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The Journal of Military Electronics & Computing

Tech Focus: Small Form Factor Boards Roundup

MULTIFUNCTION BOARDS DELIVER I/O SYNERGY

PLUS:

Rugged Box-Level Systems Tackle Power Hurdles

Exclusive Interview: General Peter Pace, Former Chairman of the Joint Chiefs

Volume 12 Number 8 August 2010 cotsjournalonline.com

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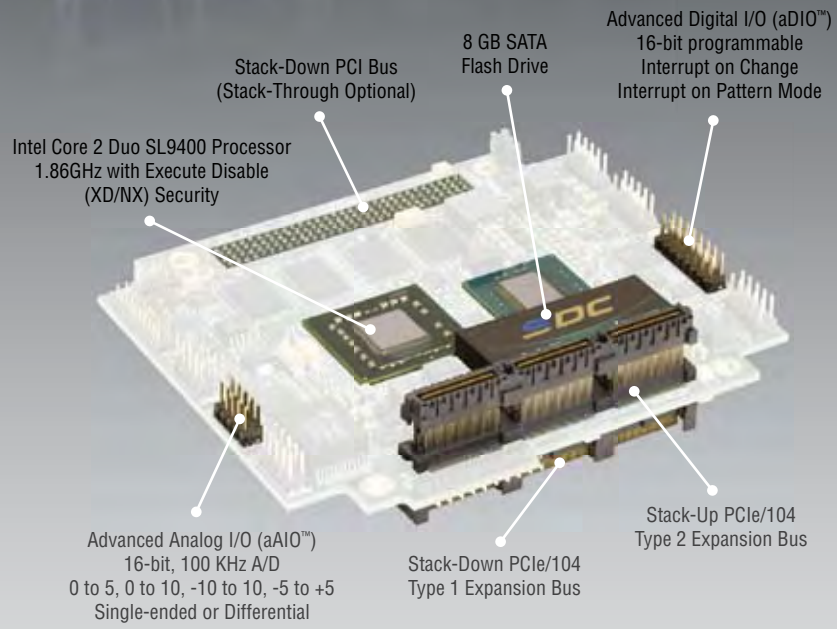

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†*See figure on left for details*
‡*See web site for details on each model*

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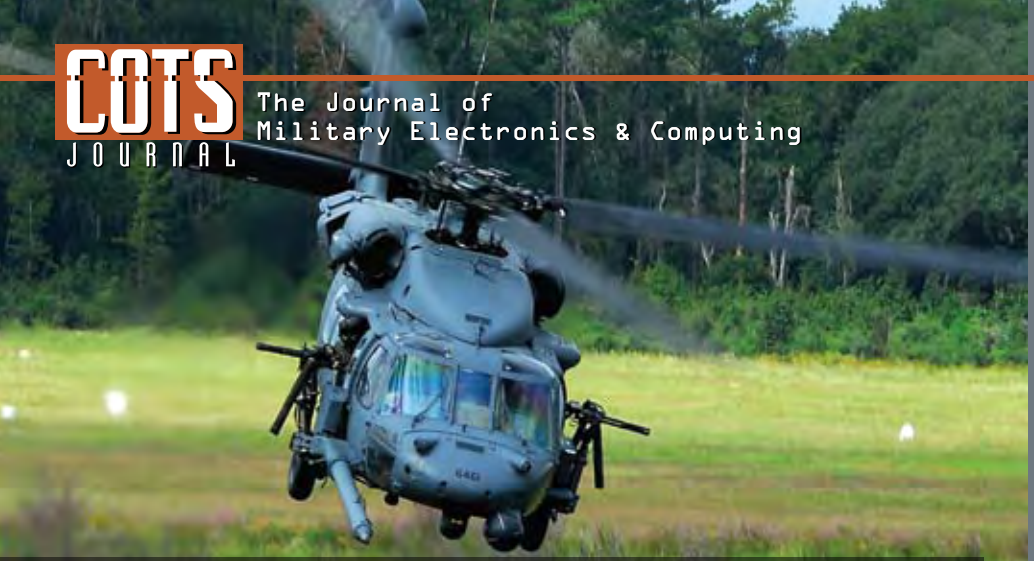

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COTS (kots), *n.* 1. Commercial off-the-shelf. Terminology popularized in 1994 within U.S. DoD by SECDEF Wm. Perry's "Perry Memo" that changed military industry purchasing and design guidelines, making Mil-Specs acceptable only by waiver. COTS is generally 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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GCV Inching toward Reality

Coming in September
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On The Cover: An upgrade to HH-60G Pave Hawk helicopter integrates all communications and navigation information into one control display unit. The new Pave Hawks are equipped with electronic countermeasures that detect enemy radar and missile threats. These communications, navigation and electronic warfare systems are linked via 1553 data buses. Shown here, two HH-60G Pave Hawks land during a personnel recovery training exercise. (U.S. Air Force photo/ Senior Airman Noah R. Johnson)

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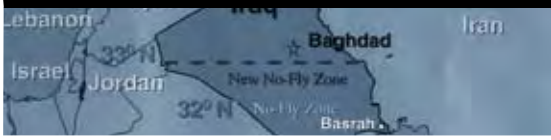

Multiple Vendor Fairy Tale

Even the military is following the trend of consumer electronics—more functionality, smaller, less power and cheaper. The only problem is that the military can't accept a "use it for 18 months then throw it away" policy. In decades past, every one of those goals was a compromise for the military—and cheaper was never able to become part of the consideration. Engineers had a limited amount of allowable space, weight and power to play with—which usually meant they had to compromise on any extra capability and performance.

Non-Developmental Items or COTS products found the majority of their home in existing platforms requiring upgrades or technology insertions. Having to go into existing platforms set the parameters of how much space, weight and power the upgrade was restricted to. Increased silicon performance and integration advancements meant a program could usually get the functionality needed while at the same time adhere to the durability requirements of the system and its constraints within the end platform.

Most systems—at least vetronic systems—use the ATR (Air Transportable Rack) as the common denominator for system envelope classification. These are defined as ATR-Long, ATR-Short, ½ ATR and ½ ATR-Short. This is similar in concept to the way the embedded board industry divides up bus board sizes: 9U, 6U and 3U. What's happened recently is that, in some cases, the available system envelope within a platform has exceeded the space required to accomplish all the specifications of the upgrade. This results in upgraded ATR systems with empty board slots. And in some cases the ongoing advancements in silicon have brought the level of board integration to the point where an upgraded ATR system contains just one board providing all the processing upgrades and enhancements of the system it is replacing.

ATR systems evolved as containers around the necessity to internally interconnect different electronic modules/boards. In previous decades parallel bus technology was used as the interconnection; more recently, serial and serial/parallel bus technology have become the backbone of these systems. Multiple board systems also played into the military's desire to have systems with a 20-year availability. Bus boards allowed for a fairy tale concept of having multiple vendors. These vendors could in theory provide similar substitute boards if a vendor could no longer provide a board—or if a vendor was acquired by another company and the product was discontinued.

The real truth is that if an element—such as a board—within a pre-integrated system has to be replaced with a board that isn't a direct substitute, then the system needs to be requalified. And more than likely the application software also needs to be modified and then requalified. Any end-user or platform supplier will tell you, the last thing anyone wants to do is to get into the application software. That was what the multi-vendor fairy tale concept was intended to eliminate. Often times when a one to one board replacement isn't possible, it justifies an entire pre-integrated system review. There was no fairy tale salvation and no insurance if a vendor or their product disappeared.

Even for the military, there will always be a demand for computing performance that's higher than the current technology can provide. Today there are large high-performance systems using several xTCA and OpenVPX boards on one end of the spectrum and single board PC/104 or small proprietary systems on the other. As a result of silicon advancements, we're now at the point where we're seeing cases where a single computational element (small board or box) performs all the tasks necessary for a particular subsystem. In some respects these single element systems may actually fulfill some of the fairy tale concept. That's because the application software in those systems has no need to consider the interplay between the elements within. Since there's only one element, the software only needs to control signals in and out. The single element supplier—or replacement supplier—is responsible for everything going on inside. Now that may be wishful thinking, and the replacement vendor can't always emulate previous system operation, but at least it makes sense in theory.

It does seem strange to be looking at a vehicle's system bay and see a very small metal box in place of what was once a ½ ATR-Short system. Even stranger looking, that small box—only a fraction of the size of the ATR it replaced—sports what now looks like two oversized connectors going into it. New platforms, especially UAVs, are not constrained with the ATR legacy form factor and are taking full advantage of fully contained non-bused single supplier systems as they become available. Perhaps what is needed is a new envelope standard to replace the old ATR envelopes. And something with a little vision for the future wouldn't hurt either. Now where's that tooth fairy? ▮▮

Pete Yeatman, Publisher
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The Inside Track

Curtiss-Wright Inks Contract for Terrier Engineer Support Vehicle Program

BAE Systems has awarded a $4 million contract to Curtiss-Wright Controls to provide two packaged commercial-off-the-shelf (PCOTS) integrated processor subsystems for use in the Terrier (Figure 1) general support engineer vehicle for the British Army. The multifunction Terrier is an air-transportable, tracked, armored, engineer vehicle that performs obstacle and mine clearance, digging of trenches or fortifications for equipment and troops, route opening and maintenance and general engineering tasks.

Curtiss-Wright designs and manufactures the "Special-To-Role" and "Drive-By-Wire" subsystems, which provide overall electronic control of the vehicle and the capability to operate the vehicle remotely in high hazard conditions, such as mine clearing. The subsystems integrate a number of modular COTS cards, additional I/O and data storage within a rugged, high-performance package to withstand extreme environments, from desert heat to arctic cold. Curtiss-Wright will design, develop and manufacture the PCOTS systems for Terrier at the company's Embedded Computing facility in High Wycombe, England. The contract began in 2009 and is expected to continue for five years.

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

Figure 1

The Terrier is the British Army's air-transportable, tracked, armored, engineer vehicle that performs obstacle and mine clearance, digging of trenches or fortifications for equipment and troops, route opening and maintenance and general engineering tasks.

Cobham Chosen for Global Hawk Unmanned Aerial Refueling Demo Program

Northrop Grumman has selected Cobham Mission Equipment as a major subcontractor for the KQ-X program. This DARPA (Defense Advanced Research Projects Agency) program will demonstrate autonomous aerial refueling between two unmanned NASA Global Hawk aircraft. Cobham Mission Equipment will be providing the hose and drogue refueling system in addition to engineering support and aerial refueling expertise.

Cobham Mission Equipment provides a "wingtip to wingtip" capability offering a comprehensive range of weapons carriage and release equipment including missile launchers, cryogenic cooling for missile seekers, pneumatic missile fin actuation and wing store carriers, bomb ejection, defensive aids, chaff and flare systems. Cobham also provides air-to-air refueling, including fourth generation "nose to tail" solutions from the cockpit of the donor aircraft to the tail of the receiver platform. More than 1,000 systems have been delivered for buddy-buddy refueling, tactical and strategic tanking for fixed wing aircraft and helicopters, with UAV development well advanced.

Cobham Mission Equipment
Wimborne, United Kingdom
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[www.cobham.com].

BAE Systems and Northrop Grumman Add to Their GCV Team

BAE Systems and Northrop Grumman announced additional members to their GCV team in their bid for the U.S. Army's Ground Combat Vehicle (GCV) competition. The new GCV team-mates include QinetiQ North America and Saft. QinetiQ North America will provide the electric drive propulsion system or E-X-Drive for Ground Combat Vehicles. The E-X-Drive is the key component of the hybrid electric drive system, which minimizes electrical demand, saves on vehicle fuel costs, improves reliability, provides higher dash speed and acceleration and increased onboard and off-board power. Saft will provide the energy storage system for the GCV (Figure 2).

As the prime contractor, BAE Systems will continue to provide the overall program management and systems integration for GCV, and will also be responsible for providing the vehicle design, structure, logistical support as well as the readiness and sustainment of the platform. Northrop Grumman will serve as the C4ISR

Figure 2

A graphic rendering of the BAE Systems-Northrop Grumman GCV design. The vehicle will employ a host of open architecture electronics.

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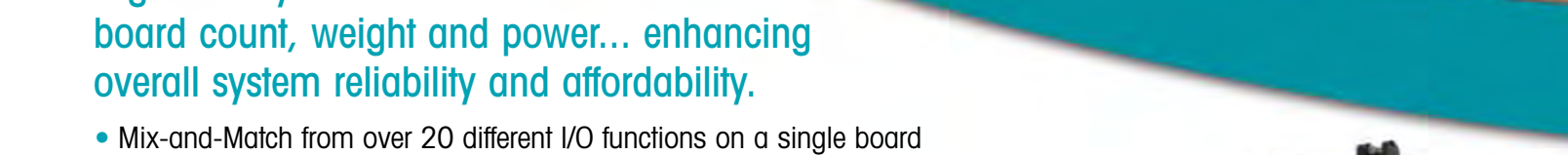

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(command, control, communications, computers, intelligence, surveillance and reconnaissance) lead. The BAE Systems-Northrop Grumman GCV offering is said to be the first combat vehicle designed from the ground up to operate in an IED-threat environment. It will offer an integrated electronic network capability and embedded intelligence, surveillance and reconnaissance assets to connect the warfighters. The open architecture electronics will also be adaptable to future network upgrades as new technologies mature.

BAE Systems
McLean, VA.
(703) 847-5820.
[www.baesystems.com]

Army Taps ViaSat to Supply Next Gen Blue Force Tracking

ViaSat has received a $477 million IDIQ contract to supply the next generation of high-speed, high-capacity, low-latency Blue Force Tracking (BFT) equipment to the U.S. Army as part of the Force XXI Battle Command Brigade and Below (FBCB2) Program. In addition to being selected as the provider for this faster and more accurate command and control satellite communication system, ViaSat also received the first delivery order for $37.7 million to fund deliveries of first article and initial production terminals and other ground networking equipment.

Armed forces use BFT to view regularly updated troop positions on screens in vehicles and aircraft to differentiate between friendly and enemy forces. These awards signal the transition of the BFT program from a proprietary network to BFT-2, an open IP-standard communication network. Previously, ViaSat had delivered prototype second-generation BFT-2 terminals under contract to Northrop Grumman, and then a Low Rate Initial Production (LRIP) award from the U.S. Army for system testing. The units met network capacity requirements and demonstrated data throughput that far exceeded specifications. The efficiency gain and latency reduction improve situational awareness and accuracy, and enable satellite channels to accommodate more simultaneous users and messages.

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[www.viasat.com].

L-3's Cockpit Display Flies on F-35 BF-4 Mission Systems Aircraft

L-3 Display Systems announced that it has successfully flown its F-35 Joint Strike Fighter lightweight, high-performance Panoramic Cockpit Display (PCD) subsystem on the Lockheed Martin BF-4 Mission

Military Market Watch

U.S. Military Fixed-Wing Aircraft Spending Forecast

U.S. Defense Aerospace in 2010 is led by platforms and technologies for counter-insurgency and counter-terror operations. These complex missions will continue to require robust funding for a wide variety of spacecraft, aircraft, weapons and services. Total Military aircraft sales are expected to increase about 2.0 percent in 2010 to 64.0 billion (Figure 3). Led by the U.S. armed forces, there will be fewer, but more capable multi-mission airframes. Increased buying in Asian and Middle Eastern countries in 2010 will not offset the military spending cuts in Europe; total exports will be down from 2009 levels. Despite an emphasis on fixed price contracts to encourage the use of mature commercial technologies, defense aerospace industry employment and profits should remain stable. A variety of COTS-based ruggedized hardware technologies continues to be successfully applied to these aviation programs. The U.S. DoD demand for aviation electronics continues to be strong, especially for rugged applications that maximize SWaP efficiencies.

The U.S. Navy is building a replacement aircraft for the P-3, the Boeing Multi Mission Maritime aircraft that will focus on open ocean surveillance and strike. India is the first foreign customer. Shortages of medevac, ground attack and transport aircraft were keenly felt in 2009, especially by allied forces in Afghanistan, and are now being addressed. The Osprey tilt-rotor built by Bell-Boeing made its first operational deployment with the U.S. Marines in 2009 and production will continue in 2010 along with Air Force and Special Operations Command deployments. The manufacturing of F-22 and F-35 fighters by Lockheed Martin continues with partners and customers in at least eight countries.

Other market segments that will continue to have very heavy contract activity and margins in 2010 include training aircraft, spare parts and logistic and maintenance services. The 2010 focus on counter-insurgency and counter-terror missions combined with an extremely high operations tempo will stress airframes, engines, avionics and sensors. In 2010 and the years that follow, there will be increased maintenance contracts and avionics upgrades. For more information please contact Brad Curran of Frost & Sullivan at: Brad.Curran@frost.com.

Figure 3

Total military aircraft sales are expected to increase about 2.0 percent in 2010 to $64 billion.

