

# COTS

JOURNAL

The Journal of  
Military Electronics & Computing

## MULTI-FUNCTION BOARDS

— RESHAPE MILITARY I/O —

Volume 11 Number 8 August 2009

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### PLUS:

VITA-Standard Boards  
Fuel Tech Upgrades

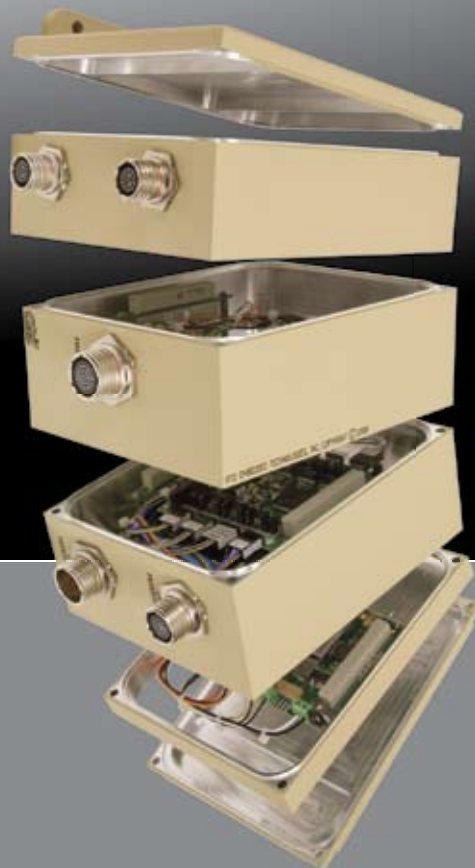
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August 2009 Volume 11 Number 8



The Journal of Military Electronics & Computing

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Commonality and Opportunity in UAVs

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Advanced sensor systems in the Long-Endurance Predator UAV rely on a processor that's adjacent to sensors and with direct access to original sensor data, so that image exploitation can occur in real time. As the UAV flies and collects data over a designated area for hours at a time, the multi-look, multi-sensor nature of its mission can be fully exploited. Shown here, AGM-114 Hellfire missiles are loaded on an MQ-1 Predator UAV.

(U.S. Air Force photo by Airman 1st Class Jonathan Steffen)



**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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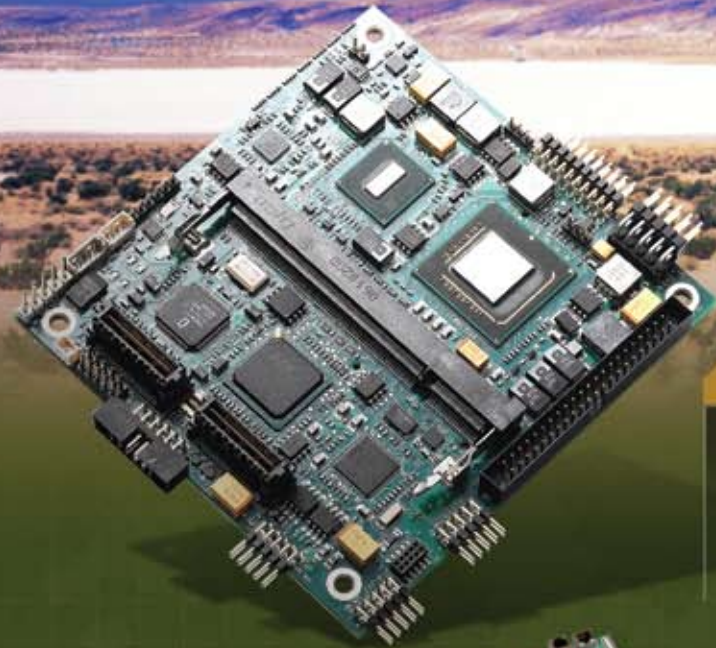
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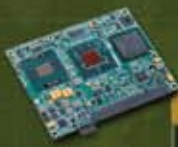


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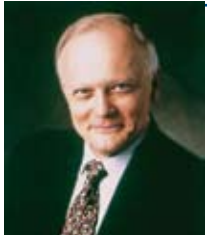
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# Publisher's **Notebook**



## Ringside, or in the Ring... It's Gonna be Interesting

**T**he budget and program sparring continues in Washington. Congress and the White House have so many big issues on the table that require immediate resolution. The workload is so demanding it may not be worth it to be in politics any more. I have to give Secretary of Defense Gates his due. He's standing by his convictions and fighting Congress on all its proposed budget alterations. This has become a battle of wills that highlights the question: Is the administration or the legislature running the defense of our nation?

One of the biggest issues that concerns the larger suppliers of deployable systems to the military is the elimination of "supplementals." The administration has vowed to eliminate supplementals and make them part of the overall Defense Budget. The problem is this: If for 2011 you assume roughly \$50 billion to \$100 billion per year in supplementals to pay for military operations in conflict areas that has to come out of the regular budget, from where do you take it? If the current level of supplemental money has to be pulled from the Defense Budget, then it has to be at the expense of some big-ticket new programs, thus causing hurt for the big defense contractors.

Congress doesn't want to take any money from pet programs that will provide long-term money to their districts—whether or not the military wants or needs the equipment. Someone at some time will have to come to grips with this. Right now this rhetoric is contradictory. I know the government can just print all the money it wants. We saw that in the last year. Their political positioning right now is saying "the Defense Budget will be held to a 2% growth, there will be no supplementals, we will continue to focus on Afghanistan, and we will continue funding Congresses pet programs." All that together won't play. Someone and some of these things will need to cry uncle.

We're now beginning the round where the top suppliers to the DoD have started to make statements regarding how they plan to adjust their company's focus to weather the impending changes in the requirement of the U.S. military. The 18 to 24 month production cycle that has kept the revenue stream for these suppliers at current levels through 2010 will go away by 2011. I don't think there's much they can do to hold the current level of profitability. In order to keep revenues from declining, they need to either diversify into different markets, start another cycle of acquisitions, or focus on where the military is shifting their needs.

Not that Michael Strianese, CEO of L3, needs my acknowledgement, but I agree with the thoughts he voiced recently in *Defense News*, July 20, 2009. In essence he said the military was changing,

that it needs things quicker and cheaper, and that it would be a rocky road for some—but his company was going to position itself to meet the changes. To some that may seem like motherhood and apple pie, but to me it says this is no time to panic. Just find out what your customer needs and be the best at providing that. I'm sure that some military suppliers will find success in shifting focus to other government segments or non-military markets. But this is a rough road that will require some capability alterations for success. The pot holes of non-military markets are their fierce competition and extremely short development times that require cutting-edge designs.

Closer to home, no matter what happens to the total defense budget, the need for embedded electronics for the military will be increasing. It's the "Where will it be needed?" that's the big question. The simple answer is always the same when the DoD goes through this cycle: upgrades and retrofits first, and developments that will take the warfighter out of harm's way second. As we inevitably move out of the current budget cycle and into the next round to start to focus on the next defense budget, more adjustments will be made determining the programs that will benefit from technology insertions, and which ones will wither away.

With only a "feel" for what our military commitment in Iraq and Afghanistan will look like in 2011, it's difficult to determine what programs will receive the go ahead for upgrades and retrofits—trickling down to funding in the embedded electronics industry. The embedded electronics community can't take the overall budget number and translate that into something they can develop a business plan around. So the community will need to be quick to react as programs get selected for continuance.

Unless the U.S. is driven into another major conflict, we're going to see an increased need for new and improved stand-off systems that support observation and quick strike missions. We may also start a new round of small embedded companies being acquired by primes in order to get around their behemoth internal organization and obtain some "quicker cheaper" capability. The real question for our market will be where does this leave the larger embedded suppliers and their relationship with the new altered primes? In the next few years there will be a lot of sparring matches at all levels of military suppliers. Let's hope we have a lot of winners and very few TKOs. ■■

**Pete Yeatman, Publisher**  
*COTS Journal*

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# The Inside Track

## ITT Awarded JTRS Support Contract

ITT has been awarded a \$22.9 million contract for Single Channel Ground and Airborne Radio Systems (SINCGARS) Software In-Service Support (SwISS) by the Joint Tactical Radio System (JTRS) Joint Program Executive Office. The work will include technical support, enhancements, maintenance and upgrades to the JTRS SINCGARS waveform (Figure 1). The total program value could reach \$62 million if all options are exercised. ITT has partnered with Thales, of Clarksburg, MD, to perform the work.

The Indefinite Delivery Indefinite Quantity (IDIQ) contract includes a two-year base period, with three one-year options. Under the terms of the award, work will be completed by ITT's Commu-



Figure 1

The standard AN/PRC-148 MBITR can be seamlessly upgraded to the AN/PRC-148 V3/V4 JEM, which was the first radio to be JTRS Software Communications Architecture 2.2 compliant.

nications Systems business. ITT will begin performing work on the first delivery order in June with an expected completion date in late 2010. The JTRS program fields interoperable, system-defined radios across multiple military platforms. Potential services under the contract include structured software engineering and program management processes in support of effective and quality software development.

ITT  
White Plains, NY.  
(914) 641-2000.  
[[www.itt.com](http://www.itt.com)].

## Army Awards Saft \$3.2 Million Increase Lithium-Ion Contract

The U.S. Army Tank-Automotive Research Development Engineering Command (TARDEC) is awarding Saft an additional \$3.2 million, building on the \$17 million contract it signed with the battery manufacturer in 2004. The new contract enables Saft to increase the production capability of its very high power (VHP) lithium-ion (Li-ion) technology under TARDEC's Manufacturing Technology (ManTech) program.

The ManTech program provides funding for the de-

velopment of low-risk, affordable technologies for military systems. The goal is to improve production costs through product flow improvements, simplifying the design of manufactured products and reducing labor hours. Since receiving funding from ManTech in 2004, Saft's Space and Defense Division has seen a fivefold increase in production capability, while also decreasing production costs on cells by 70%. These cost savings will likely enable the U.S. government to recover the entire cost of the ManTech program based on current production orders, resulting in a projected savings of \$26 million by 2013.

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## Raytheon Awarded Navy Contract for Future Air and Missile Defense Radar

Raytheon received a \$9.9 million contract to perform concept studies for the U.S. Navy's Air and Missile Defense Radar (AMDR). This radar suite will consist of an S-band radar, X-band radar and radar suite controller. AMDR is being developed to fill capability gaps identified by the Joint Requirements Oversight Council in May 2006. A key requirement of the AMDR will be its scalability for installa-

tion and integration on multiple platforms. The program will initially support the U.S. Navy's Future Surface Combatant, followed by other ship classes, including the next-generation cruiser, CG(X) (Figure 2).

The AMDR S-band component—the initial focus of the concept study—will provide



Figure 2

The CG(X) cruiser is intended to replace the Ticonderoga class AEGIS cruisers. Shown here is an artist's rendering of a possible CG(X) design.

volume search, tracking, ballistic missile defense discrimination and missile communications. Under the contract, Raytheon IDS will study the radar's S-band capabilities, as well as the radar suite controller's functionality. IDS will deliver the S-band and radar suite controller conceptual design, systems engineering studies and analyses, and a technology development plan. The majority of work for this contract will be performed at Raytheon IDS' Surveillance and Sensors Center, Sudbury, MA, and is scheduled to be completed by December 2009.

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### Mercury Gets \$2.7 Million Production Order for Predator UAV Upgrade

Mercury Computer Systems announced it received a \$2.7 million production order from General Atomics Aeronautical Systems, Inc. (GA-ASI, www.ga-asi.com) to provide RACE++ Series rugged computing modules for the Predator unmanned aircraft system (UAS) Lynx Block 20 synthetic aperture radar (SAR) technology upgrade.

Since 1998, Mercury has continued to provide its scalable RACE Series and RACE++ Series computing modules and software to enable high-performance signal processing for multiple generations of GA-ASI's Lynx SAR product line. The Lynx family of SAR reconnaissance and surveillance systems, along with Mercury's signal processing modules, are installed on a variety of Predator series UAS. As the most combat-proven unmanned aircraft system in



Figure 3

A MQ-1B Predator unmanned aircraft system takes off for a training mission at Creech Air Force Base, Nevada.

## Military Market Watch

### COTS Becoming Ever More Customized

No longer does the military buyer simply acquire a COTS aircraft with few changes. There are significant military requirements that dramatically increase the unit costs as well as the risk associated with the program. The evolution actually began during World War II. While there were hundreds of aircraft taken "off the shelf" with seats and other "amenities" removed and a radio or two added, more significant changes were made to light bomber/reconnaissance platforms, including machine guns and other engines.

Today, there are still platforms that are full or near COTS, for example, the Boeing 737-700 (C-40) and various business aircraft. And we still see huge numbers of GA pistons and turboprops purchased for training and general-purpose transport duties. However, the larger programs are far more complex and complicated in their design, development and unit cost (Figure 4).

While lower unit price drives COTS, performance drives customization. There are very significant performance requirements that cannot be avoided and are continuing to multiply. The Boeing P-8A unit flyaway for the U.S. Navy, for example, is \$183M, \$100M more than its C-40C transport cousin. According to Boeing, the P-8A retains just 25% airframe structural commonality with its commercial counterpart 737-700. That is due to a variety of reasons including constant operation in a marine environ-

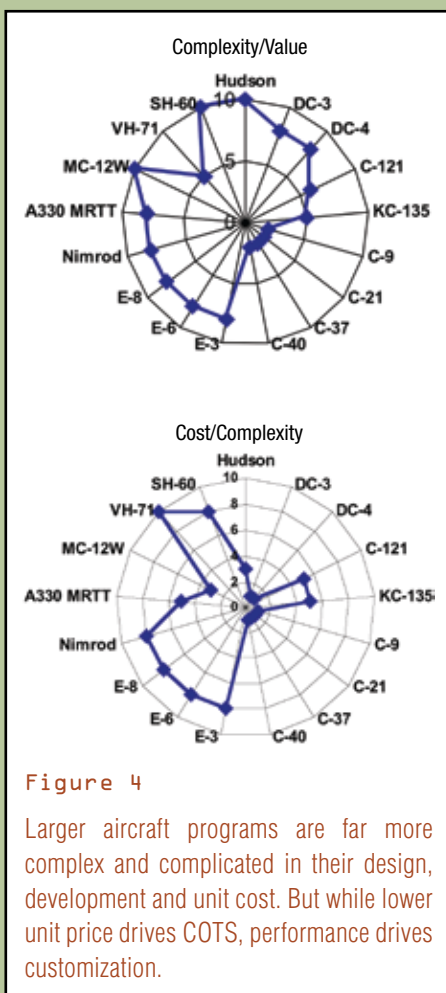


Figure 4

Larger aircraft programs are far more complex and complicated in their design, development and unit cost. But while lower unit price drives COTS, performance drives customization.

ment, low altitude cruising and high G orbiting, internal carriage of sonobuoys and weapons including torpedoes and cruise missiles, and addition of very expensive and advanced radar, communications, navigation and self defense systems.

A more radical example of customization might be the recently terminated VH-71A, the AW101-based helicopter for the U.S. Marine Corp Presidential service operation. VH-71A started out as a fairly mundane extension of the already expensive and complex EH-101 (now AW101) three-engined tactical and maritime helicopter. But after planners finished, a \$100M/per unit helicopter had "morphed" into a nearly \$400M albatross from which there would be no recovery. DoD added technical requirements leading to enormous weight increases necessitating new GE engines, new power transmission system and rotor blades to carry that higher weight, and self-defense capabilities unheard of in all but a few aircraft, namely the B-2, VC-25A, F-22 and F-35 combat aircraft. With competing operational and budget demands, COTS and customization cannot continue on the current path. It's just a question of how the two are going to share it in the future.

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the world, the Predator UAS provides continuous and persistent armed reconnaissance and battlefield support to ground troops.

The Lynx Block 20 radar upgrade is an extension of a production run requested by the U.S. Air Force and will bring the number of signal processing computing modules that Mercury has provided to GA-ASI to more than one thousand. GA-ASI's world-class family of Lynx SAR systems and Predator UAVs continues to be deployed extensively on reconnaissance and surveillance missions, bringing all-weather, very-high-resolution imagery to the warfighter.

Mercury Computer Systems  
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### Event Calendar

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**Autotestcon 2009**

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**September 15**

**Real-Time & Embedded Computing Conference**

Toronto, ON

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**September 21-24**

**Embedded Systems Conference**

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[www.esc-boston.techinsightevents.com](http://www.esc-boston.techinsightevents.com)

**September 29**

**Real-Time & Embedded Computing Conference**

Long Beach, CA

[www.rtecc.com/longbeach2009](http://www.rtecc.com/longbeach2009)

**October 1**

**Real-Time & Embedded Computing Conference**

San Diego, CA

[www.rtecc.com/sandiego2009](http://www.rtecc.com/sandiego2009)

**October 5-7**

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**October 19-21**

**MILCOM 2009**

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**October 27**

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**Real-Time & Embedded Computing Conference**

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**November 19**

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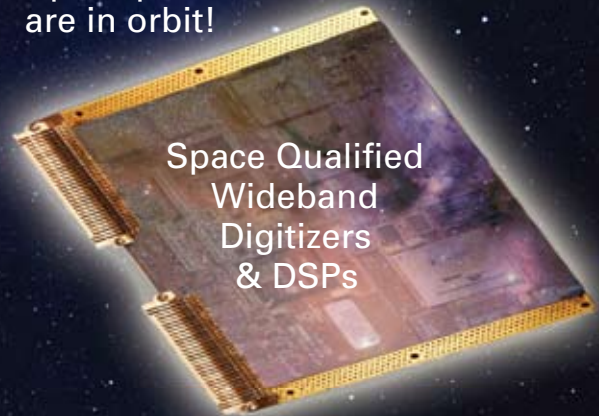
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# Special Feature

Multi-Function Boards for Military I/O

# Multi-Function Boards Revamp the Military I/O Landscape



## The notion of combining several I/O functions on one card fits neatly into the needs of avionics and other military I/O requirements.

