Tech Focus: Solid State Drives Roundup

COTS JOURNAL

The Journal of Military Electronics & Computing

Volume 12 Number 11 November 2010

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POWER CONVERTERS SUIT UP FOR HARSH ENVIRONMENTS

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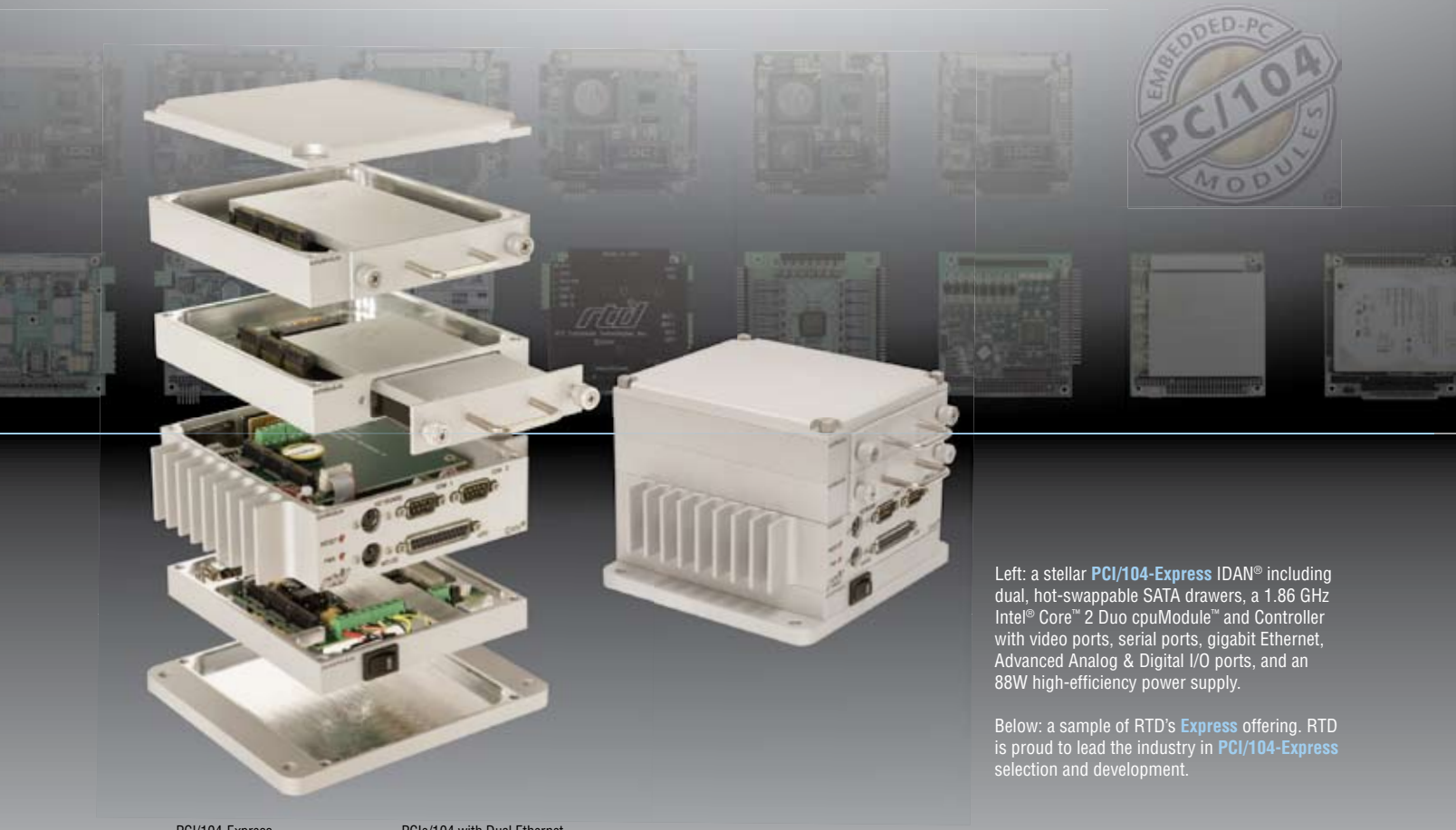

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COTS JOURNAL
The Journal of Military Electronics & Computing

12 Power Supplies and Converters Bulk Up for Rugged Roles

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

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

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On The Cover: Earlier this year General Dynamics Land Systems was contracted to supply LRS-2000 Rate Sensor Assembly units for the Stabilized Commander's Weapon Station (SCWS) on the Army M1A1 Abrams tank. Shown here, soldiers of South Carolina Army National Guard man an M1 Abrams during South Carolina National Guard Air and Ground Expo 2009. (U.S. Army photo Sgt. Roberto Di Giovine/Released)

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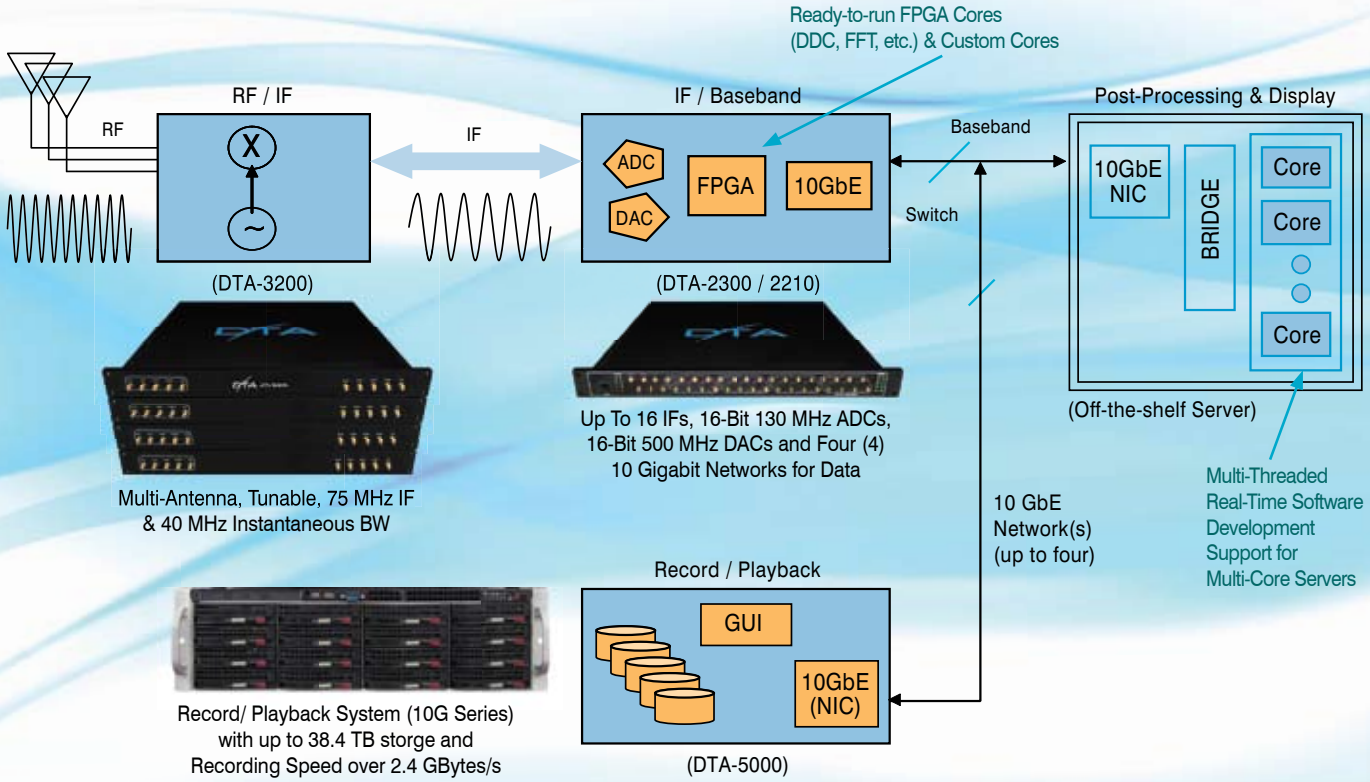

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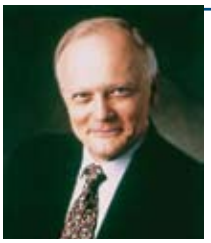


Publisher's Notebook

Big Doin's in November

November is going to come on strong with the elections on November 2nd and MILCOM October 31st through November 3rd. This may sound strange, but I'm glad I completed my absentee ballot in early October. The political ads on TV and radio get worse and worse every day. Knowing I had to focus on getting ready for MILCOM, I did a lot of early Web candidate research weeks ago. That research eliminated any need to filter through the stuff they're all saying about each other now and trying to find a grain of relevant data.

Along with my research on political candidates, I also had to go through the entire MILCOM exhibitor list and find out who was going to be there from the embedded electronics industry. Coming from a marketing and senior management background, I just go crazy when I see companies with missed opportunities. Failure to take time to at least fill in a company listing stating what your company does is unforgivable. A company spends thousands of dollars and eats up employee time to go to a show or conference. To make that investment and then not cite what their company does in the conference's listing should be completely unacceptable to company management.

Back to the election. By the time you read this the election results will be in and we'll know if Congress has had a shift in the balance of power. The one thing that is a certainty is that following the election—and through the first quarter of the calendar year—we will see a change in what and how things will be acquired by the DoD. The election results have three possibilities: Congress has no shift in the balance of power, there is a minor shift, or there is a major shift.

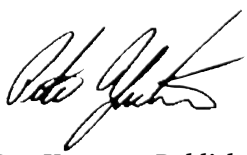
Before trying to crystal ball how the election will affect our industry, let's understand what the current procurement situation looks like. Without clear signals from the administration and Congress, there has been reluctance for anyone to stick their head up and make a commitment. That's just the way government bureaucracy works. After all, the best way for a government employee to make it to retirement is to be certain that if you go out on a limb and commit, you have lots of cover from above. During times when there is a perceived uncertainty of what the powers-to-be really want, everyone in the decision chain waits for the person above to direct action. We've experienced this for about a year, crushing RDT&E spending and slowing down many new programs.

Unless we end up with no shift in the balance of power after this election, there will be turmoil between mid-November—when both current houses have voting scheduled—and January 3, 2011 when new members take office. A shift in the balance of power will initiate lame duck feather bedding and forcing through last minute political agendas by outgoing members. The groups and people on the outs have nothing to lose. Outgoing members and remaining members who will be losing control can pass off blame to the incoming members, and by the time the next election rolls around no one will remember. Please understand that this is nothing new for this Congress. This is the way it's always been done. The only potential for relief is the President because he can veto the bills.

Many individuals in our industry believe that a significant shift in the control of Congress will improve DoD expenditures as soon as it is seated in January. This more than likely will not be the case. A major shift in power will only empower any new political groups and newly elected members of Congress, to throw the baby out with the bathwater and re-think everything. Such action may be politically good for them but will be bad for our industry—and, I fear, a catastrophe for our war fighters. There are probably some hardcore individuals in our industry who think such a shift would indicate going back to the way things were after the 2006 congressional shift. That freewheeling spending is in the past and won't be seen again no matter who is in control. On top of all that SecDef Gates will be leaving in Q1, adding more turmoil to the mix.

I'm sure that talk about the election will be topic one at the upcoming MILCOM conference in San Jose, Oct 31 – Nov 3. Once again the exhibitor list shows growth in the number of small to mid-size electronics exhibitors. Just five years ago this conference was thought of as a big iron communications show for prime contractors to influence senior military staff and politicians. Now there is less big iron and greater emphasis on the latest technologies ending up in deliverable systems. Sooner or later AFCEA will have to accept how important our industry is to the military communications market and force the old boys club to give embedded electronics its proper respect and priority in this conference.

During MILCOM *COTS Journal* will once again meet with industry analysts, users and suppliers and update our assessment of the military embedded electronics market's future direction. Based on those communications, next month we will convey a consensus of where attendees think we are and where we are going. ■■



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The Inside Track

General Dynamics Canada to Supply Smart Display Army MRAP Vehicles

General Dynamics Canada received an order to supply more than 1,000 Smart Display Units (SDU) for installation in U.S. Army Mine Resistant Ambush Protected (MRAP) vehicles (Figure 1). The order represents the first use of General Dynamics Canada's technology on the MRAP platform, expanding the reach of the company's comprehensive suite of vehicle electronics currently embedded in the majority of the U.S. armored vehicle fleet. The MRAP vehicles' command, control, communications and computer, intelligence, surveillance and reconnaissance (C4ISR) capabilities are being upgraded to support future growth and improve operational capability for the crews. General Dynamics Canada will provide the SD7310, its latest-generation smart display designed specifically for on-the-move operation, in armored fighting and tactical vehicles.

The SD7310 integrates a 10.4-inch ruggedized computer and high-resolution touch-screen display into a single device, eliminating the need for a separate and dedicated computer processing unit. It is ideally suited to address the critical size, weight and power, and cost (SWAP-C) requirements of space-constrained vehicle platforms. The current order reflects requirements of a first phase program in which 500 MRAP vehicles will be upgraded and each will be equipped with two SD7310 displays. General Dynamics Canada received the order from WestWind Technologies, which was recently awarded an Indefinite Delivery/Indefinite Quantity (IDIQ) contract by the U.S. Army TACOM Life Cycle Management Command (TACOM LCMC) to supply the C4ISR digital backbone B-Kits. TACOM is the acquisition and support center for all of the Army's ground vehicles.

Figure 1

The MRAP vehicles' C4ISR capabilities are being upgraded to support future growth and improve operational capability for the crews.

General Dynamics Canada
Ottawa, Ontario, Canada
(613) 596-7000.
[www.gdcanada.com]

Emerson and Mercury Team to Pool OpenVPX Efforts

Emerson Network Power and Mercury Computer Systems announced that they will collaborate to promote interoperability on open standards-based subsystems for military and aerospace applications. This alliance seeks to provide interoperability between the companies' range of embedded computing solutions, in order to enable defense customers to migrate their performance away from proprietary closed architectures to flexible open solutions, reducing risk and lowering development and deployment costs as a result.

According to their announcement, the alliance is aimed at combining the strengths of both companies. Among these are Mercury's position in high-performance signal and image processing, open standards hardware and software, and systems integration and services, as well as Emerson Network Power's expertise in standards-based embedded computing technology for the telecommunications, industrial automation, aerospace/defense and medical markets. Mercury's OpenVPX and Emerson's ATCA commitments were also cited.

Emerson Network Power
Embedded Computing
Tempe, AZ.
(800) 759 1107.
[www.emerson.com]

Mercury Computer Systems
Chelmsford, MA.
(978) 967-1401.
[www.mc.com].

Curtiss-Wright to Provide Recorders for Tornado Aircraft

Curtiss-Wright Controls has received contracts with a total potential value in excess of $4.9 million from Cassidian Air Systems to provide Digital Video and Data Recorders (DVDR) and associated replay facilities, for a fleet-wide upgrade to Panavia Aircraft GmbH's German and Italian Tornado aircraft. Cassidian Air Systems, Panavia's prime contractor, awarded two contracts, the first for German Tornado aircraft and the second for the Italian Tornado fleet, to Curtiss-Wright's Specialist Electronics Services (SES) Ltd. business unit.

Cassidian Air Systems selected Curtiss-Wright's DVDR solution for its demonstrated ability to record six channels of high-quality, high-bandwidth video data, as well as numerous additional data and voice channels. The contracts will commence in the first quarter of 2011, with deliveries direct to the air forces in Germany and Italy continuing for the following two years. The Tornado combat aircraft is Europe's largest military

Figure 2

The Tornado combat aircraft is Europe's largest military aircraft cooperation program.

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aircraft cooperation program (Figure 1). Curtiss-Wright's DVDR enables aircraft data to be downloaded via a removable 48 Gbyte solid state memory cartridge for replay and de-briefing, by using the company's REVEAL high performance visualization and analysis software tool.

Curtiss-Wright Controls
Charlotte, NC.
(704) 869-4600.
[www.cwcontrols.com].

Lockheed Martin Completes Preliminary Design for 3D Radar

The U.S. Air Force has approved Lockheed Martin's preliminary design for its next-generation mobile, long-range surveillance and ballistic missile defense radar. The Three-Dimensional Expeditionary Long-Range Radar (3DELRR) (Figure 3) will serve as the principal ground-based sensor for long-range detection, identification, tracking and reporting of aircraft and missiles for both the Air Force and the Marine Corps. The system will replace the Air Force's AN/TPS-75 air search radar. The Marines are also evaluating the system as a replacement for its AN/TPS-59 ballistic missile defense radar.

Figure 3
The Three-Dimensional Expeditionary Long-Range Radar (3DELRR) will serve as the ground-based sensor for long-range detection, identification, tracking and reporting of aircraft and missiles for both the Air Force and the Marine Corps.

The new radar's open architecture will allow it to easily adopt emerging technology. That should expand the system's viability well beyond the typical 20-year life of today's sensor systems. The Air Force approved Lockheed Martin's first capability demonstration of significant systems-level technology in March 2010. The company will conduct a second radar capability demonstration later this fall to prove that its design meets or exceeds the U.S. Department of Defense's stringent requirements for technology readiness.

