension antenna designs for phased array and synthetic aperture array (SAR) systems.

Steering the array dramatically improves the range and target resolution, and airborne arrays take full advantage of electronic steering as no moving mechanisms are necessary. Missile detection and

countermeasure applications use beamforming to improve tracking of an object allowing for early detection and improved responsiveness. And lastly, beamforming allows spatial frequency sharing by commercial mobile phone carriers by dividing one cell into several beamformed sectors that can share the same frequency.

As an example, Figure 3 shows the configuration for a Pentek Model 5353 3U VPX module. To build a 16-channel beamformer you would use four Model 5353 modules. This digital beamforming system takes advantage of the expansion plane for cascading beamformed data between cards. Each of the four modules digitizes four IF signals from four antennas in the array. Four digital down converters perform beamforming phase and gain adjustments and then translate the IF signals to baseband. A summation engine accepts a propagated sum from a previous card, adds the four channels from the local card and then generates a new sum signal for delivery to the sum input of the next card in the chain. The summation paths use Aurora 4X gigabit serial links for the expansion plane connections across the backplane.

VPX and VXS Summary

While VPX systems can deliver aggregate transfer rates much higher than VXS, a vast majority of system requirements can be fully satisfied by the tremendous boost in rates that VXS offers over the legacy VME. Investments made by board vendors and system integrators in VXS hardware, interfaces, middleware, software and applications will translate easily into VPX, when system needs dictate. With so many VPX-compatible products available today, and with the new OpenVPX/VITA 65 standardization, system integrators can feel confident selecting VPX architectures for high-performance embedded applications.

Further evidence that the industry has embraced VPX are two new extensions. The VITA 66 Fibre Optic Interconnect specification for VPX defines a family of fiber optic interconnects that allows VPX connectors J2 though J6 to be replaced with optical connectors. The VITA 67 Coaxial Connector specification for VPX defines a shielded coaxial analog RF connector using the same mechanical dimensions as VITA 66. DRS is leading the VITA 67 initiative and Pentek is actively teaming with DRS on specification acceptance and product development. VPX dramatically improves embedded system performance and can achieve rates previously unattainable with earlier technology. For all of these very tangible considerations, VXS and VPX will dominate as the preferred architectures for future high-performance commercial and military embedded systems. ▮▮

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Tech Recon

OpenVPX Advantages and the VME Legacy

OpenVPX Re-Energizes Multi-Compute System Concepts

Diverse computing elements can be connected together in various topologies under the OpenVPX Systems Specification, to create multiprocessing systems. A radar processing system example highlights the benefits of the architecture.

Pete Jha, Senior Software Engineer
Curtiss-Wright Controls Embedded Computing

A growing number of applications require multiple processors for greater processing power or higher reliability. In order to solve complex problems in harsh environments, a system is generally composed of SBCs, DSP boards, FPGAs, memory boards, switches and so on. These computational entities can be connected together, in various topologies as defined by the OpenVPX Systems Specification, to create lightly and tightly coupled multiprocessing systems. Tightly coupled systems share a singular global address space with different memory hierarchies participating on a common bus. Lightly coupled systems contain multiple address spaces interconnected via a high-speed communication system.

OpenVPX provides a framework in which computational entities can be aggregated together to create larger systems. There are two dominant architectures addressed by the OpenVPX Specification: centralized and distributed.

Architecture	Advantages	Disadvantages
Distributed	· No additional slots required, saving space, cost and power · For systems up to 16 cards, average number of switch hops is lower · System specific topologies can be accommodated.	· Individual card failures coud affect communication between other cards · More complex to understand fabric usage
Centralized	· Backplane can be more generic · Simpler topolgy to model, no sharing of connections	· Requires extra slot(s) with added cost, power and lower MTBF · Greater opportunity for single-point of failure that can cause system failure

Figure 1

Listed here are some of the major advantages and disadvantages of centralized and distributed architectures.

The primary characteristic differentiator between these two architectures is the requirement for switches; a switch is required for traffic routing within a centralized system.

OpenVPX Architectures

There is no one architecture that is best suited for all computing applications. Figure 1 compares some of the major advantages and disadvantages of both of these dominant architectures. Distributed architectures are most prevalent in systems where computational density is desired. These architectures do not require any additional slots. Additionally, in systems with less than sixteen computing entities, the number of switch hops is lower than in centralized systems. However, in the event of any slot failure, communication across the fabric is at risk. The system-wide knowledge of the fabric interconnection is more complex to ascertain. To fully qualify the fabric interconnection, additional information must be made available to the system software.

Centralized architectures have a significantly simpler topology and a more generic backplane design. The tradeoff in

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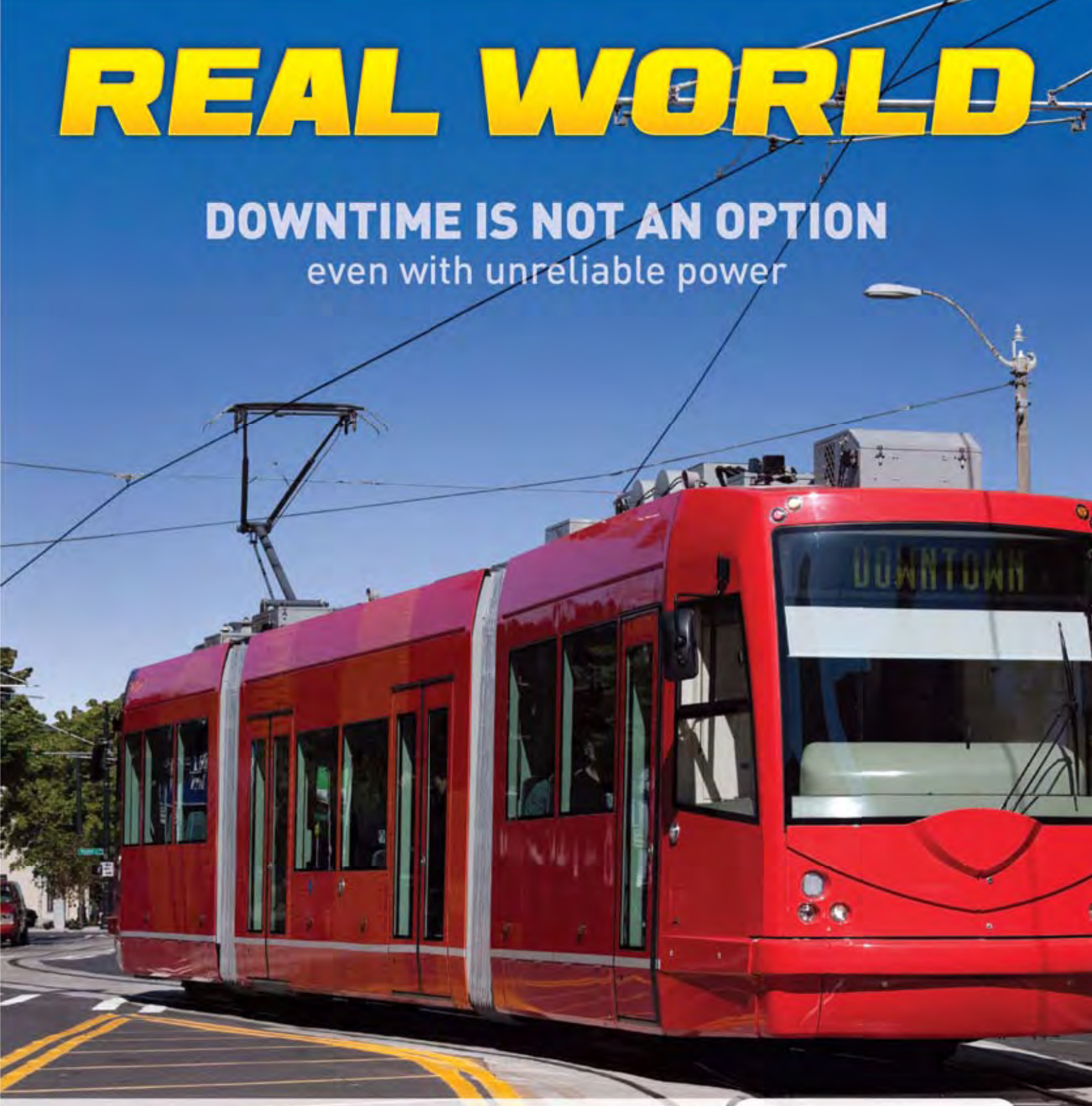

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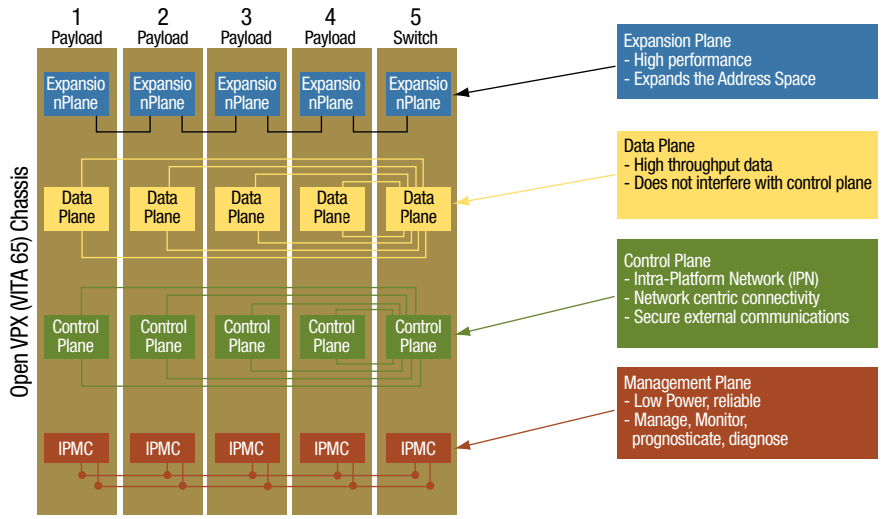

Figure 2

The OpenVPX Systems Specification abstracts out common system functions by aggregating differential pairs of pins into four planes: Data, Expansion, Control and Management/Utility.

simplicity requires an additional slot for a switch. Since the focal point of this architecture is a switch, in the event of a switch failure the whole system may become unusable. A switch failure can be ameliorated by having a redundant switch for failover.

OpenVPX Planes

The OpenVPX Systems Specification abstracts out common system functions by aggregating differential pairs of pins, which are referred to as Planes: Data, Expansion, Control and Management/Utility (Figure 2). The Data Plane provides a dedicated high-speed path for high throughput between computational entities. The Expansion Plane allows for a host processor to expand its address space and is typically PCI Express. A networked in-chassis communication plane is referred to as the Control Plane. The Management Plane is used to monitor, manage and diagnose the health of the system. More information on this topic can be found in the Open VPX Systems Specification.

VPX and OpenVPX have wide applicability for military, aerospace and industrial uses; including but not limited to radar, multi-INT (for example, radar data exploitation and information dissemination), image processing, avionics, homeland security, telecom and transportation. Radar Signal Processing systems are unique in their need for greater computing power, higher bandwidth and processing of analog input signals. These systems require high system throughput and are some of the most challenging applications in the military and aerospace industry. Figure 3 illustrates an OpenVPX system that was built for just such a purpose. A VPX system contains 192 pairs of differential pins and the connectors are arranged into groups of collective pins, which are 0th indexed from P0 to P6.