Jeff Child  
Editor-in-Chief

Thanks to the magic of today's level of semiconductor integration, multi-function board products have emerged enabling military system designers to blend a variety of I/O functions onto a single stand-alone card or

PMC, XMC or AMC mezzanine card. The challenge has been to choose 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.

While still an avionics bus at heart, the MIL-STD-1553 bus continues to play



Figure 1

The avionics systems of the B-2 Spirit Bomber are linked together through a 1553 network. Shown here is a B-2 Spirit being refueled by a KC-135.

## Special Feature

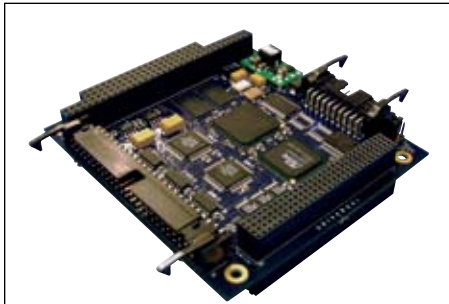


Figure 2


The PM429-2 is a PC/104-Plus-compliant card for ARINC 429 and ARINC 717 avionics databuses. The PM429-2 offers up to 16 ARINC 429 channels and 4 ARINC 717 channels on a PC/104-Plus platform.

a role in a wide variety of systems such as tanks, ships, missiles and satellites. For example, The B-2 Spirit bomber's (Figure 1) avionics systems are the heart of the stealth bomber's combat capability, linked together through a 1553 network. Several vendors continue to support 1553 with board-level solutions that provide 1553, often included with other functions. Among those vendors are AIM-USA, Aitech Defense Systems, Alpha Technology, Ballard Technology, Curtiss-Wright,



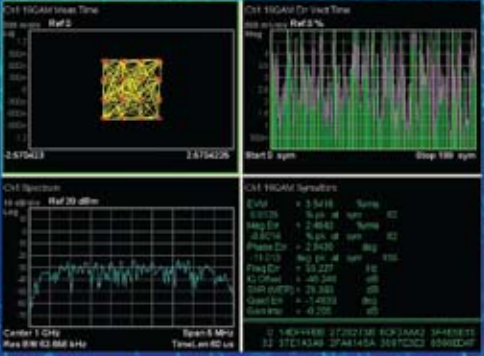
Figure 3

North Atlantic Industries has added MIL-STD-1553 and CANBus functions for its wide range of VME, cPCI and PCI multi-function boards.



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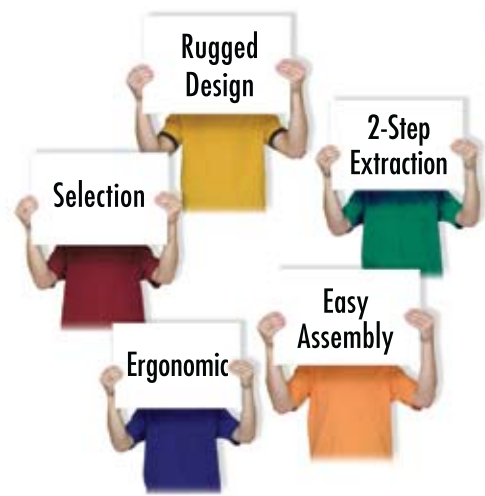
### Multi-Function PMCs

Exemplifying the mezzanine side of multi-function offerings, Aitech Defense Systems offers a compact, multi-I/O PMC that provides a variety of configuration options for the highest levels of flexibility in different I/O environments. The low-power, single-width M705 features

an unprecedented level of PMC density with up to five dual-channel, dual-redundant MIL-STD-1553B channels, 16 ARINC-429 receive channels and eight ARINC-429 transmit channels, up to six RS-232/422/485 serial channels and eight opto-isolated digital discrete input channels, all of which reduce the number of I/O cards required when developing subsystems. Additional board options include an ARINC 708 Weather Radar

interface contained as VHDL within the large onboard FPGA.

The MIL-STD-1553 (STANAG 3838) channels support BC/RT/MT operation modes and offer 128 Kbytes (64K words) of dual-port RAM per channel. The discrete input channels serve as general-purpose I/O ports that connect to the GPIO FPGA, but are primarily used to externally assign the RT address to the MIL-STD-1553 channels. The PMC is available in the widest temperature range of -55° to +85°C (-67° to +185°F) and with software in rugged and military levels of ruggedization.



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### Stand-Alone PC/104-Plus

The multi-function trend has even reached the realm of small form factor cards. An example is Ballard Technology's PM429-2 (Figure 2), a PC/104-Plus-compliant card for ARINC 429 and ARINC 717 avionics databuses. The PM429-2 offers up to 16 ARINC 429 channels and 4 ARINC 717 channels on a PC/104-Plus platform. Another attractive feature of the PM429-2 is its universal API library, which allows developers to program software on a commercial or other Ballard product such as an Ethernet or PCI card and seamlessly import it to the PM429-2.

In addition to these capabilities, the PM429-2 provides an IRIG timer and 16 input/output avionics discrete I/O signals. The discrete I/O can be used as general-purpose I/O or as trigger inputs and sync outputs for protocol functions. The PM429-2 discrete output circuits are open-ground switches capable of sinking up to 200 mA and can withstand up to 35 VDC applied to the pin. The discrete I/O are capable of interfacing with industry standard avionics discrete signals.

### CANbus and 1553 Together

In the case of multi-function board specialist North Atlantic Industries, 1553 was added to their existing set of multi-function solutions. North Atlantic Industries (NAI) earlier this year added MIL-STD-1553 and CANBus functions for its wide range of VME, cPCI and PCI multi-function boards. Known as N7, N8 (Figure 3) (MIL-STD-1553) and P6 (CANBus) modules, they provide two



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dual-redundant MIL-STD-1553B Notice two interface channels. Each channel can be configured to act as a Bus Controller (BC), Remote Terminal (RT) or Monitor (MT). Features include 128 Kbyte (64K words) onboard memory per channel, register compatibility with the Summit family of devices from Aeroflex, support for automatic message return, and Automatic Health Monitoring (BIT). The P6 module provides four independent, isolated channels of Control Area Network (CAN) serial data bus links, conforming to the ISO 11898 International Standard.

The ARINC 429 bus is an interface that certainly makes sense to share with 1553. Data Device Corp updated its Multi-I/O MIL-STD-1553 / ARINC 429 USB Avionics Device product BU-671023UX. The BU-67103UX Multi-I/O MIL-STD-1553 / ARINC 429/575 USB Avionics Device is ideal for lab applications, while the BU-67102UX provides the same functionality in a more rugged package. The devices are available with up to two dual redundant

1553 channels, each capable of operating in Bus Controller (BC) or Multi Remote Terminal (RT) modes, with a concurrent Bus Monitor (MT). In addition, the device contains four ARINC Receive channels, two ARINC Transmit channels, eight Digital Discrete I/Os, IRIG-B Time Code input and one Pulse-Per-Second (PPS) output. Also available in 1553 and ARINC-only models.

The cards feature a common test/embedded API, and are supplied with a wide array of software including the BU-69092SX series software, which is DDC's MIL-STD-1553 AceXtreme C Software Development Kit (SDK), including source code samples and detailed documentation. The USB Avionics Devices additionally include the DD-42992SX ARINC 429 Multi-I/O C SDK, incorporating source code samples and detailed documentation. Additional software packages include the BusTrACEr 1553 Graphical Analyzer/Simulator and dataMARS Real-Time Avionics Bus Analysis software. ■■

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# Special Feature

Multi-Function Boards for Military I/O

## Multipurpose SBCs Drive Wide Range of Battlefield Apps

The demands of the Networked Battlefield have become so advanced that sophisticated, multipurpose SBCs are needed to blend the graphics, video, security and connectivity required for these systems.

Nauman Arshad, Senior Product Line Manager  
Curtiss-Wright Controls Embedded Computing

New trends in processor chipsets and bus architectures are aligning to meet the increasing demand for small form factor multipurpose single board computers for use in rugged military applications. Today's generation of high-performance, low-power but function-rich chipsets such as Intel's new Atom processor Z5xx series provides the processing power needed for general-purpose processing while providing support for a wide range of I/O types that enable 3U SBCs able to address many applications with a single lightweight card. The addition of an XMC/PMC mezzanine expansion site further widens the flexibility of this new class of SBC, enabling compute/communications solutions small enough for a warfighter to wear or carry, or powerful enough to control selected critical vehicle operations. Figure 1 shows the variety of Network Battlefield nodes that require this level of compute functionality.

These multipurpose SBCs are ideal for space, weight and power (SWaP)-constrained applications such as embedded security systems, R-MIDs (Rugged-Mobile Internet Devices), secure radios, man-packs, wearable electronics, vetronics, in-vehicle networking, telematics, situational



Figure 1

Multipurpose SBCs enabling compute/communications solutions small enough for a warfighter anywhere in the Networked Battlefield.


awareness systems, graphics systems, embedded robotics, electronic vehicle health monitoring systems, and general-purpose low-power rugged or secure computing.

With the use of popular communications standards such as Zigbee (IEEE 802.15.4-2003) and 802.11a/b/g/n, and combined with video, audio, security



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## Mike Deliman

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Figure 2

The VPX3-1100 ATOMIC board provides a 1.6 GHz Intel Atom processor and up to 512 Mbyte DDR2 SDRAM, 1 Gbyte NAND Flash, a BIOS Firmware Hub (FWH) and a Trusted Platform Module for trusted boot.

and GPS options, as just some examples of advanced features, a 3U SBC can become a veritable Swiss Army knife, able to tackle a wide range of functions. If that board is also outfitted with a rich array

of serial I/O, and features gigabit Ethernet and PCI Express connectivity and high-speed backplane and ruggedization benefits of the VPX bus architecture, the SBC becomes a no-compromise, fully

featured rugged PC for stand-alone or multi-computing applications.

### Supply Chain Management

The Zigbee wireless-personal area network (WPAN) communications specification defines a low-power digital radio management protocol that is commonly used today with RFID tags in supply management. In military applications a Zigbee-enabled multipurpose SBC can be used to quickly and efficiently inventory the status of equipment on a vehicle or within a basecamp. It can be used to facilitate mission preparation or manage the logistics supply chain.

Providing an SBC with support for the standard commercial 802.11a/b/g/n wireless network technology, though on a rugged platform, enables a warfighter to act as an individual node, able to be recognized to join a network as they leave or enter a vehicle. A soldier wearing an 802.11-enabled multipurpose SBC in their manpack, using the A/B/ or G protocols, is able to readily connect back

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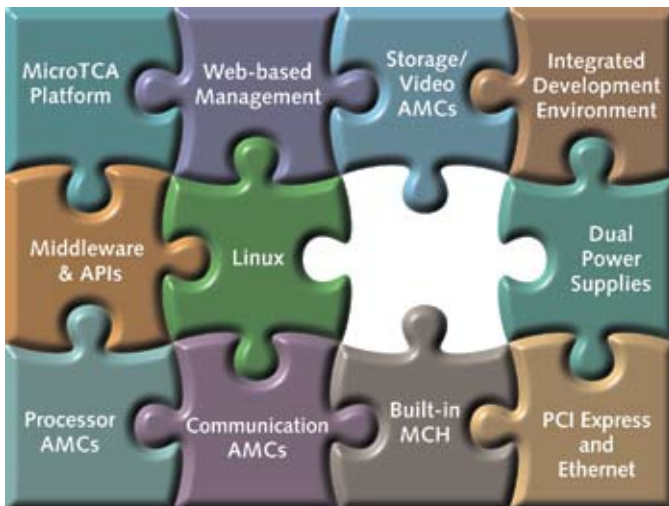
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to the vehicle or basecamp, wherever the access point is for their wireless, allowing the soldier to stay connected. This can be a great help for improving or increasing situational awareness.

Once connected to the network, each soldier in essence becomes a sensor. If provided with a small helmet camera and audio support, the resultant data can be fused with the sensor data of other soldiers in the field to give a richer picture

of real-time conditions. The video image and audio can be compressed and sent over the wireless 802.11N protocol back to the vehicle. The compression can be done either in hardware, using a JPEG200 or MPEG4 compression/decompression routines, or in software. The Atom chipset, for example, provides a DVI port that can support a camera, or alternatively a USB-enabled camera can be connected through the USB port, or the multipur-

pose SBC's Ethernet port can be used. By providing the multipurpose SBC with a Right/Left stereo audio jack, two-way communications can enable instructions from remote command/control.

### Voice/Video/Data Messaging

After the voice/video data is compressed using available algorithms, it can be sent out over a wireless mezzanine card, such as Curtiss-Wright Controls' XMC-660, back to the vehicle or to Command/Control. The multipurpose SBC can be used to power a wireless-enabled PC tablet that provides the warfighter with access to the Internet for a variety of purposes, such as accessing emails and instructional Powerpoint presentations. Video can be displayed on helmet visors or the multipurpose SBC can be connected to larger displays inside the vehicle. Using video and voice it is possible to provide training and repair information remotely, enabling the maintenance technician to "see" the equipment being repaired via the networked video from the helmet camera.

When deployed on an unmanned ground vehicle (UGV), the multipurpose SBC's processor can drive the UGV "by wire" and be used to control a facial recognition system connected to an on-vehicle camera. Support for Gigabit Ethernet on the multipurpose SBC enables uncompressed video data received from a wireless network to be processed, fused with other data and then sent out to an individual soldier or vehicle. In the vehicle, this real-time data can be distributed to a wireline network and shared with all appropriate personnel. USB ports on a multipurpose SBC can be used to connect mouse, keyboard and external storage devices. Effectively, the multipurpose SBC turns into a ruggedized PC.

### Advanced Security

A multipurpose SBC enables systems integrators to build secure rugged defense electronic systems for multiple applications that need to protect sensitive information, encryption keys, Intellectual Property (IP), or reverse engineering at the blade level. For example, volume protection and security can be provided via special covers and an XMC mezzanine card designed

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## Special Feature

with circuitry to detect tamper attempts. When reverse engineering efforts are detected, penalties such as data wiping, key eraser, or other system integrator defined penalties can be implemented.

For secure data, encrypted USB devices can be supported. A kiosk powered by the multipurpose SBC can enable multiple personnel, using encrypted USB devices and password protection, to identify and authenticate their access to secure

data. The Intel Atom supports virtualization technology, enabling the separation of data in hardware. With a proper MILS-compliant real-time operating system, virtualization can be used to enable RED/BLACK computing to provide individuals access only to the levels of security to which they are authorized.

If based on the VPX bus architecture, the multipurpose SBC can use PCI Express to combine with other processor,

DSP or communications boards to create a multicomputer system with significantly increased processing power. PCI Express can also be used to connect to a VPX carrier card, which can be used to support a wide range of expansion options. For example, the addition of 1553 PMC enables a gateway to be created between the multipurpose SBC's Gigabit Ethernet and 1553 connection technologies.

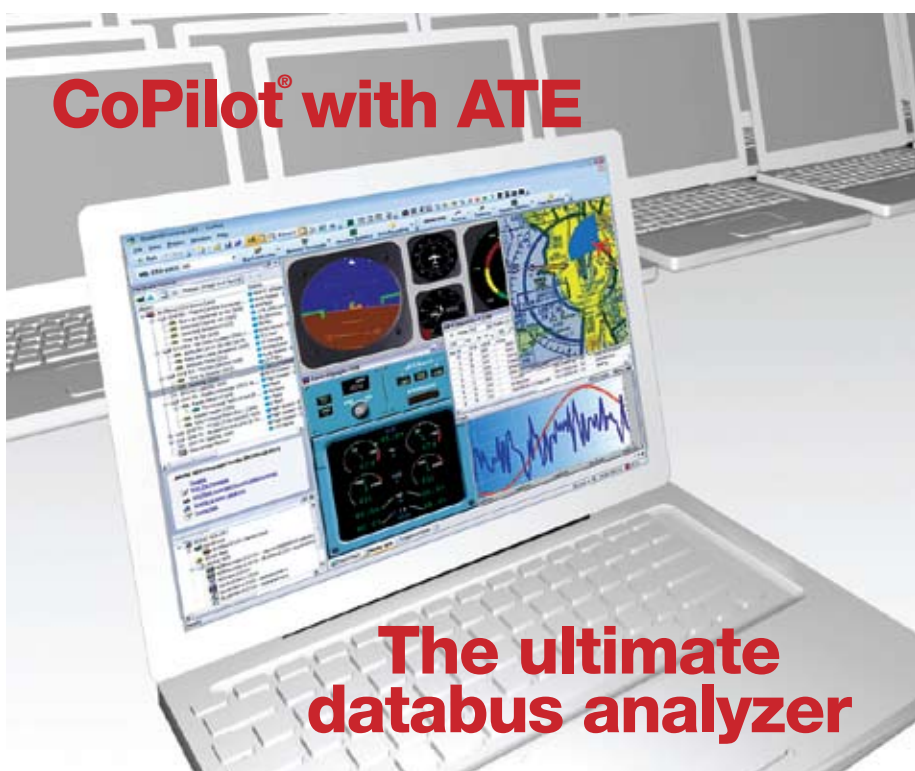
### CanBus for Vehicle Status Monitoring

The use of a CanBus PMC can enable vehicle status monitoring by creating a CanBus-to-Gigabit Ethernet gateway. Many ground vehicles use CanBus for low-level control messages for deeply embedded electronics. Similarly, the 1553 standard is commonly used in aircraft. In many cases, it does not make sense to replace these legacy interfaces. Investments in legacy buses and the low-level electronics that connect to them can be protected by using a gateway that interfaces the legacy systems to the newer GbE connected systems that are required for Network Centric Operations/connectivity.