Lockheed Martin
Bethesda, MD.
(301) 897-6000.
[www.lockheedmartin.com/ms2].

RF Micro Awarded Navy Contract for GaN RF Power Technology

RF Micro Devices has been awarded a $1.5 million R&D contract by the Office of Naval Research (ONR) related to gallium nitride (GaN) microelectronics, including the development of materials, device fabrication and high power circuits. The $1.5 million R&D contract award expands RFMD's contract backlog over the next six quarters to approximately $5 million.

Since calendar 2004, RFMD has been awarded over $14.5 million in R&D contracts by the U.S. Government for development of its GaN high power RF technology. GaN technology is aimed at advanced military applications, including radar, mobile communication and electronic warfare (EW) systems. In addition to military systems, RFMD's GaN RF power technology delivers enhanced performance to a growing number of commercial power amplifier applications, including private mobile radio (PMR), 3G/LTE wireless infrastructure and CATV transmission networks.

RF Micro Devices
Greensboro, NC.
(336) 664-1233.
[www.rfmd.com].

ITT Electronic Systems Chooses ORBexpress for Software Radio

Objective Interface Systems (OIS), provider of the most widely used communications middleware for software-defined radios (SDRs), announced that its ORBexpress product has been chosen as the middleware foundation for ITT Electronic Systems' Soldier Radio Waveform (SRW) and for ITT's Rifleman (Figure 4), Soldier and SideHat radios. The SRW is a key element in the U.S. Department of Defense's efforts to build a mobile and adaptive communi-

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cations network implemented in a wide range of Joint Tactical Radio System (JTRS) radios.

The SRW provides massive quantitative and qualitative advances over its predecessor technologies, offering dynamic, ad hoc networking and two orders of magnitude improvement in throughput. The SRW was successfully demonstrated using ITT radios during Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) events conducted by the U.S. Army Communications-Electronics Research, Development and Engineering Center at Fort Dix, NJ. SRW 1.01.1C is the first JTRS Networking Waveform to achieve Software Communications Architecture (SCA) 2.2.2 compliance and to be evaluated and assessed by NSA for fielding and certification. ITT also implements the SRW in all three of its SCA-based radios, which offer significantly new capabilities to the warfighter.

Figure 4
ITT's Rifleman Radio, a lightweight body-worn radio, allows dismounted infantry soldiers and Marines to communicate among themselves and surrounding vehicles, sensors and unmanned vehicles.

Objective Interface Systems
Herndon, VA.
(703) 295-6500.
[www.ois.com].

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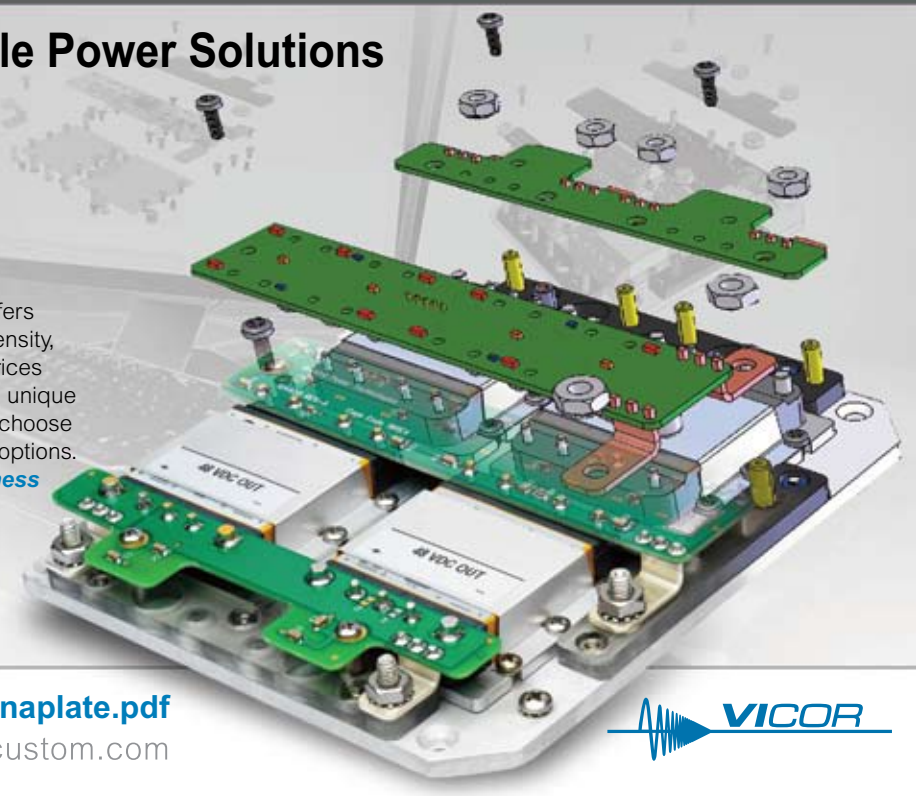

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Special Feature

Military Power Supplies and Converters

Power Supplies and Converters Bulk Up for Rugged Roles

Often the unsung hero of a military system design, power supplies and converters are critical enablers for meeting today's rugged requirements. Vendors are smoothing the way with flexible options and robust solutions.

Jeff Child
Editor-in-Chief

Selecting power supplies and power conversion electronics rank as make or break technical choices in embedded military computer systems. With more and more computing stuffed into smaller spaces, power has direct implications on the size, cooling and mobility of a system. Add to that the challenges of multi-voltage electronics and the complexity of distributed system architectures, and it's clear that military system designers need solutions that address those needs. The good news is that military power conversion vendors are easing the burden with more efficient products, new partitioning strategies and increased ruggedization.

One strategy that converter vendors are enabling is broadening the capability of existing converter architectures by providing advanced filtering. Along just those lines, Vicor offers its MIL-COTS VI BRICK Filter as a stand-alone filter or integrated with the PRM Regulator Module. The filter enables designers using Vicor's MIL-COTS VI BRICK and V•I Chip PRMs to meet conducted emission / conducted susceptibility per MIL-STD-461E/F and input transients per MIL-STD-704A/E/F and MIL-STD-1275A/B/D. It accepts an input voltage of 16.5 - 50 VDC and delivers output power up to 120W.

The integrated filter is 95% efficient and has a non-isolated regulator capable of both boosting and bucking a wide-range input voltage (16.5 to 50 VDC) and delivers output power up to 120W. The stand-alone MIL-COTS VI Brick Filter is a separate DC front-end module that provides EMI filtering and transient protection. Applications for the VI BRICK Filter are typically military ground vehicle (Figure 1) and airborne systems. Examples of ground vehicle applications include communication, targeting systems, flat panel displays, RF jamming and GPS mobile tracking.

Filtering for Distributed Power

Also focusing on the filtering side of the equation, VPT's latest military offering is an EMI (electromagnetic interference) filter module for distributed power systems. The new VPTc10-28 (Figure 2) EMI filter satisfies strict reliability requirements for commercial avionics and military systems in the U.S. and Europe. The VPTc10-28 Series EMI filter and transient suppressor combines two modules in one space-saving package. This module reduces the reflected noise of DC/DC converters while simultaneously protecting a power system from inrush current damage and reverse polarity conditions. These new EMI filters feature up to 10 amps of output current and up to 150W of output power. They meet conducted susceptibility requirements of DEF STAN 59-411 Part 3 Issue 1 for Land Applications, MIL-STD-461C, CS01 and CS02, and MIL-STD-461D/E/F when used with VPT Series DC-DC Converters.

Taking Aim at Military Comms

Another solution focusing on distributed power is Martek Power's T series. Military communications systems represent one of the most dynamic areas of system design today in the defense market. And distributed power has become the 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 supplies 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.

Figure 1

Military vehicles are relying on sophisticated power conversion for vehicle applications such as communication, targeting systems, flat panel displays, RF jamming and GPS mobile tracking.

Power supplies are seeing advances alongside power conversion products. Power supplies that blend high wattage and rugged performance are meeting new demands from military system designers. TDK-Lambda has extended its successful LZSA series of industrial power supplies to include a new 48V at 1500W model. Like the other models in this series, the new LZSA1500-4 has a unique feature set and safety-agency approvals not commonly found in standard off-the-shelf supplies. A wide operating temperature range, compliance with MIL-STD-810E standards for shock and vibration, and the ability to operate in explosive gas atmospheres make the LZSA series of power supplies ideal for use in a variety of applications.

These rugged power supplies are available with a nominal output of 12V at 1000W, 24V at 500W,

Figure 2

The VPTc10-28 Series EMI filter features up to 10 amps of output current and up to 150W of output power. It meets conducted susceptibility requirements of DEF STAN 59-411 Part 3 Issue 1 for Land Applications, MIL-STD-461C, CS01 and CS02, and MIL-STD-461D/E/F.

1000W or 1500W, and now 48V at 1500W. They feature wide user-adjustment ranges of 10 to 15.75V, 18 to 29.4V and 36 to 56V respectively to accommodate non-standard voltage requirements. With integral fan-cooling they provide full-rated output power from -40° to +60°C, derating linearly to 60% load at 71°C ambient. The LZSA series accepts a wide input range from 85 to 265 VAC, 47 to 440 Hz and can operate with a DC input of 100 to 400 VDC. These units include active power factor and harmonic correction. These 500 to 1500W power supplies meet Class B EMI standards (both radiated and conducted) and are safety-approved to UL60950-1, EN60950-1, UL508 and Factory Mutual: FM3600, FM3611 and FM3810 specifications.

The military's desire to pack a lot of computing muscle into small spaces is fueling the need for high-density power components to drive those electronics. Along such lines, Calex Manufacturing offers the HCM Series (Figure 3) of high power density chassis mount DC/DC Converters. These 150-watt rugged, encapsulated DC/DC converters are ideal for harsh industrial and COTS military applications. All 10 models in the series offer a wide 4:1 input range, from 9 to 36 VDC and 18 to 75 VDC, making the units ideal for 24-volt industrial, 12- and 24-volt battery applications and 48V power sources. The output voltages available are 3.3, 5, 12, 15 and 24 volts DC. All models are isolated input to output.

Figure 3

The HCM Series chassis mount 150W DC/DC converters are suited for harsh industrial and COTS military applications. All 10 models in the series offer a wide 4:1 input range, from 9 to 36 VDC and 18 to 75 VDC.

VME Slot-Card Power

Beyond component-level power products, rugged board-level power supplies provide system designers with a complete modular solution for slot-card military systems in form factors like cPCI and VME. A recent example VME solution is Rantec Power Systems' VME28M. Recently completing qualification, it is a conduction-cooled 6U VME package, operating from 28 VDC per MIL-STD-704A-F and MIL-STD-1275A-B, with a nominal input operating range of 16-36 VDC. It operates without degradation through all input transients and surges defined in MIL-STD-704B-F and MIL-STD-1275A-B. The product also operates without degradation through MIL-STD-

Figure 4

The SynQor line of 28 Vin DC/DC converters is offered in half-brick, quarter-brick and sixteenth-brick packages. The converters operate from an input voltage of 16V to 40V continuously and will withstand 50V transients for up to 1 second, meeting MIL-STD-704D input voltage range requirements.

704A high input transient (100V for 50 mS).

The VME28M provides over 200W from 4 isolated output voltages; 3.3V, 5.0V, +/-12V and includes remote on-off, remote sense, over-current protection, over-voltage protection and over-temperature protection, as well as providing AC-FAIL, SYSRESET and SYSFAIL signals. It is qualified for an operating temperature range of -55° to + 85°C measured at the thermal interface of the power supply card edges, at full rated output power. Environmental Qualification included MIL-STD-810 requirements for Altitude, Humidity, Fungus, Explosive Atmosphere, Sand and Dust, Salt Fog, Shock and Vibration. The power supply meets the following specific EMI requirements of MIL-STD-461E: CE101, CE102, RE102, CS101, CS114, CS115, CS116 and RS103 for Air Force Aircraft, Fixed Wing Internal, greater / equal to 25 meters nose to tail. It also meets the following specific requirements of MIL-STD-461C for Army, Navy and Air Force applications: CE01, CE03 and CS01.

High Barrier of Entry

Vendors supplying the military power converter market are a relatively closed group. Building up acceptance in this area of technology takes a long time. While many telecom power supply and power convertors vendors have attempted to shift into the lucrative and stable defense market, few have had success. An exception to that rule has been SynQor. Focusing on synchronous rectification technology to provide high-efficiency converters, SynQor has been able to satisfy demanding military needs.

SynQor offers a line of 28 Vin DC/DC converters in half-brick, quarter-brick and sixteenth-brick packages (Figure 4). Offing full power operation from -55° to +100°C, these "off-the-shelf" converters operate from an input voltage of 16V to 40V continuously and will withstand 50V transients for up to 1 second, meeting MIL-STD-704D input voltage range requirements. Designed for cost-

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sensitive Mil-COTS applications, these ruggedized, encased packages ensure survivability in demanding environments. The high power density half-brick, quarter-brick and sixteenth-brick packages are fully encased and have industry standard footprints and pinout configurations. Although these efficient designs do not require a heatsink, the encased package will accommodate standard DC/DC converter heatsinks. A flanged baseplate version is also available.

The SynQor converters provide fourteen output voltages from 1.2V to 50V and have an adjustable trim from +10% to -20% (+/-10% for sixteenth-brick) to meet numerous application requirements. The fixed switching frequency design yields predictable EMI filtering and, when used in conjunction with a Mil-COTS EMI filter, differential mode noise is attenuated by more than 80dB and common-mode noise is attenuated by more than 36dB. Protection features include input undervoltage lockout, output current limit and short circuit protection, active back-bias limit, output over-voltage protection and thermal shutdown. All models have at least 2250 VDC isolation rating between input and output, are rated with MTBF values in excess of 1 MHrs at a baseplate temperature of 70°C. ▮▮

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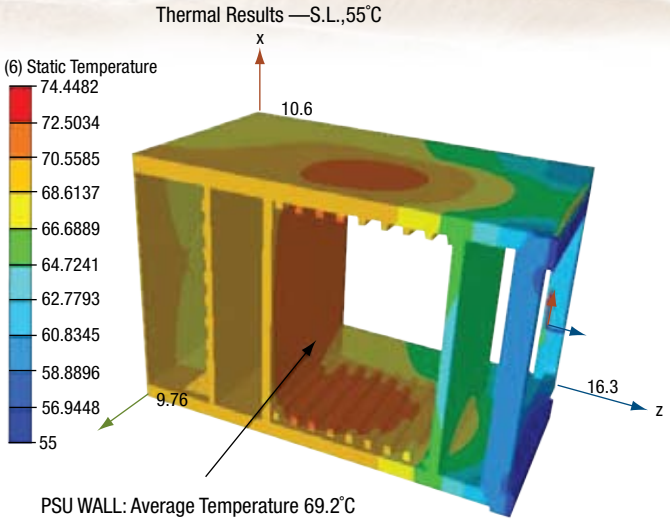
Rugged Box Systems Face Unique Power Issues

As military system performance requirements become more demanding, the pressure is on to deal with power dissipation and cooling. Matching the right technique to the application is critical.

David O'Mara, Product Manager
Conduction Cooled Systems
Kontron

All military engineers face the same challenges in designing to match size, weight, power and cooling requirements. But as systems have become more complex with higher speed and density components, smaller form factor boards and reduced system footprints coupled with requirements to operate in more rugged environments, designing for effective thermal management has obviously become more challenging. Plus, the trend toward miniaturization and smaller transistor sizes has lead to current leakage. That directly translates to unwanted heat dissipation.

Improved thermal management methods continue to be developed to satisfy enhanced cooling requirements that match new standards specifications—such as MicroTCA, CompactPCI, PicoITX or a specific operating environment. Extensive thermal management knowledge is needed to solve complex cooling issues associated with unique or extreme embedded computing environments frequently found in military applications. Designers are regularly tasked with weighing the merits of standardized off-the-shelf versus custom solutions when evaluating cooling method options to stay within overall system cost goals.



SLOT	AVE WALL TEMP (C)
1	66.2
2	67.1
3	68.7
4	69.1
5	70.1
6	71.3
7	71.9
8	71.1

Figure 1

This thermal image illustrates isotherms for a 1 ATR chassis with 400W total power dissipation.

Proper cooling for electronics is important to ensure long life and reliable operation, and as temperatures increase, reliability decreases. For instance, a component operating at 50 percent rated power will have its failure rate double if there is a 20°C rise in temperature. Higher density, higher speed chips also mean higher power densities and hence the need for improved cooling techniques. A multitude of issues can occur due to poor thermal management such as system failures, exceeding junction temperature limits and ultimately fatigue or mechanical failure due to differential thermal cycling or thermal expansion. Figure 1 shows an example thermal modeling of an ATR system.