Radar Processing Example

The Radar Processing System is composed of a Receiver Processor, Signal Processor, Expansion Boards and Gigabit Ethernet Switch. In this example a distributed system was chosen for its higher computational density and lower hop count due to its chassis size. This system consists of off-the-shelf Curtiss Wright modules: three SBCs, eight DSPs, four expansion slots capable of being reached by SRIO fabric and one Ethernet switch. These computing enti-

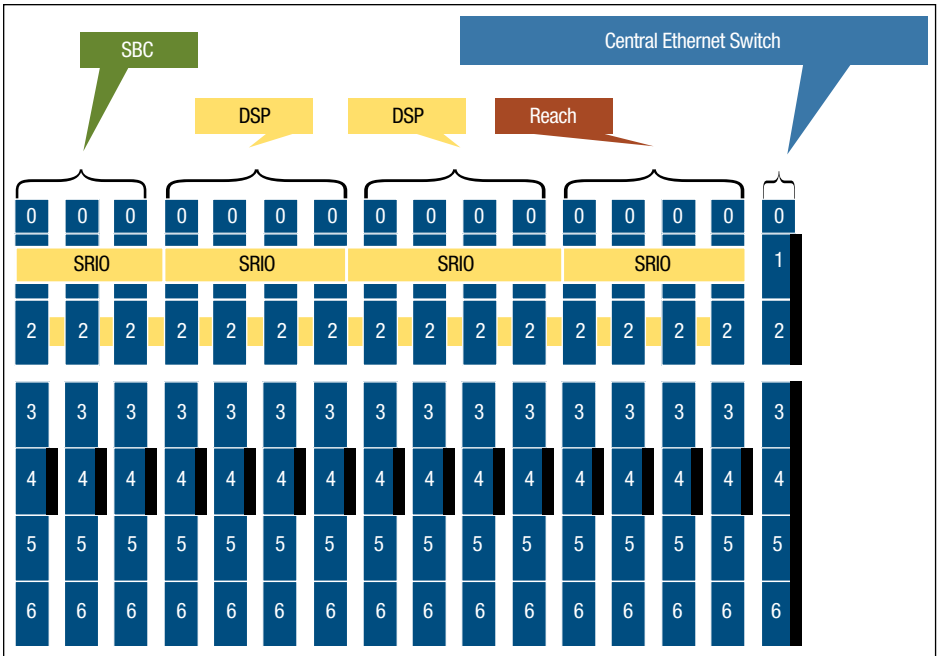

Figure 3

This radar signal processing OpenVPX contains 192 pairs of differential pins and the connectors are arranged into groups of collective pins, which are 0th indexed from P0 to P6.

ties are housed in sixteen-slot 6U VPX chassis. This system contains a fully meshed Serial RapidIO for the Data Plane and Gigabit Ethernet, denoted by vertical black lines (Figure 3, again), for the Control Plane.

Processor coupling is aided with the use of Serial RapidIO as the primary data plane fabric on P1. In a lightly coupled multiprocessing system such as described here, greater computational bandwidth is provided through a mechanism for passing data between logically isolated host processors. These host processors can create symbiotic relationships within a given chassis between the Receiving Processor, Signal Processor and Expansion slots. The data plane fabric provides 10 Gbit/s SRIO to each slot; and each slot contains a one Gigabit Ethernet control plane network connected to the Switch. This system is capable of producing over 200 Gflops of total DSP processing power and abundant primary memory and secondary solid-state storage.

A loosely coupled distributed Radar Processing System was described to illustrate advantages of using an OpenVPX-compliant architecture to increase bandwidth and improve overall system throughput. As more applications require additional processing power, multiprocessing systems, such as the one described here, will become increasingly more ubiquitous. *Pete Jha serves as the Chair of the VITA 65: OpenVPX Technical Working Group.*

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System Development

Eleventh Annual End-of-Life Supplier Directory

DoD and Specialist Firms Shift to Complete Lifecycle EOL Strategies

Military system developers face an ongoing burden of component obsolescence. Fortunately, a well-established cadre of government groups, distributors and specialty engineering firms offer ways to ease those challenges.

Jeff Child
Editor-in-Chief

There's no sign that the ever-present burden of obsolescence—referred to as Diminishing Manufacturing Sources and Material Shortages (DMSMS) in defense circles—is going away any time soon. As commercial and consumer system lifecycles shrink, the components used in those broad markets are facing ever shorter life spans. Today, end products in those areas are almost universally designed to be disposable. The defense industry, in fact, remains one of the very few segments of the electronics market that actually repairs and upgrades its electronics subsystems rather than just throwing out the obsolete product.

Fortunately, there's a well-established infrastructure of companies and government organizations in the business of addressing the obsolescence problem. There's a variety of ways to deal with the problem of a chip or board that has gone end-of-life. There are numerous aftermarket chip suppliers who stock inventories of obsoleted devices. Among them is a mix of small firms specializing in aftermarket business, and large distributors who include after-market products in their portfolio.

COTS Journal's Eleventh Annual End-of-Life Supplier Directory, displayed on the following three pages, lists those players and what they do. It's interesting that, over the past year, none of the companies listed have gone out of business—even though the economy has hurt others in the electronics field. In fact, many I've talked to recently continue to do a brisk business.

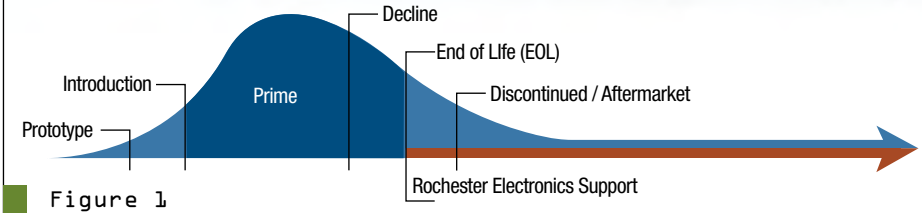
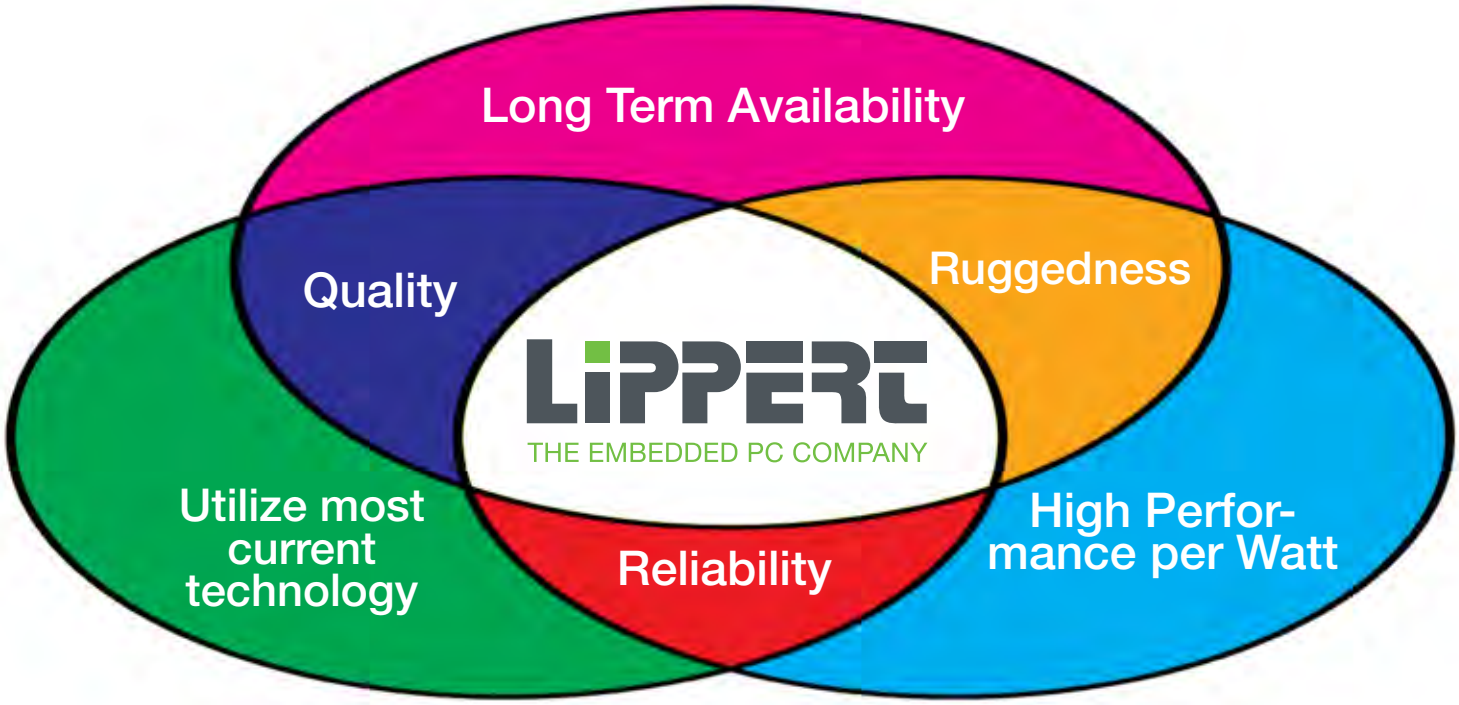


Figure 1

In the case of Rochester Electronics, an EOL part can be migrated to its facilities before it is discontinued by the original manufacturer. They can then provide availability of the part indefinitely beyond that.

Rochester Electronics, for example, has stepped up their level of EOL support with a new service called the Extension-of-Life process. Rochester Electronics acquires the original manufacturer's remaining inventory, including packaged devices, finished devices, die, intellectual property, tooling, test programs and test equipment, to provide continuous supply and extend the life of many semiconductor series. That's important because typically, when an original semiconductor manufacturer discontinues a device, it is difficult for customers to accurately forecast last-time buy requirements, absorb the additional inventory and storage costs associated with last-time buys, or find an available drop-in replacement.