Frost & Sullivan
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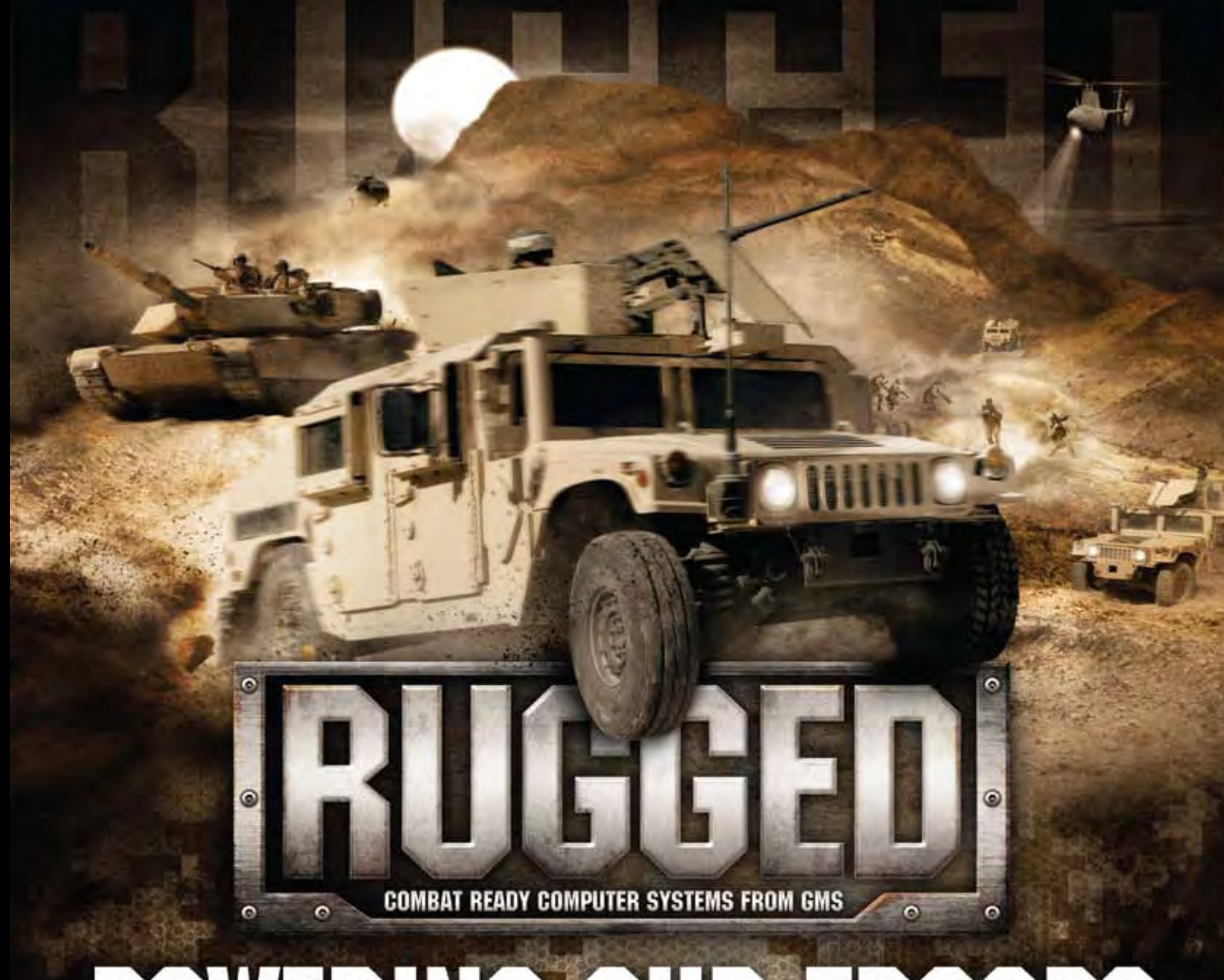

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Systems Aircraft (Figure 4). The next-generation lightweight panoramic display and processing technology provides the F-35 BF-4 situational awareness and sensor fusion. L-3's PCD features the largest monolithic large area display (20"x8") available in the military market, as well as a high-performance, highly reliable computer/graphics processor, both of which are fully redundant. The PCD supports the Lockheed Martin Operational Flight Program (OFP) and is optimally engineered to support the mission-critical needs of the F-35 sensor-centric fifth-generation fighter.

The BF-4's general test objectives include providing data for mission systems Block 0.5 functionality in the F-35 flight environment to evaluate hardware and software implementation and integration, and providing data to support mission systems component development. The Block 0.5 software incorporates important capabilities, including air-to-air search and synthetic aperture radar modes, identification friend/foe transponder, integrated UHF/VHF radios, electronic warfare radar warning receiver, and navigation functions. Information is presented to the pilot through state-of-the-art cockpit and helmet displays.

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Figure 4

F-35 BF-4, a short takeoff/vertical landing (STOVL) variant, was used for testing the AESA radar, EW, ICNI, ICP, GPS, INS and HMDS systems.

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Jeff Child, Editor-in-Chief

While the dramatic benefits of Moore's law are obvious with processors and memory—faster speeds, more density—the I/O realm enjoys the constantly increasing levels of semiconductor integration too. The advent of ever more integrated chip solutions has enabled multifunction board products to emerge, enabling military system designers to blend a variety of I/O functions onto a single stand-alone card. These multifunction I/O boards are reaching across a number of form factors including PMC, XMC, AMC, PC/104 and PCI Express. Makers of such boards have had to be clever in choosing I/O technologies that are suited for use together. Among the most successful areas along those lines is the strategy of mixing multiple channels of 1553, ARINC-429, Serial I/O and other interfaces on one card. Other functions such Serial FPDP and Ethernet are also moving onto multifunction solutions.

The need to support legacy MIL-STD-1553 bus networks plays big in the multifunction board space. Though many decades old now, 1553 is used in a wide variety of systems such as tanks, ships, missiles and satellites. For example, the workhorse military transport C-130J Hercules (Figure 1) has a 1553 data bus linking its mission computers and backup bus interface units. The aircraft's network monitors and records the status of the aircraft's structure and systems. Several vendors continue to support 1553 with board-level solutions that provide 1553, often included with other functions. Among those vendors are ACCES I/O Products, AIM-USA, Ballard Technology, Critical I/O, Curtiss-Wright, Data Device Corp., Excalibur Systems, GE Fanuc and Kontron America.

Ethernet and 1553

If there's one interconnect that seems to have emerged as the great "glue" technology for the military, that's Ethernet. The conflict between the needs of net-centric communication and the current situation where the vast majority of

Figure 1

The C-130J Hercules, a workhorse transport aircraft for the military, has a 1553 data bus linking its mission computers and back-up bus interface units.

basic military equipment interconnects via MIL-STD-1553 can be easily resolved with the use of "Network Bridges" to these legacy data buses. Such a "Bridge" is now available from MBS Electronic Systems, which offers autonomous connectivity between MIL-STD-1553 and Full Duplex Gigabit Ethernet. This FPGA-based standalone module (Figure 2) is one of a family of Gigabit Ethernet interface modules, referred to as ÆSyBus modules, which provide a low latency connection to a range of military and aerospace data buses using UDP/IP protocol. The open source nature of this solution, combining Ethernet and UDP/IP protocol, allows these devices to be easily accessed by any networked computer and operating system without the need of any additional drivers or software infrastructure. Furthermore, these devices can be accessed simultaneously by up to 10 separate computers, which can individually log on to the module, configure and control its resources and automatically receive status and data messages, periodically or as needed.

The MIL-STD-1553 ÆSyBus Module can be configured to operate as a bus controller, remote terminal or passive monitor. In all cases, terminal/bus status is collected with receive data for automatic transfer to the applications in accordance with the configured requirements of the user. A configurable hardware scheduler is also provided for accurate scheduling commands when operating as a bus controller. The modules are available in a robust conduction-cooled enclosure, with build options to meet various environmental conditions, or as interface cards that slot into a VME I/O-type enclosure.

Sensors Data Via Ethernet and FPDP

The military has warmed completely to the idea of using Ethernet as a high-performance interconnect technology. Its ubiquity and longevity make it hard to resist. Applying Ethernet to wide-band sensor I/O, Critical I/O offers SensorLink (Figure 3), a board-level solution that allows wideband sensors to be easily connected to, and managed over, 1 Gbit and 10 Gbit Ethernet networks. SensorLink enables system designers to implement an Ethernet "Sensor Fabric" for high-performance systems. The FPGA-based board is a fully self-contained sensor-to-10 Gbit Ethernet bridge. It bridges multiple parallel sensor data ports that can be configured as industry-standard parallel FPDP and FPDP II, high-speed parallel LVDS, or PCIe-to standard 1 Gbit or 10 Gbit Ethernet, without the need for any host processor at the sensor.

With SensorLink, Ethernet data networks can be applied to even the most demanding real-time applications such as radar, data acquisition, sonar, FLIR, SIGINT, video distribution and signal

Figure 2

This FPGA-based board is one of a family of Gigabit Ethernet interface modules, referred to as ÆSyBus modules, which provide a low latency connection to a range of military and aerospace data buses using UDP/IP protocol.

processing. Completely self-contained and requiring no host processor, SensorLink allows sensor data to be streamed at wire speed with very low latency to other devices connected to the Ethernet network such as signal processors, workstations, storage devices or other SensorLink devices. SensorLink also greatly simplifies the management of sensors by allowing remote processors to configure, control and monitor them through the same Ethernet connection without interrupting the sensor's real-time data flow. SensorLink allows system developers to directly leverage standard Ethernet networks without investing many man-years in software and compatibility testing.

Multifunction I/O on the Desktop

Multifunction I/O solutions are also moving onto the desktop for military system developers to do their development and test work. An example is Ballard Technology's LP429-5 (PCI) and LE429-5 (PCIe) PC expansion cards for communicating with ARINC 429 and ARINC 717 systems. These feature-rich interfaces provide programmable dual redundant data buffers and deep built-in memory. Models offer 4 to 32 ARINC 429 channels, and up to 4 ARINC 717 channels, 16 input/output avionics level discretes, and IRIG time synchronization/generation. Avionics discretes can be used as general purpose I/O or linked in hardware to databus activity as triggers or syncs.

The Lx429-5 products support maximum data throughput on all avionics interfaces. Each channel is independently configurable for high or low speed operation. Messages can be captured by a sequential monitor for all channels, or via individual message monitoring. Notification of databus activity is handled through the onboard Event Log, which can be processed by polling or via an interrupt. To dramatically reduce the host CPU processing, the sequential monitor has a DMA mode that automatically moves records to host memory through PCI/PCIe bus mastering.

Figure 3

SensorLink provides a fully self-contained sensor-to-10 Gbit Ethernet bridge. It bridges multiple parallel sensor data ports that can be configured as industry-standard parallel FPDP and FPDP II, high-speed parallel LVDS, or PCIe-to standard 1 Gbit or 10 Gbit Ethernet, without the need for any host processor at the sensor.

A Variety of Military I/O

Another important trend affecting military I/O is the emergence of multifunction board products. Semiconductor integration has enabled board-level products to cram multiple functions on a single card. Along just such lines, North Atlantic Industries (NAI) has made available ARINC 429/575 support for its wide range of VPX, VME, cPCI and PCI Multifunction boards. Known as the A4, it joins an extensive list of functions that are currently available from NAI. The ARINC 429/575 A4 provides up to six programmable ARINC-429/575 channels. Each channel is software selectable for transmit and/or receive, high or low speed, and odd or no parity, supporting multiple ARINC 429 and 575 channels simultaneously.

One major advantage of this multifunction approach is higher functional density, which reduces overall board count, thereby saving space and cost, reducing heat dissipation and increasing overall system reliability. Other available functions include A/D, D/A, Synchro/Resolver/ LVDT/RVDT Simulation and Measurement, CANBus, MIL-STD-1553, Synch/Asynch RS232/422/485, Discrete, TTL/CMOS, Reference Generator, Differential Transceiver and Resistance Temperature Detectors (RTD). The ARINC 429/575 function is supported on VPX, VME, cPCI and PCI Multifunction Boards with operating temperature ranges of -40° to +85°C and 0° to +70°C.

Small Form Factor Solutions

The era of the multifunction board has encroached on the PC/104 space too. Serving those needs, Data Device Corp. has teamed with Advanced Digital Logic (ADL) to supply PC/104-Plus and PCI-104 cards for use in applications that require MIL-STD-1553 or ARINC 429 interfaces. DDC and ADL have proven interoperability of DDC's BU-65578C MIL-STD-1553 card and BU-65590C Multi I/O (1553 and 429) card with the ADL systems.

DDC's cards (Figure 4) provide a mix of MIL-STD-1553 and ARINC 429 receive/transmit channels along with user-programmable digital discrete or avionics discrete I/O, selectable external

or internal time-tag clock, and an IRIG-B time synchronization input and output. The cards have an intelligent hardware offload engine that dramatically reduces PCI bus and host CPU utilization, while storing 1553 monitor data in a convenient and portable IRIG-106 Chapter 10 file format.

Another small form factor I/O approach is the Pico-I/O small form factor line of products from ACCES I/O Products. Its new model PICO-II8IDO4A is designed for expansion on Pico-ITXe single board computers. This dense, multifunction product features eight individually optically isolated inputs, four fully protected solid-state FET outputs capable of switching up to 3A each, and two 16-bit analog inputs. The circuit isolation makes the module ideal for use in control and instrumentation applications where high-voltage protection is required. Individual channel-to-channel isolation allows every channel to be physically and electrically separated from the others. In addition, the two 16-bit analog inputs provided by the PICO-II8IDO4A allow for the monitoring and control of a variety of system parameters such as temperature, voltage, humidity and more.

Figure 4

The BU-65590C Multi I/O (1553 and 429) cards provide a mix of MIL-STD-1553 and ARINC 429 Receive/Transmit Channels along with user-programmable digital discrete or avionics discrete I/O, selectable external or internal time-tag clock, and an IRIG-B time synchronization input and output.

The tiny module occupies just half the area of a PC/104 board yet approaches the capability commonly found on the larger board standard. The PICO-II8IDO4A is especially useful in applications where high common-mode external voltages are present. Isolation is required to guard electronics from transient voltage spikes and offers greater common-mode noise rejection in electrically noisy surroundings containing industrial machinery and inductive loads. In addition to protecting industrial applications from accidental contact with high external voltages, the isolation provided eliminates troublesome ground loops. The PICO-II8IDO4A utilizes a high-speed custom function driver optimized for a maximum data throughput that is 50-100 times faster than the USB human interface device (HID) driver used by many competing

products. This approach maximizes the full functionality of the hardware along with capitalizing on the advantage of high-speed USB 2.0.

Pushing the Boundaries

The trend toward greater levels of board-level integration isn't slowing. One of the most comprehensive examples of a multifunction solution is Curtiss-Wright Controls Embedded Computing's XMC-660. This multifunction mezzanine card combines wireless, GPS and cryptography to deliver portable, secure in-the-field wireless connectivity. The lightweight, small form factor XMC-660 is an ideal solution for quickly and easily adding high-performance trusted wireless communications to VME, VPX and CompactPCI embedded systems for applications including luggable computers, manpacks and secure laptop computers.

Designed for rugged environments, the XMC-660, based on the VITA 42 XMC standard, uniquely combines support for Wi-Fi 802.11 n/a/b/g communications, Zigbee 802.15 asset tracking, and GPS location services on a single plug-in mezzanine card, to deliver an ideal solution for systems integrators building embedded wireless networks. Power dissipation for the card is 7W (typical) / 8.4W (max). It requires only a 5V power supply from the basecard. All other necessary voltages are generated on board the XMC-660. ▮▮

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Distributed Strategies Tame Complex Sensor/Control I/O Demands

Faced with the onslaught of ever greater compute density and I/O density requirements, strategies like distributed processing and distributed I/O architectures are becoming more and more attractive.

Lino Massafra, VP of Marketing
North Atlantic Industries

Modern military platforms continue to place an ever greater reliance on electronics for their operation. Just as aircraft have transitioned to fly-by-wire systems, ground vehicles are transitioning to drive-by-wire. At the same time, greater numbers of sensors are being incorporated into sea, air and ground vehicles. These are used to detect everything from incoming projectiles to engine vibration. Moreover, an increasing number of electronically controlled actuators are being used to affect a response based on the sensor data. Each of these sensors and actuators must be connected to some type of I/O point to collect data for processing. As an example, consider a simple turn-by-wire design. The operator (driver) turns right, requiring an input measurement. Then a control point is used to activate the correct actuator to change wheel position around the vertical axis.

All this raises a number of questions. How do we fit this increased electronic content, interconnect all of these sensors without increasing weight, and finally process this exponential increase in data? If the electronics are replacing a mechanical system—like a mechanical steering system—the added electronics are usually lighter and smaller than the system being replaced, albeit at the cost of higher processing requirements. Many times, however, sensors are added to increase performance, without an associated decrease in space and weight. As always, more electronics implies higher processing requirements and an increased number of interconnects.

Figure 1

Submarines are particularly heavy users of sensors. A significant number of vibration sensors are needed on a modern submarine to ensure complete stealth. Shown here, the Virginia-class fast attack submarine USS Virginia (SSN 774) cruises through the Bay of Naples.