VPX also provides support for the VITA 48-defined front and back metal covers that enable and simplify in-the-field maintenance and replacement of cards. For example, a vehicle can maintain a library of replacement cards with significant space and weight savings compared to sparing complete subsystems.

An example of a multipurpose SBC is Curtiss-Wright Controls' VPX3-1100 ATOMIC board (Figure 2). This 3U VPX card provides a 1.6 GHz Intel Atom processor and up to 512 Mbyte DDR2 SDRAM, 1 Gbyte NAND Flash, a BIOS Firmware Hub (FWH) and a Trusted Platform Module for trusted boot. The VPX3-1100 ATOMIC backplane input/output includes two high performance PCIe (x1) fabrics, 2x GbE interfaces, 2x RS232 Serial interfaces, 8x GPIO, 2x USB 2.0, DVI, Audio (Mic, L/R), and XMC I/O. ■■

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# Special Feature

Multi-Function Boards for Military I/O

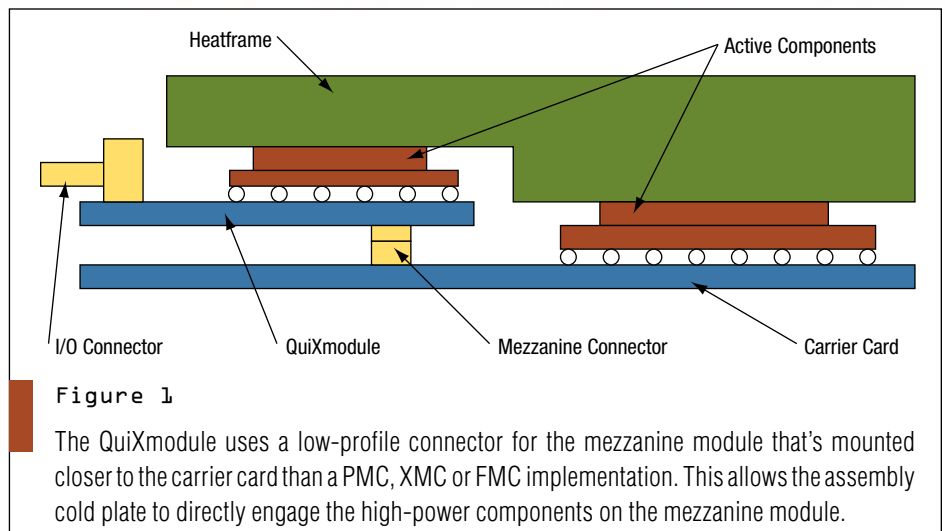
## Performance Demands Drive Multi-Function I/O Trade-offs

Ever greater chip integration enables powerful board-level functionality. But targeting the right performance and feature set to meet the application need is no simple matter.

Andrew Reddig, President and CTO  
TEK Microsystems

Over the last 20 years, military embedded systems developers have struggled to balance two trends: increased functionality vs. standard off-the-shelf products. As chip suppliers provide more and more capability within a smaller size, weight and power envelope, the amount of functionality that can be packed onto a single 6U VME-type card gets higher and higher. Unfortunately, the mechanical constraints of the backplane and front panel have not grown as quickly, making it difficult to create a single off-the-shelf product that meets every system's requirements, particularly when it comes to I/O interfaces. While it is possible to create a range of similar board designs with different options, this works against the potential cost savings of standardization and can increase system integration complexity.

In the early 1990s, board suppliers started to address this problem through the use of "daughtercards" or mezzanine I/O modules. By designing a carrier card with the core processing and memory components and using one or more separate mezzanine cards for I/O, board suppliers could offer off-the-shelf products with a user-configurable set of I/O functions.



As this approach gained traction, industry standards such as IP Modules (ANSI/VITA 4-1995), PCI Mezzanine Card (PMC, or IEEE 1386.1-2001) and Switched Mezzanine Card (XMC, or ANSI/VITA 42-2008) were developed, in each case enabling ecosystems of interoperable modules and carrier cards from multiple suppliers.

### The Open Standard Trade-off

Open standards are valuable when the critical mass for an ecosystem exists, but they necessarily sacrifice highly optimized performance in specific applications to support the widest possible range of re-

quirements. When the performance requirements are less demanding, the value of the ecosystem (more competition, wider range of options, lower costs) exceeds the limitations imposed by the standard and so the trade-off is acceptable to the defense marketplace. However, when an application needs very high throughput, efficiency, or power/thermal performance, the limitations of a least-common-denominator standard may not be viable.

One application area where this is particularly true is in high-performance A/D and D/A conversion. The signal integrity and throughput requirements for

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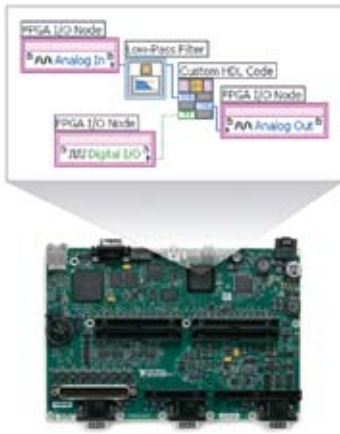
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## Special Feature



Figure 2

This configuration, designated Titan-V5, combines a four-channel A/D with 12-bit resolution at 1 Gsample/s with a four-channel D/A with 14-bit resolution at 1.2 Gsample/s.

multichannel acquisition and processing are difficult to implement efficiently using standards-based mezzanine designs, and the power and thermal requirements of multi-gigasample per second (Gsample/s) converters are in some cases beyond what is possible using standard mezzanines, particularly for deployed environments.

While open standards are desirable in principle, a single vendor solution such as the QuiXmodule architecture has some key advantages over a generic approach. Because the mezzanine and carrier cards are always shipped as an integrated unit, the cold plate is a single machined component designed for optimum thermal transfer from the specific mezzanine and carrier card being used. The mezzanine-to-carrier power and electrical interface is also configured appropriately for the specific interface being implemented, and the firmware interface between the A/D and the FPGA is optimized for throughput while enabling multi-channel synchronization across boards. If an open-standard interface was being used, it would by necessity be more general purpose and would be hard pressed to meet the mechanical, power, thermal and electrical performance characteristics of the more application-specific implementation used by each QuiXmodule.

High-performance signal processing systems are typically driven by the combination of sample rate, resolution

and channel count. As each of these parameters increases, the total throughput from the mezzanine to the carrier card goes up, and the power dissipated on the mezzanine for the A/D itself also rises. A typical configuration might use eight 12-bit channels at 1 Gsample/s in a single 6U card, resulting in throughput of 12 Gbytes/s ( $8 \times 12\text{-bits} \times 1 \text{ GHz} = 96 \text{ Gbits/s} = 12 \text{ Gbytes/s}$ ) and total A/D power of 30W.

For signal acquisition, raw resolution and bandwidth are only effective if the analog front end and the acquisition subsystem maintain good signal integrity as the signal is moved into the digital domain for processing. The use of a mezzanine card potentially helps this problem as the analog components are physically on a separate card from the digital processing components on the carrier card. However, even with the best design practices on the mezzanine card portion of the design, it is still necessary for the carrier card to avoid placing high-speed components underneath the mezzanine and to take other steps to make sure that the integrated assembly maintains good analog performance. These aspects of the design are typically not addressed by industry standards, which are designed for both analog and non-analog interfaces, making it difficult to reliably integrate mezzanine I/O modules and carrier cards together without sacrificing analog signal quality.

Finally, while A/D devices take advantage of better fabrication processes to improve power efficiency, the increase in both resolution, sample rate and channel density continues to drive total power upward. Mezzanine I/O power requirements of 30 or even 50 watts are not uncommon, and the traditional 10 mm mezzanine spacing with high-power components mounted between the two cards results in an assembly that is difficult to cool, leading to higher junction temperatures and decreased reliability.

### FPGA-based Implementation

Tekmicro's signal acquisition products use a mezzanine I/O design called QuiXmodule, which meets the requirements of high-density signal acquisition

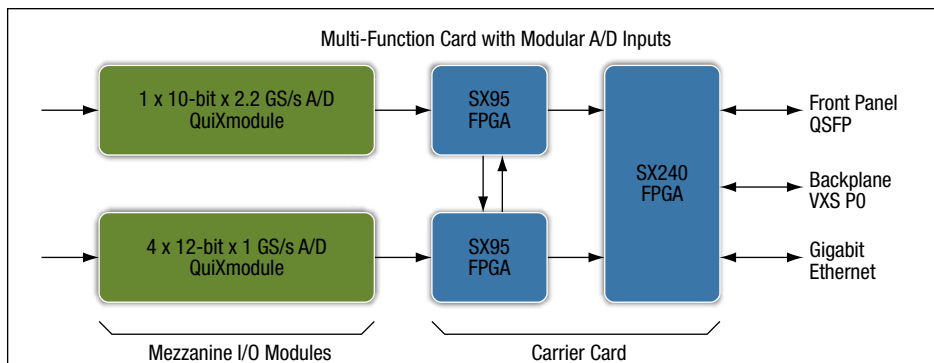


Figure 3

Using the same architecture as Figure 2, it is also possible to mix and match different A/D resolutions to combine ultra-wideband acquisition channels with lower bandwidth channels to look at specific frequency ranges after handoff from the wider frequency but lower resolution input.

and processing applications. Each module is approximately 74 x 50 mm in size, with front panel access for high-performance coax connectors. The mezzanine connector provides up to 6.25 Gbytes/s of throughput to the carrier card using Virtex-5 FPGA technology, supporting the range of A/D and D/A converters in use today with headroom for newer technologies. By using a low-profile connector (Figure 1), the mezzanine module is mounted closer to the carrier card than a PMC, XMC or FMC implementation, allowing the assembly cold plate to directly engage the high-power components on the mezzanine module. This improves thermal efficiency and makes it possible to support very high-speed A/D and D/A converters even in deployed environments.

6U cards in both VXS and VPX systems can support two QuiXmodules, and the same QuiXmodule design can also be used in a 3U VPX environment and other low-SWaP form factors. This allows each module to be leveraged and reused in a range of system envelopes.

### A Variety of A/D Configurations

Through the use of a mezzanine-based architecture, Tekmicro's QuiXilica-V5 VXS 6U card supports a range of functions using a single 6U card. The most common configurations simply "double up" on a given module, for example using a four-channel A/D module to implement

eight 12-bit channels at 1 Gsample/s in a 6U assembly.

However, a number of different configurations have also been selected by systems integrators. Many systems need to combine signal acquisition and generation within a single system, and ideally with very low input-to-output latency. By using an input module and an output module on the same carrier card, a multifunction card can be configured that combines the desired A/D input and D/A output with sub-microsecond latency between the two functions. Figure 2 shows an example of this configuration, designated Titan-V5, which combines a four-channel A/D with 12-bit resolution at 1 Gsample/s with a four-channel D/A with 14-bit resolution at 1.2 Gsample/s.

Using the same architecture, it is also possible to mix and match different A/D resolutions to combine ultra-wideband acquisition channels with lower bandwidth channels to look at specific frequency ranges after handoff from the wider frequency but lower resolution input. Figure 3 shows a block diagram of this configuration, combining a single 10-bit 2.2 Gsample/s channel with four 12-bit 1 Gsample/s channels in a single assembly. ■■

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# Tech Recon

VITA Standard Boards in Tech Upgrades

## VITA Standard Boards Keep Tech Upgrade Path Alive

A host of military programs continues to rely on VME SBC technology upgrades. Meanwhile VPX and VXS open the door to new levels of fabric-based connectivity.

Jeff Child  
Editor-in-Chief

Among the reasons for VME's soaring success in military systems is its unique ability to remain backward compatible and facilitate technology refresh in military programs. A new board with the latest and greatest processor, memory and I/O can easily be dropped into a slot that could be decades old. That kind of easy upgrade becomes trickier as new fabric-based VITA-standard boards enter the mix.

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

These sort of tech refresh/tech upgrade programs form the heart of much of the embedded-computer business. Among the highest profile of these include the F-18 Advanced Multi-Purpose



Figure 1

A tugboat assigned to Naval Station Pearl Harbor assists Arleigh Burke-class guided-missile destroyer USS Paul Hamilton (DDG 60) through the harbor waters.

Display program; Bradley Vehicle Electronics Upgrade; B-52 mission computer upgrade; Aegis Guided Missile Destroyer Sonar Upgrade (Figure 1); B-2 Bomber Radar Upgrade; Boeing B-1B Bomber Avionics Upgrade; Abrams Tank Systems Enhancement Package (SEP) upgrade

and the C-130 cockpit upgrade. Another example is Thales-Raytheon Systems' upgrade of their Firefinder Weapons Locating Radars, which includes the AN/TPQ-36 Weapon Locating Radar (see sidebar "Weapon Locating Radar System gets VME Tech Upgrade") and the



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## Weapon Locating Radar System Gets VME Tech Upgrade

Thales-Raytheon Systems' upgrade of their Firefinder Weapons Locating Radars includes the AN/TPQ-36 Weapon Locating Radar (see Figure) and the AN/TPQ-37 Artillery Locating Radar. The AN/TPQ-36 is an artillery, rocket and mortar locating radar. Location of artillery at ranges beyond the capability of the AN/TPQ-36 is provided by the AN/TPQ-37, the other radar that makes up the Firefinder system. Using only a different computer software program, the same operations shelter can be used for either Firefinder radar. The AN/TPQ-37 is a coherent, electronic-scanned, range-gated pulse Doppler radar.



Figure

The AN/TPQ-36 Weapon Locating Radar is an artillery, rocket and mortar locating system. An upgrade to the AN/TPQ-36's radar processor consists of a 3-Card Slot VME Implementation with two PowerPC-based boards, two PMC slots and VME clock interface card.

In October 2005 the U.S. Army tasked Thales-Raytheon to craft a form, fit, function replacement for the Legacy AN/TPQ-36 radar processor. Requirements called for support of both AN/TPQ-36 and AN/TPQ-37 Radars, allowance for future upgrades, open architecture and a 12-month maximum development schedule.

While the original 1970 design of the AN/TPQ-37 radar processor was comprised of 128 circuit boards and used machine language, the AN/TPQ-36's radar processor, which was upgraded in 1994, was a VME-based system. For the new combined radar solution, Thales-Raytheon engineers chose a 3-Card Slot VME Implementation consisting of two Thales (now Kontron) PowerNode 3 Cards for signal and data processing, two PMC daughter cards for A/D and synchronization and one interface clock card. The system uses a real-time Linux OS. The PowerNode 3 VME board sports dual Motorola PowerPC G4 7457 processors running at 1 GHz, 2 Mbytes of onboard L3 cache per processor, plus 2 Mbytes private SRAM. Up to 1 Gbyte of onboard SDRAM is accessible at the local bus speed of 133 MHz. The conduction-cooled boards have VME 2eSST (150 Mbyte/s) capability and have slots to two PMC slots.

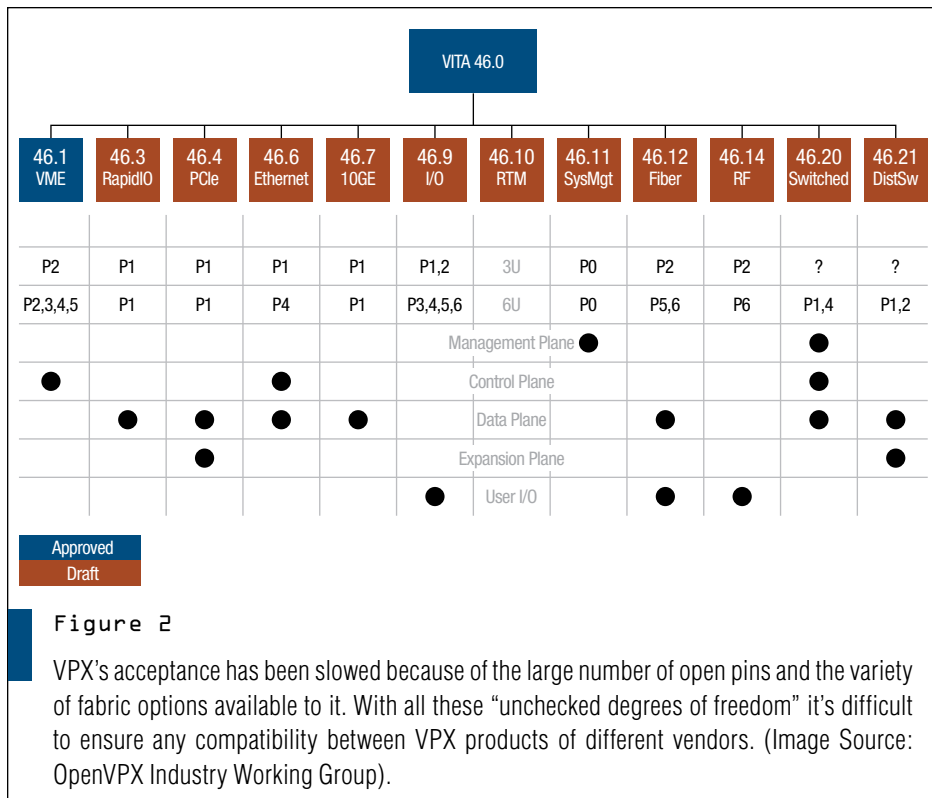


Figure 2

VPX's acceptance has been slowed because of the large number of open pins and the variety of fabric options available to it. With all these "unchecked degrees of freedom" it's difficult to ensure any compatibility between VPX products of different vendors. (Image Source: OpenVPX Industry Working Group).