A discontinued semiconductor announcement creates a costly inconvenience of reallocating engineering resources, and results in time-consuming re-design, retest and re-qualification, particularly when the part is used in government and mil/aero and other high-reliability or long-life applications. According to George Karalias, director of marketing and communications at Rochester Electronics, partnering with Rochester further up the product lifecycle curve means the semiconductor product never truly reaches end-of-life (Figure 1) and can ease a defense customer's end-of-life planning. Along with a strategic last-time buy from the OEM, plans can be made to have Rochester be the continuing source for their critical devices. ▮▮



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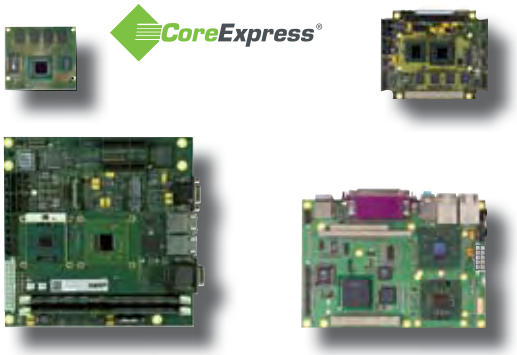

Model	Format	CPU, Clock	RAM (max)	Miscellaneous
CoreExpress-ECO	CoreExpress®	Atom™ 5xx 1.1 ... 1.6 GHz	2 GB soldered	2 x PCI Express, SDVO, USB
Cool XpressRunner-GS45	PCI/104-Express	Core™ 2 Duo	1 GB	LAN, SATA, USB
Cool RoadRunner-945-GSE	PC/104-Plus	Atom™ N270 1.6 GHz	2 GB soldered	LAN, 2 GB SSD, SATA
Cool RoadRunner-PM	PC/104-Plus	Pentium® M 0.6 ... 1.8 GHz	1 GB	LAN, USB
Cool RoadRunner-4	PCI-104	Pentium® M 0.6 ... 1.8 GHz	1 GB	LAN, USB
Hurricane-PM	EPIC	Pentium® M 0.6 ... 1.8 GHz	1 GB	LAN, USB, uDoC
Thunderbird	Mini-ITX	Pentium® M 0.6 ... 1.8 GHz	1 GB	LAN, MiniPCI
Thunderbird/MM	Mini-ITX	Pentium® M 0.6 ... 1.8 GHz	1 GB	LAN, USB, uDoC, Mini PCI, DVI, SPDIF, IEEEE1394
Thunderbird-GM45	Mini-ITX	Core™ 2 Duo 2.53 GHz	4 GB	LAN, SATA, USB, Intel® AMT, Adaptive-IO™
Thunderbird-E3100	Mini-ITX	Core™ 2 Duo 1.89 GHz	8 GB ECC	LAN, ASF, SATA, USB, MiniCard

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System Development

Eleventh Annual End-of-Life Supplier Directory

Company/Organization	Contact	Category	Comment
ARINC	Annapolis, MD. (800) 633-6882. [www.arinc.com].	B, DB, L, R	Develops and performs processes to minimize the impact of obsolescence for military and commercial systems, identifies problems, researches and recommends potential solutions, determines spares shortages, performs economic lifecycle cost studies to determine when to implement technology insertions or refreshes. Related engineering services include lead-free screening, reverse engineering and systems integration.
Arrow/Zeus Electronics	Melville, NY. (631) 847-2000. [www.arrow.com].	O	Distributor targeting North America's military and aerospace markets. Focuses on high-reliability semiconductor, passives and system products. Provides info on Environmental Compliance Research such as RoHS, WEEE, Lead-Free and other Green Initiatives.
Avnet	Phoenix, AZ. (480) 643-2000 [www.avnet.com].	DB, E, L, O, P, R, S	Global electronics distributor with numerous value-add services from testing and screening to assembly. Offers supply-chain and design-chain services, logistics solutions, product assembly, device programming, and system configuration and integration.
Center for Advanced Life Cycle Engineering (CALCE)	College Park, MD. (301) 405-5323. [www.calce.umd.edu].	B, DB, R, S	The Center for Advanced Life Cycle Engineering (CALCE) is recognized as a driving force behind the development and implementation of physics-of-failure (PoF) approaches to reliability, as well as a world leader in accelerated testing, electronic parts selection and management, and supply-chain management.
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/lifecycle planning. Expertise includes Chip Scale Packaging (CSP) and Multi-Chip Modules.
CPU Technology	Pleasanton, CA. (925) 224-9920. [www.cputech.com].	B, E	CPU Tech produces secure processors that protect software and systems from reverse engineering. Acalis enables the development of secure and compatible electronics modernization technology solving obsolescence problems while reducing size, weight and power (SWAP).
DMEA	McClellan Park, CA. (916) 231-1568. [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 presents the system manager with appropriate solution options to not only keep the system operational but also transform it to the next level of sophistication. These solution options range from component upgrades to board or system upgrades with advanced technology.
DPA Components International	Simi Valley, CA. (805) 581-9200. [www.dpaci.com].	D, P, S	Provides manufacturing, testing and analytical services for electronic piece parts to the U.S. military, aerospace and the space industry.
DSCC-VQ	Columbus, OH. (614) 692-0663. [www.dscc.dla.mil/ offices/sourcing_and_ qualification/].	DB, G, R	Manages over 225 Qualification Listings in 15 Federal Supply Groups (FSGs) and in more than 40 Federal Stock Classes (FSCs). The Branches also perform over 300 facility and line audits to determine compliance with the qualification requirements, verify product performance, quality and reliability, assist in interpreting technical specifications, and determining manufacturing capabilities.
Electronic Material Industries	Toluca Lake, CA. (818) 763-9584. [www.militarycomponents.com].	O	Buys, sells and stocks military and commercial electronic components. Specializes in military, industrial and commercial-type component parts, and carries a large selection of obsolete and hard-to-find spare parts.
Falcon Electronics	Commack, NY. (800) 444-4744. [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.
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. These products include: VME bus, STD & STD32 bus, CompactPCI, MBI, MBII, SBUS, QBUS, UNIBUS, telecom systems, SCSI bus boards, graphic boards, data storage units,chassis and canisters and small computer systems. Both custom and off-the-shelf products are manufactured.

Company/Organization	Contact	Category	Comment
GIDEP	Corona, CA. (951) 898-3213. [www.gidep.org].	DB, G, R	The DoD's centralized database for DMSMS issues. GIDEP is working closely with different government activities on several DMSMS projects that will eventually be migrated to GIDEP system. Among these projects are the DMS Shared Data Warehouse, the DMSMS Prediction Tool and the Army DMS Info System. Future migration of these systems in GIDEP would facilitate GIDEP's role as the central repository of data for DMS management.
IEC/IECQ	Geneva, Switzerland. + 41 22 919 02 15. [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) 790-0600. [www.IHS.com].	DB, L	4DOnline Parts Universe catalogs 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.
Innovasic Semiconductor	Albuquerque, NM. (505) 883-5263. [www.innovasic.com].	E	A fabless semiconductor company that offers extended-life processors, peripherals and mixed-signal devices for embedded communication and control. Solves obsolescence problems by developing pin-compatible integrated circuits that have been discontinued by the original manufacturer.
Inventory Locator Service (ILS)	Memphis, TN. (901) 794-5000. [www.ilsmart.com].	DB, L	Inventory Locator Service enables subscribers in the aerospace, defense and marine industries to buy and sell parts, equipment and services. Over 5 billion parts listed, 60,000 customer accesses each day and 20,000 subscribers.
L-3 IEC	San Diego, CA. (858) 552-9500. [www.iechome.com].	B, E, P	Facilities for electronic and mechanical design, rapid prototype development, ISO-compliant flexible manufacturing systems, and complete functional lifecycle support.
Lansdale Semiconductor	Tempe, AZ. (602) 438-0123. [www.lansdale.com].	D, E, O, P	Aftermarket support of obsolete ICs from major semiconductor suppliers. 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. Qualified to MIL-PRF-38535, Class Q and Class V. Many of the products are manufactured using MIL-PRF-38534 as a guideline and screened to Maxwell's self-defined Class H and Class K flows.
Micross Components	Austin, TX. (888) 330-8811. [www.micross.com].	B, DB, L, R	Has capabilities for Class S (space level) and radiation-tolerant manufacturing, including MIL-PRF-38534 Class 'V' Assembly. All MIL-STD-883C Methods & Conditions Service provider to the Mil & HI-REL/Space marketplace. Active relationships with DSCC and DMEA. Deals in semiconductor components (memory, logic, linear and analog) modules and subassemblies, both standard and custom in a variety of hermetic/ceramic and plastic packages. Certifications for MILPRF- 38535 (Class Q) and MIL-PRF-38534 (Class H).
Minco Technology Labs	Austin, TX. (512) 834-2022. [www.mincotech.com].	D, O, P	Semiconductor, processor and tester serving military, space and commercial industries. Offers custom packaging division with additional emphasis in standard part packaging, known-good die processing, and other high-reliability applications. QML 19500 Certified by DSCC.
NAPCO	Hopkins, MN. (952) 931-2400. [www.napcointl.com]	B, DB, D, O, P, S	A material manager, procurement, distribution and light manufacturing supplier of military spare and repair parts for a wide range of military vehicles and electronic equipment to the U.S. Department of Defense, OEMs and over 60 Defense Forces around the world.
Now Electronics	Huntington, NY. (631) 351-8300. [www.nowelectro.com].	L, O, P	Distributor specializing in military and aerospace level components. Approved supplier to Lockheed-Martin, Northrop-Grumman, Raytheon, Boeing Sanmina-SCI Systems, the U.S. Defense Dept., NATO and many others.
Pikes Peak Test Labs	Colorado Springs, CO. (719) 596-0802. [www.pptli.com].	B, D, E, L, O, P, S	Lab experienced in SEM (Scanning Electron Microscopy) with Elemental Analysis (EDX) capabilities, electronic component upgrade screening to MIL-STD-883, Class B, lid torque, radiation hardness testing and evaluation. They provide many more analytical solutions. Call for further details.
Precience	Gaithersburg, MD. (240) 883-9170. [www.precience.com].	DB	Precience ComplianceXpress provides a cohesive regulatory RoHS, China RoHS, and WEEE environmental compliance management. It centralizes all component and bill of material information for collaboration with suppliers and regulators. The solution offers additional capabilities such as component obsolescence and lifecycle management solutions.

Company/Organization	Contact	Category	Comment
QP Semiconductor	Santa Clara, CA. (408) 737-0992. [www.qpsemi.com].	DB, D, E, F, R	The company today is the largest fabless semiconductor firm serving the military, aerospace and high-reliability industries. The company focuses on providing replacement hermetic parts for DMS (Diminished Manufacturing Sources) and EOL (End of Life) products.
Richardson Electronics	LaFox, IL. (630) 208-2200. [www.rell.com].	DB, O, P	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. Manufactures more than 20,000 devices from a wafer bank of over 10 billion manufacturer-supplied die and Rochester-fabricated die using the original manufacturer's tooling and process information. Manufacturing flows include commercial, industrial, military temp, MIL-STD-883, SMD, QML, Space and customer SCD.
Sarnoff	Princeton, NJ. (609) 734-2168. [www.gemes.com].	B, E, F, R, P	Designs and manufactures military quality microcircuits. Utilizing on-site, highly flexible, MIL-PRF-38535 QML-certified wafer fabrication facility, Sarnoff has developed a variety of specialized processes and design approaches that provide quick-turn, low-volume, military-quality microcircuits to solve DMS obsolescence problems. 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. Facility Certified to MIL-PRF-19500 - JANTXV Level. Qualified to MIL-PRF-38534 Hybrids Class H Level.
Sypris Test and Measurement	Orlando FL. (407) 678-6900. [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.

Company/Organization	Contact	Category	Comment
T.S.I. Microelectronics	Danvers, MA. (978) 774-8722. [www.tsimicro.com].	D, E, O, P	Specializes in Hybrid Microcircuits and assembly of semiconductors in hermetic packages, such as: Flat Packs, DIPS, TO-46, TO-18, TO-87, TO-39, TO-99, TO-3, TO-254, TO-257, TO-258 to name a few. T.S.I.'s product line includes replacement device for products that have been discontinued by sources.
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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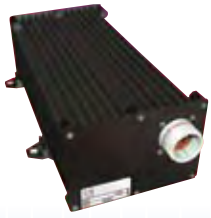

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Fax: (858) 677-0898
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Web: www.us.kontron.com

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Technology Focus

Ethernet Switch Boards

Switch Ethernet Stakes Claim as Embedded Interconnect

There's no doubt that Ethernet is here to stay. It continues to gain broad acceptance in the military as more and more new and legacy programs look to Ethernet for both networking and fabric interconnect requirements.

Jeff Child
Editor-in-Chief

Ethernet switch boards have won a place as a critical building block for a variety of military programs. Once used only as a pure networking solution for command and control systems in the military, Ethernet is now gaining traction in numerous other military applications as an interconnect fabric in compute-intensive applications. It's also deployed as 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). The number of programs embracing Ethernet—including both upgrades and new advanced systems—continues to ramp upward.