Multifunction I/O Strategies

To accommodate this increased level of electronics, manufacturers are implementing a number of strategies. First, by using high levels of integration, a far larger number of I/O points can be placed on a single PCB today than in the recent past. Although certainly not proceeding at the

same pace as digital electronics integration, none the less, analog integration is proceeding along a rapid slope. Where five years ago, 32 A/D convertors or D/A convertors on a single PCB was considered high density, today 60 or more is commonplace. In fact, it is now to the point that the number of analog functions that can be placed on a PCB is limited more by the number of I/O pins on the connectors than on the density of the electronics that can fit in a given PCB real estate.

To address this problem, manufacturers are turning to VPX from VME or cPCI. VPX has approximately twice the I/O of VME. Second, the I/O boards being provided today are "smart." These boards not only perform A/D, D/A or simple I/O functions, they also provide sophisticated levels of data processing. For example, simple I/O boards have A/D converters that sample the input data at some rate, and send that data to a mission computer for processing. Modern military ships, submarines, aircraft and even ground vehicles can have many thousands of points to sample. For example, think of the number of vibration sensors needed on a modern submarine to ensure complete stealth (Figure 1).

Meanwhile, in an effort to gain more information over ever increasing bandwidths, the sampling rate is increasing from a few thousand Hz to over 100 KHz, with bit depths increasing from 12 bits to 16 and 24. These data rates can easily overwhelm the most powerful processor, especially when complex algorithms like FFTs and FIR filtering need to be performed. With onboard FPGAs and DSPs as shown in Figure 2, the I/O board manufacturer can easily provide preprocessing to offload the main processor. Since these components are highly programmable, the hardware of these COTS boards remains the same, but the functions provided are highly configurable, either by the I/O board provider, or the end-user systems integrator.

Minimizing SWaP

These "smart" boards provide another very important feature that minimizes system size and power (SWaP); the ability to perform multiple functions on one PCB. In the past, many boards were available with 32 or 64 A/Ds or D/As, or 28V discretes, as well as separate boards for different types of communication functions (MIL-STD-1553, serial, ARINC429, CANBus, etc.) and processing (SBCs). Many systems, however, require smaller numbers of many different types of I/O and communications. To address this, manufacturers have created multifunction VME, cPCI and VPX boards. These boards allow the system integrator to select from a large number of available functions, and incorporate smaller channel counts of many functions on one PCB.

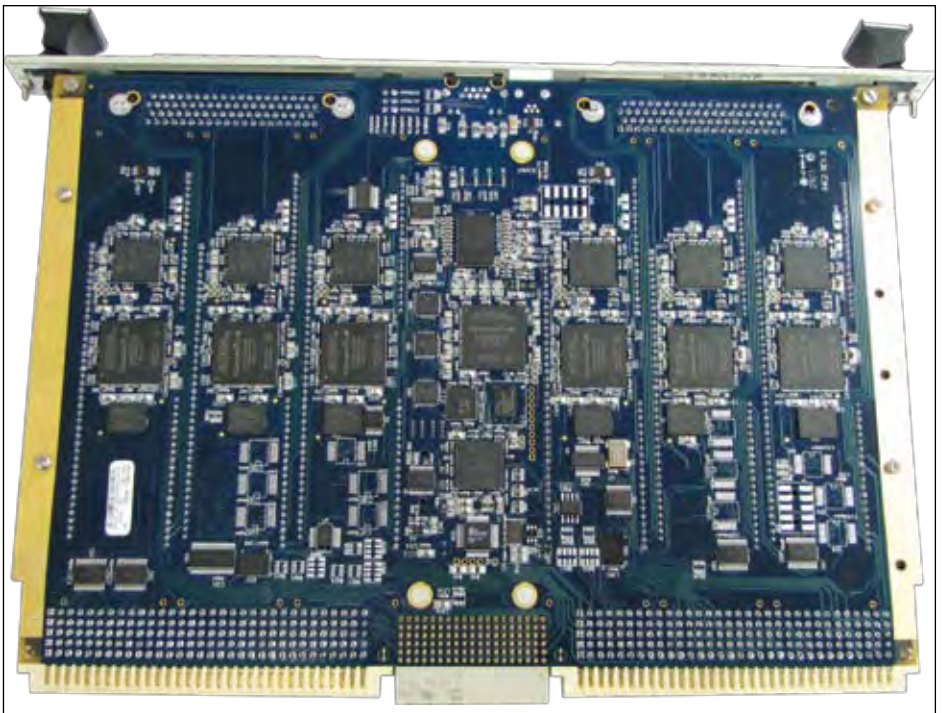

Figure 2

Onboard FPGAs and DSPs as shown here enable I/O board manufacturers to provide preprocessing to offload a system's main processor. This allows the functions provided to be highly configurable, either by the I/O board provider or the end-user systems integrator.

This is made possible through the ability of the base board FPGAs and DSPs to be programmed at final assembly to perform almost any task. For example, a single board can incorporate A/D, D/A, RTD, MIL-STD-1553, ARINC429 and 28V discretes, just to name a few (dozens of different functions are available). Another possibility is a multifunction I/O board that contains SBC (either PowerPC or Intel) support, along with the ability to provide large combinations of the many available functions. This single board can replace up to six dedicated boards. Just as importantly, these multifunction boards are COTS. The base board and the modules are designed, tested and stocked by the manufacturer. The system integrator simply orders the board with the required functions. The manufacturer performs the final assembly, downloads the necessary FPGA/DSP code and performs final test.

Moving to Distributed I/O

The next level up is a strategy that is just starting to take shape; distributing I/O data and processing. This concept is extremely powerful, and can simultaneously solve a host of issues. The I/O chassis Sensor Interface Unit (SIU) is usually some type of rugged self-contained design, which includes the necessary power supply, configurable I/O, communications with the mission processor and an optional SBC function. This approach allows system integrators to place I/O points very near the actual sensors, pre-process the data, and then send the reduced data back to the mission proces-

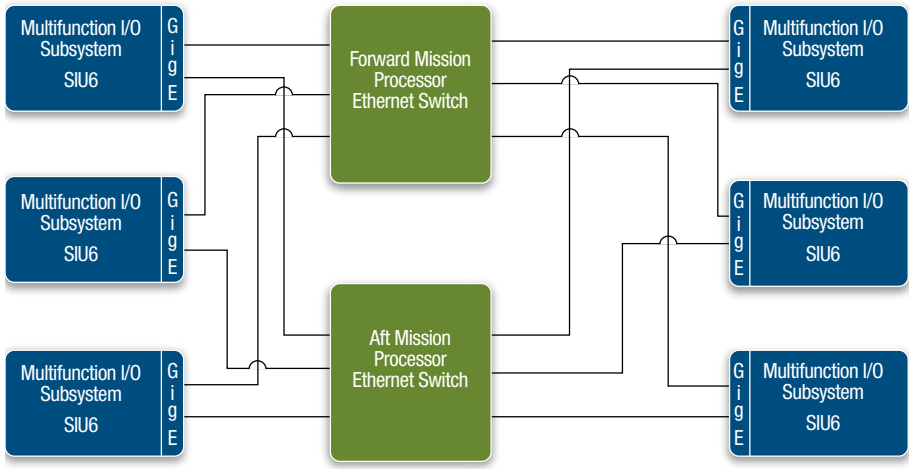

Figure 3

In this conceptual redundant system design, each SIU has two or more Gbit Ethernet or other communications channels, so each is always connected to both the main and redundant mission computers. The main mission computer can stay in control of the system, despite various hardware failures.

sor. For example, going back to the simple turn-by-wire design, the system requires an input function that can measure the position of the steering wheel (A/D, S/D or Encoder), measure the position of the drive wheel around the vertical axis (another A/D, S/D or Encoder), and a D/A or PWM to actually drive an actuator to turn the wheel.

The main processor would most likely need to implement a control loop to perform this function. In addition, a number of cables now need to run from the sensors and actuators back to the main processor chassis, which also houses the I/O functions. Now imagine a remote self-contained SIU or multiple SIUs depending on the size of the platform, which contains all of the I/O functions needed to perform this task, as well as an SBC function. The SIU can be placed close to the sensors and actuators to implement the control loop necessary to perform the actual function. In this scenario, the main processor doesn't need to implement a control loop, but would simply read the steering wheel position and only have to send a short message to the remote SIU that said, as an example, "turn 6 degrees," significantly reducing the main processing load.

Another major advantage is reduc-

tion in cable length. This reduction has the advantage of not only a potentially significant reduction in weight, but also in reduced noise pickup, wire losses, ground loop potentials, and in many cases significantly reduced EMI. This can be most advantageous in aircraft, where hundreds of wires now need to travel only a few feet, versus 100 feet or more, or in ships and submarines, which can be many hundreds of feet in length. The weight difference between 100 twisted/shielded pairs, 50 feet in length vs. a dual Gbit Ethernet wire or fiber connection of the same length is enormous, greater than a 10-1 reduction. Since the SIU uses standard 28 VDC or single/three-phase 115 VAC, the power cabling to the SIU is also short, as this standard power is usually available across the entire platform at many points.

Figure 4

Box-level SIUs like this can support up to 300 I/O points, configurable for many different I/O functions, supports the equivalent of an SBC to process data, and communicates to the main mission processor over a multitude of communication interfaces including Gbit Ethernet, MIL-STD-1553, ARINC429 and CANBus.

Maintenance and Redundancy

Maintenance is also reduced and made easier by the fact that these SIUs are usually intelligent and incorporate extensive BIT, making them self-diagnosing. If an SIU fails, it is much simpler for maintenance personnel to isolate the problem and replace a chassis with four or five connectors than it is to try to diagnose a problem with a system that contains tens of boards, find the bad board and replace it, usually taking down an entire rack of equipment in the process. Reduced cabling also helps in maintenance and system availability. Instead of running hundreds of signals hundreds or even

thousands of feet, we can now run just a few fiber optic cables, each of which can contain redundant fibers. If one of the fiber connections fails, a technician can easily isolate the bad fiber and switch to a redundant one.

Redundancy is another area where this approach excels. In the past, redundant systems required entire racks of equipment to be duplicated, with the issue of who decides which rack is in control, along with which processor. Usually, if anything failed in one rack, the entire rack needed to be shut down, and the backup took over. With distributed SIUs, the task not only becomes easier to manage, it also has an inherent "fail-soft" property. Since each SIU controls a subset of all platform functions, if an SIU fails, only that subset needs to be switched over to the backup hardware. Additionally, each SIU has two or more Gbit Ethernet or other communications channels, so each is always connected to both the main and redundant mission computers. The main mission computer can stay in control of the system, despite various hardware failures. Figure 3 shows a conceptual redundant system design using this approach.

Combining 1553, ARINC 429 and More

As an example, North Atlantic Industries offers a "standard" SIU that supports up to 300 I/O points, configurable for many different I/O functions, supports the equivalent of an SBC to process data, and communicates to the main mission processor over a multitude of communication interfaces including GigE, MIL-STD-1553, ARINC429 and CANBus, just to name a few. This SIU is shown in Figure 4. One of the main advantages of this SIU is that it is a fully qualified COTS design that can be configured to meet the system integrator's needs, yet be delivered quickly with little or no NRE.

As with both consumer and industrial systems, the trend toward greater electronic content in military platforms will accelerate, due to the many advantages that smart electronics provides. Although increased use of electronics can provide significant advantages to the modern system designer, its application must be approached carefully. With the ever increasing number of I/O points, along with higher sampling rates, greater dynamic range and greater functionality implemented using electronic I/O, a system can quickly become difficult to implement and maintain. Clearly, using both intelligent I/O boards and distributed I/O SIUs not only reduces the processing requirements of the main system processors and significantly reduce cable weight, it also provides for a simpler system implementation that is more easily maintained. This will push the electronic content of present and future military platforms ever higher.

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Power Issues in Box-Level Systems

Rugged Box Systems Wrestle with Power Challenges

As demands for compute density ramp upward, box-level systems are facing their own unique power, size and cooling issues.

Jeff Child
Editor-in-Chief

There's no avoiding the trend toward processors and other key components ramping up in wattage. And more power means more challenges dissipating heat. Rugged box-level systems are now available that address these problems themselves. Exotic techniques such as spray-cooling and liquid-cooling are all on the table as possible ways to attack the cooling challenge. Meanwhile, clever new mechanical designs that maximize system-wide conduction-cooling are equally important.

In tandem with the military's drive toward greater compute density, there's a growing demand to reduce size, weight and power (SWaP) of system electronics. More and more programs are pushing for as much computer processing muscle as can possibly fit into a board-level solution. Driving those demands is a desire to fit more functionality in the same space or into a smaller footprint. In the air, this means smaller and longer endurance for systems like UAVs. For ground vehicles this means more weight can be allocated to the all important armor of ground vehicles.

Figure 1

UAVs like the MQ-9 Reaper are driving the need for compact, low-power box-level solutions. Shown here preparing to land after a mission in Afghanistan, the Reaper has the ability to carry both precision-guided bombs and air-to-ground missiles.

New Twist on the Problem

The emergence of rugged box-level systems has brought different twists to the size, weight and power problem. Over the past couple years, stand-alone rugged box-level systems have become one of the fastest growing areas of military embedded computer design. These complete system boxes—which often support standard form factor boards inside them—provide a complete, tested and enclosed computing solution that eliminates complex integration chores for customers. Today dozens of vendors have some sort of stand-alone rugged box-level system in their offerings—many even

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Figure 2

Approximately the size of an external hard drive, the 2-slot PowerBlock 15 has a convection-cooled or cold-plate mountable design, suitable for deployment on small platforms operating in harsh environments.

have whole product lines in that category. Among these are Acromag, Advantech, Aitech Computers, Ampro Computers, AP Labs, Curtiss-Wright, DRS Technologies, Extreme Engineering, General Micro Systems, GE Fanuc Embedded Systems, Macrolink, Mercury, MEN Micro, Octagon Systems, Parvus, Quantum 3D, Rave Computer, RTD Embedded Technologies, VersaLogic, WIN Enterprises and WinSystems.

A new set of challenges faced by defense programs has driven the rugged requirements for defense electronics to new levels. Defense forces are meeting the need for more intelligence-gathering assets by placing sensors on unmanned vehicles (UVs)—which are airborne (UAVs), ground-based, or undersea. Early implementations such as the Global Hawk and Predator UAVs were fairly large platforms, but each succeeding generation is smaller. The challenge is to make the sensor-supporting processing power fit into a smaller size, weight and power (SWaP) budget. These smaller computing packages must also be rugged enough to withstand operation within deployed UVs.

Cooling Concerns

Since cooling is directly related to SWaP in many cases, the term SWaP-C is now widely used to describe these governing constraints. This is especially true for ground vehicle, UAV and manned aircraft applications, where tight spaces, operational demands and payload parameters must be factored into the final system solution (Figure 1). As these constraints have gotten tighter, electronics systems also are often being designed to perform multiple tasks, rather than having multiple systems dedicated to separate tasks. While a consolidation of functions can help to conserve overall space in the vehicle, it places even more demands on the primary system thereby further driving up performance, storage, cooling and reliability requirements.

Often times a stand-alone rugged box system can be smaller, more power efficient, more rugged and so forth, if only because of its broader utilization compared to a purpose-built computer. If the box-level system supplier is building the platform all the time, to fulfill demand, one can be pretty confident in their procedures and outcomes, compared to the early specimens of a project-specific computer. Finally, once the deployment has reached an appreciable size, it may be a welcome luxury to regard the computer as a single LRU, and just return it for service when necessary, instead of owning fault isolation down to the board level.

Next-Generation Solutions

The stand-alone rugged box trend has pervaded all corners of the military embedded computing space. Many product lines have even moved on to second-generation, smaller spin-off versions. An example along those lines is Mercury Computer Systems' new, rugged, man-pack-sized system. Enhancing the Ensemble 1000 Series family of computing systems, the 2-slot PowerBlock 15 has a convection-cooled or cold-plate mountable design, suitable for deployment on small platforms operating in harsh environments. Approximately the size of an external hard drive, the portable system can be configured with any of the processing, I/O, or storage modules currently used in the 6-slot PowerBlock 50 chassis.

Ensemble 1000 Series systems, using either the PowerBlock 15 (Figure 2) or the PowerBlock 50 chassis, are scalable and optimized for real-time applications. A point-to-point PCI Express connection delivers high-throughput, non-blocking, serial connectivity between processing and I/O nodes. External I/O can be customized to accommodate virtually any type of digital or analog I/O. Processing options include the Intel EP80579 SoC (system-on-chip) device, Xilinx Virtex-4 and Virtex-5 FPGAs, the AMD M96 GPU (Graphics Processing Unit), and Freescale PowerQUICC processors, all supported by SATA hard-disk and solid-state storage drives.

Another significant challenge is driven by changes within computing technology.

Figure 3

The XPand4200 system weighs less than 15 pounds fully populated. It conducts heat from conduction-cooled modules to heat exchangers, where the heat is dissipated to the ambient environment by forced air cooling. The system measures 4.88 x 6.0 x 13.5 inches.