AN/TPQ-37 Artillery Locating Radar. Most all of these upgrade programs involve standards-based embedded-computer solutions such as VME.

### VPX and VXS Claim New Territory

Now that the newer fabric-based VITA specs—VPX and VXS—are solidly in a "productizing" phase of their development, the industry is starting to ponder a break with traditional VME and its long legacy of complete backplane backward compatibility. This won't happen overnight by any means. VME board vendors say that old VME 2eSST and VME64 are what they're shipping the most today. Many new programs are looking to either make the leap to the VPX switched fabric-based backplane, or incorporate VXS to work alongside legacy VME boards in a hybrid solution.

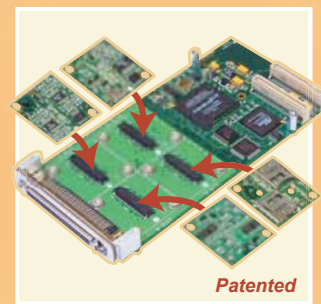
The military is itching to put VPX to work in both new and legacy/upgrade programs. System developers are attracted to the increased potential bandwidth, level-2

maintenance features, I/O options and ruggedness of VPX. VPX—in vendor-specific configurations—has already found its way into some programs. Meanwhile, VXS's share of the market is growing in niche applications. It offers a significant performance boost over VME64x, and its backward-compatibility is particularly attractive in many systems.

A problem that's hindered VPX's progress is that, with the large number of open pins and the variety of fabric options available to it, it's difficult to ensure any compatibility between VPX products of different vendors (Figure 2). Aiming to address just that problem, earlier this year an initiative was formed called OpenVPX Industry Working Group. OpenVPX is an independent association whose members include nearly all the major military VME vendors. The group also includes a number of leading defense prime contractors. OpenVPX's ultimate goal is to craft a System Design Guide that will include predefined sys-

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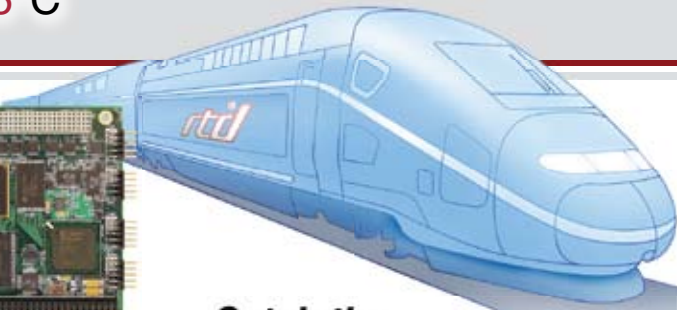
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	McBSP Serial Ports	✓	✓			✓	✓	✓							
<b>Analog Input</b>	Single-Ended Inputs	16	16	16	16	16	16	16							
	Differential Inputs	8	8	8	8	8	8	8							
	Max Throughput (KHz)	1250	1250	500	100	1250	500	500							
	Resolution (bits)	12	12	12	16	12	16	16							
	Input Ranges/Gains	3/7	3/7	3/4	1/4	3/6	3/3	3/3							
	Autonomous Calibration	✓	✓												
	Data Marker Inputs	3	3	3		3									
<b>Conversions</b>	Channel-Gain Table	1K	1K	1K	1K	1K	1K	1K							
	Scan/Burst/Multi-Burst	✓	✓	✓	✓	✓	✓	✓							
	A/D FIFO Buffer	8K	8K	8K	8K	8K	8K	8K							
	Sample Counter	✓	✓	✓	✓	✓	✓	✓							
	SyncBus	✓	✓			✓	✓	✓							
<b>Digital I/O</b>	Total Digital I/O	16	16	16	16	16	16	16	48	18/9	64	48	48	48	48
	Bit Programmable I/O	8	8	8	8	8	8	8	24	6/0		48	48	48	✓†
	Advanced Interrupts	2	2	2	2	2	2	2	2			2	2	2	✓†
	Input FIFO Buffer	8K	8K	8K	8K	8K	8K	8K							
	Versatile Memory Buffer											4M	4M	4M	8MB
	Opto-Isolated Inputs										48				
	Opto-Isolated Outputs										16				
	User Timer/Counters	3	3	2	2	3	3	3	3	3		10	10	10	6
	External Trigger	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓†
	Incr. Encoders/PWMs									3/9		4/8	4/8	4/8	✓†
<b>Analog Out</b>	Analog Outputs	2	2	2	2	2	2	2							
	Max Throughput (KHz)	200	200	200	100	200	100	100							
	Resolution (bits)	12	12	12	16	12	16	16							
	Output Ranges	4	4	3	1	4	5	5							
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tem profiles for 3U and 6U VPX-based systems, and they're hoping to accomplish this by October 2009. OpenVPX is an effort outside VITA and its standards body, the VITA Standards Organization (VSO), but it's using the same rules and procedures. And OpenVPX plans to turn the design guide over to VITA control upon completion. ■■

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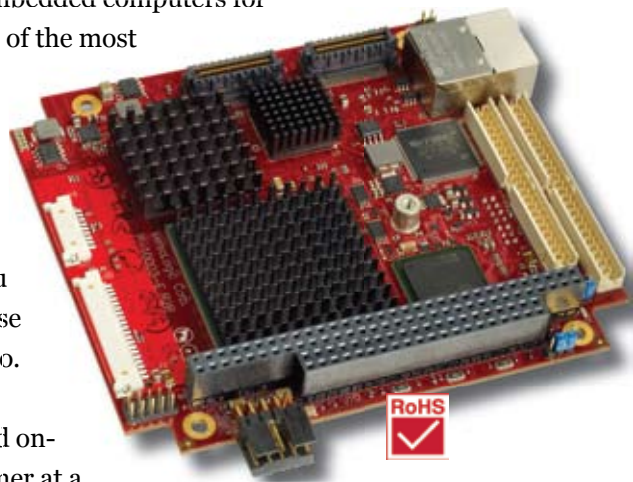
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# Tech Recon

VITA Standard Boards in Tech Upgrades

## VITA 42.6: Standardizing 10 Gbit Ethernet for XMC

VITA 42.6 defines an open standard for supporting 10 Gbit Ethernet on the XMC form factor, further enabling the acceptance of Ethernet in rugged military applications.

Rob Kraft, VP of Marketing  
AdvancedIO Systems

High-performance applications such as radar, sonar and SIGINT are pushing current switching fabrics to the limit. Responding to this need, a task group led by AdvancedIO has developed VITA 42.6, which defines an open standard for supporting 10 Gbit Ethernet (10GbE) in the form of XAUI (10G Attachment Unit Interface) or its IEEE sister standard 10GBASE-KX4 switched interconnect protocol over the standard XMC form factor connectors.

The standard solves several current industry problems. The high bandwidth and universality of the Ethernet protocol proves a ready complement to the XMC form factor, which excels in providing high-bandwidth mezzanine connectivity in rugged environments such as military ground, air and marine platforms where vibration, intense heat and humidity are challenges.

The development of a standard for carrying 10GbE over XMC's two high-speed serial connectors (J15 and J16) provides a method for getting 10GbE on and off those XMCs in conduction-cooled applications that preclude the use of front-panel connections. It also provides a higher bandwidth connectivity alternative for applications requiring more band-

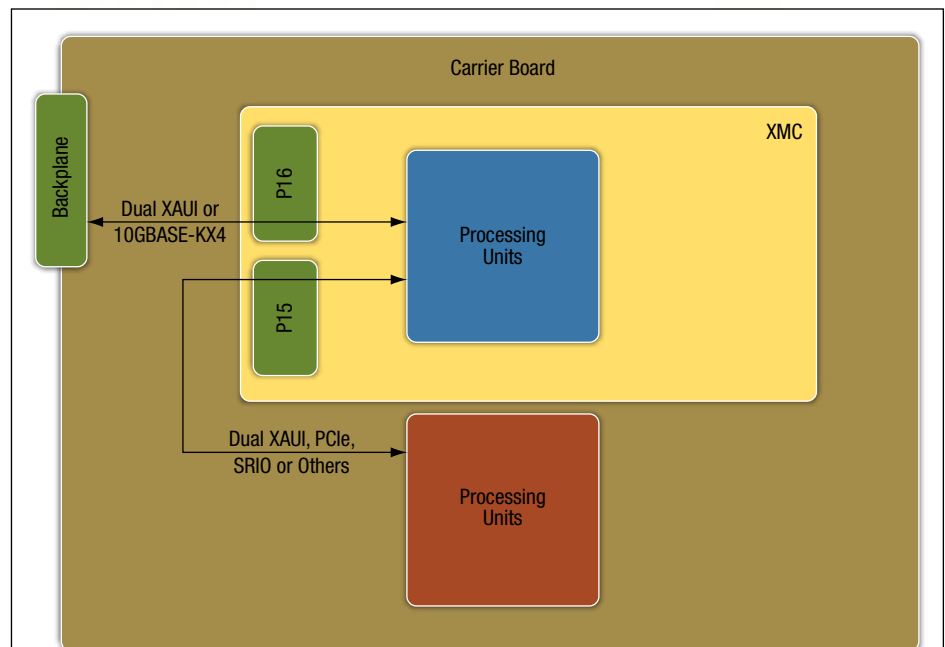


Figure 1

With VITA 42.6 developers have a lot of flexibility—both connectors can be used or only one (either XAUI or another fabric).

width than that offered by the popular PCI Express fabric on XMC connectors. And it provides a path for future XMC sensor modules to directly connect into emerging 10GbE backplane fabrics, without the need for any additional bridging technology or carrier real estate.

### What Is XAUI?

XAUI is a technical innovation that dramatically improves and simplifies the routing of electrical interconnections. Developed by an IEEE task force, XAUI delivers 10 Gbits/s of data throughput using four differential signal pairs in each



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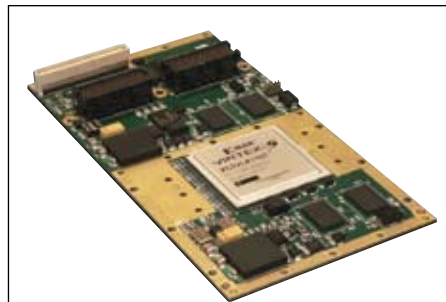


Figure 2

The V1120 is a 10GbE XMC designed to support VITA 42.6. The conduction-cooled rugged module uses VITA 42.6 on the Pn6 connector to provide a XAUI interface to the carrier for applications not permitting front-panel access. The module supports PCIe on the Pn5 connector.

direction. It is ideal for chip-to-chip, board-to-board and chip-to-optics module applications.

XAUI, which is electrically similar to IEEE 10GBASE-KX4, is organized into four lanes, each lane having two pairs of signals, one pair for sending and the other pair for receiving (enabling full-duplex transmission). This supports up to two XAUI/10GBASE-KX4 links per XMC connector. The links are denoted Link 0 and Link 1 on the primary connector, and Link 2 and Link 3 on the secondary connector. VITA 42.6 distinguishes between the two forms of Ethernet connectivity. XAUI links are referred to as Type I links whereas 10GBASE-KX4 is referred to as Type II.

Each XAUI lane runs at 3.125 Gbits/s in each direction with 20% overhead due to the widely used 8B-10B signal encoding, netting 2.5 Gbits/s per lane. When you combine the transmission of the four lanes into a link, XAUI offers you 2.5 Gbits/s x 4 lanes, providing 10 Gbit/s throughput.

### VITA 42.6 in Systems

Designed from the ground up to handle high-speed signaling between mezzanine cards and carriers, VITA 42.6 takes into consideration the requirements for successfully routing multi-gigahertz differential signals. Techniques used include the interleaving of ground and signal

pairs in order to minimize noise coupling at these high frequencies.

Figure 1 portrays how this protocol layer standard builds on the connectors defined by the XMC base standard. It illustrates some of the ways that VITA 42.6 could be used to communicate to elements on the carrier and to a VPX system backplane. Here, the primary connector (J15) of the carrier board brings in data via XAUI, PCIe (as defined by VITA 42.3), SRIO (as defined by VITA 42.2) or other fabrics. This data could be from other mezzanine cards (e.g., an analog-to-digital or other type of I/O XMC module), or from a device on the carrier, such as a processor. The secondary connector (J16) is portrayed as heading to the backplane, but it could instead be terminating at a switch or processing device on the carrier. Although the example above showed the use of both XMC connectors, a simpler VITA 42.6 application might only use the J15 connector for performing high-rate XAUI data transfers between an I/O or processing mezzanine and the carrier.

By enabling different protocols on different connectors, VITA 42.6, XMCs can be used to bridge from one protocol on one connector to Ethernet on the other. This provision enables board developers to accommodate systems where data input is still being managed by more than a single type of fabric.

Applications needing to connect 10GbE from the mezzanine to the backplane for distribution to other cards in the chassis can now use 10GBASE-KX4 on the XMC connector. Figure 2 portrays AdvancedIO's V1120, a 10GbE XMC module designed to support a VITA 42.6 XAUI or 10GBASE-KX4 interface to the carrier or backplane. Since 10GBASE-KX4 is the language spoken on the 10GbE backplane, there is no longer a need for a bridge between 10GbE and another fabric, like PCIe. Sensor input can come down the fatter 10GbE pipeline and be immediately distributed across the backplane. ■■

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# System Development

USB and PCI Express in Military Test

## USB and PCI Express Revolutionize Military Test

Together, USB and PCI Express have fundamentally simplified and reenergized the realm of military test and instrumentation.

Jeff Child  
Editor-in-Chief

Fading fast are the days when complex military electronics systems required large racks of boards to implement test platforms for them. Advances in serial fabric interconnects and embedded computing technologies have had a profound effect on the test and instrumentation market. Now the same test functions can be done on the PC using USB, PCI Express data acquisition and test modules. Meanwhile the PC itself—whether in desktop, laptop or single board embedded computer form—functions as the platform for running the test software and serves as the user interface.

Recent marriages of standard form factors have further enhanced the performance and modularity available for these applications. CompactPCI and PCI Express have blended into the emerging CompactPCIe. And CompactPCIe has in turn been adopted as the basis for the new version of the PXI instrumentation standard, called PXI Express. This standard allows CompactPCIe boards to be used with instrumentation-specific boards



Figure 1

The X Series of multifunction data acquisition devices for PCI Express and PXI Express is comprised of 16 new X Series DAQ devices, which provide enhancements to analog I/O, digital I/O, onboard counters and multidevice synchronization.

that have additional timing and trigger lines defined.