Last year Parvus received new contracts from General Dynamics Land Systems (GDLS) in support of the U.S. Marine Corps' next-generation amphibious assault vehicle, the Expeditionary Fighting Vehicle (EFV) (Figure 1), for two additional EFV Line Replacement Units (LRUs). These orders build on Parvus' success with GDLS and the EFV program, designing and delivering the vehicle's Tactical Switch Router (TSR) subsystem to customer specifications on time and ahead of schedule. No financial information was disclosed.

The new LRUs under contract include the Emergency Track Deployment (ETD) subsystem and Battery Conditioning Unit (BCU). Parvus has also received additional follow-on contracts for reliability enhancements and functional upgrades to the EFV's Tactical Switch Router (TSR) to expand its functionality with an integrated Gigabit Ethernet switch. The latest upgrades enhance intra-vehicle local area networking (LAN) capabilities for Internet Protocol (IP)-enabled computing workstations and radio frequency (RF) devices on board the EFV.

In another switched Ethernet win, GE Intelligent Platforms last fall secured an order from GDLS for 3U VPX single board computers, graphics processors, disk subsystems and switches in support of GDLS's work on the Abrams Evolutionary Design (AED) program for the M1A2 tank. The AED is the design development program for future Abrams tank computer systems and will see the gradual replacement of 6U VME-based systems supplied by GE Fanuc to GDLS for the Abrams Continuous Electronics Enhancement Program (CEEP) and System Enhancement Program (SEP V2). The AED program is expected to be at least equal to the scope and value of the CEEP program.

Figure 1

The Expeditionary Fighting Vehicle (EFV) is an armored amphibious vehicle capable of seamlessly transporting Marines from Naval ships located beyond the visual horizon to inland objectives.

All these GE products comply with the REDI (Ruggedized Enhanced Design Implementation) VITA 48 standard. The REDI/VITA 48 standard provides guidelines that enable designers to develop boards that are capable of operation in the harsh environments typical of military operations. They also provide the Army with a Line Replaceable Module (LRM) solution that makes Level Two Maintenance possible, ensuring faster, more cost-effective repair and replacement in the field—a key requirement for the armed forces. The order from GDLS includes a variety of GE Fanuc products including VPX SBCs, a VPX XMC carrier, a VPX Ethernet switch and a VPX SATA SSD. All are 3U form factor.

Technology Focus:
Ethernet Switch Boards Roundup

Rugged 10 Gbit Ethernet XMC Sports Dual Front-Panel Interfaces

The military has completely embraced Ethernet both as a network technology and as a fabric interconnect scheme. With that in mind, AdvancedIO Systems offers the V1121, a conduction-cooled 10-Gigabit Ethernet (10GbE) XMC module with dual front-panel optical interfaces. The V1121 brings the benefits of open standards-based connectivity to real-time, high-bandwidth applications operating

in harsh physical environments where long cable runs or challenging electromagnetic interference (EMI) concerns preclude the use of copper-based interconnects. The V1121's programmability, supported by AdvancedIO's ExpressXG FPGA framework, enables the integration of application and preprocessing functionality directly into the 10GbE fat pipe. This capability solves challenging connectivity bottlenecks that would occur in more traditional architectures where this tight integration is not possible.

While found in many types of high-performance real-time systems, these bottlenecks are particularly prevalent in demanding C4ISR applications including situational awareness, SIGINT and network security. Built with a Xilinx Virtex-5 FPGA, it shares the same architecture as other field-proven AdvancedIO 10GbE products. The V1121 also has two SFP+ optical 10GbE interfaces, independent large banks of memory for buffering packets, and additional interfaces to facilitate synchronization and time stamping. The module interfaces to the host fabric via PCI Express. Air-cooled versions are also available.

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

24-Port Gbit Ethernet Switch Board Rides VME

VME and Ethernet have a history of living together on embedded computing platforms. Concurrent Technologies' latest Gbit Ethernet switch board, the FP 210/024, is designed to operate alongside their range of VMEbus-based single board computers. The FP 210/024 is an "unmanaged" embedded Ethernet switching platform that provides a low-cost, low-power switching solution for integrators. Typically consuming less than 20 watts, it offers twenty-four 10/100/1000 Mbit/s auto-negotiating Ethernet ports, twelve accessible via the VMEbus P2 I/O connector and up to twelve via the front panel with the option for two being optical. The switch core contains a wire-speed, Layer 2, Quality of Service (QoS) switch

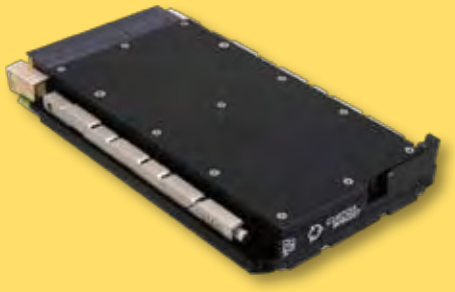
fabric. Commercial and extended temperature versions are now available, and ruggedized, conduction-cooled or air-cooled versions will be available shortly. This switch facilitates communications within a chassis as well as supporting the network outside the chassis in a variety of applications including defense.

The FP 210/024 sustains full duplex full wire 10/100/1000 Mbit/s speeds on all twenty-four ports. Ports 1 to 12 are used for connection to the nodes via the VMEbus P2 I/O connector. Ports 13 to 24 are via twelve RJ45 connectors on the front panel. The switch can handle time-critical/multimedia traffic such as voice, video and data as it utilizes four hardware priority queues per port and supports a range of QoS traffic classifications: port ID, MAC address, IEEE 802.1p, IEEE 802.1Q, IPv4 and IPv6.

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

GbE Multi-Layer Switch/Router on 3U VPX

The VPX ecosystem continues to expand. The latest example is Curtiss-Wright's VPX3-683 FireBlade, available with 24 GbE SerDes ports and up to two x10 GbE XAUI ports, and is ideal for system integrators architecting secure high-performance IPv4/v6 Intra-Platform Networks (IPNs). This rugged, compact 3U VPX card, which can operate as a fully



managed switch/router, provides significant performance and configuration advantages to developers building Layer 2 and Layer 2/3+ networks. With support for the "de facto" industry standard CLI, the VPX3-683 FireBlade significantly speeds time-to-market by reducing set-up, configuration and maintenance times.

Based on the VPX board architecture, the card combines high bandwidth and unmatched ruggedization with support for standards-based 2 Level Maintenance (2LM) to enable in-the-field repair and upgrades while reducing long-term maintenance and sparing costs. Operational as a fully managed switch/router, the VPX3-683 FireBlade router delivers substantial advantages to system integrators designing Layer 2 or Layer 2/3+ networks. The VPX3-683 FireBlade is supported with numerous advanced management interfaces including CLI, SNMP and Web for easy configuration and network management. Complete Layer 2/3 software, Quality of Service (QoS), IP multicasting and security is provided for a feature-rich solution that can support the simplest to the most complex network requirements. Quantity pricing for the VPX3-683 starts at $7,995.

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

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6U VPX Ethernet Switch Offers Full Wire Speed Switching

The military has warmed completely to Ethernet, both as a network technology and as a fabric interconnect. Elma Electronic now offers a highly innovative 6U VPX 28-port Ethernet switch that provides full wire speed switching of up to 125 Mbits/s, with 24 1 Gigabit Ethernet (GigE) ports and up to four 10 GigE ports. The new fully managed ComEth 4340a switch, available from Elma in North America, supports Layer 2 bridging and Layer 3 IPv4/

v6 Unicast and Multicast routing with Layer 2 through Layer 4 advanced traffic classification, filtering and prioritization. It is ideal for applications requiring strict data prioritization and filtering, and advanced traffic classification traffic monitoring required by demanding network applications, as well as delay-sensitive and critical environments.

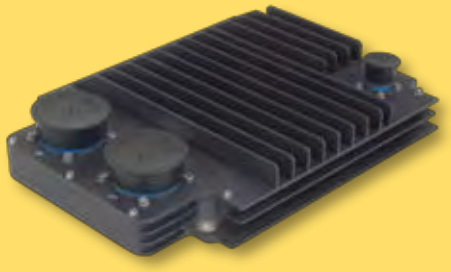
The ComEth 4340a offers flexible port options: four of the 24 GigE ports and two 10 GigE ports come out the front of the switch; 16 ports are accessible via the rear of the switch and are configurable in groups of four as 1000BT or 1000Kx ports. Accessible via a browser, CLI or SNMP, the new ComEth 4340a is easily managed, and a comprehensive built-in test suite provides simple maintenance and added security. Pricing for a ComEth 4340a Ethernet Switch starts at $8,500 in single quantities.

ELMA Electronic
Fremont, CA.
(510) 656-3400.
[www.bustronic.com].

Ethernet Switch Boasts Rugged Enclosure

The trend toward packing board-level electronics into rugged box enclosures continues to grow. Case in point, GE Intelligent Platforms offers the RES-210 Rugged Ethernet Switch. Designed for demanding applications that will be deployed in harsh environments—such as on board military platforms that are subject to high altitudes, vibration, shock, temperature extremes, humidity and salt fog—the RES-210 claims to be one of the smallest, lightest 10-port fully managed Layer 2/3+ Gigabit Ethernet switches available, making it ideal for size/weight-constrained deployments.

A successor to the RES-110, it includes support for IPv6 as well as for IPv4. In the near future, support for IPv6 will be a requirement

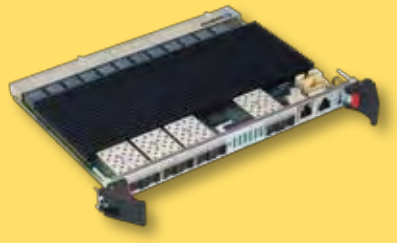


for military and defense customers and the RES-210 offers a path forward to next-generation Internet systems with their larger address space and improved security, reliability and flexibility. Provision of a 28V power supply that is both MIL-STD-704E and MIL-STD-1275B compliant allows the RES-210 to be configured in ground vehicles and aircraft as well as other military platforms, making it especially flexible. The RES-210 is based on GE Fanuc's recently announced CP923RC Gigabit Ethernet switch, and is enclosed in a rugged, small form factor chassis. It features GE Fanuc's OpenWare switch management environment. Comprehensive and powerful, OpenWare provides integrated management services including configuration, monitoring, switching control, addressing, routing and all supported protocols. Configuration and monitoring functions are accessible from a serial console or via a network. Supported access methods include Telnet, SSH and SNMP.

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

10 Gigabit Ethernet Switching on CompactPCI and VME

10 Gbit Ethernet is fully entrenched in the networking world and has now migrated into the realm of military embedded computing. Exemplifying this trend is the Kontron CP6930 6U switch, which brings 10 Gigabit Ethernet switching to CompactPCI and VME embedded systems and communication networks. With six SFP+ interfaces for 10 Gbit, two SFP interfaces for 1 Gbit Ethernet switching on the front and



24 GbE ports on the back, the new switch boosts the performance of VME and CompactPCI systems based on the latest processor boards for intra- and intercommunication. The non-blocking, fully managed L2/L3 switch allows system designers to stay ahead of the rising transaction and traffic loads in many embedded system designs and communication networks therefore maximizing the usage and longevity of their systems and reducing the TCO for customers' solutions.