In the closed environment of a box-level system, effective thermal management is critical for handling power dissipation. With the growing popularity in the military market of box-level systems—or stand-alone rugged boxes—the power envelope a designer must contend with becomes much more finite. With

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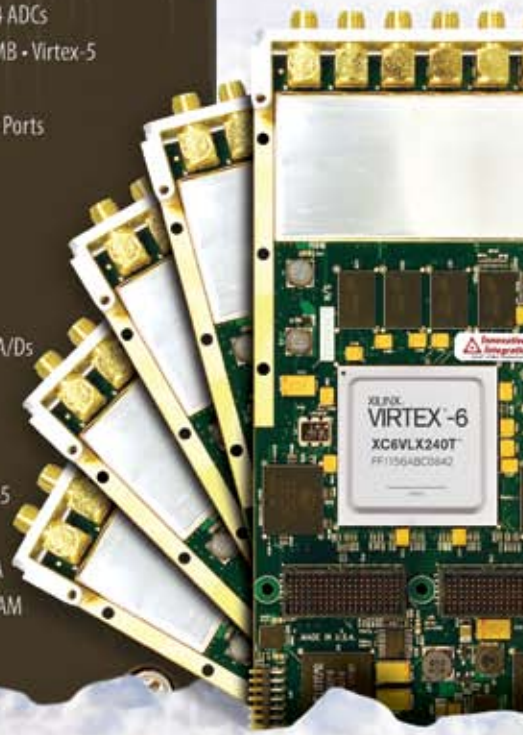

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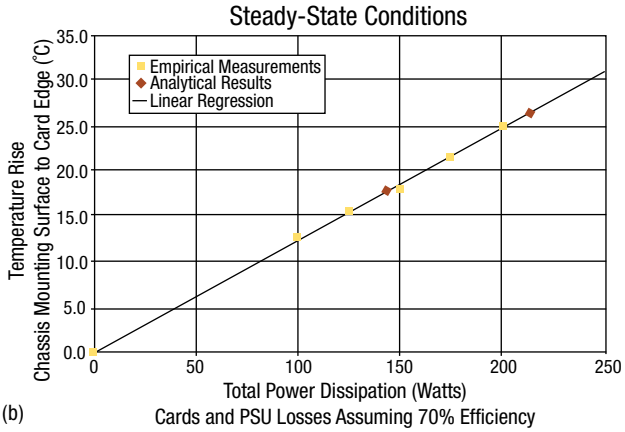

(b)

Figure 2

Cold-plate cooling is one technique incorporated in the FS-5977 (a), a half ATR system for conduction-cooled boards. The graph (b) charts temperature versus total power dissipation for the FS.5977 over stead-state conditions.

Matching Cooling Strategy with Application Type

Cooling Technology	*Application*
Convection Cooling Typically more benign environments	Shipboard/subsurface
	Aircraft (within pressure body) or use high altitude fans
	Some helicopters (with shock tray)
	Some ground mobile applications (composite wheeled)
Conduction cooling Typically more rugged environments	Airborne rugged (Fighters, UAVs, Pods, Helicopters)
	Ground mobile (Tanks, APCs)
Liquid cooled	Airborne rugged high density (similar to conduction cooled). F-22 uses liquid cooling
	Ground mobile

Table 1

Choosing the proper method for power dissipation in a box-level system depends mainly upon the system's component density, performance and endurance goals and the environment where it will operate.

that in mind, it is important to make decisions early in the design cycle to determine how heat is generated within the system by looking at power dissipations and component locations, air flow paths and general thermal performance. Thorough thermal analysis and testing to select the right thermal management solution are major factors in the overall success of the design.

Choosing the Right Strategy

Determining the best method for power dissipation in a box-level system depends mainly upon the system's component density, performance and endurance goals and the environment where it will operate. Table 1 summarizes which cooling approach is best for which application. Convection cooling typically uses natural air circulation or forced air by the use of fans that come in direct contact with system boards. This is acceptable if air is clean and dry. It has a power dissipation limit of typically 50W per board (with a maximum of 55°C air temperature). Convection cooling is used in more benign environments such as shipboard/subsurface, aircraft within a pressurized body or used with high altitude fans, in selected helicopters with shock trays, and for particular ground

mobile applications such composite wheeled vehicles.

Conduction cooling uses forced air through hollow side walls or passive techniques such as cold plates or passive convection, and allows system boards to be isolated from ambient air, which is an advantage in dirty environments. The power dissipation limit is similar to convection systems—50W per board (with a maximum of 55°C air temperature). Higher power dissipations up to 75W per board can be achieved but some sacrifice in MTBF results due to the need for multiple high-performance fans. Conduction cooling is designed into typically more rugged environments in airborne rugged systems on Fighters, UAVs, Pods and Helicopters and in ground mobile tank and APC systems.

Taking Full Advantage

Conduction cooling can also be achieved using liquids on the chassis side walls. This cooling method can handle a lot more heat with a power dissipation limit of 160W per board (board edge temperature of 71°C). Another liquid conduction-cooling configuration is employing a board "flow through" module. Liquid flows through the chassis wall and then through the module for even more efficient thermal management. These modules deliver individual board dissipation of up to 400W and a card edge temperature of 71°C. Liquid cooling is also used in rugged, high-density airborne applications such as on the F-22 Fighter and in ground mobile equipment deployed in harsh environmental or temperature extremes.

As an example, properly designed conduction-cooled systems consume only 50 to 75 percent of the space of convection-cooled systems in an ATR style chassis. Using more efficient thermal transfer characteristics, these systems can operate at higher ambient temperatures than equivalent air-cooled systems. Cold-plate cooling is one technique incorporated in the AP Labs FS-5977, a half ATR system for conduction-cooled boards (Figure 2). System boards, power supplies and other system components are sealed in an air tight enclosure, with edges mechanically clamped to the sides of the enclosure. Heat from the edges of system components is conducted through the chassis side walls and dissipated to a bottom mounted cold plate.

With the help of recent processor technology advancements such as the Intel Atom and improved cooling techniques, military designers have new, reliable box-level system options that provide the small footprint, low power and performance that satisfy their demands for reduced SWaP. At less than 50 percent of the size and cost of comparable backplane-based systems, it is clear that proven box-level options that solve power dissipation issues have a clear place in the military market. ▮▮

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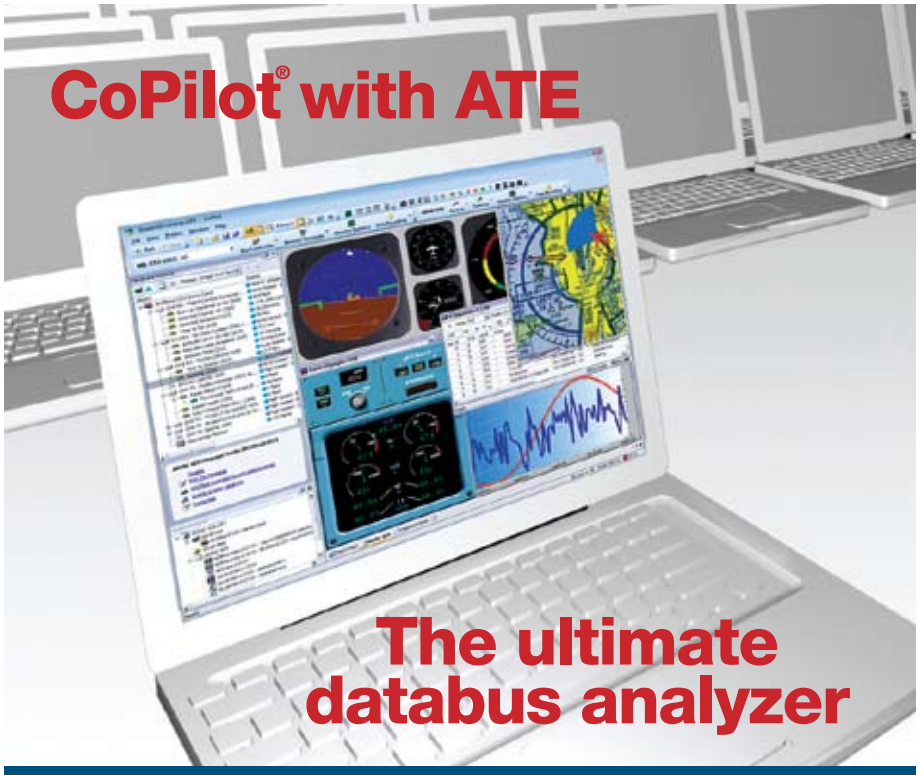

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Tactical Radio Technology Update

Tactical Radios Make Progress on All Fronts

Leveraging the wealth of work developed on software defined radios, the JTRS program is making advanced programmable tactical radio communication a reality.

Jeff Child
Editor-in-Chief

Advances in the software defined radio market continue to overlap nicely with the DoD's software radio efforts. For the DoD's Joint Tactical Radio System (JTRS) program many of the technology pieces are coming together with its organizational problems put to rest. At the heart of JTRS is the development of an open architecture radio waveform technology that allows multiple radio types—handheld, aircraft, maritime—to communicate with each other. With the goal of meeting diverse warfighter communications needs through software programmable radio technology, JTRS is central to the military's plan for Network Centric Operations using seamless real-time communications—both with and across the U.S. military services, and with coalition forces.

Figure 1

The Harris AN/PRC-117G was the first JTRS SCA-certified and NSA Type-1 certified wideband manpack radio system. Soldiers here connect to OEF SIPRNet using an AN/PRC-117G during RTO/Operator Training for the first time.

A Busy Past 12 Months

The past twelve months have been a busy time as JTRS-based radio technologies, standards and products move forward. In February, the JTRS Network Enterprise Domain (NED) Program Office released the JTRS NED Test and Evaluation Waveform Portability Guidelines. The document provides guidance and lessons-learned for waveform developers on producing waveform software that can be readily ported to multiple Software Communications Architecture (SCA)-compliant radio platforms.

One of the goals of JTRS is procuring waveform application software in a form that can be ported to different Joint Tactical Radio platforms at a cost considerably lower than that for new development.

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Figure 2

Rockwell Collins successfully conducted UHF SATCOM and HF waveform Functional Qualification Testing (FQT) on the JTRS vehicular Ground Mobile Radios (GMR).

Waveform portability is a key attribute of the JTRS program because it reduces cost, permits faster technology insertion, guarantees interoperability between radio families, and reduces training and maintenance. The document details general development guidelines in addition to specific guidance for General Purpose Processor, DSP and FPGA processing elements. JPEO JTRS made this information available to the at-large software defined radio industry and it is also mandatory for all JTRS developers to follow the guidelines.

In another significant milestone for JTRS, in June the Joint Program Executive Office for the Joint Tactical Radio System (JPEO JTRS) approved the JTRS Modem Hardware Abstraction Layer on Chip Bus (MOCB) Application Program Interfaces (API) for public release. The API is available for download from the JPEO JTRS Software Communications Architecture (SCA) website at http://sca.jpeojtrs.mil/api.asp.

Parallel Interfaces

The MOCB API provides parallel interfaces between the radio's channel modem interfaces from the application software. The MOCB API supports communications between application components hosted on General Purpose Processors, Modem Digital Signal Processors and/or Modem Field Programmable Gate Arrays. The concept of the MOCB API is to provide a consistent host environment for waveform applications and waveforms across SCA-compliant platforms.

APIs are a companion to the SCA and define relationships and communication between radio waveform applications and the software defined radio set. Standardization of APIs within the JTRS program enhances portability and reusability of waveform and operating environment software. The JPEO has released a set of APIs to provide similar benefits to the commercial radio industry. The SCA plays a vital role within JPEO JTRS by standardizing the deployment, management, interconnection and intercommunication of software application components in embedded, distributed-computing communication systems. While the SCA is published and maintained by JPEO JTRS, it has received wide support and use from the commercial radio developers and industry organizations.

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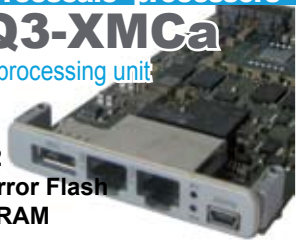
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Figure 3

The AIM II module is an integral component of the JTRS Manpack radio (AN/PRC-155), as well as other radios that will be furnished by the government for integration into dismounted soldier systems and fixed-wing aircraft.

JTRS SCA-certified and NSA Type-1 certified wideband manpack radio system. This summer Harris received an $11 million order from the U.S. Department of Defense for Falcon III AN/PRC-117G (Figure 1) multiband manpack radio systems. The field-proven AN/PRC-117G addresses the DoD's need for an upgradeable platform that enables tactical communications networking and intelligence, surveillance and reconnaissance in both line-of-sight and beyond-line-of-sight applications. The wideband networking capabilities of the AN/PRC-117G give warfighters critical real-time information through a man-portable radio that is significantly smaller, lighter and more capable than legacy units.

The Mission Modules for the AN/PRC-117G provide the radio with additional functionality such as a second wideband channel, high-frequency communications, ISR and jamming. The Mission Modules attach to the AN/PRC-117G through a standardized and interchangeable architecture. Mission Module flexibility allows users to take only the capabilities they need into the field, while optimizing the size, weight and power capabilities to fit varying requirements.

With its fully integrated and NSA-certified High Assurance Internet Protocol Equipment (HAIPE) networking encryption, the AN/PRC-117G provides the highest level of information assurance connectivity to tactical commanders and deployed forces in the field. This capability enables direct classified voice calls and data exchanges between levels of command on the battlefield. The AN/PRC-117G manpack radio development has followed the U.S. Joint Tactical Radio System (JTRS) program's Enterprise Business Model (EBM).

SRW Network Testing

One of the critical waveforms for the manpack radio is the Soldier Radio Waveform. Last month Harris and ITT announced progress in their collaboration to accelerate the fielding of the SRW. Harris and ITT have successfully exchanged voice and data between the Harris Falcon III AN/PRC-117G manpack and ITT's Soldier Radio development model using the specified SRW Version 1.01.1C. This is the first time that independently developed tactical radios have interoperated using open-standard wideband JTRS technology. Both the AN/PRC-117G and ITT's Soldier Radio were developed under the JTRS Enterprise Business Model, which is designed to spur innovation in tactical communications. Harris' rapid implementation demonstrates the portability of SRW.

The Soldier Radio Waveform is being developed to serve as a standard for wideband tactical communications for the U.S. Department of Defense. SRW will deliver voice, data and high-bandwidth networking capabilities to forces at the tactical edge. Following the success of the exercise, Harris plans to conduct addi-

tional testing to include additional SRW features, such as communications security and SRW Network Manager integration. The company is integrating SRW into the AN/PRC-117Gmanpack, with release expected next summer.

GMRs Roll Forward

On the vehicle JTRS radio front, progress is also being made. Early this year Rockwell Collins successfully conducted UHF SATCOM and HF waveform Functional Qualification Testing (FQT) on the JTRS vehicular Ground Mobile Radios (GMR) (Figure 2). This testing was conducted to ensure that the Software Communications Architecture compliant waveforms met all allocated JTRS requirements.

FQT reasonably simulates the production environment. Successfully conducting FQT verifies that the UHF SATCOM and HF waveforms will provide expected operational waveform functionality before GMR systems are fielded. The waveforms can then be used to support the Production Qualification Testing phase of the GMR program. Like all JTRS Operational Requirement Document waveforms in the 2 MHz to 2 GHz frequency range, the UHF SATCOM and HF waveforms can run in any of the GMR system's four reprogrammable Universal Transceivers.

Rockwell Collins is a member of the Boeing-led GMR team whose vehicular JTRS radio design is based on the Rockwell Collins Modular Communications Platform—a unique Software Defined Radio packaging concept that partitions hardware modules according to function at the lowest operational level. This innovative approach substantially improves mission effectiveness and simplifies testing, repair and upgrades in the field, while the design reduces total life cycle cost for platforms on the battlefield.

Security Technology

Security of these JTRS radios is another key attribute in the mix. In September, the AIM II programmable cryptographic module by General Dynamics C4 Systems was certified by the National Security Agency (NSA) to secure classified information up to and including Top Secret, Sensitive Compartmented Information (SCI) for the JTRS Handheld, Manpack and Small Form Fit (HMS) and Airborne Maritime Fixed (AMF) radios. The AIM II module is an integral component of the JTRS Manpack radio (AN/PRC-155) (Figure 3), as well as other HMS small form factor radios that will be furnished by the government for integration into dismounted soldier systems and fixed-wing aircraft.

The AIM II module comprises a secure hardware foundation with embedded software-based cryptographic algorithms to protect classified information from use by unauthorized personnel. The new module is also interoperable with today's military and government communications equipment and encryption devices. ■

Sensor and Signal Processing Apps Ride FPGA Wave

Leveraging the unique DSP capabilities available in today's FPGAs, military signal processing systems are advancing to a new level. Board-level solutions ease the way.

Jeff Child
Editor-in-Chief

Faster FPGA-based DSP capabilities combined with an expanding array of IP cores and development tools for FPGAs are enabling new system architectures. Military applications that rely on heavy amounts of waveform processing—like sonar, radar, SIGINT and software radio— continue to leverage advances in FPGA technology. As FPGAs evolve to ever greater sophistication, complete systems can now be integrated into one or more FPGAs.