Exemplifying the impact of PCI Express in the test arena is National Instruments' new X Series (Figure 1) multifunction data acquisition (DAQ) devices for

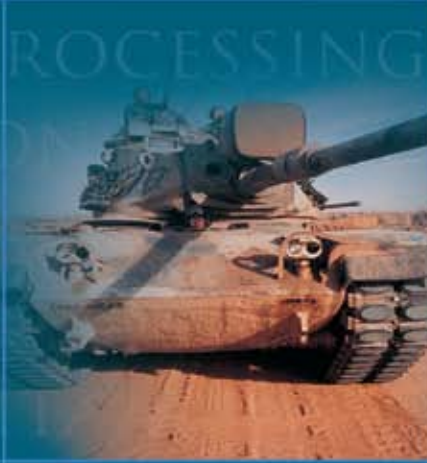
PCI Express and PXI Express. The 16 new X Series DAQ devices provide enhancements to analog I/O, digital I/O, onboard counters and multidevice synchronization. X Series devices integrate native PCI Express support for high-throughput



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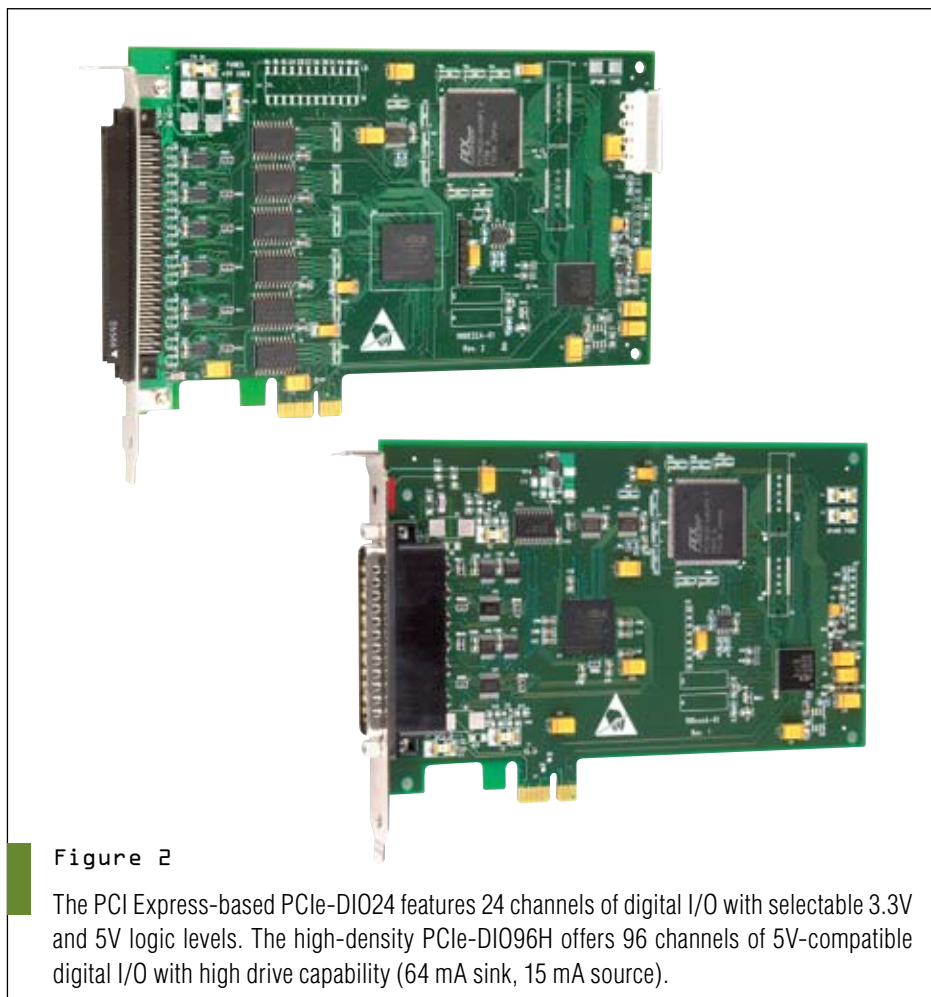


Figure 2

The PCI Express-based PCIe-DIO24 features 24 channels of digital I/O with selectable 3.3V and 5V logic levels. The high-density PCIe-DIO96H offers 96 channels of 5V-compatible digital I/O with high drive capability (64 mA sink, 15 mA source).

data transfer, advanced timing and synchronization technology for precise measurement and control, and the ability to perform advanced processing and analysis on today's multicore systems.

X Series DAQ devices, which include up to 32 analog inputs (AI), four analog outputs (AO), 48 digital I/O lines and four counters, range from low-cost 250 KS/s multiplexed AI to 2 Msample/s (MS/s) simultaneous sampling AI. Simultaneous X Series devices integrate up to 16 ADCs on a single device at 2 MS/s per channel, so engineers can sample all AI channels at a high rate and with minimal phase offset. With high sampling on all channels, simultaneous X Series devices pass large quantities of data back to the host PC, delivering a total AI throughput of up to 64 Mbytes/s.

### Beyond PCI Bus Speeds

With the added throughput of analog I/O, digital I/O and counter operations, total throughput can surpass 100 Mbytes/s for a single device—the practical maximum of the PCI bus. For this reason, X Series devices use the high-throughput PCI Express bus. PCI Express offers several benefits to data acquisition applications, including dedicated bandwidth to each device of up to 250 Mbytes/s in each direction. With this additional band-

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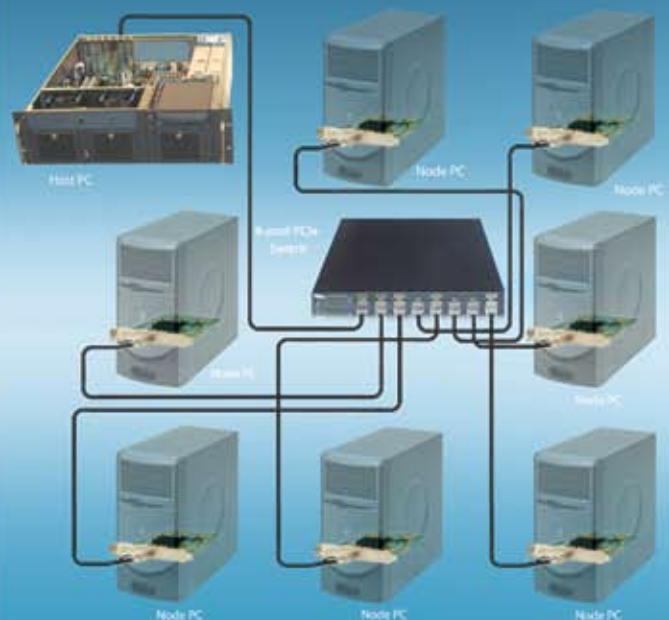
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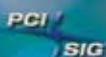
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width, users can acquire larger quantities of analog, digital and counter data, and with the dedicated nature of the bus, engineers can easily expand their systems to include multiple data acquisition devices.

Measurement Computing, meanwhile, has expanded their digital I/O offerings with the release of PCI Express versions of its two most popular PCI boards (Figure 2). The PCI Ex-

press-based products offer enhanced functionality while maintaining software and connector compatibility, allowing for seamless migration of existing applications to next-generation computer platforms. The PCIe-DIO24 features 24 channels of digital I/O with selectable 3.3V and 5V logic levels. The high-density PCIe-DIO96H offers 96 channels of 5V-compatible digital I/O



Figure 3

The 7800 series of half-length x8 PCI Express (PCIe) 2.0 carrier boards satisfies the data flow requirements, cooling considerations and power consumption needs demanded by high-performance military systems.


with high drive capability (64 mA sink, 15 mA source). Both boards offer software selectable pull-up and pull-down resistor configurations.

### Carrier for PMC/XMCs

PCI Express is also moving into the area of ultra-high-performance applications. PCIe carrier boards have become commonplace in the market, none are targeted specifically for high-performance military applications. With that in mind, Pentek this month released the 7800 (Figure 3) series of high-performance I/O boards built upon a versatile half-length x8 PCI Express (PCIe) 2.0 carrier board. The new 7800 carrier boards satisfy the data flow requirements, cooling considerations and power consumption needs demanded by high-performance military systems. The carrier board hosts a PMC/XMC module to fulfill a wide range of software radio, data acquisition and beamforming applications.

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Figure 4

The USB-AI16-16A is a high-speed USB 2.0, 16-bit multifunction analog input board that is ideal for precision measurement, analysis, monitoring and control in a variety of military embedded applications.

The new 7800 carrier board includes a x8 PCIe 2.0 interface capable of plugging into a x8 or x16 slot in a PC or a blade server. As a half-length board approximately 6.5 inches long, it fits virtually in any PC. Pentek's complement of 7800 x8 PCI Express Products includes a dual multiband transceiver with FPGA, a multichannel transceiver with Virtex-4 FPGAs, a Quad 200 MHz, 16-bit A/D with Virtex-5 FPGAs, a 256-channel DDC with four 200 MHz, 16-bit A/Ds, a 32-channel DDC with four 200 MHz, 16-bit A/Ds, a dual 400 MHz A/Ds, 800 MHz D/As with Virtex-5 FPGAs and a multi-frequency clock synthesizer.

### USB Revamps Desktop Test

USB brings a blend of high performance, ease-of-use and high integration to military test systems. That means fairly sophisticated test systems measuring temperature, vibration and other factors can be implemented on a desktop controlled by a PC rather than requiring a rack of A/D and controller boards. Also, by leveraging the bandwidth and performance of USB 2.0 technology, applications can do bidirectional high-speed transfer of data between the USB device and a computer. This "signal streaming" approach makes it possible to acquire

and generate multiple analog and digital I/O signals simultaneously.

ACCES I/O's latest offering in the USB analog input module space is its USB-AI Series. This line of 12- and 16-bit USB modules starts with its flagship model, the USB-AI16-16A (Figure 4). This high-speed USB 2.0, 16-bit multifunction analog input board is ideal for precision measurement, analysis, monitoring and

control in a variety of military embedded applications. The USB-AI16-16A can sample inputs at speeds up to 500 kHz for the board's 16 single-ended or 8 differential analog input channels. Standard features in the USB-AI Series include 16 digital I/O lines and a 16-bit counter/timer. The USB-AI Series includes five models (USB-AI16-16A, USB-AI16-16E, USB-AI12-16A, USB-AI12-16 and USB-

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AI12-16E). A unique channel-by-channel programmable gain feature enables measurement of an assortment of large and small signals in one scan—all under software control at up to 500 kHz.

The USB-AI Series was designed to be used in rugged industrial environments, but is small enough to fit nicely onto any desk or testing station. The boards measure just 3.550 by 3.775 inches and ships inside

a steel powder-coated enclosure with an anti-skid bottom. The USB-AI Series can be integrated into any PCI-104 or PC/104 stack by connecting it to a USB 2.0 port usually included on board with embedded CPU form factors such as EBX, EPIC and PC/104—especially important since many newer CPU chipsets do not support ISA and have plenty of USB ports.

### System Configurations

Today's military system designer is using USB not just for stand-alone plug-and-play data acquisition but also in system configurations. Data Translation provides an OEM version of its DT9812-10V low-cost USB module. The DT9812-10V-OEM is part of its ECONseries of low-priced modules and provides two, 20-pin connectors to accommodate all I/O signals without an enclosure. This allows the user to embed this low-cost board into their own system. Key features of the DT9812-10V-OEM include 8 analog inputs, 2 analog outputs, 16 digital I/O (8 in/8 out) and one 32-bit counter timer. The card supports independent subsystem operation at throughput rates up to 50 kHz. A signal range of +/- 10V is supported on both the analog input and analog output. The product can generate sine, rectangle, triangle, or DC waveforms with the analog outputs and offers 12-bit resolution for both the analog input and analog output subsystems. ■■

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# Technology Focus

Small Form Factor Boards

## Small Form Factor Boards Meet SWaP Challenges

Size, Weight and Power (SWaP) is a top priority in many of today's military programs. A variety of standards-based and non-standard small form factor boards offers solutions to those demands.

Jeff Child  
Editor-in-Chief

Long gone now is the era when a military embedded computer by definition meant a rack of board-level systems. Now complete computing systems easily fit on the area of a napkin or even a playing card. Small SBCs—in both standard and non-standard form factors—are in high demand for applications that are extremely space- or weight-constrained or where traditionally only a fully custom solution would do the job. Small UAVs, robotics, mission-specific handheld systems and even intelligent munitions are prime examples. The Talon SWORD Unmanned Ground Vehicle (Figure 1) is an example along those lines.

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, Stackable-USB, COM Express, MicroETXexpress, along with a variety of small non-standard boards. Since *COTS Journal* covered PC/104 and its younger cousin EPIC as dedicated Roundup topics in the May issue this year, this Roundup is restricted to small form factors other than PC/104 and EPIC.

The two most significant trends impacting small form factor boards in the last several months is the proliferation of boards based on Intel's Atom processor, and the roll out of products using Small Form Factor Special Interest Group (SFF-SIG)-created standards such as SUMIT. At ESC earlier this year, the SFF-SIG followed up on its earlier work by ratifying Revision 1.0 of the MiniBlade spec, and also introduced a new revision to its SUMIT specification. SUMIT Interface Standard Revision 1.3 provides supports for four additional PCIe x1 lanes for a total of six, one additional USB 2.0 interface for a total of four, and DMA support on the LPC bus to enable higher-speed data transfers. The update is fully upward compatible with the earlier SUMIT version.

On the processor side, the Intel Atom processor has been among the top architectures on new SBC products over the past year. The emergence of the Atom means there's no longer a reason to suffer with high power dissipation as a trade-off for using an Intel Architecture platform. The Intel Atom proces-



Figure 1

Small Unmanned Ground Vehicles (UGVs) like the Foster-Miller SWORDS system exemplify the type of application that's suited for small form factor SBCs. The SWORDS system runs off lithium-ion batteries and allows soldiers to fire small arms weapons by remote control from as far as 1,000 meters away.

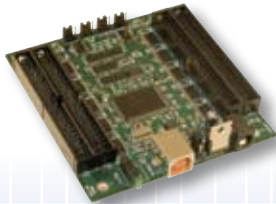
sor Z5xx series provides a variety of design options with 2.0 or 2.2W power levels, two package sizes and industrial as well as commercial temperature ranges. The Atom's low power makes it suited for the kind of Size, Weight and Power (SWaP)-constrained applications—small UAVs, UGVs, portable comms gear and so on—that are so critical these days. For the military, a key point is that the Atom has embedded lifecycle support. Military system designers were reluctant to consider the Atom until the assurance of 15-year part availability was offered. ■■

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- ▶ Dual display (LVDS & SDVO)
- ▶ Two SATA through Golden Finger

**American Portwell Technology, Inc.**

**Phone:** (510) 403-3399

**Fax:** (510) 403-3184

**E-mail:** [info@portwell.com](mailto:info@portwell.com)

**Web:** [www.portwell.com](http://www.portwell.com)



### NP951-B16C 3.5" board configured in ES951 SFF chassis



- ▶ Revision controlled, long life 3.5" board
- ▶ Intel 945GSE chipset
- ▶ ATOM N270 processor
- ▶ 2 USB, 1 VGA, 1 COM, 1 MiniPCI, 1 GLAN, 1CF, 12VDC
- ▶ Sold as Small Form Factor (SFF) system ES951
- ▶ DFI Technologies, LLC is MBE company with GSA schedule contract GS-35F-0617V

**DFI Technologies LLC (dba DFITECH )**

**Phone:** (916) 568-1234

**Fax:** (916) 568-1233

**E-mail:** [Vieng@dfitech.com](mailto:Vieng@dfitech.com)

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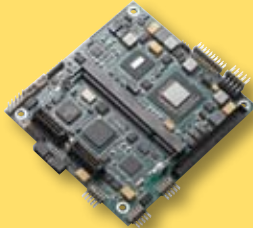
**Web:** [www.IndustrialCompactFlash.com](http://www.IndustrialCompactFlash.com)

# Technology Focus:

## Small Form Factor Boards Roundup

### Atom-Based SBC Uses SUMIT I/O Interface

The SUMIT expansion interface reinvents stackable and mezzanine architectures by packing an enormous amount of data bandwidth and easy connectivity—including multiple PCI Express lanes, USB 2.0 interfaces, LPC bus, I2C bus and SPI bus—into a fraction of the space previously occupied by only the 33 MHz parallel PCI-104 bus. Among the first products to use the interface was ADLINK Technology's CoreModule 730 embedded processor board, based on the ultra-low-power Intel Atom Z510 and Z530 processors at 1.1 and 1.6 GHz.



With PCI Express, Gigabit Ethernet, USB 2.0 ports and a CompactFlash socket, the CoreModule 730 features the lowest power Intel chipset available, the US15W, to complement the Intel Atom processor for a total power consumption of only 5W. Conductive-cooling solutions are also easy to implement for small sealed boxes with no internal air flow. The SUMIT-ISM is a 90 x 96 mm form factor that specifies a board outline and mounting holes and is completely flexible in terms of expansion interfaces. The CoreModule 730 offers a choice of 1.1 GHz and 1.6 GHz Atom processors, US15W chipset, DDR2 533 SODIMM RAM up to 2 Gbytes, Gigabit Ethernet, four USB 2.0 ports, IDE interface, CompactFlash socket, 8 general-purpose I/O pins (GPIOs), and integrated graphics engine with H.264 decode acceleration, analog VGA output and 18-bit / 24-bit LVDS interface for LCD displays.

ADLINK Technology  
San Jose, CA.  
(408) 360-0200.  
[www.adlinktech.com].

### 3.5-inch SBC Sports 2.16 GHz Core 2 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 / Core 2 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, 2xRS232 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 Mini-ITX Motherboards Boast Power Savings, Rich I/O

The perception of Intel CPUs as more power hungry than their competitors, is in full retreat now that the Atom family of microprocessors has entered the game. Riding that wave, Advantech announced production of its first Intel Atom industrial-grade Mini-ITX motherboard. The AIMB-210, with an Intel Atom N270 CPU, features a super low-power design, but without sacrificing performance. Rich connectivity with up to eight USB 2.0 and six COM ports is integrated in a standard 170 x 170 mm form factor.



The AIMB-210 incorporates an Intel Atom 45nm processor, and is designed to enable space-efficient solutions with a power-saving feature. Equipped with the Intel 945GSE chipset, total power consumption comes in at around a mere 14W. The AIMB-210 has a 533 MHz Front Side Bus and up to 2 Gbytes of DDR2 533 SDRAM. The AIMB-210 supports dual display with multiple display types, such as CRT + LVDS, TV-Out + LVDS, or LVDS1 + LVDS2 (optional) with TV-out via S-Video / Composite Video connections. Video output is complemented by HD audio for a complete audio/visual solution.

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

## Qseven-Based Carrier/SBC Duo Rolls

The Qseven connector scheme leads the way on the notion of combining a variety of I/O technologies onto one connection. Supporting that standard, American Portwell Technology has announced the PQ7-M102XL module board and its companion PQ7-C100XL 3.5-inch ESB developer carrier board, supporting an industrial temperature range of -40° to 85°C. At a mere 70 mm x 70 mm (2.75 x 2.75 inches), the ultra compact PQ7-M102XL module board supports the Intel Atom processor Z510PT (1.1 GHz) or Z520PT (1.33 GHz) series and the Intel System Controller Hub US15WPT. The PQ7-M102XL module board features 512 Mbytes system memory; dual independent display by LVDS/SDVO; one Gbit Ethernet; eight USB ports; expansion of two SATA, one SDVO, one PCI-E x1, LPC interface and high definition audio interface.