The new Kontron CP6930 6U switch fits into both CompactPCI and VME (via the VITA 31.1 specification) system chassis and offers an AMCC PowerPC for individually configurable application control and a Microcontroller for IPMI-based platform management. With the fully managed software environment and a comprehensive firmware package, the Kontron CP6930 is customizable based on the individual requirements of the installation. The Kontron CP6930 hot-swappable cPCI switch serves 24 GbE ports to the backplane or rear transition modules and six high-capacity SFP+ 10 GbE links at the front for high-speed inter- and intra-connects plus 2 SFP 1 Gbit ports. Utilizing these interfaces not only enables systems to cascade, but also enables the latest processor boards such as the Kontron CP6016 with the 10 Gbit Kontron XMC401 to be interconnected inside the system with highest bandwidth. The Kontron CP6930 is available now.

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

Fanless, Ethernet Switches Offer Maintenance-Free Operation

Mission-critical defense applications can't tolerate their network links going down. Serving such needs, MEN Micro has expanded its new MIPIOS line of rugged embedded modular computers and components to include two new IP67-compliant Ethernet switches: the managed RS1 and the unmanaged RS2. Each features eight Fast Ethernet ports on standard M12 connectors with support for both full- and half-duplex operation as well as high-speed non-blocking and store-and-forward switching with auto-negotiation. Layer 2 switching (IPv4/

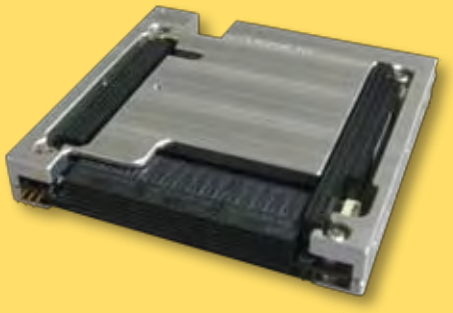
IPv6), quality of service (QoS) support with four traffic classes IEEE 802.1p and three-level 802.1q security and an 8K MAC lookup table with automatic learning and aging are also standard on the switches. Two redundant power supplies provide a nominal 24 VDC, with a 9V to 36V input voltage range.

As part of MEN Micro's MIPIOS line, the new switches are fanless, maintenance-free and extremely rugged allowing them to perform reliably in the most demanding environments. The highly reliable, convection-cooled switches are fault-tolerant and automatically restore themselves, so if a link becomes unavailable temporarily, it will function correctly after the disturbance without the need for a reset or restart. The RS1 and RS2 also have a built-in test mechanism for increased reliability. Pricing for the RS1 is $1,733 and $1,153 for the RS2.

MEN Micro
Ambler, PA.
(215) 542-9575.
[www.menmicro.com].

10-Port PC104+ Gbit Switch Does Management, IPv6 QoS

As chips get ever more function-dense, board designers can pack onto small boards the functionality that used to require an entire 6U-sized card. Along those lines, Parvus has unveiled the COM-1268, a rugged 10-port PC104+ Gigabit Ethernet switch card designed for robust networking performance under extreme shock/vibe and thermal conditions common to aerospace and defense applications. A follow-on to Parvus' 5-Port PRV-1059 10/100 switch board, COM-1268 delivers twice the port density, ten times the bandwidth, and the addition of management capabilities for local/remote control and monitoring, while retaining the small form factor of PC/104-Plus.



The COM-1268 Layer 2 GigE switch comes extended temperature rated (-40° to +85°C) and equipped with ten 10/100/1000 Mbit/s ports for networking IPv4- and IPv6-compatible computing devices. Managed by an onboard microprocessor, the product supports IPv4/IPv6 Quality of Service (QoS) traffic prioritization, Virtual Local-Area Network (VLAN) trunking, Simple Network Management (SNMP) and Rapid Spanning Tree (RSP) redundancy. The COM-1268 is designed with industrial components and comes with thermal heatsink plates to simplify systems integration and conductive cooling. A rugged, impedance-matched backplane-style connector brings out high-speed Gigabit Ethernet signals, along with an RS-232 serial console for CLI management, status LEDs and declassification. An out-of-band 10/100 Ethernet port is also available for Web GUI management of port settings. Up to four of the board's switch ports can support fiber optic connections.

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

PICMG 2.16 Board Sports Dual 10 Gbit Ethernet Uplinks

Applications like airborne or shipborne communications systems demand a mix of high bandwidths and the resilience of high availability. Feeding such needs, PT (formerly known as 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.

PT's line of high-availability Advanced Managed Platforms is available in configurations including 1 Gbit or 10/100 Ethernet switches, comprehensive remote shelf management, high-performance x86 and PowerPC compute elements accommodating Linux, Solaris 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.

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

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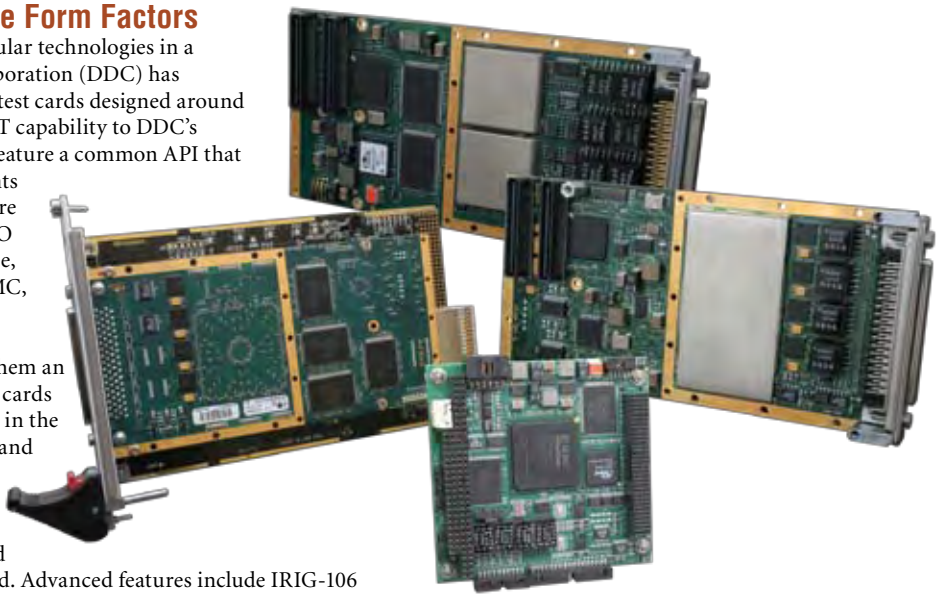
MIL-STD-1553 and ARINC 429 on Multiple Form Factors



MIL-STD-1553 and ARINC 429 interfaces remain popular technologies in a variety of avionics and defense systems. Data Device Corporation (DDC) has introduced a new line of rugged 1553/429 embedded and test cards designed around its next-generation AceXtreme 1553 core, adding Multi-RT capability to DDC's field-proven and reliable data bus technology. The cards feature a common API that can be used for test cards, embedded card, and components to simplify application code development, shorten software development time and eliminate risk, while the unique I/O mix and high channel count of the hardware reduces space, power, weight and cost. The new line of cards includes PMC, PCI, cPCI and PC/104-Plus versions.

AceXtreme cards are designed to function in extreme environments, and a wide variety of form factors makes them an ideal choice for test/lab environments as well. AceXtreme cards are available in conduction-cooled or air-cooled versions, in the following form factors: PC/104-Plus, PCI-104, PMC, PCI and cPCI. The cards are ideal for systems with limited space yet high I/O requirements, featuring a wide combination and mix of MIL-STD-1553, ARINC 429, Digital Discrete I/O, Avionics Discrete I/O, RS-232/422/485 Serial I/O and IRIG-B input/output on a single rugged, space-saving card. Advanced features include IRIG-106 Chapter 10 onboard formatting, user-selectable BC disable / TX inhibit for safety-critical applications, and an onboard DMA engine for increased data throughput and low host CPU/PCI utilization.

The cards feature a common test/embedded API that minimizes software development time by allowing programmers to use the same software across products, platforms and applications. For further savings, the optional BusTrACEr 1553 Monitor/Generator software package provides programmers with an easy-to-use interface and one-click automated source code generation, to quickly and easily create custom application code. DDC also offers the dataSIMS Bus Analysis and Simulation software package for those users wanting to create a complete environment of simulation, acquisition, display and storage of real-time data. dataSIMS simulates and concurrently monitors multiple mixed MIL-STD-1553, ARINC 429 and user I/O multiplex channels, performing real-time conversions of raw data to engineering-units, resulting in accurate, fast and extensive numerical and graphical views of communications data. A LabVIEW support package is also available, providing intuitive, high-level virtual instruments and samples.

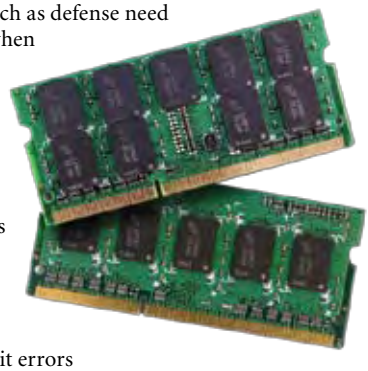
Data Device Corp., Bohemia, NY. (631) 567-5600. [www.ddc-web.com].

Front End Power Supplies Target Comms and DPA

Military communications systems represent one of the most dynamic areas of system design today in the defense market. And distributed power has become an architecture of choice for many systems. Martek Power's newly released T series front-end power supplies are hot-swappable, power factor corrected units. Featuring a wide 90-264 VAC or 36- 72 VDC input range, 12 VDC or 48 VDC (1200 or 1500 watt) output and a 5V standby output, the new power supply series are designed and ideal for data storage, data communication and distributed power architecture. Hot plug and active current sharing scheme of the T series enable continuous operation without interruption and redundancy to the 12 VDC or 48 VDC bus.

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

DDR3 ECC DRAM Module Family Boasts Rugged Design



High-reliability applications such as defense need more than ordinary ruggedness when it comes to memory modules. Swissbit's latest additions to its INDUSTRIAL family of high-speed / high-performance SDRAM memory modules are its DDR3 1, 2 and 4 Gbytes unbuffered Small Outline DIMMs (SO-DIMMs) with ECC (Error Detection and Correction). All modules in this storage family provide ECC support to aid in the correction of single bit errors potentially caused by electrical or magnetic interference and/or background radiation. For this purpose an additional DDR3 SDRAM containing eight data lines has been added. Availability of these modules is in both commercial 0° to +85°C (TCase) and industrial -40° to +95°C (TCase) temperature grades.

Swissbit, Bronschofen, Switzerland,+41 71 913 03 03. [www.swissbit.com].