In radar, for example, system developers can now use FPGA chips and boards to build radar receiver systems with a higher instantaneous bandwidth thanks to the converters, and can handle the corresponding increase in compute power required to process the received data streams. In the past, an ASIC-based radar design approach could achieve the performance needed, but such systems lacked the flexibility inherent in FPGA-based designs.

Radar Processing

An example radar system that makes use of signal processing is the Army/Navy Transportable Radar Surveillance (AN/TPY-2) radar (Figure 1). Recently the Missile Defense Agency (MDA) awarded Raytheon Company a contract to construct, integrate and test a new AN/TPY-2. The AN/TPY-2 is the most capable and reliable radar currently deployed to defend against the ballistic missile threat. This will be the eighth AN/TPY-2 Raytheon has built for MDA.

Figure 1

The Army/Navy Transportable Radar Surveillance (AN/TPY-2) is a phased-array radar that provides early detection, tracking and discrimination of ballistic missile threats.

Raytheon delivered the seventh earlier this year, on cost and ahead of schedule. These radars are deployed by MDA for forward operations to deter, dissuade, and if necessary, enable defeat of enemy ballistic missiles, as well as to support test and development of the Ballistic Missile Defense System. Raytheon has tapped Mercury Computer Systems to deliver systems architecture, development, qualification and integration services to Raytheon National and Theater Security Pro-

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Board-Level Solutions

Using FPGAs, board-level subsystems are able to quickly acquire and process massive amounts of data in real time. Board-level product developers continue to create powerful compute engines that perform signal processing computation on the FPGAs themselves. At the same time, FPGAs are enabling a new class of I/O board solution that enables users to customize their I/O as well as do I/O-specific processing functions. Tried and true form factors like XMC and VXS/VME are holding their own versus newer form factors.

Figure 2

The 71620 module is a multichannel, high-speed data converter XMC that is designed for connection to HF or IF ports for communications, radar and telemetry.

The latest high-end FPGAs have been a real game-changer for radar and telemetry system designs. Pentek's 71620 module (Figure 2) is a multichannel, high-speed data converter XMC that is designed for connection to HF or IF ports for communications, radar and telemetry. The Pentek 71620 analog front end features three Texas Instruments ADS5485 200 MHz 16-bit A/Ds delivering wide dynamic range and an input bandwidth of 350 MHz, ideal for signal intelligence, radar, beamforming and undersampling applications. In addition, a dual channel TI DAC5688 800 MHz 16-bit D/A provides two wideband analog outputs. Built-in 2x, 4x and 8x interpolation filters and a digital upconverter translate real or complex baseband input signals to any IF center frequency up to 360 MHz.

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Four separate DRAM banks of 256 Mbytes each are larger than previous designs. These multiple banks offer flexibility in dedicating separate resources to I/O streams and processor requirements, eliminating the overhead associated with arbitrating for a single, shared bank. While synchronous SDRAM offers a fast, extremely dense memory, its architecture shares a data path for reading and writing. The 71620 XMC is designed for conduction-cooled assemblies, and PCIe versions are also available. The 71620 is immediately available starting at $11,500.

FPGAs for Video Capture

Also riding XMC is the XMC-270 from Curtiss-Wright Controls Embedded Computing. This rugged, high-resolution frame grabber and video capture XMC (VITA 42.3) card delivers high-resolution analog and digital video capture functionality and advanced serial connectivity. The board also features a built-in PCI Express core to provide high-performance video and image storage. Extra functionality and customizability is provided through an advanced Xilinx Virtex-5 FPGA. The XMC-270 simplifies and speeds the integration of high-end image and video capture functionality into embedded COTS systems designed for use in harsh environments.

Available in both air- and conduction-cooled versions, the XMC-270 sup-

Figure 3

The XMCV5, an XMC mezzanine card, is designed for a wide spectrum of DSP applications. The card lets developers choose from a selection of three Xilinx Virtex-5 FPGAs with build options for the Virtex-5 FX100T, SX95T and Virtex-5 LX110T.

ports high-resolution digital and analog video formats, including legacy interlaced analog video. The card can transfer raw video data in a wide variety of color depths including 8-bit YCbCr (BT.656-4), 32-bit RGB8888 (with Alpha), 16-bit RGB565 and 8-bit Mono (green only). It provides a comprehensive range of video capture features including full frame rate, reduced frame rate (user programmable) and snap shot. The XMC-270 supports a wide range of video capture functionality including six independent NTSC/PAL/RS170 CVBS/S-Video inputs, two independent DVI (TMDS) inputs and two independent RGB HV/SoG inputs. XMC-270 performance features include an x8 PCI Express interface, video integrity monitoring for video freeze detection on DVI channels, thermal sensor, and is available in a range of air- and conduction-cooled ruggedization levels.

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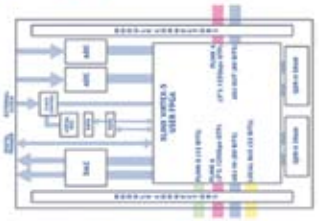

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Meanwhile the XMCV5 (Figure 3), an XMC mezzanine card from GE Fanuc Intelligent Platforms, is designed for a wide spectrum of digital signal processing (DSP) applications in ground mobile, airborne fixed and rotary wing and naval applications including radar, sonar, signals intelligence (SIGINT) and image processing.

The card lets developers choose from a selection of three Xilinx Virtex-5 FPGAs. The XMCV5 gives customers the flexibility to strike the right balance between hardware-oriented FPGA-based computing and software-based application code running on either PowerPC- or Intel-based platforms as part of a solution based on a range of rugged single board computers, carrier cards, multiprocessors and sensor I/O products. Available in five ruggedization levels allowing for deployment in the harshest environments, the XMCV5 is the first rugged XMC to harness the power and flexibility of all three Virtex-5 FPGA families with build options for the Virtex-5 FX100T, SX95T and Virtex-5 LX110T. The XMCV5 is available in a range of configurations for rugged air-cooled systems as well as in conduction-cooled form factors.

VXS Maintains a Strong Niche

Though seemingly destined to be eclipsed by VPX, the more established VXS has captured a strong following as a solution for "here and now" switched fabric throughput. Feeding such needs, Mercury Computer Systems has announced two Echotek Series products, both using three Xilinx Virtex-5 FPGA processors, two high-speed fiber transceivers and two FPGA Mezzanine Card (FMC) sites for high-bandwidth I/O. As integrated components, they extend the functional range of Mercury's VXS and RACE++ Series systems with digitization and FPGA processing of sensor-based data streams.

The new Echotek Series DCM-V5-VXS digital receiver features the latest in A/D and D/A technology via converters mounted on the FMC sites, allowing for high-speed/high-resolution data conversion while still preserving the quality of the original signal. The module couples this data conversion capability with mar-

ket-leading processing power delivered by a set of three Virtex-5 SX240T or LX330T FPGAs, which can be programmed by the end user for customer-specific application features. Moreover, these FPGA processors provide up to 3,156 DSP slices. Each Virtex-5 FPGA is accompanied by both DDR-II-SDRAM and QDR-II-SRAM chips and is connected by multiple high-speed data paths to the FMC sites, to the system backplane interface, and to two fiber transceivers.

Higher Bandwidth Data Capture

Applications such as beam-steering, simultaneous multi-signal generation for communications and radar systems have one thing in common: they're hungry for ever more high-performance multichannel signal generation. A new FPGA-based multichannel signal generator from Tek Microsystems offers eight 14-bit synchronized data streams at 1.2 Gsample/s analog outputs from an FPGA-based board utilizing three Xilinx Virtex-5 FPGAs in a single 6U VME / VXS slot.

The Charon-V5 uses the 1.2 Gsample/s Analog Devices AD9736 14-bit DAC to generate multiple signals at bandwidths of up to 600 MHz. The eight 14-bit DAC digitizer channels are each combined with three Xilinx Virtex-5 FPGAs in a single VME/VXS payload slot. The front-end FPGAs are typically two SX95T devices generating eight channels of analog output data coupled with a back-end FPGA for multichannel processing and backplane communications. To meet application requirements, the back-end FPGA can be configured with any Xilinx Virtex-5 FPGA in the FF1738 package, including the SX240T with over 1,000 DSP48E slices for signal processing applications. In addition to the analog outputs, there are six high-speed serial fiber or copper I/O channels on the front panel as well as fabric and network connectivity via the optional P0 VXS backplane connector. ▮▮

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CPUs and GPUs Vie for New Signal and Image Processing Roles

Ordinary CPUs offer impressive processing muscle, but to meet the huge floating point and throughput needs of signal processing, GPUs are emerging as a new alternative.

Anne Mascarin, Product Marketing Manager
Scott Thieret, Technology Director, GPU Computing
Mercury Computer Systems

Many advanced applications for high-performance embedded computing demand massive amounts of computing power. As radar systems and other sensor systems get more complicated, the computational requirements are becoming a bottleneck. Real-time, on-platform systems in applications such as persistent surveillance and electronic warfare have huge Gflops and/or Gbyte/s requirements, and strict power and size limits. Traditional CPU-based boards simply do not meet computational or size, weight and power (SWaP) constraints.

A graphics processing unit or GPU (also occasionally called visual processing unit or VPU) is a specialized microprocessor that offloads and accelerates graphics rendering from the microprocessor. The highly parallel structure of GPUs makes them more effective than general-purpose CPUs for a range of complex algorithms. Historically, GPUs have been viewed as compelling, programmable floating-point graphics rendering engines designed specifically for personal computers, workstations and gaming consoles. Also, the availability of embedded GPU solutions suitable to the stringent requirements of high-performance signal processing has been scarce.

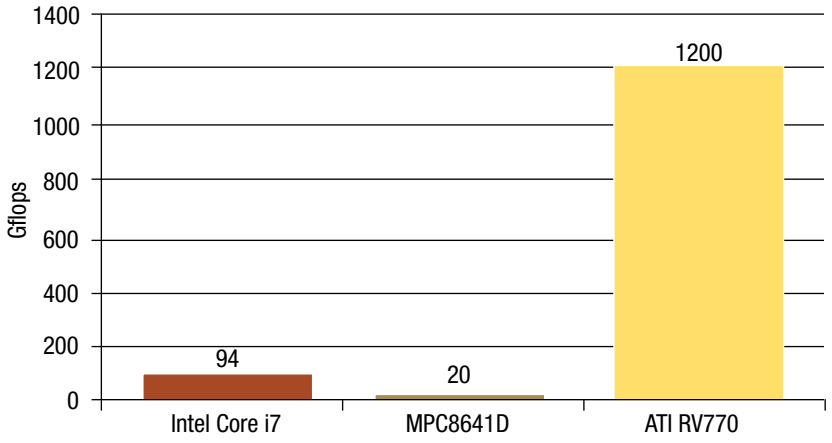

Figure 1

Theoretical peak performance comparison between the Intel Core i7, the Freescale MPC86941D and ATI ATIRV770GPU.

With recent architectural advancements, however, the algorithmic scope of GPUs has grown dramatically. Non-video applications such as signals intelligence (SIGINT), oil and gas exploration, security, signal processing and video transcoding are now addressed using GPUs with excellent results. GPUs excel at traditional signal processing algorithms (like the FFT), and industry performance benchmarks on implementing GPUs in high-performance signal processing applications have shown that GPUs can obtain 20x performance improvement and more over other processors as shown by the Georgia Tech Research Institute. The ability of GPUs to process radar, infrared sensor and video data faster than a typical CPU make them ideal for use in

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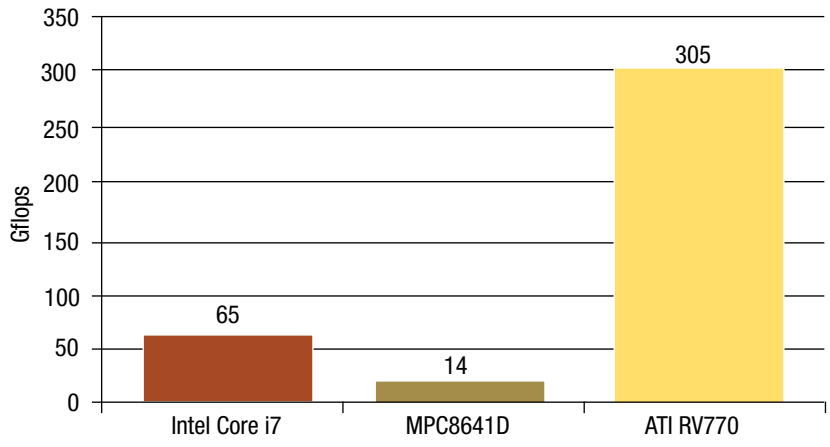

Figure 2

1K complex single-precision floating-point FFT performance comparison between the three processors.

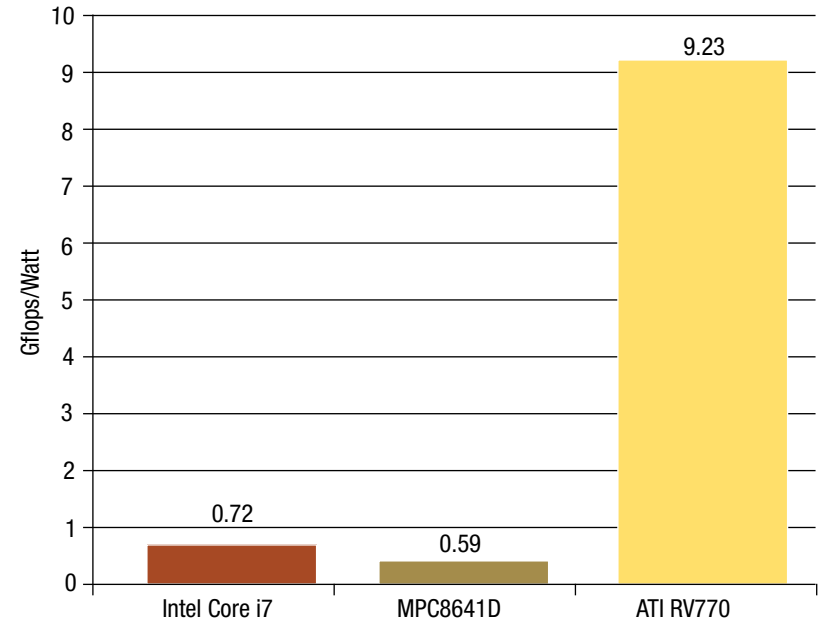

Figure 3

Peak theoretical Gflops/watt performance compared between the three processor types.

high-performance embedded computing applications where performance metrics are paramount.

Large performance differences exist between leading CPUs and GPUs, as shown in recent lab tests, which measured theoretical peak performance, performance per watt and performance per watt for the FFT on the Intel Core i7, the MPC8641D and the ATIRV770GPU. The theoretical peak is based not on an actual performance from a benchmark run, but by counting the number of floating-point additions and multiplications (in full precision) that can be completed during a period of time, usually the cycle time of the machine. In terms of theoretical peak performance, the Intel Core i7 delivered 94 Gflops, the MPC86941D performed at 20 Gflops, and the ATIRV770GPU provided 1200 Gflops performance. (Figure 1).

While this is an interesting comparison, a more significant metric is the performance of each processing device on relevant algorithms. For embedded signal processing—particularly radar and signals intelligence systems—the 1K complex single-precision floating-point FFT is one of the most common and important benchmarks. This algorithm was measured at 65 Gflops on-chip (L1 to L1) using all four cores on the Core i7, 14 Gflops on-chip (L1 to L1) using both cores on the MPC8641D, and 305 Gflops on the RV770 GPU while streaming (DRAM to DRAM). (Figure 2).

A critical measurement for embedded applications, performance per watt is a measure of the energy efficiency of a particular computer architecture or computer hardware. Literally, it measures the rate of computation that can be delivered by a computer for every watt of power consumed. In these tests, performance per watt was calculated using 130W as the total chip power for each device. The Core i7 had 0.72 peak theoretical Gflops/watt, the MPC8641D had 0.50 Gflops/watt, and the RV770 GPU had a much higher 9.23 Gflops/watt using peak board power. This included power for the GPU, memory, interfaces and power conversion (Figure 3).

Similarly, computing the performance per watt for the FFT resulted in 0.41 Gflops/watt for the MPC 8641D, 0.5 1K single-precision FFT Gflops/watt for the Core i7, and 2.35 single-precision FFT Gflops/watt for the RV770 GPU. This is almost a 5x improvement in performance over the Core i7, and almost a 6x performance improvement over the MPC8641D, even though the Core i7 is sourcing and sinking data from/to L1 cache and the GPU is streaming from/to off-chip DRAM (Figure 4).

These performance differences are due to the basic structure and function of the processors. CPUs feature large caches and branch-prediction logic for decision-based code and more complex algorithms. They excel at flow control and disposition of data, for which they were principally architected. Conversely, GPUs are massively parallel array processors with limited branching performance.