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New components, especially processors, are orders of magnitude faster, but they are also much, much hotter, magnifying the cooling challenge. In the early 90s a 66 MHz CPU consumed about 7W of power. In an office environment it would not even need a cooling fan. Now processors will often draw over 50W, sometimes over 150W, depending upon clock speed, core type and processing load.

How OpenVPX Fits In

With all that in mind, defense program teams have a situation requiring that much hotter, albeit faster, components must operate with increasingly difficult SWaP restrictions. Meeting this new level of challenge requires a systems-level approach to solutions design. A broad range of applications can be addressed by a more rigorous, standards-based approach. The evolution of the OpenVPX standard is proving to be a great benefit to this systems-level approach. Created to improve interoperability of off-the-shelf modules, OpenVPX does this by implementation of predefined system topologies that simplify integration of components while retaining a significant range of configuration flexibility.

When programs reach the stage for integrating a deployable system, OpenVPX leverages the VITA 47 and VITA 48 standards. Designs can be optimized at the systems level for ruggedness and cooling, while the use of standards-based components—modules and chassis—reduces the integration effort and speeds time-to-deployment. Adhering to a systems level approach based on open industry standards gains these advantages while retaining a large degree of design flexibility.

An example of this new generation of VPX-based, compact, power-friendly box-level systems is an 8.8 pound sub-½ ATR, forced air-cooled enclosure for conduction-cooled modules from Extreme Engineering Solutions. Called the XPand4200 (Figure 3), a fully populated version weighs less than 15 pounds and is suitable for C4ISR applications in vehicles such as UAVs, helicopters, planes, tanks and light armored vehicles, HMMWVs and UGVs. The XPand4200 conducts heat from conduction-cooled modules to heat exchangers, where the heat is dissipated to the ambient environment by forced air cooling. The system measures 4.88 x 6.0 x 13.5 inches.

Up to six conduction-cooled, 0.8" pitch 3U VPX, 3U cPCI, or power supply modules can be configured into the XPand4200. Additionally, the XPand4200 can be configured to meet custom I/O requirements with conduction-cooled PMC/XMC modules available from X-ES or third parties. The XPand4200 supports Gigabit Ethernet, graphics, RS-232/RS-422, MIL-STD-1553, ARINC 429, as well as custom conduction-cooled PMC/XMC I/O through D38999 circular connectors. An optional front-panel USB port provides system monitoring and maintenance ca-

pabilities. There are several power supply options, supporting up to 200W from a MIL-STD-704 28V DC or 115V AC input, as well as internal EMI filtering and hold-up for up to 60 ms at 200W. ■■

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

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

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Power Issues in Box-Level Systems

Power Supplies Move toward System-Level Thinking

Highly integrated power supplies are changing the landscape of military electronic systems. The combination of ruggedness and smarts provides system designers the tools for rapid system development.

David W. Lee, Project Engineer
Curtiss-Wright Controls Electronic Systems

Power supplies are a critical part of any ruggedized electronic system. In its simplest form, a power supply provides critical functions such as voltage regulation, surge protection and EMI filtering. A system may not function well, if at all, when the power supply is not designed properly. The development of a military grade power supply requires expert knowledge. Development can be lengthy and expensive; therefore, many system integrators today simply reuse existing designs or purchase them off the shelf to meet time-to-market requirements. A "smart" power supply, designed with the concept of modular building blocks, enables flexible and rapid development that scales to the power requirements of a variety of electronic systems.

Conventional power supplies perform basic power conditioning functions, such as converting MIL-STD-704 or MIL-STD-1275 28V input power into VME/VPX output voltages such as 5V, 3.3V and 12V. "Smart" power supplies, on the other hand, go beyond merely generating regulated voltages and provide the system integrator with tools (Figure 1) that are tightly coupled with the functionality of the power supplies in ways that were not previously packaged into a single module. Built-in features such as self tests, current/voltage/temperature monitoring, failure reporting, controlled power-up and power-down sequencing and nuclear event circumvention can be modularized to reduce the system development.

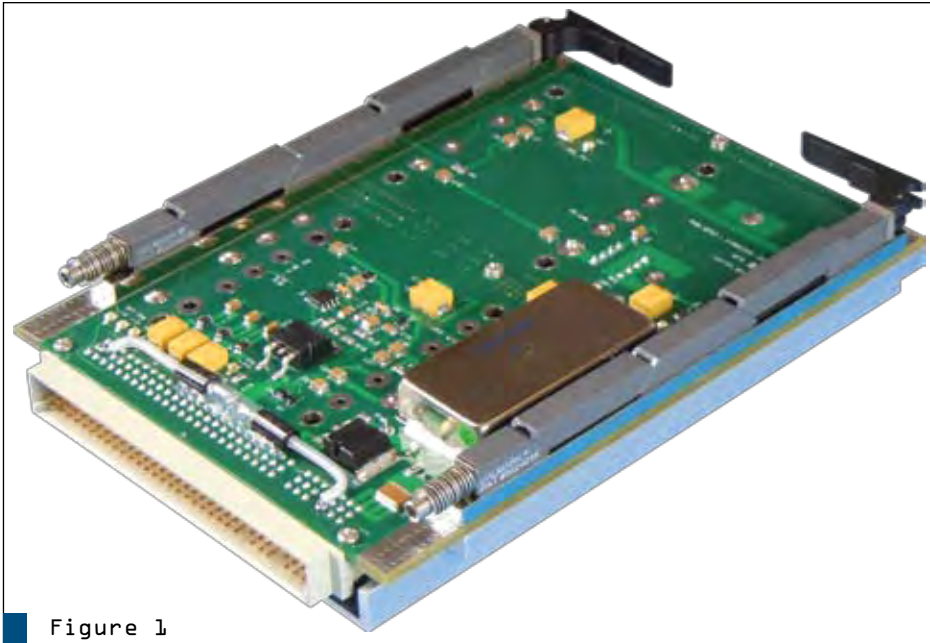

Figure 1

"Smart" power supplies go beyond just generating regulated voltages, and bring together functions such as self tests, current/voltage/temperature monitoring, failure reporting, controlled power-up and power-down sequencing and nuclear event circumvention.

VITA 62 and Smart Power

For that same reason, the recent VITA 62 standard defines a modular packaging standard for 6U and 3U VPX power supplies, making a COTS solution possible. Figure 2 shows an example of a VITA 62 3U VPX power supply. While the basic func-

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tions of power supplies remain the same, a modular design that conforms to standard pin-out and form factor enables system designers to quickly connect the dots and build the system with confidence.

In the past, monitoring, fault reporting and fault handling capabilities have often been implemented outside of the boundary of the power supply, such as a combination of a custom-design single board computer and an analog-to-digital I/O board, where I/O capabilities and processing power are available. While this might make sense at the time the system is being designed, it will eventually become a problem when components go obsolete. If no off-the-shelf replacements are available, the cards need to be redesigned to match the original pin-outs and functionality, which is both costly and time-consuming.

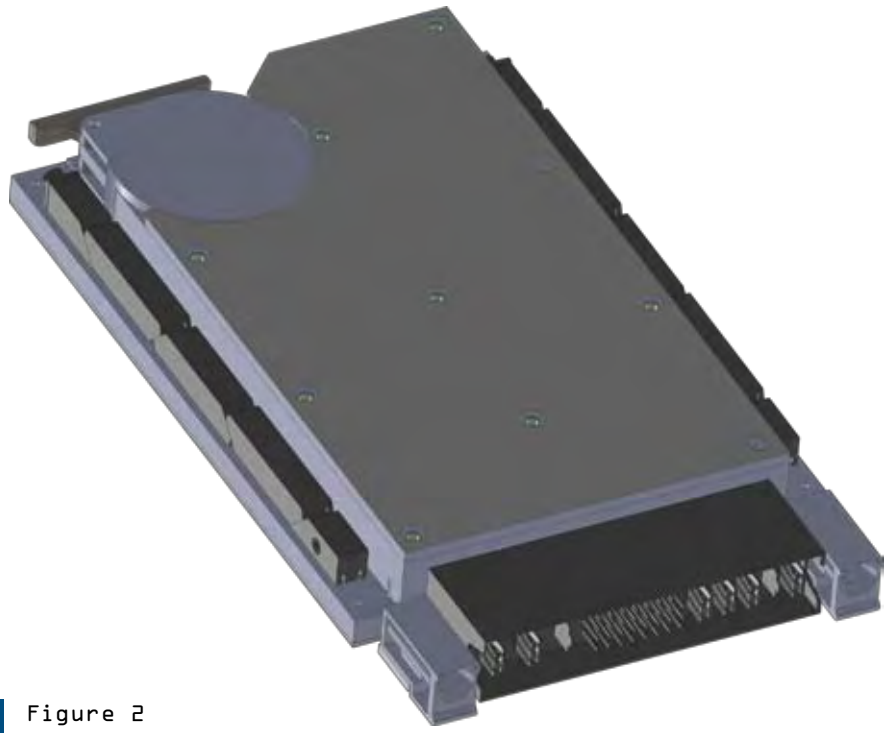

Figure 2

The VITA 62 standard defines a modular packaging standard for 6U and 3U VPX power supplies. Shown here is an example of a VITA 62 3U VPX power supply.

Power Supplies Enter Digital Age

DC-to-DC converters and microcontrollers have rapidly evolved in recent years such that it is now possible to incorporate many "bonus" features into a smart power supply module. An industrial microcontroller would typically provide Analog-to-Digtital Conversion (ADC), discrete I/Os, memory and a programmable microprocessor core for monitoring, self tests and implementing other custom logic. With the advent of these small-footprint and highly integrated software programmable microcontrollers, designers can now place these capabilities right into the power supply module itself, substantially reducing development time. Without an integrated microcontroller, a designer would have to use multiple ICs and an array of discrete components, which will occupy valuable real estate on the already crowded circuit board.

A smart module may communicate with the host processor via a serial bus, I^2C, or, in the case of VITA 46.11-compliant systems, Intelligent Platform Management Bus (IPMB) for VPX. For example, the microcontroller on board a power supply can continuously monitor the functionality of the module. In the event of a power failure, the host computer will be notified of the fault via a standard protocol called Intelligent Platform Management Interface (IPMI), enabling it to react appropriately depending on the application. This is particularly useful in a large system. A self-contained smart power supply alleviates the need to put the power monitoring circuits, which require custom I/O and board area, elsewhere in the system. This approach enables the entire system to be designed using true "COTS" building blocks (such as SBCs, switches and video cards).

Power Management and PMBus

Internal to the module itself, the Power Management Bus (or PMBus) may also be used to communicate with increasingly popular PMBus-enabled components, such as power monitors, DC-to-DC converters, trims and power distribution modules. PMBus is a 2004 standard drafted by a coalition of industrial partners. To ensure interoperability and simplicity, PMBus is based on the System Management Bus (SMB) protocol over an I^2C physical layer, similar to IPMB in concept. The adoption of PMBus would further simplify power supply designs and free up board area for other features.

Due to the need for rapid system development using off-the-shelf components and to satisfy system-level self-test coverage requirements, there is an increasing demand for power supplies to be self-contained. The present integration level enables these additional features to be packaged into the same (or smaller) form factor as earlier designs. For comparison, Figure 3 shows a conventional half-ATR power supply design.

Nuclear Event Circumvention

Another modular power supply feature is the incorporation of a nuclear event detector (NED) to protect against damage to the system electronics in a nuclear event. Nuclear event circumvention is quickly becoming an important power supply capability among military customers, especially for ground vehicles.

For its part, Curtiss-Wright has developed modular, radiation-tolerant, smart

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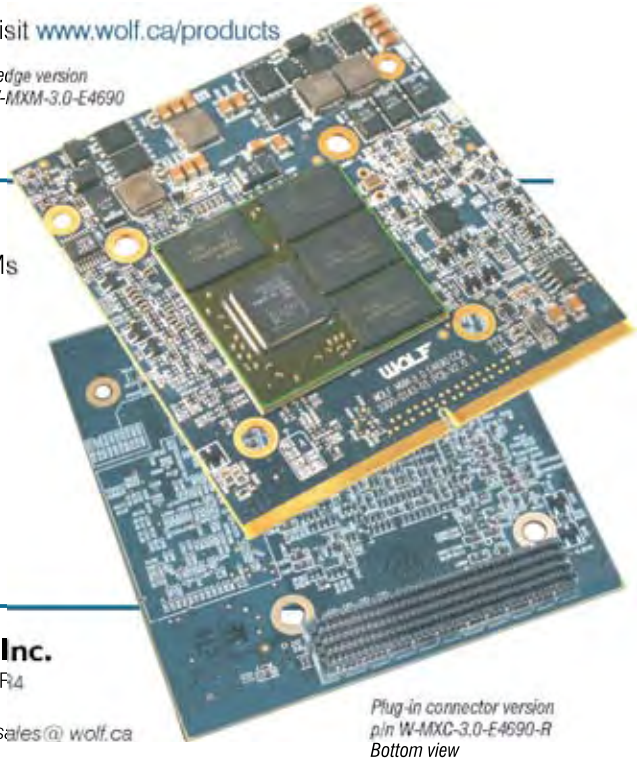

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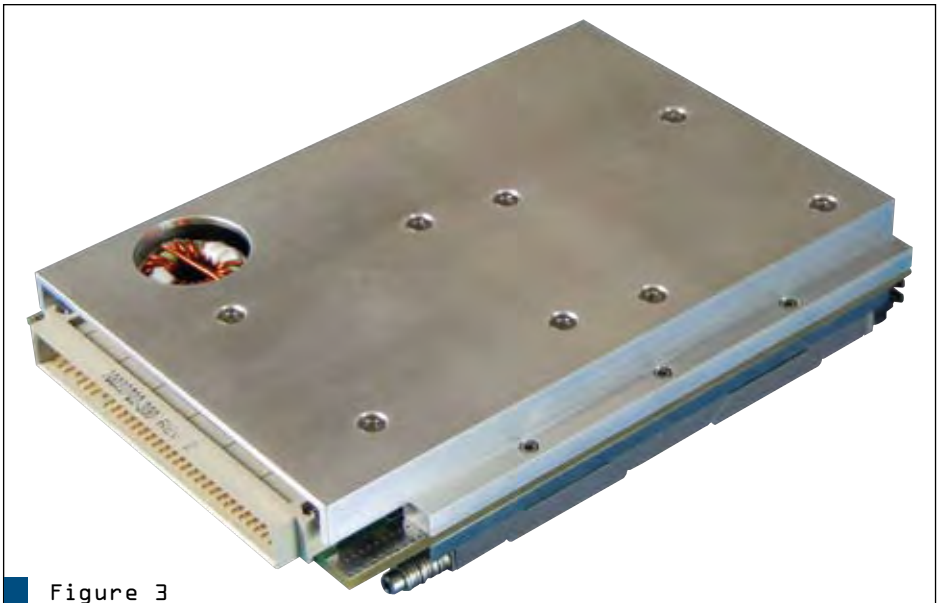

Figure 3

Today's integration level enables system-level self-test coverage to be packaged in the same (or smaller) form factor as earlier designs. For comparison, shown here is a conventional half-ATR power supply design.

power supplies with NED and crowbar technologies, which have been tested and proven at the White Sands Missile Range. These products passed military nuclear survivability requirements and are currently deployed in ground combat vehicles and other platforms. VITA 62 also has direct support for power supplies equipped with NEDs.

Aircraft and Vehicle Standards

Ruggedized military electronic systems require power supplies that typically take unregulated power input and generate multiple voltage outputs. Such MIL grade power supplies include the MIL-STD-704F standard for aircraft and MIL-STD-1275 for vehicle use. A smart power supply designed to meet the VITA 62 standard enables electronic systems to be intelligently managed by optimizing system visibility.

Power supplies that include power management and power distribution solutions enable system designers to concentrate on other aspects of their electronic systems, to achieve quicker time-to-market. The modular approach to power management and power distribution, along with custom and standard engineered system solutions, enables smart power supply vendors to optimize and scale power supply designs for the military system designer's specific power requirements. ▮▮

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EXCLUSIVE INTERVIEW:
General Peter Pace, Former Chairman of the Joint Chiefs

Recently COTS Journal*'s Jeff Child had the unique honor and privilege to interview General Peter Pace, who served as the 16th Chairman of the Joint Chiefs of Staff. General Pace shared with us his unique perspectives on military technology and the defense acquistion business. In his role as Chairman of the Joint Chiefs, he served as the principal military advisor to the President, the Secretary of Defense, the National Security Council and the Homeland Security Council. He is currently serving on the board of directors of several corporate entities, and last month was appointed to the board of directors for Wi2Wi, a provider of modular wireless technology for military and commercial embedded applications.*

COTS Journal: It's been said that military networks, and specifically networked information sharing on the battlefield, was once just a force multiplier, but it is now viewed as a warfighter necessity. Would you give me your perspective on how you see the impact of real-time networked information sharing on the battlefield?

General Peter Pace: Yes, the "network" was once just a force multiplier but is now an essential part of power, both soft and kinetic. As we look to the future, the speed and precision of those network technologies are going to be more and more important. That's especially true when you're operating in highly populated areas where most of the people on the battlefield are not part of the battle. Situational awareness and intelligence sharing is important. Interoperability is important. And sharing across agencies is important. All those reasons reinforce the importance of the network and information sharing among warfighters.