The PQ7-C100XL developer carrier board is based on Portwell's popular 3.5-inch ESB form factor and features one VGA port and one LVDS port for dual independent display; one Gigabit Ethernet port; seven USB ports; two SATA ports; one SDIO socket; expansion via one mini PCI-E; plus an onboard 12V DC to DC circuit for DC-in applications. Available now, Portwell's PQ7-M102XL module board with companion PQ7-C100XL developer carrier board is suited for low-power, wide-temperature and fanless devices in military applications.

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

## 1.6 GHz Atom Board Has Complete Motherboard Functionality

Gone are the days when an Intel-based board meant living with a relatively high power dissipation. The Atom CPU changed that. The NP951-B16C from DFI Technologies is a 3.5-inch board with a 1.6 GHz Atom N270 (Diamondville SC) processor and 945GSE /82801 chip set. Onboard memory consists of up to 2 Gbyte of DDR2 SDRAM. Graphics features include an 133/166 MHz internal graphics core that supports 18-bit dual-channel LVDS and CRT resolutions up to SXGA+. One mini PCI is provided for expansion. Onboard audio is provided by a Realtek ALC262 High Definition Audio CODEC with 2-channel audio output. A stereo DAC supports 16/20/24-bit PCM format with 44.1/48/96/192 KHz sample rate. Two stereo ADCs support 16/20-bit PCM format with 44.1/48/ 96/192 KHz sample rate



Networking features include a Realtek RTL8111C PCI Express Gigabit controller that supports 0 Mbit/s, 100 Mbit/s and 1 Gbit/s data transmission. Rounding out the I/O offerings are two Serial ATA interfaces, a mini-DIN-6 port for PS/2 mouse and PS/2 keyboard ports, a VGA port, two 2 USB 2.0/1.1 port and CompactFlash socket. The board supports a variety of wake-up features to ensure power efficiency. Intelligence provides CPU/system temperature and overheating alarms, CPU voltages and failure alarms and system fan speed and failure alarms. The board operates at temperature ranges of 0 to 60°C and humidity of 10 to 90 percent. Size of the card is 4.02 x 5.76 inches.

DFI Technologies  
Sacramento, CA.  
(916) 568-1234.  
[www.dfitech.com].

## Board Pair Blend Atom and I/O Variety

Non-backplane, stand-alone board form factors continue to expand their acceptance among military developers. Riding that wave, GE Fanuc Intelligent Platforms announced the bCOM2-L8000 COM Express module (shown) and the mITX-945S-ED motherboard. These new platforms—the first from GE Fanuc to feature the Intel Atom processor—can provide the foundation for systems builders, whether integrators or end users, to create embedded solutions that provide PC functionality in a broad range of applications where low power consumption and minimal heat dissipation are key requirements, but where the system designer cannot compromise on I/O capability.



The bCOM2-L8000's extensive I/O capability includes one Gigabit Ethernet port, two Serial ATA interfaces, support for up to two IDE devices and eight USB 2.0 ports, while expansion can be achieved via three PCI Express lanes. The mITX-945S-ED is equally well provided with I/O functionality, and includes two Gigabit Ethernet ports, PCI Express and PCI expansion slots, a COM port, two Serial ATA ports, support for up to two IDE devices and four USB 2.0 ports. Support for graphics (up to SXGA+ resolution) and audio is also provided. Importantly, the mITX-945S-ED features a 12-volt DC input, eliminating the need for an ATX power supply.

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



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## Small Form Factor Boards Roundup

### 2.16 GHz Core 2 Duo System Is Just 34 Cubic Inches

Applications like UAVs call for the contradictory requirements of high compute density on the one hand with small size, weight and power on the other hand. General Micro Systems attacks that challenge with its "Raider" (S705), a new rugged, ultra-small, Core 2 Duo-based system. Adding to the system's versatility is its super-small envelope with single drive version at only 4.6 x 4.6 x 1.6 inches, weighing only 2 pounds with power requirements as low as 15W. Raider has the ability to support up to six wireless radios on four to six antennae feeds.



Other key features are Dual GigE with TCP/IP offloading engine, high-performance video, Dual Com ports with 232/422, four USB ports, full audio for VoIP applications, full BIT and EBIT testing, and thermal management for safe thermal operation. Raider's facility for rugged environments (-40° to +85°C, MIL-STD 810F), along with its ability to operate from a single voltage source (+16 to +28 VDC), make the S705 ideal for demanding applications such as UAVs. Two optional 256 Gbyte solid-state disks can be fixed or removable, offering the ability to store a half Terabyte of acquired data for security purposes in sensitive operations. Pricing for the conduction-cooled version of Raider (S705) starts at \$8,300 in single quantities.

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

### MicroETXexpress COM Board Features Advanced Graphics

The military is putting more and more emphasis on sophisticated graphics/video-based interfaces for displaying situational awareness data. Kontron's microETXexpress-DC Computer-on-Module offers a host of features coupled with superior graphic performance for the development of mini devices. The energy-efficient Kontron microETXexpress-DC is equipped with the Intel Atom processor N270 (1.6 GHz) with Hyperthreading, Intel 945GSE and Intel ICH7M chipset as well as Kontron's new S5 Eco State. With its 3-D graphic power and dual independent display support via SVDO, LVDS, VGA and TV-out, the board is ideal for a wide range of military embedded applications.



The board supports up to 2 Gbytes of socketed DDR2 533 RAM. SVDO signals for VGA and DVI are transmitted by the integrated Intel Graphics Media Accelerator (GMA 950) over the PCI Express Graphics (PEG) pin-out, and the module is further equipped with TV-out. Thanks to its 18-bit LVDS dual-channel graphics with up to 224 Mbytes of graphic memory, Kontron's microETXexpress-DC features dual independent display support with a digital resolution of 1.600 x 1.200 pixels (UXGA) and 2.048 x 1536 pixels (QXGA) via CRT. The card boasts a comprehensive feature set and provides via the COM Express type 2 connector: 1 Gbit Ethernet, two SerialATA, one PATA, eight USB 2.0 and three PCI-Express x1 Lanes and a PCI 2.3, 32 bit / 33 MHz.

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



### Ultra-Small Form Factor Board Is Conduction-Cooled

MEN Micro offers an ultra-small form factor called ESMINI. MEN's MM1 was the first Ultra-Small Computer-on-Module of the new ESMINI family. Based on the Intel Atom processor in 45nm technology, the COM module offers processor frequencies of up to 1.6 GHz combined with a power consumption of only 5 to 7W and extended temperature range. The chief attraction of the MM1: The electronics are completely enclosed, which means that they are thermally coupled to the system via conductive cooling as well as 100% EMC-protected. Combined with an application-specific carrier board, the small module with dimensions of only 95 mm x 55 mm is the perfect solution for industrial, harsh, mobile and safety-critical applications.



The COM module offers a multitude of I/O. Besides serial I/O, for example PCI Express, LVDS and SDVO for graphics, High Definition audio, Ethernet, SATA and USB—the MM1 also supports legacy I/O like CAN bus and COM interfaces as well as up to 120 GPIOs. The interfaces are accessible via a customer-specific carrier board. The DDR2 SDRAM with a size of up to 1 Gbyte is soldered against shock and vibration. The MM1 also supports other storage devices like USB flash on the carrier card. The real-time clock and a board management controller with watchdog complete the functionality of the MM1.

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

### Controller Adds Graphics to StackableUSB

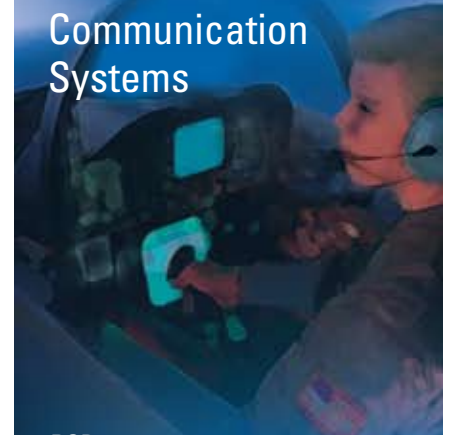
USB for years went underutilized in military embedded applications. That's starting to change as uses for the technology present themselves. Using USB as a link for stacked embedded boards is the whole idea behind StackableUSB. Micro/sys satisfies the demand for graphical user interfaces in low-power, space-constrained embedded applications with the introduction of its new USB3201, a graphics controller and a compact 2.8-inch (320x240 pixel) color LCD, which comes with a highly modular, easy-to-use software package. Using StackableUSB, the USB3201 easily mates with small, energy-efficient microcontrollers operating off a 9V battery, as well as x86 and ARM SBCs, to provide OEMs complex 2D and simple 3D graphics within the popular 104 Form Factor. The USB3201 exemplifies USB's ability to enable sophisticated, low-power systems across all CPU platforms.



Powered by the Microchip PIC32 and the Microchip Graphics Library, the USB3201 can support multiple input devices. The user-friendly software package has an open documented interface for LCD driver support, making it easy to interface to any LCD with the creation of a single low-level C file. With both a CPU and RGB interface, it is easy to accommodate an LCD with a maximum 480x272 WQVGA resolution. The USB3201 set, including the controller and LCD touchscreen, starts at \$265 in single quantity.

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

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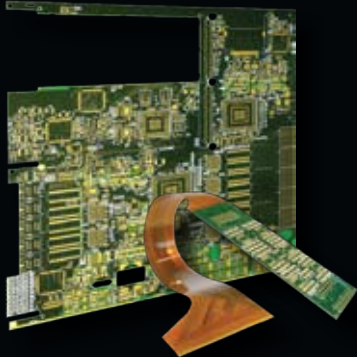
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## Small Form Factor Boards Roundup

### Pico-ITXe Card Sports SUMIT Connectors

The SUMIT connectors integrate common high- and low-speed, legacy and serial expansion buses, including, most notably, PCI Express, LPC, SPI and USB 2.0. Supporting up to four customizable I/O expansion modules, the EPIA-P710 Pico-ITXe board from Via Technologies enables a highly flexible and affordable implementation of serial connectivity options. Designed as the perfect baseboard, the Via EPIA-P710 uses an intelligent board layout to allow efficient module stacking and to aid heat dissipation.



The Via EPIA-P710 board features two SUMIT connectors. SUMIT is an open standard administered by the SFF-SIG. Measuring a mere 10 cm x 7.2 cm, the Via EPIA-P710 uses a 1 GHz Via C7 processor and the latest Via VX800 advanced all-in-one media system processor, which features the integrated Via Chrome9 IGP with DX9 Graphics and MPEG-2/4, WMV9 and VC1 video decoding acceleration. The board supports up to 2 Gbytes of DDR2 system memory, one IDE channel, two S-ATA channels and the Via Vinyl HD Audio. I/O configurations include two SUMIT QMS connectors that provide I/O support for up to three USB, one LPC, two PCIe x1, a PCIe x4, SMBus and SPI buses. Pin headers provide Gigabit LAN, VGA, LVDS, audio and front panel LED.

VIA Technologies

Fremont, CA.

(510) 683-3300.

[[www.via.com.tw](http://www.via.com.tw)].

### Small 48-Point Digital I/O Module Uses SUMIT Standard

Earlier this year, the Small Form Factor Special Interest Group introduced the SUMIT (Stackable Unified Module Interconnect Technology) connector standard. SUMIT is an electromechanical connectorization specification that enables stacking of common serial and legacy chipset expansion buses on I/O modules for next-generation embedded systems products. Some of the first products supporting that standard have started to emerge. WinSystems, for its part, introduced the first Pico-I/O module designed for expansion on Pico-ITXe SBCs. The PCO-UIO48-G is a 48-point digital I/O interface with interruptible event sense.



An important feature of the card is that it can monitor 24 of the rising and falling digital edge transitions, latch them, and then signal the host processor that a change of input status has occurred. This is the most efficient way of sensing and signaling a CPU of real-time events without the burden of continuous polling of the digital I/O points. Pico-I/O modules are designed to offer low-cost I/O expansion for Pico-ITXe single board computers from VIA and other manufacturers. The module requires only +3.3 volts; however, an optional onboard regulator is available to allow it to be powered from +5 VDC. Operational temperature range is from -40° to +85°C. A Pico-I/O module is small and measures only 60 mm x 72 mm, which is half the area of a PC/104 module. The PCO-UIO48-G lists for \$59. A depopulated version with 24 lines, called the PCO-UIO24-G, lists for \$49.

WinSystems

Arlington, TX.

(817) 274-7553.

[[www.winsystems.com](http://www.winsystems.com)].

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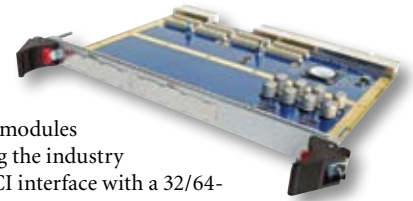
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## cPCI Carrier Board Supports High-Power PMCs

Mezzanine functions such as 10 Gbit Ethernet, PMC I/O or FPGA PMC modules require more power than the typical PMC mezzanine. With that in mind, Xembedded LLC, a XycomVME Company, has announced the XCPC-9200 CompactPCI Dual Carrier module. This new CompactPCI Dual PMC Carrier module provides 25 watts of power to each PMC site. The XCPC-9200 is well suited for 10 Gigabit Ethernet, PMC I/O or FPGA PMC modules requiring more than the standard 12 watts of power supply outlined in the IEEE- P1386.2001 specification. Using the industry standard PLX PCI-6540 PCI-X-to-PCI-X transparent bridge, the XCPC-9200 supports the PMC and CompactPCI interface with a 32/64-bit data path and bus speeds of 66/133 MHz on the PMC sites and 33/66 MHz on the CompactPCI bus.

The XCPC-9200 functions well in both 3.3V I/O and 5V I/O backplanes. The PMC sites support 3.3V I/O. XCPC-9200 is available in conduction-cooled, -40° to 85°C and air-cooled -25° to 70°C versions. The XCPC-9200 offers both front and rear-panel I/O support in a standard 6U CompactPCI. An optional rear transition module, XCPC-9092, is available to distribute the rear I/O to 68-pin SCSI type connectors.

Xembedded, Ann Arbor, MI. (734) 975-0577. [[www.xembedded.com](http://www.xembedded.com)].



## RAID 5 NAS Appliance Provides High Shock and Vibe Tolerance



For rugged military applications data storage needs a level of reliability beyond the typical RAID solution. Along those lines, ACT/Technico, now part of

Elma Electronic Inc.'s Systems division, offers the RAIDStor NAS Appliance, a compact, rugged network attached storage (NAS) platform that provides highly reliable, redundant data collection and storage in applications with high shock and vibration parameters.

The new 2U convection-cooled RAIDStor NAS Appliance is designed to meet MIL-S-901D Grade A (barge test) and MIL-S-167 (vibration) requirements with no data loss or hard drive damage, making the system ideal for harsh military environments. It is being deployed in equipment used on Aegis class cruisers. Built on a CompactPCI platform, the RAIDStor NAS Appliance comes with four hot-swappable, removable storage drives—either solid-state flash or rotating—in two horizontally mounted 6U single slot blades. The RAIDStor offers RAID level 5 protection across the four drives for a distributed parity redundancy architecture. This design provides 100% data preservation even with a failure of any one drive. For applications requiring software loading, an optional DVD drive is also available.

Elma Electronic, Fremont, CA. (510) 490-7388. [[www.elma.com](http://www.elma.com)].

## 3U VPX Solid-State Drive Boasts 256 Gbyte Capacity

The ecosystem for VPX continues to grow as more and more VPX products enter the market. Curtiss-Wright's latest offering is the VPX3-FSM (Flash Storage Module), a new rugged, high-performance and high-capacity solid-state SATA storage 3U VPX card that includes a NIST certified 256-bit AES data encryption capability. Rated at 160 Mbyte/s memory read/writes when configured as RAID0, and 75 Mbyte/s per port in a JBOD configuration, the conduction-cooled VPX3-FSM speeds and simplifies the addition of high reliability encrypted mass storage to VPX-based embedded systems in deployed applications.

The VPX3-FSM provides 256 Gbytes of high reliability SLC NAND flash storage in a 3U VPX (VITA 46) or VPX-REDI (VITA 48.2) form factor with a 1.0" pitch. The onboard flash memory is arranged as four 64 Gbyte banks, and can be configured to appear to the host SBC as four separate SATA drives or as a single SATA drive with hardware RAID0 support. With a wide range of ruggedization configurations available, the VPX3-FSM will be supported with Curtiss-Wright Controls Conduction Cooled Levels 100, 200 and 300. The VPX3-FSM's microcontroller also performs 256-bit AES encryption key management functions and supports five modes of key management. Volume pricing for the VPX3-FSM starts at \$12,000.

Curtiss-Wright Controls Embedded Computing, Leesburg, VA. (703) 779-7800. [[www.cwembedded.com](http://www.cwembedded.com)].