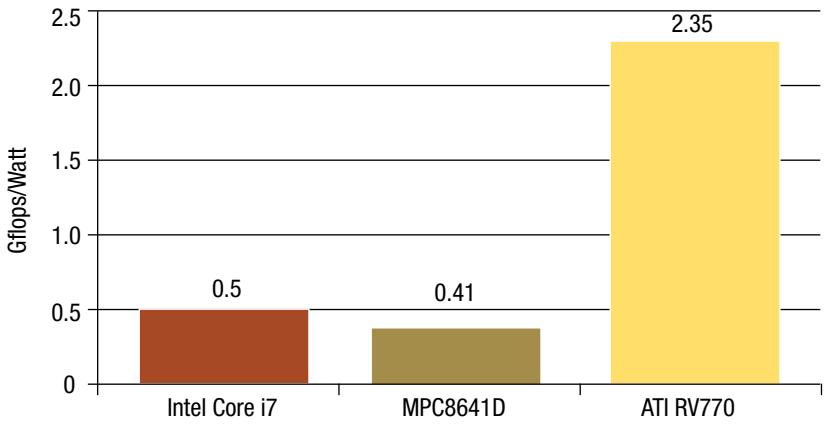

Figure 4

1K single-precision FFT Gflops/watt compared.

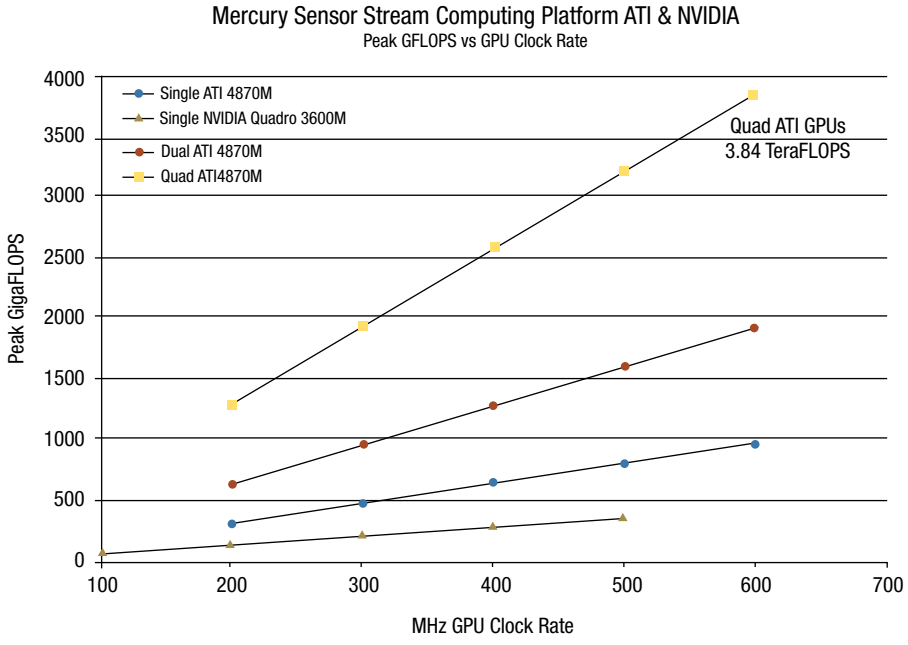

Figure 5

Gflops performance of the SSCP increases linearly with an increase in clock speed.

They operate on large amounts of data simultaneously because they have been architected to maximize arithmetic performance for graphical operations. They are compute and memory bandwidth-intensive machines, containing small amounts of cache, which are optimized for large dataset throughput with computational kernels. This property makes GPUs very successful in compute-intensive signal and image processing systems.

The data referenced was generated using workstation cards in a benign environment. GPU performance was also measured in Mercury Computer Systems' Sensor Stream Computing Platform (SSCP), a 6U VXS-based system that harnesses the processing power of GPUs for high-performance, data-parallel computing in rugged environments.

The SSCP can be configured with one or two VXS-GSC5200 boards, each of which can be configured with one or two GPU-based MXM modules, currently ATI

4870M or NVIDIA QUADRO 3600M. An air- VX6-200 Dual Dual-Core Xeon VXS Single-Board Computer is included in the SSCP for I/O and control. The peak theoretical performance of the SSCP system is shown in Figure 5

A crucial feature of the SSCP is the ability to "tune" the power signature of the GPUs. This is particularly useful for on-platform applications, where peak algorithm performance per watt is extremely important. In the previous chart, the peak Gflops of the various SSCP configurations (single, dual and quad ATI 4870M, and single NVIDIA QUADRO 3600M) increase linearly with an increase in GPU clock rate. This is just one of the "knobs" users can use to optimize the performance per watt on a deployed system-by-system basis.

SSCP performance was also measured in terms of Gflops per chassis watt. Because the Gflops performance of the SSCP increases linearly with an increase in clock speed (Figure 5), dividing the Gflops performance for a particular algorithm (1K complex single-precision FFT and fast convolution in this example) by the chassis power dissipated by a particular SSCP configuration yields a new metric, the Gflops per chassis watt. The power is full "draw-from-the-wall" watts; this includes fans, power supply inefficiencies and the x86 host processors, as well as the power for the GPU(s).

The ATI RV770 GPU significantly outperforms both the Intel Core i7 and the MCP8641D processors in terms of Gflops and Gflops/watt for peak and FFT/fast convolution metrics. Even more dramatic, two orders of magnitude performance improvements of the RV770 are seen when running Mercury image processing libraries over quad-core Xeon processors running IPP in areas such as image formation and analysis for persistent surveillance. Mercury's hardware design permits rapid technical insertion for its GPU-based products.

The new generation of mobile defense platforms for C4ISR applications requires more optimization for size, weight and power (SWaP) than ever before. As seen throughout this article, GPUs are increasingly valuable components of almost all embedded systems that require fast, standards-based processing of display data. Powerful GPU-based solutions like those from Mercury address these challenges by combining expertise in embedded computing, innovation in high-performance signal and image SWaP-constrained systems and ruggedized designs. Due to a modular approach to deployed GPUs, Mercury is able to upgrade new GPU technology rapidly. Mercury is currently validating new, state-of-the-art GPUs from both NVIDIA and ATI for its OpenVPX product line. These GPUs have already shown dramatically improved peak performance, performance per watt and algorithmic scope. ▮▮

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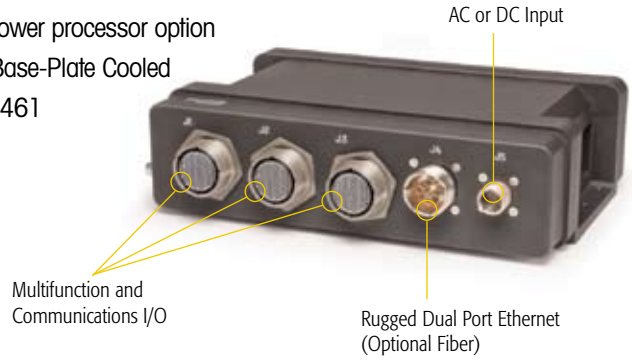

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Technology Focus

Solid-State Disk Drives

Solid-State Storage Drives Leverage Consumer Advances

Solid-state drives are becoming less of a niche solution and more of a mainstream choice for military embedded system storage.

Jeff Child
Editor-in-Chief

The latest crop of high-density, rugged solid-state storage solutions is enabling military system developers to pack in system complexity without the burden of memory storage constraints. Just as computing interconnects have transitioned away from parallel buses toward serial interconnect schemes, so too have the interface technologies of the high-density storage realm. That trend is also fueled by the continued dependence on compute- and data-intensive software. With that in mind, Serial ATA has become the dominant interface technology for new storage subsystem designs. SCSI and Fibre Channel in contrast seem to be waning—although far from retreating. Meanwhile, the redundancy of RAID architectures is still a preferred way to ensure reliable mission-critical operations.

The current trend for many applications is to move from a parallel to serial interface to increase system performance, lower the cost and simplify the integration. Anticipating this trend, there is a plethora of SSDs available with interfaces ranging from USB, small cards (SD and MMC products) and SATA interface products for the military embedded market. When the application requires more storage, the most suitable choice is a pure SSD with Serial or Parallel ATA interface. Single chip drives are also reaching densities large enough for storing code and large amounts of data in any application where space is limited and durability and reliability matters.

Because they have no moving parts, flash-based solid-state disks (F-SSDs) are able to operate under harsher conditions than magnetic hard disk drives. And since F-SSDs targeted for military and aerospace apps use the same fundamental flash components as the consumer realm, the price advantages can be leveraged across all markets. Any downside associated with flash-based disks is quickly falling by the wayside. Random access speeds rival and now beat other media, retention and rewriting cycles have dramatically increased, and many systems offer a single-control erase-all function with or without power for security-sensitivity applications. Those factors have moved F-SSDs closer to the forefront as the lead option for rugged mass storage.

Figure 1

The ScanEagle with NanoSAR payload collects data on an onboard 32 Gbyte solid-state drive.

In a rugged environment, the rotating mechanisms of a hard drive can fail, and are subject to partial and sometimes even total loss of data. Severe conditions including high shock, vibration, altitude, humidity and extreme temperature ranges increase failure rate percentages of hard disk drives, which is unacceptable for mission-critical systems. An example is the ScanEagle UAV. The ScanEagle with NanoSAR payload collects data on an onboard 32 Gbyte solid-state drive (Figure 1). ▮▮

Technology Focus:
Solid-State Drives Roundup

Stacking Technology Enhances Serial ATA Flash Drive

Serial ATA is quickly becoming the dominant storage interface technology—in both flash and rotating disks. Apacer has launched its new Serial ATA Flash Drive (SAFD) 254 for industrial and embedded applications. Apacer's latest SAFD 254 employs its proprietary stacking technology, which supports the widest range of operating temperature by as much

as 128 Gbytes compared to all other available industrial SSD solutions in today's market. With the highly reliable NAND SLC memory, the SAFD 254 is capable of read/write speeds of up to 150/130 Mbytes/s.

Apacer's SAFD 254 uses global wear leveling technology, which manages the uneven "wear" on the sectors of a flash media memory by distributing the writes through whole sectors of the flash media to extend its life cycle. The built-in S.M.A.R.T technology (Self-Monitoring, Analysis, and Reporting Technology) provides users with an interface that allows instant display of key information including spare blocks and erase counts, which reduces the risk of sudden disk damage and proactively notifies customers to back up system and data. Also, the built-in low-power detector initiates cached data saving before the device's power supply is too low. Such intelligent power failure recovery function prevents the system from data damage or data error due to sudden power outage, providing superior data security.

Apacer Memory America
Milpitas, CA.
(408) 586-1291.
[www.apacer.com].

SATA Solid-State Drive Serves up 416 Gbytes

Solid-State Drives have rapidly captured market share away from rotating disks dives. SSDs are also much more rugged than traditional HDD solutions. The E-Disk Altima from BitMicro Networks is a robust SATA. A 2.5-inch, flash-based solid-state drive capable of storing up to 416 Gbytes of data, sustaining transfer rates of up to 100 Mbytes/s and can withstand shock and vibration up to 1,500G and 16.4G rms respectively. Mobile computing applications are set to benefit

from these features since the 2.5-inch E-Disk Altima E2A3GL solid-state drive is a drop-in replacement for disks used in business laptops or rugged portable PCs. It is among the new generation of E-Disk SSDs supported by the EDSA DMC and LUNETA MFI ASICs.

With the ongoing transformation of the personal computing market from desktop PCs to laptops, the 2.5-inch E-Disk Altima SATA solid-state drive easily meets the SSD requirements of mobile computer users. It can also be used as an SSD upgrade for business-critical, enterprise-class applications that require scalable and resilient solid-state storage solutions.

BiTMICRO Networks
Fremont, CA.
(510) 743-3193.
[www.bitmicro.com].

6U NAS Blade Provides up to 1.2 TB SATA Storage

Board-level RAID solutions have revamped the character of military storage systems. Elma Electronic Systems offers the 6211 cPCI RAIDStor with up to 1.2 Terabytes in a single cPCI slot or 2.4 Terabytes with two slots. The new 6U CompactPCI blade network attached storage (NAS) board provides automatic and transparent cross-network or intra-blade data

replication and re-sync for enhanced data security and preservation. The new RAIDStor is suitable for use in any embedded application demanding high availability and reliability. These include data intensive applications, message processing and network-centric military applications.

Standard with dual 2.5" SATA hard disk drives, the new RAIDStor also comes in lower capacity configurations. Front panel, removable drive canisters with hot swap enable the fastest mean time to repair (MTTR) in the industry. Solid-state drives can also be used for rugged, high-capacity RAID reliability. The cPCI RAIDStor can be arranged in a single- or dual-star network topology to provide complete redundancy in network paths as well as port failover services enabled or disabled with a single command for continuous system availability. The cPCI RAIDStor is configurable to RAID level 0 (data striping) for increased bandwidth as well as RAID level 1 (data mirroring) or RAID level 5 (distributed parity—requires dual blade/four drive configuration) for data redundancy. Pricing for the 6211 cPCI RAIDStor starts at $5,000 for single-slot configurations and $6,000 for a dual-slot version, capacity dependent.

Elma Electronic
Fremont, CA.
(510) 656-3400.
[www.elma.com].

256 GB SATA SSD Provides 256-bit Encryption

Military solid-state disk applications need more than just rugged storage. Security is equally as important. Serving such needs, Extreme Engineering Solution is shipping the XPort6192, a ruggedized, removable SATA solid-state disk supporting 256-bit AES encryption and declassification capabilities. With its storage capacity of up to 256 Gbytes and its maximum performance of up to 240 Mbytes/s (read) and 215 Mbytes/s (write), the XPort6192 is ideal for conduction- or air-cooled military applications requiring secure, high-capacity, and high-performance removable storage media.

The XPort6192 tops the XPort6191, the company's previous generation of removable SATA SSD products with higher capacity, greater performance, and more security features. To facilitate the upgrade, the XPort6192 provides a migration path by supporting all the same carrier options as the XPort6191. Both the XPort6192 and XPort6191 can be housed by the XPort6170 (3U VPX carrier) or the XPand3200/XPand4200 (½ ATR chassis). The XPort6192 features include a small form factor that fits within a standard 3U 0.8-inch pitch slot, AES 256-bit encryption (optional), Secure Erase support and optional declassification (enhanced erase) support. The unit is designed for -40 to 85 degrees C operating temperature range and has an endurance of 100,000 program/erase cycles. The high-reliability connector supports 100,000 insertions/extractions.

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

IDE Ruggedized SSD Measures a Mere 7.5 cm³

Ultra-small "chip-sized" solid-state drives have transformed the kind of processor-based mobile military applications that are now possible. Taking that trend a step further, Austin Semiconductor has introduced a smaller, more compact 7.5 cm^3 (31mm sq x 7.8 mm max height) ruggedized SSD. The newly redesigned SSD supports an embedded IDE, PIO/4 interface, has MTBF of more than two million hours and is ideal for harsh environment operation. The unit offers 0° to 70°C operation with future -40° to +85°C in the future.

The solid-state disk is based on a proprietary package (die) stacking technology to create an extremely space-conscious, robust Solid-

State Disk. The SSD is capable of operating in harsh, vibration-prone product platforms. The device has a SLC NAND flash controller and two stacks of NAND flash, each containing 1, 2 or 4 NAND components. Each NAND component, either a 4-, 8- or 16-Gbit device, is based on the use of single silicon and stacked silicon solutions. Total bit density is either 4, 8 or 16 Gbytes. Fast ATA host to buffer transfer rates support True IDE, PIO/4 modes. Sector buffers are 512 bytes, and ECC correction is configured as 6 bytes within a 512 byte sector. The device supports flash memory power-down logic and Automatic Sleep Mode. Wear leveling technology is built in. Burst transfer rate is 16.67 Mbytes/s and sustained transfer rate is 6.7 Mbytes/s.

Micross Components
Austin, TX.
(888) 330-8811.
[www.micross.com].

VME SAS/SATA SSD Works at 80,000 Feet

VME remains a popular form factor for military platforms, and that includes storage. Phoenix International's VS1-250-SSD Serial Attached SCSI (SAS)/Serial ATA (SATA)-based Solid-State Disk VME blade delivers high-capacity, high-performance data storage for military, aerospace and industrial applications requiring rugged, secure and durable mass data storage. This 6U, single-slot module houses one or two each 2.5-inch SAS or SATA SSDs of up to 256 Gbytes per device, and can be interfaced through its front panel connector or its P2

connector. The high-speed module will sustain read/write data rates of 120 Mbytes/s with an access time of 0.5 msec.

The VS1-250-SSD has an operating temperature range from -40° to 85°C and functions at an altitude greater than 80,000 feet. The VS1-250-SSD also complies with current defense department security standards providing multiple levels of secure erase techniques. As a drop-in replacement for a traditional hard disk drive, the VS1-250-SSD offers significantly lower power consumption and eliminates seek time, latency and other electromechanical delays commonly associated with conventional rotating media. The VS1-250-SSD's performance and versatility is enabled by Phoenix Internationals state-of-the-art technology, which provides very high transfer and I/O rates, enhanced endurance and maximum data integrity. A conduction-cooled version of the unit is also available.