"Bottom line is you want to push the envelope, but you've got to know where the envelope is."

CJ: There's been a number of military programs that have suffered problems and delays because of their reliance on what are deemed "immature technologies." These are defined as technologies that haven't advanced to a sufficient state to where they fit the requirement of the program. The application of wireless networking in military systems often falls into that category. On the other hand, I know that being forward-looking is important when conceiving program requirements—especially because of the very long development cycles of defense programs. Can you share your thoughts on this trade-off and how it can or should affect businesses practices?

Pace: I see things a bit differently in the past couple years now that I've had the chance to talk extensively with a lot more business leaders than I could in the past. Understandably—and for correct reasons—there are some firewalls between the guys who develop the requirements inside the building—as I was responsible for when I was Vice Chairman—and the acquistion community that goes out and gets the industry to produce the deliverables.

When you're inside the building on the requirements side you don't have a clear picture of what industry is capable of producing. You might think that—on a scale of 1 to 10—the industry can produce a 6, so you ask them to stretch that and give you a 7 or an 8. But in fact, they're able to produce an 8 or a 9 right now, but you don't know that because there is not enough deep dialog happening to make that clear.

That's one problem. The other problem is that when we ask for something companies tend to be optimistic about their abilities to produce and deliver. They're not telling stories. They just have great confidence in themselves and their ability to solve problems. We need to find a way to get more trust built in the sharing of data between the requestor and the provider. I hope we'll get to a point where it happens more like the following: I ask for an 8, but you look me in the eye and tell me "Look Pete, we're at a 2 right now. We might get you to 5 by such and such time, or 8 by such and such time." The key is to have a very open dialog to help set expectations.

A great example is the current developments in Army vehicles. The current vehicles under development are going to be very dependent on space-based technologies like satellite communications. If the guys developing the ground vehicles believe something that's not true about the capabilities of the space-based systems, and develop a whole platform based on that, then you end up with as you said "immature technologies" not being ready when the warfighter thought they would be ready. Then everybody gets disappointed and frustrated in the system. It's helpful for people to step up and say "Look, this is where we are. This is what's possible and the probability of getting here is this." Bottom line is you want to push the envelope, but you've got to know where the envelope is.

CJ: With that in mind, I see a lot of positive signs in that engineers at the prime contractors seem to be relying more on the expertise of their suppliers. They're realizing they don't have to be the experts in designing embedded computers and network gear for example, but can instead rely on their technology suppliers.

Pace: That's great and I agree with you. I just think the more we can push for more Industry Days kind of events the better. Those allow industry a chance to explain what they can do to those who are producing requirements and brainstorming the kinds of capabilities we'd like to have down the road. If we can share that information more openly, then those who are responsible for requirements and acquistion have a better understanding of A, what's possible, and B, what the risk involved is.

The bottom line is that it's always about where you want to go to, and where we want to go to is always an "immature technology." The discussion has to be about how long it will take to get from an immature state to where it becomes absolutely reliable and you're worried about your next immature technology problem.

CJ: As the number of reconnaissance platforms increases—both manned and unmanned—so too do the capabilities of those platforms to capture ever greater amounts of video, images and so on. The result is a deluge of situational awareness information streaming in perhaps faster than the warfighter users of such information can act on it. Do you see that situation as forcing a change in how warfighters manage information or as highlighting a need for technologies that better process, sort and manage information for the warfighter? Or both?

Pace: I see it as both. First of all the warfighters must prioritize their information needs. And then the technology needs to support that menu-driven set of priorities. The warfighter can't sit there and say "I've got too much information." As a commander I need to tell you what's important to me. What are my essential elements of information? Then, out of the same database you can program what I need, what you need and what he needs in a way that optimizes the shared database rather than trying to give all of us all the same information. Then it's about feeding us the data we need to make the decision we need to make on our part of that battlefield.

CJ: While the term "COTS" gets misused and distorted at times, it's clear that the application of commercial-off-shelf products—like embedded computers, networking gear and chip solutions—has enabled military platforms of all kinds—on land, sea and air—to employ best-of-breed technologies. In a

way it's all COTS because any military computing system today is based on microprocessors and memory chips from the commercial world. The idea of a military-specific processor chip doesn't really exist anymore. As someone who has lived through the DoD's and defense industry's transformative COTS movement, what are your thoughts and perspective on the COTS movement and how it's impacted procurement and military technology?

Pace: There are certain things that are uniquely military. But, as you pointed out, the vast majority of sub-components that comprise a final system are commercial-off-the-shelf, and therefore, in my mind, COTS is fundamental to accessing the best of breed. Dual technology that serves both the private sector and government is in fact the most efficient way to go both cost-wise and in terms of time-to-market. If you look at major U.S. Military weapon systems, they take years and years to develop and build. From the time you start thinking about the F-22 to when it gets built, the computer systems embedded in it have morphed X numbers of times. So COTS and all that the marketplace outside of government achieves really needs to be leveraged as much as possible. It is important because it ensures the best technology is available to the troops and it keeps the cost of individual systems down for the taxpayer.

The bottom line is that technology is not the be all and end all—but it sure does facilitate a lot of efficiency and effectiveness. It's an area where we as a nation have always been very efficient in adapting to. In doing that, I really believe that it is not possible for the industry and government to talk to each other too much. We need more opportunities to share where we are and where we're going and what's needed. I've been tremendously impressed by the patriotism of those that are producing these tools for the nation. Yes, it's good business. But they're proud of what they're doing and want to put the world's best technology into the hands of our warfighters.

General Pace served on the President's Intelligence Advisory Board and is currently on the Secretary of Defense's Defense Policy Board. He served as leader-in-residence and the Poling Chair of Business and Government for the Kelley School of Business, Indiana University for the 2008-2010 Tenure. General Pace is a graduate of the United States Naval Academy, holds a Master's Degree in Business Administration from George Washington University, attended the Harvard University Senior Executives in National and International Security program, and graduated from the National War College.

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Technology Focus

Small Form Factor Boards

Small Form Factor Boards Make Big Impact

Military system developers are flocking to the latest product and standards innovations from the small form factor board community.

Jeff Child,
Editor-in-Chief

Small form factor boards—while always of keen interest to the military market—are becoming ever more critical for defense applications. Such applications include small UAVs, robotics, mission-specific handheld systems, intelligent munitions and many others. Robotic systems like the Small Unmanned Ground Vehicle (SUGV) (Figure 1) are a perfect example of the type of systems that face the most difficult challenge with reducing size, weight and power (SWaP).

The "Small Form Factor Boards Roundup" on the following pages showcases some examples of such products. Included are boards in form factors such as Pico-ITXe, mini-ITX, StackableUSB, COM Express along with a variety of small non-standard boards. Since *COTS Journal* covered PC/104 and PC/104-family boards as a dedicated Roundup topic in the June issue this year, this Roundup is restricted to small form factors other than PC/104-family boards.

The small form factor area of the embedded computer market for a long while had been lacking when it came to new approaches. That's changed in recent years as groups like the Small Form Factor Special Interest Group (SFF-SIG) has focused on trying a variety of different approaches to suit the miniaturization of board-level electronics. Formed only about three years ago, the SFF-SIG has—in keeping with its purpose—been very active in rolling out new specifications. Last fall the group released both revision 1.0 of the ISM (Industry Standard Module) and SUMIT-ISM Specifications for small, rugged, stackable embedded systems. The SUMIT-ISM Specification documents the use of SFF-SIG's flexible SUMIT (Stackable Unified Module Interface Technology) interface on popular 90 x 96 mm stackable modules. The ISM Specification provides an explicit form-factor-only definition upon which the SUMIT-ISM Specification is built.

Figure 1

Designed in partnership with iRobot, Boeing is developing several robotic solutions. One of them is the Small Unmanned Ground Vehicle (SUGV) 300 series of robots. These robots can be equipped with cameras, sensors, computers and sophisticated software to perform basic reconnaissance, dispose of explosives and other tasks.

Most recently, the SFF-SIG announced the adoption and release of the CoreExpress Specification revision 2.1. CoreExpress was originally developed as a proprietary standard by LiPPERT Embedded Computers GmbH. Under the terms of an agreement between SFF-SIG and LiPPERT, the entire embedded community will now be able to develop CoreExpress modules and applications without regard to confidentiality and without royalties of any kind. CoreExpress is a Computer-on-Module (COM) specification optimized for state-of-the-art, ultra-low-power processors like Intel's Atom and VIA's Nano. The form factor measures only 58 mm by 65 mm, and weighs about 28 grams. Its very low power requirements (5W) make it suitable for small, battery-powered and wearable embedded military devices.

Seeing a demand for a "tiny" class of embedded computing for military and other applications, a new group has formed around a new specification called FeaturePak. Exemplifying the overlap between the various industry groups and standards, FeaturePak is designed to have a level of compatibility with existing small form factor specs. FeaturePak modules interface to the host system via a single low-cost, high-density 230-pin connector, which carries PCI Express, USB, I^2C and several other host-interface signals, plus up to 100 points of application I/O per module. The host interface is CPU agnostic and is compatible with both Intel and RISC architecture systems. The modules can easily be integrated into embedded designs along with Qseven, COM Express, SUMIT, PCI/104-Express, EBX and EPIC. ▮▮

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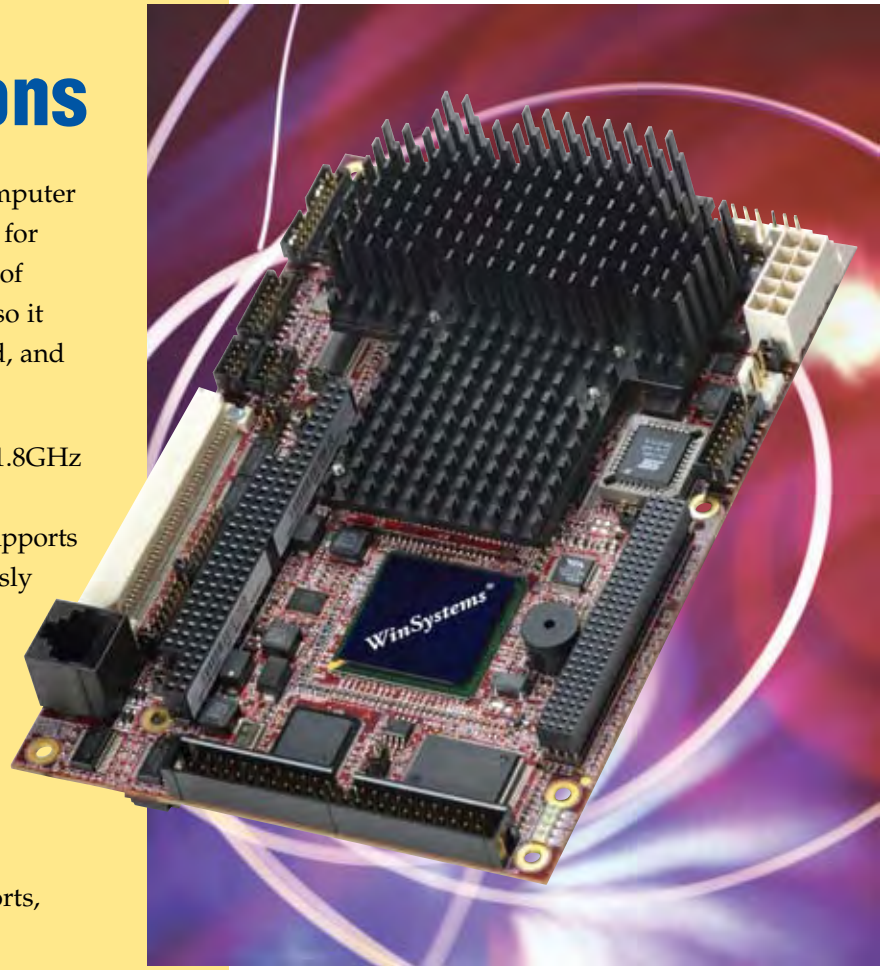

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Small Form Factor Boards Roundup

COM Express Module Targets Graphics-Intensive Apps

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

Equipped with the 45nm Intel Core2 Duo processor, the Express-MV is available with a clock speed of up to 2.26 GHz. Combined with up to 8 Gbytes of DDR3 dual-channel

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

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

3.5-inch SBC Sports 2.16 GHz Core2 Duo CPU

Busless, stand-alone SBCs are capturing a growing niche in the defense realm. Avoiding the size, weight and power overhead of a slot-card backplane approach can be very beneficial. With that in mind, Advanced Digital-Logic (ADL) announced the release of its ADL945HD 3.5-inch form factor computer board. The

ADL945HD is based on the Intel Celeron M / Core Duo / Core2 Duo and the Intel 945GM chipset processors, with clock speeds up to 2.16 GHz. The Intel Generation 3.5 graphics engine is integrated into the chipset, along with the Intel Graphics Media Accelerator 950 (Intel GMA 950), and can drive either a CRT and/or LVDS LCD.

The memory is added by way of a SODIMM200 socket and can accept up to four Gigabytes of DDR2 DRAM. The ADL945HD power management incorporates ACPI/APM functions. The standard ADL945HD also incorporates EIDE, SATA, 4x onboard External USB 2.0, 4x Internal USB 2.0, 2xRS-232 COM ports, PS/2 keyboard and mouse, parallel printer, AC97 Sound, separate 10/100Mbit and Gbit Ethernet LAN and more.

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

Atom COM Modules Feature 84 x 55 mm Size

Reducing size, weight and power ranks high on today's list of military requirements. Advantech's newest COM CPU module, the SOM-7562, measures only 84 x 55 mm in dimension and is powered by the new Intel Atom N450 processor, with integrated onboard graphic and memory controller (GMCH) on a single chip, enabling even better power reduction, smaller system designs and performance improvements. The Thermal Design Power rating of the new Atom

architecture is less than 5.5W, yet it offers better performance and lower power consumption than before. The new integrated "all-in-one" chip design is perfect for compact mobile device applications.

The SOM-7562 also works smarter to assure better application integration with the help of Advantech's software SUSI API suite, which features a watchdog timer, hardware monitor, and GPIO APIs and utilities to help customers integrate and configure specific features into their applications. The board is compliant with the COM Express type 1 standard pin definition, and with slight modification is able to share with current COM Express or COM Micro carrier boards. The board is particularly suited for personal handheld or portable defense applications.

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

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COM Express Module with Mobile Core i7 and QM57 Chipset

A new COM Express module is part of a portfolio of Type VI COM Express Basic (small footprint) modules from American Portwell. The Type VI COM Express Basic is becoming a new standard in 2010. At 125 mm x 95 mm (4.92 x 3.74 inches), the compact PCOM-B216VG-VI is based on the Intel Core i7 processor and the Mobile Intel QM57 Express chipset. This dual-core platform supports error-correcting code (ECC) memory and Intel Active Management Technology (Intel AMT) 6.0 along with Intel Trusted Execution Technology for effective remote management and enhanced security.

In addition, it features two SO-DIMM (non-ECC) sockets to support DDR3 SDRAM 800/1066MT/s up to 8 Gbytes; one Gigabit Ethernet; expansion (via the COM Express carrier board) of one PCI Express x16 lane, which can be configured to two x8 lanes; one DVI-D, one HDMI and one Display Port (DP) interface, seven PCI-E x1, LPC interface and high-definition audio interface; and a PCOM-C211 Developer COM Express Type VI carrier board. Equipped with Intel Turbo Boost technology—which automatically allows processor cores to run faster than the basic operating frequency—the PCOM-B216VG-VI addresses the market's performance and power consumption concerns because it also supports Intel Intelligent Power Sharing Technology. This balances the load of TDP (Thermal Design Power) and temperature between the CPU and the graphics engine by enforcing power clamps to non-turbo levels.

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

Adapter Board Boasts FeaturePak Embedded I/O

A new adapter board allows the use of FeaturePak I/O expansion modules in systems that provide SUMIT-ISM expansion stack locations. The FeaturePak socket on the SUMIT/FP Adapter consumes a single PCI Express x1 lane from the SUMIT-A bus connector on the SUMIT-ISM module. The adapter provides a pair of 50-pin I/O header connectors for convenient access to

all FeaturePak I/O. In addition, it includes pass-through connectors for the SUMIT-ISM stack's SUMIT-B bus and PC/104 (ISA) bus. An extended operation temperature range of -40° to +85°C is supported.

The FeaturePak specification defines tiny, application-oriented personality modules—three-fifths the size of a credit card—that snap into low-cost, low-profile, reliable sockets on single board computers (SBCs), computer-on-module (COM) baseboards and full-custom electronic circuit boards. FeaturePak modules interface to the host system via a single low-cost, high-density, 230-pin connector, which carries PCI Express, USB, I^2C and several other host-interface signals, plus up to 100 points of application I/O per module. Additionally, the modules can easily be integrated into embedded designs along with Qseven, COM Express, Mobile-ITX, SUMIT, PCI/104-Express, EBX and EPIC. Small quantities of the SUMIT/FP Adapter are available in 60 days, priced at $190.