## Fiber Optic Switch Has Enable/Disable Capability

Fiber optic technologies offer a robustness far beyond copper switches. Electro Standards Laboratories has designed the new Model 6278 Dual Channel ESCON Duplex Enabled/Disabled Switch that allows the user the capability of enabling or disabling the connection between devices connected to the IN and OUT ports of each channel. All IN and OUT ports are ESCON, Multimode, 62.5/125 micron, and support a wavelength of 1300 nm. The Model 6278 2-Channel ESCON Switch uses MEMS-Based mirror switch technology and supports a Gbyte data rate. Both channels of the network switch are switched simultaneously, and switch ports are transparent to all data, also maintaining switch position on power loss while continuing to pass data.

The unit's port connectors include four ESCON Duplex female connectors labeled CH1 IN, CH 1 OUT, CH2 IN and CH2 OUT. The front panel features a manual pushbutton to allow local switching. A front panel LED display shows switch position and power status. The unit is powered by a UL-approved wall mount power module, 120 VAC, 60 Hz supplies 12 VDC, 500 mA to the unit. The switch features a rackmount configuration 19.0 x 1.75 x 8 inches. Weight is approximately 4.5 pounds.

Electro Standards Laboratories, Cranston, RI. (401) 943-1164. [[www.electrostandards.com](http://www.electrostandards.com)].





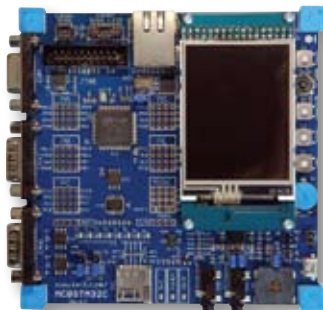
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## Development Kit Supports STM32 Connectivity Line

Compute density is a watchword in today's military, and that goes for handheld, portable military systems too. Along just those lines, Keil announced immediate support for the STMicroelectronics STM32 Connectivity Line in the Keil MDK-ARM (Microcontroller Development Kit) and RL-ARM (Real-Time Library). Keil has also introduced the new MCBSTM32C evaluation board and starter kit.

The STM32 Connectivity Line is based on the ARM Cortex-M3 processor and features full-speed USB On-The-Go (OTG), dual CAN2.0B interfaces, and 10/100 Ethernet including hardware support for IEEE1588 Precision Time Protocol (PTP). The devices share common peripherals with other STM32 families, thereby allowing easy project migration, and have up to 256 Kbyte flash and 64 Kbytes RAM. The latest release of MDK-ARM supports all STM32 devices and includes set-up files, device-specific views and example projects. MDK provides a complete development environment for creating, debugging and verifying embedded software applications. It features the industry-standard compiler from ARM, the Keil  $\mu$ Vision IDE, and sophisticated debug and data trace capabilities that utilize the advanced features of the Cortex-M3 processor. It is specifically optimized for single-chip, high-performance devices such as the STM32. The Keil MCBSTM32C evaluation board features the STM32F107VC microcontroller, 10/100 Ethernet, two CAN, two serial ports and a QVGA LCD with touch screen.

Keil, Plano, TX. (972) 312-1107. [[www.keil.com](http://www.keil.com)].



## Dual-Channel Display ETX Board Sports Via Eden CPU

Small form factor cards are vital solutions in a variety of military systems like small UAVs, UGVs and mobile comms gear. The latest ETX board from AAEON Technology is based on VIA C7 and VIA Eden processors. Designed for niche applications that require high-resolution, dual-channel display support, the ETX-CX700M board is highly suited to a range of modern multimedia-rich electronic gaming and entertainment systems. The ETX-CX700M combines a VIA processor with the VIA CX700M system media processor, providing a range of expansion and storage options and 24-bit dual channel configurations of LVDS, CRT, DVI and TV outputs.

Employing a 4.5 x 3.7-inch ETX COM format, the ETX-CX700M from AAEON is available with either a 1.6 GHz VIA Eden or 2.0 GHz VIA C7 processor combined with the fully integrated VIA CX700M media system processor, supporting up to 1 Gbyte of DDR2 system memory. Simultaneous and dual view display support is available in 24-bit dual channel configurations through a combination of LVDS, CRT, DVI and TV outputs, with screen resolutions of up to 1600 x 1200. Up to 128 Mbyte of system memory is available as dedicated video memory while hardware acceleration for MPEG-4, MPEG-2 and WMV is also supported. Storage includes IDE channel and two S-ATA II ports and a Compact Flash socket, while networking is provided through 10/100 Ethernet support. Other buses supported include 32-bit PCI, 8-bit/16-bit ISA, SMBus and I<sup>2</sup>C.

AAEON Electronics, Hazlet, NJ. (732) 203-9300. [[www.aaeon.com](http://www.aaeon.com)].



## Secure Digital Flash Card Is Ready for Rough Duty

Flash-based technology is the preferred storage medium for a wide range of harsh environment military applications. Along just those lines, Swissbit's Industrial series of Secure Digital (SD) Flash storage cards are specifically designed, manufactured and tested to withstand extreme environmental conditions. The usage of single level cell (SLC) Flash components combined with a 32-bit RISC controller provides many enhanced product features, like built-in error correction (ECC), bad block management, wear leveling algorithms, power loss protection and power saving modes. Swissbit offers a diagnostic command set to read out wear level classes and bad block counts, which help customers determine the remaining life-time of the product in the field or during qualification.

The S-200 series of SD cards are robust in nature because of the use of small Land Grid Array (LGA) components and the selection of the materials used to create the housing and printed circuit board. A 100% ultrasonic welded border and extra thick plastic is the chosen material to construct the stable ABS/PC housing that surrounds the SD card's internal components. Swissbit has SD Cards available from 256 Mbytes to 8 Gbytes and in Industrial and Extended temperature grades.

Swissbit NA, Austin, TX. (512) 302-9001. [[www.swissbit.com](http://www.swissbit.com)].



## 6U Core2 Duo cPCI Blade Is Conduction-Cooled

The CompactPCI form factor has taken an undeniable hold in the military market. The latest rugged offering from ADLINK Technology is its cPCI-6880 series of 6U CompactPCI blades featuring the 45 nm Intel Core2 Duo processor T9400 with a 2.53 GHz core speed, 6 Mbyte L2 cache, 1066 MHz FSB and a 40W typical total power consumption. The cPCI-6880 sports the latest Mobile Intel GM45 Graphics Memory Controller Hub, supporting dual-channel DDR2-800 SDRAM on one SO-DIMM socket and an optional 4 Gbytes of soldered onboard memory for a maximum of 8 Gbytes.

A DVI-I interface is provided on the front panel and VGA is routed to the Rear Transition Module (RTM). The cPCI-6880 can be operated in a system slot as master or in a peripheral slot (universal mode) to meet compute-density needs. The cPCI-6880 Series accommodates a 2.5-inch Serial ATA hard drive directly mounted on the SBC and RTM, an optional CompactFlash slot and built-in 4 Gbyte USB NAND flash for additional storage options. Available I/O includes four GbE ports, three USB 2.0 ports and one RJ-45 serial port. For I/O expansion, the cPCI-6880 Series offers one PCI-X 64-bit/66 MHz PMC site and user-defined I/O signals to the rear I/O. The cPCI-6880 is currently available at a list price of \$2,299.

ADLINK Technology, San Jose, CA.  
 (408) 360-0200. [[www.adlinktech.com](http://www.adlinktech.com)].





## PC/104-Plus and PCI-104 Cards Offer 1553 and ARINC 429

The era of the multifunction board has arrived, and the PC/104 space is riding that trend too. PC/104 is well accepted in the military realm. 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 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.

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



## PCI Express Carrier Family Suits Demanding Applications

While PCIe carrier boards have become commonplace in the market, none are targeted specifically for high-performance military applications. With that in mind, Pentek released the 7800 series of high-performance I/O boards built upon a versatile half-length x8 PCI Express (PCIe) 2.0 carrier board. The new 7800 carrier boards satisfy the data flow requirements, cooling considerations and power consumption needs demanded by high-performance military systems. The carrier board hosts a PMC/XMC module to fulfill a wide range of software radio, data acquisition and beamforming applications.

The new 7800 carrier board includes a x8 PCIe 2.0 interface capable of plugging into a x8 or x16 slot in a PC or a blade server. As a half-length board approximately 6.5 inches long, it fits virtually in any PC. Pentek's complement of 7800 x8 PCI Express Products includes a dual multiband transceiver with FPGA, a multichannel transceiver with Virtex-4 FPGAs, a Quad 200 MHz, 16-bit A/D with Virtex-5 FPGAs, a 256-channel DDC with four 200 MHz, 16-bit A/Ds, a 32-channel DDC with four 200 MHz, 16-bit A/Ds, a dual 400 MHz A/Ds, 800 MHz D/A with Virtex-5 FPGAs and a multifrequency clock synthesizer. These modules are all fully assembled and factory-tested PCIe assemblies so customers can simply plug them into their systems. Pentek's Model 7800 is available immediately with prices starting at \$9,995.

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



## Core2 Duo SBC Rides 3U CompactPCI Plus

PICMG 2.30 CompactPCI PlusIO complements the basic PICMG 2.0 CompactPCI standard by providing the migration path between CompactPCI Plus and CompactPCI. MEN Micro has released the first 3U Intel-based SBC that conforms to the new PICMG 2.30 CompactPCI PlusIO standard. The new standard adds serial functions on the J2 rear I/O connector in CompactPCI systems for added flexibility and versatility as well as easier system upgrades. The F19P adheres to the known CompactPCI standard, while providing a migration path to the new serial CompactPCI Plus standard. The board is available with a range of Intel processors, from the 2.26 GHz Core 2 Duo SP9300 to the 1.20 GHz Celeron M 722.

The new board offers a multitude of I/O options per PICMG 2.30, including four USB 2.0 ports, four fast SATA/SAS ports, four PCI Express x1 links and one Gbit Ethernet port via the J2 rear I/O connector. In addition, the F19P supports seven PCI Express x1 links for fast communication: three for onboard Ethernet and four x1 links, or one x4 link via the rear I/O or a special side card. The board sports up to 8 Gbytes of the new fast DDR3 DRAM soldered for high shock and vibration resistance as well as with a robust CompactFlash/MicroSD card. Pricing for the F19P starts at \$1,413 in single quantities (Celeron M 722).

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



## Rugged 150 Watt 3U, cPCI DC/DC Converter Rolls

Military applications need more than the ordinary level of ruggedness when it comes to power conversion solutions. Feeding such needs, North Atlantic Industries has announced its latest, next-generation 3U, cPCI DC/DC converter. The 55MQ2 provides 150 watts of output power (+5VDC, +3.3VDC and ±12VDC) at full load over its operating temperature range of -55° to +85°C. This rugged design is ideally suited for military airborne, shipboard and ground applications. The 55MQ2 is designed and manufactured to NAVSO P3641 component derating guidelines and each unit receives ESS screening.

The 55MQ2 contains an integrated EMI filter compliant with MIL-STD-461E. Its input is compliant with transient requirements of MIL-STD-704A through E. It is available with optional compliance for MIL-STD-1275, with reverse polarity protection. The 55MQ2 is fully compliant with PICMG 2.11, 47 position connector pin-out. It fits standard 3U cPCI or VPX 0.8-inch pitch. It is a true Single Slot Solution (does not interfere with inter-board separation plane on either side). It is compatible with the Power Management Bus. Typical efficiency is 80%. Pricing for 100 pieces of 55MQ2 is \$2,388 each.

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





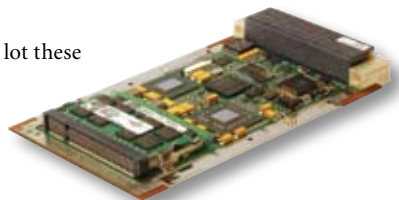
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### 3U VPX SBC Beats SWaP Challenges

The term “SWaP” or Size, Weight and Power, crops up a lot these days in military system design circles. They want SWaP as low as possible. Along just those lines, GE Fanuc announced the VPXcel3 SBC341 3U VPX rugged single board computer. Taking advantage of the latest Penryn processor technology from Intel with its 2.26 GHz SP9300 Core2 Duo processor and 25W thermal design power (TDP), the SBC341 responds to the growing requirement for maximum throughput with minimum power dissipation.

The SBC341 is available in five ruggedization levels, enabling it to provide the most cost-effective solution whether it is deployed in a benign development environment or in a harsh operational environment. Other key features of the SBC341 include support for up to 8 Gbytes of DDR3 memory (twice as much as the SBC340), allowing multiple demanding applications to be run concurrently. Extensive I/O flexibility allows complex systems to be built, with Gigabit Ethernet, x16 PCI Express for high-speed communication with an external graphics processor (x4 PCI Express and x1 PCI Express also provided), four USB ports, COM1 and COM2 ports and two SATA interfaces.

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

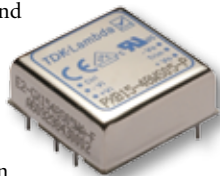
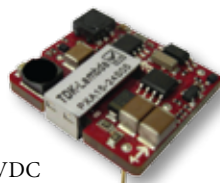


### 15W DC/DC Converter Measures 1 x 1 Inch

Ordinary consumer power converters don't cut it in harsh environment applications. Serving those apps, TDK-Lambda has added two new series to its already successful PX family of DC/DC converters. The fully isolated PXA and PXB Series have a tiny 1 x 1-inch footprint and are available in open frame (PXA) and shielded metal case (PXB) versions. The PXA Series offers single-output models with nominal inputs of 24V and 48VDC in 2:1 and wide 4:1 versions. The PXB Series offers both single and dual-output models with nominal inputs of 12 VDC in a 2:1 version and inputs of 24V and 48VDC in 2:1 and wide 4:1 versions.

Available single-output voltages for the PXA and PXB series include 3.3V, 5V, 12V and 15 VDC. In addition, the PXB series offers dual-output models that provide +/- 5V, +/- 12V and +/- 15 VDC outputs. Efficiency is up to 88 percent. Operating temperature range is -40° to +85°C. The PXA is available in through-hole or SMD mounting formats, and the PXB in a through-hole mounting format. All models are CE-Marked and are certified to UL/CSA/EN60950-1 safety standards as well as meeting the rigorous MIL-STD-810F thermal shock and vibration specifications. The PXA and PXB series are available now and priced from \$28.00 each in 500-unit quantities.

TDK-Lambda, San Diego, CA. (619) 575-4400. [[www.lambdapower.com](http://www.lambdapower.com)].



### Rugged Box PC Boasts Rich I/O

Stand-alone rugged box systems are the latest trend in military applications. System developers are looking for more integrated solutions. Advantech has announced the release of the latest in its ARK 3000 series—an economical Celeron M-based Box IPC with Intel 910GML Express chipset and excellent I/O connectivity. The ARK-3400 offers a fanless computing solution based on the Celeron Mobile processor (370 or 373), and supports up to 2 Gbytes of standard DDR2 SODIMM memory.

With a long I/O coastline, the ARK-3400 offers lots of connectors, lots of functionality: six USB 2.0 ports, two Giga LAN connectors, four serial ports including two RS-232 plus two RS-232/422/485 with autoflow control, two PCI slot, and one MiniPCI slot, which can be used for wireless LAN. There is CF card support, and 16-bit GPIO. For data storage there is one 2.5-inch SATA HDD bay, and one eSATA panel connector. There is also a CF card slot behind a handy access door. The extruded aluminum heat sink is an integral part of the case in this fanless design. Passive heat dissipation makes for a stable, long-lasting system that can operate reliably from -20° to 55°C. The cable-free interior architecture also contributes to the durability of this build.

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

### Dual Channel 1553 Boards Designed for Rugged Apps

1553 seems like it's been around since the dawn of time, but it remains the tried and true solution for a vast array of avionics and military vehicle systems. Feeding those needs, the DNA-1553-553 and DNR-1553-553 from UEI is a pair of two-channel, dual redundant, 1553 bus interface boards that provide two independent, dual redundant bus interfaces for 1553 communication. The DNA version is compatible with UEI PowerDNA and UEIPAC “Cubes” while the DNR version is designed for use in UEI's twelve and six slot RACKtangle chassis.

Each port may be independently configured as a Bus Controller (BC), Remote Terminal (RT), or Bus Monitor (BM). Designed to function in harsh environments, the DNA/DNR-1553-553 is fully tested for operation from -40° to +85°C, 0 to 70,000 ft. and can withstand 5g vibration and up to 50g shock. Pricing for the DNA-1553-553 is \$5,500, and for the DNR-1553-553 it is \$5,650.

United Electronic Industries, Walpole, MA. (508) 921-4557. [[www.ueidaq.com](http://www.ueidaq.com)].





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## 2U Core 2 Duo Platform Has Highly Expandable I/O

2U rackmount solutions are gaining momentum in the military, especially in systems using a lot of off-the-shelf 1U and 2U gear-like routers. Win Enterprises has released a 2U rackmount platform that features modular I/O capabilities and can expand from a basic level of 8 x GbE to 26 x GbE. With the PL-10450 from WIN Enterprises, customers can configure the I/O they require with copper and fiber LAN expansion modules.



The unit features the Intel 3010 express chipset and ICH7R I/O controller, which support an Intel Core 2 Duo/ Pentium Dual CoreLGA775 processor with 533/800/1066 MHz FSB. Support is provided for ECC and non-ECC high-speed DDRII memory with up to 8 Gbytes. One removable 3.5" SATA HDD bay and CompactFlash socket are available for system storage.