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

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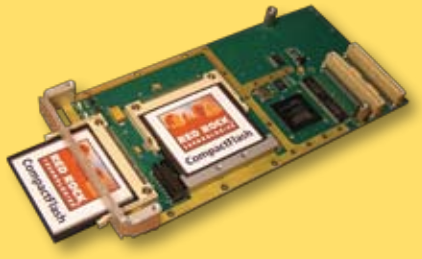
Conduction-Cooled PMC Delivers 32 Gbytes of SSD Storage

Mezzanine technologies like PMC offer a tried and true means of mixing and matching functionality on a slot card board. Now, complete mass storage subsystems can reside on a PMC rather than occupying a full slot in the backplane. Serving just this need, Red Rock Technologies provides a conduction-cooled PMC Compact Flash Module. The card uses CompactFlash Solid-State Drives to achieve capacities of up to 32 Gbytes in a single PMC slot. The board is ruggedized for



extreme temperature, shock and vibration environments. A 32-bit PCI bus at 33 MHz/66 MHz is provided and the card is 3.3V and 5.0V PCI interface-compliant and compliant with ATA/ATAPI-6 PIO Mode 4 transfer rates.

The boards have an ambient temperature range of -40° to 85°C and operate at a relative humidity of 8 to 95 percent non-condensing. Shock rating is 1000G per MIL-STD-810F, with a vibration rating of 16G peak to peak. The card operates at altitudes of up to 80,000 feet. Mean Time Between Failures (MTBF) for the base modules is rated at an estimated 500,000 hours and 25°C, with the MTBF for the onboard drives estimated at 4,000,000 hours at 25°C. Maximum weight is 4.5 ounces.

Red Rock Technologies
Scottsdale, AZ.
(480) 483-3777.
[www.redrocktech.com].

SAS Solid-State Drive Uses Multi-Level Cell Tech

A new development in flash memory is a serial-attached SCSI (SAS) solid-state drive (SSD) equipped with enterprise-grade multi-level cell (E-MLC) NAND flash technology. The 2.5-inch XceedIOPS SAS SSD from Smart delivers superior endurance in enterprise environments due to the use of the latest 34nm E-MLC NAND flash technology. Specified

endurance for E-MLC flash is 30,000 program/erase (P/E) cycles, whereas competing commercial MLC (C-MLC) technologies typically demonstrate only 1,500 to 5,000 P/E cycles. Endurance is further enhanced by an advanced wear leveling algorithm combined with advanced data management hardware, delivering the industry's lowest levels of write amplification while also significantly boosting performance. As a result, the Smart XceedIOPS SAS SSD family of products will deliver a minimum of five years of operational life in environments that write up to 10x the device's total data capacity per day.

Specifically optimized for high-performance enterprise storage and server systems, the XceedIOPS SAS SSD achieves up to 26,000/20,000 IOPS random read/write and 250/230 Mbyte sustained read/write. Available in 100, 200 and 400 Gbyte capacities, the new XceedIOPS SAS SSD offers high reliability and data integrity due to extensive error-correction and detection capabilities, multi-level data-path and code protection, data-fail recovery and data-integrity monitoring. Designed to fit the restricted power envelope of enterprise storage environments, the XceedIOPS SAS SSD incorporates staggered power-on support. In addition, the new XceedIOPS SAS SSD supports long data sector (LDS), which allows host transfer sizes of 512, 520 and 528 bytes.

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

SSD Suited for Harsh Environment Use

Military applications demand a higher level of reliability for their SSD needs than other applications. Serving those needs, STEC offers its MACH8 family of solid-state drives. At the heart of the MACH8 family of Solid-State Drives is STEC's leading-edge flash controller able to address multiple flash components simultaneously to achieve 100 Mbyte/s sustainable read/write speeds. This same controller allows the MACH8 MLC to achieve 90 Mbyte/s reads and 60 Mbyte/s writes. The MACH8 product embeds Full Data

Path Protection, STEC's proprietary set of algorithms capable of protecting data anywhere within the SSD, from cache to flash.

An IOPS-intensive version is available for transactional heavy applications. The unit is a drop-in replacement for traditional 1.8-inch and 2.5-inch drives. The drive supports both Serial ATA and PATA and has optional support of purge and encryption. Superior data protection is provided through Total Drive Wear Leveling to ensure drive endurance. Two operating temperatures are supported: Commercial temperature from to 0° to 60°C and industrial temperature from -40° to 85°C.

STEC
Santa Ana, CA.
(949) 476-1180.
[www.stec-inc.com].

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SATA 3 Gbit/s SSDs Target Rugged Laptops

The military much prefers solid-state drives over rotating disks. SSD are not only inherently more rugged, they also have sustained performance. Super Talent Technology offers the TeraDrive CT SSD, which uses the SandForce 1222 SSD processor to deliver high performance in laptops and desktops. The new TeraDrive CT has a standard SATA-II 3 Gbit/s interface. It delivers sequential read and write speeds up to 285 and 275 Mbytes/s respectively.

Built-in Garbage Collection and TRIM support ensure sustainable performance over the life of the drive, without degradation.

The TeraDrive CT features RAISE technology for enhanced reliability and DuraWrite technology for significantly increased endurance, state-of-the-art wear leveling, bad block management, and excellent ECC with up to 24 symbols correctable per 512 byte sector. The TeraDrive CT, built with MLC NAND flash, uses new improved firmware that yields greater usable capacity than earlier 1222 based SSDs. It is offered in capacities from 60 Gbytes to 480 Gbytes. Prices range from $199 to $669.

Super Talent
San Jose, CA.
(408) 934-2560.
[www.supertalent.com].

Rugged SSDs Offer Removable Solutions

For some applications, a complete ruggedized removable SSD solution is the best option. Along just those lines, Targa Systems Division of L-3 Communications offers two versions of its SATA Data Transfer Systems for the Military and Aerospace markets. The Series 3 PC Card SATA DTU boasts capacities to 32 Gbytes, and the Series 4 Removable Disk SATA DTU (shown) has capacities to 256 Gbytes with transfer rates to 50 Mbyte/s.

The Targa Series 3 PC Card SATA Data Transfer System is suited for airborne platforms. Typical airborne platform

application systems include flight management, cockpit instrument display, terrain awareness and warning, map systems, radar systems, cockpit/ground communications, navigation positioning and satellite communications. The removable PC Card feature of the Series 3 product line allows for easy updating of files. In those applications requiring higher storage capacity and/or greater read/write speeds than PC Cards can offer, Targa offers its Series 4 Removable Disk SATA DTUs. The Series 4 SATA DTU offers capacities up to 256 Gbytes in a compact, rugged and removable 2.5-inch flash disk. The removable disk feature of the Series 4 product line allows for easy updating of files. Data Transfer rates up to 50 Gbytes/s are available.

Targa Systems, L-3 Communications Canada
Ottawa, Ontario, Canada.
(613) 727-9876.
[www.targasystems.com].

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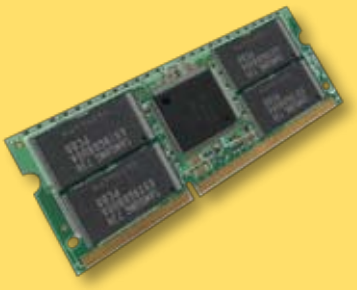
Module Marries SATA SSD and DDR DRAM

For a variety of military applications, small integrated computing functionality is a critical requirement. Now system designers can get a complete memory subsystems—main memory and mass storage—on a single component. Offering exactly that is Virtium Technology's SSDDR SODIMM product. SSDDR is the memory and SSD board design that combines



Serial ATA Solid SATA SSD and Double Data Rate Synchronous Dynamic Ram (DDR SDRAM) technologies in a single SODIMM socket for SBCs, ETX, COM Express and ATCA applications.

This SSDDR product solves the storage design challenge facing many SBC designers in search of SATA SSD module solutions for embedded SSD applications. SSDDR serves two independent functions. The NAND flash module provides localized SATA SSD storage for the operating system, and DDR SDRAM provides the main memory for the CPU. Virtium's SSDDR solution can be easily adapted and implemented as both the storage and memory functions share the existing JEDEC standard socket. Basically, the SSDDR module and Standard DDR module are interchangeable within the same SODIMM socket. With this SSDDR SODIMM solution, data throughput dramatically increases two to four times over other embedded SSD and interfaces such as USB (Universal Serial Bus), CF (Compact Flash with IDE interface) and SD (Secure Digital). SSDDR SODIMM is the higher performance SATA disk on module for embedded applications. The product line ranges in price from $150 to $800 depending on density, configuration and volume.

Virtium Technology
Rancho Santa Margarita, CA.
(949) 888-2444.
[www.virtium.com].

2.5-Inch SSD Family Boasts High Reliability

Military system developers used to have to suffer a lot of trade-offs when deciding on flash-based storage versus traditional rotating disks. That gap has narrowed considerably in recent years. Exemplifying that trend, Western Digital (WD) offers its WD SiliconDrive N1x 2.5-inch solid-state drive (SSD) family. The SSDs feature fast read/write speeds in high capacities and are designed for embedded system OEM applications that require superior performance, high reliability and long product life. The single-level cell (SLC)-based WD SiliconDrive N1x SSDs are an ideal storage

solution for a wide range of embedded system OEM applications in growing markets such as automotive and transportation, data center, communications infrastructure, video surveillance and industrial automation.

The new WD SiliconDrive N1x family of products complements the recently announced multi-level cell (MLC)-based WD SiliconEdge Blue SSDs, which offer a cost-effective alternative for less-demanding OEM applications while still providing high read/write speeds and high random write IOPS (Input/Output Operations Per Second) performance. WD SiliconDrive N1x SSD products feature a native SATA 3.0 Gbit/s interface with target read speeds up to 240 Mbytes/s and write transfer rates up to 140 Mbytes/s in capacities up to 128 Gbytes. WD SiliconDrive N1x SSDs deliver maximum drive endurance and high sustained sequential write speeds to satisfy the 24/7 operational requirements in critical OEM applications.

Western Digital
Lake Forest, CA.
(949) 672-7000.
[www.wdc.com].

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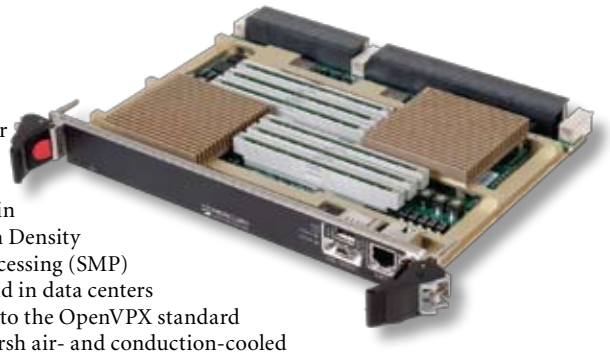
Intel-based Rugged Server-Class Board Targets ISR Apps



Intel processors have quickly made inroads into the military market. By using the familiar Intel architecture, Linux operating system and server-class computing, applications can more easily migrate from workstations and ground stations to tactical environments, facilitating a common code base between the lab and deployed environments. With all that in mind, Mercury Computer Systems has announced the Intel-based Ensemble HDS6600 High Density Server for rugged deployed ISR systems. The HDS6600 supports 8-way symmetric multiprocessing (SMP) and is based on Intel's Xeon processor, enabling enterprise-class performance typically found in data centers to be forward deployed, in the air and other harsh environments. The HDS6600 is designed to the OpenVPX standard for ease of integration with traditional sensor hardware, supporting rapid deployment in harsh air- and conduction-cooled environments.

In addition to deployed server applications, the HDS6600 achieves new performance levels in traditional signal and image processing applications. With dual quad-core Intel Xeon enterprise server-class processors in a standard 1-inch OpenVPX slot, a 10-board system reaches over 1 Tflops of peak performance, and an order of magnitude improvement in signal and image processing throughput performance compared to rugged Intel modules available today. To achieve the highest efficiency, an ISR subsystem must have performance balanced with both I/O and memory. The high performance communications among HDS6600 modules is facilitated by Mercury's Protocol Offload Engine Technology (POET), which encapsulates standards-based protocol management, such as Serial RapidIO and PCIe, with high-speed real-time switching capability. The large 12 Gbytes of onboard SDRAM memory is well balanced for the 8 Intel Xeon cores, and represents a 4X increase over previous generation module memory size. The HDS6600 Intel rugged server can be combined with Mercury's latest GPGPU offerings. For example, two high-end GPGPU-based GSC6200 modules, each with two GPGPUs, can be directly connected to a HDS6600 through the OpenVPX expansion plane.

Mercury Computer Systems, Chelmsford, MA. (866) 627-6951. [www.mc.com].

Voltage Controlled Oscillators Are Hermetically Sealed

Crystek has introduced a new series of TO-8 VCOs (Voltage Controlled Oscillators) to provide high-performance frequency control in harsh, demanding environments. Crystek's CVCOT8BE line features a full-functioning VCO in a rugged, hermetically sealed TO-8 package to protect the VCO from moisture, contaminants and other environmental elements. The metal-can construction features gold plated pins with no internal wire bonds for enhanced signal integrity. Two models are currently available: the CVCOT8BE-2100-2200 (2100-2200 MHz) and C VCOT8BE-2400-2500 (2400-2500MHz). These VCOs feature a typical phase noise of -101 dBc/Hz at 10KHz offset and excellent linearity. Tuning sensitivity is rated at 55 MHz/V. The devices feature a control voltage range of 0.5V~4.5V with an input voltage of 8V. Maximum current consumption is 25 mA and output power is 0 dBm. Crystek's TO-8 VCO line has an operating temperature range of -40° to +85°C.

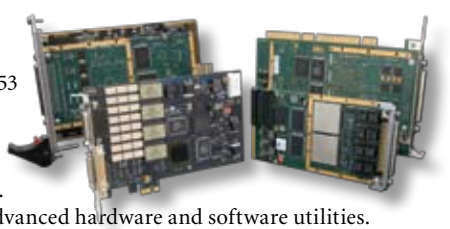
Crystek, Ft. Myers, FL. (239) 561-3311. [www.crystek.com].

Rugged Box-Level System Offers Low Power Solution

Octagon Systems has announced the Fleet CORE M, a rugged computer that excels in demanding applications requiring more robust I/O connectors. The total integrated thermal design provides fanless operation over a -30° to 70°C temperature range. The Fleet CORE M incorporates the field-proven, Octagon Hedgehog power supply technology providing superior protection for noisy and unstable mobile applications. The unit is ideally suited for size, weight and power constrained applications. The standard I/O includes Ethernet, USB, COM, DVI-D, with resolutions to 1920 x 1440 and four inputs and two outputs of digital I/O. The processor is a 1.1 GHz Intel ATOM. Memory includes 1 Gbyte industrial temperature grade DDR2 DRAM. Typical dissipation is under 10W and transient compliance exceeds SAE J1113-11 and ISO-7637-2-2004. Vibration exceeds MIL-STD-214A while shock exceeds MIL-STD-202G. Operating temperature is 30° to 70°C and storage temperature is -40° to 85°C.

Octagon Systems, Westminster, CO. (303) 430-1500. [www.octagonsystems.com].

MIL-STD-1553 Card Family Offers Multifunction Capabilities



Data Device Corporation has introduced a new line of PMC, PCI, cPCI/PXI and PCI Express MIL-STD-1553 cards (BU-672 Series) designed around its next-generation AceXtreme 1553 core, adding advanced test and simulation capability to DDC's field-proven and reliable data bus technology. The BU-672 series adds Multi-Function capability allowing a 1553 Bus Controller (BC), up to 31 Remote Terminals (RT), and Bus Monitor (MT) to run concurrently per channel. The cards are available with up to four dual-redundant 1553 channels.

The AceXtreme Multi-Function series also includes a powerful Test and Simulation Toolkit that delivers advanced hardware and software utilities. These new cards, along with all other DDC cards, simplify application code development by utilizing a common API that can be used for test/embedded cards and components, so that software developed for any DDC 1553 solution can be easily reused in all other applications without costly and time-consuming software programming. Software development time can be further simplified by utilizing DDC's BusTrACEr software's one-click application code generation feature, enabling software development in minutes rather than months.

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

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5W DC/DC Converter Offers 4:1 Input, Remote On/Off

ConTech has announced the "SMW" Series of DC/DC converters. The SMW Series offers 5W of fully regulated output power with an industry standard SMT footprint. Total board space required for this package is 1.31 x 1.01 x .40 inches. The series offers a 4:1 input range with nominal input voltages of 24 VDC and 48 VDC. Single outputs offered are 3.3, 5, 12 and 15 VDC. Dual outputs are +/-5, +/-12 and +/-15VDC. The operating ambient temperature range of the SMW is -40° to 71°C. The units are encapsulated with a thermally conductive potting compound in a non-conductive plastic case. The series is isolated input to output with an isolation voltage rating of 1500 VDC. The case is designed to withstand most solder/wash processes. The SMW Series has a Remote On/Off feature that when used has a standby current of 10ma. Pricing for the SMW Series is $17.06 each (1,000s).