Diamond Systems
Mountain View, CA.
(650) 810-2500.
[www.diamondsystems.com].

Rugged COM Express Card Suits Constrained Apps

Non-backplane, stand-alone board form factors continue to expand their acceptance among military developers. Riding that wave, GE Intelligent Platforms offers the bCOM2-L1100 rugged COM Express board. Designed specifically to respond to the growing requirement to deploy powerful computing solutions in harsh, space-constrained environments such as mining, oil and gas, manufacturing, test/measurement, unmanned vehicles, exploration, transportation and military/aerospace, it features an Intel Core2 Duo processor operating at up to 2.26 GHz

and up to 4 Gbytes of soldered DDR3 SDRAM. Soldered components substantially improve reliability.

The bCOM2-L1100 provides extensive protection to ensure reliable operation in applications that are subject to shock, vibration and extremes of temperature (-40° to +85°C). All components are soldered to the board for optimum reliability, while mechanical stand-offs provide a high degree of insulation from external forces. Available in a standard version for benign environments, the bCOM2-L1100 is optionally available in extended temperature variants and with conformal coating. Despite its small size, the bCOM2-L1100 offers a broad range of connectivity and I/O capabilities, including Gigabit Ethernet, eight USB 2.0 ports, four Serial ATA (SATA) ports (RAID-configurable), one PATA port, eight GPIO ports (four in, four out), one LVDS port, two SDVO channels, VGA, High Definition Audio (HDA) and PCI Express (configurable as one 4x PCI Express lane or four 1x PCI Express lanes). Also provided is a x16 PCI Express port for high-end graphics and video applications.

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

Atom-based Rugged SBC Is iPhone-Sized

For many of today's military applications, it's all about compute density. Feeding that need, General Micro Systems (GMS) has developed an Intel Atom-based rugged SBC that offers unbelievably low power consumption. Combined with its exceptionally small footprint and high performance, the Atom XPC40x (extended temperature, conduction-cooled) and Atom XP40x (standard temperature) satisfy the intense demand for an ultra-small computer with full-size processing power.

Easily accommodating 64 Gbytes of storage via onboard solid-state disk in its miniature 3.5 x 2.5 x 0.5-inch package, Atom is the world's smallest full-featured rugged computer. It boasts 533 MHz DDR-2 SDRAM and is powered by a 1.6 GHz Intel Atom processor that provides 512 Kbytes of Cache. With full laptop functionality, Atom offers high-performance graphics with 3D acceleration, and includes five USB-2.0 ports and support for two Express Mini Cards for Wi-Fi, CanBus or other user I/O. The Atom XPC40x is designed to operate at -40° to +85°C with a maximum thermal gain of only 5°C above ambient. Because of its heat tolerance, it is ideal for applications where ambient temperature is high, such as a controller located in an engine compartment or for small robots and UAVs working in extreme temperatures. The Atom, with its exceptionally low power consumption/dissipation (3W average, 10W peak), imposes little to no impact on the user, eliminating many inherent problems with wearable computers. Pricing starts at $1,295 for the conduction-cooled XPC40x and $695 for the standard-temperature XP40X in single quantities.

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

Core i7 COM Module Offers Improved Graphics

A COM Express Computer-on-Module offers 32nm Intel Core i7 / Core i5 processor technology, high energy efficiency, wide graphics support, customizable PCI Express configuration and ECC dual channel RAM to ensure data accuracy. The ETXexpress-AI from Kontron comes in the COM Express Basic form factor and features the processor-integrated HD graphics with DisplayPort support. For safety-critical applications, the Kontron ETXexpress-AI integrates up to 8 Gbytes of ECC system memory and an optional Trusted Platform Module (TPM).

The performance of the new Computer-on-Modules is scalable from the start with a choice of four different Intel Core i7 or Core

i5 processors. The Kontron ETXexpress-AI is available with the 1.06 GHz Intel Core i7 620UE, the 2.00 GHz Intel Core i7-620LE, the 2.40 GHz Intel Core i5-520E, and up to the 2.53 GHz Intel Core i7-610E Processor. All versions support up to 2 x 4 Gbytes of dual channel DDR3 SO-DIMM modules with ECC and offer a comprehensive range of interfaces via the COM Express COM.0 Type 2 connector: 1x PCI Express Gen 2 graphics (PEG) (also configurable as 2x PCIe x8), 6x PCI Express x1, 4x Serial ATA, 1x PATA, 8x USB 2.0, Gigabit Ethernet, dual-channel LVDS, VGA and Intel High Definition Audio. Additionally, older non-PCI Express-compliant components can be incorporated via the integrated PCI 2.3 interfaces. The integrated Intel AMT 6.0 Active Management Technology enables out-of-band remote management. An 8V-18V universal power supply for simplified power distribution rounds out the feature set.

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

Atom-based COM Module Offers Extended Temperature Operation

Ideal for systems where the overhead of slot-card backplanes isn't desirable, COM modules are becoming a key form factor choice for military systems. An upgraded ESMexpress Computer-on-Module (COM) incorporates the Intel Atom XL processor to provide tested, qualified operation in the extended temperature range of -40° to +85°C (-40° to +185°F) in both conduction- and convection-cooled environments. It also features an

increased memory capacity of 2 Gbytes, double its predecessor. Because the enhanced XM1L from MEN Micro conforms to the ANSI-VITA 59 RSE standard currently in development, it provides a cost-effective and easily upgradeable means of employing advanced embedded technology in highly rugged applications as found in industrial, harsh, mobile and mission-critical environments.

The low-power XM1L uses the Intel Atom XL processor family operating at up to 1.6 GHz in combination with an IA-32 core based on 45nm process technology, while drawing a maximum of 7W. In addition to the upgraded 2 Gbytes of soldered DDR2 SDRAM system memory, the XM1L supports other memory, including USB flash on the carrier board and 512 Kbytes of L2 cache integrated into the processor. Pricing starts at $497.

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

StackableUSB Carrier Boards Support SUMIT Spec

The SUMIT connector interface ranks as one of the most innovative approaches to maximized small form factor board space. Micro/sys has added to the growing line of StackableUSB carrier and hub boards with the addition of a SUMIT version, enabling StackableUSB I/O modules to make plug-and-play connections to SUMIT CPU single board computers. The CRR-SUMIT and HUB-SUMIT attach to SUMIT-enabled 104 Form Factor (3.55 x 3.775 inch) SBCs providing OEM users four bays for the powerfully small StackableUSB I/O modules that come either USB, SPI or I²C enabled.

Micro/sys offers a root-port carrier and a hub version. The HUB-SUMIT expands a single USB port from the SBC into four USB channels. Alternatively, the CRR-SUMIT allows an OEM to interface with up to four separate root USB ports from the SBC, assuming the SBC has that number of Client ports. Additionally, for users who are concerned about stacking I/O devices directly over the CPU (as the SUMIT standard requires), the CRR-SUMIT and HUB-SUMIT solve OEMs' space concerns for air circulation. The basic CRR-SUMIT starts at $125 in single quantity. The basic HUB-SUMIT starts at $150 in single quantity.

Micro/sys
Montrose, CA.
(818) 244-4600.
[www.embeddedsys.com].

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Fanless Pico-ITX Board Sports VIA Nano Processor

Compact, low-power, fanless SBCs are just what the doctor ordered in deployed military systems. VIA Technologies offers the VIA EPIA-P820, the first Pico-ITX form factor board to feature the high-performance, 64-bit VIA Nano processor, bringing industry-leading digital multimedia performance and virtualization capabilities to the smallest of spaces with the VIA AMOS-3001 chassis system.

The VIA AMOS-3001 is an entirely fanless and thoroughly robust chassis system that is specially designed to work with the VIA EPIA-P820. Leveraging the digital prowess of the VIA EPIA-P820, the VIA AMOS-3001 offers a powerful, rugged and HD-ready industrial-class PC that combines all the benefits of high-performance 64-bit computing and ruthless

hardware acceleration of HD media across the latest display connectivity standards including native HDMI support. The ultra-compact VIA EPIA-P820 supports 2 Gbytes of DDR2 system memory and leverages a power-efficient, high-performance 1.2 GHz U2500 VIA Nano processor that measures a mere 10 cm x 7.2 cm. The VIA EPIA-P820 uses a specially designed I/O add-on board, which supplements the native HDMI port to add a VGA port, a Gigabit LAN port and two USB 2.0 ports.

VIA Technologies
Fremont, CA.
(510) 683-3300.
[www.via.com.tw].

1.6 GHz Intel Atom SUMIT-ISM Board Supports COMIT

The SUMIT I/O connector scheme and the COMIT Computer on Module standard rank as the two most significant fruits of the Small Form Factor-SIG in the past year. Supporting both is the EBC-Z8530-G from WinSystems—an SBC powered by an Intel 1.6 GHz Atom processor that measures 203 mm x 147 mm (8.5 x 5.75 inch) and supports the new Stackable Unified Modular Interconnect Technology—

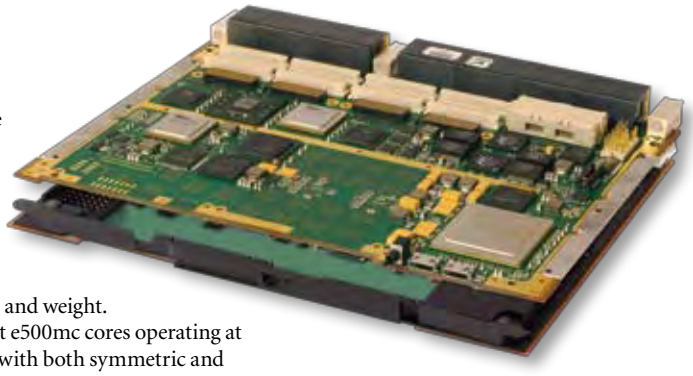
Industry Standard Module (SUMIT-ISM) expansion standard. The RoHS-compliant operates over an industrial temperature range of -40° to +70°C .

The EBC-Z530-G's I/O interface features two Gbit Ethernet ports; VGA and LVDS flat panel video, a PCI Express MiniCard interface for a wireless networking module, four USB 2.0 ports, four serial COM ports, HD audio, PATA controller for both a CompactFlash and hard disk, 48 lines of digital I/O, LPT and a PS/2 port for keyboard and mouse. Additional I/O module expansion is supported with two SUMIT and legacy PC/104 connectors. The EBC-Z530 supports COMIT and is targeted toward small form factor processor modules and baseboards leveraging the latest ultra-mobile and moderate power processor/chipset combinations. WinSystems is using a 62 mm x 75 mm card (which is roughly the size of a credit card) that includes the Atom, SCH, memory and power supplies.

WinSystems
Arlington, TX.
(817) 274-7553.
[www.winsystems.com].

Products

OpenVPX SBC Serves Up QorIQ P4080 Processor



OpenVPX has finally hit its stride as its ecosystem of products comes together. The latest GE Intelligent Platforms offering is the SBC612 rugged 6U OpenVPX single board computer. Featuring the 8-core QorIQ P4080 processor from Freescale Semiconductor, the SBC612 marks the latest iteration of GE's expanding VPXtreme6 family of 6U VPX platforms and delivers a substantial step forward in performance for applications including ISR, electronic warfare and mission computing. For many legacy applications based on Power Architecture, the SBC612 will allow a multi-slot configuration to be reduced to a single slot, saving size and weight.

At the heart of the SBC612 is the latest Freescale QorIQ P4080 processor, with eight e500mc cores operating at up to 1.5 MHz. These eight cores offer outstanding flexibility to the system designer, with both symmetric and asymmetric multiprocessing architectures being supported, and with the possibility of hosting multiple operating systems on the same device. This flexibility is ideal for re-hosting legacy multiboard applications within a new OpenVPX system architecture. With four x4 Serial RapidIO links and four x4 PCI Express links, the SBC612 supports up to 8 Gbytes of dual channel DDR3 memory. It provides a uniquely flexible I/O set that includes Gigabit Ethernet, fast serial COM ports, USB 2.0, SATA and GPIO. Further incremental system resource expansion is provided by two mezzanine sites, both of which are XMC/PMC capable, and offer the option of having XMC I/O and/or PMC I/O routed to the VPX backplane connectors. In addition, an AFIX (Additional Flexible Interface eXtension) site is available for even more plug-on system expansion. The AFIX site not only allows access to the current range of standard AFIX modules (graphics, SCSI, 1553, digital I/O, flash memory), but also offers the opportunity to add customer-specific features at minimum cost and in the shortest timescales.

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

Terabyte Drive System Provides Backup and Disaster Recovery

Today's military data storage needs are greater than ever, but the data is no less mission-critical. Serving such needs, Olixir Technologies offers the Mobile DataVault Systems. They're built for a variety of different application requirements such as backup and disaster recovery, adding removable near-line storage or replacing tape libraries. These systems utilize Mobile DataVault Transportable Drives, which feature 1,200 Gs of patented shock and vibration protection. Plug-and-play installation and push-button hot-swapping (most interfaces) of drives makes this a truly easy-to-use solution. This scalable solution is infinitely expandable and compatible with Olixir's full line of Mobile DataVault Drives, allowing unlimited versatility when choosing configurations or increasing capacity. System is available in Desktop Tower or Rackmount Chassis configurations and can be configured with optional RAID.

Olixir Technologies, Milpitas, CA. (408) 719-0595. [www.olixir.com].

Programmable Power Supplies Provide up 8 kW

Pioneer Magnetics has introduced the PM33216B, a new breed of programmable 15V to 70V PFC power supplies providing full output power up to 6 KW with single or three phase AC Input from 180 to 264 VAC or three phase AC Input to 365 to 528 VAC. The output voltage and current are linearly programmable from 5% to 100% via an external analog input from 0V to 5V or 10V. Designed to support both stand-alone and parallel configurations, these models are configured both in standard Non-Plug and Hot-Plug I/O interface. The 5" x 5" units have internal forced air cooling and built-in protection from electrical overloads. Dozens of standard options are available including variable speed fan control. Custom options are also available.

Pioneer Magnetics, Santa Monica, CA.
(310) 829-6751.
[www.pioneermagnetics.com].

Adaptable Measurement Platform Targets SIGINT Apps

For SIGINT and electronic warfare, today's wider and faster signals will become mainstream tomorrow. Serving such needs, Agilent Technologies has introduced the N7100 signal intelligence (SIGINT) search, collection and direction-finding system. The N7100 is a highly adaptable, multi-mission platform designed for quick-reaction deployment. The system allows users to capture and locate challenging signals in difficult radio-frequency (RF) environments. The hallmarks of the N7100 system are its modularity, compact size and raw measurement speed. The system's speed enables new capabilities, such as ultra-fast wideband search, fully integrated wideband direction-finding (DF) and sustained multiband signal collection. Other capabilities include RF surveys, signal monitoring, and wideband signal recording and playback to rackmount disk arrays.

For maximum productivity, the N7100 supports the widely used Agilent E3238S signal search and collection software and easily integrates with existing E3238S systems. The N7100 also supports the Agilent universal signal detection software, which recognizes more than 20 types of modulation and lets system users create new signal detectors during ongoing operations without programming. The N7100 product family includes a mainframe and four plug-in system and measurement modules. The mainframe and all four modules may be ordered today, with delivery expected in 16 weeks. Prices for N7100 systems configured for SIGINT applications start at $102,386.

Agilent Technologies, Palo Alto, CA. (650) 752-5000. [www.agilent.com].

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Analog Multiplexer Family Provides Low Voltage Interfaces

Aeroflex Colorado Springs offers a new product family of HiRel Analog Multiplexers. Analog Multiplexers are used in aerospace applications to send multiple signals to subsystems for monitoring. The addition of Aeroflex Colorado Springs' low-voltage LVCMOS interface 16-1Muxes provides the industry an alternative to the available 5V Muxes. The eight new products are available with a variety of interface and analog voltage features. The UT16MX110 for example is an Asynchronous Parallel LVCMOS Interface with 5V single supply. The digital core and I/O voltages are 3.3V digital core, 3.3V or 5.0V I/O supply depending on version. All products are 100 krad(SI) TID with a LET of 91 MeV-cm2/mg and latch-up immune to 110 and are packaged in a 28-pin flatpack. The Aeroflex UT16MX110 is $806 in quantities of 100 for QML Q.

Aeroflex, Plainview, NY. (516) 694-6700. [www.aeroflex.com].

Rugged Power Supply Provides 48V at 1500W

Military power supply needs go way beyond those of consumer electronic applications. With that in mind, 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 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, 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 from 100 to 400 VDC. These units include active power factor and harmonic correction. They also comply with SEMI-F47 standards for input droop down to 100VAC at full load. All models include an industry leading 5-year warranty.

These 500 to 1500W power supplies meet Class B EMI standards (both radiated and con-ducted) and are safety-approved to UL60950-1, EN60950-1, UL508 and Factory Mutual: FM3600, FM3611 and FM3810 specifications. They also comply with the Ring Wave Lighting Surge Test per IEEE C62.41 (6kV/30 Ohm, Criteria A) and Immunity Standards per EN61000-4-X. All units are RoHS-compliant and carry the CE Mark. The model LZSA1500-4 (48V output) is available now and priced at $975.00 each in 1000 piece quantities.