The PL-10450 supports both ECC and none-ECC high-speed DDR2 memory. The networking I/O architecture is based on extensive scalable I/O from today's mainstream I/O technology: PCI-E x8/x4/x1. The unit supports a maximum of 26 x GbE in both copper or SFP, has a redundant power supply and is RoHS-compliant. The PL-10450 supports DOS 6.22, Windows XP SP2 and Linux Fedora Core 6, 7 and 8. Pricing begins at \$1,209. Price includes CPU. Memory and storage are extra.

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

## Adapter Links Legacy RS-232 Ports to USB

One problem military embedded computers face these days is that, as computing cores shrink to smaller sizes, they still have to link to the same variety of legacy I/O. Addressing such needs, Saelig offers the CE-USB, a fully integrated, USB-powered, USB2.0-to-RS-232 adapter. Packaged in a DB-9 form factor shell, the CE-USB is designed to add a USB interface to legacy serial products without hardware or software redesign requirements. The CE-USB simplifies legacy updates by replacing an industry-standard right-angle PCB-mount DB9 connector with a near-identical part, with the mechanical specifications of an AMP 745131-1. It uses the DB-9's same PCB pad pinout to allow immediate updates to older serial products without layout changes, while drawing no additional power from the embedded system, and just 35 mA from the USB port.



Drivers are supplied for all major operating systems, including Windows, Mac and Linux. CE-USB's device drivers allow it to appear to an operating system as an additional COM port and send 8-bit asynchronous serial data at selectable speeds between 300 and 921.6 Kbits/s. PC application software accesses the device as it would a physical COM port. Existing COM port applications can thus be used to transfer data via a PC's USB port, with zero software changes. Pricing starts at just \$25.99.

Saelig, Pittsford, NY. (585) 385-1750. [[www.saelig.com](http://www.saelig.com)].



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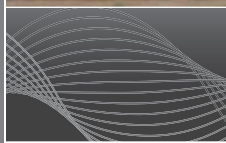
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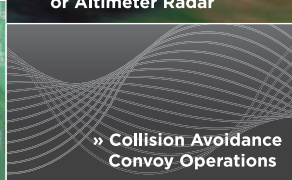
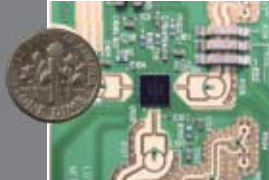
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### PC/104-Plus Card Sports Three Gbit Ethernet Links

Ethernet and PC/104 are two technologies that the military thinks highly of. MPL's Triget Family is a series of PC/104-Plus Gigabit Ethernet modules that is specially designed for rugged applications.

Extended temperature versions for -40° up to +75°C are available as well. The boards consist of highly integrated, flexible and robust PC/104-Plus-compliant Ethernet modules for industrial use. With a single PC/104-Plus module a system can be expanded with up to three Gigabit Ethernet interfaces. By using a PCI-to-PCI Bridge on the module, the Triget requires only one slot on a PC/104-Plus stack. Therefore, the stack still can be expanded with up to three additional PC/104-Plus cards.

To match different system requirements, two interface options and two mechanical versions are offered. Choose between RJ45 or 2 mm lockable headers as well as different mechanical sizes. Features include up to three Gigabit LAN controllers while using only one PC/104-Plus slot. The boards are capable of 33 MHz / 66 MHz PCI operation and support a 5V tolerant 3.3V PCI bus.

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

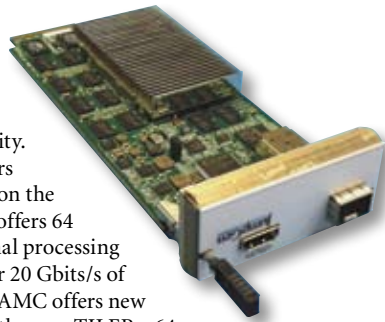


### PrAMC Serves Up 64-Core Processor

The multicore trend fits neatly into the military's desire for ever-increasing compute density. Feeding that need, JumpGen offers an AdvancedMC platform based on the Tiler TILEPro64 processor that offers 64 cores of general-purpose and signal processing compute power coupled with over 20 Gbits/s of full-duplex I/O. The TPM-100 PrAMC offers new levels of performance enabled by the new TILEPro64 processor design features and the Tiler Multicore Development Environment (MDE) version 2.0. The single-wide TPM-100 is the latest JumpGen PrAMC platform that supports 10 Gbit/s Ethernet interfaces to address growing military requirement for IP networks.

TPM-100 features include the TILEPro64 processor with 64 cores running at 700 MHz, 2 Gbytes of ECC DDR2 memory running at 800 MHz, and up to 8 Gbytes of persistent memory in the form of a solid-state drive. The front panel offers dual 10GigE interfaces (AMC.2 Type 6 or AMC.2 Type 5 with 10 Gbit/s SFP+) as well as an RS-232 Serial and an optional SFP+ for 10 Gbit/s fiber connection. The board is available in both full and mid-size AMC configurations, ATCA, MicroTCA and proprietary architecture systems, and is RoHS-compliant. In addition, a complete set of tools and runtime software stack are provided by the Tiler Multicore Development Environment version 2.0.

JumpGen Systems, Carlsbad, CA.  
760-931-7800. [www.JumpGen.com].



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### DATA STORAGE TECHNOLOGY

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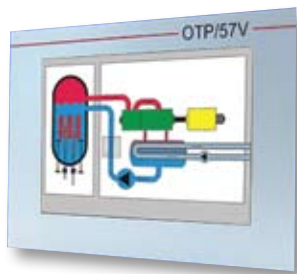
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### Touch Panel PC Suited for Small Spaces

Driven by the engine of Network-centric operations, the military has stepped up its demands for human interface terminals. The OTP/57V from SSV Software Systems is a compact touch panel PC targeted for HMI applications where small mounting space is a challenge. The unit is supported by a main processor that is fanless and is based on the Vortex86DX SoC by DMP. The processor unites CPU core, North and South Bridge as well as numerous peripheral functions in one single IC. The memory complement consists of 1 Gbyte NAND flash and 128 Mbyte DDR2 DRAM. Available interfaces are 1x 10/100 Mbit/s Ethernet, 2x USB host with 480 Mbit/s, 2x RS-232, 1x RS-485 as well as 1x CAN.

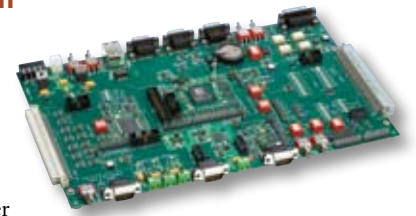


The OTP/57V is equipped with a 5.7" TFT color screen with touch function. The integrated XGI VOLARI-Z9s LCD controller with 64 Mbyte DDR2 video DRAM in addition to a display resolution of 640 x 480 pixels and a brilliance of 400 cd/m<sup>2</sup> ensure brilliant data visualization and a very high image quality. The rugged front (IP65) facilitates quick mounting in 19" control cabinets with three height units (3 HE). The preinstalled Embedded Linux, X-Server as well as the original Sun Java runtime Environment (J2SE JRT) with Swing support make the system an open and high-performance HMI platform, which enables you to respond flexibly to changing requirements anytime.

SSV Software Systems, Hanover, Germany. +49 (511) 40 00 042.  
[\[www.ssv-embedded.de\]](http://www.ssv-embedded.de)

### MicroTCA Carrier/Shelf Reference Kit Taps FPGA

MicroTCA is quickly gaining attention in the military realm. Pigeon Point Systems has a new MicroTCA Carrier Management Controller (MCMC) Board Management Reference (BMR) Starter Kit based on Actel's Fusion mixed-signal FPGA. The starter kit delivers a solution for the mandatory management controllers used in MicroTCA Carrier Hub (MCH) modules, including the Carrier Manager and Shelf Manager functions.



In addition to the MCMC functionality, the ARM Cortex-M1 processor in the Fusion mixed-signal FPGA hosts the Pigeon Point  $\mu$ Carrier Manager and  $\mu$ Shelf Manager components to enable cost-effective and compact management of an entire MicroTCA shelf. The kit includes schematics for a complete MCMC subsystem ready for integration into an MCH design along with a customer-adaptable design for the Fusion FPGA that serves as the core of that subsystem. Bench top MCMC and supporting hardware enables an immediate ramp up on MicroTCA's IPMI-based management framework, without waiting for custom hardware. In addition, corresponding firmware is delivered in source code form.

Pigeon Point Systems, Scotts Valley, CA.  
 (831) 438-1565. [\[www.pigeonpoint.com\]](http://www.pigeonpoint.com)



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## Multifunction Boards Offer Digital and Analog I/O

Military test and instrumentation systems used to require racks of boards. Now the same functions are possible using a handful of PCI Express cards. Contec has announced a series of PCI Express-compliant multifunction boards featuring 16 single-ended or 8 differential channels of analog input, 1 analog output and 4 TTL-level channels of both digital input and output. An 8/16 channel multiplexer is available to double the available analog inputs. The "E" Series from Contec offers 16M data input buffer memory allowing background sampling—conducted independently from the operation status of the Host PC or its software—to be performed for a variety of trigger conditions.

There are four different models, providing a choice of resolution (12- or 16-bit) and conversion speed (10  $\mu$ sec/channel or 1  $\mu$ sec/channel). In addition, Contec offers a variety of optional signal conditioners that allow for the expansion of the boards' functions. Available options include simultaneous sample and hold, cold-junction compensation, gain and low pass filtering. All boards in the Intelligent "E" Series ship with Contec's data logging software "C-Logger," which allows the end-user to display recorded data in graphs, save files, and easily import data files into Excel.

Contec, Sunnyvale, CA. (408) 400-8700. [[www.contec.com](http://www.contec.com)].



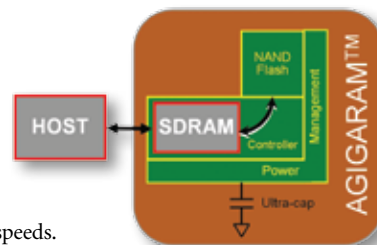
## Non-Volatile RAM System Boasts 2 Gbyte Capacities

Mission-critical systems sometimes need a mix of non-volatile storage and RAM-like access speeds. Battery-backed memories can offer high speeds but are subject to numerous problems, such as hazardous material issues, increased design complexity, long charge times, limited operating life and a high total cost of ownership. Non-volatile SRAM systems like the AgigaRAM system from AgigA Tech provide a battery-free power subsystem teamed with high-speed synchronous DRAM, NAND Flash, intelligent power management and a proprietary system controller.

During normal operation the AgigaRAM functions exactly like a synchronous DRAM (SDRAM). When power is lost, however, it automatically saves the data to NAND Flash using the energy stored in the power subsystem. When power is restored, the data is transferred back into the SDRAM. AgigA RAM Tech announced two product families: Bali and Capri. The Bali product features 4 Mbyte to 64 Mbyte densities and high-speed 100 MHz SDRAM with 200 Mbyte/s peak transfers. It includes an I<sup>2</sup>C command/control bus and uses 3.3V VCC for 4 Mbytes to 32 Mbytes, 5.0V VCC for 64 Mbyte capacities. The Capri Product is targeted at higher-end applications. This product comes in sizes ranging from 256 Mbytes to 2 Gbytes and uses a much higher speed DDR-800 interface. It also integrates a battery-free power pack.

AgigA Tech, Poway, CA.

(858) 375-4530. [[www.AgigATech.com](http://www.AgigATech.com)].



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## Coming Next Month

**Special Feature: Advanced Signal Processing Chain: From Sensors to Storage.** Choosing a data recording solution for an advanced signal processing military system might seem a straightforward task. But in reality it ranks among the more critical and challenging decisions engineers have to make. Consider the multitude of components found in modern sensor systems and the differing characteristics of those components. Pairing sensor acquisition/analysis subsystems with recording and storage subsystems requires consideration of interconnect preprocessing and reliability issues. Articles in this section step readers through these issues and highlight the current crop of data recording systems.

**Tech Recon: Navy I/O Update: NTDS, ATDS and STANAG Boards.** As the U.S. Navy works to upgrade its shipboard command and control systems and develop brand new next-generation vessels, it's making a shift from legacy systems to an open systems environment. Articles in this section update readers on technology and product trends that are critical to naval networking and I/O, such as NTDS, ATDS, TADIL A and NATO STANAG 4146 standards.

**System Development: Cooling Challenges in Airborne Systems.** There's just no avoiding the trend toward processors and other key components ramping up in wattage. And more power means more challenges dissipating heat. Airborne systems have the added complication of pressure variations and wide temperature swings. Exotic techniques such as spray-cooling and liquid-cooling are all on the table as possible ways to attack the cooling challenge. Articles in this section touch on all these present-day and future cooling solutions.

**Tech Focus: Solid-State Disk Drives.** Free from the woes of moving parts, flash-based solid-state disks F-SSDs are able to operate under the harshest conditions, unlike magnetic hard disk drives. And because F-SSDs targeted for military and aerospace apps use the same fundamental flash components as the consumer realm, the price advantages can be leveraged across all markets. This Tech Focus section updates readers on F-SSD products and provides a product album of representative drives.



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# Editorial

Jeff Child, Editor-in-Chief

## Commonality and Opportunity in UAVs

There's no doubt that military Unmanned Aerial Vehicles (UAVs) represent huge opportunities for our marketplace. From 2008 on through 2013, the Department of Defense plans to invest over \$16 billion to develop and procure additional UAVs and associated systems. An ongoing issue in UAV development has been the challenge to achieve some commonality among the Service Branches' unmanned aircraft programs. Efforts to leverage common aspects of UAV programs across the Service Branches have been mixed, but not without some notable successes. In a series of reports on this topic, the Government Accountability Office (GAO) looked at the progress of selected UAV acquisition programs, analyzing the extent to which the Services are collaborating and leveraging commonality among those programs. The report analyzed cost, schedule and performance data for eight unmanned aircraft systems—accounting for over 80 percent of the DoD's total planned investment in unmanned aircraft systems from 2008 through 2013—and two payload programs (ASIP and MP-RTIP).

Although cost and schedule overruns certainly aren't unique in the UAV realm, the GAO report cited that the cumulative development costs for the 10 programs it reviewed increased by over \$3.3 billion (37 percent in 2009 dollars) from initial estimates—with nearly \$2.7 billion attributed to the Air Force's Global Hawk program. Several programs have experienced significant delays in achieving initial operating capability, ranging from 1 to nearly 4 years.

Several of the tactical and theater-level unmanned aircraft acquisition programs GAO reviewed have identified areas of commonality to leverage resources and gain efficiencies. For example, the Marine Corps chose to procure the Army's Shadow system after it determined Shadow could meet requirements, and was able to avoid the cost of initial system development and quickly deliver capability to the warfighter. Meanwhile the Navy decided to use a modified Global Hawk airframe for its Broad Area Maritime Surveillance system. Other programs missed opportunities to leverage commonality.

Although several unmanned aircraft programs have achieved airframe commonality, service-driven acquisition processes and ineffective collaboration are key factors that have inhibited commonality among subsystems, payloads and ground control stations. For example, the Army chose to develop a new sensor payload for its Sky Warrior, despite the fact that the sensor currently used on the Air Force's Predator is comparable and manufactured by the same contractor. The pressure is on now to push for more commonality among unmanned aircraft systems.

One of the most successful UAV collaboration efforts was the Army and Navy's development of the Fire Scout. As part of the Fu-

ture Combat Systems program, the Army began developing in 2000 a vertical takeoff and landing UAV called Fire Scout. On their own initiative, program managers from the Army Fire Scout contacted their counterparts in the Navy Fire Scout program to share information and look for any synergies between the two programs. The DoD's recent decision to terminate the FCS ground segment raises additional uncertainty over the Army's Fire Scout plans. Today the Army's Fire Scout program is being hindered, not because the FCS program has been renamed and restructured, but rather because the airframes can't be tested without WIN-T and JTRS. WIN-T will be the data link that allows control of the Class IV UAS from mobile ground stations, and JTRS will provide a communication relay capability. Neither of those subsystems is expected to be available soon.

The strategy of using a common airframe on different UAVs doesn't directly affect our segment of the industry—the embedded computing and electronics industry. What does impact us is commonality—and the increase of open systems—inside UAVs. Board and box-level embedded computing is already critical in most all types of UAVs. Larger UAVs use backplanes crammed with VME and CompactPCI boards—the Global Hawk and Predator, for example. Meanwhile, small UAVs haven't fully embraced standard boards yet, but they're looking to form factors like PC/104, COM Express and others. Meanwhile, complete stand-alone rugged box-level subsystems—often designed for a special payload function or generic function like communications/networking—are also having an increasing role in UAVs.

The question keeps coming up, however, as to how effectively and comprehensively these UAV programs are using open system embedded computing technologies. It's one thing to use standard form factor computing architectures in a program. It's another to plan out the use of common architectures across several similar UAV programs. Among the recommendations of the recent GAO reports was that “before initiating new unmanned aircraft development programs, the DoD should require the Services to demonstrate in their acquisition plans and strategies that they are taking an open systems approach and that the potential for commonality has been rigorously examined.” The DoD agreed with that recommendation, although how that translates into action isn't completely clear. The DoD does already have in place Defense Instruction 5000.02 that requires program managers to employ Modular Opens Systems Architecture (MOSA). If UAV development efforts within the DoD become more standardized, it's possible that the idea of standard form factor embedded computing will gather more momentum in this market segment. ■■



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