ConTech, Concord, CA. (877) 302-4411. [www.ConTech-us.com].

OpenVPX Platform Accelerates Deployed Avionics Systems Development

The needs of a development environment are very different than those of deployed military systems. Addressing just that issue, Extreme Engineering Solutions is shipping the Avionics Development Platform (ADP) to facilitate the development and rapid deployment of avionics systems. The ADP is a prepackaged 3U OpenVPX development platform that provides functionality and I/O commonly required by avionics applications. The ADP enables the deployed system hardware to be developed in parallel with the software development effort to reduce overall development schedule and risk.

The ADP utilizes an OpenVPX development chassis that supports conduction-cooled payload modules, an OpenVPX backplane and air-cooled RTMs. The same conduction-cooled 3U VPX modules used in the lab development platform can be utilized in the deployed system. As a result, software developed on the ADP will run on the deployed system, reducing schedule risk and increasing the Test Readiness Level (TRL) of the deployed system.

The ADP includes an OpenVPX development platform with a development power supply, an RTM bay, and ten one-inch pitch slots for 3U conduction-cooled modules. It has a 3U OpenVPX backplane with eight payload slots, two switch slots and two power slots. The 3U VPX SBC is based on the Intel Core 2 Duo, Intel Core i7, Freescale MPC8640D, MPC8572E, P2020, or P4080 processor. Optional payload modules range from a 3U VPX PCI Express and Gigabit Ethernet integrated switch to a MIL-STD-188-203-1A (ATDS) interface PMC. Operating system BSP and drivers are provided for all VPX and mezzanine modules.

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

Solid-State Drives Provide 400 Gbytes of Storage

STEC has announced its MACH16 SSD product line, the latest in the series of MACH family offerings, which include the company's MACH4 and MACH 8 drives. This new line features a unique and advanced ASIC controller that is designed for high-end performance. The MACH16 SSDs deliver sustained performance of 30,000 IOPS at 4K transfer size and maintain endurance beyond the 5-year service life that is required for Enterprise-level server environments. The drives also incorporate STEC's proprietary advanced Flash management technology, which enables the drives to negate failure errors and extend Mean Time to Failure (MTTF), highlighting their position as one of the most advanced and intelligent SATA drives available in the market. The product line is launching with both MLC and SLC media and supports multiple Flash geometries.

STEC
Santa Ana, CA.
(949) 476-1180.
[www.stec-inc.com].

Rugged 6U VPX SBC Has Integrated Onboard I/O Resources

Knowing which switch fabric to go with has always been a complication in the VPX world. Offering a solution to that, Aitech Defense Systems has introduced a rugged 6U VPX SBC that offers the selection between PCI Express or Serial Rapid IO and a host of onboard I/O ports. Using an integrated dual core PowerPC processor, the new single-slot C110 combines low power performance with increased memory capabilities, making the board ideal for Radar system boot computers, Sonar processors, Video and Graphics engines and single board process and machine control applications.

Because it is built to OpenVPX and VPX specifications, the C110 is fully compliant with legacy VME operations, such as VME64 per VITA 46.1, while supporting advanced VME protocols including 2eSST and 2eVME. Four x4 ports, configurable to either Serial RapidIO or PCI Express, make up the VPX core backplane fabric. The C110's extensive onboard I/O resources include four Gigabit Ethernet, four USB 2.0 ports, two SATA 2.0 ports, six asynchronous serial ports and eight GPIO (general purpose discrete I/O) channels. Withstanding extreme military shock and vibration over an extended temperature range of -55° to +85°C (Mil-Spec), the new C110 remains reliable in extreme environmental conditions.

Aitech Defense Systems, Chatsworth, CA. (888) 248-3248. [www.rugged.com].

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1U System Serves Up 3 GHz Dual Core Processors

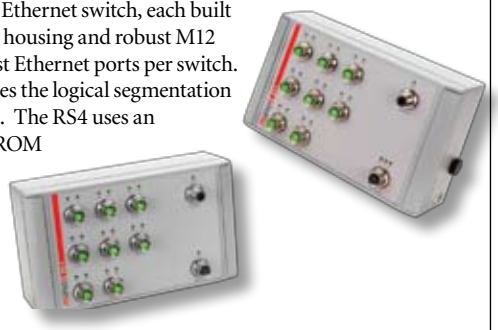
Military systems lean toward using the fastest processors available. That's critical because embedded computers inevitably become obsolete over the long development cycles common in the military. General Micro Systems has introduced the fastest server class rugged 1U computer system for the embedded military market. The S279 ("Axiom") is based on the highest performing processors on Intel's road map, the Quad and Dual Core Xeon chipset. Incorporating these sophisticated processors in a small, rugged module fulfills the new Virtual Machine Server concept, and the U.S. Army's mandate of a minimum of 3 GHz processors for its systems. The Axiom is available with the latest blazing-fast Intel Xeon processors—either two Quad Core LP, with up to 2.7 GHz of power, or two Dual Core, with up to 3 GHz. Dual Core variants operate in environments ranging from -40° to +85°C and Quad Core variants from -40° to +80°C.

Through its patented cooling technology, which eliminates gap pads, GMS has become the first and only manufacturer to successfully package these super high-performance processors in such a small envelope and still meet rugged system shock and vibration requirements. The miniature 1U rugged Axiom measures only 11 x 7 x 1.75 inches and is compliant to MIL-STD 810G, MIL-STD 704E and MIL-STD 461F. With I/O interfaces such as PMC/XMC, MiniPC and ExpressMini, as well as custom I/O via SAM and SAMVideo, the Axiom is ideal for Headless Network servers or Virtual Machine systems hosting six to eight independent images of different operating systems, each with a specific mission.

The Axiom supports up to 32 Gbytes of 144-bit ECC DDR2 memory, features an ultra-fast dual Front Side Bus, each with up to 1333 Mega Transfers per Second, has dual 10 GigE ports and three GigE ports with TCP/IP Offloading engine, ultra-high performance Dual Pipe video with dual DVI-I ports, and up to 256 Gbytes of 1.8-inch rugged SSD (optional). Pricing for the S279 Axiom starts at $18,000, in single unit quantities.

General Micro Systems, Rancho Cucamonga, CA. (909) 980-4863. [www.gms4sbc.com].

Ethernet Switches Feature Rugged Housings and Connectors



MEN Micro offers the RS3 managed Ethernet switch and the RS4 unmanaged Ethernet switch, each built using durable aluminum housing and robust M12 connectors with eight Fast Ethernet ports per switch. The managed RS3 includes the logical segmentation of ports (802.1q VLANS). The RS4 uses an application-specific EEPROM to provide managed switch functionality, such as 802.1p priority as well as port based priority and VLAN or IEEE 802.1q IDs, with fixed settings. The aluminum housing of the convection-cooled switches measures 220 mm x 130 mm x 70 mm. Operating temperature is -40° to +70°C. The switches are fully compliant with EN 50155 class Tx and are e1 certified. Because there are no socketed components, the RS3 and RS4 withstand substantial shock and vibration. Pricing for the MIPIOS Ethernet switches start at $1,553 for the managed RS3 and $1,148 for the unmanaged RS4.

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

GPU Expansion Systems Exploits PCIe Cabling

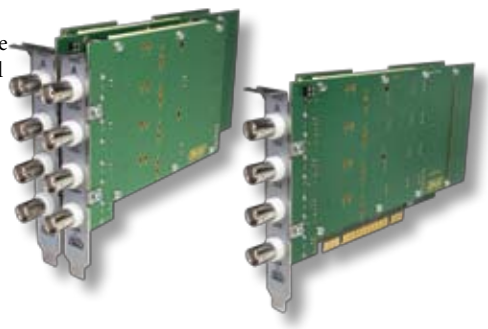
One Stop Systems (OSS) offers a 2U expansion enclosure that provides four or eight PCIe x16 Gen2 slots, two PCIe x16 cable interfaces, ample cooling, and an 850-watt power supply to support up to four GPU boards or other high-speed I/O cards, a two PCIe x16 Gen 2 host cable adapter and two PCIe x16 one-meter cable. The system includes a system monitor (fans, temperature, voltage), dual redundant 850-watt power supplies, one or two PCIe x16 Gen 2 host cable adapters and one or two 1 meter PCIe x16 cables. Operating temperature range is 0° to 35°C while storage temperature is -40° to 85°C. The unit operates in 10 to 90 percent relative humidity (non-condensing) and operates at 0 to 10,000 feet.

One Stop Systems

Escondido, CA

(760) 466-1646.[www.onestopsystems.com].

Transient Recorders Blend High Speed with High Precision

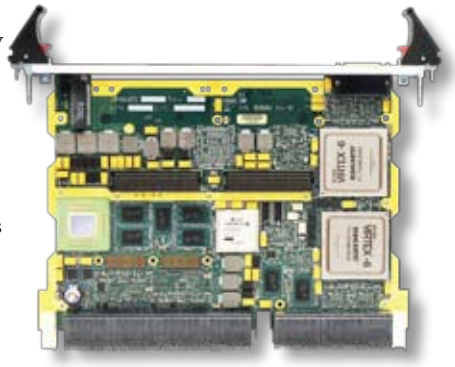


Elsys Instruments has expanded its family of LAN-controlled transient recorders to include several high-speed modules that offer sampling speeds of 240 Msamples/s or 120 Msamples/s at 14-bit or 16-bit vertical resolution. The new compact TPCX-24014 and TPCX-12014 series combine Elsys' unique measurement precision featuring vertical and offset accuracy specified at ±0.1 percent of full scale with exceptionally increased sampling speeds.

Housed in a single-width PCI slot, the new transient recorders feature analog bandwidth at Nyquist frequency of 120 MHz for 240 Msample/s versions and 60 MHz for 120 Msample/s versions. The new modules feature four single-ended channels that can be switched into two true, fully differential channels. Four differential channel recorders are obtained by mechanically and electrically integrating a pair of two-channel differential units. Standard acquisition memory length on the new units is 32 Mpoints/channel with an optional 128 Mpoints/channel available for increased digital bandwidth so that signals may be sampled proportionally faster for the same event duration. Pricing starts at $12,400 for a 4-channel TPCX-24014 and at $11,450 for a 4-channel TPCX-12014.

Elsys Instruments, Niederrohrdorf, Switzerland.+ 41(0)56 496 01 55. [www.elsys-instruments.com].

VITA 46/VITA 48 Board Features Dual Virtex-6 FPGAs



FPGAs are causing a true revolution in military embedded processing. The latest version 6 of the Xilinx Virtex line is feeding that flame. Riding that wave, Curtiss-Wright Controls Embedded Computing (CWCEC) has announced the CHAMP-FX3, the first rugged, high-performance FPGA OpenVPX 6U VPX board that features dual Xilinx Virtex-6 FPGAs. Available in both conduction-cooled and air-cooled versions, the CHAMP-FX3 provides dense FPGA resources combined with general purpose processing, I/O flexibility and support for multi-processing applications. It speeds and simplifies the integration of advanced digital signal and image processing into embedded systems designed for demanding Radar Processing, Signal Intelligence (SIGINT), ISR, Image Processing, Electronic Warfare applications.

The CHAMP-FX3 combines the dense processing resources of two large Xilinx Virtex-6 FPGAs (SX475T or LX550T) with a powerful AltiVec-enabled dual-core Freescale Power Architecture MPC8640D processor on a rugged 6U OpenVPX-compatible (VITA 65) form factor module. The CHAMP-FX3 complements this processing capability with a rich assortment of rear-panel I/O and memories, including a Serial RapidIO (SRIO)-based switching fabric, 16 high-speed serial links per FPGA, and 20 pairs of LVDS links to the backplane that can be used to support high-speed parallel interface such as Camera Link. For system expansion, the board also provides two (2) FMC sites (or a single FMC/VITA 57 site) and a PCI Express (VITA 42.3) or Serial RapidIO (VITA 42.2) XMC site. The FMC sites have been enhanced to support the next generation of FMC cards with 80 pairs of differential signals. Early Access Units will be available in Q1 2011.

Curtiss-Wright Controls Embedded Computing, Ashburn, VA.

(703) 737-3660. [www.cwcembedded.com].

Ethernet Data Acq Module Has Built-in ISO-Channel Technology

A new ultra-high-resolution Ethernet (LXI) data acquisition module for test and measurement offers simultaneous sampling of up to four fully isolated 24-bit inputs. Using proprietary ISO-Channel protection, each analog input on the DT8824 from Data Translation is galvanically isolated from any other input and has its own return path, which further enhances noise immunity. ISO-Channel technology utilizes galvanic isolation methods to guarantee 1000V isolation between any input channel to any other input channel and ±500V to earth ground. ISO-Channel vastly increases reliability by implementing a separate isolated return path for each 24-bit A/D converter used by the four input channels, all operating in parallel. A rugged enclosure for noise immunity is provided in a 1U, ½ rack small profile. The DT8824 includes a comprehensive software CD for making measurements quickly and easily and is priced at $2,495.

Data Translation, Marlboro, MA. (508) 481-3700. [www.datatranslation.com].

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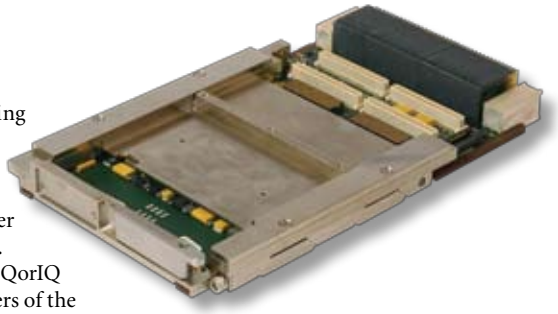
3U VPX SBC Features 8-Core Processor

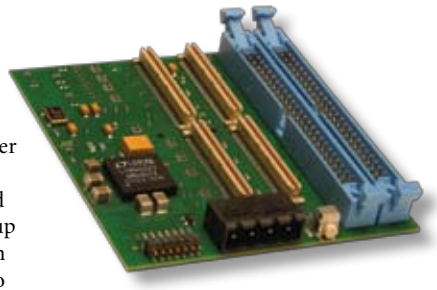


Compute-density is the watchword for many of today's advanced military applications. Feeding those needs, GE Intelligent Platforms has announced the rugged, OpenVPX-compliant SBC312 3U VPX single board computer (SBC). Designed for demanding space- and weight-constrained environments such as unmanned vehicles and based on the 8-core Freescale QorIQ P4080 processor, the SBC312 delivers substantial processing performance while maintaining power consumption and heat dissipation at the level of earlier dual core 3U VPX single board computers. The sixth 3U VPX SBC platform announced by GE, the SBC312—which is also available with the QorIQ 4-core P4040 processor—provides an optimum technology insertion opportunity for existing users of the SBC310 and SBC330, further enhancing their sustainable competitive advantage.

The SBC312 is available in five air- and conduction-cooled ruggedization levels for maximum reliability in military/aerospace applications, and is also available in VITA-48 format for 2-level maintenance. It features up to 4 Gbytes of dual channel DDR3 memory, and provides significant flexibility, allowing the SBC312 to be configured to precisely meet the demands of a broad range of applications and environments. Two x4 PCI Express Gen2 links are provided, each of which can be configured as four x1 PCI Express links. One link can be optionally configured as 10 Gigabit Ethernet. Two 1000BaseT ports are provided, together with two serial ports, two USB 2.0 ports, two SATA ports and up to eight GPIO ports. A PMC/XMC mezzanine site is also provided to enable application-specific functionality to be added.

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

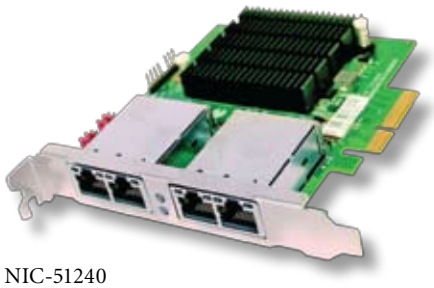
PMC Carrier Enables FPGA Modules in Stand-Alone Mode



A busless PMC module carrier card allows use of a PMC module in an independent stand-alone mode. The APMC4110 carrier card from Acromag delivers power to a PMC module and regulates the PCI bus start-up sequence to prevent a system lock-up by the connection to the local bus. The APMC4110 is suitable for custom computing applications based on a re-configurable FPGA module operating independently of VME, CompactPCI, or other bus-level resources. With the busless carrier card, no expensive card cage or other computer chassis is required. As a single-slot non-intelligent carrier, the board acts simply as an adapter to route signals to and from a PMC module. The user has full access to the field I/O via two 50-pin ribbon cable connectors. Pricing starts at $275.

Acromag, Wixom, MI. (248) 295-0310. [www.acromag.com].