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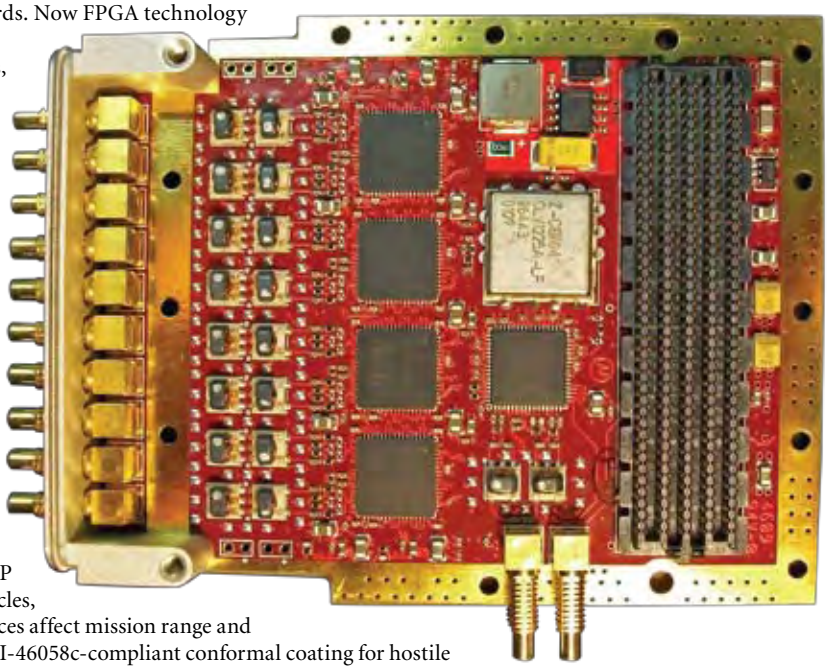
Family of Eight FMC Boards Offer 5 Gsamples/s

The definition of "system" used to mean whole racks of boards. Now FPGA technology has shrunk systems and subsystems down to mezzanine-sized modules. FMC takes advantage of that trend. Along those lines, 4DSP has released eight new analog-to-digital / digital-to-analog boards based on the FPGA mezzanine card standard (FMC). FMC-compliant carrier cards are available in the CompactPCI, VPX or PCI Express form factors.



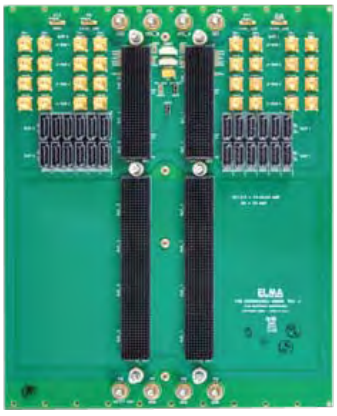
The 4DSP FMC Series cards provide a large range of bit-width and sample rates. Unique features include a user-selectable option to have data sampled by an internal clock source (optionally locked to an external reference) or use an externally supplied sample clock. A trigger input for customized sampling control is also available. I/O connections are on the front panel as per VITA 57.1. Cascading multiple FMC boards for synchronized high channel count is possible.

Equipped with power supply and temperature monitoring, the 4DSP Series FMC cards have several power-down modes to switch off unused functions to reduce system level power and heat. These features are well suited for software defined radio (SDR) and similar applications where battery or other low-power sources are required. The 4DSP Series of FMC cards are ideal for man-pack, ground mobile vehicles, UAVs and other airborne applications where limited power sources affect mission range and on-station mission time. The boards are also available with Mil-I-46058c-compliant conformal coating for hostile environmental applications. The products that make up the new range of eight boards are available in 1, 4 and 8 channel configurations as sampling rates of 65 Msamples/s up to 5 Gsamples/s. A/D resolutions available include 8-,10-,12- and 14-bits.

4DSP, Reno, NV. (775) 233-5784. [www.4dsp.com].

Test Backplane Aids VPX Systems Development

There's a frenzy of VPX development activity underway, and customers are looking for tools to get moving on it. With that in mind, Elma Bustronic offers a 2-slot test backplane for VPX board developers and integrators. The Elma Bustronic 2-slot test backplane is designed to the latest VITA 46 specifications. The backplane allows the user to power up and test their J1 fabric connections as they would be interconnected in the target application. Signals can be passed from one slot to the next via high-speed interconnecting cables, via signals introduced through the J1 fabric connector, or accessed on the J1 fabric connector using the test backplane's SMA and SATA cable headers. The test backplane accepts 6U cards with the 3U size supported by use of a shelf divider.



The VPX Test Backplane solves a signal access issue with VPX systems that utilize Rear Transition Module (RTM) boards. VPX cards are usually developed together with an RTM module that does not access the J1 fabric signals. In conventional designs, an engineer cannot probe these J1 fabric signals while using the Device Under Test's (DUT) RTM module to access other I/O signals. Pricing for the 2-slot VPX test backplane starts under $1,500.

Elma Electronic, Fremont, CA. (510) 490-7388.

[www.elmaelectronic.com].

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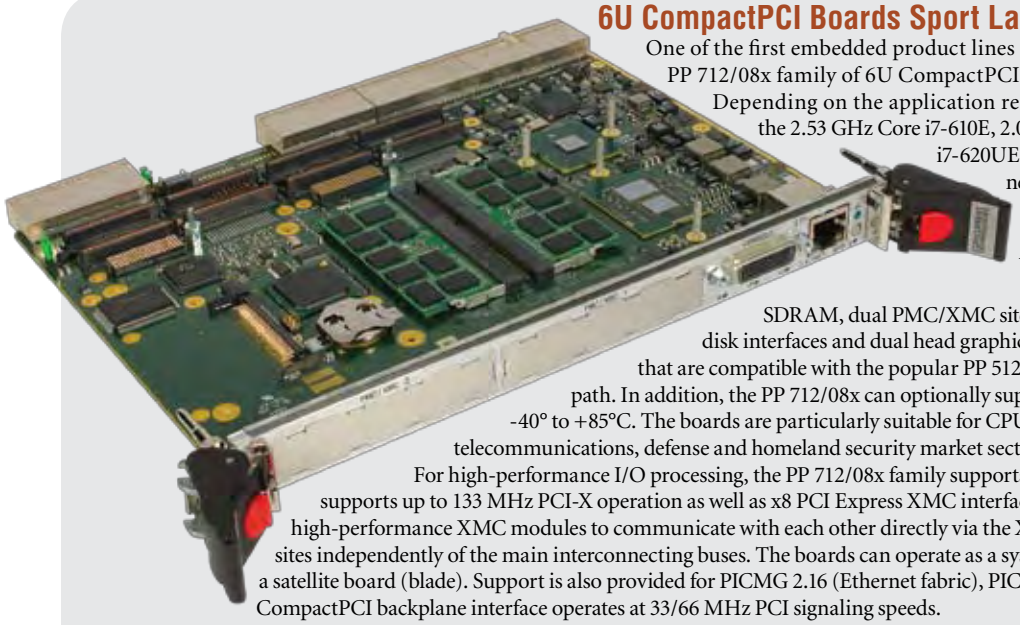
6U CompactPCI Boards Sport Latest Core i7 processors



One of the first embedded product lines to feature the Intel Core i7 processor is the PP 712/08x family of 6U CompactPCI boards from Concurrent Technologies. Depending on the application requirements, a choice of processors is available: the 2.53 GHz Core i7-610E, 2.0 GHz Core i7-620LE and the 1.06 GHz Core i7-620UE. Based on 32nm process technology and the new integrated memory/graphics controller architecture, these processors are from the Intel embedded roadmap, which offers at least seven-year availability.

With up to 8 Gbytes of DDR3-1066 ECC SDRAM, dual PMC/XMC sites, three Gigabit Ethernet ports, four SATA300 disk interfaces and dual head graphics, the PP 712/08x also offers rear I/O interfaces that are compatible with the popular PP 512/06x family providing a continuing upgrade path. In addition, the PP 712/08x can optionally support extended temperatures ranging from -40° to +85°C. The boards are particularly suitable for CPU-intensive processing applications within the telecommunications, defense and homeland security market sectors.

For high-performance I/O processing, the PP 712/08x family supports two PMC/XMC sites and each PMC site supports up to 133 MHz PCI-X operation as well as x8 PCI Express XMC interfaces. As an option it is also possible to enable high-performance XMC modules to communicate with each other directly via the XMC Pn6 connectors between the two XMC sites independently of the main interconnecting buses. The boards can operate as a system controller board, a peripheral board or as a satellite board (blade). Support is also provided for PICMG 2.16 (Ethernet fabric), PICMG 2.9 (IPMI) and PICMG 2.1 (hot swap); the CompactPCI backplane interface operates at 33/66 MHz PCI signaling speeds.

The PP 712/08x includes three 10/100/1000 Mbit/s Ethernet interfaces and the front panel also provides two USB 2.0, RS-232, dual head graphics via two digital (1600 x 1200) and analog (2048 x 1536) interfaces. The rear I/O connections provide three further USB 2.0 ports, an RS-232 port, four SATA300 mass storage interfaces and an Intel High Definition Audio interface. Other features are a watchdog timer, long duration timer, LAN boot firmware and options for an onboard 2.5-inch SATA300 disk and a CompactFlash site. For applications requiring rear I/O connections a transition module is available.

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

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SATA Solid-State Drive Provides Higher Endurance and Capacity

Solid-state drives now offer capacities once only available on hard disk drives. And, for the military, SSDs offer reliability and security features that rotating disks lack. A next-generation enterprise-class solid-state drive (SSD) is available in 1.8" and 2.5" form factors. The XceedIOPS SATA from Smart Modular Technologies is offered with either single-level cell (SLC) or enterprise-grade multi-level cell (E-MLC) NAND technologies. The XceedIOPS SATA integrates E-MLC technology. Endurance for E-MLC is specified at 20,000 program/erase (P/E) cycles, whereas current-generation commercial MLC demonstrates 1,500 or 5,000 P/E cycles. The combination of the SF-1500 processor's minimal write amplification and E-MLC flash enables the XceedIOPS SATA SSD to handle the most demanding workloads.

Smart Modular Technologies, Newark, CA. (510) 623-1231. [www.smarm.com].

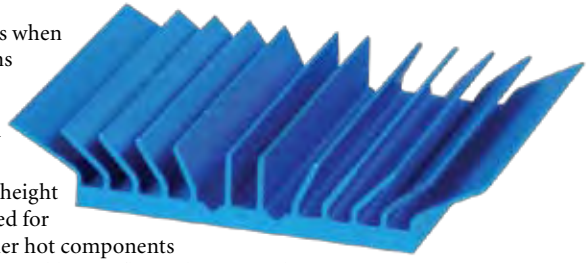
Box-Level System Is Based on Latest Atom N450

Box-level systems are gaining ever more interest in the military market. Many of them rely on networking as their interface to the outside rather than a backplane bus. An ultra-low-voltage desktop network appliance utilizes the new Intel Atom processor N450 and measures approximately half the size of A4 paper, so its compact footprint means it can be placed easily anywhere in the office. The CAD-0205 from American Portwell Technology supports four GbE ports and two pairs of bypass segments. It is able to support one 2.5-inch HDD and up to 2 Gbyte memory. Other features include one RJ45 console port, dual USB ports, one Mini PCIe slot and VGA.

American Portwell Technology, Fremont, CA.

(510) 403-3314. [www.portwell.com].