TDK-Lambda Americas, San Diego, CA. (619) 628-2859. [www.us.tdk-lambda.com].

Ultra Compact Mini PC Weighs Only 1.2 Pounds

Stealth Computer has released a new form factor of the mini PC; the model LPC-100 is their smallest to date. The new Stealth ultra-small form factor PC offers tremendous processing power in a tiny package that measures only 4.0" x 6.1" x 1.45" (102 mm x 155 mm x 37 mm) or about the size of a paperback novel. The machine weighs in at a mere 1.2 lbs or .62 kg. The Stealth ultra-small PC outperforms most other small sized PC systems due to the integration of the latest Intel Core2 Duo mobile processors. The LPC-100 is available with a standard Intel Dual Core Celeron T3100 (1.9 GHz) or optional Intel Core2 Duo processors P8400 (2.26 GHz) or T9400 (2.53 GHz). Stealth's space saving computer utilizes the Intel Mobile GM45 Express Chipset featuring Intel's graphic media accelerator with superior 3D graphics performance.

Stealth Computer, Woodbridge, Ontario, Canada. (905) 264-9000. [www.stealth.com].

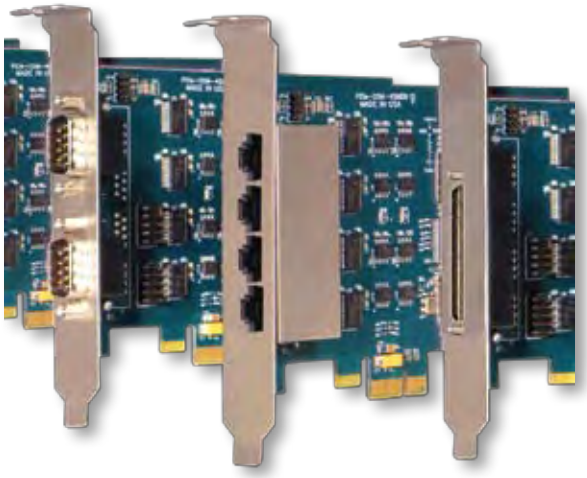
Full-size PICMG 1.3 SHB Board Sports Core i7/i5/i3 Processors

Gone are the days when desktop and mobile microprocessors took years to move into the embedded military realm. Today such processors move onto embedded platforms as soon as possible. Adlink Technology has announced the NuPRO-E330, the latest PICMG 1.3 full-sized System Host Board (SHB) in their product lineup. The NuPRO-E330 supports next-generation Intel Core i7/i5/i3 processors at clocks speeds up to 3.33 GHz and dual-channel DDR3 1066/1333 MHz memory up to a maximum of 8 Gbytes in two DIMM slots.

The NuPRO-E330 supports Intel Active Management Technology 6.0 (Intel AMT 6.0). Intel AMT 6.0 allows users to remotely manage assets, reduce downtime and minimize on-site visits. Utilizing out-of-band system access, Intel AMT 6.0 allows users to remotely detect, isolate and recover systems, even when they are powered off. The NuPRO-E330 provides additional data security with six SATA II interfaces supporting Intel Rapid Storage Technology for RAID 0/1/5/10 functionality. For applications requiring quad-core capability and integrated graphics, Adlink also presents the mPCIe-8770 Mini PCI Express graphics card. The mPCIe-8770 features onboard GPU and memory to provide VGA output to the rear I/O bracket and can be installed on the NuPRO-E330 with no increase in card height.

Adlink Technology
San Jose, CA.
(408) 495-5557.
[www.adlinktech.com].

Family of PCIe RS-232/422/485 Serial Comms Cards Rolls

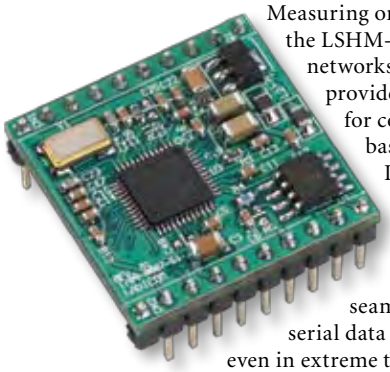


It seems that no matter how complex and compute intensive military systems get, there's still a need to interface to a large number of serial ports. Serving such needs, ACCES I/O Products has released a new family of PCI Express serial communication cards featuring both DB9 and RJ45 connectivity—the PCIe-COM family. These PCI Express cards feature a selection of 8, 4, or 2 ports of software selectable RS-232, RS-422 and RS-485 serial protocols. The cards feature a x1 lane PCI Express connector that can be used in any available x1, x2, x4, x8, x12, or x16 PCI Express expansion slot.

Each RS-232 port is capable of supporting data communication rates up to 921.6 kbps and implement full modem control signals to ensure compatibility with a broad variety of serial devices. RS-422 and RS-485 models support data communication speeds up to 3 Mbit/s. Existing serial peripherals can connect directly to industry standard DB9M or RJ45 connectors, which are provided on board each card or via a breakout cable. The PCIe-COM family was designed using type 16C950 UARTS and uses 128-byte transmit/receive FIFO buffers to decrease CPU loading and protect against lost data in multitasking systems. The cards are fully software compatible with current PCI 16550 type UART applications and allow for users to maintain backward compatibility. Prices range from $179 to $549, depending on model.

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

Serial-to-Ethernet Module Provides Small Footprint



Radicom Research has made available its LSHM-200 Serial-to-Ethernet Modules for Embedded System Applications (LSHM-200). Measuring only 1" (W) x 1" (D) x 0.25" (H), the LSHM-200 connects serial devices to IP networks with a 10/100BaseT interface. It provides an easy and affordable solution for connecting microcontroller-based systems with serial ports to IP networks for remote control and monitoring applications. Capable of operating between temperatures of -40° and +85°C, the LSHM-200 allows for seamless access and communications of serial data through any 10/100BaseT Ethernet, even in extreme thermal conditions. It provides data transfer among multiple IP addresses simultaneously via Telnet ports with TCP/IP protocols under Ethernet. Radicom Research's Half-Inch Serial-to-Ethernet module is available now. Prices begin at $24.00 in quantities of 100.

Radicom Research, San Jose, CA. (408) 383-9006. [www.radi.com].

Quarter-Brick DC-DC Converters Offer 300W at 94% Efficiency

Murata Power Solutions has extended its HPQ range of high-power quarter-brick isolated DC-DC converters with the introduction of the HPQ-12/25-D48, a 300W model with 12V output. The new model features a wide 2:1 input range of 36 to 75V and output of 12V, plus high output current of up to 25A in an industry standard quarter-brick package (2.3" x 1.45" x 0.44"). The HPQ-12/25-D48 also boasts high efficiency of up to 94.5%. The HPQ-12/25-D48 is ideal for a wide range of markets and applications. Excellent ripple and noise specifications assure compatibility with circuits using CPUs, ASICs, programmable logic and FPGAs. Ideal for battery-powered and telecom equipment, applications for the HPQ-12/25-D48 include small instruments, area-limited microcontrollers, data communications equipment, remote sensor systems, vehicle and portable electronics. Pricing starts at $39.79 in OEM quantities.

Murata Power Solutions, Mansfield, MA. (508) 339-3000. [www.murata-ps.com].

60 Watt Chassis Mount Encapsulated AC/DC Power Supply

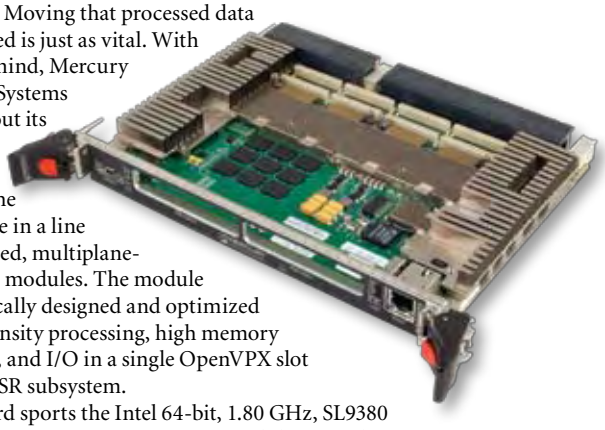
ConTech has rolled out the "PC60" Series of AC/DC switching power supplies. The PC60 Series offers 60 watts of output power in an encapsulated case, making it well suited for ruggedized backplane applications. The optional Din-Rail mount and easily accessible terminal blocks give it the versatility to be used as a power solution in a large assortment of applications.

The PC60 series offers output voltages that range from 5.1 VDC to 48 VDC, with efficiencies up to 84%. The series also has output over-voltage protection. The units are encapsulated with a thermally conductive potting compound in a plastic resin and fiberglass case that meets UL94V-0. The enclosed case has external terminal blocks for ease of connection and is chassis mountable. Adding optional accessory DIN-03 Base Plate easily converts the chassis mount case to a standard Din-Rail mount. The PC60 series is rated for 3000 VAC isolation, is UL approved, and is RoHS compliant. Pricing for the PC60 Series is $59.50 each.

ConTech, Concord, CA. (925) 609-1193. [www.contech-us.com].

Core2 Duo OpenVPX SBC Targets ISR Apps

For military ISR applications, it's not just all about high-density processing. Moving that processed data at high speed is just as vital. With all that in mind, Mercury Computer Systems has rolled out its Ensemble 6000 6U SBC6521, the first module in a line of Intel-based, multiplane-enabled 6U modules. The module was specifically designed and optimized for high-density processing, high memory bandwidth, and I/O in a single OpenVPX slot within an ISR subsystem.

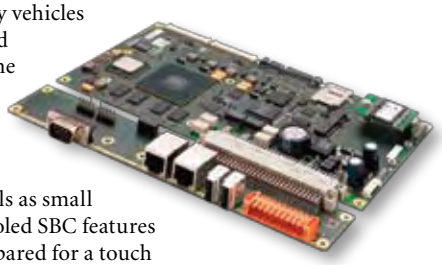


The board sports the Intel 64-bit, 1.80 GHz, SL9380 low-voltage Core2 Duo Penryn CPU and the 3100 chipset that combines a Memory Control Hub and I/O Control Hub (MCH/ICH) capabilities in single device. Onboard main memory includes 2 Gbytes of DDR2 SDRAM with ECC support. The board's OpenVPX multiplane architecture approach creates an extensible architecture that facilitates interoperability among the various subsystem functions. The expansion plane, one of the planes in the OpenVPX multiplane architecture, provides scalable I/O and high-speed communications between the SBC6521 and the rest of the subsystem. Scalability and intra-system high-speed communications are crucial elements for the embedded signal and image processing applications required by all ISR subsystems; for example, as part of an ISR subsystem, the SBC6521 supports high-powered XMC mezzanine cards for electronic warfare (EW) applications such as high-speed direction finding and signal jamming. The SBC6521 module also serves as the subsystem host for the previously announced GPU-based Ensemble 6000 Series GSC6200; together these modules form the basis for embedded rugged defense surveillance platforms, performing processing, exploitation and dissemination (PED). When augmented with Mercury's the SBC6521 and the GSC6200 products, PED applications can achieve 10-60 times greater performance compared to previous generation systems.

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

Rugged SBC Offers Robust Display Functions

A rugged, maintenance-free SBC is targeted for use in mobile and intelligent display environments including trains, public transportation, airplanes and other specialty vehicles as found in construction and agricultural applications. The compact SC21 from Men Micro measures only 220 mm x 150 mm x 35 mm to easily fit into display devices with TFT LCD panels as small as 10.4" The conduction-cooled SBC features backlight control and is prepared for a touch screen interface. Controlled by the Intel Atom XL Z520PT, the SC21 features a core processor speed of 1.33 GHz and a system bus frequency of 533 MHz for exceptional computing power in space-constrained environments. The board is priced at is $845.



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

Multi-frequency Clock Synthesizer Rides PMC

Synchronized sampling using precision clocks is key in any military multichannel A/D and D/A system used in radar or communication. Serving those needs, Pentek has released the user-configurable Model 7191 programmable clock synthesizer PMC module. Like its predecessor, the Model 7190, the new Model 7191 gives designers working with A/Ds and D/As a highly precise clock source with the added flexibility of custom frequency generation under simple software control. The Model 7191 is ideal when the desired clock frequency is not initially known, such as in laboratory systems or field-configurable deployed applications.

The card achieves its combination of flexibility and performance by using low-noise VCXOs for the fundamental frequency generation. The VCXO output is followed by a clock synchronizer from Texas Instruments to allow synchronization with common frequency reference sources. The Model 7191 generates four different user-programmable VCXO frequencies, plus four divided versions (by 2, 4, 8 and 16) of each oscillator. Using the provided software, users can freely route up to five different frequencies from this set of 20 choices to the board's eight buffered 50-ohm outputs. The user-programmability of the Model 7191 provides arbitrary frequencies to help speed development by providing immediate access to non-standard operating frequencies. Conventional crystal oscillators for custom frequencies often require extremely long lead times. The board's base format is an industry-standard PMC module with 32-bit 33/66 MHz PCI interface, usable on any type of carrier that supports PMC. Pentek also offers this module on simple carriers for PCI, PCI Express, CompactPCI, VME and VPX form factors. The price of the Model 7191 Multifrequency Programmable Clock Synthesizer is $2,995.

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

I/O-rich SHB Features Twin Intel Nehalem/ Westmere Processors

A PICMG 1.3-style system host board (SHB) supports twin multicore Intel Nehalem and Westmere processors. MB-80100 from WIN Enterprises features the Intel LGA 1366 processor socket that enables CPU scalability across the Nehalem and Westmere multicore processor families. The MB-80100 features the Intel 5520 Chipset, FireWire, an LSI 1068E RAID chip and PCI-X. Unlike other PICMG 1.3 boards, the MB-80100 provides up to 20 lanes of full 64-bit PCI Express. The 32 nm Westmere processor family is expected to grow to 8- and 12-core versions. These processors will be supported by MB-80100 as they become available. The MB-80100 supports up to 20 Lanes of PCI Express Gen 2.0 as well as a MXM-II interface and a custom MXM-II pass-through card to bridge x16 lanes. It also features six Non-ECC or ECC Registered DDR3 240 pin slots for Triple Channel Memory to each processor.

WIN Enterprises, North Andover, MA. (978) 688-2000. [www.win-ent.com].

Rugged Box PC with Modular I/O Serves Cost-Sensitive Apps

The stand-alone rugged box trend has hit all levels of product types. A new I/O server industrial PC is targeted at reducing costs as an alternative to PC/104 or CompactPCI embedded computers. Field I/O signals in the IOS-7200 Industrial PC from Acromag are interfaced through an internal carrier card with related plug-in I/O modules. Working together, the rugged, fanless box computer and conduction-cooled I/O modules provide a truly integrated system for many measurement and control projects. A low-cost Geode CPU processes the I/O signal data and manages numerous interface connections for peripherals and networking. Inserting a mix of up to four mezzanine IOS modules on the slide-out carrier card enables A/D, D/A, discrete monitoring/control, counter/timer, serial communication and FPGA computing functions. A Model IOS-7200 I/O Server PC starts at $1,695.

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

New Front I/O Systems for Rugged Enterprise Server Family

Two new high-performance servers for mission-critical applications in harsh environments are offered as 2RU and 3RU systems in a 17-inch (431.8 mm) depth chassis with all I/O accessible from the front of the machines. Power supplies, disk drives, Gigabit Ethernet controllers and a graphics port are also front panel accessible. Front panel only access and a shallow depth design, make the RES-22XR3/FIO and RES-32XR3/FIO from Themis Computer suitable solutions for use in space-constrained environments. Themis' new systems are offered with four-core (5500 series) or six-core (5600 series) Intel Xeon processors, with up to 144 Gbytes of memory, extensive disk storage—up to eight lockable and removable drives, hot-swappable fans and hard disk drives, and single or redundant power supply options for increased reliability in challenging environments.

In addition, the front panel access and I/O includes two lockable and removable 2.5" SATA or SAS drives (RES-22XR3/FIO) or up to three lockable and removable 2.5" SATA or SAS drives (RES-32XR3/FIO) as well as one CD-RW/DVD-RW drive. There are two Gigabit Ethernet ports (RJ45), one or two RS-232 Serial port (DB9), up to six USB 2.0 ports plus PS/2 keyboard and mouse ports. Power connector and switch and status LEDs are included as well as, in some configurations, a VGA port.

Themis Computer, Fremont, CA. (510) 252-0870. [www.themis.com].

Two-slot OpenVPX Development Platform Supports 3U and 6U Cards

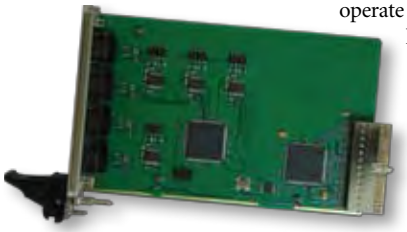
This has become the year of OpenVPX, especially in terms of new products. With its latest, Elma Electronic offers a new two-slot VPX/OpenVPX test and development platform that accommodates both 3U and 6U boards via a shelf divider. The new E-Frame Series Test Platform from Elma Electronic can connect multiple backplanes to efficiently simulate various fabric topologies, eliminating the need for costly custom backplanes and allowing high-speed signals to be passed from one slot to the next. The new E-Frame Series enables developers to power up one or more VPX blades under test and interconnect the J1 fabric connections to emulate the user's application. Signals from an external device can also be introduced through the J1 fabric connector or accessed on the J1 fabric connector using the provided SMA and SATA cable headers.