PCI-E 2.0 Gbit Ethernet Adapter Includes Bypass Mode



For applications requiring increased throughput and High-Availability (HA) on server-based systems, American Portwell has introduced a new PCI-E Gen 2 (5 Gbit/s) quad copper Gigabit Ethernet adapter. Based on the Intel 82580EB controller, the NIC-51240 adapter includes a built-in watchdog timer (WDT) to switch to bypass mode for Ethernet ports on host system "hang" or power failure. Configuration of a selectable Normal/Bypass mode and software programmable WDT time-out setting is quick and easy. The new Ethernet adapter is PCI-E 2.0 5 Gbit/s solution-ready and backward compatible with PCI-E 1.0 2.5 Gbit/s bus. Its bypass function can be disabled completely for use as a regular Quad GbE port NIC-type adapter. NIC-51240's built-in bypass mode (failure or power-off) enables the unit to bypass a failed system and provide maximum uptime for the network.

American Portwell, Fremont, CA. (510) 403-3399. [www.portwell.com].

VME/VXS Board Offers Highly Connected Virtex 6 FPGA Processing

For today's advanced FPGAs it's not just about the on-chip signal processing. Getting data off and on the FPGAs is just as important. With all that in mind, TEK Microsystems has announced the first platform based on its next-generation QuiXilica-V6 architecture, bringing Xilinx's Virtex-6 FPGA technology to VME and VXS-based applications. The new QuiXilica-V6 VME/VXS baseboard combines three Xilinx Virtex-6 FPGAs with two QuiXmodule sites, supporting the industry's widest range of Analog-to-Digital Converter (ADC) and Digital-to-Analog Converter (DAC) resolutions and bandwidths using a common hardware architecture. Like previous generations of QuiXilica products based on Virtex II Pro and Virtex 5 technology, the QuiXilica-V6 VME/VXS is compatible with legacy VME systems as well as newer ANSI/VITA 41 VXS based systems in both laboratory and deployed / rugged applications.

The two front-end FPGAs are attached directly to the QuiXmodule sites, providing a simple and direct high-speed connection between the ADC and DAC devices and the FPGA. The third FPGA can be used to support additional processing and also any required protocol support for either front panel or backplane interfaces. All of the FPGA sites use the FF1759 package, which supports both LXT devices, optimized for high density logic, as well as SXT devices, optimized for digital signal processing.

TEK Microsystems, Chelmsford, MA. (978) 244-9200. [www.tekmicro.com].

Mini-ITX Motherboard Sports Core i7/i5/i3 Processors

A new industrial-grade, Mini-ITX motherboard supports the latest Intel Core i7/i5/i3 processors with LGA 1156 sockets. The Intel 45nm Core i7 and Core i5 700 series processors are quad core CPUs with integrated memory controller. The 32nm Intel Core i5 600 and Core i3 series processors are dual core with integrated graphics and memory controller, and Intel HD Graphics with DX10 support. The AIMB-280 from Advantech is capable of SATA RAID 0, 1, 5 & 10 to ensure reliable storage and system protection for network-intensive applications. The AIMB-280 comes with high connectivity and expansion options including: one PCIe x16 expansion slot, two serial ports, eight USB 2.0 ports and four Serial ATA II 300 Mbyte/s connectors.

Advantech, Irvine, CA. (949) 789-7178. [www.advantech.com].

VPX Board Family Packages Virtex-6 FPGAs for Mil Apps

The OpenVPX ecosystem has grown leaps and bounds over the past 12 months. In synch with that trend, Pentek unveiled the first in a family of ruggedized boards for high-performance military and avionics applications utilizing the industry's most advanced FPGA technology. Pentek's 53xxx Cobalt board family incorporates Xilinx's Virtex-6 FPGAs for onboard signal processing, delivering digital sampling rates to 1 GHz in a compact 3U VPX form factor. By combining processing, data conversion, and preconfigured functions, the 53xxx family is suitable for such applications as UAV, CommINT (Communications Intelligence) transceivers, airborne communications recorders, airborne radar countermeasures, shipboard diversity transceivers and armored vehicle anti-IED systems.

Pentek's 53xxx Cobalt family is the first to bring Virtex-6 FPGA technology to the VPX format. With more than twice the resources of previous Virtex generations, including new enhancements in digital signal processing, logic and clocking, the Virtex-6 family provides developers with a previously unavailable level of customizable processing power. Pentek gives the FPGA full access to all data and control paths and then harnesses its raw processing power by pre-configuring boards with key functions. This strategy provides a wealth of useful turn-key operations, while leaving enough unused FPGA capacity for adding customer-developed IP.

All Cobalt VPX products are available with a choice of Xilinx Virtex-6 LXT or SXT FPGA devices to match the application. Other common features of Cobalt boards include PCI Express (Gen 2) interfaces up to 8 lanes wide, synchronous clocking locked to an external system reference, and an LVPECL synch bus for synchronizing multiple modules to increase channel count. The Cobalt 53xxx 3U VPX module pricing starts at $14,490.

Pentek, Upper Saddle River, NJ. (201) 818-5900. [www.pentek.com].

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CURTISS WRIGHT Controls Embedded Computing

CHAMP-AV5 Multi-processing Board

The CHAMP-AV5 VME64 multi-processing board is powered by two 2.53GHz dual-core Intel® Core i7 processors, delivering up to 81 GFLOPs. It features 17GB/s (peak) DDR3 memory, high-bandwidth PCI Express® (PCIe), 16Gbyte flash, 4GB SDRAM, and two mezzanine sites. Applications include radar, signal intelligence and image processing.

Curtiss-Wright Controls Embedded Computing

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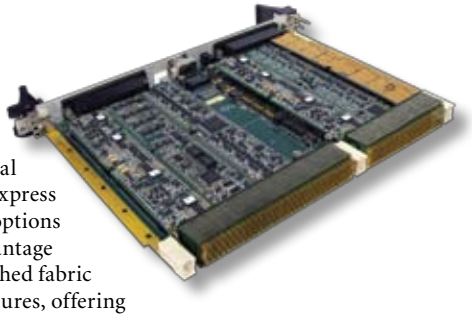
Web: www.mc.com

6U, OpenVPX I/O Card for Multifunction I/O and Serial Comms



A new single-slot, OpenVPX, 6U, multi-function I/O and serial communications card supporting VME, Gigabit Ethernet and Serial RapidIO (sRIO) or PCI Express (PCIe) control interface options enables users to take advantage of the higher speed, switched fabric communication architectures, offering significantly greater capability. The 67C3 from North Atlantic Industries contains six independent module slots, each of which can be populated with a function-specific module and can now be controlled by VME, dual Gigabit Ethernet and sRIO or PCIe. The 67C3 is available with an operating temperature range of -40° to +85°C. Pricing for a rugged, conduction-cooled 67C3, configured with 96 programmable 0 to 60V discrete channels, starts at $9,982 in quantities of 100 or more.

North Atlantic Industries, Bohemia, NY. (631) 567-1100.

[www.naii.com].

Handheld Digital Multimeters Suit Rugged Applications

Agilent Technologies has announced the U1270 Series of handheld digital multimeters (DMMs), setting new levels of performance in industrial handheld DMMs. This series offers a wide range of measurement capabilities; including feature sets that are found only in higher end industrial handheld DMMs. The U1270 Series allows engineers and technicians to make faster, more accurate measurements. The new DMMs include capabilities such as low impedance mode to eliminate stray voltages, and low-pass filtering to remove noise that distorts voltage and current readings. The new Smart Ohm function helps ensure confidence in results by minimizing false readings due to leakage current.

To enhance usability, the DMMs have a slim, easy-to-grip profile and controls that are easy to operate, even when wearing heavy gloves. The U1270 Series are the world's first DMMs to feature a flashing backlight as visual alert to enhance continuity checks in dark, noisy environments. The IP54-certified U1270 Series expands Agilent's range of handheld DMMs that are CAT III 1000V and CAT IV 600V compliant. The U1250 Series delivers features and accuracy to optimize electronics troubleshooting. Prices are $340 for the U1271A handheld DMM and $370 for the U1272A handheld DMM.

Agilent Technologies, Palo Alto, CA. (650) 752-5000.

[www.agilent.com].

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Rugged Box Embeds Core2 Duo Processor

Kontron has made several key feature enhancements to its Kontron high-performance embedded computer COBALT (Computer Brick Alternative). New features to the highly versatile and rugged baseline platform include the addition of a DC power supply and additional customizable I/O capabilities that are particularly suited to meet the rugged and harsh environmental demands of control systems in new military vehicle applications. This small, low-profile box-level system meets the military's Size, Weight and Power (SWaP) requirements and features a no-backplane design that is both reliable and cost-effective. The Kontron COBALT is a fanless, fully enclosed design for efficient thermal management in a small 6.5 x 9.725 x 2.95-inch (165.1 x 247,015 x 25.4 mm) form factor weighing less than 5.5 (2.5 kg) pounds.

The embedded module-based system enables designers to have full development flexibility allowing them to scale the computing performance based on specific application requirements from a very low power Intel Atom processor-based implementation to a Core2 Duo processor system. The rugged embedded computer can be configured for either 28 VDC (complying to MIL-STD-1275 or MIL-STD-704) or 115 VAC input power to provide compatibility with full range of ground vehicle, UAV, airborne or shipboard requirements.

Kontron, Poway, CA. (888) 294-4558. [www.kontron.com].

VPX Cube Offers 3U Conduction-Cooled Enclosure

A ruggedized 4-slot conduction-cooled enclosure for VPX 3U modules is designed to MIL-STD-810F, DO-160E and MIL-STD-461E standards, and is compliant with applicable VITA 46 (VPX), VITA 48 (REDI) and VITA 65 (OpenVPX) specifications. The CCE-3VPX4 VPX Cube from Dawn VME Products features 4 slots of 3U VPX on a 1" pitch high bandwidth backplane and an integrated, wide temperature range 400W power supply. The chassis is cold plate base-coupled, conduction cooled. Its short and efficient thermal conductivity path provides for robust cooling performance and maximum power dissipation. Operating temperature range is -40° to +85°C. Full environmental sealing ensures reliable, all-conditions operation.

Dawn VME Products, Fremont, CA.
(510) 657-4444.
[www.dawnvme.com].

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Special Feature: Embedded Electronics in Small UAVs The flight control, mission control and communications gear aboard Small UAVs—like the Raven, Dragon Eye, Shadow and Killer Bee—face some of the most rigorous size, weight and power restrictions. Selecting the right embedded electronics and embedded computers in those systems becomes a make or break decision. This section focuses on the electronics aboard UAVs under 1,320 pounds and range from Line-of-sight control UAVs up to those that fall under the "light sport aircraft" standards.

Tech Recon: Graphics Chips get Drafted for Military Processor Duty Leveraging cutting-edge graphics chips developed for the demanding gaming market, military graphics subsystems are now able to offer complex video and graphics functionality in highly integrated board-level solutions. Cockpit display upgrades and simulation/training applications rank as two of the most demanding users of these advanced graphics technologies. Articles in this section examine the graphics solutions available in PMC, XMC and other form factors, as well as a product roundup of display interface products.

System Development: Trends in Pre-Testing Box-Level Solutions A stand-alone rugged box is an integrated system that typically comprises a set of modular embedded boards housed in a rugged enclosure that has its own power supply and interface ports to link to a variety of user terminals. Stand-alone rugged boxes are typically sold as a complete working system, often with some degree of environmental testing done beforehand by the vendor. This section examines the pre-testing available with today's crop of rugged box-level systems.

Tech Focus: XMCs and Processor XMCs XMCs are becoming entrenched as the natural successor to PMC as the leading mezzanine form factor in military applications. Meanwhile, fabric-based Processor XMCs accommodate that trend nicely, enabling military system integrators to swap out just the computing core and leave the base board unchanged. This Tech Focus section updates readers on these trends and provides a product album of representative XMC and PrXMC products.

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Editorial

Jeff Child, Editor-in-Chief

We Disrupt This Communication

After years of hard work, setbacks, technology hurdles and reorgs, the DoD's Joint Tactical Radio System (JTRS) program is on the verge of reaching its goal of widespread deployment. With low rate initial product of JTRS radios on deck for next year, its time is nearly at hand. The timing thought is filled with irony and perhaps bad karma because this is happening at a time when consumer smartphones have seriously overlapped the capabilities that JTRS radios provide. JTRS is a multifaceted program, but the segment of handheld JTRS radios is particularly faced with this issue. With phones like the iPhone, Droid and Blackberry so familiar to warfighters, there's a strong pull to adapt consumer smartphone technology for military use. This theme loomed large at the MILCOM conference in San Jose earlier this month where exhibitors showcased solutions built around devices like the iPhone, iPad and others. Other similar efforts have emerged in recent months from DARPA and various military primes.

At Milcom Lockheed Martin showed off its MONAX solution. The idea of MONAX is to put a sleeve attachment on an off-the-shelf iPhone or other smart-phone and combine that with a deployed network that enables iPhones to operate as military-specific software defined radios in theater. MONAX is an enhanced version of commercial 3G wireless operating on non-traditional frequencies. The two parts include a portable MONAX Lynx sleeve that connects touch-screen smartphones to the MONAX XG Base Station infrastructure on ground or airborne platforms, offering uninterrupted service to soldiers in the field. The system includes a set of apps for situational awareness and command and control, facial recognition for checkpoint use, enterprise intelligence, surveillance and reconnaissance (ISR) data access, cyber security situation awareness and protection, and a starter set of mission reports for automation.

While Lockheed's MONAX makes use of actual consumer phones like the iPhone, General Dynamics Itronix offers a more custom build solution with its GD300, a rugged arm- or chest-worn computer. Weighing less than 8 ounces, the Android-based GD300 operates like an ultra-sensitive commercial GPS unit or, with the click of a cable, interfaces with tactical radios like the Rifleman Radio (AN/PRC-154) for secure access to the tactical network. The GD300 uses a quadra-helix antenna for real-time global positioning that defies interference even when the user is positioned in mountainous regions or urban environments. The GD300 hosts the open architecture, Android-based operating system to easily accommodate current and emerging applications for warfighters at all command levels.

DARPA meanwhile is actively pushing for more leveraging of the smartphone revolution. In an RFI released back in March, DARPA cites in its own words that "A soldier's radio, for example, has very limited data capability and essentially no multimedia capability. Current language translation devices support neither messaging nor collaboration of any form. This inflexibility in function is further exacerbated by the military's own acquisition process, a process that can take years to complete and involves an unwieldy linear process of formal requirements definition, technology development, and system certification." With that in mind DARPA RFI seeks to discover sources of commercial and noncommercial apps with potential relevance to the military specifically and the national security community more generally. DARPA's initial interest will focus on apps developed on the iPhone or Android platforms that can be used today with little or no additional research and development expenses.

The idea of military-specific iPhone apps isn't new. December of last year, Raytheon rolled out intuitive situational awareness applications for the iPhone such as a compass, global positioning system, accelerometer, 3G networks, Wi-Fi and a multi-touch screen. Raytheon also designed other innovations for the device, including disruptive-tolerant networking, content-centric networking and augmented reality, incorporating security guards for tactical operations. The company developed a situational awareness application based on military messaging standards that provide multimedia access, audio and textual point of interest, free text messaging, collaborative planning, spot reports and emergency call for fire.

It's hard to say whether comparing an adapted iPhone to a military-specific JTRS radio is apples and oranges. But there's no doubt that an iPhone is incredibly familiar to many warfighters. That means orders of magnitude less training than is required for something like a JTRS handheld radio. The argument about security also comes into play and the notion that smartphones are definitely not built with all made-in-the-USA components. That said, in terms of obsolescence, a high volume smartphone is far more likely to have commercial forces keeping it, and its parts, ready and available. Could all this relegate JTRS handheld radios to niche military uses? Maybe. It wouldn't be the first or last time a disruptive technology has usurped another and changed the rules of the game. ▮▮

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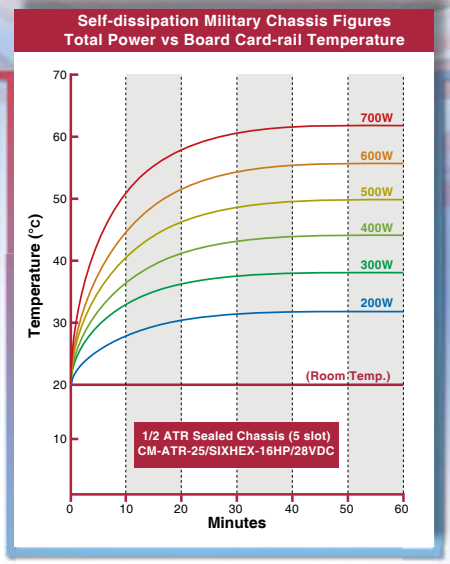

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		28VDC	OTHER †	+5VDC	+3.3VDC	+12VDC	-12VDC	VME64	cPCI	VPX	Excluding Rear Fans
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	A-575W		✓	40A	22A	12A	12A	✓			850W
	B-450W	✓		20A	45A	8A	8A		✓		700W
	B-550W		✓	20A	45A	12A	12A		✓		800W
	C-475W	✓		20A	22A	16A	8A			✓	700W
	C-575W		✓	20A	22A	21A	12A			✓	850W

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