Low Profile Heat Sinks Support Constricted Packages

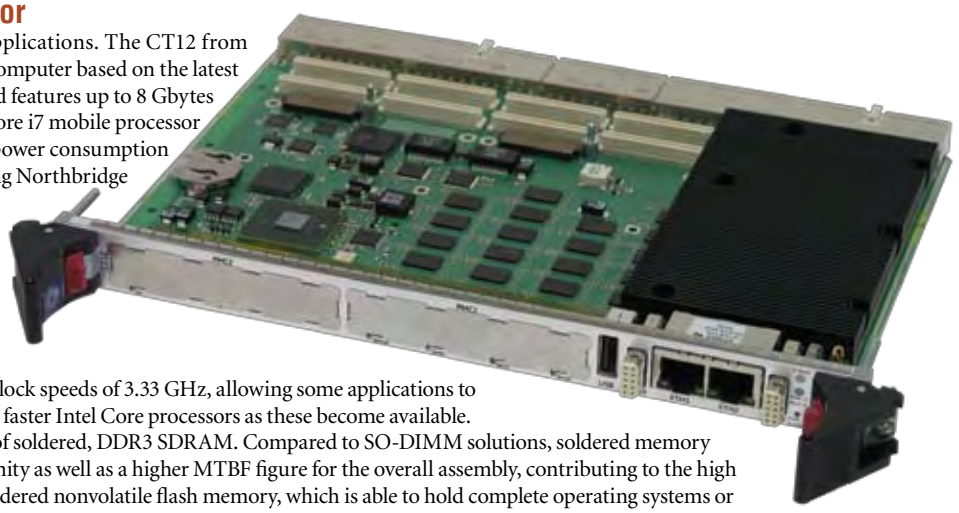


Gone are the days when military applications needed heat sinks only for the large components. Today even small ICs run hot. A line of lower height heat sinks is designed for cooling ICs and other hot components in narrow packaging and low airflow velocity conditions. The maxiFLOW heat sinks from Advanced Thermal Solutions feature a spread fin array that maximizes surface area for more effective convection (air) cooling. Standard sink heights are as low as 9.5 mm. The heat sinks are fabricated from extruded aluminum. Pricing for ATS low-profile maxiFLOW heat sinks starts at less than $10.00 each, which includes the mounting hardware and phase change thermal interface material.

Advanced Thermal Solutions, Norwood, MA.

(781) 769-2800. [www.qats.com].

6U SBC Sports 2.53 GHz Core i7 Processor



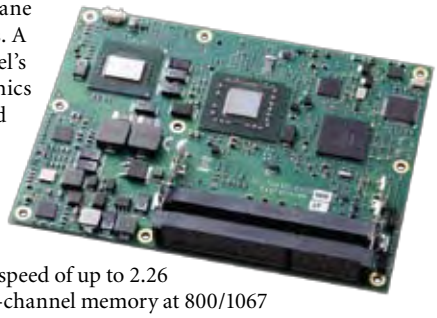
CompactPCI has earned its acceptance into military applications. The CT12 from GE Intelligent Platforms is a 6U CompactPCI single board computer based on the latest 2.53 GHz Intel Core i7 (Arrandale) processor technology and features up to 8 Gbytes of DDR3 memory. At the heart of the CT12 is Intel's latest Core i7 mobile processor technology, designed to deliver high performance with low power consumption and low heat dissipation. It is highly integrated, incorporating Northbridge components—memory controller, PCI Express for external graphics, integrated graphics and the DMI connector—which make it both faster and more compact. Its clock speed, dual core architecture and new performance features allow applications to be executed more quickly—or allow more tasks to be executed concurrently. Using TurboBoost technology, the CT12 can operate in single core mode—for applications where dual core operation is not necessary—at clock speeds of 3.33 GHz, allowing some applications to execute even faster. The CT12 is designed to allow upgrade to faster Intel Core processors as these become available.

The CT12's processor is complemented by up to 8 Gbytes of soldered, DDR3 SDRAM. Compared to SO-DIMM solutions, soldered memory offers higher levels of mechanical shock and vibration immunity as well as a higher MTBF figure for the overall assembly, contributing to the high reliability of the CT12. Also provided is up to 16 Gbytes of soldered nonvolatile flash memory, which is able to hold complete operating systems or application code, substantially increasing overall system speed.

Four Gigabit Ethernet ports (two front, two rear) are provided by the CT12 to support intensive networking without the need to add mezzanine modules, reducing cost. Also provided are two PMC/XMC sockets, five USB 2.0 ports, two VGA and DVI ports, three COM ports and three SATA interfaces, giving maximum connectivity and configuration flexibility. Supported operating systems for the CT12 include Linux and Microsoft Windows.

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

COM Express Module Aimed at Graphics-Intensive Embedded Apps



COM Express is rapidly become the non-backplane standard of choice for new military system designs. A new Computer-on-Module (COM) is based on Intel's Core2 Duo processor and GS45 chipset with Graphics Media Accelerator (GMA) 4500MHD, and is suited for power-sensitive applications requiring high graphics performance. The Express-MV is a COM Express Type 2 module from Adlink that supports the Intel Core2 Duo and Celeron M processors.

Equipped with the 45nm Intel Core2 Duo processor, the Express-MV is available with a clock speed of up to 2.26 GHz. Combined with up to 8 Gbytes of DDR3 dual-channel memory at 800/1067 MHz, the Express-MV provides higher data-transfer speed at 30% less power consumption compared with DDR2 memory. In addition to the onboard integrated graphics, a PCI Express Graphics x16 (PEG x16) bus for SDVO/HDMI/DisplayPort or general-purpose x8, x4 or x1 PCI Express devices is also supported. Up to six additional PCI Express x1 lanes are also available from the Southbridge. The Express-MV also features a single onboard Gigabit Ethernet port and four SATA/300 ports. Legacy support is provided for a single IDE channel, 32-bit PCI, LPC, SMBus and I2C. List price is $495.

ADLINK, San Jose, CA. (408) 966-5200. [www.adlinktech.com].

COM Express Module Serves up CoreT i7, 8 Gbyte DRAM

Compute-density has become the new watchword in numerous military system projects. Serving just such needs, Congatec offers a COM Express that features the latest Intel CoreT i7-620M processor with a core speed of 2.66 GHz, with 4 Mbyte L2 cache and up to 8 Gbyte fast (1066 MT/s) dual channel DDR3 memory. The conga-BM57 is a two-chip solution that utilizes the powerful Mobile Intel QM57 Express Chipset. The integrated graphics controller supports the Intel Flexible Display Interface (FDI) in order to allow for two independent video channels on VGA, LVDS, HDMI, DisplayPort or SDVO interfaces.

The major highlight of the COM Express Basic (95 x 125 mm) module with a type 2 connector pin-out is the boosted graphics performance. The 3D performance was increased substantially over the last generation of Intel integrated graphics. Paired with the additional computing performance of the CoreT i7 processor, the conga-BM57 is a suitable solution for intense graphics applications, which are often found in gaming or medical image applications. The implemented Intel Turbo Boost Technology provides an on-demand boost in the clock speed for one processor core if the other core is less utilized. This new feature improves the computing performance by as much as 25 percent—as measured by congatec during benchmark testing.

In order to keep the power consumption at about the same level as the predecessor generation, the CoreT i7 supports new power management states. The C6 state, already known from Intel Core processors, saves the architectural state to a dedicated SRAM. Then the cores can be switched off to reduce the current to almost zero. The independence of the C6 states for each core boasts even greater power savings for the platform. Five PCI Express lanes, eight USB 2.0 ports, three SATA, one EIDE and a Gigabit Ethernet interface allow for fast and flexible system extensions. Fan control, LPC bus for slow-speed extensions and Intel High Definition Audio complete the feature set.

Congatec, Cardiff-by-the-Sea, CA. (760) 635-2600. [www.congatec.us].

Core i7-based 6U VME Is Conduction- or Air-Cooled

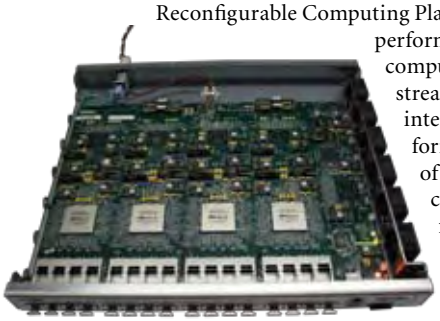
The Intel i7 processor moved into the military embedded board space probably faster than any mobile desktop before it. A high-performance 6U VME single board multiprocessing computer is suitable for ruggedized systems requiring high-bandwidth processing and low power consumption. With the Intel Core i7 processor, the XCalibur4331 from Extreme Engineering Solutions delivers enhanced performance and efficiency for today's network information processing and embedded computing applications. The XCalibur4331 is available with the Intel Core i7-610E, 620LE or 620UE processors and is combined with the QM57 chipset. The processor supports Intel Hyper-Threading Technology and includes an integrated high-definition 3D graphics controller and dual-channel memory controller.

The XCalibur4331 provides two separate channels of up to 16 Gbyte (8 Gbyte each) DDR3-1066 ECC SDRAM, two PrPMC/PrXMC slots, 8 Mbyte of NOR flash and up to 128 Gbytes of NAND flash. The XCalibur4331 also supports four Gigabit Ethernet ports, one DVI graphics port, I²C, PMC I/O, XMC I/O and RS-232/422/485 serial ports out the back panel. Optional front panel I/O includes and HDMI port, 10/100/1000 Base-T Ethernet, USB 2.0 and I/O routed to an optional XMC slot adapter for access during development.

Extreme Engineering Solutions, Middleton, WI. (608) 833-1155. [www.xes-inc.com].

Reconfigurable Computing Platform Boasts 20 Gbit/s Links

Advances in FPGA processor muscle are enabling a whole new level of military reconfigurable computing capability. Sixis offers the SX2000 Reconfigurable Computing Platform, a scalable, high-performance reconfigurable computing platform designed to streamline and accelerate data-intensive applications. This 1U form factor system is comprised of four fully interconnected compute nodes, each featuring an Altera Stratix IV EP45GX230K FPGA with 2 Gbytes DDR3 memory, four QSFP high-speed serial port, and a 1.5 GHz Freescale MPC8536E PowerQUICC III processor with 512 Mbytes DDR3 memory; 20 Gbit/s interconnects are available between all nodes. Providing unlimited expansion capability, the unit can be scaled with up to 42 systems per 6-foot rack and unlimited racks.



Sixis, Morrisville, NC. (919) 674-4500. [www.sixisinc.com].

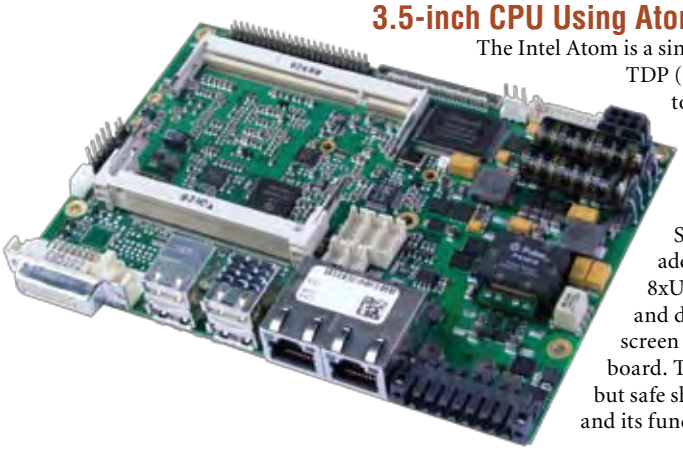
VCO Provides 2580 to 2650 MHz Operation

A variety of military comms applications depend on VCOs with good linearity capability.

Along just such lines, Crystek's CVCO55CC-2580-2650 VCO (Voltage Controlled Oscillator) operates from 2580 MHz to 2650 MHz with a control voltage range of 0.5V~4.5V. This VCO features a typical phase noise of -110 dBc/Hz at 10 kHz offset and has excellent linearity. Output power is typically +3 dBm. Engineered and manufactured in the USA, the model CVCO55CC-2580-2650 is packaged in the industry-standard 0.5-in. x 0.5-in. SMD package. Input voltage is 5V, with a max current consumption of 40 mA. Pulling and Pushing are minimized to 1.5 MHz and 1.5 MHz/V, respectively. Second harmonic suppression is -15 dBc typical.