The use of a standard VPX RTM (rear transition module) plugged into the back provides access to the J0, J2, J3, J4, J5 and J6 connectors, while simultaneously accessing high-speed signals in the J1 connector, routed out the side of the backplane. Each slot's J1 "A" channel is broken out into 16 SMA connectors and the "B", "C" and "D" channels into four SATA2 cable headers (12 total per slot). The new E-Frame Series measures 9U x 42 HP (8.4") x 11.73" and weighs only 18 lbs. Located on the rear of the chassis, power input voltage is 97 VAC to 264 VAC auto-ranging and power input frequency is 47 Hz to 63 Hz. Total power consumption is 580W. The test platform operates from 0° to +50°C at altitudes of up to 6,000 feet. It withstands shock of up to 10 Gs at 11 ms and vibration to 1 G at 10 Hz to 330 Hz in non-condensing humidity from 5% to 95%. Pricing is $6,200 in single unit quantities.

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

High-Density Serial Comms cPCI Module Supports Extended Temp

The new TCP467 from Tews Technologies extended temperature is a high-density 3U CompactPCI Serial Communications Controller that provides four channels of high-performance RS232/RS422/RS485 selectable serial connectivity. The serial channels can be individually programmed to operate as RS232, RS422 or RS485 full/half duplex interfaces. In addition, programmable termination is provided for the RS422/RS485 interfaces. After power-up all serial I/O lines are in a high impedance state for critical applications. Physical connection is achieved through front panel I/O with four RJ45 Modular Jack connectors. All channels generate interrupts on CompactPCI interrupt INTA. For fast interrupt source detection the UART provides a special Global Interrupt Source Register. The TCP467 operates in extended temperature range (-40° to +85°C) standard.



TEWS Technologies, Reno, NV. (775) 850-5830. [www.tews.com].

Mini-ITX Board Takes 64-bit Computing Rugged Systems

The EPIA-M840 from Via Technologies packs the latest 64-bit VIA Nano E-Series processor, dual Gigabit LAN, eight COM ports and support for two dual channel 24-bit LVDS displays, creating the ideal backbone for a range of military embedded applications. Available in both 1.6 GHz and a fanless 1.2 GHz SKUs, the VIA EPIA-M840 Mini-ITX board brings native 64-bit software support, the industry's most efficient speculative floating point algorithm and full software virtualization support in an industry-leading low power architecture. The VIA VX800 media system processor adds DirectX9 integrated graphics, HD audio, dual Gigabit networking and supports up to 3 Gbytes of DDR2 system memory. The VIA VX800 also offers advanced video acceleration for MPEG-2, WMV9 and VC-1 video formats, plus a VMR capable HD video processor.

VIA Technologies, Fremont, CA. (510) 683-3300. [www.via.com.tw].

Image Processing Module Supports High Frame Rate Interfaces

A new image processing and acquisition module supports applications that require both high data transfer rates and high computational throughput. The PCI-104-3000 from Advanced Optical Systems provides the computing power for today's most challenging military video acquisition and signal processing applications. It incorporates industry standard high frame rate sensor interfaces including FireWire (1394a), Camera Link (Base) and Gbit Ethernet; with a reconfigurable processing engine based on FPGA technology. The PCI-104-3000 also provides a high bandwidth auxiliary bus for transferring large blocks of processed data to another board for further processing or for user-defined input/output. If your application requires multiple sensor input options, real-time digital signal processing capacity and high bandwidth parallel computing all in a small package, the PCI-104-3000 is the right solution.

Advanced Optical Systems, Huntsville, AL.

(256) 971-0030.

[www.aos-inc.com].

COM Express Modules Sport Latest Atom CPUs

Two Compact format COM Express modules are powered by the latest Intel Atom D410/D510 processors at 1.66 GHz coupled with up to 4 Gbytes DDR2 memory. The COMX-430 and COMX-4440 COM Express modules from Emerson Network Power have a wide range of built-in devices to connect to standard PC interfaces including LCD (LVDS) and CRT displays, both SATA and legacy PATA disks, PCI Express and PCI peripherals, USB devices and Gigabit Ethernet networks. They support a range of solid-state disks via the SATA interface or CompactFlash via the IDE interface on the carrier. Microsoft Windows XP, Windows 7 and Fedora 12 Linux operating systems are supported as standard.

The COMX-430 and COMX-440 are based on the common Type 2 COM Express pin out and are Compact format (95 mm x 95 mm). This makes them suitable for both existing applications requiring a new processing module from a trusted vendor as well as new applications that need to incorporate off-the-shelf PC controller functionality onto custom I/O baseboards. The modules are designed for use in a variety of applications that require low power consumption, scalable performance and easy-to-use embedded PC functionality.

Emerson Network Power, Carlsbad, CA. (407) 241-2751.

[www.emerson.com].

Rugged Server brings Dual Xeon to Extended Environmental Conditions

With up to 12 processing cores designed with new 32 nm technology, a new industrial server offers high performance density that makes it a fit for virtualization functionality, allowing formerly separate apps to be moved onto a single, cost-effective system. The Industrial Silent Server KISS 4U KTC5520 from Kontron is a highly robust and long-term available open standard platform, offering up to dual Intel Xeon 5600 Series processors. It features an operating temperature range of 0° to 50°C, an operating humidity range of 10-95%, all-around IP 20 protection (optionally upgradeable to IP 52 at the front), and high shock and vibration protection, which makes the server perfect for applications where more ruggedized systems are necessary.

The server board can be fully managed remotely. The Industrial Silent Server is available with up to two Intel Xeon (5500 or 5600) series processors and up to 48 Gbytes of DDR3 ECC registered SDRAM per processor. The server paves the way for a wide range of extensions, thanks to 1x PCI Express x16 (PEG) (configurable as 1x PCI Express x8), 3 PCIe 2.0 x8, 1 PCIe x4 (using x8 slot) and 1 x PCI. Also on board are 2 x Gbit Ethernet, 6 x USB 2.0 (2 on the front) and 1 x COM (RS232).

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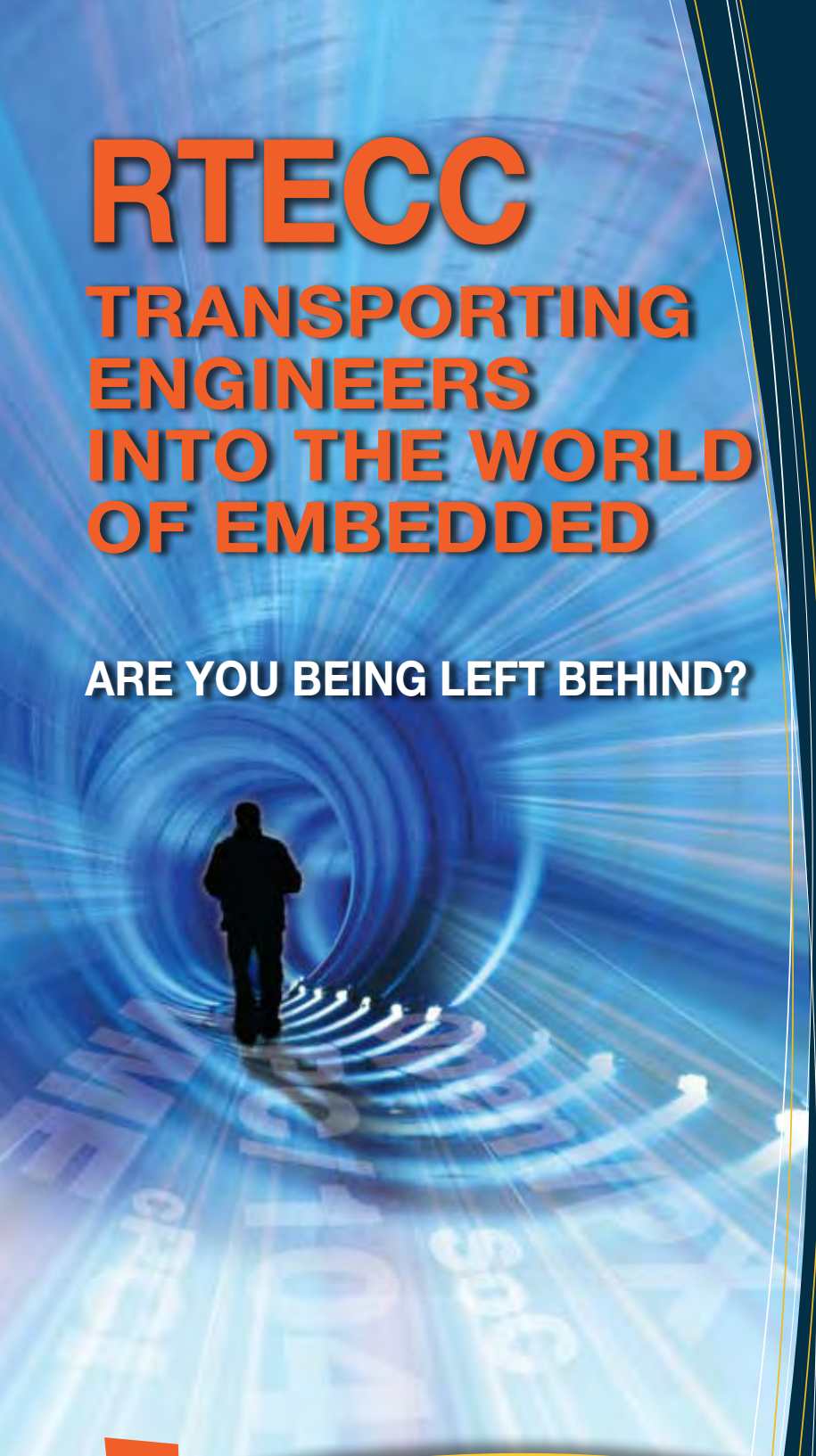

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Special Feature: Target Report: Technology Building Blocks for the Net-Centric Warfighter As the U.S. military transforms itself to Network-Centric operations, every node in the networked military will be affected. Gradually, every vehicle, every aircraft, every ship, every UAV and every soldier on the ground will be able to quickly share data, voice and even video with almost any level of the DoD's operation. This section explores the display, computing and networking technologies that are all a part of a Net-Centric military.

Tech Recon: MicroTCA and AMC do Rugged Duty MicroTCA is gaining interest as a compact, integrated solution, using the growing selection of AMC mezzanine cards essentially as slot cards. Articles in this section examine the latest trends along those lines, as well as an update on efforts to ruggedize MicroTCA.

System Development: Cutting Size, Weight and Power in Radar and SIGINT Systems Waveform-intensive applications like sonar, radar, SIGINT and software radio seem to have an endless appetite for signal processing power. Faster DSPs coupled with a broader range of IP cores and development tools for FPGAs are joining forces to form new DSP system architectures. These technologies are enabling radar and SIGINT systems that pack more computing into smaller units, drawing less power. Articles in this section examine the SWaP issues in these applications and the products available to address them.

Tech Focus: Rugged Stand-Alone Box Products Traditional embedded board vendors are adding stand-alone rugged box-level systems to their military market offerings. These complete system boxes often support standard form-factor boards inside them. The result is a complete, tested and enclosed computing solution that eliminates complex integration chores for customers. This section looks at this emerging product class and outlines the problems they solve. A product album rounds up the latest representative products in this area.

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ABOVE & BEYOND

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Editorial

Jeff Child, Editor-in-Chief

GCV Inching toward Reality

Anyone who's been in the defense industry for any significant number of years has probably felt the impact of a major program getting cancelled or restructured. The upheaval ripples through companies of all sizes—technology supplier companies and defense contractors alike. And the disrupted or lost opportunities are hard to cope with. Such was the case with the Army's massive Future Combat System program. In April of last year Secretary of Defense Robert Gates made a bold decision to not just restructure FCS but to cancel the program. While all the reasons for cancelling it seem valid in hindsight, even I as a journalist felt a pang of loss—only because it was a program I had gained a lot of knowledge about over the years. Over the past year, the Army has turned its efforts toward the development of a new vehicle called the Ground Combat Vehicle (GCV). Being in the technology information business, I've been hungry for details about the GCV, but the past several months haven't yielded much as primes have been busy responding to RFPs and the development of their bid designs.

Some light was shed late last month when BAE Systems and Northrop Grumman did a media briefing talking about some specifics of their team bid for the GCV competition. They provided a graphical rendering of their GCV design (see p.8 in this issue). As is typical of such briefings, most of the media is interested in "outside in" sorts of details about the GCV, so the briefing was geared in that direction. As Editor of a technology magazine, my interests are more from an "inside out" perspective, but the BAE Systems folks were kind enough to get me that level of information in response to the follow up questions I had.

The burning question for our military embedded computing industry is, of course, what type of embedded form factors and architectures will be used in these vehicles? A good number of vendors in our industry had contracts to supply boards to various manned vehicles of the FCS programs, so they're watching what happens with the GCV very closely. One of the points I was most curious about was how much of GCV's computing and networking systems (including software) would be leveraged from work developed as part of the Future Combat Systems program. The RFPs for the GCV permitted bidders to make use of prior Army investment in armor configurations. It was stipulated however that contractors would not get an inherent advantage for doing so, and would instead be judged on their own merits.

As expected, the BAE Systems/ Northrop Grumman team said that they will indeed leverage significantly from FCS work. The CGV employs a general purpose computing platform throughout the vehicle, and they say their choice for those processors is a direct derivative of the FCS computer. The GCV's software architecture also builds on lessons learned from FBCB2 Joint Capabilities Release (JCR). The JCR version of Force XXI Battle Command Brigade and Below (FBCB2) software provides a common FBCB2 platform solution for both the Army and U.S. Marine Corps. By staying aligned with the FCS computer design, the GCV's computer is primed to incorporate the FCS-developed Network Interface Kit's (NIK) battle command software and network communication capabilities.

The GCV's C4ISR system will exploit the capabilities of both JTRS and WIN-T by directly integrating those capabilities into the vehicle. All that is intended to meet the requirement to augment the commander's situational awareness and ability to coordinate squad operations.

It's natural to assume that the GCV would leverage a technology like OpenVPX for its C4ISR computer systems. When asked about that, the BAE-NG team expressed that embedded computing technology doesn't completely address the difficult GCV environment. They do expect to exploit OpenVPX products, but those products will have to meet not just the rigorous temperature profile, but also meet requirements for shock/vibration, for chemical, nuclear, biological, and for high altitude electromagnetic pulse (HEMP) survivability. Meeting those requirements with a high-availability computing and data bus platform will, they say, call for close collaboration between product developers and system integrators. Other factors such as information assurance and roadmaps for performance/capacity growth will also come into play.

Not surprisingly, they couldn't share many details about their GCV's drive electronics because it's still competition sensitive. But they are using a strategy for their drive electronics and the weapons control that is scalable, survivable and open—along the same lines as their GCV C4ISR platform implementation.

It may be a few months still before contracts are awarded. And how many contractors are involved will depend on funding. Then begins the technology development phase, subsystem prototypes and so on. The current schedule calls for first production vehicles to be around 2017. Given the history of extreme costs and problems with the FCS program, it's clear that Congress's level of scrutiny on the GCV program will be high. That will probably translate into fewer numbers of prototype platforms and the computing and electronics that go with them. That could impact the types of volumes embedded computer vendors can sell into that process. But it could just as easily build up the pressure for primes to leverage computing solutions from outside embedded computing vendors rather than doing their own. ▮▮

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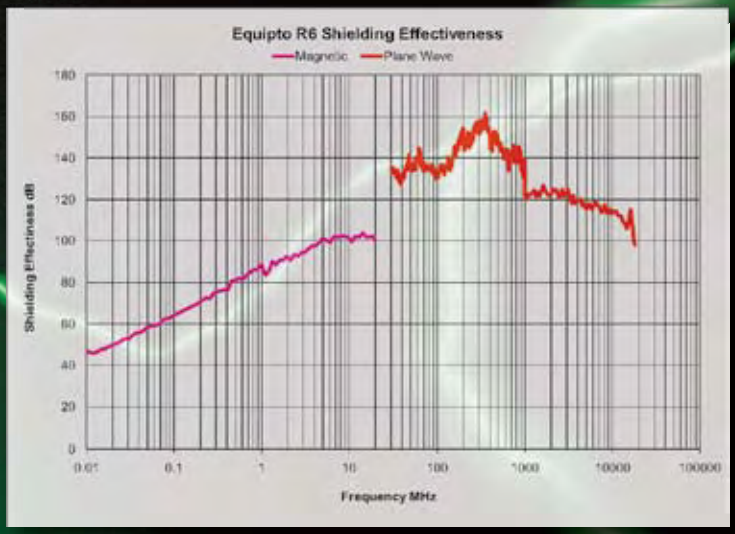

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