Crystek Corporation, Ft. Myers, FL. (239) 561-3311. [www.crystek.com].

3.5-inch CPU Using Atom Z510/Z530 Runs up to 1.6 GHz



The Intel Atom is a single core processor built on a 45nm process that boasts an impressive 2.64 watts TDP (CPU only). The Intel Atom delivers the benefits of genuine Intel architecture to small form factor and thermally constrained military applications. The ADLS15HD from Advanced Digital Logic is a 3.5-inch embedded single board computer based on the Intel Atom and the Intel US15W (Poulsbo) chipset. The Intel graphics controller drives graphics up to 1600 x 1200 at 60 Hz by way of onboard DVI and/or 18/24-bit LVDS LCD. Memory is added via an SODIMM200 socket that will accept up to 2 Gbytes of DDR2-400/533 DRAM. In addition to ACPI/APM functions, the ADLS15HD has the following features: EIDE, 8xUSB 2.0, 2xRS232 COM ports, PS/2 keyboard and mouse, AC'97 and HDA 5.1 Sound and dual Gigabit Ethernet LAN. The ADLS15HD also supports ELO resistive touch screen and has an isolated 24 VDC input that is 20-30 VDC tolerant for powering the board. The ADLS15HD also provides a built-in UPS (1 second std.) that will allow for a fast but safe shutdown. The board runs on a 24 VDC power source and includes an onboard UPS, and its functionality can be expanded with an onboard miniPCI.

Advanced Digital Logic, San Diego, CA. (858) 490-0597. [www.adl-usa.com].

ETX Module Sports Atom Pineview Processor

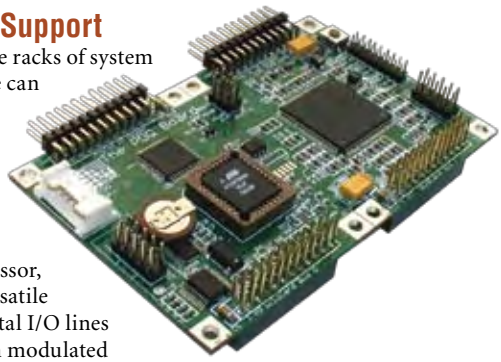
The ETX form factor has become entrenched as a favorite non-backplane computing option. WIN Enterprises offers an ETX system-on-module (SOM) with a choice of either the Intel Atom D450 or D510 processor (code-named Pineview-M and Pineview-D, respectively). With low power consumption and 1.66 GHz of performance, the MB-80200 from Win Enterprises provides fanless operation for applications that include portable medical, gaming/entertainment, military, kiosk and aerospace. The Atom processors D450 and D510 provide a reduced onboard footprint through their integration of the Northbridge functions, such as memory and graphics control, into the processor itself. This two-chip design enables smaller, more mobile products over the traditional three-chip solution.

WIN Enterprises, North Andover, MA.

(978) 688-2000. [www.win-ent.com].

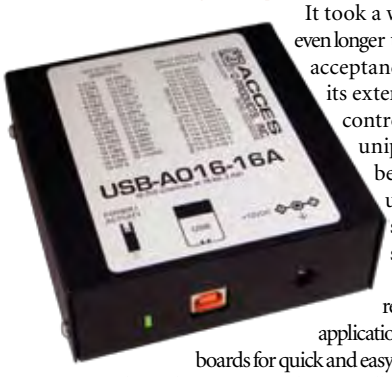
Data Acq SBC Features Rich I/O Support

Military data acquistion once required large racks of system boards. Now the same functionality and more can be served up on a small board. Exemplifying this trend is the PDQ Board from Mosaic Industries. The card packs 1 Mbyte of memory, communications, dozens of analog and digital I/O lines, and dual expansion I/O buses onto a compact 2.5 x 4-inch board. The PDQ Board sports a Motorola 68HCS12 processor, dozens of analog and digital I/O lines plus versatile serial communications links. It delivers 8 digital I/O lines with counter/timer capabilities, 8 pulse-width modulated (PWM) digital output signals and 8 general-purpose digital I/O lines. The PDQ Board is competitively priced at $159 in 100s.



Mosaic Industries, Newark, CA. (510) 790-1255. [www.mosaic-industries.com].

USB Analog Output Cards Offer 12- and 16-bit Resolutions



It took a while for USB to find its way into embedded applications and even longer to catch hold in military embedded apps. Now it has gained acceptance in both. ACCES I/O has announced the latest addition to its extensive line of small form factor USB-based data acquisition and control I/O modules—the USB-AO Series. The boards feature both unipolar and bipolar output ranges. Additional specific ranges can be achieved as factory options. All analog output channels can be updated either individually or simultaneously. System calibration specific to user requirements can be performed via a provided, easy-to-use, software utility.

A micro USB header connector is provided in parallel with the high retention type B connector and can be used for stacking and embedded applications. Available accessories include a wide variety of cables and screw terminal boards for quick and easy connectivity. The USB-AO Series was designed to be used in rugged industrial environments but is small enough to fit nicely onto any desk or testing station. The USB-AO Series can be integrated into any PC/104-based stack by simply connecting it to a USB port included on board with embedded CPU form factors such as EBX, EPIC and PC/104. Prices range from $299 to $699.

ACCES I/O Products, San Diego, CA. (858) 550-9559. [www.accesio.com].

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COTS JOURNAL

Special Feature: Rugged Box-Level Systems vs. Slot-card Solutions A trend has been building in the past couple years where traditional embedded board vendors are adding stand-alone rugged box-level systems to their military market offerings. These system boxes provide a complete, tested and enclosed computing solution that eliminates complex integration chores for customers. This section looks at this emerging product class and its trade offs versus slot-card solutions.

Tech Recon: Shock & Vibration Testing for Embedded Boards Meeting the stringent levels of shock and vibration ratings required by most defense and aerospace programs is no slam dunk. As systems get more dense and complex, the problem of engineering boards and enclosures isn't getting any easier. Relying on outdated Mil-Spec guidelines like MIL-STD-810F and others is no longer sufficient, and full environment stress screening techniques like HASS and HALT have moved into the forefront. Articles in this section delve into those areas and compare the solutions available.

System Development: High-Density Storage in Military Systems As military systems continue to rely more and more on compute- and data-intensive software, the interface to memory and storage subsystems can't risk becoming a bottleneck. Over the past several years serial interconnect schemes have been steadily pushing aside parallel buses, and that trend has impacted the memory and storage realm just as it has every other facet of military embedded computing. This section examines the emergence of Ethernet and IP-based storage interfaces, while comparing how traditional interface schemes like SATA, Fibre Channel and SCSI are positioned these days.

Tech Focus: Multicore Boards There used to be a long gap between the emergence of a microprocessor product line and the demand for it among the military embedded computing realm. Now with the dual-core, multicore CPU trend firmly established in the general computing market, embedded board vendors have followed up quickly with boards based on those CPUs like the Core2Duo and others. This Tech Focus section updates readers on these trends and includes a product album of representative boards.

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Jeff Child, Editor-in-Chief

A Future Without Future

In technology circles, there's something about sticking the word "future" in a name that somehow guarantees its demise. Many in the embedded board business remember the bus architecture called "Futurebus" that emerged in the early 90s. Despite it being a kind of engineering geek's dream in terms of complexity and elegance, it was too overdesigned and too cumbersome to make any real headway in the market.

Futurebus also had so many different options and configurations—called "profiles"—that it was impossible to ensure any degree of the interoperability between vendors' boards as seen in VME for example. As a matter of fact, the use of the word "profiles" in OpenVPX raised a few eyebrows amongst us industry old-timers at first. But we got over that once we understood that, unlike the parallel bus age of Futurebus, we now live in the era of serial interconnects along with technologies that make reprogramming pin functions fairly straightforward. Another "curse of the word future" example is the short-lived Future I/O. Future I/O was one of those of the "weeding out" of switch fabric technologies that happened in the late 90s. InfiniBand and later PCI Express eventually won that fight, while Future I/O ended up a road not taken.

Closer to home for the defense business was the demise of the Army's Future Combat Systems program. FCS was essentially the Army's centerpiece of its transition plans for a lighter, faster and more functional combat force. Hindsight is 20/20 of course, but in retrospect it's not hard to imagine that a program conceived in the wake of the conflict in Bosnia would need to re-target itself at some point. And it did go through many restructures and cuts over the last couple years. The fact that Secretary of Defense Robert Gates decided last April to not just restructure FCS but to cancel the program sent a significant message that more than tweaking or modifying the existing program was necessary. Since that cancellation the Army got busy over the summer and through the fall conceptualizing the goals for a new Ground Combat Vehicle (GCV) and its overall Brigade Combat Team (BCT) modernization strategy. The current plan is to deliver Increment 1 capability to seven Infantry Brigade Combat Teams starting in 2011. The rest of the BCTs will then receive upgraded capabilities on an incremental basis.

The plan for the Early Infantry BCT (E-IBCT) is a package consisting of the following systems: the Non Line of Sight-Launch System (NLOS-LS), Urban and Tactical Unattended Ground Sensors (U/T UGS), Class 1 (Block 0) Unmanned Aerial Vehicle (UAV), and Small Unmanned Ground Vehicle (SUGV) Block 1. The Early IBCT systems will be fully integrated and networked through a Network Integration Kit (NIK) enabling data sharing and the Command and Control (C2) of systems except for NLOS-LS, which is controlled through Advanced Field Artillery Tactical Data System (AFATDS). All E-IBCT systems are currently under ongoing evaluation and testing by the Army.

A recent GAO report talked specifically about the positive steps the Army has made toward a new vehicle modernization plan while also pointing out the opportunities to do things differently this time and learn where FCS went wrong in some cases. It's a critical time for the Army to put these modernization efforts on the best possible footing by buying the right capabilities at the best value. The report cites the Army's choice to begin future developments with mature technologies and to make use of competitive prototyping.

However, DoD recently approved, with a number of restrictions, low-rate initial production of the first increment of FCS spinout equipment, such as new radios and sensors, despite having acknowledged that the systems were immature, unreliable and not performing as required. The restrictions include required DoD reviews of Army progress toward improving the systems' maturity and reliability. The spinout equipment was being developed within the FCS program, and the decision to approve production reflects DoD and Army emphasis on providing new capabilities quickly to combat units. However, this decision runs the risk of delivering unacceptable equipment to the warfighter and trading off acquisition principles whose validity has been so recently underscored.

The Request for Proposals for the Ground Combat Vehicle went out in late February with a deadline of late April. It will likely be September before program contracts will be awarded. From the details I've learned my conversations with Army officials, it sounds like—compared to FCS—there's going to be a lot more scrutiny from the DoD and Congress as GCV development and procurement moves forward. Dollars won't be allocated for lots of prototyping gear without solving technology maturity and reliability issues prior to either fielding equipment or approving additional system procurement.

It's ironic that right in the middle of this early RFP stage for the GCV, I'm hard at work researching a special Target Report for the May issue of *COTS Journal* on exactly this topic of military vehicle modernization. But I'm not worried that it's too soon for anyone to speculate what the GCV will look like. That's because my focus in the report will be on the electronics that make up the Army's modernization program—the embedded computing, the communications gear and so on. There's a lot of meat to explore there about what systems will be re-tasked from the FCS efforts and how they will all fit together under the Army's revamped plans and goals. Remind me, though, never to use the word future in the headline again.

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